Environmental management in a kennel: assessment and reduction of the environmental impacts

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Abstract

The abandonment of domestic animals in public places is a severe socio-environmental problem, hence municipal kennels are essential to the management of these animals. However, many kennels do not have an effective environmental management system, as they have limited financial and human resources. Thus, this work aimed to identify the environmental aspects and impacts of a kennel located in the south of Minas Gerais (Brazil) and also to propose low-cost solutions for reducing significant environmental impacts. The significant environmental impacts of the kennel are water and soil pollution, resulting from wastewater generation, besides animal feces and unused and expired medicines disposal. Therefore, it was proposed the construction of a septic tank followed by an anaerobic filter and a biodigester, and also the correct disposal of the pharmaceuticals. Finally, the kennel is essential to the zoonose control in the locality.

Keywords: Zoonoses. Septic Tank. Anaerobic Filter. Biodigester. ABNT NBR ISO 14001:2015.

Introduction

The abandonment of domestic animals in public places is an important social-environmental problem. It usually occurs due to irresponsible human attitudes, often because of the lack of knowledge of the fundamentals of responsible custody, which consists of veterinary treatment, adequate food and shelter supply (LIMA; LUNA, 2012). The abandonment of domestic animals is an environmental crime according to the Brazilian legislation, which characterizes this practice as mistreatment (BRASIL, 1988).

The presence of ownerless domestic animals on public roads is responsible for many problems for the citizens, as sanitation problems, traffic accidents, and zoonoses, such as leishmaniasis, rabies, ehrlichiosis, babesiosis, among others (LIMA; LUNA, 2012). Thus, the government should be responsible for the management of these animals in order to reduce the negative impacts on the environment and human health. Some municipalities have municipal kennels or Zoonoses Control Centers and Animal Welfare. These places are essential to promote educational

activities and adoption events, and also to provide veterinary assistance (IBGE, 2010). However, in the absence of government commitment, kennels are managed by not-for-profit organizations, which relies on private donation and volunteer work to take care of the animals.

The kennels provide an important service to the environment and public health because they reduce the occurrence of zoonoses (BARROSO *et al.* 2020). However, the kennels can also be responsible for negative environmental impacts, such as the contamination of soil and water due to incorrect disposal of solid waste and wastewater. Therefore, kennels should set up an effective environmental management system to improve their environmental performance.

Environmental management systems are important tools to promote continuous improvement and approach to environmental concerns, because they include the implementation of environmental impacts monitoring and control and also preventive and corrective actions, by investing in financial resources and infrastructure (INOUE *et al.*,

2013; SOUZA, 2020). Most kennels managed by not-for-profit organizations have difficulties in their environmental management, as volunteers and financial resources are scarce. The financial resources collected from private donations are mainly utilized in the animal's care.

Given this context, this work aimed to identify the environmental aspects and impacts of a kennel located in the south of Minas Gerais (Brazil). Additionally, it aimed to propose low-cost solutions for reducing significant environmental impacts, aiming to contribute to the environment and human health, besides the welfare of animals.

Material and methods

The studied kennel is located in the south of Minas Gerais. It consists of an area provided by the city hall and located away from the urban center, where eight dog stalls were built. Currently, there are 30 dogs in the kennel. The place does not have electrical power and it is supplied by groundwater. The kennel management is carried out by volunteers and it is funded by private donations. The maintenance activities occur once a day and they consist in feeding the animals and cleaning the stalls. Additionally, if necessary, prescribed pharmaceuticals are administered. The kennel does not have veterinary assistance, and the animals are taken to veterinary clinics for assistance on demand.

The proposed methodology of this work is summarized in the flowchart presented in Figure 1.

First, it was necessary to identify the maintenance activities of the kennel in which the environmental aspects and impacts were identified and assessed. For each activity, the authors identified the environmental aspects and, based on them, the impacts were assessed. The methodology for the assessment of the environmental impacts was adapted from Seiffert

Figure 1 – Methodology flowchart.
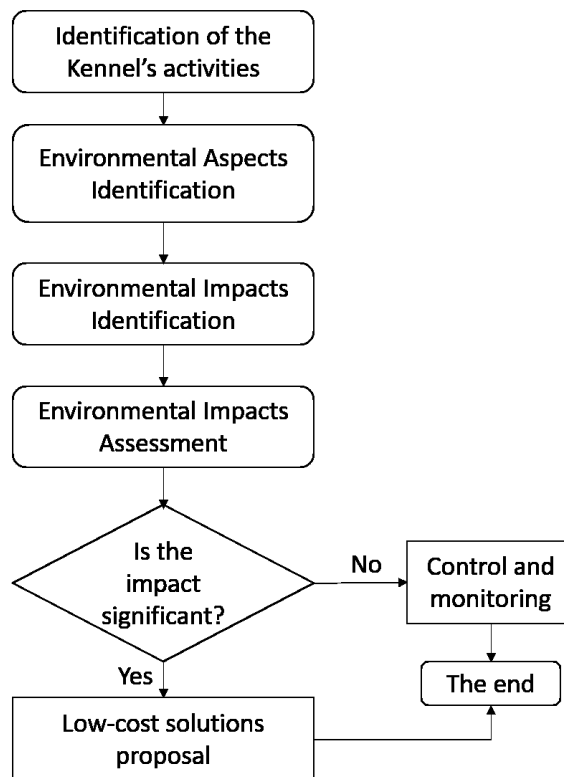
Source: Prepared by the authors (2021).

(2017) and is briefly described in the following. All environmental impacts were classified according to the scenario, incidence, class, consequence and frequency. The description of the criteria is shown in Table 1.

Regarding the consequence, Table 2 presents the criteria for the assessment of the environmental impacts according to scope (Local/Regional/Global) and severity (Low/Medium/High). The classification as low and high severity is related to environmental impacts with negligible potential magnitude and high magnitude, respectively. Environmental impacts which are not classified into these categories were classified as medium severity. A specific score was assigned according to both these parameters, as shown in Table 2.

Regarding the frequency, Table 3 shows the description and values assigned to each of the categories (Low/Medium/High).

Table 1 – Description of the criteria used to assess the environmental impacts.

Criterion	Description
Scenario	Normal (N): related to daily routine; Not normal (Nn): related non-routine activities; Emergency (E): related to unplanned situations.
Incidence	Controlled by the organization (SC); Influenced by the organization (SI).
Class	Positive (P) and Negative (N) impacts.
Consequence	Classification based on the impact's scope and severity.
Frequency	Low (less than once a month); Average (more than once a month); High (daily).

Source: Seiffert (2017).

Table 2 – Classification of the environmental impacts according to the scope and severity.

Scope/Severity	Local	Regional	Global
Low	20	25	30
Medium	40	45	50
High	60	65	70

Source: Seiffert (2017).

Table 3 – Classification of the environmental impacts according to the frequency

Frequency	Description	Score
Low	The aspect occurs less than once a month.	10
Medium	The aspect occurs more than once a month.	20
High	The aspect occurs daily.	30

Source: Adapted from Seiffert (2017).

Table 4 - Classification of the environmental impacts according to the sum of the scores obtained in the consequence and frequency categories.

Classification	Score
Negligible (N)	Total Score ≤ 50
Moderate (M)	50 < Total Score < 70
Critical (C)	Total Score ≥ 70

Source: Adapted from Seiffert (2017).

Furthermore, the impacts were classified according to the sum of the scores from the previous categories, as shown in Table 4.

Finally, the environmental impacts were assessed according to their significance. Negligible environmental impacts were classified as not significant, as well as critical impacts were considered significant. Moderate environmental impacts were classified as significant if they are related to a legal requirement. Thus, federal and Minas Gerais' legislation was consulted. Municipal legislation was not considered in this work. For the significant environmental impacts, low-cost solutions were proposed to reduce those impacts, given the financial resource limitations of the kennels.

Results and discussion

Table 5 shows the identification of the environmental aspects and the classification of the impacts, according to the criteria: scenario (SCE), incidence (INC), class, consequence (CONS), and frequency (FREQ).

Table 5 – Identification of the environmental aspects and classification of the impacts resulting from the kennels' activities.

Activity	Aspects	Impacts	SCE	INC	CLASS	CONS	FREQ	Classification	Significance
Stalls cleaning	Water consumption	Use of non-renewable/scarce natural resources	N	SC	N	Low/Local (20)	High (30)	Negligible	Not significant
	Wastewater generation	Water and soil pollution	N	SC	N	Medium/Regional (40)	High (30)	Critical	Significant
	Use of cleaning products	Use of non-renewable/scarce natural resources	N	SC	N	Low/Local (20)	High (30)	Negligible	Not significant
	Packaging generation	Reduction of landfills life-expectancy	N	SC	N	Low/Local (20)	Medium (20)	Negligible	Not significant
	Animal feces production	Soil pollution	N	SC	N	Medium/Regional (40)	High (30)	Critical	Significant
	Animal feces production	Water pollution	N	SC	N	Medium/Regional (40)	High (30)	Critical	Significant
	Animal feces production	Diseases spread	N	SC	N	High/Regional (65)	High (30)	Critical	Significant
Dogs feeding	Dog food consumption	Use of non-renewable/scarce natural resources	N	SC	N	Low/Local (20)	High (30)	Negligible	Not significant
	Dog food waste and packaging generation	Water and soil pollution	Nn	SC	N	Low/Local (20)	Low (20)	Negligible	Not significant
Veterinary assistance	Medicines consumption	Use of non-renewable/scarce natural resources	N	SC	N	Low/Local (20)	Medium (20)	Negligible	Not significant
	Veterinary assistance	Diseases spread reduction	N	SC	P	High/Regional (65)	Medium (20)	Critical	Significant
	Medicines packaging generation/ expired or unused medicines disposal	Water and soil pollution	N	SC	N	Medium/Regional (40)	Medium (20)	Moderate	Significant
	Carcass disposal	Water and soil pollution	Nn	SC	N	Medium/Regional (40)	Low (10)	Negligible	Not significant

Source: Prepared by the authors.

Regarding the stall cleaning, the following environmental aspects were identified: water consumption, wastewater generation, use of cleaning products, packaging generation, and animal feces production. The environmental impact resulting from water consumption is the use of natural resources and it was classified as not significant. Although the cleaning of the stalls occurs daily, the amount of water used in this activity is approximately the average daily human consumption (about 200 liters per inhabitant/day, in medium-sized cities) (SPERLING, 2005).

The aspects 'use of cleaning products' and 'packaging generation' were also classified as not significant, as the kennel uses the same type and number of products (soap and chlorine) used on household cleaning. Additionally, the aspect 'dog food packaging generation' was classified as not significant because this waste is classified as non-hazardous (ABNT, 2004), hence, it should be destined for recycling. The kennel must control and monitor these not significant impacts.

Another environmental aspect related to the cleaning of the stalls is the wastewater generation, which can provoke soil and water pollution. The discharge of wastewater is one of the main water pollution sources and wastewater treatment is essential to reduce its environmental impacts. The protection of water resources is a global concern and a sustainable development goal (CAMPOS *et al.*, 2020).

The kennel's wastewater is composed of animal feces and urine, and dog food residues. In addition, the kennel's wastewater contains cleaning products used in the maintenance of the stall. Souza (2015) analyzed the wastewater of the Parque Francisco de Assis (PFA) kennel, which is located in the urban area of Lavras (Minas Gerais). Table 6 shows the average values of the measured parameters and provides a comparison with Minas Gerais legislation.

According to Table 6, as expected, the wastewater measured parameters are not in accordance with the Minas Gerais legislation. A low-cost alternative for wastewater treatment is a septic tank followed by an anaerobic filter. The septic tank (FIGURE 2) is responsible for removing floatable materials. The sludge volume deposited at the bottom of the tank is continuously reduced by anaerobic digestion. The anaerobic filter (FIGURE 3) is responsible for removing BOD since the microorganisms

Table 6 – PFA kennel wastewater characterization (SOUZA, 2015) and comparison with Minas Gerais current legislation.

Parameters	PFA Wastewater 2	Legislation[1]
BOD (mg/L)	189	< 60 mg/L
COD (mg/L)	612	< 180 mg/L
pH	7,2	6 - 9
Total Solids (mg)	926	-
Suspended Solids (mg)	313	< 100 mg/L
Nitrogen (mg/L)	165	-
Phosphorusr (mg/L)	92	-
Total coliforms (MPN 100/mL)	$2{,}06 \times 10^{12}$	-
Thermotolerant coliforms (MPN 100/mL)	$1{,}73 \times 10^{12}$	-

[1] Deliberação Normativa Conjunta COPAM/CERH-MG nº 1, de 5 de maio de 2008 (Minas Gerais, 2008); 2(SOUZA, 2015). Abbreviations: BOD (Biochemical Oxygen Demand); COD (Chemical Oxygen Demand); pH (Hydrogenic Potential); NMP (Most Probable Number).
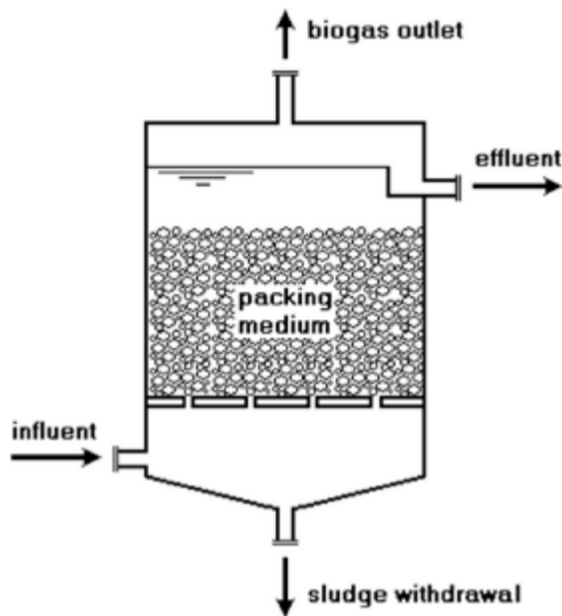
Source: Prepared by the authors (2021).

attached to the support material degrade the substrate contained in the sewage flow (SOUZA, 2015; SPERLING, 2005).

Figure 2 – Schematic representation of a single-chamber septic tank.
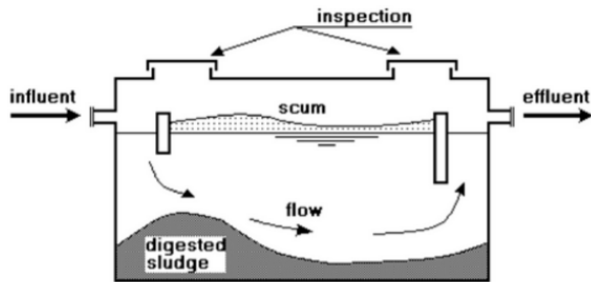
Source: Adapted from Sperling (2005).

Figure 3 – Schematic representation of an upflow anaerobic filter

Source: Adapted from Chernicharo (2001).

Compared to aerobic technologies, the proposed treatment system is less efficient. Despite that, this system has been widely used in small rural communities, due to its low construction and operation costs. Furthermore, the sludge production is low and the system achieves good sludge stabilization, which eliminates the need for sludge treatment units.

Like other anaerobic systems, operational control is essential to avoid bad smells (SPERLING, 2005). The constructive simplicity and low operational costs were the main parameters to choose this treatment system due to the limited financial and human resources of the studied kennel. The use of cleaning products, especially composed of chlorine, could jeopardize the performance of the biological treatment system, therefore, it is necessary to further investigate this scenario.

The daily production of feces is about 40 liters. Currently, the feces are directly disposed on the soil. Besides soil pollution, the incorrect disposal of feces can be responsible for disease spread. As the feces production occurs daily, the resulting impact water and soil pollution was classified as high frequency, regional scope and, medium severity, and the impact disease spread was classified as high frequency, regional scope, and high severity since the diseases spread might be irreversible.

Visceral leishmaniasis, for example, is considered by the World Health Organization (WHO) as one of the five diseases that have been neglected, besides its priority for elimination. Ten countries were responsible for 95 % of cases in the world in 2018, including Brazil, which is responsible for 96 % of cases in the American continent (WHO, 2020; PAHO, 2018). Visceral leishmaniasis is a concerning disease, caused by a protozoa parasite of the Leishmania genus. In urban areas, domestic dogs are the main reservoir. The main vector of visceral leishmaniasis is the phlebotomine sandfly, also known in Brazil as "mosquito palha", "tatuquiras", "birigui", among others. Sandflies require a humid microclimate in order for their eggs to develop and larvae need a cool, moist habitat with decaying debris, such as the cells where the feces are currently disposed of (BRASIL, 2006).

The incorrect disposal of animal waste has been an environmental problem due to soil

and water pollution (LIMA; LUNA, 2012). The implementation of a biodigester system could be a low-cost alternative for the correct disposal of the dog's waste, preventing soil and water contamination (OLIVEIRA; PROENÇA, 2021).

A biodigester system is composed of an inlet box – where the substrate is deposited and the biogas is produced – and of an outlet box for the gas and the biofertilizer (PINTO, 2008). The airtight structure ensures that the biogas released from the organic matter digestion is stored and, also, provides an anaerobic atmosphere, preventing the oxygen to enter the system (OLIVEIRA; PROENÇA, 2021). Thus, the biodigester is fed with organic matter, such as animal feces, and it is decomposed by micro-organisms to produce biogas and other material that is mainly used as fertilizer (SALES FILHO, 2014).

Therefore, biodigester is an alternative for the correct disposal of animal waste in the kennel, preventing soil and water pollution and disease spread. Besides low construction and operational cost, other advantages of the biodigester are its operational simplicity, the removal efficiency of pollutants, organic matter, and pathogens, long useful life, and it is possible to control the bad smells (ANGONESE *et al.*, 2007; JORGE, 2004).

The environmental aspects '*medicines packaging generation and expired or unused medicines disposal*' were classified as moderate. However, the resulting environmental impact was classified as significant because there is federal legislation about the subject. Thus, control measures are necessary to reduce the possible environmental impacts.

Currently, there is no usual procedure in the kennel for the correct disposal of unused and expired medicines, as well as their packaging. Pharmaceuticals can be responsible for adverse effects to the environment depending on their composition and then they should be correctly disposed of to avoid environmental and human

health risks, and the pollution of water and soil compartments (SILVA, LEÃO, 2019).

The Federal Decree No. 10,388 (2020) points out the need for a reverse logistic system in Brazil for the unused and expired medicines, as well as their packaging, and establishes that municipalities with a population of 100,000 inhabitants or more must have medicine collection points in their drugstores. After collection, distributors are responsible for transporting the waste to a temporary storage location. Finally, manufacturers and importers are responsible for transporting the waste to the environmentally suitable destination, that is, incineration, co-processing, or class I landfill. Also, according to the decree, the person responsible for returning expired or unused medicines to collection points is the consumer, which implies that kennel volunteers should return the unused medicines to the nearest collection point (BRASIL, 2020). The Decree does not include veterinary medicines. However, most of the pharmaceuticals used in veterinary treatment are also human medicines. Thus, this simple procedure would already reduce the possible environmental impacts resulting from the incorrect disposal of medicines.

Finally, it is noteworthy that the kennel provides an important environmental service by controlling the diseases spread, such as leishmaniasis, distemper, and rabies, which can cause severe social and public health problems. Therefore, zoonose control in the kennel is essential to avoid the spread of these diseases to other animals and humans and it occurs by means of animal's basic care, such as veterinary assistance, and dog feeding. Additionally, annual animal vaccination is essential for zoonose control. Currently, the dogs get rabies and V10 vaccines, which protect them from distemper, parvovirus, coronavirus, adenovirus, parainfluenza, canine infectious hepatitis, and 4 types of leptospirosis (MINISTÉRIO DA SAÚDE, 2016). The dog's health is also observed daily (MINISTÉRIO DA

SAÚDE, 2016). The cleaning of the kennel is also essential for preventing disease spread. Cleaning and disinfection must occur periodically. The studied kennel is cleaned daily.

From a biocentric point of view, the kennel is essential to provide a better quality of life to ownerless animals. Many rescue dogs live on the streets, where they can be run over or mistreated victims. The kennel provides food and potable water, shelter, and veterinary assistance. Additionally, these animals have the possibility of being adopted by responsible tutors in the adoption events.

Conclusion

This work identified and assessed the environmental aspects and impacts of a kennel located in the south of Minas Gerais. The cleaning of the stalls and veterinary assistance activities were responsible for the significant environmental impacts, which are related to the aspects: wastewater generation, animal feces production, and unused and expired medicines disposal. These environmental aspects can be responsible for water and soil pollution, besides diseases spread. At the same time, the kennel provides an important environmental service by means of the animal's health care, which reduces the zoonoses spread. In order to reduce the environmental impacts, it was proposed the construction of a septic tank followed by an anaerobic filter for wastewater treatment, and a biodigester for animal feces disposal. The unused and expired medicines, as well as their packaging, should be returned to the closest collection point at drugstores, according to the federal decree.

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