

Life inside the Black Water

Meenakshi Sharma¹ and Puneet Pal Singh Cheema²

^{1,2}Guru Nanak Dev Engineering College Ludhiana, Punjab, (INDIA)

E-mail: ¹sharmameenakshi224@gmail.com

Abstract—An estimated 1.2 million scavengers in the country are still involved in the sanitation of our surroundings. The working conditions of these sanitary workers have remained virtually unchanged for over a century. Apart from the social atrocities that these workers face, they are exposed to certain health problems by virtue of their occupation. In this paper, more stress is emphasized on the health disorders faced by the scavengers in the city of Amritsar, Punjab and their working conditions has also been elaborated. These health hazards include exposure to harmful gases such as methane, carbon monoxide, ammonia and hydrogen sulfide, cardiovascular degeneration, musculoskeletal disorders like osteo-arthritic changes and intervertebral disc herniation, infections like hepatitis, leptospirosis and helicobacter, skin problems, respiratory system problems and altered pulmonary function parameters. This can be prevented through engineering, medical and legislative measures. While the engineering measures will help in protecting against exposures, the medical measures will help in early detection of the effects of these exposures. This can be partly achieved by developing an effective occupational health service for this group of workers. Also, regular awareness programs should be conducted to impart education regarding safer work procedures and use of personal protective devices and the cleaning operation be improved by using mechanical operations.

Keywords: Scavengers, methane, carbon monoxide, ammonia, hydrogen sulfide.

1. INTRODUCTION

There are millions of fellow Indians who do one of the dirtiest job for just Rs 250 per day and in return also get disease and death, at least 22,327 Dalits of a sub-community die doing sanitation work every year. A 'sewer diver' is provided with a bottle of bootleg booze to dull his senses before they begins their odious chore. They are not provided with any kind of protective clothing so they are forced to spend hours a day in the filthy water in just their underwear. According to a report almost 70 per cent of the manual scavengers die on the job. While Government's new clean initiative is a welcome step, shouldn't we give top priority to stop this most dangerous and inhuman method of manual scavenging first? Government should provide a life of dignity to all scavengers (Workers). Scavenger Vikas Singh, a body representing sanitation workers of the Brihanmumbai Municipal Corporation (BMC), sought data under the Right to Information Act in 2006, and found that 288 workers had died in 2004-05, 316 in 2003-04, and 320 in 2002-03, in just 14 of the 24 wards of the BMC

.About 25 deaths every month. These figures do not include civic hospital workers, gutter cleaners or sanitation workers on contract. Compare this with the 5,100 soldiers — army, police, paramilitaries — who have died between 1990 and 2007 combating militancy in Jammu & Kashmir.

The men and women — invariably Dalits — who ceaselessly manage to keep our cities, towns and villages clean, die every day around us. We never notice their lives or deaths. These are the soldiers who, bereft of the honour of uniform and the posthumous glamour of martyrdom, sacrifice their lives making sure the rivers of filth flow unhindered. Forced to touch, immerse themselves in — and perforce taste — the fermented faces of millions, they are condemned to untouchability. The genocide passes unnoticed since there are a million invisible Dalits who will quietly take the place of the dead.

A network of 5,600 km of sewers with about 1.5 lakh manholes,— which consumes 2,781 million litres of the sewage Punjab generates daily. The journey begins from kitchens, bathrooms and toilets through four-inch house drains that empty into the main sewer. The 9-inch trunk sewers carry the slush to bigger lines of 2m to 3m diameter. This network of pipes is laid below ground level with “sufficient gradient” to ensure a “self cleansing” velocity of about 1 meter per second. Reared on a mixed diet of domestic, commercial and industrial wastewater, with stormwater drains sometimes hitching a ride and burdening its mangled intestines, the beast develops serious indigestion every day. It is indiscriminately fed a wide range of objects that causes clogs — condoms, sanitary pads, non-degradable thermocol, a variety of plastics, industrial sludge, kitchen waste, toilet cleaning acids, medical waste (syringes, blades, even placenta), glass shards, household gadgets, construction debris. It is then that the 5,500 *beldars*— as sewer workers are designated by the DJB— enter its bowels. (In Chennai, the sewerage network spreads across 2,800 km with 80,000 manholes— a manhole every 35 metres.) The indigestion produces a variety of gases. When sewage decomposes and ferments in a stagnant state, hydrogen sulphide is formed .

Known as sewer gas, it has a distinctive smell of rotten eggs. Overexposure to this gas can cause olfactory fatigue — an inability to detect its odour — which most manhole workers

suffer from. Hydrogen sulphide, which is explosive, acts as an irritant and asphyxiant, affecting oxygen supply to the brain and stem cells. More than 100 parts per million (ppm) of this gas in a manhole can result in instantaneous suppression of respiration. Less than 10 ppm, which is routine, can result in conjunctivitis and headaches.

2. AIMS AND OBJECTIVES

The main aim of this paper is to make an awareness in the people regarding the scavengers who are facing certain health disorders by virtue of their occupation. With this the working condition of the workers has also been improved.

3. EXPOSURE TO HARMFUL GASES

The workers are commonly exposed to gases like hydrogen disulfide, methane, ammonia and carbon monoxide. Watt *et al.* studied 26 sewer workers exposed to smell and found that 53.8% developed sub-acute symptoms including sore throat, cough, chest tightness, breathlessness, thirst, sweating, irritability and loss of libido. Severity of symptoms seemed to be dose related. Richardson studied exposure to hydrogen sulfide in 68 sewer workers and found that the FEV₁/FVC values were lower in sewer workers who had a high H₂S exposure.

4. HARMFUL EFFECTS OF HYDROGEN SULFIDE

Hydrogen sulfide is a flammable gas, which burns with a blue flame, giving rise to sulphur dioxide, a highly irritating gas with a characteristic odor. Mixtures of hydrogen sulfide and air in the explosive range may explode violently. Even at low concentrations, hydrogen sulfide has an irritant action on the eyes and the respiratory tract. Intoxication may be hyperacute, acute, subacute or chronic. Hydrogen sulfide enters the body through the respiratory system and is rapidly oxidized to form compounds of low toxicity. There are no accumulation phenomena and elimination occurs through the intestine, urine and the expired air. In cases of slight poisoning, following exposure from 10 to 500 ppm, a headache may last several hours, pain in the legs may be felt and, rarely, there may be loss of consciousness. In moderate poisoning (from 500 to 700 ppm), there will be loss of consciousness lasting a few minutes but with no respiratory difficulty. In cases of severe poisoning, the subject drops into a profound coma with dyspnoea, polypnoea and a slate-blue cyanosis until breathing restarts. Tachycardia and tonic-clonic spasms are seen. Inhalation of massive quantities of hydrogen sulfide will rapidly produce anoxia resulting in death by asphyxia. Epileptiform convulsions may occur and the individual falls apparently unconscious and may die without moving again. This is a syndrome characteristic of hydrogen sulfide poisoning in sewer workers. However, in such cases, exposure is often due to a mixture of gases including methane, nitrogen, carbon dioxide and ammonia.

In sub-acute poisoning, the eyes are affected by palpebral edema, bulbar conjunctivitis and mucopurulent secretion with, perhaps, a reduction in visual acuity—all of these lesions usually being bilateral. This syndrome is known to sugar and sewer workers as “gas eye”.

5. HARMFUL EFFECTS OF AMMONIA

Ammonia is a corrosive substance and the main toxic effects are restricted to the sites of direct contact with ammonia (i.e., skin, eyes, respiratory tract, mouth, and digestive tract). For example, if you spilled a bottle of concentrated ammonia on the floor, you would smell a strong ammonia odor; you might cough, and your eyes might water because of irritation. If you were exposed to very high levels of ammonia, you would experience more harmful effects. For example, if you walked into a dense cloud of ammonia or if your skin comes in contact with concentrated ammonia, your skin, eyes, throat, or lungs may be severely burned. These burns might be serious enough to cause permanent blindness, lung disease, or death. Likewise, if you accidentally ate or drank concentrated ammonia, you might experience burns in your mouth, throat, and stomach. There is no evidence that ammonia causes cancer. Ammonia has not been classified for carcinogenic effects by the Environmental Protection Agency (EPA), the Department of Health and Human Services (DHHS), or the International Agency for Research on Cancer (IARC).

6. HARMFUL EFFECTS OF CARBON MONOXIDE

Carbon monoxide is highly poisonous gas. It is a colorless and odorless gas and hence its presence cannot be detected immediately. When inhaled, carbon monoxide readily combines with the hemoglobin of our blood. Hemoglobin, as you know, helps in carrying oxygen from lungs to the tissues. Oxygen combines with hemoglobin to form oxy-hemoglobin. Similarly, CO combines with hemoglobin to form carboxyhaemoglobin.

The affinity of CO for hemoglobin much more (about 200 times) than that of oxygen. In the presence of CO, the oxygen carrying capacity of the hemoglobin decreases. The deficiency of oxygen in blood may cause headache, dizziness, cardiac and respiratory problems and even death. Because of this reason, it is dangerous to sleep in a closed room with a coke fire burning inside because burning of coke in an insufficient supply of oxygen produces a lot of carbon monoxide that can cause poisoning.

7. HARMFUL EFFECTS OF METHANE

METHANE is the other lurking danger. Not only does it displace oxygen, it is also explosive. Provided with no gas detecting devices, most manhole workers have ingenuous methods of checking the concentration of these toxic gases. After opening the manhole cover, they let it vent a while, then light a match and throw it in. If there's methane, it burns out.

Once the fire abates, the worker prepares to enter. "After opening the cover, we check if the cockroaches are alive. If they are dead, we leave the sewer open for some time and then enter." Roaches are not known to die easily.

Entering the narrow, dark drain, the worker pushes his only weapon, the *khapchi* — a spliced bamboo stick — to dislodge the block. This exercise could take hours. "Holding our breath, closing our eyes, we plunge headlong. We feel our way poking with the *khapchi*," besides methane, hydrogen sulphide, carbon dioxide and carbon monoxide — assaults the person. "Even if we manage not to swallow the toxic muck, it manages to enter our bodies." Odourless and colourless, the carbon gases can cause suffocation. If the worker survives the initial ordeal, he crouches inside and loads the sludge into leaky metal buckets or wicker baskets for his team to haul out. Depending on the clog, the entire operation could take up to 48 hours. "We often work after midnight. When people sleep, the flow in the sewers is lesser, and our work does not disturb road-users. Among sewer workers, there's a category called "divers", whose brief is to *swim* through the large pipelines, find the blocks, and clear them. a manhole is "a confined, oxygen-deficient space where the presence of noxious gases can cause syncope — a sudden and transient loss of consciousness owing to brief cessation of cerebral blood flow. The brain cannot tolerate even a brief deprivation of oxygen. The long-term neurological effects of syncope can be debilitating." In most developed nations, manhole workers are protected in bunny suits to avoid contact with contaminated water and sport a respiratory apparatus; the sewers are well-lit, mechanically aerated with huge fans and therefore are not so oxygen deficient. In Hong Kong, a sewer worker, after adequate training, needs at least 15 licenses and permits to enter a manhole. In India, the manhole worker wears nothing more than a loincloth or half-pants. In Delhi, since the directives of the National Human Rights Commission in October 2002, the majority of the DJB's permanent workers wear a "safety belt". It's a joke. This belt, connecting the worker through thick ropes to men standing outside, offers no protection from the gases and the sharp objects that assault the worker. At best, it helps haul them out when they faint or die. The CEC's 2005 survey of 200 DJB manhole workers found that 92.5 percent of the workers wore the safety belt. This did not prevent 91.5 percent of them from suffering injuries and 80 percent suffering eye infections. The survey found that diseases like leptospirosis, viral hepatitis and typhoid were common. "During the course of our six-month study, three of the 200 workers died," NOT SURPRISINGLY, most of the workers die before retirement. Owing to loss of appetite and inevitable alcoholism, many men shrink to half their size if they work 20 years. The average lifespan of a manhole worker is about 45. And if a worker does not die inside a manhole, the civic body does not offer any monetary compensation for illnesses/deaths owing to occupational hazards. In Delhi, permanent workers get a monthly "risk allowance" of Rs 50. In some states this rises to

Rs 200. The entry-level salary of a sanitation worker in New York is \$30,000 per year. In the sixth year, he could earn \$67,141 (Rs 2.18 lakh per month). In India, a permanent sanitation worker with 20 years experience could make Rs 12,000 a month.

8. HEALTH DISORDER

MUSCULOSKELETAL DISORDERS

Osteoarthritis changes and intervertebral disc hernia ion are the common spinal abnormalities reported in these workers. Friedrich studied 255 sewage workers to determine the prevalence of spinal troubles (i.e., neck, upper back and lower back pain [LBP]). He reported that the 12-month prevalence rates of neck, upper back and LBP were 52.4%, 54.8% and 72.8%, respectively. The prevalence of spinal troubles increased with age. Work disability during the preceding 12 months due to LBP was significantly positively associated with age, disability, weekly duration of stooping and lifting 5 years previously and higher abnormal illness-behavior scores (odds ratio between 1.26 and 0.94).

9. INFECTIONS

The modes of exposure for the various infections are as follows:

- The most common way is by hand-to-mouth contact during eating, drinking and smoking, or by wiping the face with contaminated hands or gloves or by licking splashes from the skin.
- By skin contact, through cuts, scratches or penetrating wounds, i.e., from discarded hypodermic needles. Certain organisms can enter the body through the surfaces of the eyes, nose and mouth.
- By breathing them in as dust, aerosol or mist.

The infections commonly studied among this group of workers include leptospirosis, hepatitis and *Helicobacter pylori* infection.

LEPTOSPIROSIS

Leptospirosis is an important occupational disease affecting people coming in contact with animals and their discharges. The occurrence of infection in ones workplaces is linked to the environment to which the worker is exposed and the adaptability of the organism in that working environment. Rodents usually abound in underground sewers and are carriers of leptospira. The urine of rodents and other animals present in that area is likely to contaminate these sewers. Leptospira are excreted in the urine of the infected animals. Thus, sewer workers are at a potential risk of leptospirosis. Ambekar studied 78 sewer workers from five different municipal wards in Pune to determine the evidence of past infection with leptospira using a microagglutination test. The prevalence rate was found to be 16.6%. Evidence of leptospiral infection was found to be maximum in sewer

- [21] http://archive.tehelka.com/story_main36.asp?filename=Ne081207EVERYDAY.asp , assessed on 20 september,2015.
- [22] https://www.google.co.in/search?q=MUSCULOSKELETAL+DISORDERS&biw=1366&bih=657&source=lnms&tbn=isch&sa=X&ei=HVxQVMn8I4f58AX9jYDwDw&ved=0CAYQ_AUoAQ#tbn=isch&q=HELICOBACTER+PYLORI+patients&facrc=_&imgdii=_&imgrc=HtO-Vdhet5jOQM%253A%3BJVQOu0g4O0lZnM%3Bhttp%253A%252F%252Fwww.ddc95.com%252Fwp-content%252Fuploads%252F2013%252F11%252FPeptic1.jpg%3Bhttp%253A%252F%252Fwww.ddc95.com%252Fpeptic-ulcers-helicobacter-pylori%252F%3B400%3B320 , assessed on 23 september,2015.
- [23] https://www.google.co.in/search?q=MUSCULOSKELETAL+DISORDERS&biw=1366&bih=657&source=lnms&tbn=isch&sa=X&ei=HVxQVMn8I4f58AX9jYDwDw&ved=0CAYQ_AUoAQ#tbn=isch&q=LEPTOSPIROSIS+patients&facrc=_&imgdii=_ , assessed on 25 september,2015.
- [24] <http://www.ddc95.com/wp-content/uploads/2013/11/Peptic1.jpg> , assessed on 25 September, 2015.
- [25] https://www.google.co.in/search?q=MUSCULOSKELETAL+DISORDERS&biw=1366&bih=657&source=lnms&tbn=isch&sa=X&ei=HVxQVMn8I4f58AX9jYDwDw&ved=0CAYQ_AUoAQ#tbn=isch&q=MUSCULOSKELETAL+DISORDERS&imgdii=_ , assessed on 29 september,2015.
- [26] https://www.google.co.in/search?q=MUSCULOSKELETAL+DISORDERS&biw=1366&bih=657&source=lnms&tbn=isch&sa=X&ei=HVxQVMn8I4f58AX9jYDwDw&ved=0CAYQ_AUoAQ#tbn=isch&q=HEPATITIS&imgdii=_ ,3 october,2015
- [27] https://www.google.co.in/?gfe_rd=cr&ei=5FtQVNDFO-TA8geO1IGoCQ&gws_rd=ssl#q=MUSCULOSKELETAL+DISORDERS,13 october,2015
- [28] http://en.wikipedia.org/wiki/Sewer_gas , 15 october,2015
- [29] <http://en.wikipedia.org/wiki/Methane> , 19 october,2015
- [30] <http://www.thehindu.com/todays-paper/tp-in-school/death-in-the-drains/article5897864.ec>,23 october,2015
- [31] http://www.hopkinsmedicine.org/neurology_neurosurgery/center_s_clinics/epilepsy/seizures/types/tonic-and-clonic-seizures.html , 25 october,2015