

Sanitary conditions of the ports of Manaus-AM, 2007-2010

Condições higiênico-sanitárias dos portos de Manaus-AM, 2007-2010

ABSTRACT

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Introdução: Um porto organizado dispõe de infraestrutura física, serviços e processos e é construído e aparelhado para atender às necessidades da navegação, movimentação e armazenagem de mercadorias e deslocamento de viajantes, sob a responsabilidade de uma autoridade portuária. **Objetivo:** Analisar os determinantes das condições higiênico-sanitárias dos portos organizados da cidade de Manaus-AM. **Método:** Estudo transversal e descritivo com base nos dados da Coordenação de Vigilância Sanitária de Portos, Aeroportos, Fronteiras e Recintos Alfandegados do estado do Amazonas. Os dados foram coletados dos termos de inspeção das instalações físicas dos portos emitidos no período de janeiro de 2007 a dezembro de 2010. O processamento e análise dos dados ocorreram através de planilhas do Microsoft Excel e calculadas as distribuições percentuais. A interpretação e análise dos dados ocorreram conforme categorias de análise da RDC nº 72, de 29 de dezembro de 2009, da Agência Nacional de Vigilância Sanitária. **Resultados:** Observou-se que os processos de higiene e limpeza e os serviços de alimentação apresentaram a maior porcentagem de inspeção e mais da metade se mostrou insatisfatória. **Conclusões:** Os resultados demonstraram que as autoridades portuárias devem investir no controle das condições higiênico-sanitárias das instalações, processos e serviços dos portos organizados, para mitigar potenciais fatores de risco capazes de produzir agravos à saúde.

PALAVRAS-CHAVE: Controle Sanitário; Vigilância Sanitária; Ambiente de Trabalho; Higiene

RESUMO

Introduction: An organized port has physical infrastructure, services and processes, and is built and equipped to meet the needs of navigation, handling and storage of goods and travelers in general, under the responsibility of a port authority. **Objective:** The objective of this study was to analyze the determinants of the hygienic-sanitary conditions of the organized ports of the city of Manaus-AM. **Method:** This is a descriptive cross-sectional study, based on the sanitary inspection terms issued from January 2007 to December 2010. Data were collected through categories of analysis foreseen in RDC nº 72/2009. **Results:** We observed that the hygiene processes and food service showed the highest percentage of inspection and more than half of it unsatisfactory. **Conclusions:** The results showed that port authorities should invest in the control of the hygienic-sanitary conditions of the facilities, processes and services of the organized ports, in order to mitigate potential risk factors capable of causing health problems.

KEYWORDS: Sanitary Control; Sanitary Surveillance; Work Environment; Hygienic

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INTRODUCTION

Historically, the control of hygienic-sanitary conditions in ports plays an important role in public health, since these are places with great flow of people and entrance gateways to products and travelers. They are, therefore, susceptible to risks that can cause severe damage to collective health. The Brazilian Agency of Sanitary Surveillance (Anvisa) is responsible for supervising and inspecting these areas through the General Management of Ports, Airports, Borders and Customhouses, which monitors and controls the sanitary conditions of the main entrance gateways into the country: ports, airports and borders¹.

Describing sanitary control in port activities is still a challenge for many researchers. That is why there are few publications in this area². Such problem can be related to difficulties in access to information, its exchange, and the multiple government bodies involved in the control of port activities.

An organized port has physical infrastructure, services and processes. It must be built and equipped to meet the needs of navigation, handling and storage of goods and the movement of travelers, under the responsibility of a port authority. Ports serve as support for vessels both in rivers and in the sea. The development of sanitary control actions depends on the strategic location of the port in the Brazilian territory, based on an epidemiological and geographical point of view³.

Health promotion actions in sanitary control of ports and vessels in Brazil are regulated by RDC n. 72, of December 29, 2009, that sets out the minimum requirements to guarantee satisfactory hygienic-sanitary conditions, so that, after document analysis or sanitary inspection, no potential risk factors capable of producing health problems are found³.

The sanitary control inspection of organized ports is the responsibility of Anvisa, whose inspectors are distributed through the Port, Airport, Borders and Customhouse Departments (CVPAF) of Brazilian states. In ports, subject matter of this study, all inspectors are from other government bodies of the Ministry of Health (MS), some already extinct. Their education varies. Some of them only finished high school and were trained in in-service training programs or courses related to their jobs. They have police power and the vast majority of them has over 20 years of experience in the area.

From the point of view of the intervention of the sanitary surveillance bodies, the risks that may be found in ports play a major role, since what is being investigated is part of the sanitary surveillance system¹.

The processes subject to sanitary control must be evaluated in their technical, operational and legal aspects. For this, it is up to the inspector to judge the compliance with the requirements and to evaluate if there are any risks to people³.

Sanitary inspections in ports evaluate their physical structure and some internal services. Because they address port areas, local regulations of sanitary control of general consumption, barbershops, cafeterias, restaurants, healthcare and others do not apply because these

activities are regulated by specific federal legislation. Each process requires procedures and work routines, which can compromise the health and well-being of the population if performed ineffectively⁴.

The main processes subject to sanitary control and monitoring of organized ports, provided by the legislation³, are: drinking water supply, solid waste management, HVAC systems, good hygiene and disinfection practices of sanitary facilities, food production and marketing and harmful synanthropic fauna control systems.

Concerning the processes of good food handling practices monitored by Anvisa, the port services evaluated include actions to reduce the risks of contamination and foodborne diseases related to poor handling hygiene, methodology of time-temperature control, storage conditions and conservation of the facilities^{3,5}.

Good biological conditions of food depend on the raw material, the preparation steps and its proper processing. These elements are important to guarantee a safe final product, without risks to the health of the population⁶.

Microbiological quality control of water for human consumption identifies risk factors for diseases caused by pathogenic microorganisms related to the ingestion of water outside the minimum drinking standards allowed for human consumption according to the relevant legislation. According to the World Health Organization, the monitoring and control of water quality is important because it enables us to identify if it is in drinking conditions. If not, surveillance bodies are contacted to act in a timely manner, searching for reasons for the inconsistencies found, thus preventing the problem from spreading and damaging the health of the population. This control is performed through tests and analyses that identify protozoan cysts and helminth eggs, fecal coliforms, viruses, inorganic and organic substances⁷.

According to the sanitary legislation, ports must be equipped with a system for production or distribution of drinking water, according to some relevant standards. They must also perform microbiological and physicochemical analyses of the water, have a technically certified structure, hydraulic floor plan, cleaning and disinfection programs for the reservoir systems, fire hydrants and contamination-free distribution networks³.

Indoor HVAC systems must have an air quality monitoring program to ensure they have good conditions of maintenance, operation, control and cleaning. Their equipment must be located in protected areas, without sources of pollution. Ports must also have a valid Maintenance, Operational and Control Plan (PMOC) of the HVAC system with quality reports, as required by the legislation³.

The localization of air intake sources of HVAC systems, in general, may be vulnerable because they are subject to contamination by pigeon feces, abundant vegetation and proximity to places with construction and cleaning material. They are susceptible to bacteria, viruses and fungi that can survive for a long time. The trays of some systems can trigger the chain of transmission of *Legionella* spp., which is the most common bacteria in these systems. This bacteria can cause severe outbreaks of pneumonia, febrile diseases and skin abscesses⁸.



The control of harmful synanthropic fauna aims to prevent adult insects from living there, as they find it a breeding place for their larvae. It also aims to control reservoirs of important diseases in public health and venomous animals, among others. The lack of control over harmful synanthropic fauna can increase infectious diseases, which are already responsible for the deaths of approximately 14 million people per year, mainly in developing countries⁹.

The Cleaning and Disinfection Plan (PLD) of the facilities and equipment, performed by handlers who do not know the correct process, is a favorable condition for the proliferation of microorganisms and interferes in the sanitary quality of products and environments¹⁰. With that, cleaning procedures must be done in a safe manner, using suitable cleaning and disinfection techniques. In ports, areas of buildings that were exposed to contamination by feces, vomit, urine and other substances must undergo surface disinfection procedures determined by a PLD³.

Solid waste management seeks the implementation of good practices for packaging, handling, disposal, collection, transportation, treatment and final destination of solid waste, according to specific standards. The process begins with the correct solid waste packaging, since, if poorly packaged, in addition to causing environmental pollution, it can lead to the emergence of diseases. Attention to the solid waste packaging and handling makes the collection process easier¹¹.

Every day, ports receive a large number of people from several origins. They are travelers, workers, various service providers, tourists etc. These passers-by become vulnerable to the exposure of viruses, bacteria, fungi, and other risks inherent to an effective sanitary control.

In this context, ports are places of great public health interest. RDC n. 72/2009³ sets out the standards that regulate the evaluation of sanitary conditions. Therefore, from a sanitary control point of view, are the organized ports of the city of Manaus, state of Amazonas, Brazil, satisfactory?

The objective of this study was to describe the hygienic-sanitary conditions of the organized ports of Manaus based on RDC n. 72/2009/Anvisa³.

METHODS

In this descriptive cross-sectional study¹², we analyzed the variables used in sanitary inspections in the ports of Manaus. We described the hygienic-sanitary conditions of the ports using the secondary data from the CVPAF of Amazonas (CVPAF/AM) based on RDC No. 72/2009³.

The subject matter of this study was the group of organized ports, of which one is run by the Amazonian Navigation, Ports and Waterways Society, and the two others were private terminals located on the left bank of the Negro River, in Manaus. The remaining ports were excluded from the study because they did not have all the variables that could be analyzed by the sanitary surveillance, in which the inspection by the CVPAF/AM occurs sporadically.

We surveyed information from the secondary data recorded by the CVPAF/AM (n = 438 inspections) directly from the sanitary inspection terms issued from January 2007 to December 2010. We included data collected before and after the publication of RDC n. 72/2009, since the analyzed variables, subject matter of the sanitary surveillance of the previous resolution, were similar in the new one. The changes made in the new resolution did not change port inspection procedures dramatically, so we did not draw any comparison.

The Vessel Sanitary Inspection Term (Tisem) is a fiscal document issued in two copies and divided into four sections: A) Identification; B) Evaluation; C) Legislation used in the inspection; D) Signatures. Sections A and D, respectively, identify the port inspected and record the inspector signature and the document recipient. Section C indicates the legal grounds that guided the inspection.

The variables that determined the criteria analyzed are included in section B, according to articles 83 to 109 of chapter V of RDC n. 72/2009³: 1. Hygiene and cleaning process; 2. Food services; 3. Solid Waste Management Process; 4. Harmful synanthropic fauna control; 5. HVAC systems and 6. Drinking water system. We recorded the information in a field for the day and time of the inspection, for general observations, and for the compliance analysis (satisfactory or unsatisfactory).

We tabulated the hygienic-sanitary conditions data in an Excel® spreadsheet and analyzed it with R 2.9.0 and Minitab 15^{13,14}. For the classification of the categories, we calculated the percentage distribution of the inspection set per variable, analyzing the compliance (satisfactory or unsatisfactory).

RESULTS

In 438 inspections, we found that 43.7% addressed processes of sanitary control related to hygiene and cleaning of port facilities and 40.2% were about the inspection of food services, whose items stood out the most. Next, 6.2% and 4.6% were inspections related to solid waste and fauna and pest control, respectively. The two items with the smallest number of inspections were HVAC systems and drinking water, which represented 3.2% and 2.1%, respectively (Table 1).

We observed that, of the 438 inspection terms, 240 (54.8%) were unsatisfactory regarding the compliance with the requirements of sanitary conditions of ports required by the legislation.

As to the situation (satisfactory or unsatisfactory) of Manaus' port processes, we observed that those with the lowest level of dissatisfaction were solid waste and fauna and pest control (Table 2).

The inspection term analysis showed that the HVAC systems and drinking water items had the highest percentages of dissatisfaction, 71.4% and 77.8%, respectively, while solid waste management and fauna and pest control had the highest percentage of satisfaction, 70.4% and 70.0%, respectively (Table 2).

In spite of the quantity of items evaluated, either in number of inspections or variables analyzed, we found that the items with fewer inspections were the ones with the highest values of dissatisfaction. The items with the highest number of inspections

**Table 1.** Relative frequency distribution of the occurrence of sanitary processes in ports of Manaus, from 2007 to 2010.

Processes evaluated	Relative frequency of the evaluation (%)
Cleaning and hygiene	43.7
Food services	40.2
Solid waste	6.2
Fauna and pest control	4.6
HVAC systems	3.2
Drinking water	2.1

Source: Sanitary inspection terms of the institution, 2007-2010.

Table 2. Distribution according to the evaluation frequency of port processes of Manaus, from 2007 to 2010.

Processes evaluated	Situation				Total
	Unsatisfactory		Satisfactory		
	n	%	n	%	
Cleaning and hygiene	123	64.1	69	35.9	192
Food services	86	48.9	90	51.1	176
Solid waste	8	29.6	19	70.4	27
Fauna and pest control	6	30.0	14	70.0	20
HVAC systems	10	71.4	4	28.6	14
Drinking water	7	77.8	2	22.2	9
Total	240	54.8	198	45.2	438

Source: Sanitary inspection terms of the institution, 2007-2010.

were in the intermediary line and the food services item presented a dissatisfaction index below 50%.

Regarding the physical structure conditions of one of the ports, we noticed some problems that influenced the evaluated processes: lack of doors in the food preparation area; lack of window nets to prevent the entrance of vectors and pests; lack of sewer grid covers or drains for the outflow of water; grease trap and sewage in the internal area; sink construction or maintenance failures; bathrooms with hydraulic problems; damaged floor and ceiling.

DISCUSSION

This study enabled us to characterize the sanitary conditions of the port areas of Manaus. This had never been done before. This study is a first step toward understanding the reality of the matter in Brazil. The boundaries of this research are the hygienic-sanitary conditions of local ports. We used a tool adapted from the specific technical legislation, evaluated the port environment and made a diagnosis that informs port sanitary compliance analyses³.

The tool normally used to evaluate the hygienic-sanitary conditions of ports was also used in this study and in several studies as an evaluation tool adapted from the legislation³. Susin et al.¹⁵ used a checklist adapted from RDC n. 216, of September 15, 2004⁵ and RDC n. 275, of October 21, 2002¹⁶ of Anvisa in a study

that evaluated hygienic-sanitary, structural and operational conditions of food and nutrition units (UAN).

In this study, the drinking water processes (sanitary control of reservoirs, distribution network and drinking water supply points) in the ports of Manaus indicated a high percentage of non-conformities (77.8%), revealing a situation that can put users at risk. This situation is related to the lack of routine water quality evaluation by means of microbiological and physicochemical analysis, physical and structural inadequacy of the distribution system and port water supply spots.

In a study that evaluated the water quality of three public schools in the city of Macapá, state of Amapá, Brazil, in January 2013⁷, the researchers collected samples in three spots (water tank, kitchen faucet and drinking fountain) and analyzed turbidity, color, pH, chlorine, nitrate, total and fecal coliforms. The study showed that not all the samples were in compliance with Ordinance n. 2,914, of December 12, 2011¹⁸ of the Ministry of Health, and detected non-conformities in the analyzed parameters. It demanded urgent actions to adjust the quality of the water offered to the school communities in order to prevent health damage.

Santana et al.¹⁹ evaluated microbiological and physicochemical parameters of the water of drinking fountains of six public schools of the city of Belém do Brejo do Cruz, state of Paraíba, Brazil, based on Ordinance n. 2,914/2011¹⁸ of the Ministry of Health. They found that 66.6% of the schools did not have an adequate water supply for the students, since the results of the microbiological analysis of the reservoirs were not compliant with the legislation. The authors suggested that the water tank and drinking fountains be monitored and maintained in order to ensure good quality water.

The analysis of the HVAC system process showed that this item had the second highest percentage (71.4%) of non-conformities. Data points to the lack of environmental and microbiological control and monitoring of HVAC systems, equipment malfunction and irregularities in the maintenance of the HVAC equipment of the ports.

A study performed in Portugal by Ferreira and Cardoso²⁰ evaluated the air quality of basic education schools in the city of Coimbra and found that 92% of the schools had average concentrations of carbon dioxide (CO₂) above the maximum reference concentration (984 ppm) allowed by the Portuguese legislation. The most critical values were found inside classrooms. The authors pointed out that the irregularities were associated with inadequate ventilation.

Costa²¹ conducted a study about the air quality in the interior of a departmental building of the University of Coimbra. Based on the parameters provided by the Portuguese legislation, the researcher checked the hygiene and maintenance of the HVAC systems of 50 places of the 23 zones of the department and found that four exceeded the legal threshold for PM₁₀ Air Suspended Particles and 46% of them had high concentrations of CO₂. The author highlighted that the students presented symptoms like dry throat, raspy voice and coughing and suggested



more studies to evaluate the adequate strategy of ventilation that would improve the air quality.

In both studies performed in Portugal^{20,21}, the authors pointed out the importance of the evaluation of the air quality in indoor environments and the lack of control and evaluation mechanisms of the air quality which may put people in these environments at risk. These aspects, combined with compliance with the existing legislation, stress the need for ports to maintain a PMOC for HVAC systems and to evaluate the air quality, thus avoiding exposure to pathogens.

The percentage of 64.1% of non-conformities found in hygiene and cleaning processes is significant. There is direct relation between this situation and the implementation of a PLD and its effectiveness, supervision and its specific procedures for ports, since the provision of the services is related to less qualified service providers and/or personnel.

In a study on the hygienic-sanitary conditions of self-service restaurants in the city of Rio de Janeiro, state of Rio de Janeiro, Brazil, done by Messias et al.²², the equipment hygiene item had 50% of non-conformities. The researchers pointed out that the utensils were stored in an untidy manner and were unprotected against dirt, insects and rodents.

Assis et al.²³, in a study that evaluated the hygienic-sanitary conditions of two units of a commercial restaurant chain in the city of São Paulo, state of São Paulo, Brazil, found inadequate environmental and equipment hygiene in one of them. Among the irregularities, they found flaws in dish and kitchen utensils cleaning procedures, cleaning products without identification, as well as irregularities in the subdivisions and operation of cleaning procedures. The results reinforce the need for training and corrective actions toward good practices in the units studied.

As to the compliance analysis of food-service-related processes, that is, direct or indirect activities that occur in the ports evaluated, the percentage of non-conformities (48.9%) was very close to the percentage of conformity (51.1%). The small amount of workers dedicated to sanitary surveillance and their poor training in food safety limit a more accurate analysis of the sanitary risks in this context. These factors hinder correct diagnosis, the implementation of administrative actions to correct the distortions and critical thinking in the light of the current sanitary legislation^{3,5}.

We highlighted that the hygienic-sanitary conditions of the food services presented a few problems: in their physical structure, considering the flaws in the construction or maintenance of sinks, toilets, floor and ceiling; in hygiene, considering there is no PLD, there is a high turnover rate of handlers, lack of training and lack of relevant medical examinations.

To ensure the quality and harmlessness of the products handled in a university restaurant in the city of Londrina, state of Paraná, Brazil, Costa et al.²⁴ did a study about the hygienic-sanitary conditions there. They used a checklist adapted from the federal sanitary legislation¹⁶ and detected precarious handler procedures, equipment, utensils and lack of standard operational procedures. The authors suggested that a systematic evaluation of

the services should be performed to ensure food safety, as well as hygiene and mitigation of non-conformities.

Likewise, a study on the sanitary conditions of street food vendors in the city of Ibiúna, state of São Paulo²⁵, identified that only 3 out of 20 of them were satisfactory. Out of 29 inspected places that marketed fruit and vegetables, only two were satisfactory. The study also found irregularities in hygiene and food handling, uniforms, personal hygiene, garbage disposal and water.

Furthermore, another important finding of this study was that sanitary control processes of harmful synanthropic fauna and solid waste management had the lowest levels of dissatisfaction: 30.0% and 29.6% respectively. These results may be related to the fact that these processes are made by specialized companies, that are controlled through Special Operating Permits (AFE)³. When some abnormality occurs, this is evidenced in the physical observation by the surveillance team. However, many inspectors do not have the training needed to assess the level of risk observed²⁶.

CONCLUSIONS

In view of the foregoing, this study concludes that the hygienic-sanitary conditions of the ports of Manaus were unsatisfactory in relation to the federal legislation in force, mainly for the HVAC system processes, drinking water supply, cleaning actions and hygiene.

The monitoring of these factors can interfere directly with the health risks to which people who work and use the ports are exposed. Hence the challenge of the sanitary authority in guiding and demanding improvement and corrective measures from the port administration, so that a more efficient control of hygienic-sanitary conditions can be achieved, with the implementation of programs, processes and investment to change this situation.

To ensure the sanitary control of ports, their administration must strive to achieve compliance with the sanitary legislation. This study highlights the need for more efficient HVAC systems, with better conditions of monitoring and control. We suggest the adoption of an effective PLD, with periodical supervision and people properly trained to work in the cleaning of port environments. We also suggest improvements in the drinking water supply system.

Finally, this study highlights that Anvisa inspectors need training, since the qualification provided proved insufficient. With that, it will be possible to reach a larger number of workers, increasing the quality of the sanitary control analysis of the processes investigated, despite the shortage of inspectors to act in all irregular situations.

Given the limitation of the subject matter of this study, we expect that this survey can contribute to the academia, to the sanitary surveillance services and to the society by promoting discussions on the problems presented and encouraging new approaches in public health, especially in the area of sanitary surveillance and work processes related to the subject matter of this study.



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Conflict of Interest

Authors have no potential conflict of interest to declare, related to this study's political or financial peers and institutions.



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