

## Diagnosis of Impacts Caused by NR - 12 Adequacy in Permanent Access Media: A Case Study in an Animal Flour Industry

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**ABSTRACT:** The NR-12 regulatory standard introduced in the 1970s, was recently modified in 2010, with more detailed restructuring to preventively prevent accidents with industrial equipment workers. The standard presents elements and considerations of caution from design to scrapping. The regulation is broad and with a lot of technical detail, which has been worrying experts and entrepreneurs about the complexity of implementation, high costs and lost productivity. Any adequacy and change as a result causes some impacts. Therefore, this work sought, from an exploratory research, to diagnose the impacts of NR-12 adequacy caused in the production system of an animal flour manufacturing industry. The diagnosis focused specifically on the permanent access means item (items 12.64 to 12.76.1) of the standard, in which the company invested approximately R\$ 220 thousand to ensure the adequacy of the factory. The results were surprising and almost entirely positive, especially in terms of productivity and operational improvement.

**KEYWORDS:** NR-12; loss of productivity; operational impact; work accident.

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### I. INTRODUCTION

The numbers of accidents with equipment and machinery grew exponentially with the industrial revolution. According to SILVA, 2015 the database of the National Institute of Social Security (INSS) records more than 55 thousand accidents with equipment and machinery, corresponding to 10% of the total accidents in Brazil in 2013.

Regulatory Standard 12 - Safety at Work in Machines and Equipment, is the precept that obliges companies to preventively adapt in machinery and equipment in general to ensure safety to workers. It was instituted in the 70's, underwent recent modifications in 2010 with more requirements inserted, making it even more restrictive. The regulation is extensive, technical, and with a wealth of preventive details, which has been criticized by experts and entrepreneurs for the complexity of implementation and high costs (BAÚ, 2015). However, there is also the other side of the coin when investing in the organization of the environment, positive aspects to the worker can be achieved as: greater employee motivation, reduction with labor actions and medical expenses, and increased productivity (SANT'ANNA, 2011, et al., Huse and Cumming).

Thus, this work hopes, from an exploratory research, to diagnose the impacts of NR-12 adequacy caused in the production system of an animal flour manufacturing industry. The diagnosis focused specifically on the permanent access means item (items 12.64 to 12.76.1) of the standard, in which the company invested approximately R\$ 220 thousand to ensure the adequacy of the factory.

### II. RESEARCH METHOD

In order to identify the impacts caused by adjustments to the NR-12 in a permanent access medium, a survey was prepared and applied to equipment operators, mechanics, production supervisors and work safety. The interview was conducted on site and directly with these people with the equipment that underwent intervention. The animal meal industry in the case study has an area of 1,000 m<sup>2</sup>, 190 active equipment, 24-hour operation from Monday to Friday, and a complex operation and maintenance. The factory has high pressure and

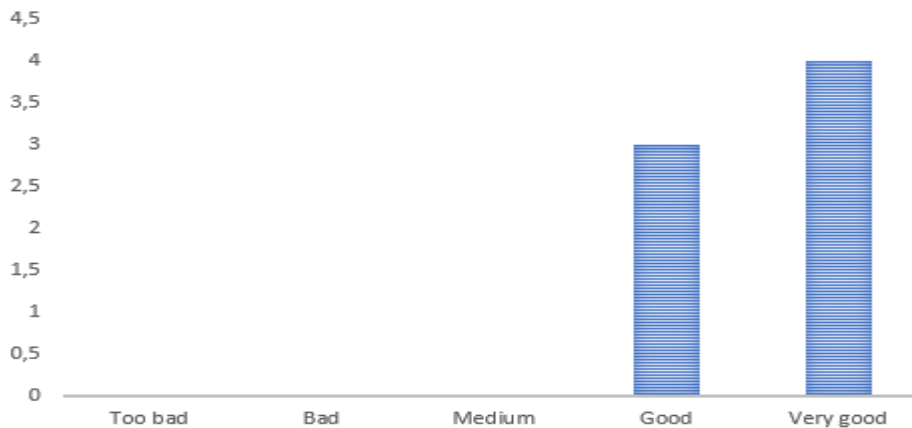
temperature equipment, silos, manholes, screw conveyors, pressure valves, pumps and reducers, and others, which justifies the need for possible adjustments to access these machines with appropriate safety.

**III. RESULTS**

The diagnosis presented results based on the direct optics of the factory team, from the operation to the production manager and work safety. Evaluating the perception of each from their delivery obligations and work routine.

The standard sets out several security items, as already mentioned, and many companies do not fully follow it. When looking for suitability, in most cases they need to retrofit the existing machine, as new equipment may be more costly. Such retrofitting may scrap the machine or intervene in such a way as to directly affect its function or production capacity. This is a concern for many business owners as it will directly affect the company's production yield and cash. In the case study, as shown in Figure 1, a different result was found from the general thinking about impact on production.

**Figure1** - Impact on productivity after adequacy of NR - 12 - means of permanent access.



Source: Authors, 2019.

The very low impact on productivity was virtually unanimous to all factory respondents. This is because the inclusion of platform and stairs has drastically facilitated the operation of cleaning silos and elevator mouths, as well as the ease of mechanical repairs to all equipment. Previously, to reach such equipment was used a lifting platform or an iron cage raised by truck muck. This condition was very unfavorable for operator or mechanic mobility, which could reach with difficulty, making the process slow, inefficient and ergonomically inadequate. With the ease and new quality of equipment cleaning, production has improved the quality of its final product, further preventing the microbiological contamination of flour and avoiding customer complaints. Mechanical repair is faster and more efficient, ensuring higher production capacity, avoiding long production downtime when equipment is damaged.

As for the percentage of impact on equipment operation and maintenance, as shown in figure 2, it was observed that all consider it very good.

**Figure 2** - Impact on equipment operation and maintenance after adequacy of NR - 12 - permanent access means.



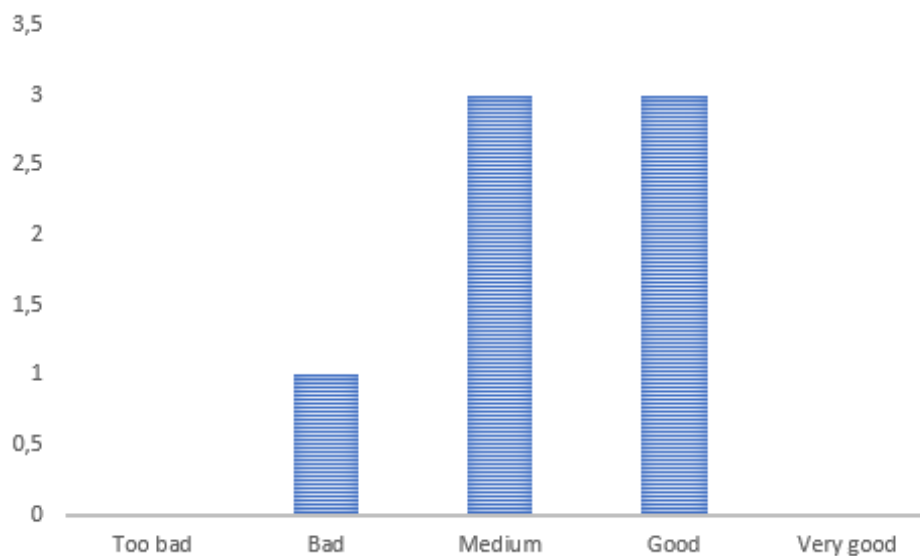
Source: Authors, 2019.

The result showed a very positive return with suitability for operation and maintenance. Respondents were very satisfied about this perspective. The old procedure forced to reach high components, where it was necessary to leave the lift platform, to engage the seat belt to the platform railing and to climb on the equipment to perform the repair work. This condition, besides being unsafe to the mechanic, generated rework, because each time it needed a tool, it made the round trip on the equipment, causing increased time with the production stop and low utilization of labor. It is noteworthy that the equipment has irregular curves, sharper, slippery parts, and with possible passage of people below. As required by the standard, in addition to the obligation of fixed access to these points, it also establishes that the platform must have a height of 0.20 m in height to avoid falling objects and railing on both sides.

The operation placed an observation that should be careful when locating the platforms and stairs, as it could reduce the space of the factory and cause other unsafe conditions or operational difficulty, such as forklift traffic.

With regard to the cost of adjusting the equipment to the standard, Figure 3 shows the results obtained.

**Figure 3** - Impact on costs the adequacy of NR - 12 - means of permanent access.



Source: Authors, 2019.

The results were further divided into the impact of cost, part defined that it is an investment and that brought many benefits in the operation of the factory, and can be rewarded by increased productivity, thus considering a good impact on cost. Another party stated that the adequacy led to improvements to the factory, however, understood that this is a high investment value and gives rise to a good budget organization. The last part considered a high investment to fit just one item of the NR 12 standard, worry about the upcoming suitability costs.

#### IV. CONCLUSION

The biggest affliction of entrepreneurs when seeking to meet regulatory standard NR 12 is how much it will cost to deploy and how much it will impact productivity. In this diagnosis it was noted that the results were very contrary to the general opinion. The results were positive in terms of productivity, reporting increased production by making the mechanical condition and faster operation during the manufacturing process. Performing fast and safe service meant a resumption of production and volume of income targets reached at the end of the day.

The motivation of the operation and maintenance was quite evident and satisfactory after the adequacy in the permanent access medium. Operators and maintainers have experienced a sense of well-being and contentment with the new working condition. Tasks have become lighter, faster, and more efficient, reducing nearly 2/3 of some equipment uptime and repair.

Finally, most considered the investment to be favorable and brought excellent operating return. According to industry supervision, the factory's 90% average is adequate to NR-12 in the item permanent access means. Those that are not, do not offer frequency of maintenance or operation, and can be done with other safe methods. The costs for adequacy were approximately 220 thousand reais, being a relatively high cost, which left a part worried about other possible adaptations to NR-12.

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