Comparison of air quality standards between Brazil and countries from the five continents

Comparação dos padrões de qualidade do ar entre o Brasil e países dos cinco continentes

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ABSTRACT

This article presents a comparative study of air quality regulations. The main objective was to compare Brazil's current technical air quality standards with international standards. The air quality standards defined by Brazil for $PM_{2.5}$, PM_{10}, lead, SO_2, NO_2, and O_3 have higher values than international norms, and Brazil lacks standards for important pollutants like mercury, cadmium, nickel, toluene, and PAHs. The use of more permissive air quality standards significantly distorts the perception of potential exposure for the population, downplaying the actual impact on public health, leading to inadequate public health planning, and resulting in avoidable hospitalisations, premature deaths, and other intangible costs like reduced quality of life for the population.

Keywords: Environmental pollution. Atmospheric emissions. Air quality standards.

RESUMO

Este artigo trata de um estudo comparativo entre legislações de qualidade do ar. O principal objetivo foi comparar as normas técnicas vigentes sobre qualidade do ar no Brasil, em relação a normas internacionais. Foram comparados os padrões de qualidade do ar definidos pelo Brasil com os padrões adotados em países dos cinco continentes. O Brasil apresentou padrões para o $MP_{2,5}$, MP_{10}, chumbo, SO_2, NO_2 e O_3 com valores maiores que outras normativas internacionais, além de não apresentar padrões para poluentes importantes como mercúrio, cádmio, níquel, tolueno e HPAs. A utilização de padrões de qualidade do ar mais permissivos deturpa severamente a percepção da exposição potencial da população, *minimizando o real impacto na saúde da população exposta, contribuindo para a falta de planejamento adequado de saúde pública e ocasionando desperdício do dinheiro público com internações evitáveis, mortes prematuras e outros custos intangíveis como qualidade de vida da população.*

Palavras-chave: *Poluição ambiental. Emissões atmosféricas. Padrões de qualidade do ar.*

1 INTRODUCTION

Air pollution, which can be defined as the presence of foreign substances in the atmospheric air, ranks among the top 10 risk factors contributing to the total number of years of life lost due to disability-adjusted life years across all age groups (GBD, 2019). Numerous epidemiological studies demonstrate that air pollution can lead to chronic diseases, exacerbation of related conditions, such as cardiovascular and respiratory morbidity and mortality, as well as premature deaths, thereby impacting the health of populations and contributing to increased public expenditure on medical care provided to the affected population (Aguilera *et al.*, 2021; Burnett *et al.*, 2018; Rajagopalan, 2018).

In Brazil, Abe and Miraglia (2016) estimated that the cost of premature deaths caused by air pollution in 29 Brazilian capitals results in an annual loss of approximately $1.7 billion. The sheer magnitude of this figure alone underscores its significance. However, it is believed that this estimate may still be underestimated, considering that the potential savings for public funds could be even higher when takinginto account other events besides premature death, such as hospitalisations due to respiratory causes, workplace absenteeism, and intangible costs like quality of life and life expectancy. This highlights that air pollution is a critical public health and economic concern.

One of the ways to control the emission of pollutants into the environment as a whole, including the atmosphere, and thereby mitigate the harmful health effects caused by pollution is the implementation of strict regulations on the subject. Setting emission limits for specific substances can improve air quality to protect human health and the environment (Vormittag *et al.*, 2021).

The World Health Organization - WHO establishes recommended limits for the concentrations of key atmospheric pollutants based on a global synthesis of scientific evidence. These recommended limits are intended to address the anticipated adverse health effects occurring in a significant portion of the population, both outdoors and indoors. While these recommendations are guidelines for countries, they do not have regulatory authority. The WHO guidelines cover annual and daily concentrations of fine particulate matter, nitrogen dioxide, sulfur dioxide, carbon monoxide, and ozone (WHO, 2021).

In Brazil, the National Environmental Council (Conama) Resolution No. 03, dated June 28, 1990, used to be the technical regulation establishing air quality standards. It has been replaced by Conama Resolution No. 491, dated November 19, 2018. In Article 2, section II of the latter, it defines:

> Article 2 - II - Air quality standard: one of the instruments for managing air quality, determined as a concentration value of a specific pollutant in the atmosphere, associated with a time exposure interval, in order to preserve the environment and the health of the population from the risks of damage caused by air pollution.

Therefore, an air quality standard is a technical instrument that legally defines a maximum limit for the concentration of a pollutant. It aims to control emissions of pollutants to protect human health and the well-being of people and the environment. (Brazil, 1990, 2018).

Vormittag *et al.* (2021) explain that the air quality standards currently in place in Brazil are not only outdated but are often violated due to the government's lack of commitment to established policies. The use of outdated air quality standards, especially when they are higher compared to international recommendations and therefore more lenient, can severely distort the potential exposure of the population to harmful levels of air pollution (Chiquetto *et al.*, 2019; Valdambrini; Ribeiro, 2021).

The primary objective of this study is to compare the current technical standards for air quality in Brazil with the international standards in effect in other countries around the world.

2 METHODOLOGICAL PROCEDURES

This is a comparative study of air quality standards among national technical regulations in different countries worldwide. Air quality standards are defined considering two parameters: the maximum acceptable concentration value in the environment for each pollutant, typically in micrograms per cubic meter (µg/m³) or parts per million (ppm), and the sampling period, which is the defined time for pollutant collection and evaluation.

The research was conducted by considering the current air quality standardisation technical regulations in each selected country during the period from November 2018 to January 2022. Air quality standards from at least one country in each continent were chosen, in addition to the air quality guidelines from the World Health Organization (WHO). Even though the WHO guidelines do not have regulatory authority, they serve as guidelines for developing and revising technical air quality standards in all countries worldwide.

Thus, the following standards were selected for comparison:

1. Conama Resolution No. 03, 1990 - Brazil's former air quality standards regulation.

2. Conama Resolution No. 491, 2018 - The current technical standard in effect in Brazil.

3. Directive 2008/50/CE - A reference standard for European Union countries, 2008.

4. Canadian Environmental Protection Act, 1999 - The technical standard for Canada, representing North America.

5. Environmental Quality Standards in Japan Air Quality, 2009 - The standard for Japan, representing Asia.

6. Resolución 2254, 2017 - Colombia, representing another South American country in addition to Brazil.

7. Air Quality Act 39: National Ambient Air Quality Standards, 2004 - The standard for South Africa, representing Africa.

8. National Clean Air Agreement, 2015 - Australia, representing Oceania.

9. WHO Air Quality Guidelines for particulate matter, ozone, nitrogen dioxide, and sulfur dioxide, 2021 - The reference guide from the World Health Organization.

This comprehensive selection allows for a comparative analysis of air quality standards from various continents and regions worldwide.

To perform the comparisons, it was necessary to convert all pollutant concentration limit values to a single unit of measurement. This was required because the values could be presented in milligrams per cubic meter (mg/m³), micrograms per cubic meter (µg/m³), parts per million (ppm), or parts per billion (ppb), depending on the specific standard and pollutant. Standardising the units allows a more meaningful and straightforward comparison of air quality standards.

The data was organised in spreadsheets, and an attempt was made to compare the limit values for each pollutant with the same sampling time in each standard.

3 RESULTS AND DISCUSSION

Conama Resolution 491 of November 19, 2018, is the result of the revision process of Conama Resolution 03 of June 28, 1990, which established national air quality standards in that year and was in effect for 28 years without updates to incorporate new scientific knowledge on the subject. The revision process began in 2014 within the Technical Chamber for Environmental Quality and Waste Management of Conama. The beginning of the revision process was considerably delayed, and its approval, on the contrary, was rushed, without adequate discussion with the public and experts to ensure that real progress was made in meeting air quality standards in Brazil (Siciliano *et al.*, 2020).

Conama Resolution 491 (2018) established 14 air quality standards for 9 pollutants, whereas Conama Resolution 03 (1990) defined 13 standards for 7 pollutants. The maximum pollutant concentration values in the air, as well as the defined sampling times, are summarised in Table 1 below:

Table 1 | Air quality standards for Brazil defined by Conama Resolutions.

BRAZIL			
	Conama 03 (1990)	*Conama 491 (2018)*	
Pollutant	Concentration (µg/m3)	Concentration (µg/m3)	Sampling time
$MP_{2,5}$	-	25	24 hours
	-	10	1 year
MP_{10}	150	50	24 hours
	50	20	1 year
Total Suspended Particles	240	240	24 hours
	80	80	1 year
Smoke	150	50	24 hours
	60	20	24 hours
SO_2	365	20	24 hours
	80	-	1 year
NO_2	320	200	1 hour
	100	40	1 year
CO	40.000	10.310	1 hour
	10.000	-	8 hours
O_3	160	-	1 hour
	-	100	8 hours
Lead	-	0,5	1 year

Source: Resolutions Conama 03/1990 e 491/2018. Adapted by the author.

This study analysed eight technical standards for standardising air quality parameters and one international reference guide, the WHO Guideline (2021).

Regarding the number of standards defined by each regulation, the one with the fewest air quality standards defined was the Canadian standard, with 7 standards, while the technical standard from Colombia defined the highest number of standards, with 19 standards. The quantity of standards defined by each regulation is summarised in Figure 1.

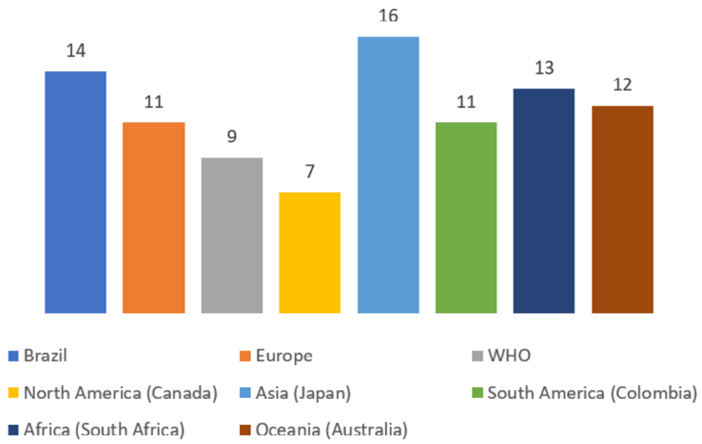

Figure 1 | Number of standards defined per country regulation

Source: Compiled by the author

The Japanese technical standard was the only one to define primary standards for the pollutants trichloroethylene, tetrachloroethylene, dichloromethane, dioxins, and photochemical oxidants. The air quality standards that are unique to Japanese standards are summarised in Table 2.

Table 2 | Air quality standards only found in the Japanese standard.

Environmental Quality Standards in Japan Air Quality		
Pollutant	Maximum concentration	Sampling Time
Trichloroethylene	0,2 mg/m³	1 year
Tetrachloroethylene	0,2 mg/m³	1 year
Dichloromethane	0,15 mg/m³	1 year
Dioxins	0.6 pg-TEQ/m³	1 year
Photochemical oxidants	0,06 ppm	1 hour

Source: Japanese Ministry of the Environment. Adapted by the author.
(Available at: https://www.env.go.jp/en/air/aq/aq.html)

Information from the Japanese Embassy in Brazil indicates that in the mid-1960s through the 1970s, Japan experienced various severe forms of environmental pollution. In addition to Minamata disease, several other pollution-related illnesses were discovered, including itai-itai disease, respiratory disorders in industrial areas of Tokyo-Yokohama, Nagoya, and Osaka-Kobe, and chronic arsenic poisoning in the Toroku region, Miyazaki Prefecture. These forms of pollution resulted from prioritising rapid economic growth at the expense of standards for protecting the health and safety of the population. These consequences prompted Japan to establish strict regulations to protect the environment starting in the 1960s.

Similar to the Japanese standard, some pollutants were only identified in the Colombian technical standard. These were referred to in the standard as “toxic air pollutants,” including cadmium, inorganic mercury, toluene, nickel (and its compounds), and Polycyclic Aromatic Hydrocarbons (PAHs). The air quality standards unique to the Colombian standard are summarised in Table 3.

Table 3 | Air quality standards found exclusively in the Colombian standard.

Toxic contaminants		
Pollutant	Maximum concentration (µg/m³)	Sampling Time
Cadmium	0,005	1 year
Inorganic Mercury (vapors)	1	1 year
Toluene	260 1.000	1 week 30 minutes
Nickel (and its compounds)	0,18	1 hour
PAH	0,001	1 year

Source: Colombia. Ministry of Environment and Sustainable Development - Resolution 2254. Adapted by the author.

A study conducted by the World Health Organization's International Program on Chemical Safety (IPCS) reveals that, in addition to the more common or "traditional" atmospheric pollutants, a significant number of toxic and carcinogenic chemicals are increasingly being found in urban air, albeit at low concentrations. Examples include metals (beryllium, cadmium, and mercury), trace-level organic substances (benzene, polychlorinated dibenzo-dioxins and dibenzo-furans, formaldehyde, vinyl chloride, and PAHs), and fibres (asbestos). These substances are emitted from various sources, including waste incinerators, sewage treatment plants, industrial processes, solvent use, construction materials, and motor vehicles (WHO, 2000).

Excluding the pollutants only mentioned in Japan and Colombia's technical standards, Table 4 was created with the standards for the remaining pollutants, organised by sampling time and referencing each regulation.

Table 4 | Comparative study between air quality standards found in the study.

		Brazil			*WHO*		*Europe*	*North America*	*Asia*	*South America*	*Africa*	*Oceania*
		Resolution CONAMA 03/1990	Resolution CONAMA 491/2018		WHO Global Air Quality (2021)		Directive 2008/50/ EC	Canadian Environmental Protection Act, 1999 (Canada)	Environmental Quality Standards in Japan Air Quality (Japan)	Resolución 2.254 (Colombia)	National Ambient Air Quality Standards (South Africa)	National Clean Air Agreement (Australia)
			(PI-1)	(PF)	(IT-1)	(AQG)						
	Sampling time	Concentration (µg/m³)										
$MP_{2,5}$	24 hours 1 year	- -	60 20	25 10	75 35	15 5	- 25	27 8,8	35 15	50 25	- -	25 8
MP 10	1 hour 24 hours 1 year	- 150 50	- 120 40	 50 20	- 150 70	- 45 15	- 50 40	- - -	200 100 -	- 100 50	- 75 40	- 50 -
Lead	1 year	-	0,5	0,5	-	-	0,5	-	-	-	0,5	0,5
Total Suspended Particles	24 hours 1 year	240 80	240 80	240 80	- -	- -	- -	- -	- -	- -	- -	- -
Smoke	24 hours 1 year	150 60	120 40	50 20	- -	- -	- -	- -	- -	- -	- -	- -
Benzene	1 year	-	-	-	-	-	5	-	3	-	5	-

		Brazil			*WHO*		*Europe*	*North America*	*Asia*	*South America*	*Africa*	*Oceania*
		Resolution CONAMA 03/1990	Resolution CONAMA 491/2018		WHO Global Air Quality (2021)		Directive 2008/50/ EC	Canadian Environmental Protection Act, 1999 (Canada)	Environmental Quality Standards in Japan Air Quality (Japan)	Resolución 2.254 (Colombia)	National Ambient Air Quality Standards (South Africa)	National Clean Air Agreement (Australia)
			(PI-1)	(PF)	(IT-1)	(AQG)						
	Sampling time	Concentration (µg/m³)										
SO_2	10 min	-	-	-	-	-	-	-	-	-	500	-
	1 hour	-	-	-	-	-	350	180	260	100	350	520
	24 hours	365	125	20	125	40	125	-	100	50	125	210
	1 year	80	40	-	-	-	-	13,09	-	-	50	52,35
NO_2	1 hour	320	260	200	-	-	200	110	-	200	200	230
	24 hours	-	-	-	120	25	-	-	75,26-110	-	-	-
	1 year	100	60	40	40	10	40	32	-	60	40	56,44
CO	1 hour	40.000	-	-	-	-	-	-	22.900	35.000	30.000	-
	8 hours	10.000	10.310	10.310	-	-	-	-	-	5.000	10.000	10.310
	24 hours	-	-	-	7	4	10	-	11.450	-	-	-
O_3	1 hour	160	-	-	-	-	-	-	120	-	-	200
	4 hours	-	-	-	-	-	-	-	-	-	-	160
	8 hours	-	140	100	160	100	120	120	-	100	120	-

Source: The author's own work.

As you can see, until 2018, Brazil did not define standards for fine particulate matter $PM_{2.5}$. According to the WHO guidelines, the evidence regarding the public health impact of this material is consistent and demonstrates adverse health effects from exposures that are currently experienced by urban populations in both developed and developing countries (WHO, 2015).

Due to their extremely small size (aerodynamic diameter less than 2.5 micrometers), these particles can penetrate the upper respiratory tract, depositing in the bronchioles and alveoli, causing a range of cardiovascular and respiratory problems in humans. The entire exposed population is affected, but susceptibility to pollution can vary based on health status and age. Epidemiological evidence shows adverse effects of fine particulate matter following short-term and long-term exposures (Santos *et al.*, 2021).

A study conducted by Abe and Miraglia (2016) showed that in the state of São Paulo alone, reducing $PM_{2.5}$ pollution levels to the WHO-recommended levels of 10 µg/m³ (annual average) would add 15.8 months to life expectancy in the population, corresponding to a delay in 5,012 deaths and an annual gain of $15.1 billion, saving healthcare expenses (this value is actually even higher if we consider costs related to absenteeism and intangible costs like quality of life and life expectancy).

The establishment of Conama Resolution 491 in 2018 introduced air quality standards for this pollutant in Brazil. However, it is important to clarify that this resolution set Intermediate Air Quality Standards (PI-1, PI-2, and PI-3) that precede the Final Air Quality Standards (PF). Therefore, the air quality standards currently in effect are the PI-1 standards. Thus, the initial standard for $PM_{2.5}$ is 60 µg/m³, a value that is still 140% higher than the one recommended by the WHO (2021).

According to the regulation, the intermediate standards will be adopted one after another, taking into account the Air Emission Control Plans ("PCEA") and the Air Quality Assessment Reports ("RAQA"), which should be prepared by the state and Federal District environmental agencies. It is also worth noting that the regulation stipulates that if the migration to the subsequent standard is not possible, the current standard prevails.

The regulation also establishes that the Air Emission Control Plans (PCEA) will be defined according to their own regulations and must be prepared within 3 years from the effective date of the regulatory act. On the other hand, the Air Quality Assessment Reports (RAQA) must be prepared annually and should contain monitoring data and the evolution of air quality. These reports must include a minimum content that requires information such as: a description of the characteristics of the state (or Federal District) region where the environmental quality assessment is being conducted, a description of the monitoring network, identification of the monitored air pollutants, types of networks used (whether automatic or manual) and parameters monitored; as well as other aspects related to monitoring methodology and management measures that are being applied.

As a result, it can be observed that under the terms of the new Resolution, each federative unit is responsible for reporting to the federal government whether or not it has achieved the concentration limits of pollutants after a certain time interval. In the event of non-compliance, the period is simply extended for the state to meet the standards (meanwhile, the population continues to suffer from high levels of air pollution).

While there are no sanctions provided in case of an inability to progress to the subsequent standard, and consequently the risk of not reaching the Final Air Quality Standards, which the WHO recommends, it can be considered an advancement to reduce the acceptable concentration values of pollutants when compared to Conama Resolution 03/90 and the inclusion of standards for important pollutants like PM2.5 and lead. However, establishing standards alone does not solve the problem; it is essential to enforce deadlines, implement mechanisms, and establish penalties for those who do not adhere to the stricter standards (Fernandes *et al.*, 2021).

In fact, the experience of not advancing the evolution of established intermediate air quality standards is a known practice in Brazil. In the state of São Paulo, the Environmental Company of the State of São Paulo (Cetesb), which is the state agency responsible for controlling, monitoring, licensing, and supervising activities that generate pollution, established a similar structure as early as 2013 and did not advance in its intermediate goals, remaining stagnant in standards that had been defined as temporary, even to this day in 2022.

This is an example of the difficulty in making progress on this issue, even starting from the state of São Paulo, theoretically the most advanced air quality legislation in Brazil. It is a very complex matter as it involves, on the one hand, the protection of health and the environment and, on the other, a wide range of interests from productive sectors that are also essential to the economy of the states and the country.

Therefore, Brazilian legislation should have been developed interdisciplinary, with mechanisms that could support productive sectors to help them reach the new standards. After all, a plume of pollutants located in one state can easily be transported to a neighbouring state, depending on the wind direction and atmospheric conditions. Thus, this progress must be achieved not only in an interdisciplinary manner but also on a regional scale to obtain tangible results in this matter.

In the case of particulate matter with particles of aerodynamic diameter up to 10 micrometres, PM_{10}, it can be observed that Brazil defines standards for the 24-hour and 1-year periods. Despite the establishment of the new air quality resolution, when compared to other regulations, it is evident that currently, for the 24-hour period, the Brazilian standard is more permissive than all the assessed technical regulations, with its value (120 $\mu g/m^3$) being 1.4 times higher than the limit recommended by the WHO and the limit adopted by the European regulation (50 $\mu g/m^3$). For the 1-year sampling period, the current Brazilian standard is now equal to the value defined by the European and South African regulations, better than the one adopted by Colombia, but still 2 times more permissive than the WHO recommendation.

Abe and Miraglia (2016) also assessed the impacts on morbidity due to short-term exposure to PM_{10} in São Paulo from 2009 to 2011. They found that if the WHO-recommended level of PM_{10} (20 µg/m³) had been achieved, São Paulo would have prevented more than 1500 cardiovascular and respiratory hospitalisations annually. An additional 5 µg/m³ reduction would have prevented over 500 more hospitalisations.

Conama Resolution No. 003/1990 did not define standards for lead (Brazil, 1990; Brazil, 2018). This pollutant can be released into the environment through industrial processes, especially in the chemical, automotive, construction and mining industries, and can be transported for kilometres and, when sedimented, can contaminate soil and water (Reis *et al.*, 2019). Furthermore, lead was once a component of gasoline, and the partial or complete ban on the addition of tetraethyl lead to gasoline in some countries reduced the concentration of this element in the air, especially in urban areas, but did not eliminate the problem of lead pollution entirely. (Vanz *et al.*, 2003).

Lead affects all organs and systems of the human body, and it can cause adverse effects on the neurological, haematological, endocrinological, growth, renal, reproductive, and developmental aspects, as well as being associated with carcinogenic, cardiovascular, and gastrointestinal effects (Vargas *et al.*, 2019).

Currently, although the air quality standard for lead is defined as a final air quality standard, the legislation took steps to institute this standard immediately upon the publication of the regulatory act. However, it is a parameter to be monitored in specific areas, depending on the type of atmospheric emission sources and at the discretion of the competent environmental agency (Brazil, 2018).

Among the standards evaluated, only Brazil has established standards for Total Suspended Particles (PTS) and smoke. According to Cetesb, PTS can be simplistically defined as those with an aerodynamic diameter of less than or equal to 50 micrograms. Some of these particles are inhalable and can cause health problems, while others can adversely affect the population's quality of life, interfering with the aesthetic conditions of the environment and hindering normal community activities. Smoke, on the other hand, is associated with particulate matter suspended in the atmosphere from combustion processes (Cetesb, 2016).

Benzene, which is classified as a Group 1 substance by the International Agency for Research on Cancer (IARC/WHO), meaning it is a chemical substance with sufficient evidence of its carcinogenicity in humans (IARC, 1987), did not have a standard defined in the Brazilian technical regulation. Among the regulations evaluated, only the regulations from Europe, Japan, and South Africa established standards for this pollutant, with the Japanese standard being the strictest, setting the lowest maximum annual average concentration allowed at 3 µg/m³.

Regarding sulfur dioxide (SO_2), the Conama Resolution 491 defines standards for sampling periods of 24 hours and 1 year. Once again, despite the reduction in the maximum acceptable concentration value, the current Brazilian standard still performs poorly when compared to other selected standards. For the 24-hour sampling period, it is only equivalent to the South African standard. It is worth noting that, for this same sampling period, the current Brazilian standard is more than 6 times the value of the standard recommended by the WHO.

For the pollutant nitrogen dioxide (NO_2), the Brazilian technical standard defines primary standards for 1-hour and 1-year periods. The maximum acceptable value for the annual average concentration of 60 µg/m³ is the same as that of the Colombian standard, but it is higher and, therefore, more permissive than the others that set standards for this period. As for the 1-hour period (60 µg/m³), it is more permissive than all the others.

Regarding carbon monoxide (CO), Resolution Conama 03/1990 set standards for 1 hour and 8 hours for sampling periods. The new regulation removed the standard for the 1-hour period, maintaining it only for the 8-hour sampling period. This pollutant does not have a standard defined by the WHO, but the standard adopted by Brazil was the same as Australia's and higher than the standards adopted by Colombia and South Africa.

Regarding ozone (O_3), the Brazilian standard previously set a standard for a 1-hour sampling period but changed it to an 8-hour period with a maximum acceptable concentration of 140 µg/m³. Once again, the Brazilian regulation proved to be worse than all the other standards that established standards for this pollutant in the same sampling period.

The study by Chiquetto *et al.* (2019) in the São Paulo metropolitan region in 2017 demonstrated that the number of people affected by exceeding the WHO's attention levels for ozone was almost ten times higher when compared to the current attention levels. This indicates that the attention levels determined by the current air quality standard clearly underestimate the number of vulnerable people in areas susceptible to high ozone levels and other pollutants.

It is clear from the study that the Conama Resolution 491/18 does not provide a clear timeline for compliance with the outdated national standards, let alone the international standards recommended by the WHO or other agencies.

The current air quality standards used by Brazil severely distort the potential exposure of the population to harmful levels of air pollution, as they underestimate the actual impact on public health. This leads to inadequate planning of public health costs and results in a significant waste of public funds on preventable hospitalisations, premature deaths, and other intangible costs, such as the population's quality of life.

4 CONCLUSIONS

It is clear that Resolution Conama 491/2018, the current Brazilian legislation, is still outdated compared to the air quality standards in force in other countries, particularly concerning acceptable concentration limits for air quality standards.

Brazil has set standards for $PM_{2.5}$, PM_{10}, lead, sulfur dioxide, nitrogen dioxide, and ozone with values higher than those in other international regulations. Additionally, it does not establish standards for important pollutants such as mercury, cadmium, nickel, toluene, and PAHs.

There are certain aspects to commend in the new resolution, such as the reduction of the permissible concentration levels for PM_{10}, smoke, sulfur dioxide, and nitrogen dioxide. Additionally, the introduction of standards for significant pollutants like lead and $PM_{2.5}$, representing a greater health risk than PM_{10}, is noteworthy. The provision for the progression of standards within the regulation is also a positive feature.

However, it is of utmost importance to establish strict timeframes for the transitions between the current intermediate standards, and these should be as short as possible to prevent them from remaining stagnant indefinitely.

It is important to emphasise the need for the inclusion of certain significant air pollutants that already have standards defined in other regulations, such as benzene, PAHs, mercury, cadmium, and nickel, among others.

Environmental legislation should continue to evolve in line with the advancements in production processes and modern lifestyles as new substances are created and released into the atmosphere every day. Therefore, it is essential to remain vigilant. Equally important to the existence and evolution of environmental legislation is its enforcement.

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