Management of asphalt plant environmental impacts

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ABSTRACT

Asphalt plants can have an impact on the environment; therefore, to detect damages and tackle problems, certain strategies need to be developed. The aim of this study was to assess the asphalt plant environmental impacts within environmental licensing process and propose preventive measures, in Brasília – Federal District. A bibliographic survey was carried out involving a case study that referred to preliminary steps and the confirmatory of the Environmental Liabilities Investigation Report. The result indicated that the asphalt plant affected the environment and as such, an environmental monitoring is recommended. As a result, the present study makes its contribution by presenting data that emphasize the importance of environmental management and the role of inspection in the preservation of the negative impacts to the environment and in the operation of an asphalt production plant.

Key words: Management, environmental impact, licensing.

INTRODUCTION

Licensing and the revision of effective or potentially polluting activities – are some of the strategies of the National Environmental Policy (http://www.planalto.gov.br/ccivil_03/leis/L6938.htm). Among other measures, it introduces Entrepreneurial and the Licensing Institution management and monitoring as ways of environmental protection and preservation.

Environmental monitoring is defined as a process of data collection, studies and continuous and systematic monitoring of environmental variables, aiming the identification and qualitative and quantitative evaluation of the natural resources conditions at a given time, as well as trends over time. As a result, the monitoring subsidizes planning measures, control, recovery, preservation and conservation of the environment in study, as well as assists in the definition of environmental policies (Lopes, 2011).

The monitoring carried out in an asphalt production activity includes, among other measures, air, soil and water control and can be carried out by means of an Environmental Liability Investigation Report (ELIR), according to the ABNT NBR n° 15515 and its parts. The report is the environmental licensing requirement as a condition to continue the administrative process.

The migration of pollutants through the soil to the surface and groundwater is a threat to the quality of water resources, as soil and groundwater are part of the same system. Therefore, what happens to the soil reflects in the groundwater, and that can negatively impact the environment.

Thus, asphalt plants may impact the environment, requiring, therefore, the development of strategies in order to diagnose damages and solve problems (Rauber et al., 2004).

This study was conducted with the aim to contribute to the management of impacts of an asphalt production plant in order to minimize/avoid possible negative impacts that could be generated by the activity production and assist in future decision making in this area through case study presentation and to demonstrate the importance of monitoring.
METHODOLOGY

The methodology of this study was based on a survey of existing legislation and an analysis of scientific studies related to the theme. The research was conducted involving official government websites, Google Scholar, and others.

The legislations were selected giving priorities to those that establish parameters for asphalt production activity with preference to federal and district regulations. The articles were chosen according to the theme and its temporality, also prioritizing the relevance to the scientific literature. The study also included a case study with the objective to complement and validate the data of revision carried out, giving a greater clarity to the management of impacts in an asphalt production plant.

DISCUSSION

Environmental licensing process

The Environmental licensing, instrument of the National Environmental Policy, is an administrative procedure by which the competent environmental agency licenses the location, installation, expansion and operation of enterprises and activities using natural resources that are considered effectively or potentially polluting or those that, in any form, may cause environmental damage, considering the legal, regulatory provisions and the technical standards applicable to the case, according to CONAMA (http://www.mma.gov.br/port/conama/legiabre.cfm?codlegi=237) and Law nº 6938/1981.

The environmental licensing process establishes several conditions to reduce the impacts on the environment caused by the industries. Among them, there is the elaboration of the ELIR.

The ELIR is an environmental study based on the soil and groundwater collection in order to assess whether the potentially polluting activities generate any damage to the environment, such as possible leaks, improper disposal or bad operation, in order to provide the appropriate management of contaminated area (http://www.tc.df.gov.br/sinj/BaixarArquivoNorma.aspx?id_norma=75312; Teixeira, 2013). The CONAMA resolution nº 237/1997, introduces an exemplifying list of activities subject to environmental licensing, and the Handbook of Environmental Licensing, prepared by the BRASIL-Federal Audit Court (2004) complements the information on the enterprises that require licensing, that is, the natural resources users and ability to cause the environmental degradation.

Within the framework presented (the main object of this study), the Asphalt Plant is framed as a part of diverse industries and is part of the aforementioned resolution.

Considerations of the activity of the asphalt plant operation

Equipment that is needed for the operation of a Machined Hot Bituminous Concrete (MHBC) production plant can be divided into the following assembled sets (Figure 1), according to the Basic Project in the Process License nº 191000022/1993 (IBRAM, 2016). In the following, each of the assembled sets will be described according to the basic project mentioned.

The production process begins with the electrical and electronic commands from the central cabin panel of the plant (A). These commands are intended to indicate the dosage of the materials that will make the asphalt.

The second stage of the process starts with the set assembled of the silos supply (B) that aims to accommodate the materials (aggregates) such as sand, stone powder, small stone, gravel, and will be used in the production of asphalt. It has an inverted pyramid trunk shape with an output at the bottom that serves as aggregates dosing in its inner part.

The metering belt for assembly of components (C) is the next set in the production line and has the function of dosing all the materials that passed through it by means of an electronic weighing system.

It is noteworthy that the plant can operate in manual or automatic mode. In first case, the operator doses the mixture in accordance with the speed of the belt; while in auto mode, the dose quantity is carried out by the equipment itself.

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1 National Council for the Environment (CONAMA), a consultative and deliberative body aiming to advise, study and propose to the Government Council the environmental and natural resources policy guidelines and to deliberate, within its competence, the norms and standards compatible with the ecologically balanced and essential to a healthy quality of life environment (http://www.planalto.gov.br/ccivil_03/leis/L6938.htm).
The next routing is the passage of the material by gravity through the assembled set of the mixing belt (D), located below the metering belts, and premixing the conveyor belt (E) to the dryer.

The assembly mounted from the dryer (F) is responsible for moisture removal and heating to ensure their final homogenization in its rotating drum running at a constant speed. After that, the material is mixed with the final aggregator binder AC in the mixer (G) thus giving origin to the asphalt; the process is performed mechanically by means of mixers “arms” and vanes.

The mixture resulted from the last stage is transported through elevator (H) to the storage silo (I), where the MHBC is stored for about 10 s and subsequently is released in the discharge silo (J). The release should occur so that the mixture does not disaggregate by the force of gravity. The next phase is the material passage to the siloand storage until the truck responsible for transportation can load the material.

During the asphalt production process there is a stage of the Petroleum Asphalt Cement (AC) insertion to the mixer. This aggregator passes through a thermal fluid heater so that the temperature is high and ensures the fluidity of the material to be used.

The thermal fluid heater, that operates automatically, is moved to liquefied petroleum gas (LPG) and uses thermal fluid oil as heating fluid. This oil passes through a coil installed inside the heater, raising the oil temperature to 185°C, and is carried by a seamless steel pipe due to physical contact between the pipe and oil, and the pipe with an aggregator, the latter is heated.

The AC used is stored in 03 (three) horizontal cylindrical tanks made of steel and lined with thermal material covered by a steel structure to prevent wetting of thermal material. The tanks are connected by steel pipe for transporting the material to the plant and heated by an internal coil connected to the thermal fluid heater.

In addition, in the previously presented sets, there are others that are not a specific part of the production process; however, they are part of the plant with the function of reducing the environmental impacts such as, for example, the mounted assembly of the bag filter. The assembly is responsible for filtering the air coming out of the dryer and is returned to the atmosphere through a chimney. Their conditions should follow the recommendations of Resolution CONAMA n° 436/2011 and n° 382/2006.

The bag filter assembled unit consists of an air exhaust, the filter itself, chimneys, exhaust pipes and air compressors. The exhaust fan sucks the thinner material and cast into the filter bag through the exhaust pipe, and has the function of sucking the heat from the torch flame for better use of the heat generated.

The function of the air compressor is bags’ cleaning using short air release, so that the dust impregnated in them fall within the bag filter and is used in the mixture itself (MHBC), reuse process and promote the bags’ cleaning, extending the life of these. Furthermore, air compressors also trigger the pneumatic mechanisms present in the plant.

Preventive methods for asphalt plant

Asphalt plant requires various preventive methods to avoid the arise of negative environmental impacts. Among the methods that should be considered are as follows:

**a) Raw materials management**: The management of raw materials used for asphalt production should be made to consider that the aggregate storage height does not exceed 2.5 m (DISTRITO FEDERAL, 2016) and ensure air quality on site. The piles at higher altitudes determined by the ordinance can cause increased dispersion of particulate matter in air and affect the health of workers and surrounding residents.

**b) Oily drainage system - ODS**: The Oily Drainage System - ODS is essential to avoid negative impacts resulting during the activity. The system consists of Oil-Water Separator System (OWS), troughs and containment basin. All components working together ensure that the oily waste is separated from the water and sent to the appropriate final treatment, as instructed (ABNT NBR 14605).

**c) Plant’s chimneys’ filters**: Other important caution is the dispersion of particulate matter in air from chimneys, so it becomes necessary for the plant to install filters inside chimneys. There are wet filters and bag filters. The second is the most appropriate, considering the less waste and its efficiency as the return of the material retained by the filters in the production process.

**d) Waste management**: Waste management must be made to ensure that all waste generated by the activity have their proper disposal. It is therefore, becomes necessary to have a waste management plan for the sector and follow the guidelines of ABNT NBR n° 14001 (ABNT NBR 14001).

Environmental liabilities investigation

The investigation of environmental liabilities is a mandatory procedure for activities that have the potential to cause contamination within the environmental licensing, and it involves the soil and groundwater collection to confirm or define a site contamination in order to provide a proper management of the contaminated area. As such, it is a major instrument in the management of environmental impacts (http://www.tcd.gov.br/sinj/BaixarArquivoNorma.aspx?id_norma=75312).
The study results will indicate whether the management is being carried out properly and, if not, recommend the necessary adjustment measures to implement to prevent further damage and mitigate the existing impacts.

**Preliminary stage**

The Preliminary Assessment corresponds to Part 1 of ABNT NBR nº 15515 (ABNT NBR 15515-1, 2009) standard and should indicate the possible presence of area contamination, so this is an initial diagnosis. The standard states the minimum content required for the preparation of the technical report resulting from this stage and this must be performed as shown in Figure 2.

**Confirmatory stage**

The Instruction IBRAM nº 213/2013 establishes the procedures for the environmental licensing of service stations, supply points, retail systems facilities, floating fuel stations and maritime retail service station, and other measures. Standard sets out the guidelines for preparing the Environmental Liability Investigation Report - ELIR for user activities of potential contaminants such as hydrocarbons, and exposes in its Annex 2 the Terms of Reference for the confirmatory stage of the study.

Instruction adds that the area is declared infected when, by means of confirmatory investigation, it is proved to be contaminated with concentrations of substances in soil or groundwater above the Research Values.

In this stage, ELIR should also take into account the ABNT NBR nº 15515-2. This resolution states that the second stage of Confirmatory Assessment should be performed when there are indications of contamination in the preliminary stage or when there is uncertainty about the existence of potential source(s).

The minimum amount must be contemplated in the Technical Report, as per standard. It can therefore be concluded the existence of contamination in the investigated area and must follow the procedures set out in Figure 3.

The results obtained from this stage and, if necessary,
from the previous should be compared with the values of Guiding intervention for Soil and Groundwater CONAMA Resolution n° 420/2009 and if the substances found do not show guiding value in this legislation, the other national and international values guiding force are obtained (CETESB, Dutch List, etc.). If the results of the chemical analysis show higher values than indicated in Intervention Guiding Values for Soil and Groundwater, the detailed Investigation and Human Health Risk Assessment in the area should be carried out. This will determine whether or not environmental remediation is needed (http://www.tc.df.gov.br/sinj/BaixarArquivoNorma.aspx?id_norma=75312).

**The detailed investigation and risk analysis**

Detailed investigation is the process of contaminated areas management, consisting of the acquisition and interpretation of data of the contaminated area under investigation in order to understand the dynamics of contamination of affected physical media and the identification of the specific scenarios of the soil usage and occupation, the existing risk receptors, exposure pathways and entrance ways, as Instruction n 213/2013 - IBRAM.

The resolution ABNT NBR n° 15515 - Part 3 (ABNT NBR 15515-3, 2011) establishes the minimum procedures for the detailed investigation of areas where the presence of the soil or underground water contamination is confirmed based on monitoring time series, preliminary assessment, or other environmental research confirmatory studies.

The standard also adds that with this step the risk analysis should be carried out after discovering that the Research value exceeded in confirmatory phase.

Another important item to note is the subsidiary use of the Board of Directors Decision n 263/2009/P – CETESB (http://cetesb.sp.gov.br/areas-contaminadas/wp-content/uploads/sites/45/2015/06/05_camaras.pdf), of October 20, 2009 in the study of ratings in cases where there are no guiding values for substances in the cited reference.

**CASE STUDY**

To illustrate and explore the application of the foregoing regulations, a case study was used in an area with the potential for contamination and that had its matter accompanied by the environmental agency of the Federal District. It is noteworthy that all the information about the studies included is accessible to the population, according to the Law on Access to Information.

The case study refers to an Asphalt Plant inaugurated in 2012 and with capacity of 120 tonnes of MHBC per hour of production, according to the degree of humidity of the materials used. Figure 4 shows a sketch of the object of this study area.

The Environmental Investigation Report - Preliminary stage (IBRAM, 2015) presents a survey conducted in the asphalt production area and was performed according to
Table 1: Preliminary Conceptual Model (IBRAM, 2015), adapted.

<table>
<thead>
<tr>
<th>Sources sector / Classification (AP or AC)</th>
<th>Substances or products</th>
<th>Release mechanism</th>
<th>Transport route of contaminants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asphalt Plant AP;</td>
<td>Diesel 50/70 AC; CM-30; LPG; Industrial Grease; Lubricating grease; Thermal Oil; Asphalt Emulsion RR 2C.</td>
<td>Leaks / spills (Possible forms of contamination are during the supply of existing tanks in the area, by improper storage of waste in the past and by the absence of oil drainage system).</td>
<td>Infiltration soil / transport by groundwater</td>
</tr>
</tbody>
</table>


Table 2: Results for VOCs with minimum and maximum values for the area under study.

<table>
<thead>
<tr>
<th>Value</th>
<th>Boiler plant and tanks AC</th>
<th>Tanks (bag filters)</th>
<th>Pile materials</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum</td>
<td>3.36</td>
<td>7.875</td>
<td>5.355</td>
</tr>
<tr>
<td>Maximum</td>
<td>118.44</td>
<td>171.465</td>
<td>212.205</td>
</tr>
</tbody>
</table>

* VOC: Volatile organic compound AC: petroleum asphalt cement

The conclusions of this study are shown in Table 1. The area in question, called asphalt production area, is paved and has no ODS for tank storage of petroleum products. This sector has air tanks and pipes for supplying the AC for the production of MHBC and containment basin in order to restrain the possible products derived from oil spills to the soil, avoiding percolation to the groundwater.

At this stage of the investigation, a historical survey of the area is carried out and it is possible to highlight the presence of settling tanks that were used to treat waste from old wet bag filters of a working mill in the past. Today, the system works with Liquefied Petroleum Gas - LPG to reduce the generation of toxic residues and thus the possibility to negatively impact the environment.

The environmental agency required the completion of the preliminary stage, and if the possibility of contamination is found, the studies corresponding to the confirmatory stage of the Environmental Liabilities Investigation Report must be initiated.

With the result obtained from the previous step, it has become necessary to perform the confirmatory stage. The study was carried out by a specialized company, and it was titled: the use of geophysical survey with ground-penetrating radar (GPR), the gas campaign volatile organic compounds (VOC's) in the soil and collecting soil samples and groundwater at various points, as Environmental Research Report - confirmatory Step (IBRAM, 2016).

The survey using GPR (indirect interference) in areas with suspected contamination was prioritized in places with no obstacles to enable the use of the radar system. The results showed areas with no sign of contaminant in most part, however, there was a portion that showed the presence of low amplitude reflections, indicating the possibility of contamination in the area. In these locations, as well as in others judged pertinent by the history of the preliminary phase, samples were taken from the VOC's vapor content, considering the need for direct interference to study what is in place. Thus, the concentration of Volatile Total Hydrocarbons, the location of wells for sample removal and monitoring of groundwater and soil were determined.

The survey data for the VOCs used a regular grid of 5 × 5 m and were densified in places where anomalies were identified. Readings were performed immediately after drilling and were measured in parts per million (ppm). Table 2 shows the maximum and minimum values found in each area. This information/surveys started in the preliminary phase and ratified in the confirmatory step, following the topographical gradient site.

The next step for the environmental liability investigation was the soil analysis and for this, samples were taken to carry out the chemical analysis and at the collection points, VOC concentrations were measured at 1.0 m deep in the soil.

Among the objectives of the collection were included verification of the presence of petroleum products/alcohol by the method screening, tactile-visual observation and, finally, the installation of monitoring wells (manual auger and mechanic 4 "and 6") of groundwater and thus
Table 3: Parameters analyzed in soil and groundwater sampling.

<table>
<thead>
<tr>
<th>Parameters analyzed in soil</th>
<th>Parameters analysed in groundwater</th>
</tr>
</thead>
<tbody>
<tr>
<td>● BTEX (Benzene, Toluene, Ethylbenzene, xylenes); ● PAH’s (polycyclic aromatic hydrocarbons); ● Total metals.</td>
<td>● BTEX (Benzene, Toluene, Ethylbenzene, Xylenes); ● PAH’s (polycyclic aromatic hydrocarbons); ● PCBs (polychlorinated biphenyls).</td>
</tr>
</tbody>
</table>

Guiding values:
CONAMA 420/2009 “Provides criteria and guiding values of soil quality for the presence of chemical substances and establishes guidelines for environmental management of areas contaminated by these substances due to human activities.” - Available in: Publication Gazette n° 249 of 30/12/2009, pp. 81-84.

Guiding values for soil and groundwater in the State of São Paulo - CETESB.

Table 4: Relation of the points with the results in the soil.

<table>
<thead>
<tr>
<th>Points</th>
<th>Nomenclature</th>
<th>Depth sounding (02 soil samples each)</th>
<th>Measurement of VOC in soil (1.0 m depth)</th>
</tr>
</thead>
<tbody>
<tr>
<td>TR04</td>
<td>Aggregates piles</td>
<td>Points were collected until reached the upper limit of the capillary fringe or until the values of vapors of VOCs reached zero, which always occurred at depths less than 12.00m.</td>
<td>188 ppm</td>
</tr>
<tr>
<td>RT09</td>
<td>Boiler Plant</td>
<td></td>
<td>16 ppm</td>
</tr>
</tbody>
</table>

*VOC: Volatile organic compounds in the soil. PPM: parts per million. M: meter.

Table 5: Parameters of groundwater monitoring wells (IBRAM, adapted).

<table>
<thead>
<tr>
<th>Points</th>
<th>Nomenclature</th>
<th>Prof. (m)</th>
<th>Filters section (m)</th>
<th>WL(m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PM 01</td>
<td>Amount</td>
<td>14.76</td>
<td>13 to 11.5</td>
<td>12.54</td>
</tr>
<tr>
<td>PM 07</td>
<td>Boiler Plant</td>
<td>9.68</td>
<td>9 to 7.5</td>
<td>7.5 to 9</td>
</tr>
<tr>
<td>PM 09</td>
<td>Parking</td>
<td>7.64</td>
<td>65</td>
<td>5.97</td>
</tr>
</tbody>
</table>


identifying the possible path covered by the contaminant, if it exists.

The company has developed a sampling plan for the area to be investigated, considering the Preliminary Stage, the geophysical survey, the VOC campaign and the local visual evidence.

The analyses of groundwater and soil samples considered the parameters highlighted in Table 3 and these were performed in a specialized laboratory. The points for monitoring soil and groundwater were marked considering the data from the survey of the VOC (Tables 4 and 5).

For the collection of the groundwater samples, wells were installed by means of mechanized treatment in order to guarantee the sanitary conditions of the place, strategically distributed, as shown in Table 5.

The removal of the water samples points listed in Table 5 occurred after the drilling of wells or after the exhaustion of these, according to ABNT NBR nº 13895. The study shows that none of the samples identified the free phase of supernatant product (upper phase) considering the area used for this study.

The point PM1 was built with the purpose to detect a source of contamination from the external area of the asphalt plant activity and analysed values of Diesel Range Organics (DRO) and Polychlorinated Biphenyls (PCBs), considering Table 3 and Table 6. This point only showed values of DRO different from zero for water and all zero values for the soil samples.

The water analysis points PM 07 e 09 resulted in null values for all parameters analyzed for water and soil. With the above, it is possible to point out that based on the quality of groundwater, only the PM-01 showed levels of contamination by DRO (Diesel Range Organics) above those permitted by the legislation referred in Table 3. Regarding soil quality, no point had contaminated soils.

The results found in the area corresponding to the asphalt plant are lower than what was initially considered from indirect studies (preliminary and geophysical research) which underscores the importance of using both techniques in an Environmental Liability Investigation Report.

The study suggests that monitoring should be carried out...
Table 6: Relevant result for PM-1.

<table>
<thead>
<tr>
<th>Sample</th>
<th>PM01 (water)</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>DRO (C8–C30) (mg / L)</td>
<td>260</td>
<td>Above the next allowed. The analysis shows that in the area there are jobs with machines and trucks, considering that Diesel is commonly used in these equipments.</td>
</tr>
<tr>
<td>PCB</td>
<td>0</td>
<td>-</td>
</tr>
</tbody>
</table>

* DRO: Diesel Range Organics. PCB: polychlorinated biphenyls

Table 8: Conceptual model output (IBRAM, 2016, adapted).

<table>
<thead>
<tr>
<th>Area / Activity</th>
<th>Asphalt plant</th>
<th>Recyclable asphalt bays</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sources / primary release mechanisms</td>
<td>Storage of products and inputs; Settling tanks.</td>
<td>Non-conforming packaging</td>
</tr>
<tr>
<td>Probable contaminants</td>
<td>AC 50/70 (CPSIS nº BR 0475)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Diesel oil (CPSIS nº BR 0109)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Diesel S10 (CPSIS nº BR 0109)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Thermal oil (CPSIS nº BR 0156)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>GxIndustrial (CPSIS nº BR 0212)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>GxLubrificante</td>
<td></td>
</tr>
<tr>
<td>Evidence of contamination</td>
<td>Tensioning in connections near tanks and gas boiler LPG; Lack of sealing of containment basins; History of non-conforming storage of greases / lubricants and waste; Absence of registration of environmental assessment of the area.</td>
<td>Area unduly allocated for this purpose; View of impacted surface soil.</td>
</tr>
<tr>
<td>Secondary source of transport</td>
<td>Soil/Groundwater</td>
<td>Soil/Groundwater</td>
</tr>
<tr>
<td>Classification</td>
<td>Uncontaminated soil and groundwater</td>
<td>Undetermined soil and Groundwater</td>
</tr>
</tbody>
</table>


at the points that presented higher values than those permitted by the norms and where the activity may be potentially contaminating. Monitoring should be carried out considering the Conceptual Model shown in Table 8.

**FINAL CONSIDERATIONS AND CONCLUSIONS**

The licensing process requires that all environmental licensing control procedures be followed to avoid possible negative impacts, as well as the realization of an Environmental Liability Investigation Report - ELIR. A good quality ELIR allows the identification of any damage caused by the activity using direct and indirect methods. It is important to consider the State's control power in verifying compliance with the conditions in the Form of administrative acts issued by the licensing body throughout the environmental licensing process.

Road maintenance is essential to reduce the chances of erosional processes resulting from the continuous and inadequate use of roads, which in turn, avoids the chances of accidents and contributes to society.

In view of the above, it is possible to note the importance of carrying out a joint work involving the licensing body, the entrepreneur and the society to guarantee the tripod of sustainable development with the maintenance of social, economic and environmental means.

In the case study presented, it was possible to illustrate the application of environmental norms and the development of a Research for impacts investigations with the use of indirect (GPR) and direct (VOC, physico-chemical analysis and Wells installation) methods to analyze the activity of asphalt production.

Finally, it can be concluded that in order to manage the
impacts of an asphalt production plant, it is necessary to use all the protection equipment required by the technical standards and conduct studies on the environmental conditions of areas with potential negative impacts, as well as systematic monitoring of the legal parameters of soil and groundwater contamination in order to minimize/avoid possible damages that may be generated by the activity. In addition, this work showed that the environmental agency monitors and supervises the operation of the activity to verify the efficiency of the prevention equipment and, if there is a possibility of negative interference with the environment from the activity, the environmental body will require the elaboration of studies, for example, the Environmental Liabilities Investigation Report, so that it is possible to confirm or delimit the site contamination to provide an adequate management of the contaminated area.

Therefore, this study makes its contribution by presenting data that emphasize the importance of environmental management and the role of inspection in the preservation of the environment and in the operation of an asphalt production plant.

REFERENCES


