Environmental Audit in the Solid Waste Collection Process in Military Organizations of the Brazilian Air Force

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This study proposes an environmental audit method for the solid waste collection process in Military Organizations of the Brazilian Air Force and the its improvement. Likewise, performing a comprehension of environmental management in the armed forces (Brazilian Air Force) focusing on managing solid waste and emphasizing the importance of environmental auditing in solid waste collection. This work brings critical social aspects, such as environmental management, to the FAB (Brazilian Air Force, *Força Aérea Brasileira in Portuguese - FAB*). The study is a documental analysis with a checklist application from *in loco* visits for observation, registration, and information collection in the GSAU-SV of BASV (Health Group of Salvador Air Base). We observed that GSAU-SV developed multiple environmental practices to manage its solid waste correctly. However, it does not have a structured Solid Waste Management Plan or disclose its actions. From the analysis of the application of the environmental audit in the GSAU of BASV, we concluded that, despite the non-mandatory nature, the execution of this practice by the Military Organizations must be stimulated.

Keywords: Brazilian Air Force. Solid Waste. Environmental Auditing.

Introduction

Barata and colleagues [1] presented that implementing environmental management in public agencies establishes a new institutional culture. It mobilizes employees to optimize resources, fight waste, and improve work environment quality.

In this context, adopting environmental criteria in administrative and operational activities is a process of continuous improvement that consists of adapting environmental effects to the policy of preventing negative impacts on the environment [2-4].

Maranhão [5] emphasizes the importance of public organizations' participation in the process of socio-environmental responsibility. It encourages the insertion of sustainability criteria in their activities and integrates social and environmental actions with the public interest.

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Therefore, military organizations must implement methods and tools capable of verifying the environmental impacts of their activities on the environment. Moreover, environmental audits have become increasingly frequent since their process culminates in environmental certification for the organizations, which proves their degree of environmental awareness and commitment to society.

The main objective of this research is to propose an environmental audit method for solid waste collection in Military Organizations of the Brazilian Air Force and possible improvements of this process.

Therefore, our specific objectives were performing a comprehension of environmental management in the armed forces (Brazilian Air Force) focusing on managing solid waste, emphasizing the importance of environmental auditing in solid waste collection, and highlighting the importance of environmental auditing in solid waste collection.

This study brings critical social aspects, such as environmental management in the FAB (Brazilian Air Force), and multiple reflection on humanitarian and environmental contributions.

We did a literature review and document analysis, performing a study in the GSAU-SV of

BASV (Health Group that provides health care to active military, reserve, and their dependents from the Salvador Air Base). We applied a checklist from *in loco* visits and observed the areas of collection, handling, and storage of waste, from the sections of the GSAU-SV, with registration and information collections.

Environmental Management in the Armed Forces

The Brazilian armed forces consist of the Army, Navy, and Brazilian Air Force, whose missions are to ensure law and order and preserve the exercise of state autonomy and the indivisibility of the Federation [6].

Maranhão [5] describes that the Armed Forces, despite their constitutional purpose, have been adopting proactive policies towards the environment throughout time, either by developing a mentality embodied in the environmental legislation in force or by operational conditions.

Therefore, aligned with national interests, the Army contributes to preserving the environment through prevention and environmental protection actions. These actions also include keeping an Environmental Management Plan in its space destined for activities in areas under the Army's jurisdiction [7].

Based on the Brazilian Standard (NBR) ISO 14.000, in 2002, the Navy promoted the implementation of the Environmental Management System (SGA) in all land-based Military Organizations (OM) to that achieving legal compliance and the minimization of environmental impacts resulting from their activities [5,8].

This environmental awareness is old, with reports since the time of the Brazilian Empire about preserving waters by controlling pollutants generated by ships [9].

In 1920 there was the first documental record of military legislation caring for the environment through the Ministry of War, about regulating and disciplining the use of natural resources of the Instruction Camps in Rio de Janeiro [10].

Since then, Brazilian legislation has approved Environmental Management Policies that involve planning, execution, and evaluation of environmental patrimony [11].

Environmental Management in the Brazilian Air Force

The Brazilian Air Force (FAB) has always been concerned with environmental management. Resolution RCA 12/-1/2014 has associated sustainability in the military context with project executions, such as in educational activities and actions against deforestation and using solar energy in military properties [12].

The exercise of environmental management, allied with the need to promote the better performance of personnel working in this area, has highlighted the importance of a normative instrument, which brings together all the specific legislation and establishes to users the applicable procedures to each situation [13].

The Air Force Infrastructure Directorate (DIRINFRA) created the Environmental Management Advisory (AGA) to advise on the normatization, planning, coordination, and control of activities related to the environment under the competence of DIRINFRA and its subordinate organizations and to provide measures for sustainability and environmental actions. In this sense, DIRINFRA began the implementation of the environmental management principles in military activities through the creation of the Environmental Management System of the Aeronautics Command (SISGA), approved by Ordinance n°1.447/GC3 of September 19, 2018 [13].

According to the Ministry of Defense Planning for Environmental Management [14]:

- In 2017, the Defense Green Book was implemented to raise awareness of those who are somehow part of the Brazilian Armed Forces and understand environmental preservation practices.
- In 2018, the Environmental Management System of the Aeronautics Command was instituted according to Ordinance No. 1.447/GC3.

- Technical and environmental standards of Ordinance No. 168/GC3 published in BCA No. 019 were approved on February 04, 2019, with instructions on Environmental Control and Management within the scope of the Aeronautics Command. Due to this fact, the Manual for Environmental Practices in Brazilian Air Force Military Organizations was prepared. The manual contains sustainability options for environmental management, such as energy resource management, solid waste, recycling, and bidding.
- In 2020, the Directorate of Infrastructure of the Air Force published OT nº 001/DGA/2020 on the Guidelines about the Declaration of the Military Character of activities and enterprises destined for the preparation and employment of the Armed Forces, followed and approved in 2021 by the Ministry of Defense of the Aeronautics Command.

Solid Waste Management

The National Policy on Solid Waste (PNRS), established by Law 12.305/2010, defines solid waste as all materials, substances, objects, or discarded goods resulting from human activities in society, whose final disposal happens in solid or semi-solid states, as well as gases contained in containers and liquids whose particularities make it unfeasible to launch them into the public sewage system or bodies of water or require solutions technically or economically unfeasible given the best available technology, aiming at reuse, recycling, and treatment of these wastes [15].

The goal of the PNRS starts with the non-generation of waste that encourages the reuse, recycling, and composting associated with the maintenance of green areas and recovery of agricultural areas with educational programs [16].

Solid Waste Management encompasses the strategies and sustainable technological and operational aspects relating to the prevention, reduction, segregation, reuse, packaging, collection, transportation, treatment, energy recovery, and final disposal of solid waste based on current standards and legislation [17].

Strategic decision-making regarding institutional, administrative, operational, financial, and environmental aspects are activities inherent to the waste management of an organization [4].

Solid Waste Management

Waste management improves production yield and reduces costs with raw materials, inputs, reagents, treatment, and final disposal in an organization since the amount of waste generated decreases [4].

Through a Waste Management Program (WMP), public or private establishments must comply with the PNRS law by putting into practice the direction of the waste generated and maintaining the separation of recyclables and organics [18].

Proficient personnel must monitor the final destination of solid waste by determining its characteristics and packaging when necessary for performing the management plan [16].

Despite all the efforts for solid waste management, the PNRS faces challenges due to the low adherence of some organizations in designating their waste, accumulating it in landfills, and without incentive to recycling companies and formalized collectors [19]. The damages caused by the lack of environmental management result in water pollution, air pollution by burning, and problems with animal waste, which affect the environment and population health (20). Correct waste management involves the implementation of the 3Rs of sustainability: reduction at source, reuse, and recycling, to reduce and continuously improve the management system, considering the product life cycle, modifications and innovations in the process, using cleaner technologies [5].

Environmental Auditing

The environmental audit is a process of environmental performance evaluation associated with an organization's environmental management, checking the positive and negative points generated

by the environmental impact. These points are evaluated with criteria through records relevant to the facts, indicating compliance or not, pointing through the PNRS and environmental management procedures for improvements [21].

The audits can be periodic or sporadic and internal or external, as in the case of those contracted by insurance companies [22].

La Rovere and colleagues (2008) compare the environmental audit and the medical examination. For them, the environmental audit is the examination that the doctor (auditor) makes of their patient (organization) to verify health status (environmental performance) and may be applied periodically or eventually in case of suspicion of some dysfunction in the body (organization), being specific to a particular body organ (some sector of the organization) or general (covering all sectors of the organization).

According to ABNT [23], audits can be divided into three parts: the first part or internal, when the organization itself makes the performing; the second part or external, when performed by interested parties; and the third part is also external, when performed by independent audit organizations, usually when there is interest in certification.

Listing internal audits are classified as environmental performance and environmental certification that evaluate the conformities to obtain a system certification established by the organization's standards, having its interest in those matters that affect the economy [24].

As an example of the external audit, legal compliance environmental audits are those applied by governmental legislation, which compulsorily evaluates the situation in which the organization finds itself according to the legislation in force [21].The audits ultimately encourage organizations to follow the guidelines set forth by the Environmental Management Guidelines so that it is a tool for monitoring, and the entire process is documented through a diagnosis made by a technician for evaluation and solutions in cases of environmental damage [25].

Materials and Methods

This research was developed in an OM of the Brazilian Air Force due to the wide range of activities performed by the military that, in many aspects, can be similar to companies or industries in the private sector. This type of research facilitates the understanding of the investigated phenomenon. In this case, a single case with participant observation was chosen due to the nature and magnitude of the phenomenon [26].

For the exploration of the theoretical referential, a bibliographic and documental survey was used, based on the databases: Central Online Content of the Brazilian Air Force, Scielo (Scientific Electronic Library Online), books, scientific articles from websites, scientific journals, and institutional publications, using a set of keywords: military organizations, Brazilian Air Force, environmental management, waste management, solid waste, and environmental audit and for operationalization of the research was structured, from the literature review, visits to the OM facilities, with direct observation of the formal and informal type.

The formal observation included participation in a meeting pertinent to Environmental Management issues. Informally, the handling of waste, the waste storage area, the sectors that produce waste, and the execution of training sessions were observed with the application of a form – Checklist, which consists of a list of requirements in an orderly and systematic manner with closed questions prepared by the researcher and with alternative answers from what was assessed: compliant, non-compliant, and partially compliant. The classification of conformity had as a criterion the normative document the PGRSS (*Plano de Gerenciamento de Resíduos do Serviço de Saúde do* GSAU-SV), without delimitation of severity according to the deviation.

The Military Organization selected for the study was the Salvador Health Group of the Salvador Air Base, which has the purpose of providing health care services, functioning as a polyclinic and 24-hour emergency service to active and reserve military personnel and their dependents of the

Salvador Air Base, with the mission of providing continuous improvement, quality of care and user satisfaction.

Results and Discussion

Environmental Description of the Salvador Health Group (Gsau-Sv) - Salvador Air Base (BASV)

BASV, Salvador Air Base, together with GSAU-SV, Salvador Health Group, previously called ES, Health Squadron, (Health Group that provides health care to active and reserve military people and their dependents from the Salvador Air Base) was created on November 5, 1942, to support anti-submarine warfare actions along the Brazilian coast. The Santo Amaro de Ipitanga field, in which the Salvador Air Base is located today, was built on a site surrounded by small sand elevations interspersed with vegetation over swampy and marshy areas, situated between the Joanes and Ipitanga Rivers, responsible for about 40% of the water supply to the metropolitan region of Salvador. The land belonged to a local farmer, who served as a mediator for the works and authorized the AirFrance airline operation at the Santo Amaro de Ipitanga Aerodrome and its operation permit, granted by the then Minister of Transportation and Public Works.

The Salvador Health Group (GSAU-SV) at BASV develops several activities in three macro health areas: Dentistry, with specialties in dentistry, endodontics, pediatric dentistry, orthodontics, periodontics, and dental prosthesis; medicine, with specialties in cardiology; general surgery; general practice; neurology; ophthalmology, and pediatrics, besides complementary services with pharmaceutical and laboratory assistance in the clinical and radiological analysis, as well as physical therapy, speech therapy, nutrition, and 24-hour emergency service.

From the delimitation of the macro areas mentioned, it was possible to identify that the GSAU-SV produces the following types of solid waste: common solid waste, chemical solid waste, biological solid waste, and sharp solid waste. Thus, the Solid Waste Management Plan (SWMP) must be prepared, updated, and executed, ensuring that all waste is managed appropriately and safely. In the GSAU-SV, there is not a PGRS; however, there is the PGRSS project (Programa de Gerenciamento de Resíduos de Serviços de Saúde – PGRSS) under construction, and within this project, there is a normative document, already in partial execution, which is the PGRSS Action Plan with the description of the PGRSS responsibilities, of operational capacity, organizational chart, generating source, classification of waste generated/ segregation/conditioning, determination of indicators and training of the PGRSS work team in the implementation phase of the activities to be sent to the competent bodies, in order to have an opinion approved and to start the PGRSS.

Audit

Based on the literature review and visits to the GSAU-SV facilities, a Checklist (Table 1) was developed and applied to evaluate conformities, non-conformities, and partial conformities within the Salvador Health Group - GSAU-SV activities.

After the results obtained with the checklist implementation, the conformities, non-conformities, and partial conformities found about the management of solid waste were pointed out. Despite not having an Environmental Policy and having the PGRSS project under construction, it is possible to evidence some strong points about environmental aspects: the existence of an internal procedure for waste sorting discussed, with technical criteria, for example, the fact of performing the sorting with a responsible person.

Legal Requirements

The strengths evidenced were: the existence of a procedure to identify the waste-generating sources with the person responsible for the waste sorting; the procedures make competent people responsible for determining the application of the legal requirements to the environmental aspects. It

Table 1. Ckecklist applied to Salvador Health Group - GSAU-SV.

Requirement Measured	Complies	Not Compliant	Partially Compliant
The collectors are in a good hygienic condition	x		
Collectors are easy to transport	x		
The collectors in the area of preparation and storage of medications in the emergency room have a lid (without manual operation)	x		
There is a segregation / selective waste collection program		x	
There is some employee training concerning waste management			x
There is a PGRS		x	
The GSAU-SV has flowcharts regarding solid waste generation, storage, and location		x	
There are Operational Programs that discipline the collection, handling, and storage of solid waste			x
The waste storage areas have adequate signage, protection systems, and labeling		x	
The GSAU-SV has a control register of solid waste volume generation according to quantity, characteristics, and class			x
There are waste minimization practices and/or programs	x		
There is a labeling system for solid waste generation	x		
There is a sector responsible for the management of solid residues	x		
There is an Environmental Policy		x	
All employees and collaborators know the legislation about Solid Waste Management		x	
All GSAU_SV employees and collaborators are aware of the Environmental Policy		x	

Source: Adapted from references [27-29].

was also found that the waste-generating sources are in good hygiene and are easy to transport, as determined by the current legislation. There is a control of the chemical, biological, and sharp-edged solid waste output (external collection by an outsourced company with an environmental license), containing the date, time of the output, people responsible for the transportation, the typology of the waste, and weighing.

Objectives, Goals, and Environmental Practices to Minimize Solid Waste

There is a PGRSS Commission, formed earlier this year, which works together with the GSAU-SV management to adopt the necessary measures to reduce the amount of waste generated within the sectors of the unit, ensuring good waste management.

Partial Conformities

We evidenced that there is the qualification/training of the hygiene employees regarding the collection, handling, and storage of residues not reaching all the unit professionals. Another point of partial conformities is a register to control the generation of solid waste volumes: biological, regular, and sharps, according to the quantity and characteristics, not covering all the waste produced in the unit.

Non-Conformities

We identified the inexistence of a PGRS, besides the PGRSS, which is under construction, that contemplates the information contained in the norm, likewise all the environmental legislation that is the basis for the issue of Solid Waste in the sector responsible for waste management; the inexistence of an Environmental Policy, as well as the understanding of all professionals of the importance of this policy and the knowledge of the legislation on solid waste management by all military professionals and servers of the unit; the lack of record of training on the themes related to the Management and Management of Solid Waste; inexistence of a segregation program, selective collection, donation of recyclables, as well as the issuing of a final destination certificate by the company responsible for the external collection of chemical, biological and sharp-edged waste, as supported by the norms, RDC and legislation; absence of adequate labeling, protection system and signage in the waste storage area; lack of a solid and critical Environmental Education Program, in accordance with the activities developed by GSAU-SV; the lack of flowcharts of the various types of waste identified since the generation, storage and location of solid waste during the environmental characterization of GSAU-SV.

Suggested Improvements

- Perform classification by class, segregation, and selective collection of solid waste produced by the GSAU-SV, which may be recyclable, through the adoption of composting practices or other viable forms of reuse.
- Environmental Education campaigns must be carried out to manage solid residues and administrative activities adequately. Training must be applied at all levels and for all military and civilian employees.
- Waste flowcharts must be prepared and posted at their respective generating sources.
- Regarding the transportation and disposal of hazardous or non-hazardous solid waste, the unit must request the company responsible for the external collection, besides the Waste Transportation Manifest (MTR), the subsequent return of the Final Disposal Certificate.
- To increase the environmental awareness of the military and civilian collaborators, posters must be made and fixed near the waste collectors, informing their functionalities and recyclability when implemented (Figure 1).

Conclusion

The method for implementing an environmental audit for the solid waste collection process in the Military Organization (GSAU-SV of BASV)

Figure 1. Identification of waste types for segregation of recyclable material source [30].

proved to be an adequate and efficient tool for environmental protection since it has the function of verifying possible violations of environmental standards that result in the minimization of environmental impacts. The tendency is that its use increases increasingly due to the urgent need to put sustainable development into practice, as currently discussed by society.

It was observed that the GSAU-SV of BASV develops environmentally good practices for correctly managing its solid waste. However, it does not have an Environmental Policy or a Solid Waste Management Plan, so essential to improving the control of waste generation directly from the generating source and, consequently, reduce waste, avoid significant environmental pollution and its consequences for public health and the environment, nor does it disclose to its public its actions and/or practices of environmental protection.

Because of the above, and based on the results obtained from the analysis of the application of environmental auditing in the GSAU- SV of BASV, it is also concluded that, despite not being mandatory, the implementation of this practice by Military Organizations should be encouraged. Thus, those organizations that have not yet implemented it should use it because it is a management tool for the preservation and protection of environmental resources, with immediate results, and such an initiative reveals in practice the manifestation of the principles of cooperation, prevention, and environmental information, capable of generating benefits such as meeting regulatory requirements, improving the institutional image and environmental management controls, with the consequent reduction of costs and increase of profits, generating social and environmental responsibility, thus avoiding penalties such as fines, notifications, sanctions and/or lawsuits.

We highlight that the results obtained cannot be generalized because the research strategy used was a single case study, whose conclusions represent only the reality of the Military Organization analyzed. Thus, it is suggested to expand the scope of the research, covering a more significant number of Military Organizations, or even conduct new research to identify other procedures and deepen the environmental auditing techniques applied by a group of Military Organizations.

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