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RESEARCH ARTICLE

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ASSESSMENT OF COMPLIANCE WITH NR-20 IN A DISTRIBUTOR OF FUELS DERIVED OF PETROLEUM AND BIOFUELS

Everaldo de Queiroz Lima*¹, Alexandra de Lima Pereira² and Mateus Queiroz Lima³

^{1, 2, 3} Occupational Safety Engineering, IEMAC - UNYLEYA, Manaus-Amazonas, Brazil.

¹ <http://orcid.org/0000-0002-6887-4594> , ² <http://orcid.org/0000-0003-4517-7806> , ³ <http://orcid.org/0000-0002-0371-3829> 

Email: *everaldolima.am@gmail.com, alexandralp1989@gmail.com, mateusql.tec@gmail.com

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ABSTRACT

With a view to greater control in the process of managing activities involving flammable and combustible products, the Ministry of Labor and Employment (MTE) standardized Regulatory Standard 20 (NR-20). In this context, a case study was carried out at a Fuel Distributor located in the city of Manaus/AM. Taking into account the stored volume and based on the NR-20, a check-list with items of the standard was created and applied and the compliance with the requirements of construction conditions, maintenance, operation, health and safety was verified. The company presented 95% Compliance, which demonstrates a good management system in occupational health and safety, given its performance in the storage, transfer and handling of liquid fuels.



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I. INTRODUCTION

According to the Brazilian Statistical Yearbook of Petroleum, Natural Gas and Biofuels of the National Agency of Petroleum Natural Gas and Biofuels (ANP) in 2014, in 2013, national sales of oil products by distributors increased by 4,7%, totaling 125, 4 million m³. Sales of diesel oil were those that had the greatest increase in relation to 2012, with an increase of 2,6 million m³ (4,6%), totaling 58,5 million m³, volume corresponding to 46,6% of the total of sales of oil products in 2013. In turn, sales of gasoline C increased by 1,7 million m³ (4,2%), totaling 41,4 million m³ and those of fuel oil grew by almost 1,1 million m³ (26,9%), reaching 5 million m³ [1].

All Brazilian regions recorded an increase in sales of diesel oil compared to 2012, the largest, in percentage terms, obtained by the Midwest (8,9%), which concentrated 12,6% of sales of this derivative. In terms of volume, the Southeast Region had the highest growth in diesel sales, of 717,3 thousand m³, concentrating 41,9% of total sales. The North, Northeast and South regions accounted for 10%, 16,4% and 19% of diesel sales, respectively.

The diesel oil market was supplied by 133 distributors, with the four leading sales companies concentrating 79,3% of the market: BR (38,6%), Ipiranga (22,8%), Raízen (14,8%) and Alesat (3,1%) [1].

All this volume of fuel sold must be transported, stored and handled by licensed companies, meeting all applicable legal requirements. Due to the nature of the stored product, the entire installation and storage system for oil products and other fuels is a potentially or partially polluting enterprise that generates environmental accidents, since leaks of oil products and other fuels can cause contamination of bodies underground and surface water, soil and air, in addition to presenting risks of fire and explosions, resulting from these leaks [2].

However, the handling and handling of these products requires a well-established risk management plan, as accidents in these cases can have fatal consequences for workers and the environmental impacts can take on quite significant proportions, such as what happened in Buncefield, England in 2005 and in 2015 at Ultracargo in Santos - SP [3, 4].

II. THEORETICAL REFERENCE

II.1 FUEL DISTRIBUTION IN BRAZIL

The national supply of fuels is declared to be of public utility under Brazilian law. In this sense, it is up to the ANP to guarantee the quality and supply of fuels to consumers throughout Brazil. In exercising this competence, the ANP prepares and publishes technical resolutions that regulate the activities included in the national fuel supply system, currently composed of more than 100 thousand economic agents operating at different levels. The distribution of fuels is essential to guarantee national supply [5].

More than 300 economic agents authorized by the ANP operate in the segments of liquid fuels, LPG, asphalt, aviation fuels and solvents. The market for the distribution of automotive liquid fuels in the country involves a universe of about 300 economic agents that work with diesel oil, gasoline, ethanol and biofuel. ANP defines the requirements for the exercise of this activity and authorizes the construction and operation of facilities for the storage of these fuels. Distributors can only purchase and remove fuel from agents authorized by the ANP, subject to its specific regulations [5].

II.2 NR-20: HEALTH AND SAFETY AT WORK WITH A FUEL AND FLAMMABLES

The NR-20 issued by the Ministry of Labor and Employment (MTE) establishes minimum requirements for the management of safety and health at work against risk factors for accidents arising from extraction, production, storage, transfer, handling and handling of flammable and combustible liquids [6].

The original version of the standard was edited together with Ordinance 3214, in 1978. In 2012, it was revised and updated, and this version 15 is still valid today. NR-20 applies to all establishments, industrial or commercial, that handle or produce flammable or combustible liquids, regardless of whether it is a refinery or a simple gas station, according to the classification presented [6].

II.3 CLASSIFICATION OF FLAMMABLE AND COMBUSTIBLE

According to the definitions in NR-20, flammable liquids are liquids that have a flash point greater than or equal to 60 °C; Flammable gases are gases that ignite with air at 20 °C and a standard pressure of 101,3 kPa; and combustible liquids, in turn are liquids with a flash point greater than 60 °C and less than or equal to 93 °C [6, 7].

Flash point means the minimum temperature at which the substance (in the case of combustible or flammable NR-20) begins to release its flammable vapors. The flash point that ethyl alcohol, also known as ethanol, for example, is around 13 °C, a low value (and for this reason it is considered flammable); on the other hand, the flash point of the wood is 150 °C, requiring a lot of heat to generate a temperature to release gases [6, 7].

III. MATERIALS AND METHODS

III.1 COMPANY DESCRIPTION – PLACE OF STUDY

The work was carried out at a company in the oil sector in the city of Manaus, which has been operating since 2000 and has been consolidating its position as one of the largest distributors of petroleum fuels and biofuels in Brazil. As defined by the ANP, the company under study carries out the activity of distribution of liquid fuels that is of public utility and comprises the acquisition, storage, mixing, transportation, commercialization and quality control of fuels [8].

It recently underwent a process to expand its storage capacity, which went from 15.000 m³ to 75.000 m³, according to Regulatory Standard n° 20 (NR-20) of the Ministry of Labor is classified as a class III hazardous facility and carries out storage, transfer, handling and handling of combustible and flammable liquids [9].

III.2 STAGES OF WORK

The steps for carrying out the work are described in the flowchart shown in Figure 1.

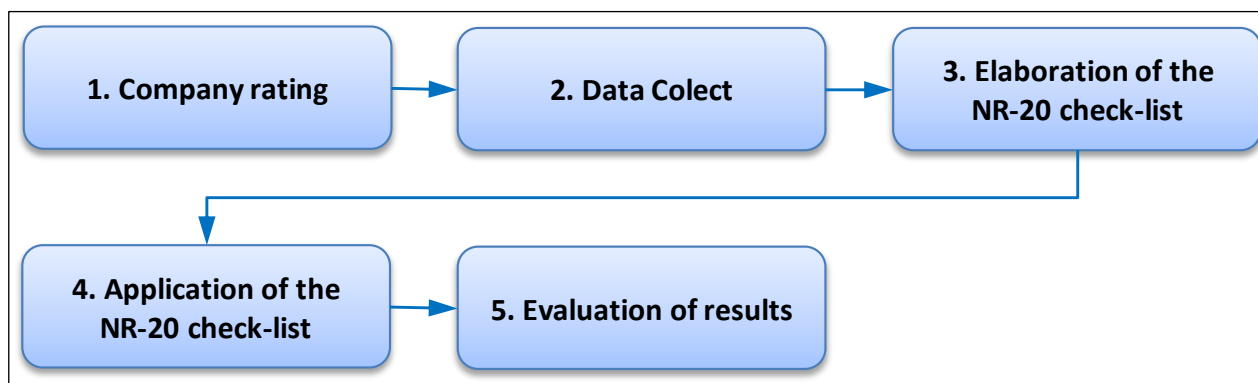


Figure 1: Methodology flowchart.

Source: Authors, (2020).

By NR-20, the company in and study carries out storage, transfer, handling and handling of flammable and combustible liquids. It is also classified as Class III Installations, according to Table 1.

The company under study is classified as “b.2 - flammable and / or combustible liquids: above 50.000 m³, since the company’s characteristic activity, storage has a storage capacity of ~75.000 m³.

The data for the study were obtained from documentary research in the reports, records and forms of the Distributor in the months of August and September 2019 and tabulated in an electronic spreadsheet using Microsoft Excel software.

From the reading and study of the NR-20, a checklist (checklist) of the requirements applicable to the company under study was elaborated, and for each requirement an objective question was elaborated that related it to the item of the standard.

Table 1: Classification of Facilities according to NR-20.

Class I
<p>a) Regarding the activity: a.1 – service stations with flammable and/or combustible liquids. a.2 – piped distribution activities of flammable gases in installations with maximum Allowable Working Pressure – PMTA limited to 18,0 kgf/cm².</p>
<p>b) Regarding storage capacity, permanently and/or transiently: b.1 – flammable gases: over 2 ton to 60 ton; b.2 – flammable and/or combustible liquids: above 10m³ up to 5.000m³</p>
Class II
<p>a) Regarding the activity: a.1 – flammable gas bottlers; a.2 – pipeline transport activities of flammable and/or combustible gases and liquids. a.3 – piped distribution of flammable gases in installations with Maximum Allowable Working Pressure PMTA above 18,0 kgf/cm².</p>
<p>b) Regarding storage capacity, permanently and/or transiently: b.1 – flammable gases: above 60 ton to 600 ton; b.2 – flammable and/or combustible liquids: above 5.000m³ up to 50.000m³.</p>
Class III
<p>a) Regarding the activity: a.1 – refineries; a.2 – natural gas processing units; a.3 – petrochemical facilities; a.4 – etanol manufacturing plants and/or alcohol manufacturing units.</p>
<p>b) Regarding storage capacity, permanently and/or transiently: b.1 – flammable gases: above 600 ton; b.2 – flammable and/or combustible liquids: above 50.000m³.</p>

Source: [6].

The work methodology used consisted of the identification and quantification of the NR-20 requirements applicable to the company, evaluation of these requirements with the existing occupational health and safety management system and elaboration of the action plan for the requirements identified as non-compliant.

During the stage of preparing the checklist, questions were asked, relating the item of the standard, in order to evaluate them with two simple answers: item conformed (C) or no-conformed (NC).

With the check list in hand, audits were carried out in the company, evaluating item by item, critically evaluating the management of safety and health at work in such a way as to allow the identification of conformed and no-conformed in each requirement. After identifying the no-conformed, actions were

proposed so that the company could continue the work and obtain compliance with all the requirements of the legislation under study.

IV RESULTS AND DISCUSSIONS

With the application and evaluation of the NR-20 check-list in the company, it was observed that of the 77 items identified, 73 are Conformed (C) and 4 are No-Conformed (NC), as can be seen in Figure 2.

Analyzing the requirements identified as no-conformed during the check-list application stage, it was possible to classify them in 2 generic categories: procedure and training, as described in Figure 3.

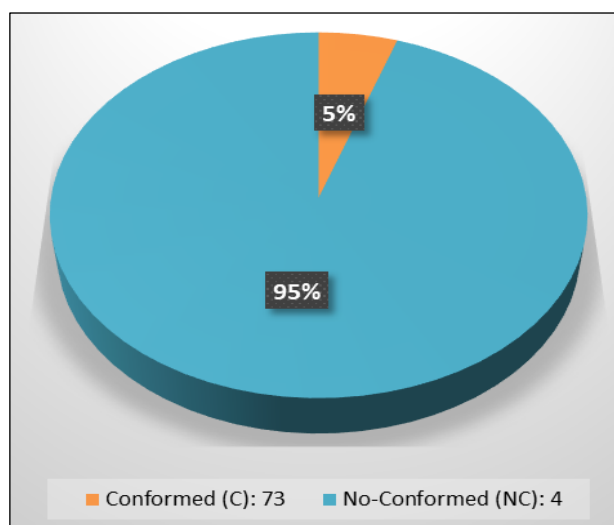


Figure 2: Evaluation of the results of applying the NR-20 check-list.

Source: Authors, (2020).

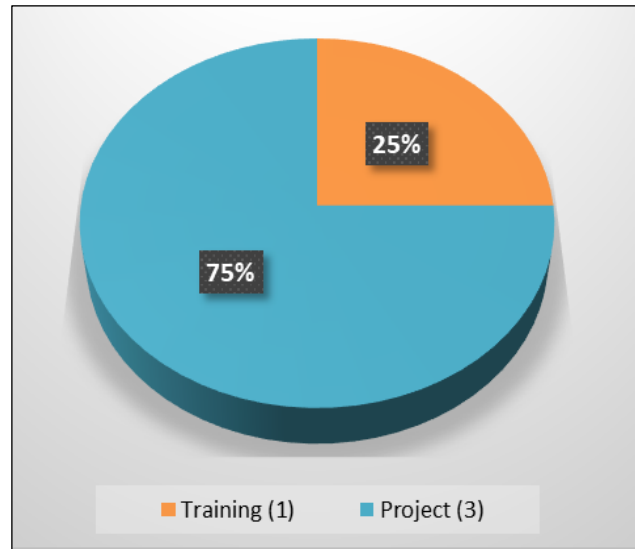


Figure 3: Classification of No-Conformed (NC).
Source: Authors, (2020).

This division aims only to facilitate the elaboration and management of the action plan, as can be seen in table 2.

Evaluating the actions proposed in table 2, it is observed that the actions inserted in the category “Projects” are the ones that demand more investments. The proposed action for item 5 is to identify and signal equipment and installations in accordance with national technical standards (ABNT and NR-26).

For item 10, it is recommended to implement the project, establish engineering measures to control fugitive emissions, emitted during the loading and unloading of fixed tanks and transport vehicles, for the elimination, minimization and/or recovery of these vapor emissions. For item 46, it is recommended to draw up a plan that includes the prevention and control of leaks, spills, fires and explosions and, in places subject to the activity of workers, the identification of the sources of fugitive emissions.

Table 2: Action plan for correction of Non-Conformities (NC).

Nº	Standard Item	Proposed Action	Category
5	20.6.3	Identify and signal equipment and installations in accordance with national technical standards (ABNT and NR-26).	Project
10	20.7.4	Implement project , establish engineering media to control fugitive emissions, emitted during the loading and unloading of fixed tanks and transport vehicles, for the elimination, minimization and/or recovery of these vapor emissions.	Project
45	20.11.19	Establish and maintain an identification system that allows to know the training of each worker and the visible use of the identification means.	Training
46	20.12.1	Develop a plan that includes the prevention and control of leaks, spills, fires and explosions and, in places subject to the activity of workers, the identification of the sources of fugitive emissions.	Project

Source: Authors, (2020).

Regarding the “Training” category, there is only one proposed action item 45, in which it is recommended to establish and maintain an identification system that allows to know the training of each worker and the visible use of the identifying means.

V. CONCLUSIONS

Thus, it was concluded that of the 77 requirements identified, the company under study presented 95% Compliance. This demonstrates a good health and safety management system, as the company operates in the storage, mixing, transportation, marketing and quality control of liquid fuels.

Based on the generated non-conformities, an action plan was proposed for the company so that, when applicable, it can satisfy all the requirements of the standard under study. Compliance with current legislation, as well as national and international standards, and especially the correct management of

risks associated with the activity of the enterprises are still the best ways to prevent accidents and mitigate any incidents, ensuring the safety and health of workers, as well as preservation of the environment and the company's assets.

With the development of this case study, it was possible to identify the requirements of NR-20 applicable to the company under study and to elaborate a check-list that helps, not only the local company, but also enables other branches and even other companies operating in the same market segment, an assessment to verify compliance with the legislation used.

VI. AUTHOR’S CONTRIBUTION

Conceptualization: Everaldo de Queiroz Lima, Alexandra de Lima Pereira and Mateus Queiroz Lima.

Methodology: Everaldo de Queiroz Lima.

Investigation: Everaldo de Queiroz Lima.

Discussion of results: Everaldo de Queiroz Lima, Alexandra de Lima Pereira and Mateus Queiroz Lima.

Writing – Original Draft: Everaldo de Queiroz Lima.

Writing – Review and Editing: Everaldo de Queiroz Lima, Alexandra de Lima Pereira and Mateus Queiroz Lima.

Resources: Everaldo de Queiroz Lima.

Supervision: Everaldo de Queiroz Lima.

Approval of the final text: Everaldo de Queiroz Lima, Alexandra de Lima Pereira and Mateus Queiroz Lima.

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VIII. REFERENCES

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