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Assessment of the Occupational Safety and Health Management Practices in Sewerage Maintenance workers in East India

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Abstract
The SDG6 goals of assuring hygiene, clean water and sanitation will not be practically possible only when hygiene is ensured among sanitation workers. There are different types of sanitation workers such as STP Operators, open drain cleaners, toilet cleaners etc. Those working as Sewerage maintenance workers face the most risk because they are the ones most exposed to hazardous materials. These workers are also prone to drowning accidents, skin infections and many more such threats.
Personal protection equipment, guidance through training, SOP are not utilized properly to ensure their safety. These risks have reduced the average life of sanitation workers to mere 50 whereas the national average is at 65 years. It does not mean there are no laws to safeguard these workers. 'The Prohibition of Employment of Manual Scavengers and their Rehabilitation Act, 2013' by the Ministry of Law is framed with a good purpose. Further, SOP for Cleaning of Sewers and Septic Tanks is published in 2018 and advisory also rolled out in 2021 for creating ERSU (Emergency response sanitation unit) to escalate the safety of sanitation workers. They focus on providing customized training, providing efficient training to enhance the life quality of sewerage workers.
Primary research was conducted across various cities of India which included 102 sewer maintenance workers to enumerate current practices involved in Sewage maintenance. Measures for Occupational safety and guarding against diseases was included. The aim of the study was to find out the challenges of legally mandated PPE and usage.

Keywords: Sewerage maintenance workers, Occupational safety and health, Personal protective equipment, Manual scavengers

1. Introduction

Drainage and sewerage systems in urban areas are an important priority in Indian settings owing to the rapid increase in urbanization. [1]. A sewerage system is an infrastructure with a network of pipes that conveys sewage or waste water from the point of origin (eg. sanitary latrines, toilets etc.) to disposal. Often these sewer pipelines get blocked, clogged, or overflow due to multiple reasons but not limited to improper solid waste disposal, low capacity, plastic and other waste thrown in open sewers by residents, etc. [2]

Sewer/Sewage workers are the workers involved in cleaning and maintaining the sewerage lines with the help of machines or manually entering the manholes to remove solid waste and other debris blocking sewage lines [3]. Despite playing an important role in the management and maintenance of health and hygiene of the society, Sewage workers are the most neglected class not getting what they deserve. The role of a sewage worker is to clean the sewer lines and make sure that the flow is smooth. This work puts them in a situation where their health is at stake and sometimes their life is also at stake [4].

As per SOP released by CPHEEO (MoHUA) in 2018, [5] 44 types of safety gear are required for manual entry into sewerage holes/ manholes. However, the poor design, non-customization options, poor ventilations are some of the reasons due to which the sewage workers don't prefer to work with PPE despite being provided by few agencies [6]. Several Reports issued by both govt and non. Govt organizations like WHO, NCSK, CPHEEO clearly state that the major reason behind accidents is lack of usage of PPE and Non-trained staff [7] [3].

According to the Annual Report 2021-22 by National Commission for safai Karamcharis 988 deaths occurred across India from 1993 to 31st March 2022 due to various issues, main reason being gas poisoning. With 308 workers died from 2018 to 2023 [8] [9]. It also states that many accidents are unreported, as most of the sewage workers work on a contract basis. Several reports and most of the sanitary workers' report confirms that respiratory problems are common in them [10] [3]. Non-availability of safety gears/machines and training programs makes this health-risky job even worse. The Report by Rashtriya Garima Abhiyan, based on research conducted by Jan Sahas Social Development Society from March to July 2018, wherein RGA covered 51 incidents involving 97 deaths from 11 states concludes that rules of providing safety gears/ training were violated 100%. The unavailability of PPE and Training creates a hazardous working environment for sewage workers in India leads to accidents (sometimes fatal also) and is the root cause of several diseases [11].

In developed Nations like United States of America, United Kingdom, a commercial diver who undertakes the work of maintenance of sewer lines/diving in sewage are labelled as waste water workers or Hazardous Materials diver/HAZMAT diver [12]. As per OSHA guidelines the workers are required to put coveralls, as protective safety suit to protect the body and clothing from biohazards [13] [14]. Such divers are typically provided with a complete dry suit with integral boots, cut-resistant gloves and helmet which are sealed directly with the suit. The dry suit is made from a material that is resistant to the hazardous materials on the site. Typically, the diver wears a vulcanized rubber dry suit, which is relatively easy to decontaminate as it has a slick outer surface. Often, the diver is also provided with an extra protection suit of PVC or nylon over the dry suit to reduce the risk of puncture [15].

2. Aim

This research aims to assess the occupational safety and health (OSH) management practices among sewerage maintenance workers in East India, with a special focus on the use and compliance of Personal Protective Equipment (PPE), particularly in relation to hazardous gas inspection and exposure. As the deaths/occupational hazards reported by multiple organizations are due to hazardous gases exposure.

Objectives

- To assess the availability, accessibility, and usage of Personal Protective Equipment (PPE) by sewerage maintenance workers.
- To examine the current practices and protocols followed for occupational safety and health among sewerage maintenance workers in selected cities of East India.

- To identify the gaps and challenges in existing OSH management systems from the perspective of both workers and municipal authorities.

3. Methodology

Scope

The scope of the assessment varied in terms of sewer workers who are engaged in cleaning, removing blockages, and maintaining sewers and sewerage lines or septic tanks. The respondents include Sewerage machine operators, Sewerage divers, Septic tank cleaners, Drain cleaners etc. Other stakeholders who are also responsible for the maintenance of sewers and sewerage lines or septic tanks for e.g. Supervisors, Government officers etc. are also included in the survey.

Study Area

The assessment of required manpower for sewer maintenance is a complex task which depends on multiple factors which includes population, population density, length of sewer pipelines, type of equipment, age of structure etc. [15] [4]. Sewer maintenance in India is primarily done by Urban Local bodies [16]. In order to meet objectives mentioned, study is focused on population residing in Municipal corporations.

The sampling technique used for the survey was purposive convenient sampling. The study was focused on different cities across India in different urban categories, selected on their demographic, geographic and infrastructural characteristics.

Region	City's Class	City	Responses collected
	Tier 1	Kolkata	40
East	**Tier 2**	Bhubaneshwar	30
	Tier 3	Rourkela	30

Table 1: Sample size

The survey was conducted as mentioned in table 1 in Kolkata (West Bengal) which is metro city located in Eastern India, Bhubaneshwar (Odisha) which is also capital of Odisha and Tier 2 city. Rourkela which is a tier 3 city. The cities were selected based on different types of ULB, tiers, population, functions, water level and geographical conditions.

Questionnaire development

An elaborate methodology was formulated to achieve the objective. A questionnaire was prepared to assess the draw-backs in the existing safety gears, practical and theoretical training. The questions framed were reviewed by experts in the field. This helped in avoiding leading questions and to get the right information.

Upon finalizing the questionnaire, A pilot run was conducted to ensure reliability and internal consistency of the responses. Cronbach's alpha statistical analysis method was utilized to determine internal consistency and reliability of each item in the survey.

The workers were briefed in short about the survey, what the aim is and how it will help the workers and what effect it will cast on the workers. About 100 sewage workers were involved in the survey with their consent.

Study Limitations

- Although best possible efforts were made to capture the common challenges faced by sanitation workers throughout India, it may be possible that ULB's workers may face unique challenges that were not identified in this study.
- The study used assessments to gain an overview of the common challenges, but a more comprehensive assessment including all types of sanitation workers would be required.
- There are limited in-country primary data sources on sanitation workers (e.g., number of workers, profiles, income, vaccination, the number of incidents of discrimination, deaths, and illnesses) and resources (e.g., research papers, reports). The results are, therefore, based mainly on qualitative data collected through in-person discussions, with limited triangulation.

4. Results

Education

It is evident as shown in table 2 that a significant proportion of sewerage maintenance workers have only basic educational qualifications. The highest number of workers (37) have received primary education, followed by secondary education (23 workers). A moderate number (19) have completed middle school, while only 14 workers have reached the senior secondary level. Notably, 9 workers reported having no formal schooling at all.

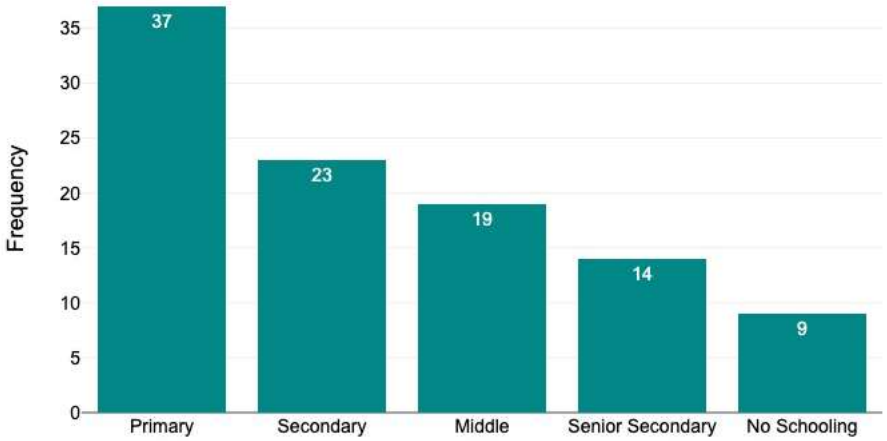

Table 2:Education profile

These findings suggest that a substantial portion of the workforce possesses limited formal education, which may impact their ability to comprehend safety protocols, follow written guidelines, or engage in training programs effectively—particularly those involving technical aspects like gas detection procedures or PPE usage. This underlines the need for visual, verbal, or hands-on safety training formats over text-heavy materials.

Out of the 102 sewerage maintenance workers interviewed, the vast majority 100 workers—were employed on private or contract-based payrolls, indicating a high prevalence of outsourced sanitation work. In contrast, only one worker was on a government payroll, and one individual was engaged as a daily wage laborer. This highlights the dominance of contractual employment in the sector, which may have implications for job security, access to protective equipment, and adherence to occupational safety norms.

PPE usage

Helmets

Helmets are required by sewerage workers for safety from hazards such as falling objects, impacts from bumping heads on fixed objects in confined spaces, penetration injuries, and electrical shocks or burns, as these environments often involve working in tight, low-ceiling areas with potential for debris, tools, or equipment to drop, as well as risks from electrical wiring or conductive materials in wet conditions [16]. Results of our survey are shown in table 3.

	Tier	Frequency	Mean	Std. Deviation	Variance	95% Confidence interval for mean
10.1 Do you wear helmet while working?	1	41	3.54	0.5	0.25	3.38 - 3.7
	3	31	2.55	1.98	3.92	1.82 - 3.27
	2	30	3.7	1.84	3.39	3.01 - 4.39

Table 3: Helmet Usage

Gloves

Gloves are critical for sewerage workers to ensure safety from chemical, biological, and physical hazards in sewer environments. The survey data on glove usage during work, rated from 1 (never) to 5 (always). The results highlight strong glove usage in Tiers 2 & 3, while Tier 1 requires improved enforcement to ensure consistent protection. However, a significant number of workers noted that gloves hamper work efficiency, with sweating being the main cause of discomfort, suggesting a need for better glove designs to enhance comfort without compromising safety.

Safety boots

Safety boots are essential for sewerage workers to protect against hazards such as slips on wet and slippery surfaces, punctures from sharp objects like debris or tools, impacts from falling heavy items, chemical splashes from sewage or cleaning agents, and electrical shocks in potentially conductive environments. A survey of 102 sewerage workers across three tiers on safety boot usage while working, rated on a scale likely from 1 (never) to 5 (always), showed varying compliance levels: Tier 1 (41 respondents) with a mean of 2 (SD 0, variance 0, 95% CI 2-2), indicating consistent but low usage; Tier 3 (31 respondents) with a mean of 4.9 (SD 0.3, variance 0.09, 95% CI 4.79-5.01), reflecting near-universal adherence; and Tier 2 (30 respondents) with a mean of 4.53 (SD 0.94, variance 0.88, 95% CI 4.18-4.88), suggesting high but slightly variable compliance, underscoring the importance of targeted safety measures in Tier 1 to enhance protection in these high-risk settings.

Detection of poisonous gases

As per SOP published by CPHEEO, on Cleaning of Sewers and Septic Tanks, it is guided to ventilate the sewer line by opening 2-3 manholes on both sides of the working stretch for at least 1 hour before starting the work to ensure escape of toxic gases in both mechanical and manual mode of cleaning. In the survey also above 95% of workers agreed that they ventilate sewer line prior to starting work to ensure scape of toxic gases [5].

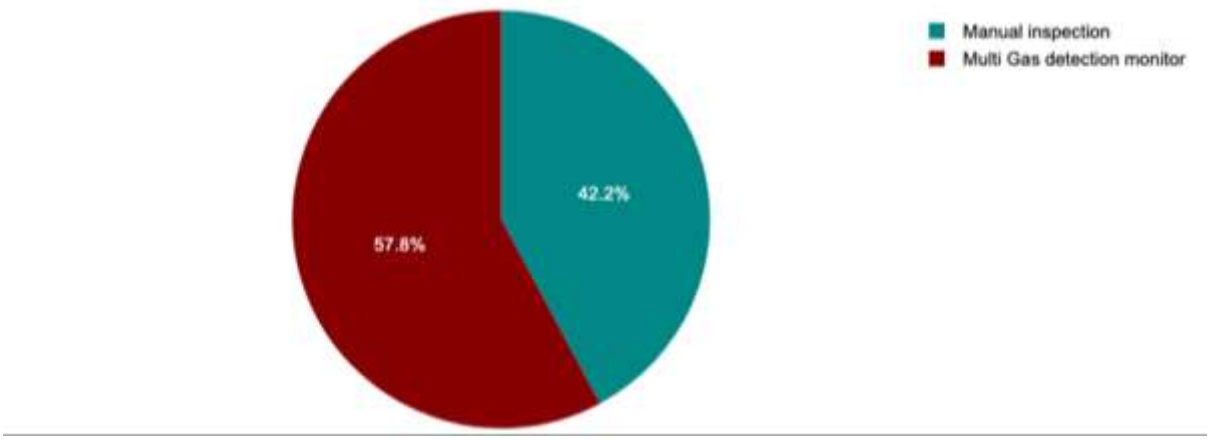

Fig 1.: Detection of poisonous gases

As per SOP guidance, detection methods to be used are multi-gas monitor, detector lamp, wet acetate paper or gas detector masks to detect any residues of poisonous gases like hydrogen sulphide, carbon monoxide, methane and gasoline vapors to ensure no residues of toxic gases. As per survey findings, as shown in figure 1, only 57.8% workers agreed to use the multi-gas detection monitor and 42% still rely on the manual mode of inspection which includes change of color, bubbles forming and even the banned practice of lighting match stick to detect poisonous gases. Workers that due to limited resources, and technical and training issues workers have to rely on manual methods of detection of toxic gases.

5. Conclusion

This study highlights critical gaps in occupational safety and health (OSH) practices among sewerage maintenance workers in East India. Most workers are employed on a contract basis, lacking formal training, job security, and adequate protection. Limited education among workers further hampers their understanding of safety procedures, particularly regarding hazardous gas inspection and proper PPE use. Although some PPE is provided, it is often uncomfortable or impractical, leading to low compliance. This increases health risks, including respiratory issues, skin conditions, and potential exposure to toxic gases. Manual entry into sewers without appropriate gas detection or safety gear remains common.

There is a pressing need for ergonomically suitable, affordable PPE and simplified training tailored to the workers' educational backgrounds. Municipal bodies must ensure strict implementation of SOPs and regular training to improve compliance. A shift toward worker-friendly, practical safety solutions is essential to protect the health and dignity of this high-risk workforce.

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