



## Potential hazard analysis of wastewater management workers: A case study of University of Nigeria Nsukka

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### Abstract

*This study aims at analyzing working conditions and risks associated with working in the sewage treatment plant of the University of Nigeria, Nsukka. Risk assessment of sewage work was identified through observation and consulting with employees carrying out the maintenance of sewers and chambers of the treatment plant. These observations and interviews were for determining the health risk of workers, the state of the treatment plant and their working conditions. The researcher conducted unstructured interviews with the workers. Data obtained were analyzed using Interpretive Phenomenological Analysis (IPA). The result showed frequent outflows of sewage due to corroded sewer, inadequate working equipment, public action towards sewage workers, unethical practices within the workplace and insecurity in the sewage yard. The reported health problems mentioned by the participants to include: i) death ii) low waist pains iii) injury and iv) gastrointestinal infection. In conclusion, it was clear that the working condition of these workers are poor and they are being subjected to an increased workload judging from their staff strength. Their health risks were associated with the manual handling and lack of protective equipment, resulting in direct contact with sewage and inhalation of bioaerosols. Therefore, the university community should put all hands-on deck to give this worker all entitlement. At the same time, renovate the sewage treatment plant for effective functioning.*

### I. INTRODUCTION

According to the Canadian Centre for occupational health and safety [1], the risk is the chance or probability that a person will be harmed or experience an adverse health effect if exposed to a hazard. It may also apply to situations with property or equipment loss or harmful impact on the environment. For many years, wastewater treatment plants have been a dangerous working environment associated with risk as death can occur due to

confined space hazards [2], accidental fall into the treatment tank or development of chronic obstructive pulmonary diseases (COPD) among sewage workers.

The Israelis company constructed the sewage treatment plant in Nsukka in the year 1960. This facility was to treat domestic sewage from offices, school hostels, and staff quarters within the school premises. The treatment processes involve conveying sewage through steel pipes to the primary chamber, barrack chamber, Imhoff tank, and finally, down to facultative ponds. Presently, the condition of the facility has so much deteriorated. Over the years, a greater length of the steel pipes has undergone pitting corrosion and has given the appearance of small holes on the steel surfaces. Most sections of the pipe surfaces are no more due to mechanical failure, yet there is no known effort made towards replacing them. These small opening has become an escape route, for sewage to flow out of the pipe and cover a large part of the sewage yard. This happens whenever blockage is removed from the sewer. Hence, this exposes the staff working in this treatment plant constantly to unhygienic conditions and consequently to potentially pathogenic bio-aerosols that may lead to the spread of various diseases [3]. Exposure to sewage involves potential infection from pathogens such as bacteria, fungi, viruses and worms [4-5].

Workers have job satisfaction and give in their best when their safety and better working conditions are guaranteed. Nowadays, that right of a worker is a mirage. The staff in this sewage treatment plant is no longer motivated and feels rejected. There is no maintenance van assigned to them for undertaking routine work on blocked sewers. Most of them have no access to basic safety kits (uniform coverall, nose mask, boots and gloves), and working tools like fork or drilling rods are limited. Most often, the frequency of changing these kits is low, and as a result, they become susceptible to hazard related to plant design and processes [6]. There are no hazard allowances or



provision of health services to them. If this situation persists, there is a likelihood that the work will not be enticing to people, and no person will take over from retired workers. That will lead to an adverse impact on the university community.

The university authority has the responsibilities to protect their employees from occupational hazard. Baseline information on the knowledge, attitude and practice of wastewater management workers is important for hazard mitigation in the workplace [7]. In the light of the above circumstance, there is a need to analyzing working conditions and risks associated with working in the sewage treatment plants of the university to give serious attention to them.

## II. Method

### Study area

University of Nigeria, Nsukka (UNN) is located at Nsukka in Enugu state, Nigeria. The sewage treatment plant is between latitudes  $6^{\circ} 52' 28''$  North and longitudes  $7^{\circ} 24' 17''$  east and at 800m distance from the junior staff quarter. It has a primary chamber, a barrack chamber, Imhoff tanks (having a dimension of about 6.700 m x 4.700 m x 10 m) and two facultative ponds. It also has a drying bed with a total area of 417m<sup>2</sup>. The effluent is used for restricted irrigation by farmers.

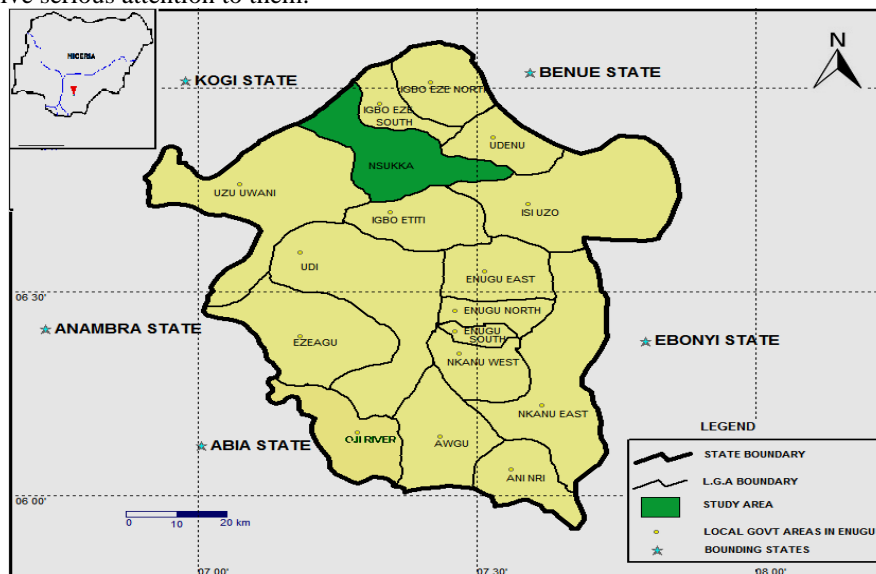


Fig 1: Map of Enugu showing Nsukka

### Data Collection

Risk assessment of sewage work was identified through observation, consulting with employees carrying out the maintenance of sewers and chambers of the treatment plant. These observations and interviews were to determine the health risk of workers, the state of the treatment plant and their working conditions. The researcher conducted unstructured interviews with the workers. The reason for choosing relatively unstructured interviews was to allow for flexibility and to adjust the questions to each worker according to his literacy. In addition, the use of unstructured interviews allowed frank expression of views about their activities, experiences, opinions and feelings concerning their work. The big concern was the issues on health and working condition. Responses from each informant were aptly captured and represented in narrative form in this study.

### Data Analysis

Data obtained were analyzed using Interpretive Phenomenological Analysis (IPA). This qualitative approach aims to explore, in more detail, the “lived experiences” of the research participant. The researcher put down notes following verbatim transcription of all interviews to show interesting or significant comments concerning the health risk.

#### *Socio-Demographic Characteristics of participants*

Research participants were men between the age of 50-56years. This age statistics shows that the workers are middle-aged men. These age brackets are prone to infectious disease as a result of a low immune system. Again, the study investigated how long respondents had been in service since the number of years may be associated with the level and magnitude of exposure. The staff is only fifteen in number. They are three technicians, one operator for



the vacuum truck, one sludge attendant, one foreman and nine sewage attendants. Three of the respondents had been in service for more than 20 years while others are in the range of 13 -19 years.

### **Consequences of working with sewage**

This section presents some of the narratives from respondents on the consequences of working in the sewage treatment plant.

#### The outflow of sewage due to corroded sewer

A worker recounted with disappointment, frequent occurrence of outflow of sewage within the compound. He reveals:

*“Daily, sewer pipe is blocked by either a cloth or pant. Then the workers will go and remove the obstruction. That increase the pressure of sewage, and as soon as the flow gets to points where there*

*are weak patched holes, the surge will burst out, and sewage will flow out to cover some part of the compound. Another occasion on which we have this experience is during rainfall. Rainwater will enter the sewer through the small holes and fill the sewer. The overflow from this sewer flows as runoff into the compound. The sewer pipes are old, weak, corroded and need total replacement. The most irritating part is that the outflow covers the area where we sit down under the mango tree and rest after work. The mango tree has been our office, and we use condemned sewer pipes as our seats”.*

This story provides the tip of the iceberg on the experiences of all respondents. The researcher observed that the mango tree was at 25 feet distance from the barrack and Imhoff tanks. The incident is hazardous to the workers' health, as depicted in Figures 2, 3, 4, and 5.



**Fig2: Sewer with section of surface lost due to mechanical failure**



**Fig 3: Pitting corrosion in sewer**



Fig 4: Outflow of sewage in the sewage yard



Fig 5: Run off containing sewage covering sewage yard

#### Hostile working condition

A worker narrated problems of the inadequate workforce, working materials and lack of maintenance van. Stating his experience, the middle-aged man recounted how they have been working without necessary equipment:

*“There was a time when we are up to fifty in number. Some are died and most retired, yet the school have not employed nor deployed staff to this utility sector. Right now, we are only fifteen in number. People ran away from this job. Some years back, in 2000, some workers were sent to come and work here, but they left on arrival and did not show up again. We carry out sewer works at different locations daily in a group of three. Each group handles a maximum of three faulty*

*sewer lines every day. Again, we work with bare hands and no boots for our feet and thus, are very vulnerable to infections due to direct contact. There is no provision for personal protective equipment like waterproof/ abrasion-resistant gloves, footwear, nose masks and uniform coverall. The same cloth we came to work with is the one we will use and work in chambers.*

*After work, we have to track back to the sewage yard looking dirty and smelly. No maintenance van is assigned to transport us to our duty post”. Formally, during the evacuation of full septic and Imhoff tanks, we are given additives or chemicals, but now, it is kerosene in place of these chemicals. This solvent is as you know, is not as effective as the chemicals that we were using before.*

#### Public shaming towards sewage workers

An older worker reported on embarrassments they face in the course of their duty. The kind of treatment received from the public is unimaginable. He continued:

*“We are humiliated because of the nature of our job, especially at staff quarters. Whenever we go to unclog drains, people run away from us. They refuse to take back whatever item we have touched, for example, broken buckets and tell us to go with it at the end. Some people who know us refuse to eat or mingle with us because we are sewage evacuator”.*

Public shaming can result in psychological effects and devastating consequences. It can cause depression, suicidal thoughts and other severe mental problems. That is seen as a helpless situation because this kind of reaction is subject to an individual's perception.

#### unethical practices within the workplace

Any practices that are not in compliance with fair labour standards and federal working guidelines fall into this category. That includes nonpayment of workers' wages and other allowances. A key informant during the interview shared his opinion on the issue:

*“Our greatest problem is the amount of money that we receive which is not enough to seek medical treatment when we are sick or buy good food that will boost our immune system. We are aware that most of us are not graduates, but the nature of our work should have given us an edge over people in other sectors. Our salaries are small. Hazard*



allowance is no more paid, not to mention shift and overtime allowances. We are not getting all these, but others in another establishment still receive theirs. Even antiseptic soap and disinfectant that should have been helpful to us are inaccessible”.

Their emotional storylines show the workers financial predicament and consequent self-depression and self-medication in times of ill-health.

#### Insecurity in sewage yard

All the security lights in the yard are not functioning, making it difficult for night shift worker to carry out their duty effectively. The same key informant continued:

*Apart from the non-functioning of security lights, we kill snakes killed here constantly. So that is why it is necessary to repair the lights for the sake of this night worker who relies only on their touch light to carry out night duties. There should be a provision of adequate first-aid equipment and efficient arrangements for monitoring the health of our staff. In the past, we go to the medical centre to take treatment. Health workers also treat the ponds and spray insecticide against mosquitoes regularly. Right now, there are no such benefitting welfare services anymore.*

#### **Health risk associated with sewage**

In this study, respondents contributed to the negative impact of working with sewage on their health. The reported health problems mentioned by the participants are discussed in detail below:

#### Death:

The participants regretted the death of their two staff who lost their life due to the nature of their job. A sewage attendant narrated the incident:

*“Joseph and Emeka died after entering a full chamber with fresh faeces to remove obstruction that prevent passage of faeces to sewer line. He following day, Joseph came to work and started complaining of ill-health. We advise him to go to hospital, so he left for his house. The next day, we received news of his death. Emeka case is that, he got infected on one leg with a terrible disease which we cannot explain. The leg was so bad that it was cut off. He stopped coming to work and later died.*

#### Low back pains:

The study participants explained that the high prevalence of body pains stem from constantly repeating awkward movements, such as bending, during the digging of pipes and manual lifting of covers of septic chambers.

A sewage attendant revealed:

*“Presently, we are having a hard time digging a pipe in Mary Slessor hostel. We have exceeded a depth of eight feet, yet the pipe is still not seen. Tomorrow we will go out to continue from where we stop. That is one of the causes of our low back pains. So, we do take pain killer daily to reduce it”.*

#### Injury

Of the ten workers interviewed, all reported that injury is the most common health problem they face. During the interviews, the workers confirmed that injuries occurred when lifting slabs of a septic tank and falling from a height. A worker that works with a vacuum truck highlighted:

*The most frequent type of injury encountered in this job is fingers or toes injury by crushing force while lifting septic tank slab cover. Fell occurs when climbing inside an inspection chamber due to weakened handles of steps that sometimes pull out. In this work, someone requires the grace of God. At staff quarters, we discovered that some septic tanks with a depth of 12 feet has weakened slabs and poses a danger to any worker.*

#### Gastrointestinal infection:

This manifest as cramping stomach pains, diarrhea and vomiting; The workers agreed that constant exposure to aerosols emitted from the sewage causes one disease or the other. Currently, a worker has a symptom that was resulting from an occupational hazard. A fellow worker narrated the problem like this:

*“Tom has been complaining of his stomach every time. He has placed himself on drugs. We have made it a point of duty to take hot drinks immediately after work since we discovered that it helps relax the stomach, which most often makes noise. This noise is as a result of breathing in terrible odour from the sewage.”*

From this respondent’s speech, there is a possibility that working in sewage can change someone’s lifestyle. These workers have become addicted to alcohol knowingly or unknowingly in their course of taking precautions. That significantly increases their chance of developing an alcohol use disorder if they did not already have one.

#### Occupational Asthma

The participants said that there is no case of asthma within them. The staff agreed that nobody has reported. However, they are sure that prolonged periods in inhalation of sewage gases in high concentrations can trigger asthma. A sewage attendant commented:



*“I am aware that there is a possibility that a worker might suffer asthma after retirement and not now. This disease condition takes time before they manifest in people. Though, we are not praying for that to happen. On frequent occasion, we enter into a full chamber (of 10 feet deep) to remove any blockage, and come out with a body full of faeces. Normally, it takes 30 minutes to an hour before we can clear blockages in pipes because it involves carting away of fresh faeces for one to see where to put his plunge”.*

The concentration of gases, dust or other potentially harmful substances while working are possible causes of asthma and lead to difficulty breathing, chest pain and wheezing. It is a known fact that natural decomposition leads to the production of sewage gases. These gases can be toxic if inhaled in high concentrations or for a prolonged period.

### III. Discussions

These workers have more than 20 years of working experience and are in the best position to give a good account on their job. Therefore, there is no doubt that workers in sewage treatment plants are at various health risks such as respiratory infections, gastrointestinal infections, injuries with the tendency of being infected. Several previous studies have shown that gastrointestinal symptoms are more common among sewage workers [8-10]. The health risks were associated with the manual handling of working tools and lack of protective equipment, resulting in direct contact with sewage and breathing in micro-organisms through either dust or aerosols. The analysis shows that the working conditions of these workers are bad. They are being subjected to increased workload judging from their staff strength. Figures 2 and 3 showed that the sewers have completely deteriorated as urgent replacement is needed.

### IV. Conclusion

Sewage workers represent important employee whose services contributes immensely to the sustainability of our environment. The study showed the negligence of sewage workers. They work without medical attention, personal protective equipment and adequate welfare facilities, including antiseptic soap, disinfectant, regular water supply and electricity. In recommendation, the university community should put all hands-on deck to give these workers all their entitlement. At the same time, renovate the sewage treatment plant for effective functioning.

### REFERENCE:

- [1]. Canadian center for occupational health and safety megeed [https://www.ccohs.ca/oshanswers/hsprograms/hazard\\_risk.html](https://www.ccohs.ca/oshanswers/hsprograms/hazard_risk.html)[accessed April 20 2024].
- [2]. Shafik SA, Megeed HAA, Saad AM, Abd El R, Elnou A. (2019) Occupational Health Hazards among Workers in Sewage Treatment Plants in Beni-Suef Governorate Journal of Nursing and Health Science Volume 8, Issue 1 Ver. I. PP 04-14
- [3]. Thirarattanasunthon P, Siriwong W, Roboson M , Borjan M. (2012) Health risk reduction behaviors model for scavengers exposed to solid waste in municipal dump sites in Nakhon Ratchasima Province, Thailand Risk Management and Healthcare Policy 97-104
- [4]. Jaremków A, Kawalec A, Pawlas K (2018) Harmful factors in wastewater treatment plant –knowledge and awareness of workers about hazards. Probl Hig Epidemiol 99(2): 189-195.
- [5]. Hansen ES, Hilden J, Klausen H, Rosdahl N (2003) Wastewater exposure and health— a comparative study of two occupational groups. Occup Environ Med 60: 595-598.
- [6]. Frank R. (2018): Bureau of labor statics ,U.S. Department of labor, Occupational out look, 11Edition, Water and liquid waste water treatment plant and system operator <http://www.cupe.bc.ca/committees/occupational-health-and-safety>[accessed April 12 2024].
- [7]. Hiruy AM, Haile AT, Acharya K, Werner D (2022) Occupational Health and Safety Practices among Workers Involved Wastewater Collection and Treatment in Addis Ababa, Ethiopia. Occup Med Health 10: 437.
- [8]. Clark SC. 1987) Potential and actual biological related health risks of wastewater industry employment. J Water Pollut Contr Fed 59:999–1008.
- [9]. Scarlett-Kranz JM, Babish JG, Srickland D, et al. Health among municipal sewage and water treatment workers. Toxicol Ind Health 1987;3:311–19.
- [10]. Rylander R. (1999) Health effects among workers in sewage treatment plants. J Occup Env Med; 56:354–7.
- [11]. Lundholm M, Rylander R. (1983) Work-related symptoms among sewage workers. Br J Ind Med 40:325–9.