Conciencia Digital

ISSN: 2600-5859
Vol. 7 No. 1, pp. 175 – 196, January - March 2024

www.concienciadigital.org

Evaluación de riesgos biológicos en el área de alcantarillado de una empresa pública en Cuenca, Ecuador

Evaluation of biological risks in the urban sewer area of a public company in the city of Cuenca, Ecuador

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Scientific and Technological Research Article
Sent: 08/11/2023
Revised: 20/12/2023
Accepted: 21/01/2024
Published: 23/02/2024
DOI: **https://doi.org/10.33262/concienciadigital.v7i1.2931**

Please quote: Ortega Maldonado, PG, & Silva Caicedo, RF (2024). Biological risk assessment in the sewerage area of a public company in Cuenca, Ecuador. ConcienciaDigital, 7(1), 175-196.https://doi.org/10.33262/concienciadigital.v7i1.2931

DIGITAL CONSCIOUSNESS,*and*It is a multidisciplinary, quarterly journal, which will be published electronically. Its mission is to contribute to the training of competent professionals with a humanistic and critical vision who are capable of presenting their research and scientific results to the same extent that their intervention promotes positive changes in society.https://concienciadigital.org
The journal is published by Editorial Ciencia Digital (a prestigious publisher registered with the Ecuadorian Book Chamber with membership number 663).www.celibro.org.ec

Conciencia Digital

ISSN: 2600-5859
Vol. 7 No. 1, pp. 175 – 196, January - March 2024

www.concienciadigital.org

Palabras claves:
Alcantarillado;
Agentes biológicos;
Microorganismos;
Método Biogaval;
Exposición;
Accidentes

Resumen

Introducción: El trabajo en el alcantarillado urbano implica riesgos biológicos para el personal operativo, incluyendo la exposición a bacterias, virus y patógenos. Esto puede causar enfermedades infecciosas, irritaciones respiratorias, problemas dermatológicos y gastrointestinales. **Objetivo:** evaluar el proceso designado como "20-10 Obstrucción de Colector" durante el mantenimiento o reparación, con el objetivo de verificar la idoneidad de las medidas higiénicas implementadas. Asimismo, se busca determinar la precisión del análisis de los riesgos biológicos asociados a esta tarea. **Metodología:** La investigación es exploratoria, de corte transversal, utilizando la investigación de campo, y la aplicación de la herramienta Biogaval para evaluación de riesgos biológicos. **Resultados:** El análisis de riesgo de 22 agentes biológicos muestra que el 63% del personal presenta un riesgo moderado, mientras que el 5% lo supera y el 32% se encuentra en el límite, destacando áreas críticas de exposición. **Área de estudio general:** Seguridad y salud Ocupacional. **Área de estudio específica:** Higiene Industrial

Keywords:
Sewage;
Biological agents;
Microorganisms;
Biogaval method;
Exposure;
Accidents

Abstract

Introduction: Urban sewer work involves biohazards for operating personnel, including exposure to bacteria, viruses and pathogens. This can cause infectious diseases, respiratory irritations, dermatological and gastrointestinal problems. Objective: to evaluate the process designated as "20-10 Manifold Blockage" during maintenance or repair, in order to verify the adequacy of the hygienic measures implemented. It also seeks to determine the accuracy of the analysis of the biological risks associated with this task. Methodology: The research is exploratory, cross-sectional, using field research and the application of the Biogaval tool for biological risk assessment. Results: The risk analysis of 22 biological agents shows that 63% of the personnel present a moderate risk, while 5% exceed it and 32% are at the limit, highlighting critical areas of exposure.

Introduction

Biological agents are present in different work activities; they are divided into intentional use, which is the direct manipulation of the agent, and unintentional use, which is accidental exposure as a consequence of the presence of biological agents.(Muñoz, 2018).

According to the Health Department of Castilla y León Sacyl(Sacyl, 2018)It states that Biological Risk is present in all work activities with a greater presence in the health area, work with animals, handling of sewage without leaving aside the maintenance of sewers. Likewise, Biological Risk is common in health workers and accidents due to needle pricks are those that generate the greatest fear of contagion; such as infections by hepatitis B and C, and HIV.(Uribe et al., 2019).

Biological risk is defined as the probability of an adverse event occurring such as: accidental infection or unauthorized access, loss, theft, misuse, diversion or intentional release, possibly causing damage.(Navarro, 2020).

Emerging infectious diseases are all those diseases caused by new microorganisms or by pathogens that have recently increased their incidence and geographical distribution by incorporating new or recently discovered hosts.(Buriticá, 2019)Re-emerging diseases are those diseases already known that were under control and did not represent a public health problem but that have suddenly increased their incidence at a given time.(Trujillo, 2020).

Within the legal regulations in force in Ecuador, the Ministry of Labor Relations of Ecuador, among its tools, has a matrix that includes the different risks for a global evaluation of the workplace; said evaluation includes biological risks; however, a specific methodology is not identified.(Cuenca et al., 2023), which is why it has been considered appropriate to apply the Biogaval method of Spain. Law 31/1995, of November 8, on the Prevention of Occupational Risks, established the avoidance of risks as the primary elements of preventive action, and those that cannot be avoided, by evaluating them. In Spain, Royal Decree 664/1997, of May 12, on the protection of workers against exposure to biological agents during work, was published, which was adapted by the order of March 25, 1998.(INVASSAT, 2018).

From the identification of the work processes and daily activities carried out by the urban sewerage operating personnel, the different risk factors have been identified, however, the biological risk has not been evaluated due to the lack of any method within our country. According to the WORKERS' SAFETY AND HEALTH REGULATIONS AND IMPROVEMENT OF THE WORK ENVIRONMENT of the(Ministry of Labor, 2016), states that "All workers exposed to viruses, fungi, bacteria, insects, snakes, microorganisms, etc., harmful to health, must be protected in the manner indicated by medical science and technology in general."

With this background, the present research aimsTo evaluate biological risks and the presence of microorganisms, using the Biogaval method, in activities where biological agents are not deliberately manipulated, within the urban sewerage area of the public company of the city of Cuenca.

Theoretical Framework

Workers who operate biological fluids are exposed to biological risks, so failure to comply with prevention measures, as well as biosafety standards, can have various consequences.(Macias, 2020)Biosecurity is understood as techniques, practices and principles to prevent unintentional exposure to pathogens and toxins, or their accidental release.(Camacuari, 2020)and Biological Protection are the institution's and staff's protection policies designed to reduce risk.

Biological Agents are microorganisms that are distributed as bacteria, viruses, fungi or parasites that can cause a health problem with fatal consequences.(Macias, 2020)and are described as:

Viruses are submicroscopic infectious agents, incapable of growing or multiplying outside a living cell, being considered an inert structure outside the host.(Mora, 2021).

Bacteria are more complex microorganisms, since they reproduce inside or outside another living being. Parasites are multicellular beings that lay their eggs inside humans through respiratory, dermal or digestive pathways.(Rojas, 2022).

The way in which the biological agent enters the body and becomes pathogenic is known as the route of entry and is described as: 1. Respiratory route; its exposure occurs through the presence of the biological agent in the inhaled air in the form of bioaerosols. 2. Digestive route; the ingestion of the biological agent into the body is necessary, once inside it reproduces and triggers its harmful effects. 3. Dermal route; it occurs through the skin that has lost its integrity due to wounds, chafing, scratches. 4. Mucosal route; similar in concept to the dermal route, but considering the mucous membranes as the gateway to the body. 5. Parenteral; it occurs through penetration into the deep layers of the skin, exposure occurs as a result of a work accident, puncture, cut, bite or animal sting. 6. Vectors; biological agents have their only possible route of entry and it is tied to the action of a vector.(Mora, 2021).

According to the WHO manual for the control of communicable diseases, in its 17th edition, it describes three possible transmission routes as:

a) Direct transmission:Direct and immediate effect of infectious agents on a receptive entry point through which the human being will be infected, biting, having sexual

relations, by spreading droplets on the conjunctiva, sneezing, talking, within a radius of one meter or less.

b) Indirect transmission: Through transmission vehicles (fomites): inanimate objects, soil, water, contaminated food, biological products. Through vectors: Mechanical mode (transfer of a microorganism by means of an insect through contamination of its legs or proboscis) or biological mode (when the multiplication or cyclic development of the microorganism takes place in the insect before the infective form can be transmitted to humans).(Muñoz, 2022).

c) Airborne transmission: Dispersion of microbial aerosols transported through the inhalation route. They are made up of particles of 1 to 5 microns that can remain suspended in the air for long periods of time and easily penetrate the pulmonary alveoli. The set of droplets and other particles that are deposited quickly are not considered airborne transmission.(INVASSAT, 2018).

The final score for transmission routes is obtained by adding the figures corresponding to the different transmission routes presented by each biological agent. In the case of having more than one route, the scores were added to obtain the correct score.(Cuenca et al., 2023).

Damage from exposure to biological agents is described as: Infection: Entry, development and multiplication of an infectious agent in the body of a person or animal.. (PAHO, 2015)Allergy is the reaction of the immune system caused by exposure to substances known as allergens or sensitizers, affecting the respiratory tract, or hypersensitivity reactions or the skin.(Zubeldia, 2021)Poisoning is caused by biological agents releasing substances known as toxins (exotoxins, endotoxins, mycotoxins).(University of Zaragoza, 2018).

Biological agents are classified as:

a) Group 1 biological agent:Without sequelae and with disability of less than 30 days.
b) Group 2 biological agent:Without sequelae and with disability greater than 30 days(Velasquez et al., 2019).
c) Group 3 biological agent: It can cause serious illness and poses a serious danger to workers, with the risk of spreading to the community and there is generally effective prophylaxis or treatment.
d) Biological agent of group 4: They cause serious illness and constitute a serious danger for workers, with a high probability of spreading to the community and generally without effective prophylaxis or treatment.(INVASSAT, 2018).

We must understand exposure to biological agents as the presence of these in the work area in which it involves the contact of said agents with the worker through any of the entry routes into the body.(Cuenca et al., 2023)

ISSN: 2600-5859
Vol. 7 No. 1, pp. 175 – 196, January - March 2024

Within the work area, once the presence of biological agents has been identified, this risk must be eliminated and only when such elimination is not possible, should the evaluation process continue.(Ministry of the Presidency, 2021). According to the hygiene measures adopted within the urban sewerage area and the information issued by the company's medical department, it was possible to see that the risk decreased, but was not completely eliminated, due to the characteristics of the environment in which daily activities are carried out, so that if the presence of biological agents persists, a biological risk assessment must be carried out.

The identification and assessment of risk from exposure to biological agents can be grouped into two successive stages:

1. Theoretical identification of risks. - Its objective is to identify the biological agents present in the work area and the collection of information on their characteristics. For activities with unintentional manipulation, identification is carried out by verifying existing epidemiological data, a list of occupational diseases, bibliographic sources, and environmental studies or measurements.(Velasquez et al., 2019).
2. Risk assessment. - To assess the risk of exposure, it is necessary to check whether all the links in the infectious chain are present, such as: Working conditions and characteristics, Procedures, Tasks, Control measures implemented. All of these will determine the possibility that the biological agent has of leaving its habitat, mixing in the environment, contacting the worker and entering the body.(Ministry of the Presidency, 2021).

Methodology

The study has a qualitative design, since the research technique carried out is fundamentally based on the different documents of various studies and articles as part of the search for information.(Webqda, 2017); and correlational because there are two types of variables, which are: the independent variable, which is the biological risk, and the dependent variable, which are the activities where biological agents are not deliberately manipulated, so they are evaluated between them, without being influenced by any variable foreign to the study.(QuestionPro, 2019).

In “Table 1” Type and level of research, the characteristics of this research are described.

Conciencia Digital
ISSN: 2600-5859
Vol. 7 No. 1, pp. 175 – 196, January - March 2024
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Table 1

Type and level of research

Type and level of research

According to its purpose	Basic	Application of Surveys belonging to the method, from which information will be obtained such as: hygiene measures implemented, use of PPE, vaccines provided by the company.
According to its scope	Cross-sectional correlational	The relationship between the independent variable and the dependent variables is sought.
According to its depth	Explanatory	Part of statistical information obtained from the work-related clinical histories of operational staff, to relate them with the aim of obtaining information on the different variables and establishing conclusions.
According to their sources	Observational	Review of medical records, survey belonging to the Biovagal method
According to his character	Qualitative	It allows us to obtain general information about the risk factor and its trend in the survey.
According to its nature	Correlational Cross-sectional	It allows us to identify deficiencies in technical management and issue a solution proposal based on the information obtained.

Fountain: Digital Science Magazine

The study universe is the operational staff of the urban and rural sewerage area of the public company of the city of Cuenca, which amounts to a total of 72 people. To calculate the sample, "Equation 1" Sample Calculation is applied, according to what is suggested(Mucha-Hospinal, 2021).

Equation 1

Sample Calculation

$$n = \frac{(N * Z^2 \propto * p * q)}{d^2(N-1) + Z^2 \propto * p * q}$$

- N = Total population 75 operational people
- Zα= 1.96 squared (if security is 95%)
- p = expected proportion (in this case 5% = 0.05)
- q = 1 – p (in this case 1-0.05 = 0.95)
- d = precision (in your research use 5%)."

n = 75*(1.96)2 *0.05*0.95

(0.05)2*(75-1) + (1.96)2*0.05*0.95

ISSN: 2600-5859
Vol. 7 No. 1, pp. 175 – 196, January - March 2024

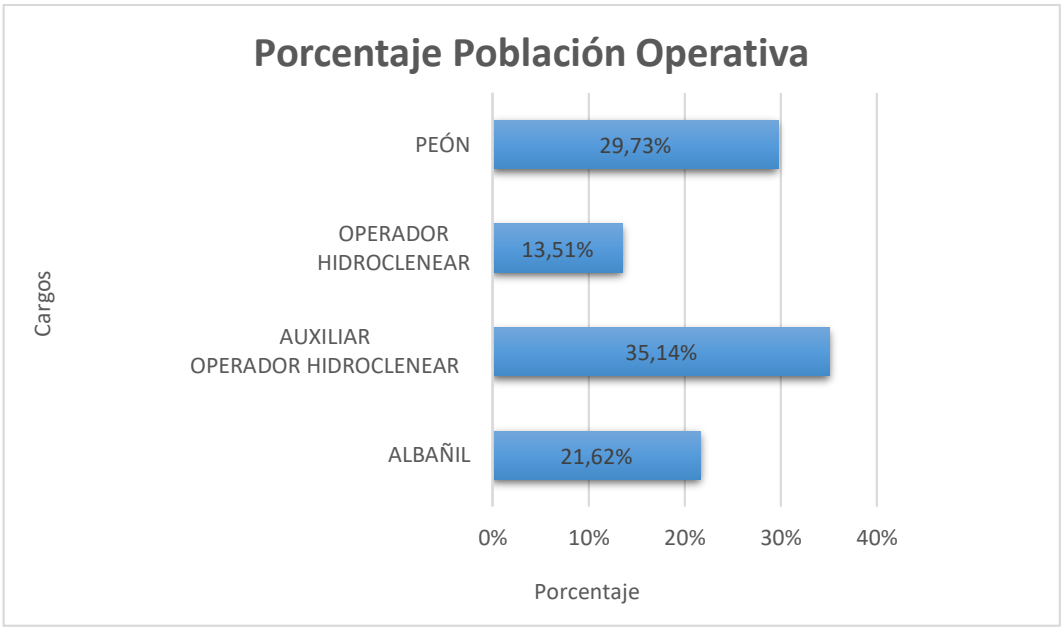
n = 37

The sample value for the present study is equivalent to 37 urban sewerage operational workers, and thismade up of the positions of laborer, bricklayer, hydro-sewer operation assistant, and hydro-sewer operator. Its scope will be solely for the operational personnel of the urban sewerage area of the public company of the city of Cuenca.

The inclusion criteria are operational personnel with at least 3 months of work in the positions of laborer, bricklayer, hydrocleaning operation assistant, hydrocleaning operator, and personnel with catastrophic illnesses (cancer) are excluded; personnel without exposure (Driver, Process Engineer, Inspector); department heads (Sanitation Administrator).In “Figure 1”Percentage of Operating Population,The number of operational personnel by position that is the subject of this study is described.

Figure 1

Percentage of Operating Population



Fountain: Public company

The information collected for this study was obtained through researchbibliographicalBased on the different documents from various studies and articles, visits were also made to the work fronts where the operational staff was interviewed, and “Form 1” was used to tabulate the information shown in the results.

For the identification of biological risks present in the work environment in which the operational personnel of the urban sewerage area carry out their daily activities, a reliable method must be used that guarantees its efficiency, so the method used in the present study is the BIOGAVAL-NEO 2018 method, which is used to carry out evaluations in activities where biological agents are not deliberately manipulated, and workers are exposed to risks arising from the presence of microorganisms.

Development of the Method

In determining the positions to be evaluated within the same area, the operational positions haveOnce the functions are assigned, their work environment is the same, so the exposure to existing risks and the severity of the consequences of possible damage could be the same.

In "Table 2"Work Process describes the daily activities belonging to the urban sewerage area and for the present study the so-called 20-10 Collector Obstruction was chosen, due to greater exposure to microorganisms.

Table 2

Work Process in the Urban Sewerage Area

Code	Work Processes
20 - 10	Collector Obstruction
20 - 20	Obstruction of Domiciliary
20 - 30	Broken Pipe
20 - 40	Clogged drain
20 - 45	Flooded House
20 - 50	Placing the Lid
20 - 60	Well Cleaning
20 - 70	Grid Placement

Fountain: Public company of the city of Cuenca

20-10 Manifold Obstruction. -It is the unclogging of the collector by using a minor tool or trucks.hydrocleanand the personnel necessary to carry out the work. If this is not possible, reconstruction will have to be carried out. (Public company of the city of Cuenca 2000).

Once the concept of the Process has been described20-10 Collector Obstruction, forIn order to fully identify the biological agent involved, the work process must first be fully understood. To do this, we carry out inspections at the work fronts in which the process could be observed and understood in detail. Among the raw materials used in this activity, we find:

Concrete pipes of different diameters, PVC pipes in case of repair or replacement of pipes, Bell spigot for joining pipes, Concrete cover, Curb. Mortar which is a mixture of cement, sand and water. Minor tool, tripod. Hydrocleaning trucks, when the pipe needs to be suctioned or washed. The personal protective equipment used in this activity is: face, hand, foot and full body protection.

The process described is carried out within the different sewers of the city of Cuenca and due to the constant existence of pathogens, we place what is described in the Classification of Biological Agents according to(Morales, 2018)and for the scoring we checked the Technical Guide for the evaluation and prevention of risks related to exposure to biological agents of the INSHT.

Results

Classification of Biological Agents (G):

Of the twenty-two (22) biological agents identified, 91% belong to Group 2, can cause illness and may pose a danger to workers, their spread is unlikely and effective treatment exists. 9% belong to Group 3, can cause serious illness and pose a serious danger to workers, with a risk of spreading and effective treatment exists.

Transmission Route (T):

According to the observation of the work process and contrasting with the data described(Morales, 2018)It is concluded that 36% of the agents are transmitted in three ways: direct, indirect and airborne, and 64% are transmitted directly and indirectly, so the values of each biological agent vary.

Contact Probability (P):

From the data reported by the MSP of Ecuador, the values of each biological agent are obtained and these are compared with the values of "Table 4" Incidence Score, thus obtaining the value of the probability of contact of each biological agent, which is directly linked to the Incidence Rate and its values vary according to the data reported by the MSP. In this way, the number of new cases of a disease in a given time interval is related to the risk of contagion in the population under study.(Cuenca et al., 2023).

Data reported by the Ministry of Public Health MSP and Risk Management

According to(Ministry of Public Health, Alert on Waterborne and Foodborne Diseases in Ecuador, 2021), Sive Surveillance Subsystem - Alert on Waterborne and Foodborne Diseases Ecuador, SE 11, describes that, in 2021, the following were recorded: 3 cases of Salmonella spp., 3 cases of Hepatitis A in Azuay.

According to(MSP, EPIDEMIOLOGICAL GAZETTE OF ZOONOTIC DISEASES: LEPTOSPIROSIS, 2021), describes that, in 2021, 1 case of Leptospirosis was recorded in Azuay.

According to(MSP, SEVERE ACUTE RESPIRATORY INFECTIONS (SARI), 2021), describes that, in 2021, there were 2 cases of adenovirus in Azuay.

According to(MSP, 2021), describes that, in 2021, 29,456 cases of Coronavirus were recorded in Azuay.

According to(Ministry of Public Health, Influenza Ecuador, 2021), describes that, in 2021, 14 cases of Influenza Virus were recorded in Azuay.

Table 3

Incidence Score

INCIDENCE/100,000 INHABITANTS	PUNCTUATION
Less than a case	1
from 1 to 500	2
from 501 to 999	3
Equal to or greater than 1000	4

Fountain: Valencian Institute of Safety and Health at Work

From the data obtained, it is established that of the 22 biological agents, 64% have a probability of less than one case and 34% are within the range of 501 to 999 cases.

Conciencia Digital
ISSN: 2600-5859
Vol. 7 No. 1, pp. 175 – 196, January - March 2024
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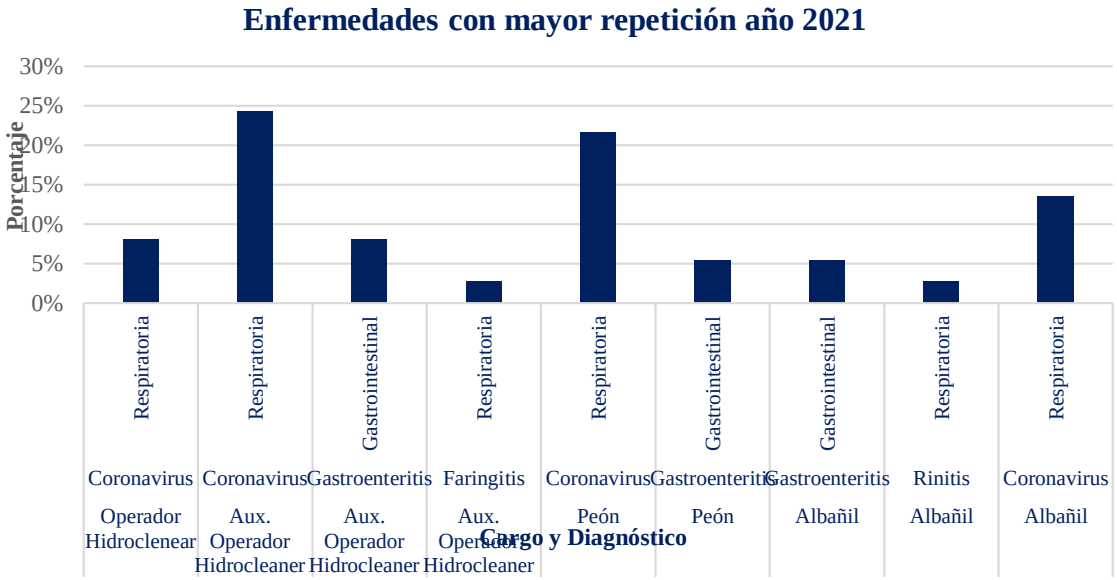
Figure 2

Disease with the highest recurrence in 2021



Fountain: Medical department of a public company

From the review of the data provided by the medical area of the public company of the city of Cuenca, it is observed that, in 2021, the highest incidence of illness present in all positions of the urban sewerage area personnel was respiratory (Coronavirus), followed by gastrointestinal (Gastroenteritis), due to microbiological entities, cellular or not, present in their work area.

Vaccination (v):

The score for vaccination was obtained through information provided by the medical department of the public company, as well as bibliographic research,Identifying worldwide the existence of vaccines that attack infections caused by bacteria, fungi and parasites,The information from “Vaccines and Disease Prevention” conducted by the Center for Disease Control and Prevention (CDC) was analyzedMolina (2018), of which we have that 55% do not have a complete vaccination schedule, 36% have 90% of the vaccination schedule and 9% have the vaccination schedule at 100%, compared to "Table 5" Vaccination.

ISSN: 2600-5859
Vol. 7 No. 1, pp. 175 – 196, January - March 2024

Table 4

Vaccination

PERCENTAGE	PUNCTUATION
More than 90% vaccinated	4
Between 70 and 90% vaccinated	3
Between 50 and 69% vaccinated	2
Less than 50% vaccinated	1

Fountain: Valencian Institute of Safety and Health at Work

Frequency of performing risky tasks (f):

The frequency score was obtained from the time recording described in the"Table 6" Calculation of Effective Time, its result is equivalent to the percentage of the total work day, this data is contrasted with the standardized data described in "Table 7" Calculation of Task Frequency.

Table 5

Time Cash Calculation

ACTIVITIES	TIME (min)	DAY (hour)	%
Lunch minutes	45	8	100
Minutes to collect work orders	25		
Minutes to go to the work area	20		
Minutes of return to the winery	30		
Minutes not worked	120		
Total time worked		6	75

Fountain: Own elaboration

Table 6

Task Frequency Calculation

PERCENTAGE	PUNCTUATION
Rarely: < 20% of the time	1
Occasionally: 20 - 50% of the time	2
Frequently: –51 - 80% of the time	3
Typically >80% of the time	4

Fountain: Valencian Institute of Safety and Health at Work

The result is equivalent to 75% of the total working day, so the score to be used will be 3 because it is within the established range.

HYGIENIC MEASURES ADOPTED

Of the 42 questions contained in "Form 1" Hygienic measures, two (2) do not apply within this study.

Table 7

Hygienic measures form

EXTENT	YEAH	NO	NOT APPLICABLE	APPLICABLE SECTOR
Work clothes available	1	0		T
Use of work clothes	1	0		T
Personal protective equipment available	1	0		T
Personal protective equipment is cleaned	1	0		T
PPE storage space is available	1	0		T
The correct functioning of PPE is controlled	1	0		T
Cleaning of work clothes by the employer	1	0		T
Double lockers available	0	0	N/A	T
Toilets are available	1	0		SLED
Showers are available	1	0		SLED
Hand washing system available	1	0		SLED
Eye wash system available	1	0		THIRST
Eating or drinking is prohibited.	1	0		T
Smoking is prohibited	1	0		T
There is time for cleaning before leaving the risk area during the workday.	1	0		T
Easy to clean floors and walls	0	1		SL
The floors and walls are sufficiently clean	0	1		SL
There are methods of cleaning work equipment	1	0		T
Disinfection procedures are applied	0	1		ASLED
Disinfestation procedures are applied	0	1		ASLED
Rat extermination procedures are applied	0	1		ASLED
There is general ventilation with air renewal.	1	0		SL
There is maintenance of the ventilation system	0	1		SL
There is sufficient first aid material (Annex VI Royal Decree 486/97)	1	0		T
There is a facility available to provide first aid	1	0		T
There is a sign of biological danger	1	0		S
There are work procedures that minimize or prevent the airborne spread of biological agents in the workplace.	0	1		THIRST
There are work procedures that minimize or prevent the spread of biological agents in the workplace through fomites.	1	0		T
There are waste management procedures	0	1		T
There are procedures for the internal transport of samples	0	1		THIRST
There are procedures for the external transport of samples	0	1		S
There are internal written procedures for reporting incidents where biological agents may be released.	1	0		S
Have the workers received the training required by Royal Decree 664/97?	1	0		T
Workers have been informed about the aspects regulated in Royal Decree 664/97	1	0		T

Table 7

Hygienic Measures Form (continued)

EXTENT	YEAH	NO	NOT APPLICABLE	APPLICABLE SECTOR
Health surveillance is carried out prior to workers' exposure to biological agents	1	0		T
Health monitoring is carried out periodically.	1	0		T
There is a registry and control of pregnant women	0	0	N/A	T
Specific measures are taken for particularly sensitive personnel	1	0		T
Are biosecurity devices available?*	1	0		S
Are appropriate biosecurity devices used?**	1	0		S
Are there procedures in place and used in the company for the proper use of biosafety devices?	1	0		S

L = Food; E = Waste; D = Wastewater treatment plants; S = Health; A = Animals; TES All activities

*Order ESS/1451/2013, of July 29. Biosecurity devices are the set of measures and devices for human protection against biological agents.
** A device that complies with Technical Prevention Note 875 will be considered adequate.
Fountain: Valencian Institute of Safety and Health at Work

Using “Equation 3” Percentage, the value obtained is used to identify the score described in “Table 8” Risk reduction coefficient, which each biological agent handles.

Equation 3

Percentage

$$\text{Percentage} = \frac{\text{Affirmative responses X100}}{\text{Affirmative answers + Negative answers}}$$

$$\text{Percentage} = \frac{30 \text{ X } 100}{30 + 10}$$

Percentage = 75%

The percentage obtained is 75%, which contrasts with the values in “Table 8” Risk reduction coefficient reaching a value of 1.

Table 8

Risk reduction coefficient

AFFIRMATIVE ANSWERS	PUNCTUATION
Less than 50%	0

Table 8

Risk reduction coefficient (continued)

AFFIRMATIVE ANSWERS	PUNCTUATION
From 50 to 79%	1
From 80 to 95%	2
More than 95%	3

Fountain: Valencian Institute of Safety and Health at Work

Table 9

Calculation of the Biological Risk Level (R)

BIOLOGICAL AGENT		G	T	P	F	V	MH	R
Enteric bacilli	Klebsiella Pneumoniae	2	3	1	3	3	1	5
	Escherichia coli	2	1	1	3	1	1	5
	Salmonella spp	2	1	4	3	1	1	8
	Shigella spp	2	1	4	3	1	1	8
	Yersinia enterocolitica	2	1	1	3	1	1	5
Mycobacterium tuberculosis		3	3	4	3	3	1	9
Bacillus anthracis		3	1	1	3	1	1	6
Leptospira Interrogans		2	1	4	3	1	1	8
Pseudomona Aeruginosa		2	1	1	3	1	1	5
Clostridium tetani		2	1	1	3	1	1	5
Clostridium Perfringens		2	1	1	3	1	1	5
Clostridium botulinum		2	1	1	3	1	1	5
Influenza virus		2	1	4	3	1	1	8
Enteroviruses	Coxackie A and B	2	3	1	3	4	1	4
	Echovirus	2	3	1	3	3	1	5
	Poliovirus.	2	3	1	3	3	1	5
Hepatitis A Virus		2	1	4	3	1	1	8
Rotavirus		2	1	1	3	4	1	2
Reovirus		2	1	1	3	3	1	3
Adenovirus		2	3	4	3	3	1	8
Parvovirus		2	3	1	3	3	1	5
Coronavirus		2	3	4	3	3	1	8

Fountain: Own elaboration

- **Interpretation of biological risk levels**

☞ **Biological action level (BAL). -**Values greater than 8 require the implementation of

preventive measures to reduce exposure.

- **Biological exposure limit (BEL). -**Values above 12 are a health hazard and represent an intolerable risk that requires immediate corrective action.

From the calculation of the risk level obtained from the 22 biological risk agents identified, 63% are below the biological action level, 5% of these exceed the biological action level, and 32% are at the limit of the biological action level, so preventive measures must be improved to reduce the exposure of operating personnel.

Proposal

Once the data obtained from the application of the Biogaval method has been reviewed, within the urban sewerage area of the municipal public company of the city of Cuenca, Ecuador, it must implement a Vaccination Plan based on the Biological Risk Factors that are within the score range from 8 onwards, in order to eliminate or minimize as much as possible the presence of said factors.

As a complement to the proposal, the municipal public company of the city of Cuenca, Ecuador, will implement as a hygiene measure the washing of work clothes of the urban sewerage area staff once the work day is over, in order to eliminate sources of contamination.

All personnel in the urban sewerage area of the municipal public company of the city of Cuenca, Ecuador, must constantly apply the implemented hygienic measures such as daily hand washing, hand disinfection, apply the work procedure for sewers, use personal protective equipment provided by the institution and must not eat food during their work day.

Discussion

The purpose of the research was to evaluate the biological risks to which the personnel of the urban sewage area of a public company in the city of Cuenca, Ecuador, are exposed during their workday, applying the Biogaval method, in order to improve hygiene measures within this work area. Environmental conditions, the sewage discharge area, are one of the main causes of illnesses due to exposure to biological risks.

Once we have examined the objectives and results of the different studies of the theses described as guides for the research of this work, we can conclude that there is similarity in the method applied, which in this case is the Biogaval method.

In another investigation carried out by Yilian Pérez Díaz, Lucía Pedroso Ramos, Lázaro Miguel Pérez Santoya, in 2017:

This coincides with the application of the Biogaval method for the evaluation of biological risk in a clinical laboratory, concluding that this method is useful for the detection of vulnerabilities and risk factors, estimating the magnitude of the exposure as very frequent, which constitutes a high risk for the exposed personnel and demands the establishment of hygienic and biosecurity measures.

In a study conducted by Oscar Mauricio Molina Morales, in 2018:

It coincides with the application of the Biogaval Method for the "Evaluation of biological risks and proposal of control measures in operational workers of the North Sewerage Operations Unit of the Metropolitan Public Company of Drinking Water and Sanitation of the city of Quito", obtaining different values since the Group in which the biological agent is classified was not considered in the investigation.

In a study conducted by Flavio Edixón Beltrón Macías in 2020:

It coincides with the application of the BIOGAVAL method in clinical laboratories in the city of Portoviejo, to assess the biological risks to which clinical laboratory professionals are exposed during their workday. It was identified that some of the biological agents are at the limit of biological action, which is why the need to improve hygienic measures is necessary to reduce the risk, despite the fact that clinical laboratories currently maintain biosecurity standards as a policy to follow and are aware of the work they do.

Conclusion

- One of the biological risk factors that affected all of humanity was the SARS-CoV-2 virus (Coronavirus), which has been attacking to date the urban sewerage personnel of the public company of the city of Cuenca, Ecuador, despite the fact that its personnel have the complete vaccination schedule.
- Another biological risk factor present among urban sewerage personnel was identified as bacteria that cause gastrointestinal diseases.
- The hygiene measures adopted within the urban sewerage area of the public company have minimized the impact of biological risks by almost 91%, proof of which is identified in "Table No. 9" Risk Level Calculation.
- From the analysis of the data it has been shown that there is greater exposure of purely operational personnel, which in the present study are: laborer, bricklayer and hydrocleaning assistant.
- Improvements must be made to the hygiene measures adopted within the urban sewerage area of the public company of the city of Cuenca, in order to minimize all the biological risk factors identified, since due to the conditions of the work area, the operating personnel often cannot fully comply with the hygiene measures implemented.

Conflict of interest

The authors declare that there is no conflict of interest in relation to the submitted article.

ReferenceBibliographic

Buriticá, SM (2019). Emerging and re-emerging diseases of viral or bacterial origin in Colombia. Colombia: Editorial Biogenesis.

Camacuari. (2020). Factors involved in the application of biosecurity measures by nursing professionals. Lima: Universidad Nacional Mayor de San Marcos. Lima, Peru.

Cuenca et al. (2023). Biological risk associated with wastewater treatment: case study using the BIOGAVAL methodology. Ibarra: Pontifical Catholic University of Ecuador.

INVASSAT. (2018). BIOGAVAL - NEO. Spain: INVASSAT.

Macías, FE (2020). Biological risks in clinical laboratories in the city of Portoviejo using the Biogaval method. Manabí: San Gregorio de Potoviejo University.

Ministry of the Presidency. (2021). Protection of workers against risks related to exposure to biological agents during work. Madrid: Ministry of the Presidency BOE.

Ministry of Labor. (2016). WORKERS' SAFETY AND HEALTH REGULATIONS AND IMPROVEMENT OF THE WORK ENVIRONMENT. Quito: LEXIS FINDER.

Mora. (2021). Level of knowledge and use of personal protective equipment by operational workers of a sewage company in Bogotá in the context of the Covid 19 pandemic. Bogota DC: ECCI University.

Morales, OM (2018). ASSESSMENT OF BIOLOGICAL RISKS AND PROPOSAL OF CONTROL MEASURES IN OPERATIONAL WORKERS OF THE NORTH SEWERAGE OPERATIONS UNIT OF THE METROPOLITAN PUBLIC COMPANY OF POTABLE WATER AND SANITATION OF THE CITY OF QUITO". Quito: SEK INTERNATIONAL UNIVERSITY.

Mucha-Hospinal, LF (2021). Evaluation of procedures used to determine the population and sample in postgraduate research papers. Challenges, 3.

Muñoz. (2018). GUIDE FOR WORKERS EXPOSED TO BIOLOGICAL RISK. Bogota: MINTRABAJO.

Muñoz. (2022). BIOLOGICAL RISK IN LABORATORY HEALTH PERSONNEL IN SPAIN. Cuban Journal of Health and Work, 4.

Navarro, J. (2020). THE RISE IN DEMAND FOR BIOLOGICAL RISK ANALYSIS SINCE 2020. Bogota: NUEVA GRANADA MILITARY UNIVERSITY.

PAHO, OP (2015). ANNEX I: Glossary. Washington, DC: PAN AMERICAN HEALTH ORGANIZATION.

QuestionPro. (2019). What is correlational research? Seattle, United States: QuestionPro.

Rojas. (2022). Biological risk assessment based on the Biogaval method to reduce occupational accidents and diseases at Molino Latino SAC- 2021. Chiclayo Peru: Technological University of Peru.

Sacyl. (1 of 1 of 2018). Biological risks | Citizens. Obtained from Biological risks | Citizens: https://www.saludcastillayleon.es/es/saludjoven/salud-laboral/1-riesgos-puedo-encontrar-trabajo/1-4-riesgos-biologicos?isprediction=1

Trujillo, LF (2020). "EMERGING, RESURGING AND IMPORTED PARASITIC DISEASES IN SPAIN". Seville: UNIVERSITY OF SEVILLE.

University of Zaragoza. (2018). Biological agents. Effects on health. ZARAGOZA: Occupational Risk Prevention Unit. Zaragoza.

Uribe et al. (2019). RELATIONSHIP BETWEEN THE PERCEPTION OF BIOLOGICAL RISK AND WORKPLACE ACCIDENTS IN A COLOMBIAN HOSPITAL, 2019. Bogota: Revista Politécnica.

Velásquez, ZR (2019). Comparison of methods used in the assessment of biological risk. Francisco de Paula Santander University, 7.

Webqda. (2017). GENERAL DESIGNS OF QUALITATIVE RESEARCH: GROUNDED THEORY. PORTUGAL: WEBQDA QUALITATIVE DATA ANALYSIS.

ZARAGOZA, UD (2018). Biological agents. Health effects. ZARAGOZA: Occupational Risk Prevention Unit. Zaragoza.

Zubeldia. (2021). WHAT IS ALLERGY? IMPORTANCE OF ALLERGIC DISEASES. Zaragoza: BBVA Foundation, 2021.

Conciencia Digital

ISSN: 2600-5859
Vol. 7 No. 1, pp. 175 – 196, January - March 2024

www.concienciadigital.org