

# ASSESSMENT OF OCCUPATIONAL HEALTH, SAFETY AND ENVIRONMENT (OHSE) OF SMALL AND MEDIUM SCALE CHEMICAL MANUFACTURING ENTERPRISES (SMCMES) IN ENUGU METROPOLIS NIGERIA

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## ABSTRACT

**BACKGROUND:** There is increasing emphasis on safety and health at workplaces since work-related injuries and ill health can ruin lives and affect businesses. The study was aimed at assessing occupational health, safety and environment practices among the Small and Medium scale Chemical Manufacturing Enterprises (SMCME) in Enugu metropolis, Nigeria.

**METHOD:** A descriptive cross sectional study was carried out among 382 respondents randomly selected from SMCMEs in Enugu metropolis. Semi-structured questionnaire was used to assess the nature of work processes, environmental conditions and prevalence of workplace chemical injury/disease in the last 12 months.

**RESULTS:** Most of the respondents operated both manual and mechanical (77%) process in their work activities. The workplace hazards observed were chemical hazards (33%), ergonomic hazards (21%), mechanical hazards (15%), physical hazards (14%) and psychosocial hazards (14%). Some common health problems were hand injury (12%) and respiratory tract infection (10%) and overall annual prevalence rate was 338 injuries/diseases per 1000 workers.

**CONCLUSION/RECOMMENDATION:** Workers in SMCME are exposed to hazards due to their poor nature of work process. There is therefore high prevalence rate of preventable work related injuries/diseases. Employers should focus on training and installing safer work environment and government should enforce the practice of OHSE in SMCME.

**KEYWORDS:** Small and Medium scale Enterprises (SME), Occupational Health, Safety, Environment, Hazards, Chemicals, Prevalence, Enugu.

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## INTRODUCTION

Entrepreneurship is fast becoming a household name in Nigeria. This is as a result of unemployment situation in the country. Since there are no jobs for the teeming population, the need for Small and Medium scale Enterprises (SMEs) became imperative as a means of ensuring self-independence, employment creation, effective and efficient utilization of local raw materials and contribution to the economic development of Nigeria. SMEs have ultimately helped to reduce the pool of unemployed young people in the country.<sup>1,2</sup>

In a study<sup>3</sup> on dwindling performance of small and medium enterprises in Nigeria, it was noted that, of all the many problems confronting SMEs, funding and poor working conditions are major

constraints to safety and good performance of these enterprises. It was suggested that if working condition that ensures occupational safety and health, good remuneration, considerable work hours, good incentives and benefits among others is put in place, the productivity or performance levels of SMEs in the country will be improved and there will be a healthy workforce.

However, research findings in occupational health and safety practice in developing countries have shown that workers are exposed to chemical, biological, mechanical, psychosocial, ergonomic and physical hazards that are emerging from new forms of industrial processes and work organization. Exposure to these hazards occurs for fairly long hours on a daily basis (often Monday to Saturday) as the majority of the active hours of the day is spent at work i.e. at least 8 hours per day. Unfortunately, since the work is often done in the home especially the micro and small businesses, the entire families are often involved, which can put them at risk.<sup>4,6</sup> Long term exposure to low levels of harmful factors at work

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is currently the most pressing problem in occupational health as its effect is seen after a long period of exposure or when the person is no longer exposed. For instance, the neurotoxic effects of lead or mercury may not be seen until 5-10 years after the onset of exposure, depending on the level of exposure. Also, carcinogenic effects, such as those of some metals and polycyclic aromatic hydrocarbons, may be delayed until 15-25 years of initial contact with these substances.<sup>7,8</sup>

Indeed, health and economic effects of workplace hazard exposure cannot be over-estimated: globally occupational injury, illness and fatality currently account for significant losses, with over 3% GDP losses annually due to these causes.<sup>4</sup> In sub-Saharan Africa, the fatality rate is 21 per 100,000 workers and the accident rate is 16,000. This means that in a year 54,000 workers die and 42 million work-related accidents occur that cause at least three days' absence from work. It has been estimated that one worker dies every 15 seconds worldwide, 6000 workers die every day and 2.34 million people die each year from work-related accidents and diseases. From statistics, more people die at work than at wars and even natural disasters. Work-related injuries and ill health can ruin lives and affect businesses. Most small businesses are particularly vulnerable to the impact of occupational accidents and work-related ill health and cannot afford it morally and economically.<sup>9-11</sup>

The need for occupational health, safety and environment (OHSE) in small and medium scale chemical manufacturing enterprises became important in this study as it had been confirmed that every year many workers are injured, ill or are killed because of exposure to harmful chemical substances. These incidents cause human suffering, loss of production and high medical cost. Working with chemicals and/or in a chemical industry poses many risks, including causing illnesses such as: chemical burns, asthma, skin infections, allergies, irritant, contact dermatitis, skin injuries, cancers, asphyxiation, allergic contact dermatitis, reproductive problems and death.<sup>12</sup>

This study was designed with intent to provide an insight of the status of health and safety in the small and medium scale chemical industries in

the Enugu metropolis of Enugu state, Nigeria and produce an in-depth analysis of the work environment in these enterprises. It is also hoped that the findings discovered will be useful in promoting the health, safety and decent general working conditions in these industries, thus contributing significantly to productivity and eradication of poverty.

## METHODS AND MATERIALS

A descriptive cross sectional study was applied to assess the nature of work processes, hazards present in the working environment and the prevalence of workplace chemical injury/disease in the last 12 months. A sample of 400 workers were randomly selected from SMEs producing chemical products such as cosmetics/household/cleaning detergents, pharmaceutical, paint and paint chemicals and wood preservatives located within Enugu North, Enugu South and Enugu East local government areas (LGAs) which made up the Enugu metropolis. The material used for data collection was a standardized semi-structured questionnaire adapted from the checklist prescribed in the ILO Work Improvement in Small enterprises (WISE) method and this checklist has been used in a related study in Nigeria.<sup>13,14</sup> Data analysis was carried out using Statistical Package for Social Sciences (SPSS) Version 16.0 for windows.

## RESULTS

Out of the initial 400 questionnaires distributed, 382 were completed and returned giving a response rate of 95.5%. The study of the nature of work processes indicated that 66 (17.3%) of the respondents work manually, 21 (5.5%) work mechanically while 295(77.2%) work both manually and mechanically as shown in Figure 1.

**Figure 1: Nature of Work Processes**

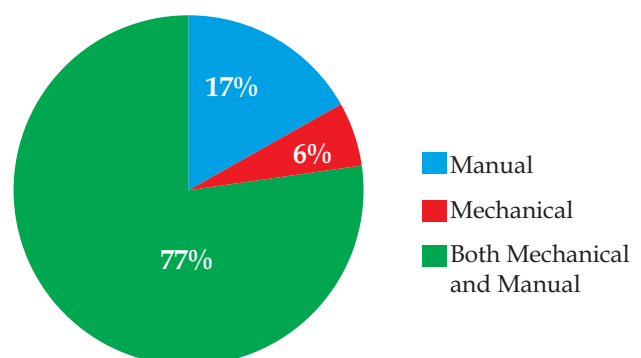


Table 1 further explains the work processes of the respondents in terms of activities engaged in their work place. The most frequent activity performed was making sure all the containers of hazardous chemicals have labels 310(81.2%) and the least performed was the use of carts, hand-trucks, rollers and other wheeled devices when moving materials 78 (20.4%) which further verify that mechanical process is low.

**Table 1: Work Processes**

Work Processes	Yes (%)	No (%)	N/A (%)	Total (%)
Use carts, hand-trucks, rollers and other wheeled devices when moving materials	78 (20.4)	301 (78.8)	3 (0.8)	382 (100)
Provided multi-level shelves or storage racks near the work area for tools, raw materials, parts and products.	214 (56.0)	168 (44.0)	0 (0)	382 (100)
Attach proper guards to dangerous moving parts of machines and power transmission equipment	256 (67.0)	99 (25.9)	27 (7.1)	382 (100)
Use mechanical devices or magazines for machine feeding to avoid hazards and increase production.	87 (22.8)	262 (68.6)	33 (8.6)	382 (100)
Attach labels and signs easy to read in order to avoid mistakes	277 (72.5)	71 (19.8)	30 (7.8)	382 (100)
Put frequently used tools, controls and materials within easy reach of workers	295 (77.2)	81 (21.2)	6 (1.6)	382 (100)
Move the sources of dust, hazardous chemicals, noise or heat out of the workplace	152 (39.8)	230 (60.2)	0 (0.0)	382 (100)
Install screens, partitions or barriers to reduce the harmful effects of dust, hazardous chemicals, noise or heat by having more openings, windows or open doorways.	189 (49.4)	193 (50.5)	0 (0.0)	382 (100)
Make sure all the containers of hazardous chemicals have labels.	310 (81.2)	72 (18.8)	0 (0.0)	382 (100)
Machines are well maintained and have no broken or unstable parts	304 (79.6)	78 (20.4)	0 (0.0)	382 (100)
Change work methods so that the workers can alternate standing and sitting while at work.	289 (75.7)	93 (24.3)	0 (0.0)	382 (100)

NA = Not Applicable

Tables 2, 3 and 4 indicate the hazards currently exposed in the workplace. The most experienced physical hazards is noise 59.2%, heat and vibration were same 31.4%, ionizing radiation 11.0%, poor lighting 7.1% and cold 0%.

Physical hazards of those exposed have a mean value of 89.2 (14.4%). Chemical hazards exposed to were; use or handling of chemicals that are skin irritants and sensitizers 81.9% which is the most exposed chemical hazard followed by dust particles 67.0%, toxic chemicals 65.4%, fumes and vapours 54.2%, poisonous gases 41.6% and metals and their compounds 11.0% being the least.

The mean of those exposed to chemical hazard is 204.5 (32.9%). Many of the respondents were not presently exposed to biological hazards as indicated in Table 2, the most exposed biological hazard is bacteria 10.2%, followed by fungi and protozoa 3.9%, virus 3.1% and the least were animals and plants. The mean of those exposed to biological hazard is 13.5 (2.2%).

**Table 2: Physical and Chemical hazards in workplaces**

Physical Hazards	Yes%	No%	N/A%	Total
Heat	120(31.4)	259(67.8)	3(0.8)	382(100)
Cold	0(0)	373(97.6)	9(2.4)	382(100)
Vibration	120(31.4)	259(67.8)	3(0.8)	382(100)
Noise	226(59.2)	153(40.1)	3(0.8)	382(100)
Ionizing Radiation	42(11.0)	337(88.2)	3(0.8)	382(100)
Poor Lighting	27(7.1)	349(91.4)	6(1.6)	382(100)
Chemical Hazards	Yes%	No%	N/A%	Total
Toxic chemicals	250(65.4)	129(33.8)	3(0.8)	382(100)
Dust particles	256(67.0)	126(33.0)	0(0)	382(100)
Poisonous gases	159(41.6)	223(58.4)	0(0)	382(100)
Use or handling of chemicals that are skin irritants and sensitizers	313(81.9)	69(18.1)	0(0)	382(100)
Fumes and vapours	207(54.2)	175(45.8)	0(0)	382(100)

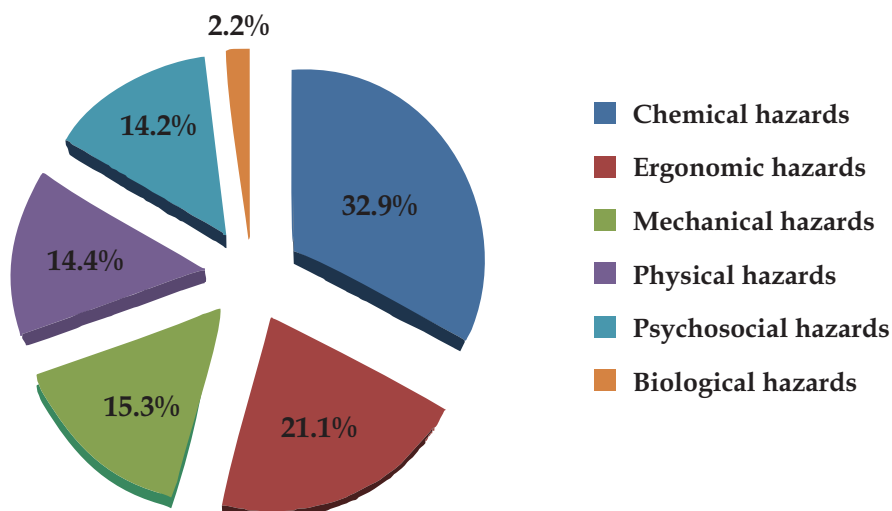
NA = Not Applicable

**Table 3: Biological, Mechanical, Psychosocial and Ergonomic workplace hazards**

<b>Biological Hazards</b>	<b>Yes%</b>	<b>No%</b>	<b>N/A%</b>	<b>Total</b>
Bacteria	39(10.2)	286(74.9)	57(14.9)	382(100)
Fungi	15(3.9)	310(81.2)	57(14.9)	382(100)
Virus	12(3.1)	313(81.9)	57(14.9)	382(100)
Protozoa	15(3.9)	310(81.2)	57(14.9)	382(100)
Animals	0(0)	325(85.1)	57(14.9)	382(100)
Plants	0(0)	325(85.1)	57(14.9)	382(100)
<b>Mechanical Hazards</b>				
Impact force (collision and fall from height)	61(16.0)	315(82.5)	6(1.6)	382(100)
Struck by object	66(17.3)	310(81.2)	6(1.6)	382(100)
Confined space	87(22.8)	289(75.7)	6(1.6)	382(100)
Equipment	160(41.9)	216(56.5)	6(1.6)	382(100)
Entanglement	105(27.5)	271(70.9)	6(1.6)	382(100)
Compressed at high pressure	82(21.5)	294(77.0)	6(1.6)	382(100)
<b>Psychosocial Hazards</b>				
Work related stress	307(80.4)	69(18.1)	6(1.6)	382(100)
Violence	12(3.1)	370(96.9)	0(0)	382(100)
Bullying(emotional and verbal abuse )	21(5.5)	361(94.5)	0(0)	382(100)
Sexual Harassment	12(3.1)	370(96.9)	0(0)	382(100)
<b>Ergonomic Hazards</b>				
Repetitive movement	286(74.9)	96(25.1)	0(0)	382(100)
Confined space	159(41.6)	223(58.4)	0(0)	382(100)
Thermal comfort	33(8.6)	349(91.4)	0(0)	382(100)
Uncomfortable workstation height	69(18.1)	313(81.9)	0(0)	382(100)
Poor body positioning	162(42.4)	220(57.6)	0(0)	382(100)
Visual fatigue	78(20.4)	304(79.6)	0(0)	382(100)

NA = Not Applicable

**Figure 2: Hazard Exposed at work place**





**Table 4: Environmental Workplace Conditions**

Environmental Working Conditions	Yes%	No%	N/A%	Total
Wastes and other unnecessary materials are cleared from workroom	358 (93.7)	24 (6.3)	0(0)	382 (100)
Adequate waste bins for different types of waste are provided	274 (71.7)	108 (28.3)	0(0)	382 (100)
Provided Proper drainage of waste water	364 (95.3)	18 (4.7)	0(0)	382 (100)
Increased natural ventilation by having more windows or doors in good working conditions	304 (79.6)	78 (20.4)	0(0)	382 (100)
Provided artificial ventilators, electric fans, or air conditioners to have a good airflow	277 (72.5)	105 (27.5)	0(0)	382 (100)
Introduce or improve local exhaust ventilation	117 (30.6)	250 (65.4)	15 (3.9)	382 (100)
Improved the heat protection of the building by backing walls or roofs with insulating materials.	139 (36.4)	201 (52.6)	42 (11.0)	382 (100)
Ceilings are adequately raised to reduce noise	238 (62.3)	138 (36.1)	6 (1.6)	382 (100)

NA = Not Applicable

Some of the respondents had experienced work related chemical injuries/diseases in the last 12 months. Some reported more than one injury of which hand injury 47 (12.3%) of 382 was the most experienced followed by respiratory tract infection 37 (9.7%) of 382, burns 19 (5.0%) of 382, dermatitis 17 (4.5%) of 382, ulceration of the eye 4 (1.1%) of 382, toxic substance poisoning 2 (0.5%) of 382, skin diseases and cancer 2(0.5%) of 382 and leukaemia 1(0.3%) of 382 while none had experienced asthma and anaemia. This is seen in figure 12 The number of work related injuries/diseases experienced in the last 12 months worked in chemical manufacturing enterprise summed up to 129 work related injuries/diseases with a overall prevalence rate of 33.8% . The prevalence rate of work related chemical injury/disease is shown in Table 5.

**Table 5: Prevalence Rate of Work Related Chemical Injury/Disease**

Have you experienced any work related chemical injury/disease in the last 12 months?	Frequency	Prevalence %
Burns	19	5.0
Hand injuries	47	12.3
Dermatitis	17	4.5
Asthma	0	0
Skin diseases and cancer	2	0.5
Toxic substance poisoning	2	0.5
Ulceration of the eye	4	1.1
Anaemia	0	0
Leukaemia	1	0.3
Respiratory tract infection	37	9.7
<b>Total</b>	<b>129</b>	<b>33.8</b>

## DISCUSSION

In this study, it is evident that many (77%) SMEs operate both manual and mechanical process in their activities. This is part of the characteristics of SMEs as they are known to operate batch process unlike larger firms that run continuous operation associated with only mechanical process.<sup>15</sup> The nature of the work process goes a long way to explain the hazards exposed to in the workplace. The use of carts, hand-trucks, rollers and other wheeled devices when moving materials and use of mechanical devices or magazines for machine feeding to avoid hazards and increase production recorded lowest work processes (20% and 23% respectively) which further confirms that majority of them were exposed to ergonomic hazards since they have to carry loads manually. Those that provided multi-level shelves or storage racks near the work area for tools, raw materials, parts and products were 56% while 77% placed frequently used tools, controls and materials within easy reach of workers and 78% change work methods so that the workers can alternate standing and sitting while at work. However these did not reflect in the ergonomic hazards recorded. These show that there are other underlying factors contributing to the ergonomic hazards such as doing the work manually.

The most currently experienced physical hazard was noise 59%, heat and vibration 31%, which confirms an earlier report in literature.<sup>14,16</sup> noise arises from the machines used for production which can lead to an induced hear loss. Chemical hazards were highly reported as this is seen in their nature of work process where only 40% move the sources of dust, hazardous chemicals, noise or heat out of the workplace and 49% install screens, partitions or barriers to reduce the harmful effects of dust, hazardous chemicals, noise or heat. Thus, they were highly exposed. This is reflected in the study of which 33% of hazards exposed were chemical hazards. Dust particles, toxic chemicals, skin irritants, fumes and vapours have also been reported as one of the major chemical hazards in chemical industry.<sup>14,17-19</sup> High rate of exposure to irritants and sensitizers have really reflected in the high rate of respiratory infections observed in the study. Respondents were least exposed to biological hazards with majority indicating that these were not applicable to their work process. This is consistent with other studies conducted in similar industries.<sup>20,21</sup> The level of exposure of

mechanical hazards among SMEs was quite low since their operation of machine was low compared to larger companies whose activities are majorly mechanical<sup>15</sup>. Most (80%) of the respondents have reported that work related stress is the most common psychosocial hazard. This is similar to findings in other several studies<sup>14, 22,23</sup> since stress tends to pose problems to many workers.

Based on their nature of work process earlier analysed, it is not surprising that ergonomic hazards were high. Earlier study in a chemical industry also reported that wrong posture, repetitive movement and lifting of object manually are the most experienced.<sup>21</sup> Most of the respondents in present study maintain good environmental management as seen in the research except for; introduction or improvement of local exhaust ventilation (31%) and improved the heat protection of the building by backing walls or roofs with insulating materials (36%) that were low. This is consistent with other literatures on environmental condition of chemical industry. Although the success was attributed to the functional Environmental Management Enforcement bodies in the states who have penalty for defaulters.<sup>24,25</sup> The enforcing agencies for environmental sanitation in the study are Enugu State Waste Management Authority (ESWAMA).

Some of the respondents had experienced work related chemical injuries/diseases in the last 12 months. Hand injury was the most reported followed by burns. Respiratory tract infections (RTI) have been widely reported in several studies done in paint, soap and detergent making industries.<sup>17,19,26,27</sup> The number of work related injuries/diseases encountered in the last 12 months worked in chemical manufacturing enterprise summed up to 129 work related injuries/diseases with an overall prevalence rate of 338 injuries/diseases per 1000 workers. The prevalence rate is comparable with two different studies on prevalence of work related injuries among SMEs industrial workers in Ethiopia in which the work related injuries were 335 injuries per 1000 exposed workers and 342 injuries per 1000 exposed workers.<sup>28,29</sup> This high prevalence rate is clearly seen in their nature of work processes. All these ailments could cause slow death at work place.<sup>30</sup> Work related injuries are preventable if adequate measures are put in place.

## CONCLUSION

The study assessed the occupational health, safety and environment practices among the small and medium scale chemical manufacturing enterprises in Enugu metropolis. Based on the findings of this study, it is evident that the prevalence rate of work related chemical injuries/diseases amongst SMEs of the chemical industry is high. This high rate can be attributed to the hazards exposed at their working environment. These hazards were due to their poor nature of work processes, which when improved can significantly reduce work place chemical injury/disease since greater numbers of workers were aware of this hazards present in their work place. Health and safety must be an essential part of production process. The work environment has to be cleared from hazards. Unfortunately, not much work has been done on HSE in chemical industry in the country, rather bulk of it is found in construction and agriculture thus, researchers are needed to work on HSE in chemical industry to portray the inherent factors in this industry in the country.

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