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PDCA Method for Environmental Management of Pollutants Generated in a Battery Industry in an Amazonian City

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Abstract*—The automotive battery industry is a fixed emission source of high pollution potential arising from secondary lead smelting processes pollutants. The management, the quality control standards of air, air pollutant emission limits as well as the allocation and disposal of waste and effluents are provided by legal norms. The objective is to identify management practices and management of atmospheric emissions and the allocation and disposal of waste and effluents in a battery industry that manufactures and reuses materials from reverse logistics to propose a management model based on PDCA- Plan, Do, Check and Act. The specific objectives are:(1)Identify the management and environmental management practices in the industry and relates them with economic development and innovation in industrial processes; (2)Check the procedures adopted for the reverse logistics management and allocation and disposal of wastes, effluents and emissions to mitigate the generation of pollutants; (3)propose management actions and environmental management, according to the PDCA method. It is a descriptive exploratory survey of bibliographical studies and field research with observations of practices in the industry and using the interview questionnaire, to present qualitative and quantitative data. The sample was randomly chosen to focus an industry that generates wastes, effluents and emissions of high polluting potential. Employing the task isintended to answer the question: An environmental management plan based on the PDCA method is able to systematize sustainable actions in an industry that generates highly toxic pollutants? The result is of interest to managers of enterprises that manufacture and reuse of waste battery. This study is important considering thelocus of research, the Amazonian City, which deserves special attention.*

Keywords*— *Environmental Management. PDCA Method. Waste and Pollutant. Battery Industry. Reverse Logistic.

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I. INTRODUCTION

This work has focused on the business environmental management plan, reverse logistics activities, generation, disposal and disposal of waste and effluents and control of air emissions in a battery manufacturing and reuses materials industry. According to the legal regulations the main pollutants from the batteries are those generated in the secondary lead industry merger process. Considering the toxicity of the materials processed in the battery industry, the studies for the environmental management are shown important for the sustainable development of the planet.

The objective is to identify management practices and management of atmospheric emissions and the allocation and disposal of waste and effluents in a battery industry that manufactures and reuses materials from reverse logistics to propose a management model based on PDCA - Plan, Do, Check, Act. The specific objectives are: (1)identify the environmental management practices in the industry and relate them with economic development and innovation in industrial processes; 2)Check the procedures adopted for the reverse logistics management and allocation and disposal of wastes, effluents and emissions to mitigate the generation of pollutants; (3)Propose environmental management actions, according to the PDCA approach set out in ISO 14001 of December 31, 2004 taking into account the provisions of ISO 9001 2000. This is a descriptive exploratory survey of bibliographical studies and field research with observations practices in the industry and using the interview questionnaire, to present qualitative and quantitative data. The sample was chosen randomly, focused in an industry that generates high potential pollutants toxic to the environment and health. The need and obligation of an environmental management system, with appropriate standards in manufacturing processes, reverse logistics, destination and disposal of waste, effluents and emissions control in a battery industry, leads the research question: An environmental management plan based on the PDCA-Plan, Do, Check and Act are able to systematize sustainable actions in an industry that generates highly toxic pollutants? To answer the question we identified practices and management actions and environmental management adopted in the industry. This research consolidates theoretical and practical knowledge of the subject under study. With the result, it was possible to guide managers, the legal rules and procedures, environmentally sound, for a battery industry, which generates highly toxic pollutants that demand attention, thinking about the environmental, social and economic sustainability for present and future generations.

II. OBJECTIVE

The general objective of this work is to study environmental management and management practices, focusing on atmospheric emissions to the disposal and disposal of waste and effluents. The research was conducted in a battery industry that manufactures and reuses materials from reverse logistics to propose a management model based on the PDCA - Plan, Do (or Execute), Check (or Verify) and Act. The specific objectives are: (1)identify the environmental management practices in the industry and relate them with economic development and innovation in industrial processes; 2)Check the procedures adopted for the reverse logistics management and allocation and disposal of wastes, effluents and emissions to mitigate the generation of pollutants; (3)Propose environmental management actions.

III. THEORETICAL CONCEPTUAL REVIEW

The literature review is based on the PDCA method for environmental management and administration of the relationship theory of economic development and innovation in the environmental management and reverse logistics materials and atmospheric effluents and emissions considered highly toxic. Rummage in scientific studies the effects on the environment and human health from pollutants generated in the industry under study. Based on legal norms for allocation, provision and limitations of air pollutant emissions to establish a relationship with the industry of reality under study.

3.1. PDCA method for the construction of Environmental Management System

According Valle (1995) Environmental Management System, proposed tools for continuous improvement in a structured process, allowing systematically organize a plan to cover all phases of a product from the initial idealization until complete elimination of waste, objectifying adequate environmental performance.

The ABNT NBR ISO 14001 of December 31, 2004, provides that the construction of an environmental management plan means implementing policies and objectives to guide and promote the commitment of all the organization for actions that lead to achieving economic, social and environment in accordance with legal regulations, resulting in sustainable development. The same rule clarifies that the implementation of a set of environmental management techniques, may reflect important results for the planet. The management of companies, regardless of the economic activity exercised, must implement environmental management policies through guiding documents, with periodic reviews to continuously keep

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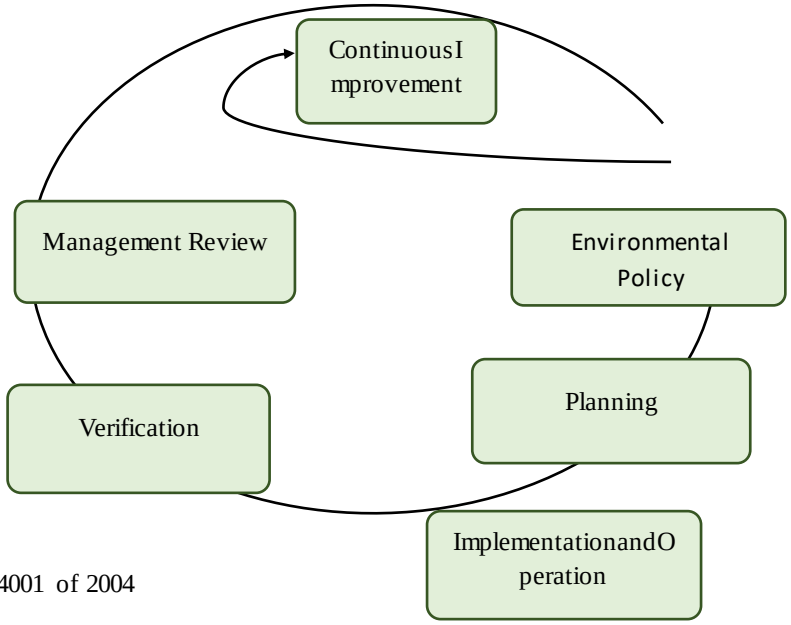
the actions to control environmental impacts in accordance with legal and environmental regulations.

The CONAMA Resolution 401 of November 04, 2008, determines that the battery manufacturer must present to the competent environmental agency, management plan for the batteries. The same Resolution establishes that, each year, the battery manufacturer must submit to IBAMA - Brazilian Institute of Environment and Renewable Natural Resources, an award on the physico-chemical composition, issued by a laboratory of the National Institute of Metrology and Standardization - INMETRO.

The process to implement an Environmental Management System - EMS proposed in the ISO 14001 series of 31 December 2004, it is based on the PDCA methodology (Plan, Do, Check, Act). To Mariani (2005). PDCA method directs the actions of management of internal processes, is used to achieve goals set for the organization, using the information to direct actions. Based on the ISO 14001 series of 2004, phases of the PDCA arerepresented in Figure 1 and establish a roadmap for actions in the company in search of the implementation of an EMS- Environmental Management System.



Fonte: Norm ISO 14001 of 2004

Fig.1: Model of the environmental management system according to ISO 14001

Based on Figure 1 the Environmental Management System is an integrated process that, according to ISO 14001 of December 31, 2004, can be called process approach. Table 1 shows the phases of the PDCA process approach to environmental management.

Table.1: Phases of approach to environmental and process management

Processes	Integratingprocesses	Result
Environmental Policy	Based on legal norms define the company's environmentalpolicies	ContinuousImprovement
Plan	Establish the obectives and processes necessary for the dye results in accordance with the organization's environmental policy	
Do	Implementtheprocesses	
Check	Monitor and mensureprocesses in accordance with the environmental policy, objectives, targets, logal and other requirements, and report ehe results.	
Act	Act to continuously improve the performance of the environmental management system.	

Source: Adapted ISO 14001 2004

3.2 The interface of the theory of economic development, innovation and environmental management

Mitcham (1995) states that since the sixties occur debates on relationship between economic growth and quality of life on earth in search of balance between development,

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economic stability in industrial nations and ecological maintenance and environmental safety of the planet.

According to Adams (2006) and Quental *et al*. (2011) the society and the economy are governed by man and the available natural resources represent a finite limit which means that the supply of natural resources and energy is limited in space and time.

For Schumpeter (1985) the agent of transformation of the economy is the entrepreneur who, through innovation destroys creatively old habits, establishing a new relationship with the market. The thought of Schumpeter (1985) propose to focus on innovation as a fundamental phenomenon of economic development, it highlights the entrepreneur's role to put into practical innovations and trigger endogenous changes that generate economic growth with changing habits of consumers. Defends innovation to change the way the current static production company conceptualizes and innovation as the development of new internal combinations seeking innovative alternatives to market a new way of making new products and meeting profitability and development.

For Porter and Van der Linde (1999) compliance innovation for the environmental adaptation is carried in response to regulatory mechanisms. The same author points out that the legal standards drive innovation to the environment and become important to ensure that companies do not create competitive advantage with actions that harm the environment. As for Weber (1999) in the contemporary world government through the imposition of stricter laws shall establish commitment and environmental responsibility to stakeholders, to reduce the environmental impact in the production process, trade and consumption of goods and services. And clarifies that the industries and trade started to use environmental management to establish a competitive business strategy.

According to Bessant and Tidd (2009) innovation plays a central role in helping to create sustainable future by conventional means, such as new processes, products and services, but also by promoting changes in behavior. The concern about the issue of sustainability is increasing on the agenda of innovation. Innovation connected to sustainability factors, usually has greater systemic implications and emphasizes the need for integrated management.

The report of the United Nations Environment Program - UNEP (2011), points out that the industry through innovative actions should take a proactive role in the green economy with efficient use of resources and increased productivity throughout the supply chain and distribution products and services.

3.3 Reverse logistics in environmental management actions of waste, effluents and emissions in industry that generate toxic pollutants

For Leite (2009) the reverse logistics deals with the return of various types of products after use and end of that lifetime back to the manufacturer for recycling, adding value to return to the production process to form new products.

Xavier and Correia (2013) say that reverse logistics is important for society because it reduces the extraction of raw materials through reuse of waste in the production process, environmentally intended materials thus protecting the environment for the benefit of sustainability.

About this, Souza and Rodrigues (2014) affirm that the practice of reverse logistics in the battery industry is to reduce the environmental impact and the reuse of materials, affluents and waste establishes an operational competitive advantage by reducing the cost of raw materials, adding value to the company.

Reverse logistics action in Brazil is foreseen in CONAMA Resolution No. 401 of November 4, 2008, which requires manufacturers, importers and retailers to deploy operating mechanisms for the collection, transport and storage as well as establishing criteria for marketing in the nationalterritory.

The Law 12.305 of 2 August, 2010 establishing the National Policy on Solid Waste, establishes standards for the management of hazardous wastes and reverse logistics, as an economic and social development tool, characterized by a set of actions, procedures and means designed to facilitate the return of waste for reuse in the productive cycle or for the environmentally acceptable disposal.

3.3.1 Air emissions, effluents and waste generated in the process of recycling the batteries industries

Important to note that the CONAMA Resolution 3 June 28, 1990 conceptualized air pollution as any form of pollution that is not in accordance with the established levels considering matter or energy, intensity and quantity, concentration, time or characteristics that makes the offensive air health, that interfere with the public welfare, cause damage to the materials, flora and fauna or compromising the security in the normal activities of the people. Already CONAMA Resolution 436 of December 22, 2011 sets limits of air pollutants emissions, points out that this is the main pollutant generated in the battery industry and results from secondary lead melting process.

Santos *et al*. (2011) affirm that the industrial process for recycling batteries for reuse of materials is potentially polluting, there is no emission of gases and particles and battery scrap residues contain lead oxide, lead sulfate, and plastics, acidic components and other heavy metals, slag residue resulting from the recycling of lead finally to waste acid solution. According to studies by Baird (1995)

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lead is a metal with a high toxicity and a tendency to accumulate in the human organism.

Baenas (2008) that focuses the contamination in the battery case by processing industries for reuse of scrap of components of used batteries. Affirm that the environmental contamination happens through the emission of pollutants causing pollution of air, soil and water contaminants emphasizes that when in contact with the skin are carried by the blood circulation affecting kidneys, bone marrow, liver and brain.

3.3.2 Environmental management of air emissions, waste and effluents generated in the process of recycling in the batteries industries

According to Francalanza (2000), the lead recycling is an environmental point of view, the most correctprocedure. But this does not mean that recycling processes adopted, can not come cause serious problems to the environment and to human health, especially the workers in this industrial segment.

To Nunes (2004) lead is highly toxic and accumulative and can be removed from industrial effluents with good efficiency with sodium sulphide. This process must occur prior to biological treatment to avoid inhibition of the microorganisms responsible for the oxidation of organic matter.

For Pacheco (2002) in the battery recycling industry, failure to comply with the rules for changing the filter sleeve may lead to lead contamination by atmospheric emissions, noting that the time of exchanging the filter sleevecontaining particulate lead, must be established pursuant to its life. It states that a filter sleeve failure when there is an excessive clogging or emission. The issue should be checked weekly using a particulate detection equipment, while the clogging must be checked daily by measuring pressure loss of the filter with specific apparatus. It states that the pressure drop of the sleeve filter is the pressure difference between the dirty and clean cameras

Especially Francalanza (2000), states that industries can use well-known procedures, correct and adequate control and minimization of potential problems with the pollutants generated in the battery industry such as: 1-neutralization of the acid and lead recovery him contained; 2- filtering job for retention of gases and particulates; 3-treatment to neutralize the slag; 4-disposal of slag in suitable landfill; 5-monitoring of emissions and particulates into the environment; 6. Monitoring of soil and groundwater conditions and; 7 periodic medical examinations of employees.

IV. METHODOLOGY

As argued by Creswell (2010), the choice of method will depend on the intent of the search to specify the type of procedure. Regarding the approach to the problem, the studies of Marconi and Lakatos (2011) are employed in search of qualitative and quantitative data capable of answering the research question and using the Economic Development Theory prescribed in Schumpeter (1985) and the Environmental ManagementSystem - EMS proposed in the ISO 14001 series of 31 December 2004 and takes into account the provisions of ISO 9001 2000 is based on the PDCA methodology (Plan, Do, Check, Act) to meet the objectives of this research and propose management actions and management for an industry that generates highly toxic pollutants.

4.2 The method used in this research.

The research assumes exploratory and descriptive character that according to Gil (2010) and Marconi and Lakatos (2011) allows to explain the problemmanagement of pollutants generated in a high pollution potential industry. Through literature review is established familiarity with the subject and based on the proposals of legal regulations and scientific studies propose an environmental management system in an industry that generates toxic pollutants.

With support in the studies of Gil (2010) opted for the field research to increase knowledge about the object under study. We used observation and interview questionnaire with industry managers, to check *in loco* and capture the explanations and interpretations of the actions taken to manage and management there generated pollutants.

The selection of the sample is in the studies of Marconi and Lakatos (2011) that suggests for the field research to select respondents who have practical experiences with the problem researched providing the analysis that stimulates the understanding and propose to know and to interpret the reality, without interfering in it for be able to modifyit.The sample non-probabilistic, intentionally incorporated, selected by random sample criterion has support in studies of Cooper and Schindler (2003), the initial selection of sampling is of the investigator. The choice of the sample is focused on the actors that is directly related to the management of generated pollutants. The choice of location was strategic to engage industry studies that processes highly toxic material.

4.3 Procedures and techniques adopted

The strategic to meet the objectives raises technical procedures to systematize the actions of pollution management in an industry that processes lead to emissions of air pollutants, waste and highly toxic and important effluent is made to establish a relationship with the theory of economic innovation and the ecological balance. Figure 2 shows the flow of the procedures adopted to incorporate the results the main knowledge acquired with this task.

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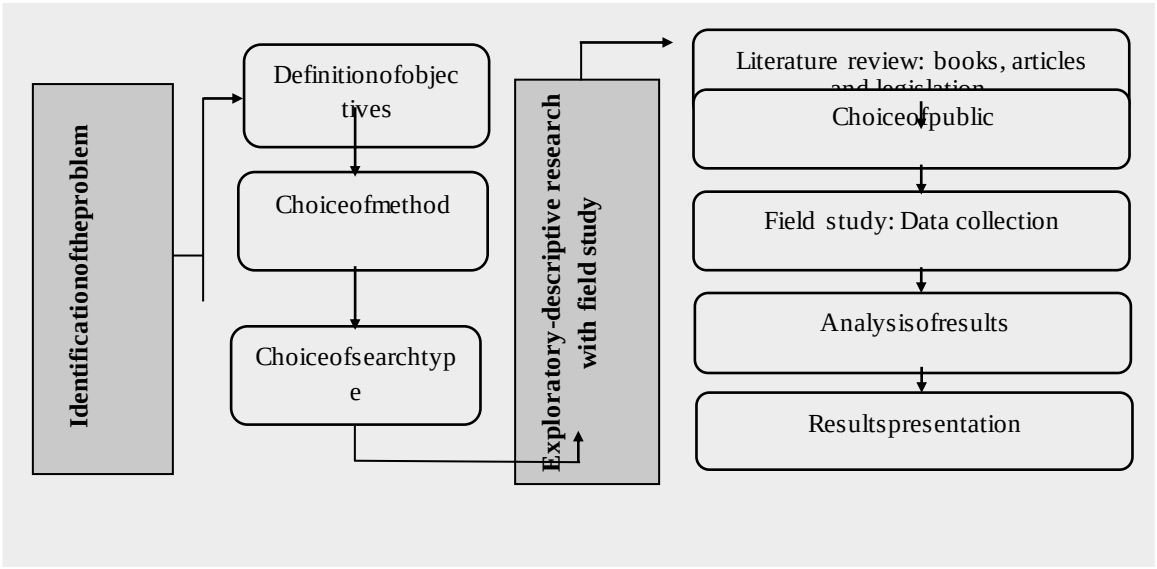

Fig.2: Table procedures adopted for research

Source: The Authors

The preparation of this task begins with the definition of objectives to choose the best method and type of research to substantiate knowledge and answer the research question. The literature review allowed prepare a questionnaire interviews and structuring expertise to the research note that was held in April 2018. In the data collection procedurewe tried to maintain discipline provided in the Gil recommendations (2010) and Marconi and Lakatos (2011). Data collection was through interviews with industry managers and observing all environments following processing in the industrial plant relating theory and practice. For the analysis established a relationship between the proposals on legal standards and the theoretical framework with the reality found.

V. RESEARCH RESULTS

This research was conducted in an automotive battery industry, located in a municipality in the region of the Brazilian Amazon in operation for over twenty years. The reverse logistics industry promotes the allocation and disposal of waste and effluent and used in the secondary smelting pyrometallurgical process for the recycling of lead. The source of heat for the processing furnace is moved wood and uses polyester filter sleeve for filtering emissions from the lead secondary fusing process. It has semi-artesian well that provides water for the industry. According to the research result in the main pollutants generated industry study are: particulate material of lead, acid solution, plastic and iron slag.

The company serves in part the legal standards of control and supervisory bodies considering that holds ISO 9001 certification and the certification of INMETRO-National Institute of Metrology, Quality and Technology and employees circulating in the industry environment, are with EPI - Personal Protective equipment, noting the expected inNR Regulatory Standard No. 6 of the Ministry of Labor. The company also serves Regulatory Norm NR-7 of 1994 which determines the exams every six months in specialized laboratory to identify the lead content in the body of the industry's employees. According to managers until the date of the survey, did not identify lead content above the permitted in any examination conducted.

5.1 The Environmental Management System - EMS, economic development and innovation in the processes and procedures in the industry under study

The scope of the review is possible to identify which industries batteries have general legal standards and specific forecasted to pollutant emissions, the degree of toxicities of waste generated when processing the lead in order to avoid contamination of the soil, water and air.

It was identified that the industry does not have a management plan that meets the Environmental Management System (EMS) provided for in Brazilian legal norms coordinated actions for the allocation and disposal of waste and effluents and air emissions. Imperative to meet the legal framework as Resolution 401 of 2008 which provides for the preparation of the plan and presentation to inspection and environmental control agenciesfor the operation of the industry. Law 12.305 of August 2, 2010, establishes standards for the waste management and effluent especially dangerous. It is worth highlighting the importance of considering the concepts of CONAMA Resolution 3 of 28 June 1990 and CONAMA Resolution 436 of December 22, 2011 which sets limits for air pollutant emissions for the industry study.

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You can see that managers have concerns about air emissions, waste and effluents generated there, however, actions to avoid contamination, need to better focus on the environment and the surroundings, the air, soil and water with global environmental vision, social and economic short-term and then for the benefit of current and future generations.

Note that it is possible to innovate in the process and procedures through planning of adequate environmental actions using the template provided for environmental management in ABNT NBRISO 14001 2004 based on the PDCA (Plan, Do, Check, Act) recommended for the industry. Thoughts currents raise the innovation part of endogenous entrepreneur actions to change market paradigms and the environment favorable actions are competitive strategies for sustainability or economic, social and environmental.

Based on the results it can be stated that the actions taken there demanding guidelines based on scientific studies and legal norms about the dangers of the procedures adopted in the company, together with the need to mitigate the pollutants to prevent imminent harm to the environment. Thesystematization and implementation of an environmental management plan with clear reasons and continuous and coordinated actions can improve the environmental vision and yet the image of the company.In this way, it is important to carry out the planning for execution, verification of the results and mitigation actions proposed by the PDCA method in order to innovate processes and procedures with a view to environmental certification, establishing competitiveness in the market mainly with the big industries.

5.2 Environmental management of reverse logistics of waste and battery waste

The reverse logistics process procedures and requires investments capable of effecting actions from manufacturing through the use of waste generated and return to recycling or reuse, and the manufacturing process or proper disposal in observing the composition of the residue.

The reverse logistics of actions taken by the industry meets the foreseen in CONAMA Resolution No. 401 of 2008 and Law 12.305 of 2010. In the new product sales collect the used battery, action is in partnership with the dealer.

To illustrate, Figure 3 shows the procedures adopted in manufacturing industries of this battery to the generation of wastes, effluents and emissions to reverse logistics procedures.

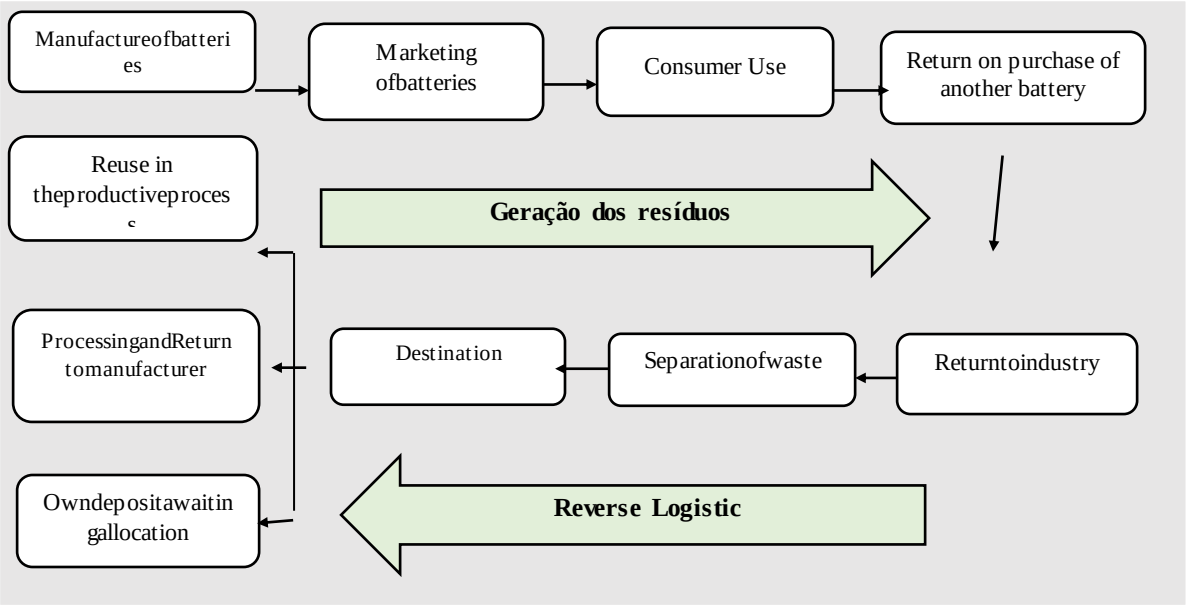

Fig.3: Procedure from manufacture to disposal of the product and disposition

Source: The Authors

The reverse logistics activities, practiced by the industry, meet the Brazilian legal standards return of waste and effluents from batteries. Important to note that the industry makes reuse of the lead taken from the battery, reverse logistics object through the secondary smelting process which generates waste effluents and highly toxic air emissions by means of lead particulate emission, acidic solution, aerosols and the slag iron. The reuse of the battery cases also generates waste plastic containing particles of lead.

5.2.1 Destination and disposition of air emissions, waste and waste battery

The batteries, reverse logistics object, industry arrive and are stored in a warehouse, subsequently sawn to separate the waste plastic grid of lead acid, and other composing the battery of the structure. Table 2 represents the interview survey results and observation of practices in

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the company as atmospheric emissions the allocation and disposal of waste and effluents arising from industrial process and associated legal norms.

Table.2: pollutant Classification actions in the industry and associated legal norms

RANKING	WASTE / POLLUTANTS	SEARCH RESULT	LEGAL NORMS
Particulate Material	Aerosols	Smoke from the chimneys is thrown into the atmosphere. Analyzes indicate acceptable limits of particulate matter.	CONAMA Resolution 436of 2011
		Dispersion of particulate material in the air by rupturing the conductive sleeves.	
		Likely suspension of lead particles in exchange for conductive sleeves.	
Liquid	Effluents from acid solution	The industry neutralizes the acid solution and returns to the industry / manufacturer.	CONAMA Resolution n° 401 of 2008 and Law12.305 of 2010
Solid	Lead particulate material	Directed by means of sleeper conductors for the collection and reuse of lead.	CONAMA Resolution 436 of 2011
	Plastic - Batteries cover	Manually crushed and then in the dry crusher and returned to the manufacturer.	CONAMA Resolution n° 401 de 2008 and Law 12.305 of 2010
	Cleaning cloths	They are incinerated in the kiln in the industry.	Law 12.305 of 2010
	Filter sleeve conducting particulate lead	Overdue the lead time is collected for reuse and the sleeves are incinerated in the industry.	CONAMA Resolution 436 of 2011
		There was no information regarding cleaning and use of control and monitoring equipment for the exchange.	Law 12.305 of 2010
	Iron Slag	Crushed and deposited in a place in the company awaiting disposal, (around 500 tons in the warehouse)	Law 12.305 of 2010

Source: The Authors - based search result.

It should be noted that the pollutants generated in the most disturbing industrial process is the particulate material, which dissipates into the air by the smoke and can result in serious problems to the environment and human health through contamination of the atmosphere by the roundness and even in places more distant. The industry presented environmental research reports, conducted in 2012, indicating limits laid down in legal regulations.

It is worth reflecting on the provisions of CONAMA Resolution 436 of 2011which limits emissions for industries batteries that are considered fixed sources that generate air pollutants in the secondary lead fusion process, highly toxic to health and the environment. Legal regulations indicate that atmospheric emissions contain particulates of lead that contaminate the atmosphere to a greater or lesser degree. The planning and emission control becomes essential to avoid and prevent environmental disasters that can cause long-term damage, irreparable human health and the environment.

It was identified that lead particulate material is filtered through a polyester filter and collected into sleeve bags for processing and reuse in the company. The filter sleeve used when replaced with new and cleaning cloths are incinerated in the company's furnace. It is suggested that the exchange of the filter sleeve should be carefully practiced, avoiding to disperse particles of lead in the environment. Given the important need to avoid the emission of lead-containing air pollutants, the legal norms and the theoretical framework give rise to the periodic exchange of the manhole filter and daily monitoring of the filtration capacity of the particles to identify the filter clogging. This process can be carried out by checking the pressure drop of the filter and controlling the emissions can be by means of devices that detect the lead

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particulates in the aerosols emitted in the chimneys, however, avoiding the contamination of the environment.

The acid solution effluent is neutralized and it returns to the manufacturer, in the same transport that brings new products, thus meeting the legal rules of destination through return. The theoretical framework that emphasizes the acidic solution used in manufacturing results in highly polluting effluent. There was the need for the industry to promote management actions acid solution effluent generated when disassembling the batteries, reverse logistics object, considering the contact with the ground in inappropriate location for the job. It is suggested waterproof floor with channels and capture the effluent for neutralization and return to the manufacturer.

It was observed that the residue of the plastic battery cases is triturated dry manual process shredder and then, return to the manufacturer for disposal. It was observed that the manual process of disassembling the battery boxes, there is the generation of residues and effluents which probably contains acid and particulate lead. This effluent containing lead runs the floor and observed cracks in the floor which suggests that pollutants have contact with the ground. Based on theoretical framework that indicates the degree of toxicity of the effluent is suggested that where the carcasses are crushed there is a structure with a waterproof floor to prevent contamination of soil and water, and channels with a thickness capable of collecting solution. It is worth highlighting the importance of a secure process to prevent soil contamination,

It was found that iron slag waste generated in the furnace after the lead is intended for processing a deposit in the industry, open place without protection. According to the search result in the city or proximity has no landfills for disposal in accordance with ABNT 10004 2004 classifies hazardous waste in Class I. According to the managers in the industry under study there is about 500 tons of slag in the tank that demands urgent allocation. Important to note the study Nunes (2004) on the toxicity of lead in industrial wastewater. It is imperative that the company studies to engage the allocation or arrangement of iron slag, waste accumulated in this company.

5.4 Proposal management using the PDCA method

Table 3 is a parallel between the actions in the industry, legal regulations, proposals for action and implementation of PDCA for management of waste and effluents and air emissions. Are processes that integrate and demand an approach to establish a systematic form a plan to consolidate the management in the battery industry.

Table.3: Actions in the industry, legal regulations and interventions based on the PDCA

INDUSTRY ACTIONS	LEGALS NORMS	PROPOSED INTERVENTION	PDCA
Management plan	1. ABNT NBR ISO 14.001 of 2004. 2. Resolution 401 de 4 de novembro de 2008.	Provide a participatory management plan with the PDCA method	Plan Do Check Act
Reverse logistic	CONAMA Resolution 401/2008 and Law 12.305 of 2010	- Establish sales and return controls to consolidate reverse logistics, software is suggested.	Plan Do Check Act
Generation of air pollutants smoke / aerosols Dispersion of lead particulates, collection in bags.	CONAMA Resolution 436 of december of 2011	-Provide filter in the chimneys to monitor particulate emissions and monitor the filtration capacity of the sleeve filter to plan the exchange before they are damaged. -Provide closed site for the collection of lead particulates from the sleeves	Plan Do Check Act
Sulfuric acid - the company promotes reverse logistics for the industry /	CONAMA Resolution n° 401/2008 and Law 12.305 of 2010	- Provide the waterproofing of the floor where the batteries are disassembled, object of the reverse logistics. -Provide channels capable of conducting the liquid waste from the place where the	Plan Do Check Act

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manufacturer after neutralization.		batteries are disassembled for safe collection.	
		-Provide mechanical crusher avoiding human contact with the battery casings.	
Plastic cover of the batteries, crushed manually and then in the dry crusher and returned to the manufacturer.		- Treat the liquid waste and lead in the soluble form generated at the time of disassembling the batteries.	
		-Monitoring the soil conditions and groundwater, well of the company and roundness.	
Cloths are cremated	Law 12.305 of 2010	-Environmentally sound disposal.	Acttocontinuously improve
Filter sleeves are incinerated in the industry itself.		-Filter sleeve contains lead if incinerated particles return to the process as particulate residues and again to the filter.	
Iron slag: Crushed and deposited at the company's own site awaiting disposal, (around 500 tons in the warehouse)	Law 12.305 of 2010 and ABNT 10.004 of 2004	- Treatment and neutralization	Plan Do Check Act
		- Waste Class I - hazardous, demands environmentally adequate disposal in Industrial landfill.	
Worker's health	NR 06 and 07	-Provide the management plan and participatory for coordinated actions within the industry.	Plan Do Check Act
		-Monitoring the worker's health continuously.	
		-Monitoring the use of PPE - Personal Protective Equipment.	
		-Monitor the environment of the industrial	

Source: The Authors - Search Results

It highlights the importance of a EMP - Environmental Management Plan, based on rules and procedures validated by the PDCA method - Plan, Do, Check, Act depicted in Figure 4, in order to direct actions environmentally sound in an industry with highly toxic pollutant emissions.

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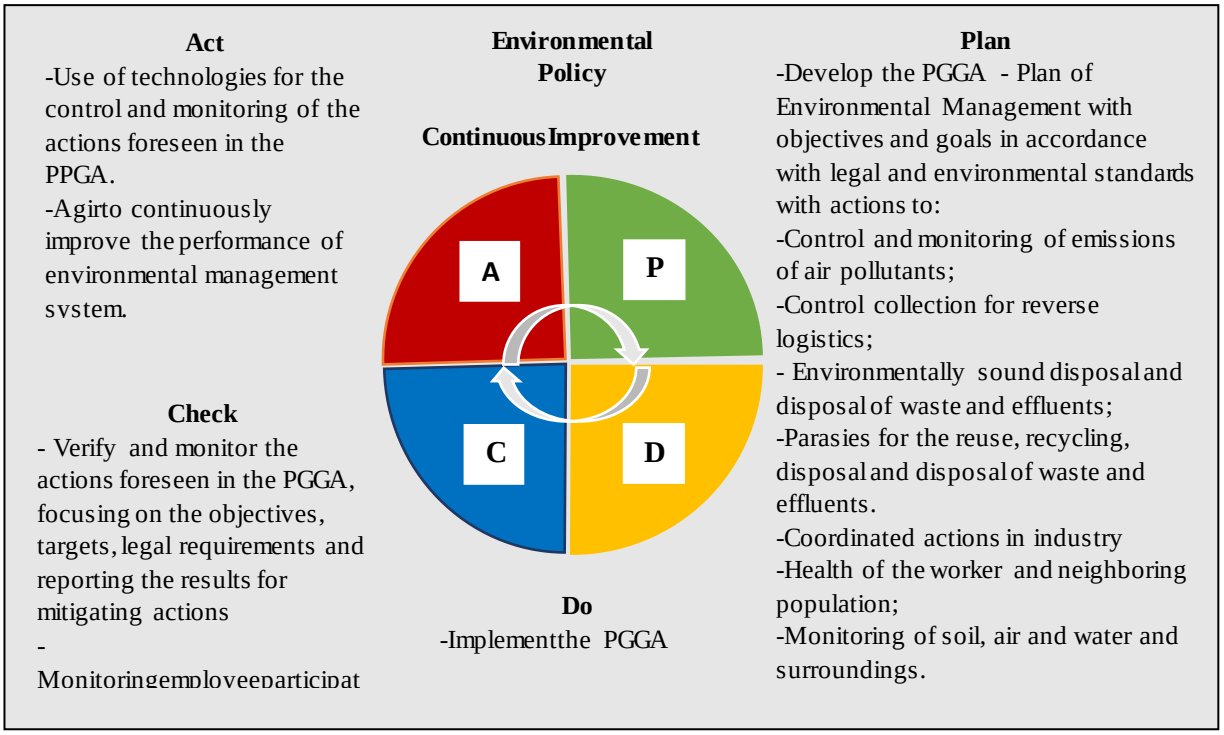

Fig.4: *Method for PDCA Environmental Management System EMS in the battery industry*
Source: Adapted ISO 14001 2004

The rules establish the need for management plan to direct actions in the battery industry, aimed at environmental protection with the allocation and provision of environmentally sound waste.

VI. CONCLUSION

The company does not have an environmental management plan and suggests to design and implement immediately to outline actions, objective and targets for the industry, able to contribute to sustainable development and environmental security of the planet. Noting that a management plan will be able to direct actions, brings security as the rules and procedures in the company and meets the legal and environmental standards.

The high pollution potential is important to implement a participative environmental management, with the involvement of all those who are in the process, so the housekeeper task answers the research question, a environmental management plan based on the PDCA method - Plan, Do, Check and Act are able to systematize sustainable actions in an industry that generates highly toxic pollutants as shown in the task.

It's concluded that aparticipative EMS - Environmental Management System is important because it promotes continuous improvement with coordinated actions innovating processes and procedures focusing on economic, social and environmental sustainability to establish competitiveness in the consumer market.

According to the theoretical framework of this task emissions of air pollutants, waste and effluent in the battery industry that are highly toxic can reach people living in the surrounding region and it is suggested that studies with the surrounding people water, air and ground.

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