



Occupational Safety and Health Practices in Glass & Ceramics Industry in Punjab 2021

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Regime to Promote Safer Working Conditions at Workplaces)
Centre for the Improvement of Working Conditions & Environment
Directorate General Labour Welfare Punjab
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List of Abbreviations

BOS	Bureau of statistics
ILO	International Labour organization
NGVS	No guideline value set
OSH	Occupational safety and health
OSHA	Occupational safety and health administration
PEQS	Punjab Environmental Quality Standards
PPEs	Personal protective equipment
ADP	Annual Development Programme
CBOSH	Capacity Building of Occupational Safety & Health

1. Introduction

Glass has occupied our lives without our knowledge. Glass is among those things that have become an integral part of our lives. Glass manufacturing began centuries ago. Yet, we are not exactly sure about the time and place of the advent of glass manufacturing. Archaeological evidence suggests that ancient people were more advanced than we may have thought earlier.

Glass is a highly brittle material, and one must be very careful while handling this material. Glass manufacturing requires highly skilled professionals. The production line staff should always be alert as the entire production line has to maintain the requisite temperature throughout the manufacturing process. The kiln should burn continuously to keep the production work going on. Nature has inexpensive and abundant raw materials for this industry.

The glassmaking process involves mixing large amounts of silica sand (95%) with comparatively smaller amounts of lime, soda ash, and other materials to give the unique glass qualities by heating the mixture in a furnace (400-500 kg/hr) until it turns into a syrupy mass at about 1500°C. Usually, the furnace runs on coal or fuel gas to produce heat. However, it is a laborious process that requires specific skills during the manufacturing process. This glass (Soda-lime glass) is mainly used as a plate, window glass, light bulb, etc., worldwide, including Pakistan [1]. The operations involve increased heat levels and the possibility of exposure of heat (radiant) to workers.

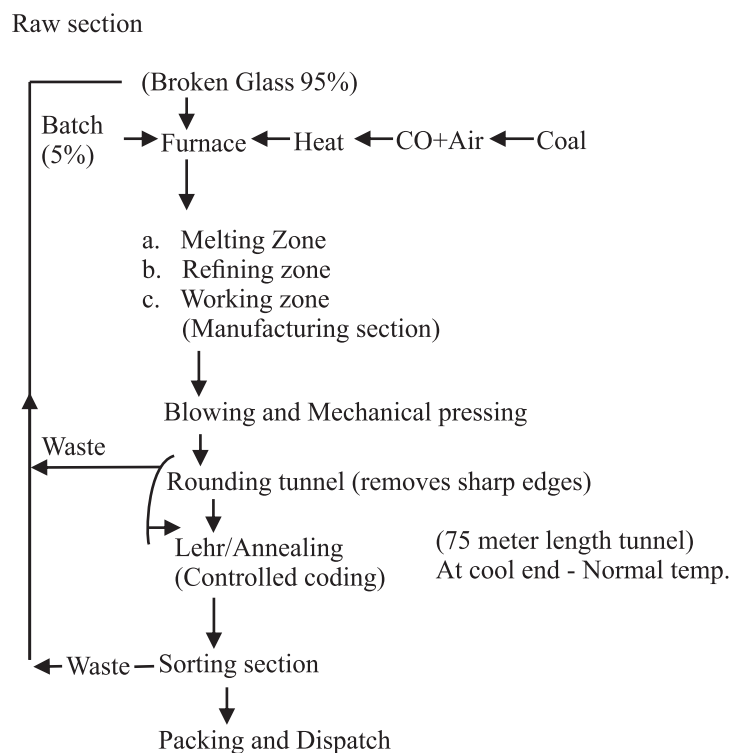


Figure 1: The Process and Materials involved in glass manufacturing

Pakistan's glass sector was set up about four decades ago, primarily manufacturing basic mirrors and toughened glass. High-quality glass for commercial use is imported due to limited demand and high manufacturing costs. The country is also an exporter of glassware categories, including bottles, float glass, and tableware. The sector is energy-intensive, with most manufacturers relying on natural gas [6]. More than 100 units in the unorganized sector are engaged in making different glass goods. These units are situated in Hyderabad, Karachi, Multan, and Lahore. About 60 percent of them produce small glass containers, tableware, etc., while the rest are concerned with making bangles, beads, small glasses for dresses, furniture, crystal glass goods, and many more. A significant chunk (73%) is situated in Punjab while 19% in NWFP, 5% in Sindh, and only 3% in Baluchistan. The glass industry directly provides jobs to more than 100,000 skilled, semiskilled and unskilled workers. In addition to this, the converter units and the informal sector are providing more than 100,000 jobs. The demand for glassware has shown a rising trend due to an increase in population and somewhat rising income among buying segments of the people [2].

The International Labour Organization (ILO) has observed that an estimated 50 million work-related injuries occur every year or 160000 every day. Scientific progress has made life more comfortable, but there is potential for permanent anatomical or physiological damage due to hazards, especially among industrial workers. Traumatic occupational injuries lead to 10,000 deaths among workers annually [3].

There are many occupational health and safety concerns in the glass manufacturing industry. In addition, there are psychosocial and physical environment impacts, with high levels of work intensity and relatively low levels of autonomy, resulting in a range of stress-related illnesses such as cardiovascular disease and mental health problems. Governments, employers and workers increasingly recognize the need to improve coverage and compliance on occupational safety and health (OSH) and foster improved management systems, with a preventive and promotional approach that includes workers' participation. Over the past decade, many developing countries like Pakistan have also taken steps to review, expand and modernize their OSH legislation, emphasizing preventive measures and shifting away from solely prescribing protection measures, in line with framework ILO Conventions on OSH. However, in practice, achieving safe and healthy workplaces is a major challenge, and the increasing use of temporary, contract and agency work poses new issues, including those associated with increased insecurity at work and work intensification. [4]

Exposure to crystalline silica dust occurs in a large variety of occupations such as metal foundries, constructions, ceramic, quarry, glass, cement, brick kiln, and pottery industries. Since crystalline silica exposure has been linked with silicosis, lung cancer, and other pulmonary diseases, its adverse effects have worldwide concerns. Therefore, silica dust exposure in workers is considered a significant health problem, especially in developing countries [5].

Currently, the major groups at risk for silicosis are workers from the sandblasting, stone cutting, construction, glass manufacturing, cement and ceramic production industries [6]

Likewise, the ceramic production industries in Pakistan have been involved with manufacturing products for daily use, sanitary, structural, art, refractory, technical, and raw materials. The ceramic manufacturing sector plays a significant role in the economy of Pakistan. The industry employs over 36000 people and contributes 0.1 % to the total GDP of the country and 0.5% to the manufacturing GDP annually. Its contribution to exports of the country is about US\$ 12.30 million per annum [7].

The traditional ceramic process generally follows milling, batching, mixing, forming, drying, glazing, firing, and assembly. Possible dust exposure sources include raw material processing, milling, forming, spray drying, glazing, firing, and waste disposal during the process. The major difference between different ceramic products is in the process of forming. Air pollution from ceramic production is suspended dust particles, aerosol particles, smoke and unburnt particles of fossil fuels, paint and glaze spray particles, and hot air. This kind of air pollution affects more severely the health of ceramic workers and other people.

The raw material used in manufacturing ceramic products is feldspar, silica, clay, Minawali clay, and talc [8]. Raw materials for glaze include Quartz, Feldspar, Limestone, Zinc oxide, Barium oxide, Zirconium and ceramic colours. Glaze is a glasslike, multi-ingredient, silicate thin layer, which adheres to the surface of the ceramic body. It is usually sprayed upon the dry body by a manual or automatic spraying method, which after firing, produces a smooth, glossy surface with beautiful colour and luster. Many glazing methods, such as spraying glaze, dipping glaze, pouring glaze, brushing glaze etc., are used, which may be manual or automatic. These sprayed clay wares are then taken to the kiln for firing. As a result, the bodies will take a series of physical and chemical reactions and take a fixed shape. The bodies are put in the tunnel entrance, and the products are pushed out from the exit. Fuel is burnt in the resisting firewall on both sides of the tunnel. The tunnel kiln consists of three zones. They are preheating zone, Heating zone, and Cooling zone. The heating zone has burners on both sides. In the third section, the product cools down by exhausting. The temperature of every section is strictly controlled by automatic ventilation equipment and the temperature-controlling facilities called thermocouples to ensure every product is fired evenly. In the last production process, the finished products are inspected as quality control and the good quality products are carefully packed for shipment.

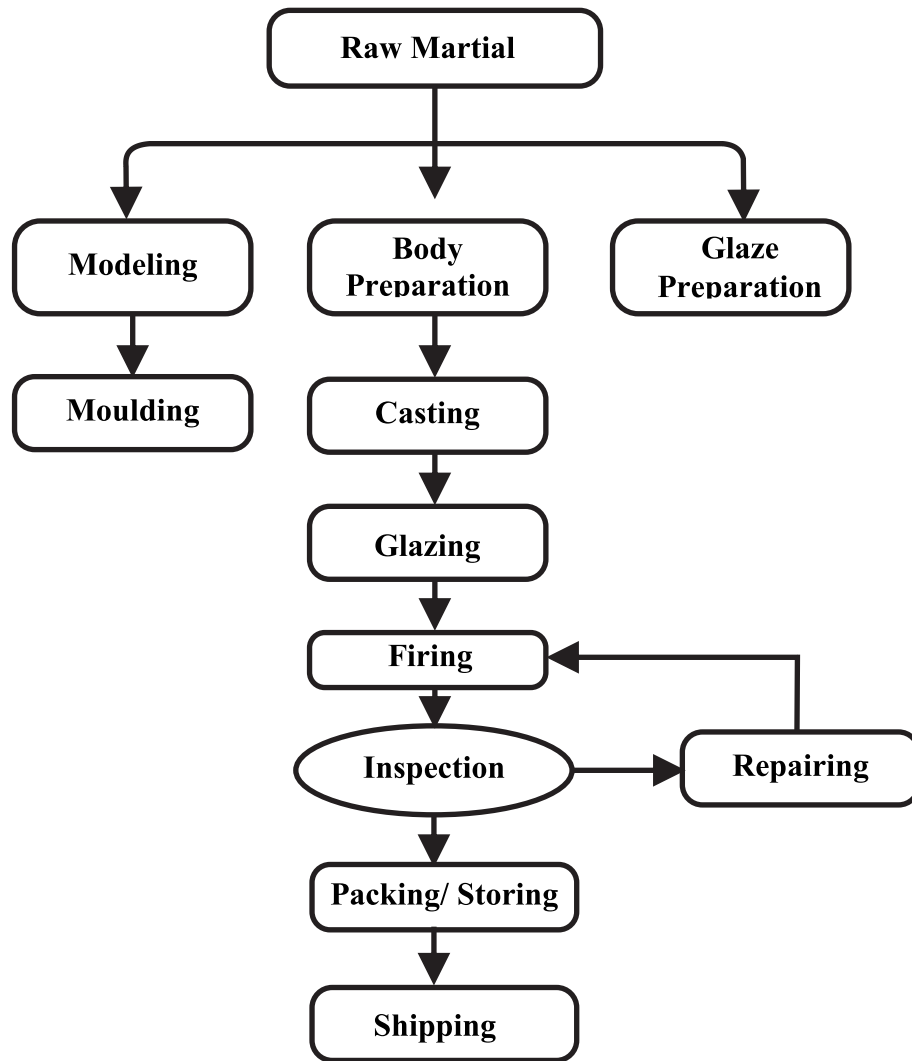


Figure 2: Production Operations of ceramics

In the ceramic industry, numerous health hazards exist, including inhalation of airborne particulate matter, predominantly crystalline silica included in raw materials, and noise exposure. The present study aimed to assess some of the health disorders among workers in the province's glass and ceramic manufacturing factories [9].

2. Objectives

The main objectives were as follows:

- To conduct occupational safety and health risk assessment of glass and ceramics sectors in the Punjab province,
- To formulate an analysis report on occupational diseases and to suggest control measures.

3. Methodology

The visits were conducted in the glass and ceramics industries of district Lahore, Gujrat, Rawalpindi, and Sheikhupura. These industries are registered with the Labour and Human Resource Department. These industries are manufacturing a variety of glass and ceramics. A total of six industries were selected throughout the province. These industries include;

Sector	Sampled units
Glass sectors Units	03
Ceramic sector units	03

In order to access situation of occupational safety and health (OSH), & workplace injuries, audiometry, spirometry, total dust measurement, illumination, noise, and on-site training was done. All these field-testing activities were carried out using state of the art calibrated instruments.

Field Testing

A team from the Labour Welfare Department comprising of Sector Specialists, technical staff and field formation of Directorate General of Labour Welfare Punjab visited the aforementioned industries and collected data. The data collection was carried out through questionnaires, checklists & hazards risk assessment of the industries. Questionnaire & checklists were designed by keeping in mind existing Labour laws. Data collection was completed in the following way:

1. Noise level testing
2. Audiometric testing
3. Total dust measurement (Personnel Exposure)
4. Spirometry testing
5. Stack emission testing
6. Illumination level testing
7. Training on Occupational safety and health (OSH) under existing legislations

3.1 Noise level testing

The noise level monitoring was carried out to measure the noise level at the workplace. This test was performed using Casella Precision Sound Level Meter Type 2100. Noise level testing in the glass & ceramics sector is shown in Tables 1 & 2, respectively.

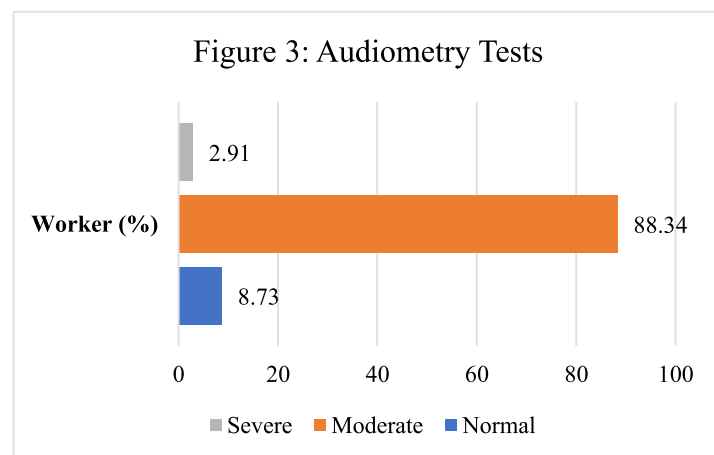
Noise testing in the glass and ceramics sector

Table 1: Glass sector		
Sr. No.	Departments/Sections	Noise Level dB (A)
1	Cold end area	90.8
2	Near Push and table machine	89.8
3	Production Hall	109.3
4.	Packing Hall	89.0
5.	Compressor Hall	96.3
6.	Near Furnace Block Cutting	94.7
7.	Silica Sand Swing	87.1
8.	Batch House	89.1
9	Furnace Department	90.9
Table 2: Ceramics sector		
1.	Cup dry area	87.7
2.	Near glaze machine	87.4
3.	Near Masa machine	117.6

There are no threshold limit values for noise in the existing local Labour legislation. Therefore, OSHA standards have been taken as a reference. According to OSHA, the permissible limit is 85 dB(A) for eight hours work shifts.

3.2 Audiometry Testing:

Audiometry tests were conducted using a Sibelmed audiometer. Workers from different sections were selected for this test. It was observed that some of the workers had slight to severe hypoacusis. **Figure 3** shows 8.73% of workers had normal audiometry, while 88.34% & 2.91% had moderate & severe hypoacusis, respectively. (**Annexure-I, Photo-I**).



Moderate hypoacusis had an elevated ratio as compared to others. This may be due to the exposure of workers to the high noise level at the workplace. It may also indicate that workers had limited/ no access to personal protective equipment (PPEs) other personal issues.

3.3 Monitoring of Total Dust (Personnel Exposure)

Exposure monitoring of total Dust (personnel exposure) was carried out in different sections of the enterprise by using a dust sampler. The workers in the industry at their workplaces were exposed to specks of dust during their routine activities. **(Annexure-I, Photo-II)**. The summary of test results is summarized below.

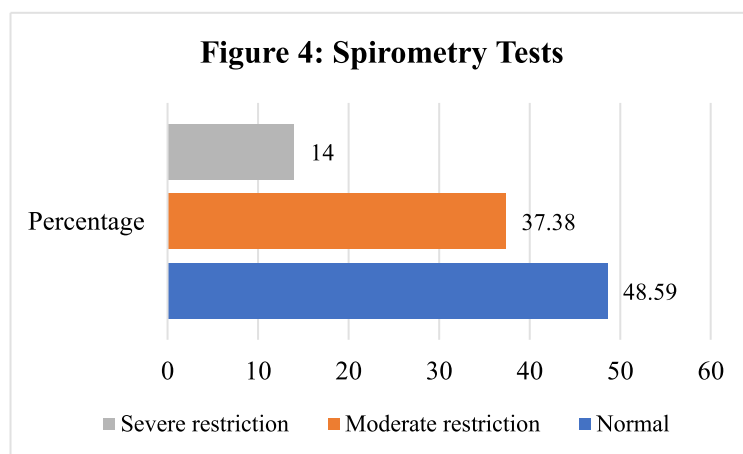
Table 3: Total Dust Exposure

Sr. No.	Departments/ Sections	Total Dust (mg/m ³)	Sr. No.	Departments/ Sections	Total Dust (mg/m ³)
1.	Press Section	1.39	14.	Fabrication Plant	2.57
2.	Compressor Utility	2.50	15.	Maintenance	1.28
3.	Quality Control	1.71	16.	Production Hall 1	0.47
4.	Mold Shop	0.75	17.	Production Hall 2	0.49
5.	Housekeeping	1.47	18.	Quality Control PD 1	0.50
6.	Batch House	2.2	19.	Production PD 1	0.48
7.	Fabrication Plant	2.57	20.	Supply chain	0.43
8.	Press Section	1.39	21.	Cutting Hall 1	0.97
9.	Compressor Utility	2.50	22.	Filing & Trimming	5.96
10.	Quality Control	1.71	23.	Glaze	3.26
11.	Mold Shop	0.75	24.	Handle fixing	1.44
12.	Housekeeping	1.47	25.	Filling	2.55
13.	Batch House	2.2	26.	Trimming	1.8

Local laws direct all industries to minimize dust levels using engineering controls & provide PPEs to workers. As per ACGIH, the total dust threshold limit value is 10 mg/m³ [10].

3.4 Spirometry Testing

Spirometry testing of 81 workers was done in targeted industries using MIR Spirodoc. Randomly selected workers from different sections were chosen for this test. Spirometry tests of workers showed that some of the workers had mild to very severe respiratory problems that may be due to exposure to chemicals/dust or smoking (Annexure-I, Photo-III).



It was observed that 48.59% of workers had normal spirometry, while 37.38% had mild to moderate restriction. The rest of the workers had severe restrictions.

3.5 Stack Emission Testing

The stack emission monitoring was carried out by using calibrated Flue Gas Analyzer Testo 350. The results of different industries are summarized below:

Table 4: Stack emission results

Parameters	Unit	PEQS	Furnace exhaust (Chimney-I)	Furnace exhaust (Chimney-II)
Capacity	Tons per day	--	455	--
Load	Tons per hour	--	450	--
Fuel	--	--	Natural gas	Natural gas
O ₂	%	NGVS	9.59	10.29
CO	mg/Nm ³	800	37.5	6.25
NO _x	mg/Nm ³	400	1219.9	584.8
NO	mg/Nm ³	NGVS	1173.4	568.7
NO ₂	mg/Nm ³	NGVS	46.5	16.1
CO ₂	%	NGVS	6.46	6.07
SO ₂	mg/Nm ³	1700	37.05	0
H ₂ S	mg/Nm ³	10	276.03	124.6
Eff. N	%	--	65.5	74.1
Eff. G	%	--	59.7	67.4
Final Temp	°C	--	502.8	368.9
Smoke	% Ringlemann scale or,	40% or 2	40% or 2	40% or 2

In Table 4, the sum of NO and NO₂ values has been used to calculate the NO_x value. As no Guideline Value Set (NGVS) for O₂, NO_x or CO₂ exists in current local laws. The rest of them have threshold limits according to Punjab Environmental Quality Standards (PEQS).

3.6 Inadequate illumination at the workplace

The illumination level monitoring was carried out to determine the status of light in different sections/areas. The measurement was done by lux meter (EXTECH, Color LED Light Meter LT-45). General and localized lighting were measured at the site. The section-wise light intensity was calculated as the average of the values taken at the workplace. The section-wise light intensity in glass and ceramics units is shown in Tables 5 & 6, respectively.

Table 5. Section-wise light intensity in the Glass sector

Sr. No	Department/Section	lux level	Sr. No	Department/Section	lux level
01.	Near furnace	39.0	11.	Cold end area	98.1
02.	Furnace control room	52.5	12.	Near Push & table machine	147.3
03.	Backside of furnace	46.0	13.	Warehouse loading area	233.5
04.	Monitoring room	80.3	14.	Overhead crane machine	205.0
05.	Tin bath area	106.3	15.	Printing hall	140.6
06.	Maintenance workshop	67.9	16.	Production hall	127.0
07.	Gas mixing room	31.8	17.	Packing hall	154.0
08.	E & I shift office	97.4	18.	Compressor hall	27.0
09.	C-Zone	18.2	19.	Batch hall	95.0
10.	Near Emergency crusher	97.4	20.	Furnace hall	228.7

Table 6. Section-wise light intensity in the Ceramics sector

Sr. No.	Departments/Sections	lux
1.	Cup handling and preparation	155.3
2.	Cup cleaning area	267.0
3.	Cup plate making area	125.0
4.	Cup glazing area	234.2
5.	Clay making area	71.0
6.	Cup handling and preparation area	50.0
7.	Cup dry area	212.6
8.	Cup finishing area	74.4
9.	Cup joint connecting area	50.3
10.	Cup glaze area	83.4
11.	Near glaze machine	35.3

According to section 19 (Lighting) of The Factories Act, 1934, (1) In every part of a factory where workers are working or passing, there shall be provided and maintained -(a) sufficient and suitable lighting, natural or artificial, or both; and (b) emergency lighting of special points in the work-room and passages to function automatically in case of a failure of the ordinary electric system. [11].

According to The Punjab Factories Rules, 1978 Lighting (Sections 19, 33-j) 39. (1) As long as any worker is present in a factory in latrines, passages, stairs, hoists, factory ground and other parts of the factory in so far as the entrance of the said places is not closed, shall be lighted in such manner that safety is fully secured in passing through or remaining in the same.

(2) (a) The general illumination over these interior posts of the factory where persons are regularly employed shall not be less than 6 feet candles measured in the horizontal place at a level of 3 feet above the floor; provided that in any such part in which the mounting height of the light sources for general illumination necessarily exceeds 25 feet measured from the floor or where the structure of the room or the position or construction of the fixed machinery of plant prevents the uniform attainment of this standard the general illumination at the said level shall be less than 3 feet candles, and where work is actually being done the illumination shall not be less than 8 feet candles or the greatest reasonably practicable illumination below 8 feet candles.[12]

The reference standard used is DIN which states the permissible limit for rough and bookkeeping /office work is 250 (lux) & 500 (lux), respectively, for eight hours work shifts [13].

3.7 Training on occupational safety and health under existing legislation

On-site training sessions were conducted for awareness about OSH. Workers, including management staff from various sections of the enterprise, actively participated in the sessions. Occupational hazards were highlighted and discussed during this activity. The main objectives of the training were prevention and control measures which are mandatory to mitigate/minimize the risk factors. It was emphasized during the training session that the use of required Personnel Protective Equipment's (PPEs), work permits, good housekeeping, periodic medical examination of the workers etc., were mandatory to avoid any possible hazard/accident at the workplace (**Annexure-I, Photo-IV**). The major topics discussed during on-site training sessions were as follow:

- Chemical safety at the workshop
- Machines guarding and accident investigation
- Ergonomics as a tool for enhancing productivity
- Fire prevention and fire fighting
- First aid and CPR
- Works in confined space
- Construction safety and electrical safety
- Compliance with national and international health safety and environment laws and standards.

4. Hazards Identification and Risk Assessment

The leading occupational safety and health hazards encountered during our visit to glass and ceramic manufacturing units were noise, chemicals, mechanical, musculoskeletal disorders, electrical and fire hazards. A brief detail of each identified hazard is given below (**Annexure-II**).

4.1 Noise Hazards

A high noise level was observed in different sections of glass and ceramics units. Workers were exposed to noise during glass and ceramic manufacturing. During noise testing, a high noise level in Cold End Area, Near Push and Table Machine, Furnace Area, Gas Mixing Room, C-Zone, Near Emergency Crusher, And Overhead Crane Machine were observed. **(Annexure-II, Photo-I).**

4.2 Chemical Hazards

Storage of hazardous chemicals was observed in the Chemicals and Diesel Storage Area. Insufficient ventilation was observed in the Diesel Storage Area. In addition, workers were exposed to chemicals during chemical polishing and matting of glass surfaces, sulfuric acid and hydrofluoric acid. **(Annexure-II, Photo-II).**

4.3 Mechanical Hazards

Unguarded machine and power transmission apparatus were observed in Plant Areas, Conveyor Belt and Roller Section. **(Annexure-II, Photo-III).**

4.4 Musculoskeletal Disorders

Awkward postures and body movements such as bending, forcing, repetitive and twisting motion during work in Packing, Loading and Unloading and Monitoring Areas. Poor manual handling was observed during the shifting of materials. The activities include lifting, pushing, pulling, and carrying material by hand. It can cause musculoskeletal disorders (MSDs) such as pain, injuries to arms, legs, joints and strain among workers. **(Annexure-II, Photo-IV).**

4.5 Provision of PPE

It was noted that workers were performing their work without PPEs. They were in loose clothing and without safety shoes. Workers must be provided with uniforms and PPEs. **(Annexure-II, Photo-V).**

4.6 Electric Hazards

Electrical hazards were observed in different sections of the industries. Electrical wires and switch sockets were kept in bad condition. Most of the electrical cables were seen without any insulation, and the cable trays were found corroded that may cause short circuits, electrical fire, electric shock and electrocution **(Annexure-II, Photo-VI).**

4.7 Fire Hazards

Fire hazards were observed in Float Unit 1, Mirrors Plant, White Sand Area, Mechanical Workshop, And Conveyer Belt Sections. During the glass manufacturing process, fire may occur due to lubricating oils and combustible binders near glass furnaces at high temperatures. This can cause explosions, burns and serious injuries or even fatalities if not appropriately handled. In addition, any electrical short circuit may lead to a fire in LPG Cylinders Storage Area. **(Annexure-II, Photo-VII).**

Furthermore, emergency exits in different enterprise sections were blocked by objects, such as packing boxes, products, rolling carts, metal bars, portable ladders, and waste materials. Some of the fire extinguishers were either expired, empty or out of order due to corrosion. **(Annexure-II, Photo-VIII).**

4.7.1 Legal Provision Related to Fire in The Factories Act, 1934, Section 25:

(3) In every factory, the doors affording exit from any room shall not be locked or fastened so that they can be easily and immediately opened from inside while any person is within the room, and all such doors, unless they are of the sliding type, shall be constructed to open outwards or where the door is between two rooms, in the direction of the nearest exit from the building and such door shall not be locked or obstructed while work is being carried on in the room and shall at all times be kept free from any obstruction.

(4) In every factory, every window, door, or other exit affording means of escape in case of fire, other than means of exit in ordinary use, shall be distinctively marked in a language understood by the majority of the workers and in red letters of adequate size or by some other effective and clearly understood sign.

(7) In every factory wherein more than ten workers are ordinarily employed in any place above the ground floor, or explosive or highly inflammable materials are used or stored, effective measures shall be taken to ensure that all the workers are familiar with the means of escape in case of fire and have been adequately trained in the routine to be followed in such case. [14]

4.8 Inadequate Lighting

Poor lighting was observed in some sections of the enterprise, mainly Furnace Area, Furnace Control Room, Monitoring Room, Tin Bath Area, Maintenance Workshop, Gas Mixing Room, C-Zone, Near Emergency Crusher, Cold End Area, Near Push and Table Machine, Cup handling and Preparation, Cup Plate Making Area, Cup Glazing Area, And in Clay Making Areas.

(Annexure-II, Photo-IX).

4.9 Slip, Trip and Fall Hazards

Slips, trips, and falls hazards at the workplace were observed due to poor housekeeping and the wet and oily floor. **(Annexure-II, Photo-X).**

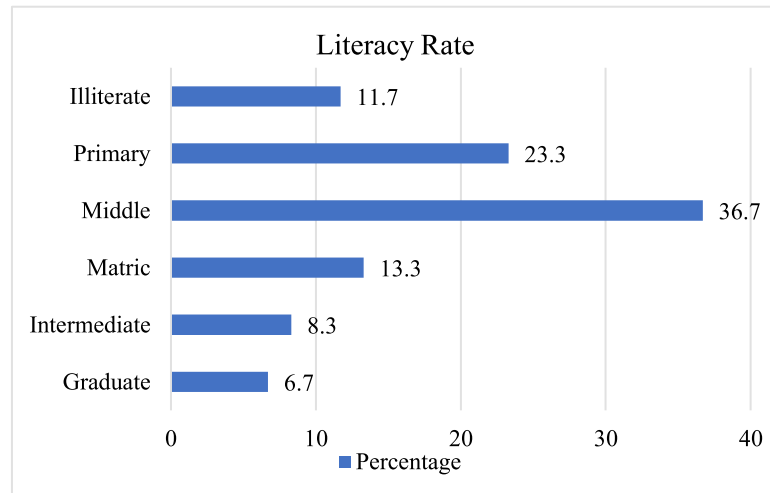
5. Demographics

5.1 Gender Disparity

100% of workers in the glass and ceramic sectors were male.

5.2 Workers Literacy Rate

The literacy level of glass and ceramics sector workers is not very encouraging as data collected shows 11.7% were illiterate, 23.3% of workers were primary, 36.7% middle, 13.3% matric, 8.3% intermediate, 6.7% were graduates.



5.3 Religion and Ethnicity

If we look at the cultural status of workers, it showed that 100% of workers were Muslim. 93.3% were Punjabi while the rest of them were Pathan.

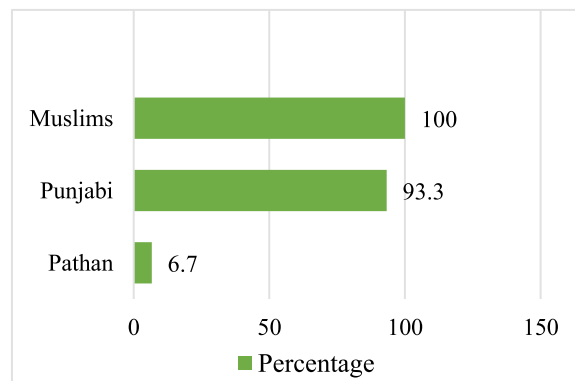
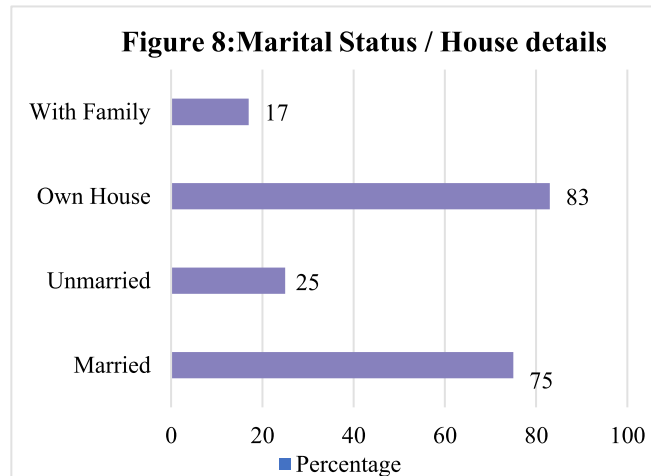


Figure 7: Religion & Ethnicity

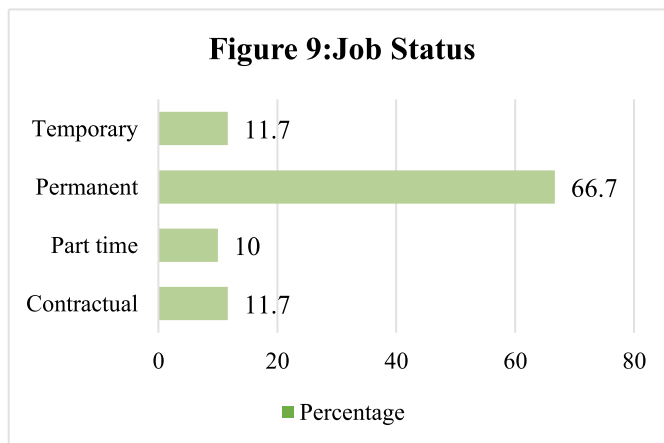
5.4 Marital Status & House details

The marital status of workers showed that 75% of workers were married, and 25% were unmarried. In addition, 83% of workers live in personal residences, and 17% live with their families.



5.5 Workers Job Status

The workers’ job status showed that 66% of workers were working on a permanent basis, 12% temporary, 10% part-time, and 12% were on a contractual mode of job.



5.6 Worker’s Wage

The wages status of workers and other staff showed that 68.3% had wages between Rs.10,000 to Rs. 19,999, 30% had wages between Rs. 20,000 to Rs. 49,999 while 1.7% of selected workers did not respond.

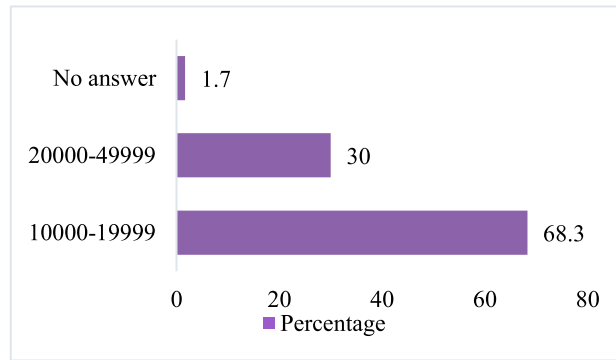


Figure 10: Workers wages (Rs.)

5.7 PPE's Compliance by Workers

When asked about the availability of appropriate personal protective equipment in the establishment, most employees (72%) reported they had PPEs, and 28% said they didn't.

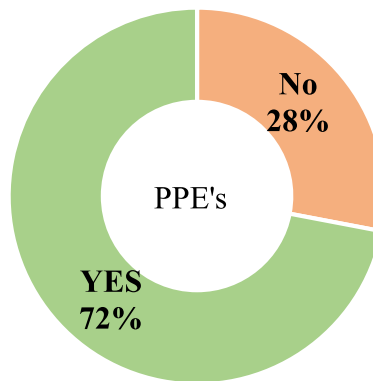


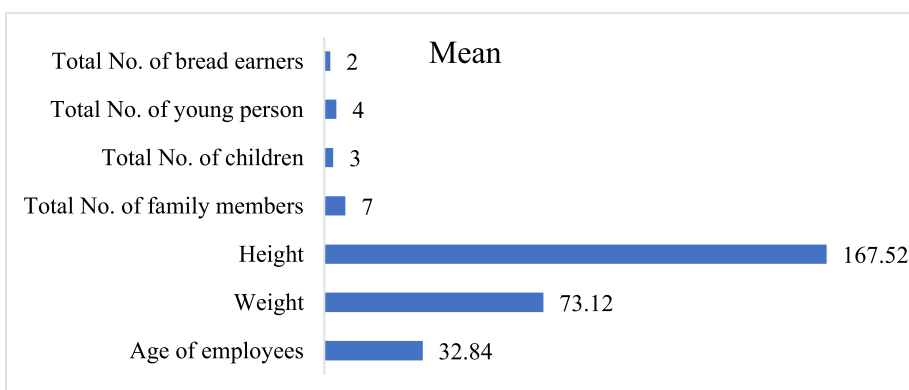
Figure 11: PPEs

5.8 Workers personnel information

Other socio-demographic data of workers showed that the minimum and maximum age of workers were 18 and 62 years. The weight and height of workers ranged from 45 kg to 177 kg and 152 cm to 183 cm, respectively. The total number of family members ranged from 2 to 14 persons while children from 0 to 7, and the total number of young persons from 2 to 10. In addition, bread earners were 1 to 6 individuals per family.

Table 7. Descriptive Statistics

	Minimum	Maximum	Mean
Age of Employee	18	62	32.84
Weight	45	177	73.12
Height	152	183	167.52
Total No. of a family member	2	14	7
Total No. of children's	0	7	3
Total No. young persons	2	10	4
No. of bread earners	1	6	2

**Figure 12: Workers personnel information**

5.9 Effect of occupational work activities on workers' health

Data related to occupational site work activities' effect on workers' health was collected and graphically presented in **Figure 13**. As self-reported by workers, it was noted that musculoskeletal disorders (MSD) were observed in workers based on their activities. Musculoskeletal disorders (MSD) are injuries or disorders of the muscles, nerves, tendons, joints, cartilage, and spinal discs. The graph shows that 9.8% of workers were aware that they had a musculoskeletal issue, 6.1% had back injuries, 8.5% had weakness in arms or legs, 7.3 % had backache, 12.2% felt difficulty in moving arms and legs, 7.3% experienced stiffness while leaning, 8.5% had difficulty in Up-down head movement, 6.1% had difficulty in moving head side-to-side. In addition, around 6.1% felt difficulty in squatting, 6.1% had lower limb issues, 8.5% had difficulty climbing stairs while carrying a load of more than 12kg, and 7.3% had a muscle-skeletal problem when using a mask.

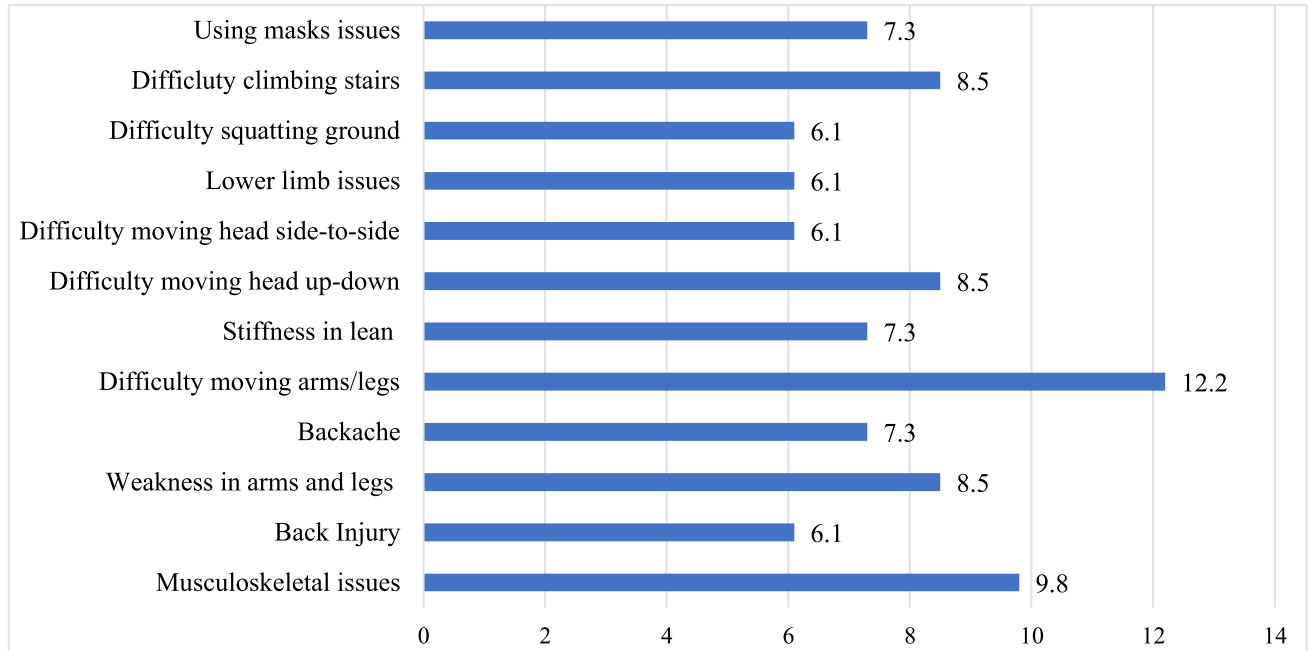


Figure 13: Musculoskeletal Disorders

5.10 Effect of Dust, Smoking and Chemical Exposure on Worker's Health

During interaction with site workers, the data related to their occupational health was collected and presented in **Figure 14**. As self-reported by workers, it was noted that ~53% of the workers were exposed to different concentration levels of dust at the worksite. In addition, ~26% were addicted to smoking, while ~10% were exposed to various chemical exposures during their routine work activities. Based on these facts, it was found that ~5% of the workers had cough and breathlessness during the walk, 2.4% had a history of asthma. However, Phlegm, wheezy, and chest infection conditions were not conveyed by any site workers.

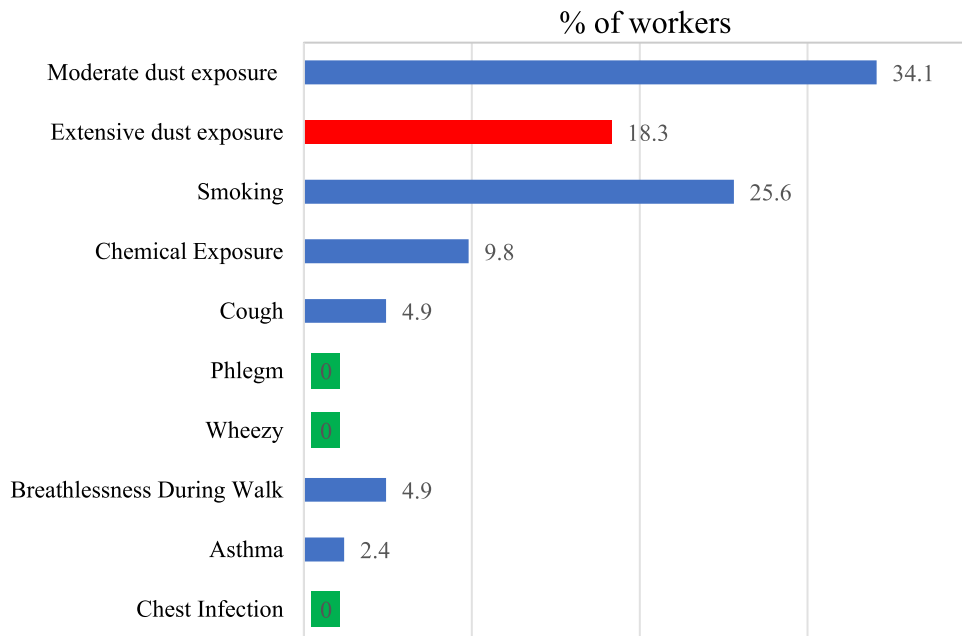


Figure 14: Effect of Dust, Smoking and Chemical Exposure on Worker's Health

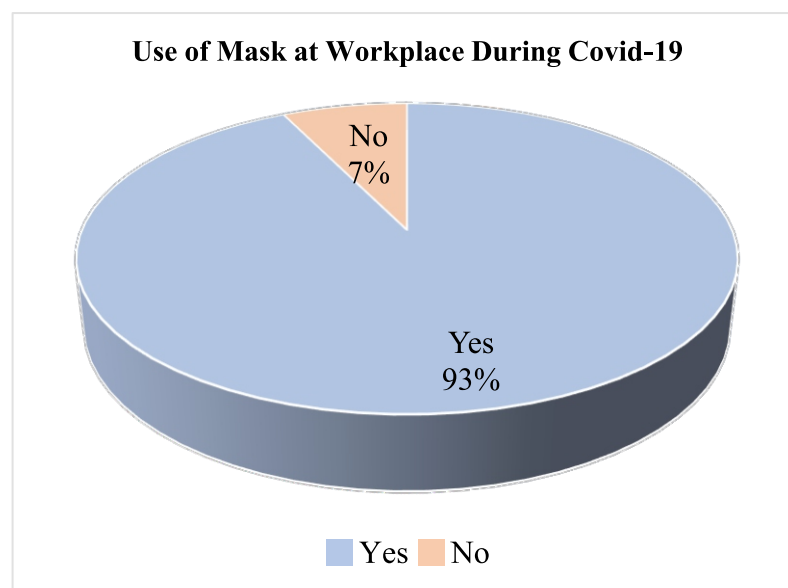
6. About COVID-19

The COVID-19 pandemic has changed the world. As the science revealed that the COVID-19 virus was spreading via airborne droplets, public health and safety and health experts recommended the use of face coverings or respirators when around other people. COVID-19, which started in 2020 and is continuing into 2021, the SAA Centre for the Improvement of Working Conditions & Environment (SAACIWCE), Directorate General Labour Welfare Punjab, Labour & Human Resource Department received multiple requests for COVID-19 related trainings and follow-ups of standard operating procedures and performed several compliance assistance activities on respiratory protection at workplaces. As a result, SAACIWCE provided valuable information about occupational safety and health, risk assessment activities and personal protection to groups of employers, workers, and future workers during the pandemic.

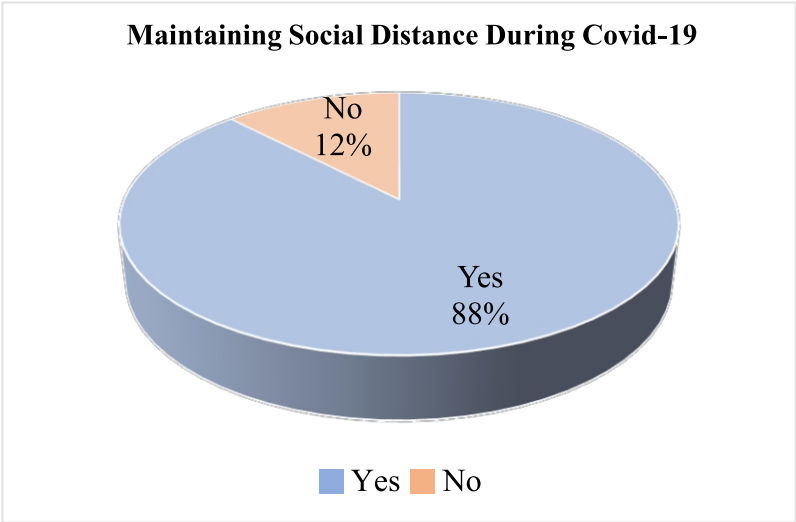
It is the obligation of the employers, workers, and their organizations to collaborate with health authorities to prevent and control COVID-19. Cooperation between management and workers and their representatives is essential for workplace-related prevention measures. Workers are responsible for following measures for occupational safety and health, infection prevention and control established for their workplace, and participating in training provided by the employer. Workers should immediately report to their supervisor any situation which may present an imminent and severe danger to their life or health. Even workers have the right to remove themselves from any workplace that they reasonably believe presents an imminent and serious threat to their life or health and should be protected from any undue consequences as a result of exercising this right (POSH Act 2019).

The pandemic has severely hampered the risk assessment activities on OSH during the field visits while maintaining the day-to-day guidelines issued by the Primary and Secondary Health Care Department, Government of the Punjab in accordance with the National Command Operation Centre (NCOC). During the OSH risk assessment activity, some questions related to the COVID-19 were also incorporated into the questionnaire. Analysis of the data showed that in the Glass & Cermaics sector, as handwashing facilities were provided to the workers, on average, every worker washed their hands eight times daily. In these times of the pandemic, wearing a mask at the workplace is mandatory.

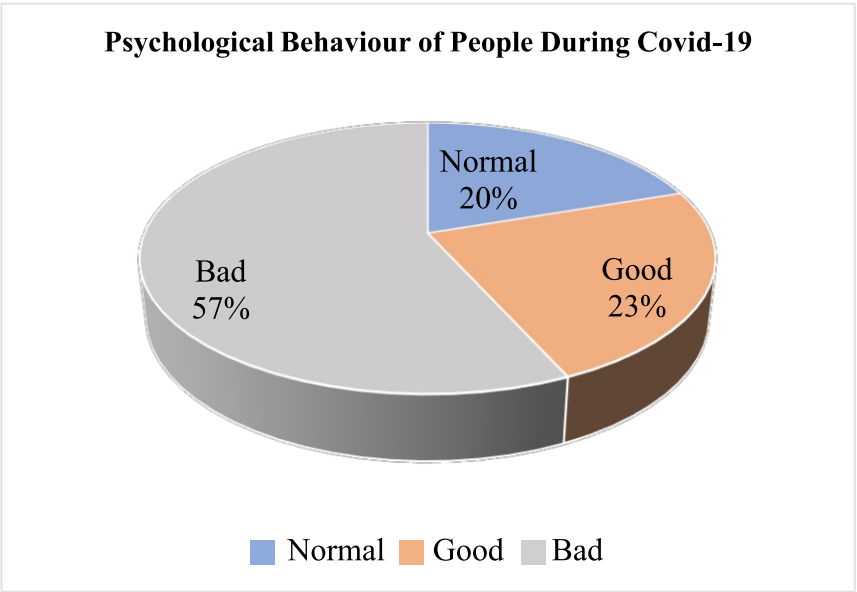
Around 93% of workers responded they were using a mask at the workplace. An average of Rs.550/- per month was being spent on purchasing them by the employer.



The data showed that around 88% of the workers and their co-workers maintained social distancing while at work. By applying statistical tools on the data, it was evident that the respiratory problems among the workers were more who were repeatedly using the mask due to non-availability of sufficient financial resources or carelessness in using them. These results are in agreement with the research studies conducted by the University of Health Sciences Lahore.



Workers were asked about the psychological behaviour during the covid-19 times. 23% of the workers responded to the behaviour as good, 20% normal, while 57% bad.



7. Recommendations.

- Use wet silica so that all dust produced from different operations will mix thoroughly with water without entering into the air.
- Take all necessary measures to avoid any fire hazard in the enterprise. Fire safety signs, no smoking signs must be installed. Cardon off the area and fire extinguishers & fire hydrants system need to be installed.
- Provides adequate emergency exits in all sections of the enterprise. The absence of exits can cause people to be trapped in case of a fire emergency.
- Use the correct cable connectors and electrical cable ducting. Damaged Cable trays must be replaced. Electric wires must be routed adequately through cable trays.
- Diagnosing the time generated silica dust and planning to eliminate or control the Dust at the source and use of engineering controls such as local ventilation (dust collector) and making wet methods to prevent releasing dust and routine maintenance of dust control systems to optimize their function.
- Surrounding type fixed guard must be installed around conveyor belts/rollers.
- All components of mechanical systems which transmit energy, including flywheels, pulleys, belts, connecting rods, coupling, spindles, chains, and gears, must be guarded.
- During service/maintenance activity Lockout/Tagout (LOTO) system needs to be implemented.
- Preventive maintenance and inspection system must be implemented for machines/equipment/electrical appliances.
- Heat stress monitoring must be ensured regularly to protect workers from high-temperature exposure in the Furnace section. Engineering control measures must be adopted. Safety signboards must be posted in all sections of the enterprise.
- Confined space entry protocol must be fulfilled. Awareness about work permits, risk assessment, approvals, night shift permits, and cover your underground water storage tank with lid or cordon off that area.
- Proper usage of PPEs should be made mandatory for every worker.
- Cleaning materials or equipment in a manner that does not cause to release particles into the air and should be cleaned by the wet cleaners or water hose.

- Height-adjustable stools must be ensured with back and footrest for the workers. In addition, sturdy ergonomic chairs must be provided for the employees in the identified section.
- Audiometry test of workers indicates that some of the workers have slight to severe hypoacusia during their ear testing. A medical doctor must properly check those workers for further medical treatment
- Spirometry tests of workers showed that some of the workers have mild to very severe respiratory problems that may be due to smoking or exposure to dust/chemicals. A pulmonologist should properly check such workers
- Conduct regular safety meetings, training and drills.
- Implement an Emergency action plan and regular safety training at worksites.
- Create case management procedures when injuries happen to reduce time lost and hasten recovery
- Establish reporting procedures for unsafe behaviours. Document and analyze near misses.
- Follow proper guidelines, safety standards & local laws to implement and establish a safe work environment for worksites.
- Periodic training of workforce Labour is mandatory to spread continuous awareness about occupational safety and health.
- Periodic health/medical checkup is obligatory for all workers regularly.
- Regular maintenance and Inspection for equipment are mandatory. Keep proper equipment maintenance records.

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Annexure-I

Glimpses of risk assessment activity during on-site Testing



Photo I. Audiometry Testing



Photo II. Monitoring of Total Dust



Photo III. Spirometry Testing



Photo IV. Training on OSH

Annexure-II

Glimpses During Risk Assessment



Photo I. Noise Testing



Photo II. Chemical Storage Area



Photo III. Unguarded Conveyor Belts



Photo IV. Awkward postures of working



Photo V. Workers working without PPEs



Photo VI. Cables without proper trays



Photo VII. Fire hazard in LPG cylinders area



Photo VIII. Emergency Exit were locked



Photo IX. Inediquate lighting



Photo X. Fall hazards

Annexure-III**Risk Assessment Checklists (Fire Safety)**

Enterprise name: _____

Date _____

Sr #	Hazard identification	Yes	No	Remarks
1	Have you identified all potential ignition sources?			
2	Have you identified all potential fuel sources?			
3	Are the LPG and flammable chemicals on-site stored safely?			
4	Have you carried out a fire drill recently?			
5	Is the boiler room free from flammable and combustible materials?			
6	Is all waste kept to a minimum and away from the buildings?			
7	Do you have an emergency plan with complete details?			
8	Are portable heaters safely used on-site with adequate ventilation?			
9	If smoking is allowed and restricted to a safe, designated area on-site?			
10	Are safety signs and equipment regularly checked & maintained at the workplace?			
11	Are all fire doors, escape routes, and associated lighting and signs checked regularly?			
12	Are all fire detectors of the right type and in appropriate locations?			
13	Can the means of warning be cleared, heard and understood by everyone throughout the whole building when initiated from a single point?			
14	If a fire detection and firefighting system is electrically powered, does it have backup power?			
15	Are the right types of extinguishers located close to the fire hazards and can users get to them without exposing themselves to risk?			
16	Are fire extinguishers mounted at a reasonable height and kept clear from obstructions.			
17	Do you regularly check the equipment provided to help maintain the escape routes?			
18	Is a warning sign posted at each lift station (on each floor) indicating "Do Not Use the Lift for Evacuation During A Fire"?			
19	Did training provide to employees on the importance of an emergency evacuation plan?			
20	Do the employees have an emergency assembly area point outside?			

Name & Designation of Assessor _____

ATS-DLD-78-A
ADULT QUESTIONNAIRE - SELF COMPLETION
(for those 13 years of age and older)

Thank you for your willingness to participate. You were selected by a scientific sampling procedure, and your cooperation is very important to the success of this study.

This is a questionnaire you are asked to fill out. Please answer the questions as frankly and accurately as possible. ALL INFORMATION OBTAINED IN THE STUDY WILL BE KEPT CONFIDENTIAL AND USED FOR MEDICAL RESEARCH ONLY. Your personal physician will be informed about the test results if you desire.

IDENTIFICATION

IDENTIFICATION NUMBER: #####

NAME: _____
(Last)
(First)
(MI)

STREET _____

CITY _____ STATE _____ ZIP _____

PHONE NUMBER: () _____ - _____

INTERVIEWER: ###

DATE: _____
MO
DAY
YR
=====

1. BIRTHDATE: _____
Month
Day
Year

2. Place of Birth: _____

3. Sex:

1. Male _____
 2. Female _____

4. What is your marital status?

1. Single _____
 2. Married _____
 3. Widowed _____
 4. Separated/Divorced _____

5. Race:

1. White _____
 2. Black _____
 3. Oriental _____
 4. Other _____

6. What is the highest grade completed in school? _____
 (For example: 12 years is completion of high school)

SYMPTOMS

These questions pertain mainly to your chest. Please answer yes or no if possible. If a question does not appear to be applicable to you, check the does not apply space. If you are in doubt about whether your answer is yes or no, record no.

COUGH

7A. Do you usually have a cough? 1. Yes ____ 2. No ____
 (Count a cough with first smoke or on first going out-of-doors. Exclude clearing of throat.)[If no, skip to question 7C.]

B. Do you usually cough as much as 4 to 6 times a 1. Yes ____ 2. No ____

day, 4 or more days out of the week?

C. Do you usually cough at all on getting up, or first thing in the morning? 1. Yes ____ 2. No ____

D. Do you usually cough at all during the rest of the day or at night? 1. Yes ____ 2. No ____

IF YES TO ANY OF THE ABOVE (7A, 7B, 7C, OR 7D), ANSWER THE FOLLOWING:
IF NO TO ALL, CHECK DOES NOT APPLY AND SKIP TO 8A.

E. Do you usually cough like this on most days for 5 consecutive months or more during the year? 1. Yes ____ 2. No ____
8. Does not apply ____

F. For how many years have you had this cough? _____
Number of years
88. Does not apply ____

=====

PHLEGM

8A. Do you usually bring up phlegm from your chest? 1. Yes ____ 2. No ____
(Count phlegm with the first smoke or on first going out-of-doors. Exclude phlegm from the nose. Count swallowed phlegm)
[If no, skip to 8C.]

B. Do you usually bring up phlegm like this as much as twice a day, 4 or more days out of the week? 1. Yes ____ 2. No ____

C. Do you usually bring up phlegm at all on getting up or first thing in the morning? 1. Yes ____ 2. No ____

D. Do you usually bring up phlegm at all during the rest of the day or at night? 1. Yes ____ 2. No ____

IF YES TO ANY OF THE ABOVE (8A, B, C, OR D),
ANSWER THE FOLLOWING:
IF NO TO ALL, CHECK DOES NOT APPLY AND SKIP TO 9A.

E. Do you bring up phlegm like this on most days for 3 consecutive months or more during the year? 1. Yes ____ 2. No ____
8. Does not apply ____

F. For how many years have you had trouble with phlegm? _____
Number of years
88. Does not apply ____

=====

EPISODES OF COUGH AND PHLEGM

9A. Have you had periods or episodes of (increased*) cough and phlegm lasting for 3 weeks or more each year? 1. Yes ____ 2. No ____
*(For individuals who usually have cough and/or phlegm)

IF YES TO 9A:

B. For how long have you had at least 1 such episode per year? _____
Number of years
88. Does not apply ____

WHEEZING

10A. Does your chest ever sound wheezy or whistling:

- | | |
|-----------------------------------|------------------------|
| 1. When you have a cold? | 1. Yes ____ 2. No ____ |
| 2. Occasionally apart from colds? | 1. Yes ____ 2. No ____ |
| 3. Most days or nights? | 1. Yes ____ 2. No ____ |

IF YES TO 1, 2, OR 3 IN 10A:

B. For how many years has this been present?

____ Number of years
88. Does not apply ____

11A. Have you ever had an ATTACK of wheezing that has made you feel short of breath?

1. Yes ____ 2. No ____

IF YES TO 11A:

B. How old were you when you had your first such attack?

____ Age in years
88. Does not apply ____

C. Have you had 2 or more such episodes?

1. Yes ____ 2. No ____
8. Does not apply ____

D. Have you ever required medicine or treatment for the(se) attack(s)?

1. Yes ____ 2. No ____
8. Does not apply ____

=====

BREATHLESSNESS

12. If disabled from walking by any condition other than heart or lung disease, please describe and proceed to Question 14A.

Nature of condition(s): _____

13A. Are you troubled by shortness of breath when hurrying on the level or walking up a slight hill?

1. Yes ____ 2. No ____

IF YES TO 13A:

B. Do you have to walk slower than people of your age on level because of breathlessness?

1. Yes ____ 2. No ____
8. Does not apply ____

C. Do you ever have to stop for breath when walking at your own pace on the level?

1. Yes ____ 2. No ____
8. Does not apply ____

D. Do you ever have to stop for breath after walking about 100 yards(or after a few minutes) on the level?

1. Yes ____ 2. No ____
8. Does not apply ____

E. Are you too breathless to leave the house or breathless on dressing or undressing?

1. Yes ____ 2. No ____
8. Does not apply ____

=====

CHEST COLDS AND CHEST ILLNESSES

14A. If you get a cold, does it usually go to your chest? (Usually means more than 1/2 the time)

1. Yes ____ 2. No ____
8. Don't get colds ____

15A. During the past 3 years, have you had any chest illnesses that have kept you off work, indoors at home, or in bed?

1. Yes ____ 2. No ____

IF YES TO 15A:

- B. Did you produce phlegm with any of these chest illnesses? 1. Yes ____ 2. No ____
8. Does not apply ____
- C. In the last 3 years, how many such illnesses, with (increased) phlegm, did you have which lasted a week or more? ____ Number of illnesses
____ No such illnesses
____ Does not apply

=====

PAST ILLNESSES

16. Did you have any lung trouble before the age of 16? 1. Yes ____ 2. No ____
17. Have you ever had any of the following:
- 1A. Attacks of Bronchitis? 1. Yes ____ 2. No ____
- IF YES TO 1A:
- B. Was it confirmed by a doctor? 1. Yes ____ 2. No ____
8. Does not apply ____
- C. At what age was your first attack? ____ Age in years
88. Does not apply ____
- 2A. Pneumonia (include bronchopneumonia)? 1. Yes ____ 2. No ____
- IF YES TO 2A:
- B. Was it confirmed by a doctor? 1. Yes ____ 2. No ____
8. Does not apply ____
- C. At what age did you first have it? ____ Age in years
88. Does not apply ____
- 3A. Hayfever? 1. Yes ____ 2. No ____
- IF YES TO 3A:
- B. Was it confirmed by a doctor? 1. Yes ____ 2. No ____
8. Does not apply ____
- C. At what age did it start? ____ Age in years
88. Does not apply ____
- 18A. Have you ever had chronic bronchitis? 1. Yes ____ 2. No ____
- IF YES TO 18A:
- B. Do you still have it? 1. Yes ____ 2. No ____
8. Does not apply ____
- C. Was it confirmed by a doctor? 1. Yes ____ 2. No ____
8. Does not apply ____
- D. At what age did it start? ____ Age in years
88. Does not apply ____
- 19A. Have you ever had emphysema? 1. Yes ____ 2. No ____
- IF YES TO 19A:
- B. Do you still have it? 1. Yes ____ 2. No ____
8. Does not apply ____
- C. Was it confirmed by a doctor? 1. Yes ____ 2. No ____
8. Does not apply ____
- D. At what age did it start? ____ Age in years
88. Does not apply ____
- 20A. Have you ever had asthma? 1. Yes ____ 2. No ____

IF YES TO 20A:

B. Do you still have it? 1. Yes ___ 2. No ___
8. Does not apply ___

C. Was it confirmed by a doctor? 1. Yes ___ 2. No ___
8. Does not apply ___

D. At what age did it start? ___ Age in years
88. Does not apply ___

E. If you no longer have it, at what age did it stop? ___ Age stopped
88. Does not apply ___

21. Have you ever had:

A. Any other chest illnesses? 1. Yes ___ 2. No ___
If yes, please specify _____

B. Any chest operations? 1. Yes ___ 2. No ___
If yes, please specify _____

C. Any chest injuries? 1. Yes ___ 2. No ___
If yes, please specify _____

22A. Has doctor ever told you that you had heart trouble? 1. Yes ___ 2. No ___

IF YES to 22A:

B. Have you ever had treatment for heart trouble in the past 10 years? 1. Yes ___ 2. No ___
8. Does not apply ___

23A. Has a doctor ever told you that you have high blood pressure? 1. Yes ___ 2. No ___

IF YES to 23A:

B. Have you had any treatment for high blood pressure (hypertension) in the past 10 years? 1. Yes ___ 2. No ___
8. Does not apply ___

=====

OCCUPATIONAL HISTORY

24A. Have you ever worked full time (30 hours per week or more) for 6 months or more? 1. Yes ___ 2. No ___

IF YES to 24A:

B. Have you ever worked for a year or more in any dusty job? 1. Yes ___ 2. No ___
8. Does not apply ___

Specify job/industry: _____ Total years worked ___
Was dust exposure 1. Mild ___ 2. Moderate ___ 3. Severe ___ ?

C. Have you ever been exposed to gas or chemical fumes in your work? 1. Yes ___ 2. No ___
8. Does not apply ___

Specify job/industry: _____ Total years worked ___
Was dust exposure 1. Mild ___ 2. Moderate ___ 3. Severe ___ ?

D. What has been your usual occupation or job -- the one you have worked at the longest?

1. Job-occupation: _____
2. Number of years employed in this occupation: _____
3. Position-job title: _____
4. Business, field, or industry: _____

=====

TOBACCO SMOKING

- 25A. Have you ever smoked cigarettes? (NO means less than 20 packs of cigarettes or 12 oz. of tobacco in a lifetime or less than 1 cigarette a day for 1 year. 1. Yes ____ 2. No ____

IF YES to 25A:

- B. Do you now smoke cigarettes (as of 1 month ago)? 1. Yes ____ 2. No ____
88. Does not apply ____
- C. How old were you when you first started reg- ____ Age in Years
cigarette smoking? 88. Does not apply ____
- D. If you have stopped smoking cigarettes com- ____ Age stopped
pletely, how old were you when you stopped? Check if
still smoking ____
88. Does not apply ____
- E. How many cigarettes do you smoke per day now? ____ Cigarettes/day
88. Does not apply ____
- F. On the average of the entire time you smoked, ____ Cigarettes/day
how many cigarettes did you smoke per day? 88. Does not apply ____
- G. Do or did you inhale the cigarette smoke? 1. Does not apply ____
2. Not at all ____
3. Slightly ____
4. Moderately ____
5. Deeply ____

- 26A. Have you ever smoked a pipe regularly? 1. Yes ____ 2. No ____
(YES means more than 12 oz tobacco in a lifetime.)

IF YES to 26A:

- B1. How old were you when you started to ____ Age
smoke a pipe regularly?
2. If you have stopped smoking a pipe com- ____ Age stopped
pletely, how old were you when you stopped? Check if still
smoking pipe ____
88. Does not apply ____
- C. On the average over the entire time you ____ oz per week (a stan-
smoked a pipe, how much pipe tobacco did dard pouch of tobacco con-
you smoke per week ? tains 1 1/2 oz)
88. Does not apply ____
- D. How much pipe tobacco are you smoking now? ____ oz per week
88. Not currently smoking a pipe ____
- E. Do or did you inhale the pipe smoke? 1. Never smoked ____
2. Not at all ____
3. Slightly ____
4. Moderately ____
5. Deeply ____

- 27A. Have you ever smoked cigars regularly? 1. Yes ____ 2. No ____
(Yes means more than 1 cigar a week for a year).

IF YES to 27A:

- B1. How old were you when you started smoking cigars regularly? _____ Age
2. If you have stopped smoking cigars completely, how old were you when you stopped? _____ Age stopped
Check if still smoking cigars _____
88. Does not apply _____
- C. On the average over the entire time you smoked cigars, how many cigars did you smoke per week? _____ Cigars per week
88. Does not apply _____
- D. How many cigars are you smoking per week now? _____ Cigars per week
88. Check if not smoking cigars currently _____
- E. Do or did you inhale the cigar smoke?
1. Never smoked _____
2. Not at all _____
3. Slightly _____
4. Moderately _____
5. Deeply _____

=====

FAMILY HISTORY

28. Were either of your natural parents ever told by a doctor that they had a chronic lung condition such as:

	FATHER			MOTHER		
	1. YES	2. NO	3. DON'T KNOW	1. YES	2. NO	3. DON'T KNOW
A. Chronic bronchitis?	_____	_____	_____	_____	_____	_____
B. Emphysema?	_____	_____	_____	_____	_____	_____
C. Asthma?	_____	_____	_____	_____	_____	_____
D. Lung cancer?	_____	_____	_____	_____	_____	_____
E. Other chest conditions?	_____	_____	_____	_____	_____	_____

- 29A. Is parent currently alive?

B. Please Specify:

_____ Age if living	_____ Age if living
_____ Age at death	_____ Age at death
8. Don't know _____	8. Don't know _____

C. Please specify cause of death.

چیک لسٹ (خطرہ تشخیص) برائے طبعی خطرات

نام فیکٹری _____

تاریخ _____

نمبر شمار	سوال	ہاں	نہیں	عملی اقدامات
1.	کیا دھول، دھواں وغیرہ جائے کار پر موجود ہیں اور ان پر قابو پانے کے لیے مناسب اقدامات کیے گئے ہیں؟			
2.	کیا تمام کام کی جگہیں و کمرے صاف ستھرے اور منظم ہیں اور فاضل مادوں کو ٹھکانے لگانے کے لیے موثر اقدامات کیے گئے ہیں؟			
3.	کیا جائے کار پر ایسے مقامات ہیں۔ جہاں مسلسل آواز کی حد 85 ڈی بی (اے) سے زیادہ ہے؟			
4.	کیا شور کی شدت کو کم کرنے کے لیے تکنیکی و انتظامی کنٹرول کا استعمال کیا گیا ہے؟			
5.	کیا کارکنان کو جائے کار پر زیادہ درجہ حرارت / نمی کا سامنا ہے اور ہوا کے گزران کا مناسب انتظام ہے؟			
6.	کیا جائے کار پر کارکنان کو شدید گرمی / نمی سے بچائو کے لیے ٹھنڈے مشروبات اور سایہ دار جگہیں مہیا ہیں؟			
7.	کیا تمام کام کی جگہیں روشن ہیں۔ اور روشنی کام کی مناسبت سے موزوں ہے؟			
8.	کیا کارکنان کا ملازمت سے قبل سالانہ طبعی معائنہ تعلیم یافتہ معالج سے کروایا جاتا ہے؟			
9.	کیا کارکنان کو جائے کار پر ذاتی حفاظتی سامان میسر ہے اور ان کو اس کی مناسب استعمال اور دیکھ بھال کی تربیت دی گئی ہے؟			
10.	کیا کام سے متعلق حفاظتی ہدایات نافذ / آویزاں ہیں؟			
11.	کیا حادثات کی تحقیقات اور تفتیش کا نظام نافذ ہے؟			
12.	کیا خطرناک کام کرنے سے قبل اس کا اجازت نامہ (Work permit) لینا ضروری ہے؟			
13.	کیا حفاظتی پوسٹرو سائن جائے کار پر آویزاں ہیں؟			

نام آفیسر بمعہ عہدہ _____



**Under ADP Scheme “Capacity Building of Occupational Safety and Health (OSH)
Regime to Promote Safer Working Conditions at Workplaces”**

Centre for the Improvement of Working Conditions & Environment

Directorate General Labour Welfare Punjab

Labour & Human Resource Department Government of the Punjab

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