



## COMPULSORY ENVIRONMENTAL AUDITS: THE STUDY OF A CHEMICAL INDUSTRY

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### ABSTRACT

This article was developed with the objective of analyzing the use of compulsory environmental audits as a tool to evaluate the environmental performance of a chemical industry. The research method used consisted of the analysis of reports of environmental audits carried out from 2011 to 2014, in the light of Directive 056 - Rev3. It can be concluded that the audit helped the company, improving its environmental performance, since there was a reduction in the number of nonconformities, a decrease in energy and water expenditure and optimization of the processes through the improvement opportunities detected.

**Keywords:** Environmental Management System; Environmental Audit; Compulsory Audit; Business Environmental Performance; Guideline 056 - Rev3

### 1. INTRODUCTION: THE CONTEXT THAT MOTIVATED THE RESEARCH

The constant environmental disasters that occurred during the 1980s and 1990s and the pressure of the media have made society wake up and demand responsible positions of the companies in relation to the environment. At first, such companies were reactive to such changes. However, they realized that a more responsible environmental posture could bring “effective gains for the business, both to better use its resources and to increase sales” despite the higher associated costs (Lopes, 2008).

According to Bartolomeo (1995), the increased importance given by companies to environmental issues was caused by the strong pressures exerted by regulators and by the population, forcing them to improve their environmental performance.

Thus, in the creation of an Environmental Management System (EMS), organizations found the means to reconcile the pressures of different stakeholders or affected by the business and compliance with legislation, in its broad sense, pertinent to the theme (Cerqueira, 2012).

To this end, self-regulation instruments such as ISO (International Organization for Standardization) certifications were created with the objective of standardizing the quality of the EMS, in addition to highlighting opportunities for improvement for the system (Lopes, 2008).

#### 1.1. Objective

Present the use of mandatory environmental audit reports under Directive 056 - Rev3 to assess the environmental performance of a chemical industry.

#### 1.2. Research questions

To achieve the described objective and to delineate the search path, the following research questions are presented:

- What is compulsory environmental auditing?
- How is the corporate environmental performance monitored?



- Can the compulsory environmental audit report be used as an indicator of the industry's environmental performance?

### 1.3. Delimitation of the research

Period of data collected: Reports from 2011 to 2014.

Geographical location of the company studied: Southeastern Brazil.

### 1.4. Structure of the article

The next chapter presents an important theoretical framework for the development of the study. In chapter 3, the literature review summarizes the main topics that were addressed in this work, such as: environmental management system, environmental and compulsory audit, Guideline 056 - Rev3 and environmental performance indicators. Chapter 4 discusses the analysis methodology used by the authors in the analysis of the reports. In chapters 5 and 6, respectively, the company's environmental performance analysis and discussion of the results generated are carried out. Finally, the last chapter presents the conclusion and a suggestion for future studies.

## 2. THEORETICAL REFERENCE

This study adopts, as a central element to guide its investigation, the Resolution of the *Conselho Estadual do Meio Ambiente do Rio de Janeiro* (CONEMA - State Council for the Environment of Rio de Janeiro) n° 021, of May 7, 2010, which will be mentioned as Guideline 056 - Rev3.

## 3. LITERATURE REVISION

In order to meet the objective and to answer the research questions, this chapter includes contents that allowed the authors to construct the results that were desired and indicated as the objective in chapter 1.

### 3.1. Environmental Management

Selden (1973) defined environmental management as:

"The management, direction and control of the use of natural resources by the government, through certain instruments, including economic measures, regulations and standardization, public investments and financing, and inter-institutional and judicial requirements."

The constant environmental disasters caused by companies around the world have led governments to create official environmental policies. In the specific case of Brazil, in January 1986, the Resolution of the *Conselho Nacional do Meio Ambiente* (CONAMA - National Environmental Council), which requires an *Estudo de Impacto Ambiental* (EIA - Environmental Impact Study) to be carried out in all production processes performed in the country, was published. Concern for the environment became so popular and widespread that companies saw it as no more as an expense, but as a strategy to get ahead of the competition (Pedrosa, 2014).

With this new context, Hurtubia (1980) defined environmental management as:

"...The task of managing the productive use of a renewable resource without reducing its productivity and quality, along with actions that minimize or even extinguish the degradation of the environment."

The United Nations Conference on Environment and Sustainable Development (Rio 92) was a milestone for the globalization of environmental thinking, since it was effectively proven that, if everyone did not commit to the environmental cause, a collapse could occur. Faced with this, industries became responsible for the environmental effects of their products and by-products and for investing in ways that did not harm the environment. In 1998, the World Commission on Environment and Development (WCED) defined environmental management as

"A process of transformation in which the exploitation of resources, the direction of investments, the orientation of technological development and institutional changes harmonize and reinforce the present and future potential in order to meet the needs of future generations" (Pedrosa, 2014).

### 3.2. Environmental Audit

ISO 14010 defines Environmental Audit as:

"A systematic and documented verification process, performed to objectively obtain and evaluate audit evidence to determine whether specific activities, events, management systems and environmental conditions or information related thereto comply with the audit criteria and to communicate the results of this process to the customer."



The EMS is closely linked to environmental auditing. Such a system depends on the audit to be able to evolve in the perspective of continuous improvement. When implementing an environmental management system, the periodic environmental audit is used to identify opportunities for improvement (Fontoura, 2014).

There are two types of environmental audits differentiated by the type of auditors: the internal and external environmental audit. According to Freitas (2001):

“The internal environmental audit is performed by the members of a company (which must be from an area independent of the area to be audited) and, if necessary, by contracted independent auditors, thus it has its internal audit results. The external audit is necessarily performed by auditors, who are external to the organization, and its results are evaluated by third parties, as a certification organization, through bodies responsible for environmental policies, and their results made available, in some cases, for public consultation, mainly in the case of certain laws “.

### 3.3. Compulsory Audits

Environmental auditing has been adopted as a voluntary practice in a number of countries, such as the United States, Canada and some European countries. However, Brazil follows a path opposite to the above-mentioned countries, where there is an increase in terms of the number of legislative initiatives aiming at mandatory environmental auditing for industries with potentially polluting activities, the so-called compulsory environmental audit (Piva, 2007).

For a company’s environmental management system, mandatory auditing is of the utmost importance as it provides valuable insight into the organization’s environmental performance, thereby exposing the limitations of its system and allowing the company to take action to eliminate the causes of nonconformities found (De Martini, 2013).

The beginning of this type of audit occurred in 1991 in Rio de Janeiro, with the creation of State Law No. 1898 of November 26, 1991, which provides for the performance of environmental audits, regulated by Decree No. 21470-A of June 5, 1995 (De Martini, 2013).

### 3.4. Guideline 056 - Rev3 - Guidelines for Environmental Auditing

In the State of Rio de Janeiro, environmental audits are carried out based on Directive 056 - Rev3, whose purpose is

“to establish the responsibilities, procedures and technical criteria for conducting environmental audits as an instrument of the environmental licensing system”.

There are two types of environmental audits mentioned in Directive 056 - Rev3, which are defined as follows:

- **“Environmental Control Audit** – Normally performed at each license application or renewal, for detailed verification of the operating organization’s environmental performance, based on legal compliance and its control policies and practices.
- **Environmental Monitoring Audit** – Carried out each year, with emphasis on the follow-up of the Action Plan of the last environmental audit complementing it with new measures and changes in terms of environmental aspects and impacts, changes in process, among others.

The basic requirements defined in Guideline 056 - Rev3 (2010) - are shown in table 1:

**Table 1** - Basic Requirements for Guideline 056 - Rev3

N°	Item
8.1.1	Regarding environmental policy and the environmental management system
8.1.2	Regarding the management structure and training
8.1.3	Regarding legal compliance
8.1.4	Regarding the production and operation processes
8.1.5	Regarding energy and water management
8.1.6	Regarding material management
8.1.7	Regarding the management of liquid effluents
8.1.8	Regarding the management of atmospheric emissions
8.1.9	Regarding noise management
8.1.10	Regarding waste management
8.1.11	Regarding the management of the use of agrochemicals for the control of vectors and urban pests
8.1.12	Regarding cleaning and sanitation of water tanks
8.1.13	Regarding environmental risk management
8.1.14	Regarding the management of environmental liabilities

Source: Adapted from Guideline 056 - Rev3

### 3.5. Environmental Performance Indicators

In the early 1990s, companies began to include environmental performance in their development strategies, with a greater focus on reducing the impact of their activities on the environment through the implementation of environmental indicators (Gouldson, 1993).



According to Adams (1992), many companies adopted the environmental performance report after being pressured by various stakeholders as a means of communicating to their stakeholders their commitment to the environment.

This technical document consists of two parts: one containing qualitative comments on the subject and the other addressing a quantitative assessment of the effects on the environment (Blaza, 1992).

In this way, according to Azzone *et Noci*. (1996),

“The environmental report is therefore produced to enable the company to establish a dialogue with its stakeholders and to serve as an internal document for the company to provide as a communication tool in order to emphasize the importance of each employee’s contribution to environmental protection.”

#### 4. RESEARCH METHOD

The methodology used for the development of this work consisted of documentary analysis (reading environmental management audit reports of a chemical industry).

In order to complement the documentary research, bibliographical researches were carried out.

It was necessary to obtain four environmental reports from consecutive years (from 2011 to 2014) in the Library of the *Instituto Estadual do Ambiente* (INEA - State Environmental Institute) for the development of the case study.

The first report analyzed was an environmental audit of control, and the others were of follow-up audits.

The reason for choosing the audited chemical industry is due to the fact that it is a unit of a multinational company present in more than 40 countries, whose main activities are the production of gases for various segments such as hospitals and the manufacture of storage tanks, activities that may pose risks to the environment. Therefore, the conclusions and the learning obtained are representative and relevant.

The basic chemical industry requirements established by Directive 056 - Rev3 were monitored to follow the development of its environmental performance.

Case study: environmental performance analysis of the chemical industry from compulsory environmental audits.

In this chapter, the audited chemical industry is analyzed based on the environmental audit reports studied.

#### 5.1. Characterization of the audited company

The present study refers to the analysis of the environmental management implemented in a chemical industry, whose activity is to manufacture cryogenic equipment and manage contaminated areas.

The following data were taken from the Monitoring Environmental Audit Report for 2014, since it is the most recent source of information within the scope of this article.

Table 2 shows the information about the audited chemical industry.

**Table 2** - Information of the audited company

Year	2011	2012	2013	2014
Main activity	Manufacture of tanks, reservoirs and boilers for central heating.			
Average number of employees	360 – company	222 – company	263 – company	273 – company
th-roughout the year	180 – Third parties	87 – Third parties	75 – Third parties	70 – Third parties

Source: Adapted from the environmental audit reports of the company audited in the respective years

The land of this unit has a total area of 35,200 m<sup>2</sup> and a constructed area of 13,750 m<sup>2</sup>, and there are no green areas or environmental preservation areas.

It is the only cryogenic equipment factory in the Group operating in the Americas. This factory not only builds cryogenic equipment but also develops projects and exports its production to other countries.

The unit has an integrated management system according to the reference standards NBR ISO 9001, NBR ISO 14001 and OHSAS 18001 and the Responsible Action Program of the *Associação Brasileira de Indústria Química* (ABIQUIM - Brazilian Association of Chemical Industry).

#### 5.2. Analysis of the environmental performance of the chemical industry

The company’s environmental performance analysis was performed based on the documents obtained in the INEA library and in light of some of the requirements of Guideline 056 - Rev3, mentioned in Table 1. In this way, items that were considered more important for the authors will be



highlighted, as they are non-conformities or opportunities for improvement highlighted by the auditors, as well as evidence of the evolution of the environmental performance of the chemical industry.

### 5.2.1. Regarding the management structure and training

- a) Section **8.1.2a** of Directive 056 - Rev3 determines "the responsibilities for environmental management, including the Technical Responsibility Term for Environmental Management, in accordance with State Decree nº 42.159 / 2009; the explicit commitment of top management; the verification of the compatibility of the managerial structure with the improvement of performance; existence of an internal and external communication system and its adequacy to the environmental management system".

In the 2011 report, there was no technical manager formalized by the environmental management. In the following years, 2012, 2013 and 2014, such responsibility was assigned to the safety engineer.

The position of the person in charge is not directly related to the environment, but this connection is not a requirement of the environmental agency. However, the training / experience of the safety engineer and his/her authority to fulfill this role must be observed.

It was not possible to verify the experience and the authority of the technical leader, as there was no such information in the audit reports.

### 5.2.2. Regarding legal compliance

- a) The item **8.1.3b** determines "compliance regarding the environmental licensing (type and validity of licenses) Permits, Authorizations, Grants, Records, Conduct adjustment Terms and other documents related to environmental issues by checking the dates of issue and its validity. Compliance with restrictions and requirements should be assessed."

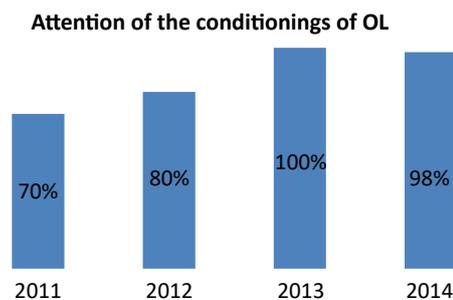
In the 2011 report, it was informed that the company requested the renewal of the delayed Operation License (OL) with the environmental agency. It should have done so until May 27, 2005 (to comply with the 120 days in advance regarding the expiration of the validity of the license, provided for in CONAMA Resolution 237, dated December 19, 1997), but did so on July 18, 2005. Due to this delay, the company was operating without a license in the period from 06/28/05 to 08/18/13, which may constitute an environmental crime in accordance with article 60 of Law 9605 of February 12, 1998, with a penalty of one to six months, or fine, or both

penalties cumulatively. Therefore, this was a serious error of the auditing company, since this fact was not made explicit in the reports.

Another non-compliance also detected in the year 2011 was the late publication of the OL issue in the newspaper of great circulation and in the Official Gazette. The license was issued on June 27, 2000, and the publication occurred on April 05, 2001, and the deadline given by the environmental agency is 30 days from the receipt of the license.

To avoid recurrence of these two deviations, the company reported that it had created an internal control document of the conditions of the license.

Figure 1 shows the percentage of attendance of the conditioners of the company from 2011 to 2014.



**Figure 1** - Attendance of OL conditioners per year

Source: Adapted from the environmental audit reports of the company audited in the respective years

Figure 1 shows that the company audited showed an evolution in performance identified by the percentage of attendance of the conditioners.

It is important to emphasize that the conditioners of the license are of vital importance for the environmental management system of a company and that they have as objective, according to the Environmental Licensing Booklet of the *Tribunal de Contas da União* (TCU, 2004 - Court of Audit of the Union), "the implementation of the environmental monitoring and follow-up programs of the enterprise. They also aim to prevent risks to health and the environment."

In 2011 and 2012, the OL 194/2000 of the company under study had twelve conditioners, which included aspects such as: septic tank cleaning, noise pollution, annoyance caused to the neighborhood by environmental pollution, waste disposal, implementation of the Waste Manifest, release of industrial effluents, incidence of vectors (insects and rodents), among others.

In the years of 2013 and 2014, the number of conditioners has grown considerably, from twelve to forty-eight. In



the year 2013, INEA issued a new license that also included the recovery of contaminated areas, thus receiving the name of *Licença de Operação e Recuperação* (LOR - Operation and Recovery License), whose number was LOR IN 024221. This Management of Environmental Liabilities contributed with twenty-three factors, in addition to addressing other issues, such as: comply with Directive 056 - Rev3 (Guideline for conducting environmental auditing); comply with Guideline 215 - Rev4 (Biodegradable Organic Load Control Directive); comply with NBR 11174 (Waste Storage); submit to the INEA sampling report for particulate matter in the chimneys of the blast booths, particulate material in the chimney of the perlite expansion system and volatile organic compounds and particulate material in the chimneys of the paint booths.

### 5.2.3. Water and energy management

a) Item **8.1.5a** determines “the existence of an inventory of energy sources and losses; Energy consumption and the existence of procedures for its reduction; Evaluation of the energy efficiency of the equipment used and procedures to guarantee its adequate maintenance”.

The audit firm did not report the efficiency of the equipment used in the audited company and did not mention any procedures to guarantee its adequate maintenance. However, in all reports, the average annual consumption of water and electricity was shown. The graphs of figures<sup>1</sup> 2 and 3 show the consumption of water and energy, respectively, per year:

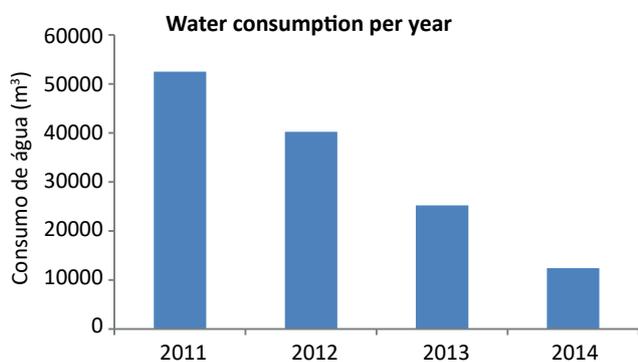


Figure 2 - Water consumption per year

Source: Adapted from the environmental audit reports of the company audited in the respective years

1 The data for 2014 refers to the period from January to November

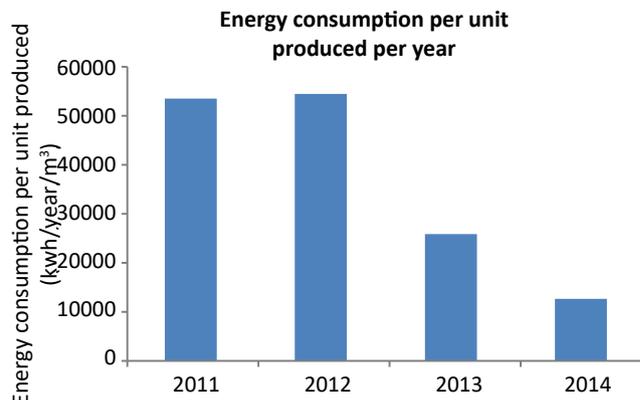


Figure 3 - Energy consumption per unit produced per year

Source: Adapted from the environmental audit reports of the company audited in the respective years

Data on water consumption per unit produced were not reported. From the graph of energy per unit produced, it can be noted that there was a high drop in consumption, from 52,118 to 12,390 kw/h / year / m<sup>3</sup>. Therefore, according to the data presented, an improvement in terms of the energy efficiency of the unit was observed.

### 5.2.4. Regarding the management of liquid effluents

a) Item **8.1.7c** establishes “the adequacy of the liquid effluents to the legal standards and the restrictions of the environmental license”.

In the 2011 report, the sanitary effluents presented deviations from the legal standards in force in the Biochemical Oxygen Demand test (BOD5). However, a corrective action that was carried out in the following year and that solved this problem was informed and deviations were no longer reported during the study period.

### 5.2.5. Regarding waste management

a) Item **8.1.10c** establishes “the waste flow, from the point of generation to the final destination, considering: the adequacy and safety of the containment systems, intermediate storage and final disposal; the adequacy in terms of existing procedures for the choice of treatment and disposal contracts; the existence of a valid environmental license compatible with the type of waste for transporters and place of destination; and the use of Waste Manifest”.

In all reports, it was informed that the companies involved in the waste management process are licensed.



The waste sent for treatment is accompanied by Waste Manifests. In the 2011 report, an alert was issued by the audit firm for legislation concerning the transportation of hazardous waste and the use of pictograms, due to Resolution 3632/11 of the *Agência Nacional de Transportes Terrestres* (ANTT - Brazilian Agency for Land Transport), which amended the Annex to Resolution 420, of February 12, 2004, approving the Complementary Instructions to the Regulation of the Terrestrial Transportation of Dangerous Goods. At the time of the audit in 2012, the auditors checked that the measures applicable to this matter had already been taken and the waste and the trucks were duly identified according to the risk classes and the UN number.

#### 5.2.6. Regarding the management of the use of agrochemicals for the control of vectors and urban pests

- A) Item **8.1.11a** establishes “the existence of vectors and urban pest control actions or phytosanitary treatments with demonstratives of the minimization of the incidence and the accomplishment of preventive or corrective measures aimed at reducing the impacts generated by the application of insecticides or rodenticides”.

In the 2011 report, there was an opportunity to improve the periodicity of treatment, which, according to an internal procedure, was semiannual. Although the frequency was established every six months, treatment was performed monthly. However, within a few months, no treatment was evidenced. Thus, considering the existence of a restaurant in the unit, the auditors recommended that this change be made, passing the periodicity of semi-annual treatment to monthly.

The company considered the opportunity for improvement to be appropriate and proceeded to adopt the monthly treatment in the restaurant and every six months in the other units. In the 2014 report, it adopted a preventive treatment that was done weekly, in addition to maintaining the previous criterion.

Also in the 2011 report, there was no evidence in terms of minimizing the incidence of pests and vectors. From 2012, this minimization was included in all reports analyzed. There was no proof that it had decreased, it was only quoted qualitatively.

#### 5.2.7. Regarding cleaning and sanitation of water tanks

- a) Item **8.1.12a** contemplates “legal compliance”.

During the period of the audits under study, the company’s reservoirs were periodically cleaned by companies licensed to the environmental agency.

The reservoir water analyzes were performed by accredited companies that had the *Certificado de Credenciamento de Laboratório* (CCL - Laboratory Accreditation Certificate). According to the INEA website ([www.inea.rj.gov.br](http://www.inea.rj.gov.br)), this certificate consists of the “administrative act by which the environmental body certifies the training of companies to carry out laboratory tests, according to the parameters that it specifies”.

## 5. RESULTS AND DISCUSSION

In this study, an analysis of the Environmental Management System of a chemical industry was made. This analysis was performed based on the environmental audit reports, following Directive 056 - Rev3, made by an auditing company in the years 2011 to 2014.

Based on data of the audit reports, it was possible to draw a graph of non-compliance per year by the audited chemical industry. Figure 4 depicts this scenario:

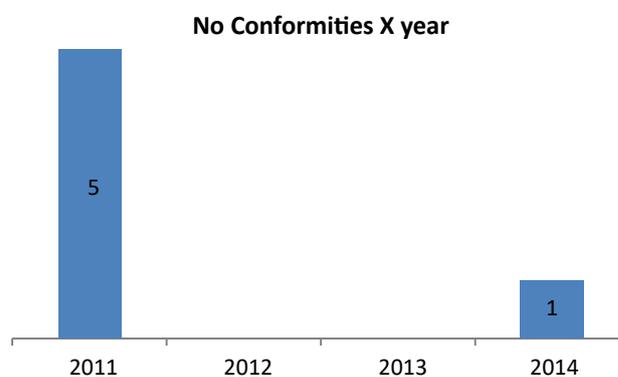


Figure 4 - Non-compliance per year

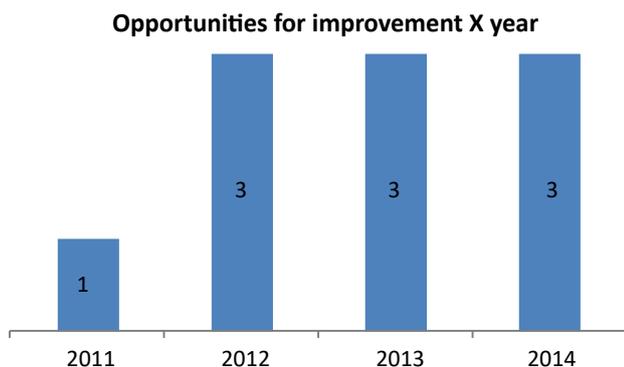
Source: Adapted from the environmental audit reports of the company audited in the respective years

It can be seen that there was a decrease in terms of the number of non-conformities presented by the audited industry, although there was one case of non-conformity in 2014.

It is important to stress that at all times the audited company appeared to show commitment to continuous improvement and sought to act on the causes of nonconformities evidenced to avoid recurrence, which can be evidenced in the report of the following year, in which the auditing company verified the implementation of corrective actions set out in last year’s report.



In addition, the chemical industry has attended all the improvement opportunities (IO) proposed by the auditing company. The graph of figure 5 records the number of IO per year:



**Figure 5** - Number of improvement opportunities per year

Source: Adapted from the environmental audit reports of the company audited in the respective years

It is important to mention that it was not possible to follow the actions related to opportunities for improvement and nonconformities in 2014, since the 2015 report was not available due to the fact that it was probably carried out during the period in which this work was performed.

The company also presented an improvement in terms of the total compliance with the conditioners of the OL, despite a small decrease of 2% from 2013 to 2014, according to Figure 1. It is important to note that, in 2013, all the constraints of OL were considered implemented by the audit team.

Another important factor, evidenced during the analyzed time interval, is that there was a decrease in terms of water and energy consumption, as already shown in figures 2 and 3, respectively.

As shown in the study, the content of Guideline 056 - Rev3 is quite comprehensive. In this way, it is a very rich material to be explored by the environmental agency in monitoring the environmental performance of companies.

## 6. CONCLUSION

Based on the analysis performed to verify the development of the Environmental Management System of a chemical industry through the analysis of the reports of the compulsory audits, it was verified that values were added to the chemical industry from the deviations iden-

tified by the audit team in relation to the requirements of the Guideline 056 - Rev3, such as the continuous reduction in terms of water and energy consumption, as well as the improvement of the degree of compliance with environmental licensing requirements, which, in fact, is already a legal obligation.

Based on the analyzes carried out in the reports, it is possible to notice an evolution of the company both with respect to the reduction in the number of nonconformities identified during the audits and in the consequent increase in the attendance of the OL conditioners. This shows that the chemical industry appeared to have been sensitive to the audit firm's recommendations and observations, thus reinforcing its commitment to continuous improvement. Meeting the requirements of Directive 056 - Rev3 evaluated by the auditing company allowed the organization to:

- Improve its environmental management system;
- Ensure compliance with its environmental policy, environmental legislation and the constraints of previous reports; and
- To transmit to stakeholders that the company is concerned about the environment, following the requirements of the environmental agency's guideline.

In addition, the improvement of the management system of the industry, the existence of policies and operational procedures for activities with significant environmental aspects and impacts, and the employees' willingness to provide information necessary for conducting the audit demonstrated the degree of commitment to environmental issues. The participation of the High Administration was highlighted, since it is the team responsible for the direction of the organization, which is always of paramount importance for the implementation of corrective actions and also for the maintenance of the environmental management system.

It can also be verified that compulsory environmental audit reports are extremely important to measure the environmental performance of the company. This is because they show the chemical industry the main constraints to improving their environmental management system, as well as verifying compliance with the constraints so that the company may be able to maintain its environmental license.

In order to complement the study in question, it is suggested to evaluate how the environmental audit reports are treated in the environmental body during the



environmental licensing process, that is, which action the information in the report can trigger and if it actually occurs.

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