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AN ANALYSIS OF WASTE MANAGEMENT IN THE MECHANICS LABORATORIES OF IFFLUMINENSE – MACAÉ CAMPUS

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ABSTRACT

Adequate waste management contributes to environmental conservation, in this sense, the laboratories of Educational Institutions carry out various activities that generate waste that, if not properly managed, can cause environmental damage. Thus, this work aimed to study the waste generated in the mechanics laboratories of the Fluminense Federal Institute – Macaé Campus, as well as the management process adopted, seeking to diagnose the current management processes and suggest improvements that can be implemented for better efficiency in the management of these types of waste. A field research was carried out, guided by the regulations that govern the area of waste management, and it was possible to identify the activities that generate waste, create an inventory of waste and a production profile of each laboratory. With this data, it was possible to point out problems in management and propose improvements in storage processes and documentation necessary for correct management.

Keywords: Laboratory. Mechanics. Waste Management. Industrial Waste. Analysis.

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INTRODUCTION

The proper management of waste from any human activity is of great importance for environmental conservation. According to El-Deir, Bezerra and Aguiar (2017), failures in waste management have the potential to affect both the environment and the population itself. Law 12.305, which institutes the National Solid Waste Policy (PNRS), meets this idea and defines that everyone has responsibility for the waste they produce through the concepts of shared responsibility for the life cycle of products, from the manufacturer to the final consumer and the integrated management of solid waste (Brasil, 2010).

When it comes to the management of solid waste produced by educational institutions, studies such as Micaroni (2002) have already shown that in this area, the generation of waste occurs mainly in teaching and research laboratories, generating less waste in terms of quantity, however, with characteristics similar to those found in industries, with a very large diversity of toxic substances varying according to the activity carried out in the respective laboratory, which makes the management of this waste, in many cases more complex than in industry.

For Marinho et al (2011), with the advances in discussions on the impacts of human activity on the environment, the lack of adequate management of waste produced by educational institutions in their activities carried out in laboratories becomes intolerable.

In this context, the main question that guided the present work was to understand: how does the production and management of waste take place in the mechanics laboratories of the Fluminense Federal Institute (IFF – Macaé Campus) and what can be done to improve?

LITERATURE REVIEW

LEGISLATION AND STANDARDS APPLIED TO WASTE MANAGEMENT

The National Solid Waste Policy brings principles and guidelines to be followed by all entities of society with regard to solid waste management. Its principles include prevention and precaution, the polluter pays, shared responsibility for the life cycle of products and cooperation between different spheres of society. Among its instruments are solid waste plans, environmental education, reverse logistics and solid waste inventory systems (BRASIL, 2010).

Regarding the classification of waste, ABNT NBR 10.004 and CONAMA Resolution No. 313 stand out, where the first classifies waste as class I - Hazardous or class II - Non-

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hazardous, with class II divided into class II A, composed of non-inert waste and class II B, composed of inert waste. The second, on the other hand, uses NBR 10.004 as a reference for the classification and coding of waste, but also brings additional coding and description for some wastes that are not addressed in the regulatory standard, in addition to elements for the preparation of a waste inventory (ASSOCIAÇÃO BRASILEIRA DE NORMAS TÉCNICAS, 2004; BRAZIL, 2002).

Regarding the storage of hazardous and non-hazardous waste, there are, respectively, the regulatory standards ABNT NBR 12.235 and ABNT NBR 11.174. Both standards establish guidelines to be followed when there is a need to store waste to wait for an adequate final destination, always taking into account the peculiarities of each class of waste (ASSOCIAÇÃO BRASILEIRA DE NORMAS TÉCNICAS, 1992; BRAZILIAN ASSOCIATION OF TECHNICAL STANDARDS, 1990).

The requirements on waste safety information are given by ABNT NBR 16.725, providing elements for the preparation of the chemical waste safety data sheet (FDSR) and labels for identification. The rule seeks to fill the existing gap due to the lack of technical regulation directed to the subject and bring a scope for the creation of the FDSR with sixteen mandatory sections, non-mandatory subtitles and free formatting. In the case of the label, two models are presented with guidelines for hazardous and non-hazardous waste (BRAZILIAN ASSOCIATION OF TECHNICAL STANDARDS 2023).

MATERIAL AND METHODS

It was sought to analyze the problem situation of the mechanics laboratories of the IFF - Macaé Campus with regard to the management of solid waste produced, carrying out a research of applied nature with a quantitative-qualitative approach, descriptive character, using action research as a method. According to Gerhardt and Silveira (2009), action research is characterized by the active participation of the researcher in the search for the resolution of the problem situation in which he is inserted.

Four laboratories were analyzed, namely the Mechanics and Adjustment Laboratory, the Welding Laboratory, the Hydraulics and Pneumatics Laboratory and the Mechanical Testing and Advanced Materials Laboratory (LEMMA). Such laboratories were chosen because, according to Rasma et al (2022), they have a varied production of waste and are within an area identified as lacking studies aimed at waste management.

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The initial step of this work generated an overview of all the waste that is produced in laboratories and the ways in which the generation and management processes take place. Therefore, a field survey was carried out during the second half of 2023, starting in July and lasting until December. At that time, visits were made to the laboratories to analyze the waste produced, all the infrastructure and the elements used in management. There was also participation in practical classes with the objective of understanding the activities carried out and how they contribute to the generation of waste.

The entire process mentioned above used as elements of comparison and guidance the recommendations available in the regulatory standards and resolutions that are cited later in this section, seeking to understand and point out what is in disagreement with the standards and create an overview that could be used to propose the elements of improvement.

As an instrument to assist in data collection, a table was elaborated that organized the information, taking into account the guidelines of CONAMA Resolution No. 313, and at the same time enabled the creation of a waste inventory. According to this regulation, for the control of industrial waste, it is essential to have an inventory, which is an instrument of waste management policies, and this must contain data on the classification, generation, quantities, storage, destination and coding of waste (BRASIL, 2002).

Thus, the table model, containing the information necessary for data collection and to generate an inventory based on what is stipulated in CONAMA Resolution No. 313, is presented below in table 1:

Frame 1: Waste Inventory Board Template

Waste	Classification	Local from Generation	Stored Quantity	Storage Method	Local Storage	Final Destination	Code Identification

Source: The Authors (2024)

ABNT NBR 10.004 was the standard used to classify the inventoried waste through the steps of the classification flowchart made available by it. Thus, the waste was classified as hazardous, class I or non-hazardous, class II A and class II B through the identification

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of its origins, comparison with the list of waste contained in annexes A and B of the standard and identification of its physicochemical characteristics.

The data on the place of generation, the forms and places of storage were detected through direct observations carried out in the field research and the amount of each waste was determined from a digital scale with a minimum capacity of 50 grams and a maximum of 150 kg. In the case of liquid waste or very light waste, but which occupies a large volume, the amount was stipulated in liters according to the volume of the container where it was stored.

The coding of the waste was done using a code composed of a letter followed by three numbers, following the criterion determined by ABNT NBR 10.004 itself in its annexes A, B, D, F and H and by CONAMA Resolution No. 313, which presents complements in relation to ABNT NBR 10.004.

With the previous phases carried out, it was possible through the classification of waste, to draw a generation profile of each laboratory because such information impacts the storage processes, guided by the standards ABNT NBR 12.235, ABNT NBR 11.174 and by Resolution No. 275/2001 of CONAMA.

As a final step, recommendations for improvements were made and documents were prepared, first for the process of storage and movement of waste, using the two NBRs mentioned above, as well as the resolution. With this, it was sought to create a model that brings a clear view of the elements necessary for the improvement of management. Following the same process, ABNT NBR 16.725/2023 was used to, in light of the panorama and gaps observed in the laboratories in relation to safety information, propose elements of improvement following the parameters established in the regulation in relation to the waste safety data sheet (FDSR) and labels.

RESULTS AND DISCUSSION

OVERVIEW OF LABORATORIES AND WASTE INVENTORY

Below is an exhibition of the laboratories, the activities that are carried out in them and the inventory of the waste produced:

- Mechanics and Adjustment Laboratory – Focuses on practical classes in the areas of material machining, using manual tools such as files, threading machines, signets, as well as machines such as saws, lathe and drill Such activities, due to the metal machining process, end up generating metal waste such as scrap,

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chips and metal dust that, depending on the situation, may be contaminated with oils, cutting fluids or even not be contaminated.

Waste from worn saws and files are also produced, as well as remains of abrasive discs, cutting discs, metal sandpaper, personal protective equipment (PPE) and waste oils and their packaging, from the lubrication of machines, in addition to other fluids used for lubrication and cooling of machining processes. The maintenance activity of these machines is also another responsible factor, especially for the generation of hazardous waste;

- Welding Laboratory – This laboratory is dedicated to welding activities, mainly using coated electrodes. It produces waste such as remains of coated electrodes, metal dust from the slag that comes off the weld, goggles, gloves, aprons, uncontaminated leather sleeves and leggings, which are the PPE used by students, teachers and technicians in practical activities. Metal scrap from welding activities and metal electrode boxes are also produced.
- Hydraulics and Pneumatics Laboratory - Performs practical activities aimed at the simulation of hydraulic and pneumatic circuits associated or not with electrical circuits. It has a small production of waste plastic hoses, electrical wires, lubricating oil, rubber belts and leftover cloths used in the cleaning of the oil resulting from the maintenance of the air compressor that is outside the laboratory and takes place every six months.
- Mechanical Testing and Advanced Materials Laboratory (LEMMA) - The activities carried out in this laboratory have varied characteristics, revolving around tests of materials that generate waste such as burlap and cloths contaminated with penetrating and developing liquids, PPE such as cotton gloves and goggles, as well as cutting fluid taken from the polycut saw, cottons contaminated with chemicals, non-recyclable polymeric resin, plastic containers and spatulas impregnated with polymer resin.

Figure 1 illustrates some of the waste produced in laboratories and their forms of storage, as detailed in Table 2:

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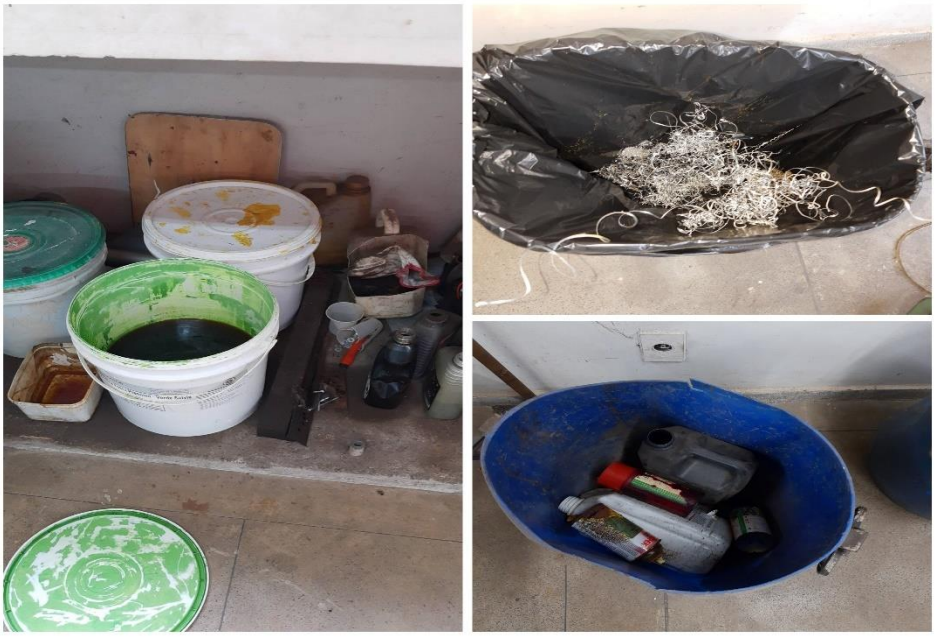
Figure 1: Waste and storage methods found



Source: The authors (2024)

Frame 2: Waste inventory

Waste	Classification	Spawn site	Stored quantity	Storage	Storage location	Final destination	Identification code
Used Lubricating Oil	Class I	Mechanics and Adjustment Lab; Hydraulics and Pneumatics Lab	50 Liters	Buckets and bottles	Mechanics and Adjustment Lab	Not ruled out	F130 (ABNT NBR 10.004)
Contaminated metal packaging (solvents, degreasing lubricants)	Class I	Mechanics and Adjustment Lab; LEMMA	1kg	Stored in a closet	Mechanics and Adjustment Lab	Common garbage	F104 (CONAMA Resolution No. 313)
Contaminated plastic packaging (oil, grease, cutting fluid)	Class I	Mechanics and Adjustment Lab; Hydraulics and Pneumatics Lab; LEMMA	2.5 kg	Stored in a closet	Mechanics and Adjustment Lab	Not ruled out	F104 (CONAMA Resolution No. 313)
Uncontaminated plastic packaging	Class IIB	Mechanics and Adjustment Lab; Hydraulics and Pneumatics Lab; Welding Lab; LEMMA	1.2 kg	Plastic trash can	Mechanics and Adjustment Lab; Hydraulics and Pneumatics Lab; Welding Lab; LEMMA	Common garbage	A207 (CONAMA Resolution No. 313)

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Contaminated metal chips (with cutting fluid, oil, and others)	Class I	Mechanics and Adjustment Lab; LEMMA	11.6 kg	Plastic bucket	Mechanics and Adjustment Lab	Not ruled out	D099 (CONAMA Resolution No. 313)
Used files	Class II B	Mechanics and Adjustment Lab	3.1 kg	Cardboard Box	Mechanics and Adjustment Lab	Common garbage	A004 (ABNT NBR 10.004)
Grinding and cutting discs	Class II B	Mechanics and Adjustment Lab; LEMMA	6.9 kg	Cardboard Box	Mechanics and Adjustment Lab	Common garbage	A099 (ABNT NBR 10.004)
Rubber straps	Class II B	Mechanics and Adjustment Lab; Hydraulics and Pneumatics Lab	1.1 kg	Stored in a Closet	Mechanics and Adjustment Lab	Common garbage	A008 (ABNT NBR 10.004)
Used saw blades	Class II B	Mechanics and Adjustment Lab	0.36 kg	Plastic bucket	Mechanics and Adjustment Lab	Common garbage	A004 (ABNT NBR 10.004)
Coated electrode tips	Class II B	Welding Lab.	9 kg	Plastic bucket	Welding Lab.	Common garbage	A099 (ABNT NBR 10.004)
Metal electrode housings	Class II B	Welding Lab.	3 kg	On the floor	Welding Lab.	Common garbage	A104 (CONAMA Resolution No. 313)
Sweeping residues containing dust and uncontaminated metal dust	Class II A	Welding Lab; Mechanics and Adjustment Lab	10 kg	Plastic bucket	Welding Lab. Mechanics and Adjustment	Common garbage	A003 (CONAMA Resolution No. 313)
Steel scrap	Class II B	Mechanics and Adjustment Lab; Welding Lab.	15.8 kg	Cardboard Box	Welding Lab.	Common garbage	A004 (CONAMA Resolution No. 313)
Welding Mask Plastic Chamois (Non-Recyclable)	Class II B	Welding Lab.	1.2 kg	Drawer	Welding Lab.	Common garbage	A007 (ABNT NBR 10.004)
Glass lenses for solder mask	Class II B	Welding Lab.	0.4 kg	Drawer	Welding Lab.	Common garbage	A117 (CONAMA Resolution No. 313)
Uncontaminated PPE (gloves, hoses, aprons, leggings, caps, goggles)	Class II B	Mechanical and Adjustment Lab; Welding Lab; LEMMA	11 kg	Plastic bag and carton box	Welding Lab.	Common garbage	A099 (ABNT NBR 10.004)
Contaminated PPE (cutting fluid, oil, grease and others)	Class I	Mechanics and Adjustment Lab	1 kg	Plastic trash can with foot pedal	Lab. Mechanics Adjustment Lab. Mechanics	Common garbage	D099 (CONAMA Resolution No. 313)
Metal sandpaper	Class II B	Mechanics and Adjustment Lab	0.3 kg	Stored in a closet	Mechanics and Adjustment Lab	Common garbage	A099 (ABNT NBR 10.004)

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Electrical wires and connectors	Class II B	Hydraulics and Pneumatics Lab	0.45 kg	Drawer	Hydraulics and Pneumatics Lab	Common garbage	A099 (ABNT NBR 10.004)
Plastic hoses	Class II B	Hydraulics and Pneumatics Lab	0.7 kg	Drawer	Hydraulics and Pneumatics Lab	Common garbage	A007 (ABNT NBR 10.004)
Cloth tows contaminated with cutting fluid, oil, grease and others)	Class I	Mechanics and Adjustment Lab; Hydraulics and Pneumatics Lab	4.3 kg	Plastic drum	Mechanics and Adjustment Lab	Common garbage	D099 (CONAMA Resolution No. 313)
Paper/Cardboard	Class II A	Mechanics and Adjustment Lab; Welding Lab; Hydraulics and Pneumatics Lab; LEMMA	2.1 kg	Plastic drum	Mechanics and Adjustment Lab	Common garbage	A006 (ABNT NBR 10.004)
Cutting fluid	Class I	LEMMA	40 Liters	Plastic drum	LEMMA	Not ruled out	F330 (ABNT NBR 10.004)
Polymer Plastic Resin	Class II B	LEMMA	0.7 kg	Cardboard Box	LEMMA	Common garbage	A007 (ABNT NBR 10.004)
Plastic bags and packaging	Class II B	Mechanics and Adjustment Lab; Welding Lab; Hydraulics and Pneumatics Lab; LEMMA	5 Liters	Plastic trash can with foot pedal	Mechanics and Adjustment Lab; Welding Lab; Hydraulics and Pneumatics Lab; LEMMA	Common garbage	A207 (CONAMA Resolution No. 313)

Source: The Authors (2024)

GENERATION PROFILE OF EACH LABORATORY

The varied production of waste presented in Table 2 both in terms of classes and type, i.e., metals, paper, glass and others, has a direct impact on the storage process. In this sense, CONAMA Resolution No. 275 establishes a color code to be used in waste storage and transportation containers with the objective of creating an easy-to-identify model with national validity and based on international standards (BRASIL, 2001).

Thus, the color profile of the containers, suitable for the waste of each laboratory, was outlined, as shown in Chart 3:

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Table: 3: Types of waste and the colors of their containers

Laboratory	Residue Type / Container Color					
	Plastic / Red	Paper & Cardboard / Blue	Glass / Green	Metal / Yellow	Hazardous Waste / Orange	Non-recyclable waste / Grey
Hydraulics and Pneumatics	Plastic bags and packaging	Paper and cardboard	-	Electrical wires	Used oil	Rubber straps
					Plastic oil packaging	
					Oil-contaminated tow	Hoses
Mechanics and Adjustment	Plastic bags and packaging	Paper and cardboard	-	Used files	Used oil	Grinding and cutting discs
					Contaminated plastic packaging	
				Saw blades	Contaminated cloth tows	Metal sandpaper
					Contaminated metal packaging	Rubber straps
				Steel scrap	Contaminated metal chip	Uncontaminated PPE
					Contaminated PPE	Sweeping waste
LEMMA	Plastic bags and packaging	Paper and cardboard	-	-	Contaminated metal packaging	Grinding and cutting discs
					Contaminated plastic packaging	Uncontaminated PPE
					Contaminated metal chip	Polymeric Plastic Resin
					Cutting fluid	
Welding	Plastic bags and packaging	Paper and cardboard	Glass lenses for solder mask	Coated electrode tips	-	Sweeping waste
				Steel scrap		Uncontaminated PPE
				Metal electrode housings		Welding Mask Plastic Chamois

Source: The Authors (2024)

RECOMMENDATIONS

During the field research, no guiding documents were found for the movement, identification and safety in the storage and management of waste.

Therefore, the following documents were developed: the Waste Storage and Movement Record Sheet, Waste Safety Data Sheet (FDSR), Label for Hazardous Waste

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and Label for Non-Hazardous Waste. Below, an explanation of the process of making them is presented and then they are presented.

The waste handling and storage record sheet was prepared in a way adapted to the characteristics of the laboratories, therefore, it was sought to create a document where the information about the waste could be described in a way that can be known about its types, classification, generation laboratory, storage laboratory, input and output quantities and final destination. Such data are among the flaws found in the field research and meet the recommendations of ABNT NBR 12.235 and ABNT NBR 11.174.

FDSR followed the steps of the sixteen sections required by the standard, which are product and company identification, hazard identification, composition and ingredient information, first aid measures, firefighting measures, spill or leakage control measures, handling and storage, exposure control and personal protection, physical and chemical properties, stability and reactivity, toxicological information, ecological information, final destination considerations, transportation information, regulatory information, and other information.

According to ABNT NBR 16.725, Brazilian Association of Technical Standards (2023), the FDSR information can be filled out based on the Chemical Product Safety Data Sheet (MSDS) prepared and made available by manufacturers. Therefore, in the case of hazardous waste found in laboratories, the information required in the FDSR may follow this indication and be based on the product's MSDS. In the case of waste that has been contaminated with products considered hazardous, this standard guides that the hazards of the contaminant must be taken into account when filling out the FDSR.

The label for hazardous waste was prepared following the requirements of the following topics contained in the standard: general considerations, identification of the hazardous chemical waste and name and emergency telephone number of the generator, chemical composition, hazard information, precautionary phrase and other information. According to ABNT NBR 16.725, Brazilian Association of Technical Standards (2023), the label can be filled in with the information from the FDSR and its manufacture must be made with material resistant to the conditions of storage, movement and transport.

In the case of the label for non-hazardous waste, the same standard says that it can contain only the name of the chemical waste, the name and emergency telephone number of the generator and the phrase "This chemical waste is classified as non-hazardous".

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Frame: 4 Waste Storage and Handling Log Sheet

INSTITUTO FEDERAL DE EDUCAÇÃO, CIÊNCIA E TECNO Fluminense							
Waste Storage and Movement Registry							
Company: Instituto Federal Fluminense - Campus Macaé Address: Rod. Amaral Peixoto, Km 164 - Imboassica, Macaé - RJ, 27973-030			Period:				Leaf:
Describe the Waste, Type and Classification according to NBR 10.004, CONAMA Resolution No. 313 or ABNT NBR 14.725	Generator Laboratory	Storage Laboratory	Quantity / Date			Final Destination	Observations
			Entry	Output	Stock		
Signature of the Responsible Party:							

Source: The authors (2024)

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Table 5: Waste Safety Data Sheet - FDSR

INSTITUTO FEDERAL
DE EDUCAÇÃO, CIÊNCIA E TECNOLOGIA
Fluminense

Waste Safety Data Sheet - FDSR

Waste Name: Page: 1/_

Last Revision Date:

1 - Identification	2 - Hazard Identification
Waste Name:	The waste is classified as hazardous by the classification system:
Generation Process:	ABNT NBR 10.004 ABNT NBR 14.725 ☐ Current land transport legislation* ☐
	Hazard Classification according to the system adopted:
Company: Instituto Federal Fluminense - Campus Macaé Address: Rod. Amaral Peixoto, Km 164 - Imboassica, Macaé - RJ, 27973-030	Most Important Hazards:
	Adverse effects on human health:
Contact phone: (22) 3399-1500	Environmental effects:
Emergency Phone: (22) 3399-_ _ _ _	Physical and chemical hazards:

3 - Composition and information about the ingredients		
Mark if the chemical is: Substance: ☐ Mixture ☐ Contaminated material ☐ Fill in the information below		
Chemical or common name	Impurities or ingredients that contribute to the hazard	CAS Registration Number

4. First aid measures		
Actions to avoid:		
First aid measures in case of		
Skin contact	Inhalation or ingestion	Eye Contact

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			Recommendations for the protection of the aid provider and/or notes to the doctor:

5. Firefighting measures	6. Control measures for spillage or leakage
Recommended means of extinguishing:	Personal Precautions:
Specific hazards from the waste:	Environmental Precautions:
Special protection measures for the firefighting team:	Cleaning methods:
	Procedures in case of emergency:

7. Handling and storage	8. Exposure control and personal protection
Handling methods:	Engineering Control Measures:
Precautions and guidelines for safe handling:	PPE for Eye/Face Protection:
Appropriate technical storage measures:	PPE for skin and body protection:
Inappropriate technical storage measures:	PPE for respiratory protection:
Specific Storage Recommendations:	PPE for emergency care:

9. Physical and chemical properties	10. Stability and reactivity
Physical state:	Reactivity:
ph:	Stability:
Flash Point:	
Solubility	Chemical Incompatibility:
Explosive Threshold	Other information:
Other information:	

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11. Toxicological information	12. Ecological information
Toxic effects:	Ecological data:
Acute toxicity:	
Chronic toxicity:	
Specific effects (carcinogenicity, mutagenicity and toxicity to reproduction):	14. Transportation Information
	National regulations for inland transport, where appropriate:
	UN Number
13. Considerations on final destination	Appropriate name for shipment
Recommended methods for safe, environmentally approved treatment and disposal:	Principal and subsidiary risk class/subclass, if any:
	Risk Number:
	Packing Group:
15. Regulations	16. Other information
Specific regulations for chemical waste:	Captions, abbreviations, or other information not mentioned: UN: United Nations CAS: Chemical Substance Identification Number * Federal Decree No. 96.044, of May 18, 1988

Source: The Authors (2024)

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Table 6: Label for hazardous waste

<table>
<tr><td colspan="4">  INSTITUTO FEDERAL
DE EDUCAÇÃO, CIÊNCIA E TECNOLOGIA
Fluminense</td></tr>
<tr><td colspan="2">Company: Instituto Federal Fluminense - Campus Macaé Address: Rod. Amaral Peixoto, Km 164 - Imboassica, Macaé - RJ, 27973-030</td><td colspan="2">Emergency Phone: (xx)xxxx-xxxx</td></tr>
<tr><td colspan="4">Hazardous Waste Name:</td></tr>
<tr><td colspan="3">Chemical composition</td><td rowspan="4">Description of hazards:

Precautionary phrase to avoid misuse and exposure to health:

Precautionary phrases for accident measures and environmental protection:

Precautionary phrases for the destination:</td></tr>
<tr><td colspan="3">Subs☐ce: Mixture ☐

Contaminated material☐</td></tr>
<tr><td>Chemical or common name</td><td>Impurities or ingredients that contribute to the hazard</td><td>CAS Registration Number</td></tr>
<tr><td></td><td></td><td></td></tr>
<tr><td colspan="4">Other Information</td></tr>
<tr><td colspan="4">The safety data sheet of chemicals of this hazardous chemical can be obtained by phone/E-MAIL:
Chemical Classified as hazardous by NBR 10.004
Identification Code given by NBR 10.004 / CONAMA Resolution No. 313 : _____</td></tr>
</table>

Source: The Authors (2024)

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Table 7: Label for non-hazardous waste

INSTITUTO FEDERAL DE EDUCAÇÃO, CIÊNCIA E TECNOLOGIA Fluminense	
Company: Instituto Federal Fluminense - Campus Macaé Address: Rod. Amaral Peixoto, Km 164 - Imboassica, Macaé - RJ, 27973-030	Emergency Phone: (xx)xxxx-xxxx
Waste Name:	
This chemical waste is classified as non-hazardous	

Source: The Authors (2024)

CONCLUSION

This study showed that the production of waste has a wide variety, covering both hazardous and non-hazardous. The laboratories of Hydraulics and Pneumatics, Mechanics and Adjustment and LEMMA were identified as generators of hazardous waste, including oils, cutting fluid, metal chips, containers and contaminated PPE.

In the case of non-hazardous waste, it was observed that inert waste is present in all laboratories, distributed among uncontaminated PPE, scrap metal, electrical wires, among others. The non-inert waste is paper, cardboard, and sweeping waste, with the welding lab being the only one that produces only non-hazardous waste.

As for waste management, it was noted the absence of procedures and adequate infrastructure in accordance with the stipulations of the regulations that govern this area and, therefore, the resolution of such problems is imperative. In this regard, this work showed the points to be observed in the adaptation process, creating a knowledge base about the residues and procedures adopted, as well as pointing out the flaws and the instruments for improvement.

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