

Investigation of workers carrying out outdoor activities in environmentally contaminated areas

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Abstract

Changes caused by industrial processes in the world today are factors of change across several environments, including soil, air, and water. Across the planet there are many areas identified as being contaminated. In the state of São Paulo-Brazil, there are more than 2,000 areas identified as contaminated by various chemicals. In the study and identification process of the impacts of these contaminated areas there are concerns with the populations which are directly exposed: workers of companies or residents. Workers with high levels of exposure or working in the maintenance of gas, water or sewer infrastructures, as well as in civil construction, are never considered. Thousands of workers throughout the world are involved in the described situations by conducting their activities without having information of the risks present in the soil or water, and consequently without the benefit of specific prevention. This study was conducted due to a concern in evaluating the health of workers in sanitation activities in the city of São Paulo, who work in areas identified as contaminated. This is a descriptive study where all contaminated areas were identified from the onset. Later, workers who carried out maintenance services for water and sewer were identified. Based upon the substances identified as contaminated, a medical service procedure was developed and additional tests were conducted. We evaluated 300 workers, who were subjected to laboratory tests and clinical examination after completion of specific procedures. The analyses are described where changes were found in AST, ALT and GGT. To conclude, it is necessary to identify risks arising from contaminated areas, evaluate the health of the workers exposed to these areas, and provide guidance on the risks that may be present in addition to the traditional risks associated with these occupations.

Keywords: occupational health, environmental health, contaminated areas.



1 Introduction: justification

Changes determined by industrial processes in the world today are factors of changes across several environments, including soil, air, and water. Across the planet there are many areas identified as being contaminated. The problem of environmental contamination by chemicals and hazardous waste, specifically in the case of soil, is associated, not only with the model of industrial development, but with reduced control and legal restrictions in the industry, its methods of treatment and final disposal sites of hazardous waste, as well as illegal dumping of waste and the abandonment of industrial areas. Also, there is a relationship with the politics of economic development, such as the use of non-sustainable natural resources, dependence upon non-renewable sources of energy, the creation of waste, the use of chemicals and the production and consumption of goods and services.

At the end of the 1970's, events with broad impacts such as the "Love Canal" in the United States or the Lekker kirk in the Netherlands showed the complexity, severity and relevance of the areas with contaminated soil to public health. In the following years other similar cases were discovered in countries such as Sweden, Germany and Canada. In Brazil, beginning in the 80's, cases such as the "City of Santos", "City of Boys", "Santo Amaro of Purificação" and "Reunited Industries Francisco Matarazzo" begin to appear. After events like these, thousands of contaminated areas were found in industrialized countries. In Germany, it is estimated that the number of suspected areas is beyond three-hundred thousand [1]. In the United States, about five-hundred thousand have some kind of contamination [2]. In Austria there is around twenty-one thousand cases, 10,700 in Denmark and around 4,000 in Switzerland [3–5]. In Brazil the number of areas and number of people exposed to soil contaminated is unknown. The Ministry of Health estimates that around two million people are potentially exposed. In the state of São Paulo – Brazil, the Company of Environmental Sanitation – CETESB has identified more than 2,000 areas considered contaminated by various chemicals.

Finally, the existence of a contaminated area can lead to problems such as damage to human health, the quality of water and biota (food), restrictions on the use of soil and damage to public and private property, leading to the devaluation of properties and damage to the environment. Thus, there is a need to know the dimension of the problem, public policies for development of integrated strategies for action to avoid and minimize direct or indirect impacts on human health and the environment. The transformation of cities with the decline of industrial districts has left an urban landscape with a large number of areas that have new restrictions on use due to the potential presence of contamination.

The soil surface layer generally defined as the earth's crust has been, or was sometimes considered, an endless recipient of substances often harmful to the environment and health. The concentration of industrial parks and population density in the main metropolitan regions of Brazil, especially São Paulo, has caused the emergence of environmental liabilities causing the contamination of soil and underground water. Commercial activity using harmful substances of the

industry and trade, for example, deposits of chemicals, metal industries, and distribution of fuel, may or will impact the soil and ground water. A contaminated area can be defined as an area, place or land where there is known contamination or pollution.

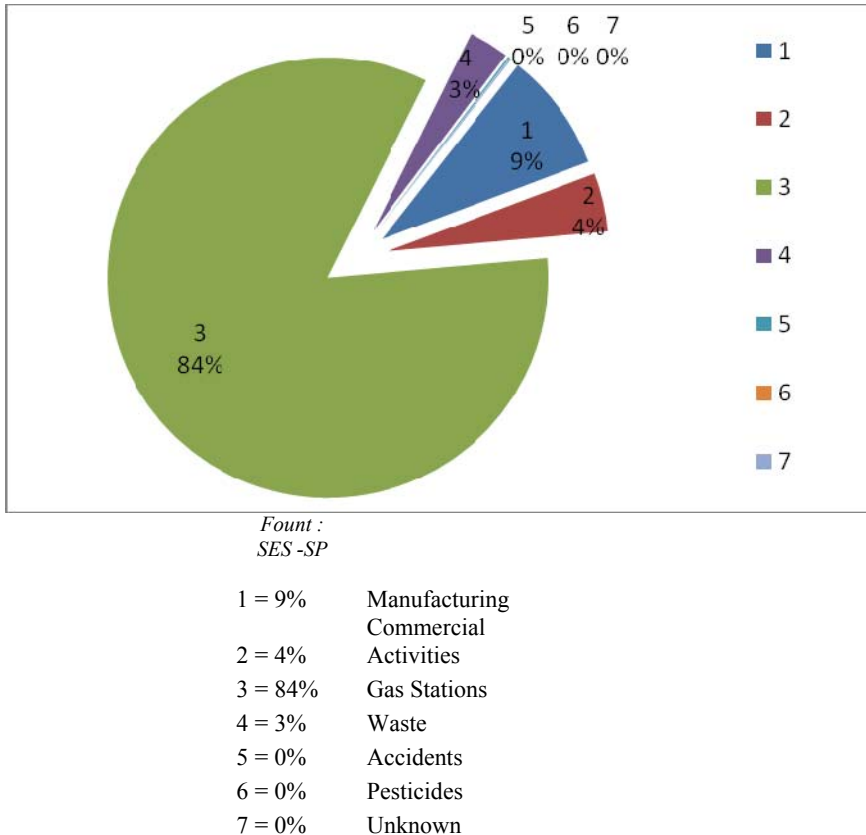


Figure 1: Activities that contaminate the environment in the State of São Paulo.

Within the identification process and studies to minimize the impacts, there are always direct environmental concerns and people directly exposed: residents or employees of the company involved. Workers with higher than normal exposure or working in the maintenance of gas, water, and/or sewer infrastructures, as well as civil construction are never considered.

In the city of São Paulo, activities related to the construction and maintenance of sanitation services is the responsibility of the Sanitation Company for the State of São Paulo - SABESP. The Company of Sanitation for the State of São Paulo was created in 1973, coordinating the supply and quality control of water for the population. SABESP is responsible for the water supply and drainage in

366 municipalities of the state, with 39 in the metropolitan region alone, 32 of which are operated entirely by the company, and with approximately 16,000 employees, many of whom work in frequent contact with areas identified as contaminated by CETESB.

In this work environment, industrial activity and technological innovations have been introducing, frequently and often in high concentration. In the waterways, an increasing number of organic and inorganic substances are now present, many with persistent and bioaccumulative toxic effects, which are released in the sewage treatment center without pretreatment. These reasons illustrate the need to put together an epidemiological profile of workers, in order to identify diseases and evaluate occupational risk regarding the type of work performed in areas identified as contaminated. Activities in the sanitation services include exposure to various risks that need to be identified and tracked, and often require the use of special equipment for protection or seeking to understand the work process or technology to prevent damage to workers' health.

This work was created due to a concern in assessing the health of workers involved in sanitation activities in the city of São Paulo, who need to receive services in areas identified as contaminated areas.

2 Objective

2.1 General objective

Identify contaminated areas where workers are present in the area of environmental sanitation and develop surveillance activities for the health of the workers of SABESP – Business Center Unit, who are exposed to contaminated soil.

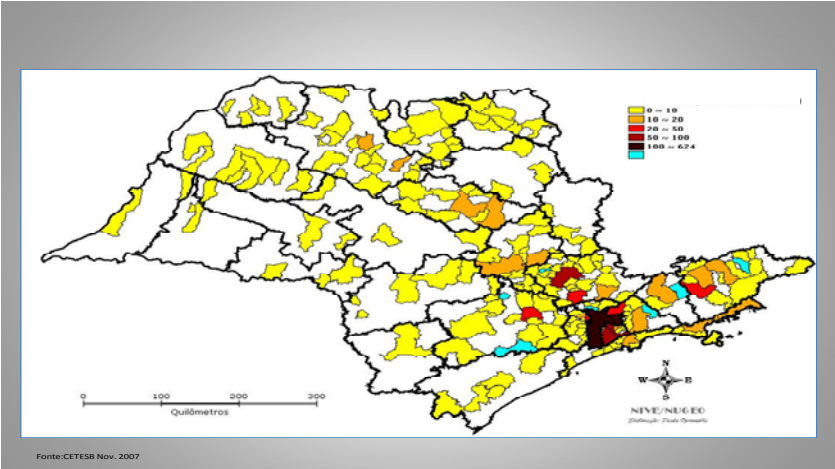
2.1.1 Specific objectives

1. Identify and prioritize areas of workers exposed to contaminated soil in the scope of the Unit Business center;
2. Develop a strategy for the risk assessment of workers' health in activities with contaminated soil.

3 Methodology

This is a descriptive study. It was developed in the area of coverage of the Sabesp - Business Center unit, located in São Paulo. This Business Unit has 1,300 employees, 45% of whom work in areas considered operational. The company has a service specializing in medical and work safety, where there is a doctor and an engineer specialized in work safety.

The activities were performed for this sector. Initially all the areas listed were identified as contaminated by the Company of Technology of Environmental Sanitation for the State of São Paulo in São Paulo.



■ = Without gas station

Figure 2: Distribution of Gas Stations that contaminate environmental areas in Municipalities of Health Areas in the State of São Paulo.

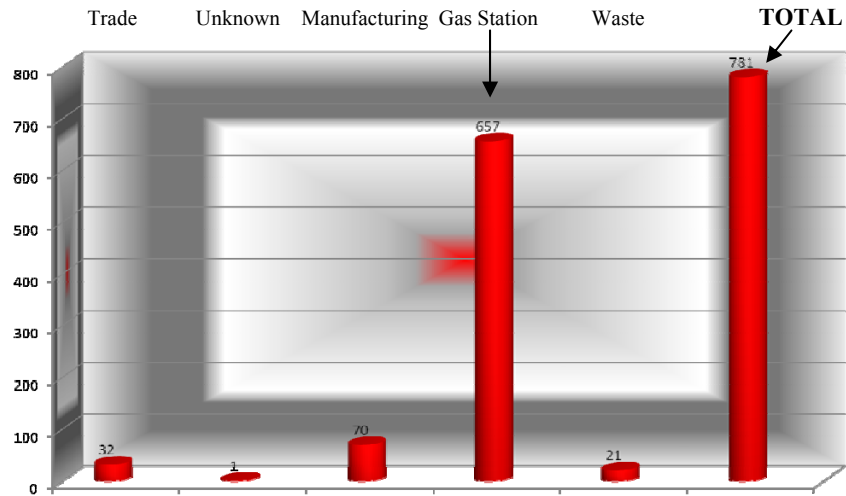


Figure 3: Activities that contaminate the environment in the region of São Paulo.

The employees of the Central Business Unit who are involved in the maintenance of water and sewer services in areas considered contaminated were subsequently identified.

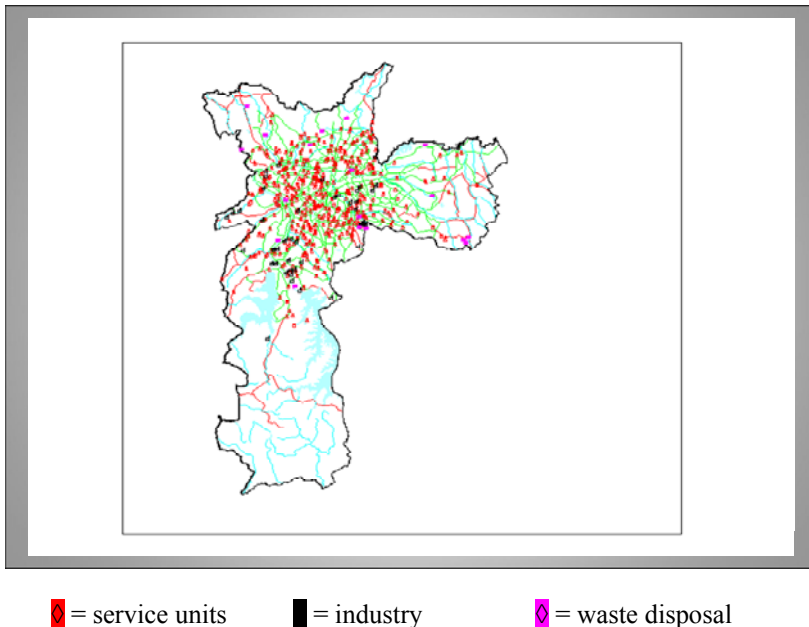


Figure 4: Map of the City of São Paulo with contaminated areas identified according to the business.

About 300 employees working in these areas were identified. The activities include:

- Dealing directly with soil in open ditches
- Replacing pipes
- Pipe maintenance
- Opening of places to be visited
- Reading water meters

All of them work routinely 8 hours a day with an hour break for lunch. It is occasionally necessary to work overtime. All workers receive free personal protection equipment provided by the company. They also receive a uniform and products to clean them.

The tests were part of routine evaluations of periodic medical examinations. Subjects were found to have increased toxins, in particular transmuconic acid, due to high concentrations of contaminants in the soil, originating from the gas stations. In particular, there was the presence of low concentrations of benzene.

A protocol was developed for the care and additional Laboratory tests were conducted, based on those substances identified as contaminants. The more frequently identified contaminants were:

- Liquid fuel
- Aromatic solvent
- PAHs

We evaluated 300 workers, who were measured through:

1. Laboratory tests
2. Completion of specific protocols
3. Clinical examination performed by Practitioners specializing in Workplace Medicine.



Figure 5: Example of activities.

The physical examination was performed with an emphasis on the neurological system, endocrine and liver, in addition to the complete evaluation. The additional tests performed included:

1. Complete hemogram
2. Hipuric Acid
3. Metilhipuric Acid
4. Transmuconic Acid
5. Lead in the blood
6. Aminolevulinic acid (ALA-U)
7. Aspartate aminotransferase (AST)
8. Alanine aminotransferase (ALT)
9. Gamma glutamyl transferase (GGT)
10. Creatinine

4 Discussion and results

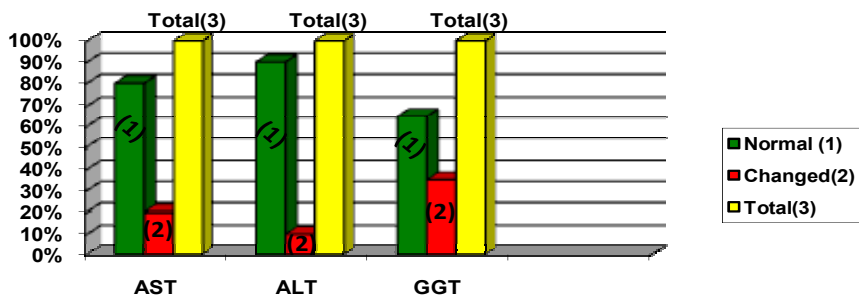
All employees identified were male and had operational level positions. The mean time in the company was 10 years.

Of the exams performed we found:

- All blood was within the normal range
- All levels of lead in the blood were within normal range.
- All levels of ALA-U were within the normal range
- All levels of methyl hipuric acid were within the normal range
- All levels of transmuconic acid were within the normal range
- The study found evident of changes in the liver as regarding the levels of transaminases and GGT.

The results are shown in Table 1.

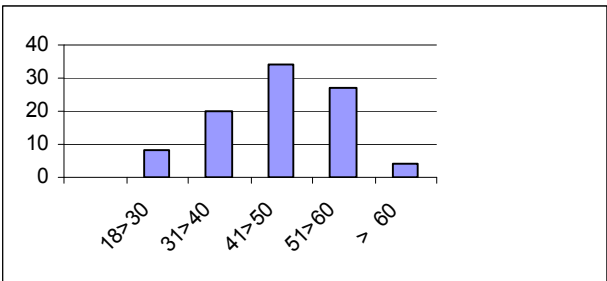
Table 1: Results of test.



When these results were investigated, no relation with liver disease caused by chemicals related to contamination was found.

The age groups of workers are shown in the figure below, which identified that the majority were between 41 to 50 years old. These statistics are similar to the working population of the company.

Table 2: Age of population.



All results were subsequently discussed with the internal committee for the prevention of accidents, CIPA. The studies found no evidence to suggest that hepatic changes were caused by exposure to the contaminated areas, however, a correlation was found between hepatic changes and the use of alcohol.

5 Conclusions

Considering the large number of areas identified as contaminated by various substances, it is necessary to identify the risks arising from these situations, assess the health of the labor population with exposure to contaminated areas, and provide guidance regarding the risks that may be present in addition to the risks traditionally associated with the occupation.

The findings related to the monitoring of workers did not find any clinical or laboratory evidence indicating a correlation between health problems and activity in contaminated areas.

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