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Thermal of the Campina Grande - PB, Brazil and its environmental impacts

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With the incorporation of new behavioral habits for the most demanding customers, respect for the environment, the industrialized countries and in industrialization have adopted quality standards for air and water, and emissions standards for industrial liquid effluents and gaseous and licensing systems of polluting activities, in line with current environmental legislation. Thus, this study aimed to evaluate the environmental impacts generated by thermal factory Borborema Energy S/A, located between the municipalities of Campina Grande - PB and Queimadas - PB, describing the social and environmental impacts local, arising from the operation of the thermal factory and also proposing mitigation measures in order to mitigate the negative impacts. The observation in loco was used for data collection, using digital images, characterization and qualitative diagnosis of the impacts from the use of the identification matrix of potential impacts in thermals. Thus, it qualified that the Thermoelectric has negative nature on the impacts and medium significance (significant) on the item noise pollution and, as very significant on the items emissions of SO_2, CO_2, NOx, CO and hydrocarbons. As for the interference with flora and fauna, it was found that it exerts great magnitude and high importance (very important). Although there is an Environmental Impact Study (EIS) and Environmental Impact Report (EIR) presented and approved, this EIS and EIR disregarded some important items and does not reflect the reality in the study area and its surroundings.

Key words: Mitigating measures, soil pollution, flora and fauna.

INTRODUCTION

With the advent of new technology and global competitiveness, there is a restructuring of organizations where there is a new design in the model of social and cultural relations within and outside the enterprise environment, involving multiple agents involved in the value chain, with internal and external customers, governments, suppliers, competitors, non-governmental organizations, among others (Mattos, 2002). The respect for environment and human sets a new standard for negotiation and power between the parties, which should not be ignored by companies that want to stay on the competition (Burmann, 2010). On the other hand, the fact

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that the consumer base is known worldwide, they are increasingly aware of their rights.

Due to various disasters of industrial pollution in the 1960's, more specifically, with the implementation of the Stockholm Conference in 1972, the industrialized countries adopted quality standards for air and for water, emissions standards for liquid and gaseous industrial waste, licensing systems of polluting activities and the use of environmental impact reports (Passos, 2009).

In globalized world, industries have adopted voluntary codes of conduct as a responsible action and international standards aiming at the acceptance of the products according to international quality standards, operational safety and less harm to the natural environment (Sant'ana et al., 2010).

The environmental policy and legislation, aimed at ensuring the well-being of today's society and future generations, as well as implement a recovery increasingly effective and a more constant vigilance in order to meet the law. Therefore, enterprise characteristics and the proposed site for installation of a factory, require the assessment of the possible environmental impacts caused by the factory, under the Environmental Impact Study and Environmental Impact Report - EIS/EIR (Terra, 2007).

In this context, it brings up a question on the implementation of a Thermal Factory in Campina Grande - PB, Brazil, with the main focus to the Environmental Impact Study (EIS) in the works planned for the deployment and operation of its Thermoelectric. The scope of this study includes characterization of the project, environmental assessment, integrated environmental analysis, identification and evaluation of environmental impacts, environmental control measures and monitoring actions in the implementation of Thermoelectric of Campina Grande - PB.

The study aims to evaluate the environmental impacts generated by thermal power plant Borborema Energy S/A, located between Campina Grande - PB and Queimadas - PB, describing the social and environmental impacts local, arising from the operation of the thermal power plant and also proposing mitigation measures in order to mitigate the negative impacts.

MATERIALS AND METHODS

The study was conducted from March to December 2015 and the study area comprised of the surroundings of thermal Borborema Energy S/A, as well as its area of influence. The study is a fieldwork, exploratory, with qualitative and quantitative approach. The thermal factory is located between the city of Campina Grande - PB and Queimadas - PB, occupying a building area of approximately 84,630 m², located in the geographical coordinates 7°17'47.44"S and 35°54'30.29"W, whose altitude is 483 meters (Google Earth, 2015; IBGE, 2010). The constructed area of the thermal is considered rural, but in its surroundings there are big population, with about 20.000 inhabitants, living in the surrounding neighborhoods, which has schools, residences, and a Private Natural Heritage Reserve (PNHR) in the process of approval, of the University Support Foundation Education and Research (Furne), with 100 hectares of extension.

Embrapa (1999) classify the soil of the area as Eutrophic Litholic Neosol with horizon "A" weak, sandy texture, stony and rocky phase according to studies carried out. The relief is strong undulating and hilly, with low agricultural potential soils with moderate to strong natural fertility deficiency, strong to very strong deficiency of water and strong susceptibility to erosion (Santos et al., 2006). Among the municipalities of Campina Grande and Queimadas in the conflict area, the class of the soil is Halomórficos soil, SS1 class, Sollonetz Solodizado Ta, with the horizon "A" weak, medium texture, caatinga hypoxerophytic phase, flat relief and undulated (Embrapa, 1972). By Köppen classification, the climate is the type As' (hot and humid) with average annual temperatures between 22 to 26°C. The average rainfall is 700 mm per year, with April to September rains. The average relative humidity is about 80% (Francisco et al., 2010).

The vegetation area is an arboreal size, not too dense, with branched trees, highlighting, shrubby strata dominated by quince, the most frequent tree species are *Schinopesis brasiliensis*, *Zizyphus joazeiro*) and *Petophorum dubium*. As for fauna, different types of birds are present such as, reptiles and rodents, which are all small (Francisco et al., 2010; Ribeiro and Teotia, 2005).

As data collection instrument was used, Arcgis software 2012, GPS Garmin Extrex Vista HCx, digital camera FUJIFILM Fine PIX S2800HD, observations in loco to conduct the survey of environmental impact indicators, and also analysis of the study of impact environmental conducted by Environmental Consulting Ltda, for Borborema Energy S/A and identify potential impacts matrix adapted. The identification, characterization, diagnosis and qualitative impacts were carried out from the parameters of environmental impact assessment adapted (Table 1). Matrices allow easy understanding of the results which can be qualitative, when using the qualitative classification criteria of environmental impacts, or quantitatively, when criteria are used on the magnitude of the impact environment under the positive and negative causes known (Brito et al., 2002; Lelles et al., 2005).

In the present study, we chose to use the identification matrix because of the flexibility to qualitatively measure the impacts. In this study, we chose to use an adaptation of the original Leopold matrix identification because of the flexibility to qualitatively measure the impacts whose measurement was by the method trial specialist and experts that is based on the ability of these issue which estimates the probability of occurrence, spatial and temporal extent, and the magnitude of certain environmental impacts. The diagnoses are expressed based on the experience and knowledge of the judges, having the following classes based on:

1. Formal forecasts
2. Forecasts based on their professional experience
3. Extrapolations from known cases and
4. Pure assumptions (Sánchez, 2013).

Regarding the method of "check - list", it is observed that this is the evaluation of environmental impacts when considering the processing capacity of the physical, biotic and anthropic

RESULTS AND DISCUSSION

Taking into account the parameters of environmental impact assessment contained in Table 1, the potential impacts have been identified and diagnosed in thermal, as shown in Table 2, taking into account reviews of images and observation in loco.

In relation to the ambient air, on the issue of air emissions of particulate matter (Table 2), it was

Table 1. Parameters of environmental impact assessment, adapted.

Aspects	Classes	Note
Nature	Positive (P), Negative (N)	It indicates when the impact has effects on the environment
Form	Direct (D), Indirect (I)	As is obvious the impact resulting from a project action, or it is an impact due from the other, or other impacts generated directly or indirectly by it
Comprehensiveness	Local (L), Regional (R)	Indicates the impacts whose effects are felt in or that they may affect broader geographic areas, characterized as impacts. It was considered as a local effect to that which is limited to the area directly affected the enterprise, and regional, one that is reflected in the area of direct influence
Phase occurrence	Implantation (I), Operation (O)	It indicates the phase of the enterprise the impact can be seen
Temporality	Short term (ST), Mid-term (MT), Long Term (LT)	Differentiates the impacts as manifestation immediately after striking action
Duration	Permanent (P), Temporary (T), Cyclic (C)	Criterion which indicates the impact time duration
Reversibility	Reversible (R), Irreversible (I)	Sorts the second impact manifestation of its effects
Probability	High (H), Mean (M), Low (L)	The probability or frequency which an impact may occur almost certainly and constantly throughout the activity
Magnitude and importance	Big (B), Medium (M), Little (L)	It refers to the degree of incidence and interference of an impact on the environmental factor in relation to the universe of this environmental factor. The magnitude of an impact is therefore treated exclusively in relation to the environmental factor in question, regardless of its importance by affecting other environmental factors. 1 to 3 - Little Important; 4 to 6 - Average Important; 7 to 10 - Very Important
Meaningfulness	Little Significant (LS), Significant (S), Very Significant (VS).	It is classified into three grades according to the combination of magnitude levels

Source: Sanchez, 2013.

diagnosed that: on the aspect of nature, the four items were negative (N); on the aspect form, was presented direct (D) in all items; the comprehensiveness qualified as local (L); and the phase occurrence identified as operating phase (O) for all items. As for the temporality, we found short term (ST), to the issues of respiratory problems, irritating smell, and bad aesthetic effect; and medium term (MT), on interference with flora. On the duration, was evaluated as permanent (P), for interference with flora and bad aesthetic effect, and cyclic duration (C) for respiratory problems and irritating smell.

Reversibility was proved to be reversible (R) for respiratory problems and irritating smell, and irreversible (I) for two other potential impacts. According to the probability, only the item bad aesthetic effect was high (H), the other items were classified as mean (M). According to the magnitude and importance, only the potential impact of bad aesthetic effect was evaluated as big important for level 10 (B10), the other three are considered as the medium importance of level 6 (M6). And yet, the significance was computed as very significant (VS) and significant (S) to other potential impacts.

The pollution of the atmospheric air, vegetation, soil, surface water and groundwater affects the degree of high vulnerability of human health, with increasing risks of quality of life, social and economically of residents surrounding the thermoelectric Borborema Energy S/A (Moraes Neto et al., 2002).

During the implementation of thermal, the fauna is generally affected by human actions, considering the removal of vegetation, which changes the environment and reduces the resources available for food and shelter animals. Complementing this, the movement of people, machinery, equipment and trucks cause noise and vibrations that disturb and scare away the wildlife in

Table 2. Identification of potential impacts matrix in thermal adapted to Leopold

Potential impact				Yes	No	Nature	Form	Comprehen-siveness	Phase occurrence	Temporality	Duration	Reversi-bility	Probability	Magnitude and importance	Meaningful-ness
Environmental elements	Environment	Air	Air Emissions of Particulate Matter	**Respiratory problems:** probability of pollution particles in the human population in the surrounding.	X	-	N	D	L	O	ST	C	R	M	M6	S
				Interference with fauna and flora: habit changes, losses and population reduction.	X	-	N	D	L	O	MT	P	I	M	M6	S
				Irritating smell: present in the emission of gases.	X	-	N	D	L	O	ST	C	R	M	M6	S
				Bad aesthetic effect: the presence of smoke.	X	-	N	D	L	IO	ST	P	I	H	B10	VS
			Emission of sulfur oxides, CO_2, nitrogen oxides, hydrocarbons and carbon monoxide	**Respiratory and cardiopulmonary problems:** coming from the burning of fuel oil.	X	-	N	D	L	O	MT	P	R	H	B9	VS
				Interference with fauna and flora: coming from the burning of fuel oil.	X	-	N	D	L	O	MT	P	I	H	B9	VS
				Rain acidification: gas concentration in the atmosphere.	X	-	N	D	L	O	ST	P	I	H	B8	VS
				Contribution to the heater effect: concentration of CO_2 in the atmosphere.	X	-	N	D	L	O	LT	P	R	H	B9	VS
				Noise pollution: coming from its operation.	X	-	N	D	L	O	ST	P	R	M	M6	S
Environmental elements	Environment	Water	Percolation of rainwater in storage areas	**Contamination of groundwater and watercourse**	X	-	N	D	L	O	LT	P	R	M	M5	S
				Raising the pH	X	-	N	D	L	O	ST	P	R	M	M6	S
				Heavy metals	X	-	N	D	L	O	ST	P	I	M	M6	S
				Dissolved solids	X	-	N	D	L	O	ST	P	I	M	M5	S
			Cooling water systems	**Interference in aquatic fauna and flora**	X	-	N	D	L	O	ST	P	I	H	B10	VS
		Soil		**Removal system of the heavy ashes**	X	-	N	D	L	O	MT	C	I	M	M6	S
				Soil quality	X	-	N	D	L	O	MT	P	R	M	M6	S
	Human Environment	Spaces		**Urban**	X	-	N	D	L	IO	ST	P	I	H	B8	VS
				Agricultural	X	-	N	D	L	IO	ST	P	I	H	B8	VS
				Forestry	X	-	N	D	L	IO	ST	P	I	H	B9	VS
	Landscape	Modifications		**Visual field**	X	-	N	D	L	IO	ST	P	I	H	B10	VS
				Specific elements	X	-	N	D	L	IO	ST	P	I	H	B10	VS

N – negative; D – direct; L – local; O – Operation; IO – implantation and operation; ST – short term; MT – mid-term; LT – long term; C – cyclic; P – Permanent; R – reversible; I – irreversible; M – mean; H – high; M5 – medium importance of level 5; M6 – medium importance of level 6; B8 – big importance of level 8; B9 – big importance of level 9; B10 – big importance of level 10; S – significant; VS – very significant.

general, damaging them, so there is a tendency to disappear locally during the execution of the works, which will alter their population (Cepemar , 2001).

The emissions of sulfur dioxide by burning fossil fuels are considered as environmental impact source on the environment. In order to minimize this impact, it is suggested to increase the generation of hydroelectricity, seek to use coal with lower sulfur content, install filters and extend the weather control. Still, there is increase in the control programs of human action, using the mitigation measures, such as clean energy production from biomass, which will minimize environmental risks and increase disaster management level (Epstein, 2010).

According to Stamm (2003), work on the study of environmental impact assessment in thermal, noise, pollution and vibrations cause the local changes, both in the construction phase and the operational phase, thus bringing remote and discomfort fauna. Also, the thermo-electric bring negative impacts to the socioeconomic environment in relation to tailings deposits, waste gases, suspended dust generation, heavy traffic roads and sewers.

It is noted that the construction of a thermal or other large enterprise, mainly modifies the aesthetics of the site, providing a change or visual pollution of the site where it was built in the enterprise. In addition to causing other irreversible damage to the environment, such as the removal of vegetation, which provides a radical and abrupt change, contribute the a possible change in the microclimate of the region.

The volatile organic compounds are gases and vapors that are generally associated with unpleasant odors, which irritate the eyes, nose, skin and upper respiratory tract. Some of these compounds are understood as carcinogens (benzene and HPA are associated with leukemia) or mutagens, such as toluene and xylenes, when on prolonged exposure. High concentrations may cause nausea, headaches, tiredness, lethargy and dizziness. The NOx increases the susceptibility to respiratory infections, such as asthma and bronchitis (Alvarez et al., 2002; Schirmer, 2007).

As the emission of SO_2, CO_2, CO, NOx and hydro-carbons (Table 2), it was found that it interferes directly or indirectly on the potential impacts. In relation to nature, the five items were negative (N). On the aspect form, all potential impacts were classified as direct (D). Subsequently, the five impacts were diagnosed as a local (L) to comprehensiveness, and how operation (O) the occurrence of phase.

Regarding temporality, the items, respiratory and cardiopulmonary problems and interference with flora and fauna were assessed as mid-term (MT); the items acidification of rain and noise pollution as short term (ST), followed by long term (LT) for the item contribution to the heater effect. The duration is qualified as permanent (P) for all potential impacts. However, for the aspect of reversibility, the items respiratory and cardiopulmonary problems, contribution to the heater effect and noise pollution were considered reversible (R), while the other two items were considered irreversible (I).

About the aspect, probability was considered mean (M) only to the issue of noise pollution and high (H) for other potential impacts. Regarding the magnitude and importance, noise pollution was estimated to be medium level 6 (M6), the others impacts were evaluated as big importance of level 8 (B8) and level 9 (B9). Still in relation to the assigned, significance was inferred as significant (S) to the item noise pollution, and as very significant (VS) to the other four items.

According to Schirmer (2004), organic compounds derived oil directly which contributes to the problems of air pollution. Among them, BTEX (benzene, toluene, ethylbenzene and xylenes), and other less abundant and highly reactive compounds such as ethylene oxide, formaldehyde, phenol, carbon tetrachloride, the clorofluo-carbonados (CFC) and polychlorinated biphenyls (PCBs). The excess of emissions of CO, CO_2, NOx, SO_2, volatile organic compounds and particulate matter, not only causes health problems of human, but also impacts on the environment, both local character, such as "smog", as global, such as the heater effect (Schirmer and Rudniak, 2009).

The impacts on the physical environment originating from the thermoelectric in operation phase, can cause changes in air quality, being the main air pollutants emitted by smokestacks, the gas motor generators: nitrogen oxides (NOx), basically composed of NO (nitric oxide) and NO_2 (nitrogen dioxide). It is observed even in smaller amounts the carbon monoxide (CO), hydrocarbons and particulates matter. The gases that contribute to the heater effect are CO_2 (carbon dioxide), N_2O (nitrous oxide) and CH_4 (methane). These results corroborate to the studies of Wärtsilä (2010) held in Thermoelectric Santa Julia I in the city of Anchieta, State of São Paulo - Brazil.

In addition to impacts of mining, coal burning industries and thermals cause environmental impacts, due to the emission of particulate matter and gases. Besides being harmful to human health, these gases are mainly responsible for the formation of acid rain. Therefore, it is suggested that the use of natural gas as an alternative is less aggressive to the environment (Gonçalves, 2010).

According Hama (2001) in the study dealing on acid rain and aluminum concentration in soil near a thermal coal, the study inferred that rainwater samples analyzed around a thermal coal in northern Paraná State was reported to be pH below 5,6, characteristic of a weakly acid rain, and the concentrations of cations and anions in the rain water had high concentrations of sulfate, followed by sodium cations, calcium and ammonium.

In Brazil, in the year 2000, the thermoelectricity was an exit as contemplated during the energy rationing, which created an emergency program of building thermals. The high cost of natural gas, quoted in dollars, and coal

generation unfeasible most of thermals projects. In addition, the large amount of water required for cooling systems potentiated the environmental cost of energy generation (Monteiro et al., 2004). During the operation phase of a thermal, the gas production changes the air quality and noise generation affect mainly workers, this impact could be minimized by the use of individual protective equipment (IPE) and technology of the equipment to be purchased (LCB, 2009).

In the diagnosis of environment, water part, encompassing the percolation of rainwater in storage areas (Table 2), qualified all items as negative (N), regarding the aspect of nature; they were direct (D) in the aspect form; they were considered local (L) in relation to the comprehensiveness; as operating phase (O), on the occurrence of phase. About aspect temporality, only the impact potential contamination of groundwater and watercourse has been classified as long term (LT), the others three, was considered as short term (ST).

Regarding reversibility, the items contamination of groundwater and watercourse, and raising the pH were qualified as reversible (R) and the heavy metals and dissolved solids as irreversible (I). The probability was assessed as mean (M) over all items. The magnitude and importance of potential impacts were described as medium of importance (M5 and M6), and its meaningfulness was considered significant (S).

The air emissions of particulate matter, respiratory problems, interference in fauna and flora, the irritating smell, the bad aesthetic effect, the emission of sulfur oxides, the acidification of rain, the emissions carbon dioxides, emissions of nitrogen oxides, the percolation of rainwater in storage areas, the elevation of pH, heavy and solid metal dissolved, cooling systems of water, the removal system of the heavy ash and residues solid process are significant negative environmental impacts caused by thermals (Cardoso et al., 2010).

About the cooling system of the water, environment and water part (Table 2), this is attributed to significant interference on the potential impacts observed. As the aspects highlighted on the item interference in aquatic fauna and flora, the aspect nature was assigned as negative (N); the form was direct (D); the comprehensiveness was evaluated as local (L); the occurrence of phase as operation (O); temporality as short term (ST); the duration as permanent (P); reversibility as irreversible (I); the probability as high (H); the magnitude and importance as big importance of level 10; and the meaningfulness was presented as very significant (VS).

The most important impacts of a thermoelectric are considered, as the emissions of gaseous pollutants in the atmosphere and the use of cooling water for condensation of steam. Also noteworthy is the wastewater generated in the thermals that are from the cooling process, which causes thermal pollution of water reservoirs, of water treatment systems, water contaminated with oil residues, among others (Salomon, 2003). The main environmental problems are human exposure to pollutants in air, water, soil and food which is a major contributor to mortality and morbidity (WHO, 1996). Already the fishes, require a minimum salt content to develop and the acid removes these water salts, killing them (Richard, 1998).

In the environment, soil part (Table 2), the potential impacts, removal of heavy ashes and soil quality, was diagnosed that the two items were considered negative (N) as its nature and direct (D) in relation to its form; local (L), as its comprehensiveness; operation (O) to the occurrence of phase; and mid-term (MT), to the temporality. The duration was stimulated cyclic (C) for the removal system for the heavy ashes, and permanent (P) to soil quality. According to reversibility, the only item that was reversible (R) was the soil quality. Regarding the probability, mean was considered for both items, and finally the magnitude and importance aspects, followed by meaningfulness were successively qualified as medium importance of level 6 (M6) and significant (S).

As for the volume, the coal ash is one of the largest waste generation in Brazil. However, only a small percentage is reused in the construction industry, the rest is disposed of improperly, causing serious damage to human health and the environment (Izidoro and Fungaro, 2007). The thermal effluent of interest to the environment may be classified as air, liquids and solids. In particular, the solid, such as particulate matter in combustion, in which part of the formed ash are entrained in the gas flow receiving the name of fly ash. A portion of this ash is retained by electrostatic precipitators and a small portion is discharged through the chimney. Not all fly ash is volatile: part of it is in the boiler bottom, being called residual or heavy ash, and thus are not part of air emissions (Araújo, 2002).

According to the Human Environment (Table 2), urban, agricultural and forestry were evaluated, where the potential impacts are proved with influence on the environment and negative nature (N). As regards the other aspects, the form was evaluated as direct (D); the comprehensiveness as local (L); the occurrence of phase both in installation and in operation (IO); temporality as short term (ST); the duration as permanent (P); reversibility as irreversible (I); probability as high (H); the magnitude and importance as big (B8 and B9); and meaningfulness as very significant (VS).

According to Carvalho and Cidade (2011), the implementation of the Thermal Porto do Itaqui, Sao Luis, MA, caused negative impacts, such as deforestation of the area for the construction of the thermal, leading to loss of biodiversity and the pollution of rivers by the waste; promotion of social impacts, by the dismantling of the livelihood of local people, affecting the massive rural society, thus contributing to the disorderly occupation of urban space.

Regarding the landscape, the visual field changes and the specific elements (Table 2) have been described as influential and its aspects presented are present; as

negative (N) in relation to nature; as direct (D) to the form; as local (L) for comprehensiveness; with its occurrence in the implementation and operation phase (IO); with temporality of short term (ST); with duration permanent (P); the reversibility was considered irreversible (I); the probability was high (H); as big (B10) to the magnitude and importance aspect; and as very significant (VS) to the meaningfulness.

Changes in landscapes are significant in studies of environmental impacts, such as when the improper land use occur in the destruction of green areas, the burial of rivers and mangroves, and the pollution of atmospheric air and water. The landscape is not simply adding disparate geographic elements and certain portion of space. The result of the dynamic combination being unstable on physical, biological and human elements, reacting dialectically about each other, make the landscape a single and indivisible whole in constant "evolution" (Silva et al., 2007).

The biggest problem of this "evolution" is that the landscapes are modified according to the need of some individuals to meet the interests of local leaders, which takes place in the case of thermal of Campina Grande - PB, through various activities (industries, leisure, education and others), which caused a very rapid population growth and consequently caused many environmental problems.

According to the study of Tagliani (2003), environmental vulnerability means greater or lesser susceptibility of an environment impact potential caused by an anthropic use, there is no way to implement projects without promoting the disorganization of social and cultural life of the town.

CONCLUSIONS

According to qualified impacts on potential impacts of identification matrix in thermal, adapted, it appears that the sulfur dioxide emissions from burning fossil fuels and OCB1 oil, are pollutants that cause health damage to the surrounding population enterprise and suffers injury, when there is change of seasonal winds. As for mitigating and compensatory measures proposed by the project, these do not include effective measures, and are very superficial and does not address compensatory measures such as afforestation, and monitoring by trained technicians, taken from the growth of native trees to its growth and the amount of trees removal at the site to be built the thermal, in order to compensate in another area, as required by law. Although there is an EIS/EIR presented and approved, this EIS/EIR disregarded some important items and does not reflect the reality in the study area and its surroundings. Regarding the operation of the thermal, as well as being harmful to the health of the population, the noise of its operation also disturbs the sleep of people, scares off the animals and brings harm to farmers. In order to minimize the impacts, it is proposed to replace the OCB1 oil, for a less polluting fuel, control and monitoring by state agencies and planting native trees in order to compensate for the removal of these species for the construction of the enterprise.

RECOMMENDATIONS

1. According to Epstein (2010), a way to minimize impacts of thermals, would be the installation of filters and weather control and the implementation of human action control programs, as well as the production of clean energy, which can minimize environmental risks and enhance disaster management level.
2. In order to mitigate the impacts of air pollution in developing cities, coming from thermoelectric Philippi Jr.et al. (1998) proposes to carry out an environmental surveillance program.
3. In order to minimize the negative impacts caused by the implementation and operation of thermoelectric Borborema Energy S/A, in Campina Grande - PB, the use of less aggressive fuels such as natural gas and biomass; planting native trees; monitoring of fauna and flora, by environmentalists and researchers entities; treatment and control of solid and liquid waste; adequate storage of waste; investments in schools for local people, including promoting the environmental education; job creation; educational campaigns; establishment of forest nurseries; compensation to local farmers if necessary is proposed.
4. Also, to promote the training of all employees and contractors working in the region in the Awareness Programme for the Environment Areas, Quality, Safety and Health.
5. Environmental education to communities report on the impact of materials such as plastics, glass and metals and presenting techniques to transform disposable waste in handmade objects and utilities.
6. Promote the transformation of social reality and the recovery of citizenship of the local population through vocational training courses (in mechanical activities, computers, carpentry, electrician, cook, etc.), carried out in partnership with technical training courses companies by example for labor-work training site, including any jobs meeting the aspirations and needs of local populations.
7. Also, contribute to the dissemination of economic, cultural and tourist potential of the region, providing technical support for the development of projects and participating in fairs and exhibitions to promote the city of Campina Grande -PB.
8. Reaffirming the commitment of Thermoelectric of Campina Grande, which is important in producing energy to protect the environment, investing heavily in the Environmental Management Program, showing that it is possible to generate wealth and preserve our greatest

wealth being human and the environment.

Conflict of Interests

The authors have not declared any conflict of interests.

REFERENCES

Alvarez Jr OM, Lacava CIV, Fernandes OS (2002). Tecnologias e gestão ambiental Emissões atmosféricas; Serviço Nacional de Aprendizagem Industrial (SENAI): Brasília 373 p.

Araújo FJC (2002). Óbices ambientais da nova matriz paradigma da termoeletricidade. Energética brasileira: paradigma da termoeletricidade. Anais...XXVIII Congresso Interamericano de Ingeniería Sanitaria y Ambiental Cancún, México.

Brito ER, Silva E, Martins SV, Ribeiro GA (2002). Perfil ambiental do empreendimento denominado de "praias fluviais", Estado do Tocantins. Ver Árvore, Viçosa 26(3):349-355.

Burmann LL (2010). Recursos naturais e sustentabilidade: a responsabilidade social, ambiental e jurídica das empresas. Dissertação (Mestrado em Direito) Caxias do Sul, UCS. 256 p.

Cardoso AR, Souza DM, Firmo ED (2010). Economia de Energia. Rev. Divul. Proj. Univ. Pret. IF Flumin 1:321-327

Carvalho FC, Cidade LCF (2011). Grandes projetos, gestão do território e efeitos ambientais no Maranhão. Espaço Geografia 14(1):29:51.

CEPEMAR (Serviços de consultoria em meio ambiente Ltda) (2001). RIMA - Relatório de impacto ambiental da termelétrica de Três Lagoas, Relatório Técnico CPM RT 009/01. 108 p.

Embrapa (1972). Solos Do Nordeste - Levantamento Exploratório - Reconhecimento de Solos do Estado da Paraíba Embrapa.

Embrapa (1999). Centro Nacional de Pesquisas de Solos (Rio de Janeiro, RJ). Sistema Brasileiro de Classificação de Solos. Brasília: EMBRAPA - Serviço de Produção de Informações; Rio de Janeiro. 412 p.

Epstein M (2010). Impacto ambiental das emissões aéreas de usinas termoelétricas - emissões de S02. Rev. Bras. Energy 1(2):1-9.

Francisco PR, Gonçalves JLG, Nunes DA, Carvalho FS, Figueiredo GJA, Lima VLA (2010). Estudo de Caso: avaliação de impactos ambientais no assentamento, Riacho do Sangue, no município de Santa Rosa-PB. 132 p.

Gonçalves FS (2010). Petróleo e combustíveis industriais: mercado e aplicações. Porto Alegre. UFRGS. 48 p.

Google Earth (2015). Versão 6.2.2.6615. Localização da termelétrica Borborema Energética S/A.

Hama P (2001). Estudo da influência da chuva ácida na concentração de alumínio em solos próximos a uma termoelétrica a carvão. (Dissertação em Tecnologia Nuclear) São Paulo. IPEN. 153 p.

Instituto Brasileiro de Geografia e Estatística (IBGE) (2010). Cidades Paraíba, Campina Grande.

Izidoro JC, Fungaro DA (2007). Utilização de resíduos de usinas termelétricas a carvão na síntese de zeólitas e sua aplicação na remoção de Zn2+ e Cd2+ em água. Rev. Bras. Pesqui. Desenv. 9(3):101-106.

LCB (Consultoria e Projetos Ltda) (2009). Estudo de Impacto Ambiental em Termelétrica. Agudos do Sul.

Lelles LC, Silva E, Griffith JJ, Martins SV (2005). Perfil ambiental qualitativo da extração de areia em cursos d'água. Rev. Árvore Viçosa 29(3):439-444.

Mattos LK (2002). As mudanças organizacionais e seus gestores nas empresas na era da informação. (Dissertação de Mestrado). Rio de Janeiro: Fundação Getúlio Vargas. Escola brasileira de. Administração pública e de empresas. Centro de formação acadêmica e pesquisa. Curso Mestrado Executivo 80 p.

Monteiro KV, Ortiz L, Marcuzzo SF, Fonseca J, Barcellos C, Santos T, Backes P (2004). Carvão: o combustível de ontem. Porto Alegre: Núcleo amigos da Terra Brasil.

Moraes Neto JM, Barbosa MP, Fernandes MF, Silva MJ (2002). Avaliação da degradação das terras nas regiões oeste e norte da cidade de Campina Grande, PB: um estudo de caso. Rev. Bras. Eng. Agríc. Amb. 6(1):180-182.

Passos PNC (2009). A conferência de Estocolmo como ponto de partida para a proteção internacional do meio ambiente. Rev. Dir. Fundam. Democ. 6:1-25.

Philippi Jr A, Pelicioni AC, Pelicioni MCF, Martins MCH, Wieliczka MGZ, Peregrina MN, Takaoka NY, Pedro SCM, Gerab ZP (1998). Vigilância epidemiológica ambiental. Asociacion Interamericana de Ingenieria Saniratia y Ambiental, Asociacion Peruana de Ingenieria Sanitaria 252 p.

Ribeiro GN, Teotia HS (2005). Estudo dos solos e uso atual da terra do agreste paraibano, através de sensoriamento remoto e geoprocessamento. Anais...XII Simpósio Brasileiro de Sensoriamento Remoto, Goiânia, Brasil. INPE.

Richard FW (1998). Acidification of lakes in the eastern US and southern Norway: a comparison; Environ. Sci. Technol. 22(2):178-182.

Salomon KR (2003). Avaliação quantitativa do impacto ambiental das emissões gasosas e do uso da água de resfriamento em instalações de geração termelétrica. (Dissertação em Engenharia de energia). Viçosa. UFI. 144 p.

Sánchez LE (2013). Avaliação de impacto ambiental: conceitos e métodos. São Paulo: oficina de textos, 3. Impressão, 2ª Ed. 584p.

Sant'ana SR, Rego MAM, Amaral SP (2004). Desenvolvimento sustentável em exploração e produção de petróleo e gás na Amazônia brasileira – estudo de caso Petrobrás. Laboratório de Tecnologia, Gestão de Negócios e Meio Ambiente – LATEC/Universidade Federal Fluminense. São Domingos – Niterói. 3:1-6.

Santos HG, Jacomine PKT, Anjos LHC, Oliveira VA, Oliveira JB, Coelho MR, Lumbreras JF, Cunha TJF (2006). Sistema brasileiro de classificação de solos. 2. ed. Rio de Janeiro: Embrapa Solos 306p.

Schirmer WN (2004). Amostragem, análise e proposta de tratamento de compostos orgânicos voláteis (COV) e odorantes em estação de despejos industriais de refinaria de petróleo. Dissertação. Mestrado Eng. Ambient. 186 p.

Schirmer WN (2007). Avaliação do desempenho de nanotubos de carbono "cup-stacked" (CSCNT) na remoção de compostos orgânicos voláteis (COV) de correntes gasosas. Tese (Doutorado em Engenharia Ambiental). 222 p.

Schirmer WN, Rudniak A (2009). Avaliação das emissões gasosas de diferentes tipos de combustíveis utilizados e seus impactos ambientais. Tecnológica, Santa Cruz do Sul. 13(1):25-34.

Silva MNA, Machado ACS, Giudice DS (2007). Consequências das transformações ambientais no processo de expansão das cidades - o exemplo de Salvador/Bahia.

Stamm HR (2003). Método para avaliação de impacto ambiental (AIA) em projetos de grande porte: estudo de caso de uma usina termelétrica. Dissertação (Mestrado em Engenharia Industrial). 159p.

Tagliani CR (2003). Técnicas para avaliação da vulnerabilidade ambiental de ambientes costeiros utilizando um sistema de informações geográficas. Anais...XI Simpósio Brasileiro de Sensoriamento Remoto. Belo Horizonte. 1:1657-1664.

Terra (2007). Consultoria em Engenharia e Meio Ambiente Ltda. Relatório de Impacto Ambiental-RIMA e Implantação da Pequena Central Hidrelétrica – PCH Santa Luzia Alto. 1:2-7.

Wärtsilä (2010), Brasil LTDA. Relatório de Impacto Ambiental (RIMA). Usina Termoelétrica – UTE Santa Júlia I ANCHIETA. 58 p.

WHO (World Health Organization) (1996). Linkage Methods for Environment and Health Analysis. General Guidelines. A Report of the Health and Environment Analysis for Decision-making (HEADLAMP) project, edited by Briggs D, Corvalán C, Nurminen M. Geneva. (WHO/EHG/95.26).