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Environmental Criminal Responsibility and Applicability of Brazilian Constitutional Principles

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Abstract— The environment constitutes a group right, endowed with an indivisible object without a determined ownership and interconnected by certain circumstances indeed. Considering its relevance and the need to ensure its preservation and safeguard the environment for present and future generations, the Magna Carta of 1988 instituted in its text the protection of the environment, by means of axiological precepts, and the infraconstitutional legal framework established stricter tuitions, including in the penal. Through bibliographic research, with the analysis of national and international scientific articles, and research of Brazilian legislation, this work was carried out in order to verify the effectiveness of environmental laws. Thus, the objective of the research is to analyze the applicability of principles, highlighting the principles of prevention in the environmental sphere, as well as the form of accountability of the causers/polluters for the damage practiced. The case study took into account the environmental damage related to the Mariana Dam, the Ultra cargo Fire and the Brumadinho Dam.

Keywords—Environmental damage, prevention, Criminal Responsibility.

I. INTRODUCTION

Because of the major changes that have occurred over the last century, such as economic growth and technological development, it is noted that the environment has become a path to prosperity and human evolution. It occurs that the environment, as a sector of the economy, ends up being under the control of those possessing the greatest economic power. Supervision f the way in which environmental laws are exploited and applied is ultimately impaired in many cases.

It is essential to address the provisions of article 225 of the Magna Carta (Brazil, 1998), where it provides that the environment is a right and a duty of all, should be preserved not only for the present, but also for future generations.

In this respect, it is necessary to emphasize the relevance of knowing that the environment constitutes a diffuse right, present as a group right, endowed with an indivisible object, without a certain ownership and intertwined by certain circumstances in fact (FIORILLO, 2017,p. 40).

In the face of this, the Federal Brazilian Constitution of 1988 instituted in its constitutional text the existence of a good that have no characteristics of public object or private, from the institute of ownership and property and thus creating a structuring for the protection of environmental values. As a result, the postulated Carta Magna instituted in the legal order a form of application of the Law from axiological precepts, endowed with an impeditive capacity, which permeate the legal framework, the principles.

With regard to the principles focused on environmental protection, the principle of prevention and the principle of the polluter pays stand out. In this sense, it seeks to make a beginner analysis of three environmental disasters occurring in the Brazilian territory: the Mariana Dam, the Ultracargo Fire and the Brumadinho Dam. Moreover, when analyzing these cases, it should be taken into account that certain conducts generate social repercussions – in view of the role of the media-, resulting in the need for a more severe intervention by the State, that is, in the criminal liability of the causer agent in a manner proportional to the.

Therefore, the considerations regarding the cases presented are sought to verify what has been infringed for the occurrence of these disasters, as well as the reasons that led to non-compliance with environmental securities regulations. Therefore, it seeks to analyse whether these disasters occur are environmental crimes, which are passive environmental criminal responsibility.

II. METHODOLOGY

The methodology used in this article will be exploratory research, wich Will be based on literary, specialized works, besides the use of scientific articles and research that substantiated the theme.

2.1 Publication Analysis

Based on the data obtained by the Portal BDTD (Biblioteca Digital Brasileira de Teses e Dissertações), it is denotes that in a period of 10 (ten) years, the amount of dissertations related to the theme of environmental law were 3135 (three thousand one hundred thirty five). In the table 1, it is possible to verify the institutions that published the dissertations in the period from 2009 to 2019, as well as the number of dissertations of each institution.

Among the data acquired, it should be noted that the University of Brasilia (UNB) was the one that had the highest number of publications. However, another significant number was the one shown in other institutions, which included the number of total publications of the institutions which had a publication below 40 (forty) dissertations.

Table.1: Master's Defenses on environmental law

Instituição	Período de publicação (2009 a 2019)	Quantidade	%
UNB	2009 a 2019	1224	39,04%
ucs	2009 a 2019	163	5,19%
PUC-SP	2009 a 2019	123	3,92%
UFSC	2009 a 2019	110	3,50%
USP	2009 a 2019	90	2,87%
UFPA	2009 a 2019	86	2,74%
UNISANTOS	2009 a 2019	86	2,74%
UFVJM	2009 a 2019	75	2,39%
UFC	2009 a 2019	73	2,32%
UFRRJ	2009 a 2019	63	2%
UNESP	2009 a 2019	51	1,62%
UFG	2009 a 2019	48	1,53%
PUC-GO	2009 a 2019	46	1,46%
PUC-RS	2009 a 2019	44	1,40%
UFRGS	2009 a 2019	43	1,37%
UFBA	2009 a 2019	42	1,33%
UFV	2009 a 2019	40	1,27%
* outras instituições	2009 a 2019	728	23,22%
Total	2009 a 2019	3.135	100%

^{*}institutions with numbers of publications below 40 dissertations Source: Organized by the authors.

In the table 2, shows the number of dissertations that have addressed the theme of environmental criminal responsibility. The analyzed data correspond to the same period from 2009 to 2019. In this respect, there is a reduction in the number of publications addressing criminal accountability under environmental Law.

Among the instituions presented in the previous table, the one that obtained the highest number of

published master defenses was Santos University Catholic (UNISANTOS), with 5 (five) publications. Moreover, when analyzing the number of publications, it appears that a small number on research related to environmental responsibility. Of the 3135(three thousand, one hundred and thirty-five) dissertations, only 26 (twenty-six), that is, only 0.82% entered the theme of criminal liability.

TABLE 2: Master's defenses referring to environmental criminal accountability

Instituição	Quantidade	×	
FDV	1	3,84%	
PUC-GO	3	11,53%	
PUC-RS	2	7,69%	
PUC-SP	3	11,53%	
UCS	3	11,53%	
UFBA	1	3,84% 3,84% 3,84%	
UFCG			
UFOP	1		
UFSC		3,84%	
UFTM	1	3,84%	
UNICAMP	1	3,84%	
UNISANTOS	5	19,23%	
USP	3	11,53%	
Total	26	100%	

Source: Organized by the authors.

It is also possible to highlight that, by filtering the data, now related to the cases under study, a dam rupture in Mariana/MG and Brumadinho/MG, as well as the fire that occurred in the Port of Santos/SP

(Ultracargo), a smaller percentage of dissertations arises. According to table 3 only three dissertations were found that addresses tow of the cases under sutdy.

Table 3: Master's defenses based on the cases under study

Instituição	Ano de Publicação	Caso citado	Quantidade
UCS	2019	Mariana/MG	1
UNESP	2018	Ultracargo	1
UNESP	2017	Ultracargo	1

Source: Organized by the authors.

Another relevant data is the one acquired on the Periodicals Capes MEC website. In a period of 4 (four) (2015 to 2019) only 19 (nineteen) scientific papers,

written in the Portuguese language, that dealt with environmental criminal liability were found.

The respective analyzes demonstrate the lack of initiative on the part of Brazilian researchers to analyze

the issue of environmental criminal liability further, as well as to analyze the environmental damage under study, from a scientific legal viewpoint.

III. RESULTS AND DISCUSSIONS

When talking about environmental disasters, it is of significant relevance to remember the incident that occurred in November 2015. Located in the municipality

of Mariana/MG, the Fundão tailings dam broke downs, characterizing itself as the largest environmental disaster faced by Brazil. The iron ore tailings released by the rupture, as well as approximately 40 (forty) million cubic meters (G1, 2019) of mud, reached communities, residents, tributaries of the region and the Rio Doce, covering 663 (six hundred, sixty three) kilometers to find the sea, in Espirito Santo(CAETANO, 2019).



O CAMINHO DA LAMA

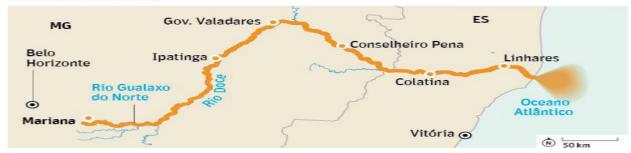


Fig. 1: Mud path in Mariana/MG

Source: Figure extracted from the UOL website, report The Tragedy(2016).

As a result of the disaster, there were material and socioeconomic losses. The district of Bento Rodrigues was devastated after the fact, homeless several people and with little availability of drinking water. Moreover, environmental impacts are almost irreversible at the present time, as mining tailings, mainly formed by iron oxide (Fe2O3), it can devastate large ecosystems (SANTOS).

A similiar case occurred in mid-January 2019, fouryears after the Mariana disaster. The Feijão Mine dam 1, located in the municipality of Brumadinho/MG, ruptured, causing a flood of mud to the region and

causing huge human, environmental, economic and social damage.

On closer examination, the mud released by the dam breach covered about 205 (two hundred five) kilometers, with a tailings volume 50 (fifty) times lower than that of Mariana (CAETANO, 2019), however, reached one of the tributaries of the São Francisco River, the Paraopeba River, contaminating the RetiroBaixo Power Plant reservoir in Pompéu/MG, according to the Minas Gerais Institute for Water Management-Igam (MG1, 2019), as shown in the image below:

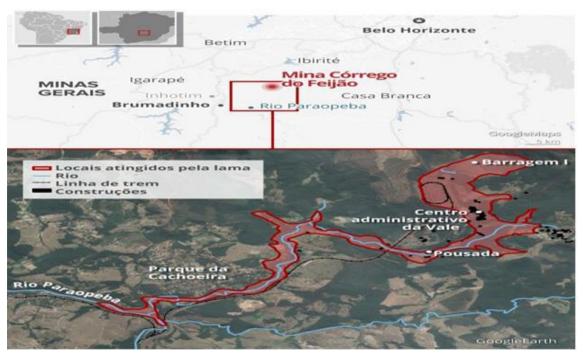


Fig. 2: Mud path in Brumadinho/MG

Source: Figure extracted from the site of G1, report The Tragedy in Brumadinho: The path of mud(2019).

Facing the above cases, both disasters occurred in dams owned by CompanhiaVale do Rio Doce (CVRD). The fines imposed on Samarco, owner of the Fundão dam and owned by Vale, amount to "R\$ 610 million by environmental agencies, R\$346 million by Ibama, and R\$ 370 million by the Minas Gerais Department of the Environment. Of this amount, only R\$ 41 million was paid". In the case of Brumadinho, it is estimated that the fines amount to R\$250 million by Ibama, R\$ 99 million by the government of Minas Gerais, R\$100 million by the Brumadinho City Hall and R\$50 million by the Juatuba City Hall, Paraopeba River contamination (CAETANO, 2019).

Moreover, the mud released by the disruptionsreached regions close to the dams, forminga kind of coverage at the site as Eler mentions (2019), in the case of Brumadinho, the mud struck an area of 3,6 km², which would be equivalent to the area of 504 (Five hundred and four). The author also adds that there is a probability of nature never returning to what it was before, due to the type of residue being difficult to remove. To exemplify, the author cites the case of Mariana, where the places hit by the mud almost all remain the same way.

The cover made by mud leads to the impediment of the development of plant species, due to the absence of organic matter in the mud, leaving the infertile region. Also, due to the composition of the

tailings, these end up affecting the ph of the earth, causing the chemical breakdown of the soil (SANTOS). Moreover, with the mud drying, there is an increase of dust, which leads to the elevation of the number of cases of respiratory problems. According to the data presented by the Institute of Health and Sustainability, approximately 35% of the residents of the Mariana region had a worsening in the health after the rupture of the dam (ELER, 2019).

The mud still affected the issue of water that, by advancing the Rivers, reached significant tributaries, such as the Doce River and the Paraopeba River.According to data analysis the level of copper present in the waters of the Rio Paraopeba reaches up to 600 (six hundred) times above the allowed rivers, used for the purpose of human supply, irrigation of plantations, fishing and recreation. In addition to minerals such as iron, manganese and copper, choromium was found at up to 42 (forty-two) times higher than acceptable in the legislation. In naonterview with agency Brasil EBC, biologist Marta Marcondes, na coordinator of theLaboratório professor AnáliseAmbiental do Projetoíndice de PoluentesHídricos (IPH), of São Caetano do SulUniversity(USCS), explains that chromium is one of the most dangerous chemical elements due to its ability to genetically alter organisms, allowing further application, or the nervous system. In this regard, this substance will alter the entire process of

homeostasis, that is, body's balance, detecting the likelihood of damage to the nervous system as well as degenerative diseases.

In the same way, the report released by the SOS Mata Atlântica Foundation, of march 2019, reveals that the river waters are not in conditions for the population to use. In addition, the tailings that are being sedimented ate the bottom of the river contribute to the lack of life, as the tailings will not disappear, but it can only be diluted at a certain time and eventually be taken to the sea, that is, the tailings if they are sedimented ate the bottom of the river need to be removed, since they are on top of all the life that they had at the bottom of the river, considered decomposers. These, in turn, contributed to the survival of other animals, as the biologist Marcondes explains.

Another relevant point to highlight is the psychological trauma. Disasters have impacts on the survivors mental health, as well as on the victims' families. In 2017, the UFMG Vulnerability and Health Research Center team conducted data collection for the PRISMMA survey, Mariana Mental Health Reality Survey, assessing 271 people. According to the survey data, almost a third of the population was diagnosed with depression. In addition, the survey also showed that 12% of participants have traces of posttraumatic stress disorder, an even more serious mental disorder. The rate is close to that found immediately after Japan's Fukushima nuclear accident in 2011 (PRISMMA, 2018).

Following, it is relevant to address another disaster: the fire of Ultracargo (G1 SANTOS, 2018). Occurred in the same year of the Mariana Dam rupture, the fire was the largest recorded in the history of the Port of Santos and registered by the São Paulo State Environmental Compamy – CETEsb. The damage caused by the fire resulted in economic damage to the fishing community around the terminal

The site of the fire is na industrial área, located off the coast of Santos, that housed 175 (one hundred, seventy five) tanks with storage capacity of up to $10.000 \, \mathrm{m}^3$ each, within an area of $183.871 \, \mathrm{m}^{-2}$. The company Ultracargo works with liquid bulk storage, highlighting the storage of chemicals, petrochemicals, biofuels and vegetable oil. (LYRA, 2015).

According to the complaint filed by the Federal Prosecutor's Office (MPF) in Santos, Terminal Químico de Aratu S.A, a subsidiary company of Ultracargo, was reported for air, sea and soil pollution caused by the fire in the fuel transfer center. Of the company that affected 6 (six) fuel tanks during 8 (eight) days (MPF, 2018).

Based on the findings, the fire was caused by an operational error in the suction and discharge pipes. After a power outage the equipment was turned on by mistake, and the valves were closed, which caused enormous pressure, causing one of the valves to explode. The pumps, which contained the closed vavel, were close to the fuel tanks, which contained the closed valves, were close to the fuel tanks, which with the explosion quickly caught fire (SANTAPORTAL, 2016).

The engineer Elio Lopes clarified that the fire began with a phenomenon called *bleve*, that is, an explosion of the expanding vapors of a boiling liquid. In addition, he added, "this is because some employee inadvertently started a pump that had the suction and discharge closed and had fuel inside. It could be even water, anexplode just the same (SANTAPORTAL, 2016).

Moreover, based on the report by Cássia Lyra (2015, the manager of CETEsb – Environmental Company of the State of São Paulo – on the Baixada Santista, claimed that the fight against fire resulted in significant changes in water quality. This was due to the material dumped in the Santos Port Statuary that changed the temperature and oxygen saturation in the water. Accordingly, according to the federal criminal expert report requested by the Federal Public Prosecution Service, it caused the death of approximately 9 (nine) tons of fish of 142 (one hundred, forty-two) species, of which 15 (fifteen) are become threats of extinction.

Based on the Federal Procesecutor's Office (2018), Ultracargo's subsidiary was not only guilty, but acted with eventual intent by taking the risks of causing pollution and other environmental damage by operating with huge amounts of flammable products without taking preventive measures.

3.1.Analysis of the principles of prevention and polluter pays

The cases under analysis demonstrate that safety and environmental protection standards are probably not fulfilled in their integrality.

In the case of disruption of Fundão dam, the Public Prosecutor's Office has been identified as failures and omissions in relation to the environmental licensing process,not taking into account the potential risks of disruption and environmental damage. Furthermore, it is noted that from the time the Mariana disaster occurred to the present moment, the process of environmental licensing for mine operation, made them more flexible, rather than being stricter the rules (BBC NEWS,2019).

As a result, in 2017 it was approved the possibility of an "Express License" (PASSARINHO,

2019), which allowed the process to occur in one step. The traditional environmental licensing process is carried out in three phases, which may take years to be released. However, concomitant environmental Licensing 1, acronym LAC 1, is carried out in a single step.

This LAC 1 was the type of licensing used by Vale, obtaining authorization to resume activities in the dam of the Córrego do Feijão,in December 2018, in order to reuse partof reject deposited there. The interest in resuming the activities was due to the new technologies that began to allow the use of the excavated material that was previously discarded. Fact is that the dam was deactivated since 2015 and after one month the Vale obtain the authorization to resume the activities, the dam broke (PASSARINHO, 2019).

With this, it is observed that the same errors previously committed in Mariana, were not repaired. The easing of environmental licensing, as well as the nonobservances of the safety guidelines provided for in Law 12.334 (2010), referring to the national policy on safety of dams were the generating factors for the rupture of the Córrego do Feijão mine. In the questionof Ultracargo, the Federal Public Prosecutor's Office evidenced that the actions and omissions taken by the company regarding the event showednegligence, recklessness incompetence of the same (MPF, 2018). Moreover, the risks of causing environmental damage, such as pollution and possible risk of extinction of some species found in the port of Santos statuary, it is denoting that the company acted with eventual intent (MPF, 2018) and, by not adopting preventive measures as well as not having an adequate system of operation that initially tackers the flames, frim ensuring rapid access to fire brigade to personal protective clothing and to the fixed fire-fighting foam system and still does not contain any means of containment of the liquid resulting from the firefighting to prevent flow for the estuary.

In this sense, a principiological analysis is necessary to.

Preliminarily, from the perspective of the principle of Prevention. Based on the Magna Carta of 1988, article 225 adopted the Principle of Prevention by highlighting the duty of the government and community to protect and preserve environmental goods. Thus, it is the State's role to properly punish the polluter, as well as to have a severe legislative framework that imposes fines and heavier sanctions as a means of effectively preventing prevention (FIORILLO, 2017, p.87-88).

With regard to the imposition of fines, the State, it seems, has played its role.

Samarci, owner IF the Fundão dam and Vale company, was fined R\$610 million by environmental agencies, R\$370 million by the Minas Gerais State Department of the Environment and R\$346 million by Ibama. Regardins these amounts only R\$41 million was paid.

In addition, in relation to the breach of the dam in Brumadinho/MG, Vale was fined R\$250 million by Ibama, R\$ 100 million by the Brumadinho city government, R\$ 99 million by the Minas Gerais government and R\$99 million by the Minas Gerais government and R\$50 million by the City Government of Juatuba, due to contamination of the Paraopeba River(CAETANO, 2019).

After an opinion from the Federal Public Prosecution Service regarding the Ultracargo fire, it was instituted that the Court imposed the fines provided for in articles 21 to 24 of the Environmental Crimes Law (Law n. 9605/98), applied in a manner compatible with the damages generated, as well as taking into account the economic group belonging to (MPF, 2018).

Based on information from CETEsb, Terminal Quimicode Aratu, owned by the Ultracargo Group, was initially fined R\$ 22.5 million, but R\$16 million was paid, due to a 30% discount provided for in Law 6.514/08 (BRAZIL, 2018), which provide that the taxpayer will be entitled to this benefit if he/she makes the payment within the estimated 10 (ten) days. In addition, Santos City Hall imposed a fine of R\$2.8 million to compensate for losses to urban mobility (ÉPOCA, 2015).

It is noteworthy that for the application of fines it is necessary to take into account the economic Power of the polluter, so that there is no distortion of the principle through an arithmetic calculation, as cited by Fiorillo (2017). As Bruna Caetano (2019) puts it, "the mining company closed the third quater of 2018 with net income of almost R\$5,8 billion" and as Fontes adds, "from January to March, the company's net revenue was R\$20, 74 billion", referring to the first quarter of 2019 of the Holding Company in which Ultracargo is one of the subsidiaries. Thus, when comparing the value of the fines to the income earned by the due companies, it is clear that these values are low, not having the effect due.

When analyzing the legislative framework, the Polluter-Paid Principle has as its central pillar, with a constitutional provision in paragraph 3 of article 225. According to Fiorillo (2017, p. 71), this principle has two strands of scope. At first, the attempt is made to avoid the occurrence of environmental damage, that is, it has a preventive character. Thus, they impose on the polluter

the duty to prevent environmental damage that their economic activity may cause.

In a second moment, Fiorillo (2017) adds the idea that IF the damage has occurred, it has to be repaired, thus having a repressive character. In this respect, the principle shows that if damage to the environment occurs, due to the activity developed, the cause/polluter will be held responsible for its repair.

It is therefore noted that the Polluter Pays Principle entails the incidence and application of certain facets of the civil liability legal regime to environmental damage. These include objective liability, the priority of specific remediation of environmental damage and solidarity to withstand environmental damage (FIORILLO, 2017).

3.2. Environmental Criminal liability

Following the discussion, it is essential to point out that in the repressive character, as stated above, there is the incidence of civil liability. However, as provided for in the Magna Carta in the referred paragraph 3 of article 225, the enforceability of the obligation to make reparations, criminal or administrative penalties does not exclude their cumulative nature.

Under this bias, the constitutional text, noting the relevance of the environmental establishes it as a fundamental right. And, as a way of safeguarding this right, it showed the subjection of those causing environmental damage to sanctions. Taking into account the social consequences that certain behaviors cause, as well as the need for more severe intervention by the State, the list of sanctions, which highlights the criminal protection of the environment.

The infraconstitutional legislator, based on the constitutional text, created Law n. 9.605/98, which disciplines environmental crimes, as well as the applicability of penalties to the respective crimes.

According to Magalhães Noronha (apud PEREIRA, 2012), crime is a human conduct that endangers or harms a legal asset protected by criminal law. Thus, the Environmental Crimes legislation makes clear the conduct of the individual, in order to systematize the conduct harmful to the environment.

Among the provisions brought by the legislation, the possibility of penalizing the legal entity is highlighted, with focus on article 225, paragraph 3 of the Federal Constitution. In this respect, Brazil was the first Latin American country to create the theory of criminal liability of the legal entity, that is, the applicability of the penalty is not restricted only to individuals, but also to legal entities.

Despite the divergences in the application of criminal liability to legal entities, the doctrine of environmental law has a majority position in favor of its application. In this sense, the understanding prevails, as Pereira (2012) points out that, the cause of the damage, regardless of whether it is a legal or natural person, is liable both in administrative and criminal waiting, and should be taken into account that the individual, representative of the legal entity, acting on its behalf and for its benefit, be held liable at the same time.

Mention, for example, of the judgment in the file of Special Appeal n. 889.528/SC, issued by Minister Felix Fischer, who admitted the criminal liability of the legal entity in environmental crimes.

According to Brazilian Superior Court of Justice, the imputation of criminal liability of the legal entity in the case of environmental crimes is allowed. To the Court, there is simultaneous accountability of legal and natural persons, as they act with their own subjective element (STJ, 2006). However, in 2013, the Federal Supreme Court understood the possibility of holding the legal entity independent of the individual. For the Supreme Court, regardless of the conviction or acquittal of individuals holding management positions, it is fully possible for the legal entity to respond criminally (STF, 2013).

Importantly, according to Costa and Marotta (2017) the Federal Supreme Court understood that the Brazilian Constitution of Republic of 1988 has conditioned the criminal liability of the legal person to that of the physical persons causing the damage.

Based on the analysis of probable environmental crimes in the three cases presented, these are framed in the crimes of pollution, extraction of mineral resources and storage of toxic products or substances that are in disagreement with the preventive measures laid down in laws or regulations, provided for in articles 54, 55 e 56, respectively of the Environmental Crimes Act n. 9.605/98.

About the pollution crime, in an objective way, in accordance with article 56 of the Law n. 9605/98 (Brazil, 1998), are those who, of any nature, may cause harm to human health, as well as the death of animals or the destruction of a relevant form of the flora, one who acts guilty may be punished. Moreover, those who fail to take precautionary measures for the extraction of minerals or the handling of toxic substances, more specifically, flammable.

As noted, environmental protection has been incorporated into the constitutional text provided for in article 225, implemented by the most severe form of

protection in force in the Brazilian legal system, criminal protection.

The companies, in the cases studied here – related to the incidents that occurred in the Minas Geraiscities of Mariana and Brumadinho – may, in theory, be held criminally responsible for the environmental crimes that occurred. However, although some indoctrinators (Fiorillo, 2017) argue that any conduct that causes environmental damage would constitute illicit, with the consequent application of sanctions, caution must be exercised in criminal policy, requiring detailed investigation of the fact and strict compliance law.

From the perspective of the principle of Prevention it is important to clarify that this accountability does not seek to make economic activity unfeasible, but only to punish the polluter who does not understand that natural resources are exhaustible and scarce, and that they do not belong to an individual or a determined individual and "its use of others, because the environmental good is a common good of the people" (2017, p. 87).

Under this bias, it is right to address the characteristics of environmental law, one of the main principles being sustainable development. Thus, one has the idea that there must be a harmonization between the development of a society, along with the preservation of natural resources, allowing present and future generations to have access to these rights(FERREIRA, 2018).

In this sense, we understand the 17 UN Sustainable Development Goals that together "are integrated and indivisible, and balance the three dimensions of sustainable development: the economic, social and environmental" (Agenda 2030, 2015).

IV. CONCLUSION

The present study addressed the principles of prevention and the principle of the debtor-payer, in order to demonstrate the urgent need to comply with standards of and environmental regulations on the parto f national companies. This need can be demonstrated by the cases addressed throughout the text, which revealed the absence of the adoption of preventive measures and the practice of the same misconceptions that cause enormous environmental tragedies.

In short, these environmental disasters serve as an alert to the occurrence of possible new disasters. It is necessary to raise awareness that environmental resources are dupable sources, goods of common use for all generations, demonstrating the need for its preservation and exploitation in a sustainable way.

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