NFSSM Alliance

MAINSTREAMING OCCUPATIONAL HEALTH & SAFETY IN FSSM SECTOR

Recommendations and way forward

ABOUT NFSSM ALLIANCE

This study was conducted under the aegis of the National Faecal Sludge and Septage Management Alliance (NFSSM Alliance), which was convened in January 2016 with support of the Bill and Melinda Gates Foundation with the mandate to build consensus and drive the discourse on Faecal Sludge and Septage Management (FSSM) forward in India. While addressing the massive challenge of safe storage, collection, transport, treatment and reuse of human waste, the NFSSM Alliance works towards inclusive and safely managed urban sanitation. It aspires to build an enabling environment to scale FSSM in India, accelerating progress towards universal access to safely managed and affordable water and sanitation. The NFSSM Alliance, in collaboration with the Ministry of Housing and Urban Affairs (MoHUA) and the Department of Drinking Water and Sanitation (DWS) under the Ministry of Jal Shakti, works on all aspects of faecal sludge management across the sanitation value chain.

This project was undertaken by the NFSSM Alliance with an objective to mainstream personal protective equipment in the FSSM sector focussing emptying, conveyance and treatment part of the sanitation service chain. As a part of this project, hazard identification and risk analysis were performed on the task – desludging of septic tank using cesspool vehicle. Along with this a survey was done in order to understand the perception of hazards and safety measures. It is inferred that personal protective equipment is the last line of defence and are rendered ineffective without applying higher order of control measures. In order to address the issue holistically, this document presents the recommendations and way forward for “Mainstreaming Occupational Health and Safety in FSSM sector”.

May, 2020

NFSSM Alliance

This research study was conducted by the National Faecal Sludge and Septage Management Alliance, India.

Special thanks to the members of the Innovation and Technology Taskforce of the NFSSM Alliance for providing valuable support during the project period.

This report has been drafted by:

saniverse environmental solutions

ACKNOWLEDGEMENT

The project would not have been complete without the support of the sanitation workers, their employers and experts surveyed and interviewed. Their responses provided an opportunity to find the root cause of challenges in adoption of occupational health and safety in sanitation sector. A special thanks to all the quality, health, safety & environment consultants and experts from various industries who provided insights. The responses from the surveys and the insights from the experts played pivotal role in drafting the recommendations for mainstreaming Occupational Health and Safety in Faecal Sludge and Septage Management sector.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

ABBREVIATIONS

BIS	Bureau of Indian Standards
BBS	Behaviour Based Safety
CBO	Community Based Organization
COVID 19	Corona Virus Disease 2019
FSSM	Faecal Sludge and Septage Management
FSTP	Faecal sludge and Septage Treatment Plant
GoI	Government of India
HIRA	Hazard Identification and Risk Analysis
IEC	Information, Education and Communication
ISO	International Organization for Standardization
NFSSM	National Faecal Sludge and Septage Management
NGO	Non-Government Organization
OHS	Occupational Health and Safety
PPE	Personal Protective Equipment
QHSE	Quality, Health, Safety and Environment
SOP	Standard Operating Procedure
STP	Sewage Treatment Plant
TUV	Technischer Überwachungsverein
ULB	Urban Local Body

EXECUTIVE SUMMARY

Occupational Health and Safety (OHS) is an all-inclusive approach for reducing the risk of hazards a worker is exposed to while providing vital sanitation services such as desludging of septic tanks, cleaning of sewer appurtenances and treatment of domestic liquid waste. Although, use of mechanical equipment has been promoted for doing "part of" this job, there are incidences, where workers have to manually do remaining part of the job, and there is at least one accident per week in India where sanitation workers lose their life. The sanitation service industry in India is informal and privately run by small medium enterprises which do not come under the lens of the regulatory authorities. Thus, most of the incidences go unnoticed and the accidents are not formally reported. This has resulted into long term impact on the individuals involved in the sanitation service industry. It has been observed that the average life expectancy of the sewer worker[1] in India is less than 50 years. Hence, OHS should be indispensable part of sanitation sector-especially Faecal Sludge and Septage Management.

By mainstreaming OHS in the FSSM sector, it is not only intended to reduce the incidents and accidents caused on the job but also its impact beyond job. However, in India, mainstreaming OHS will have bigger impact by improving the social profile of the workers and raising their dignity of work. It is believed that, OHS management if done correctly can achieve the desired results in a fraction of a cost invested in the sanitation service chain.

Observing and understanding how OHS has been mainstreamed in other industries, it can be inferenced that it is a slow process. Safety needs to be imbibed into the conduct of people at multiple levels within the industry to have a long-term holistic impact on the sector. A multi-pronged approach was established during the project for developing the recommendations. The recommendations are specific to key stakeholders involved in policy and regulation making at national level and its enforcement at state level as well as the monitoring authorities and the employers at the local level who are mandated to observe these regulations. The recommendations in this report judiciously address the challenges observed across the levels of control – Safe design, Engineering Control, Safe Work Place, Administrative Control and Personal Protective Equipment (PPE). The recommendations made in the report are classified depending on their relative urgency and importance for achieving the expected outcome. It is believed that, a step by step approach for mobilizing the key stakeholder in each phase will help in achieving a more sustainable outcome.

[1] Sanitation workers involved in manual cleaning of sewer appurtenances in the cities on a daily basis.

1 BACKGROUND

India like most of the South Asian countries has adopted water borne sanitation system which can be classified into sewered, non sewered and hybrid systems. An ideal sanitation system aims to protect environmental health by providing a clean environment that will stop the transmission of disease, especially through faecal oral route. The sewered sanitation systems are mostly infrastructure projects and "if designed and implemented well" reduces the need of human interventions to manage the human waste. However, in reality, due to improper designs and implementations, sewered sanitation system do rely on occasional cleaning of appurtenances by humans.

According to Safai Karmachari Andolan Movement[2], there are 26,00,000 dry latrines which are still serviced by manual scavengers. It also reports that there are 7,70,000 sewer cleaners, 36,176 railway cleaners in India. These scavengers are appointed by Urban Local Bodies to sustain the infrastructure on a daily basis. Manual cleaning of sewers not only violates the Industrial Disputes Act of 1947 but is also termed as manual scavenging under the Manual Scavenging Act 2013. It is believed that in Mumbai alone there are close to 30,000 conservancy workers who are appointed by the civic authorities as sweepers.

On the other hand, non-sewered sanitation systems primarily rely on the service of emptying the containment systems and hence its sanitation service chain constitutes – emptying, transport, treatment and disposal. The services of emptying and conveyance are mainly provided by operators who use special equipment such as vacuum systems mounted on the vehicle. In spite of the equipment, the process has to be carried out by humans and there is potential of health hazard to the people involved in the process or in proximity to the job site.

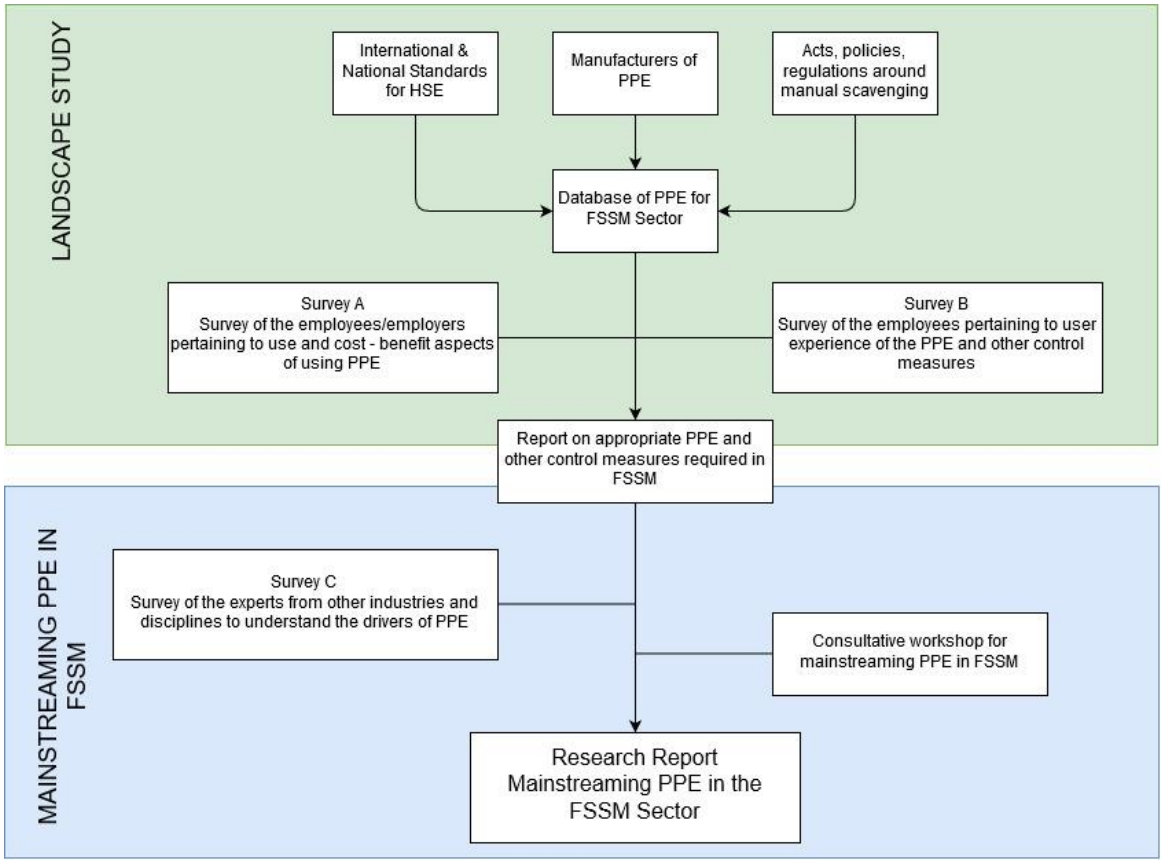
In Sewage Treatment Plants (STPs) which have high volume of sewage and sludge to treat, mostly the handling of waste is done mechanically. Unlike STPs, Faecal sludge and Septage Treatment Plants (FSTPs) have lower volume of the sludge to treat and hence relies mostly on non-mechanical treatment processes. The treatment processes involved in faecal sludge and septage treatment (screening, dewatering and drying) expose the plant operators and workforce to potential hazard of coming in contact with waste and handling of solids.

[2] https://www.safaikarmachariandolan.org/crisis

The project was initiated by Technology Taskforce of National Faecal Sludge and Septage Management (NFSSM) Alliance to understand the need and assess the current situation of pertaining to use of Personal Protective Equipment (PPE) by the workforce in Faecal Sludge and Septage Management (FSSM) sector. The scope of the work was defined by two parts (a) Landscape study and (b) Mainstreaming PPE in FSSM sector. Under each part, following specific objectives were outlined;

1. **Landscape study**
    - To assess the current norms and regulations around PPE.
    - To identify PPE to be used in the sanitation sector.
    - To recommend the appropriate combination of PPE for FSSM.
2. **Mainstreaming PPE in FSSM sector**
    - To understand the supply and demand aspects of the current PPE environment.
    - To recommend the ways to drive up the supply of quality PPE.
    - To recommend the ways to develop effective eco system for PPE adoption.

The methodology adopted for carrying out the project is shown below;



The **Database of PPE for FSSM Sector** along with the **Appropriate combinations of PPE for Sanitation Workers** was prepared and shared along with the report on **Appropriate Control Measures for Safety in FSSM** was finalized based on the inputs from the experts of Technology Taskforce and submitted to NFSSM Alliance.

For the second part of the project, surveys were carried out among the key stakeholders in FSSM. The objective of the survey was to investigate into (a) perception about hazards and risk in FSSM, (b) user experience of PPE, (c) opportunity cost of PPE and (d) drivers of PPE in other industries. The three categories of stakeholders interviewed were;

1. **Employers** – Persons responsible for employing the workforce (and monitor) to desludge septic tanks, maintain the appurtenances of sewerage system and operation and maintenance of treatment plants.
2. **Employees** – Persons who are engaged in the tasks mentioned above and are exposed to hazards.
3. **Experts** – Quality, Health, Safety and Environment (QHSE) experts from industries (such as manufacturing, construction, pharmaceuticals and food – beverage etc) who are involved in ensuring occupational health and safety on site.

The findings of the survey were shared and extensively discussed with the Technology Task Force Members. As the last part of the projects a consultative workshop was planned in end of March at Administrative Staff College of India, Hyderabad. Taking into consideration the rising number of cases of COVID 19 across India, the workshop was cancelled. An alternative method of having a consultation calls with experts and PPE manufacturers was adopted which consumed a considerable amount of time. The responses of the experts during these consultation calls were taken into considerations while drafting the recommendations and way forward for the NFSSM Alliance. The next chapter is dedicated to highlighting important discoveries and inferences made during the project, which in turn lead to recommendations for mainstreaming Occupational Health and Safety (OHS) in FSSM sector in India.

2 KEY INFERENCES

The inferences are divided into various key sections as follows;

2.1 Policies, Laws and Acts

The National Policy on Safety, Health and Environment at Workplace was published by the Ministry of Labour and Employment, Government of India (GoI) in 2009 which points towards enforcement of the laws and acts previously released by the GoI. There is no dedicated law or an act pertaining to OHS in sanitation as an industry or service and has been touched upon in the following acts;

1. The Factories Act (1948)
2. The Contract Labour (Regulation and Abolition) Act (1970)
3. The Unorganized Workers' Social Security Act (2008)
4. The Prohibition of Employment as Manual Scavengers and their Rehabilitation Act & Rules (2013)[3]

All the acts point out that it is the responsibility of the employer to ensure OHS and particularly to provide Safety Equipment and PPE to the workforce. However, it also puts equal liability on the worker to observe all the standard operating procedures and use PPE provided by the employer.

The less attention to OHS in FSSM sector can be attributed to following;

- Implementation and enforcement of the acts by the states4.
- Lack of understanding about the law and terminologies (such as manual scavenger, hazardous cleaning etc) mentioned in the Acts and Laws among the employers.
- Lack of awareness among the employers regarding the implications and consequences of not complying to the law.
- In small-scale industries and businesses, the OHS standards are not followed as the rate of reporting of accidents is far less in India[5].
- The perception among the employers that the cost of compensation if found guilty of violation of law is negligible as compared to the cost of maintain OHS at the workplace.

[3] Also referred as Manual Scavenging Act and Rules (2013) from this point onwards in this document.
[4] News article in The Hindu published under the title "Maharashtra and Gujrat lag behind in compensation for sewer deaths" written by Damini Nath on January 13th, 2020.
[5] According to the Resource Handbook for Ending Manual Scavenging (2014) there was not case registered in the first 17 years after the first Manual Scavenging Act was passed in 1993.

2.2 Occupational Hazards and Risks

There is very little involvement of QHSE experts in operation and maintenance of the public utility infrastructure such as conveyance and treatment of liquid waste. There has been no study involving Hazard Identification and Risk Analysis (HIRA) on the jobs involved in FSSM sector (ex. Desludging of septic tank). Hence, due to lack of self-capacity pertaining to OHS, the people involved in operation and maintenance of sanitation infrastructure have developed their own perception about the hazards and risks involved.

It is important to understand these perceptions as it is what drives the selection of appropriate control measure and appropriate PPE for mitigating the hazards and risks involved in the jobs involved in FSSM. Root Cause Analysis of accidents caused is one way to prioritize the appropriate control measure. The accident weed diagram illustrated below helps us to understand that there are two main reasons for accidents **(a) hazardous conditions and (b) hazardous practices.**

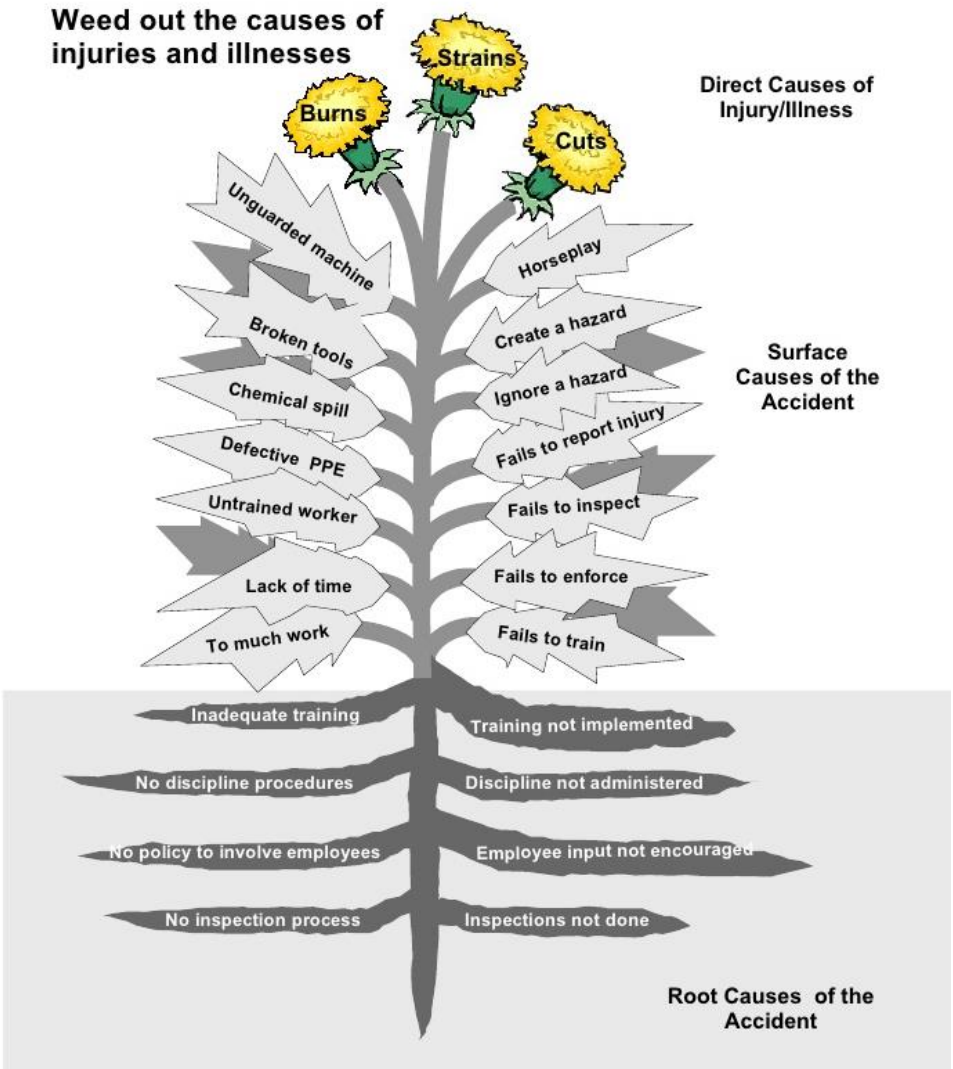


FIGURE 1: ACCIDENT WEED DIAGRAM (SOURCE: OR OSHA 102)

Biological hazard is perceived to be the highest by the stakeholders surveyed during the project. Risk of a hazard is based on probability and severity of the hazard. The severity of the biological hazards is medium or high based on the duration of exposure to the hazardous waste. In cases, where vacuum trucks are used for desludging of septic tanks along with properly designed treatment plant, the probability of person coming in direct contact with the hazardous waste is very less. Thus, the risk of biological hazard due to incidental contact with hazardous waste is less.

On the contrary, the job such as desludging of septic tank involves using various heavy tools and accessories which exposes the worker to physical hazards such as injuries due to slip, trip, fall, pinch and abrasion. Although, severity in this case is low, the probability is very high, because certain tasks are performed multiple times in a day during desludging of septic tanks using vacuum trucks. Hence, is relatively higher than the biological hazard.

2.3 Hierarchy of Control Measures

Lack of understanding about OHS also leads to less understanding of hierarchy of control measures. Figure 2 gives more details on the hierarchy of control measures for mitigating risks from hazards. The hierarchy is developed based on the effectiveness and efficacy of the control measure. Inherently safe design of the work place is the most important control measure, as it provides highest degree of protection and also extends it to people who are not involved in the operation and maintenance jobs. Unlike PPE, efficacy of safe design is not affected by the behaviour of the person involved in the operation and maintenance and hence is more reliable.

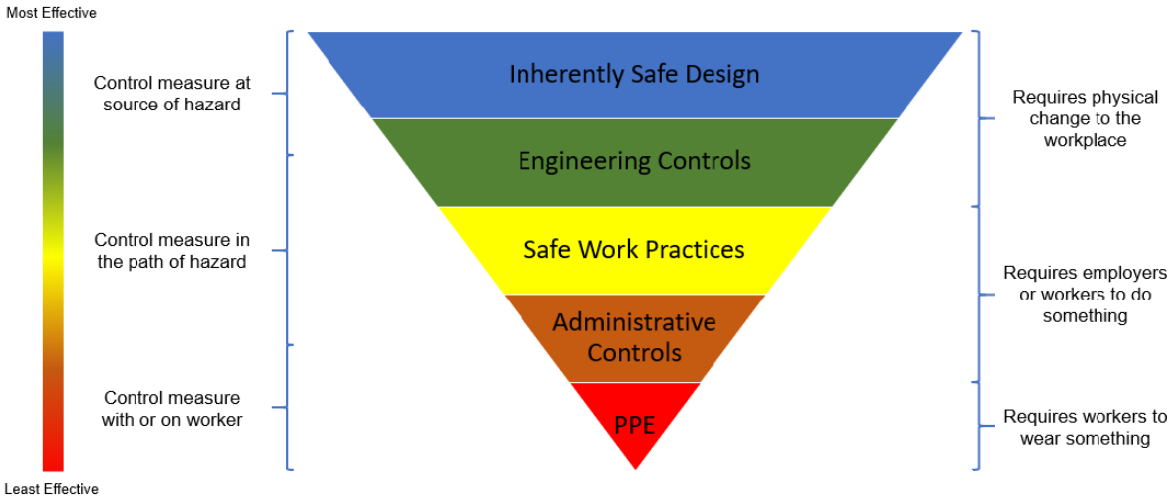


FIGURE 2: HIERARCHY OF CONTROLS TO MITIGATING RISKS FROM HAZARDS

During the survey it was observed that wherever PPE was used, higher importance was given to PPE as compared to higher order of control measures (mentioned in Figure 2). Following are few examples from the treatment plants where survey was carried out to understand perception about hazards and control measures.

Hazard: Physical, Ergonomic & Biological Hazard

Inherently safe design: Provision of proper screens at the receiving station.

Proper standing platform with guard rails

Hazard: Ergonomic Hazard

Inherently safe design: Ramp for wheel barrow

Administrative control: Appropriate training should be provided to the workers in lifting heavy objects.

Hazard: Ergonomic & Biological Hazard

Inherently safe design: Easy access for raking the screens

Engineering control: A raking tool with long handle so as to avoid splashes of waste on to the hands and body.

FIGURE 3: EXAMPLES OF UNSAFE DESIGN TREATMENT UNITS HAMPERING THE SAFETY DURING OPERATION

Figure 3 shows unsafe design of various treatment components. The first picture shows improper design of screens. In this case the person has to get into the unit, stand on the edge of the screening basket without any support and perform the job of raking of screen. Raking needs to be done quite frequently and hence a platform needs to be provided to stand with proper guard rails. Although, a safety helmet is provided in this case a preventive measure such as fall protection PPE should also be provided.

Hazard: Physical, Biological & Ergonomic

Engineering Control: Use of wheel barrow to collect and transport the dewatered solids

Administrative Control: Monitoring & enforcement mechanism to ensure workers are following SOPs and using PPE.

Recommended PPE: Mechanical resistant gloves | High visibility shirts and pants full sleeves | Steel toe ankle length safety shoes | N 95 Mask |General safety glasses

Hazard: Thermal, Physical & Ergonomic

Engineering Control:

1. Use of screw conveyor combined with bagging system to eliminate handling of biochar.
2. Use of appropriate tools so that safe distance can be maintained by the worker from the source of hazard

FIGURE 4: INADEQUATE USE OF ENGINEERING CONTROLS FOR MITIGATING RISKS FROM HAZARDS

Figure 4 shows lack of use of engineering controls for mitigating the risks involved in operation and maintenance work. In the first picture, a simple use of protective screen for shielding the worker from falling sludge and a wheel barrow for transporting it will reduce the risk of coming in direct contact with the hazardous waste such as partially treated biosolids.

2.4 Inadequate Safe Work Practices and Administrative Controls

Safe work practices and administrative controls go hand in hand. Following are few critical observations during the survey;

2.4.1 Hazard signages

None of the workplaces were marked with hazard signs (Figure 5) which are used to communicate hazards and risks (for the workers as well as persons visiting the plant) in different parts of the plant.

FIGURE 5: HAZARD SIGNS FOR COMMUNICATING RISK AND REQUIRED PPE ON SITE

2.4.2 Standard operating procedure

It was observed that Standard Operating Procedures (SOPs) were not developed for any jobs in FSSM by the employees. The gap of understanding among the workers created due to lack of SOPs can be partially filled with incubation and training. However, in none of the cases, training was provided to the workers on various steps involved to do a specific job or a task.

2.4.3 Inputs from the workers

In order to be able to enforce and implement the rules pertaining to safety, it is very important to understand the human component involved. This component plays an important part since safety practices are affected by persons' behaviour. Hence, it is very important to consult with the workers and have their feedbacks on hazards and safety on the job. During the survey this consultation and feedback mechanism was found to be lacking between the employer and employee.

2.4.4 Medical assistance

The Manual Scavenging Act and Rules (2013) mandates the employer to provide medical assistance in the form of insurance (up to INR 10,00,000) and medical check-up. However, during the survey was observed and confirmed that none of the employer knew about it and provided it to the employees.

2.4.5 Outsourcing and sub-contracting

Wherever outsourcing of job was done, the contract did contain the clause of use of PPE while performing the job. However, the contractors flouted the contract terms to either maximise their profits or the contract value simply did not allow the contractors to provide appropriate PPE for the job.

In other industries, where occupation health and safety is considered as important factor and quality ratings are followed, if the contractor is small and does not possess the knowledge about OHS, the company hiring the contractor provides the PPE and safety training before commencing the work.

2.5 Personal Protective Equipment

As stated earlier, understanding of the hazards and the risks involved drives the selection of type quality of PPE. The other reason which leads to choose of inappropriate PPE is focussing on the accidents and not the incidents.

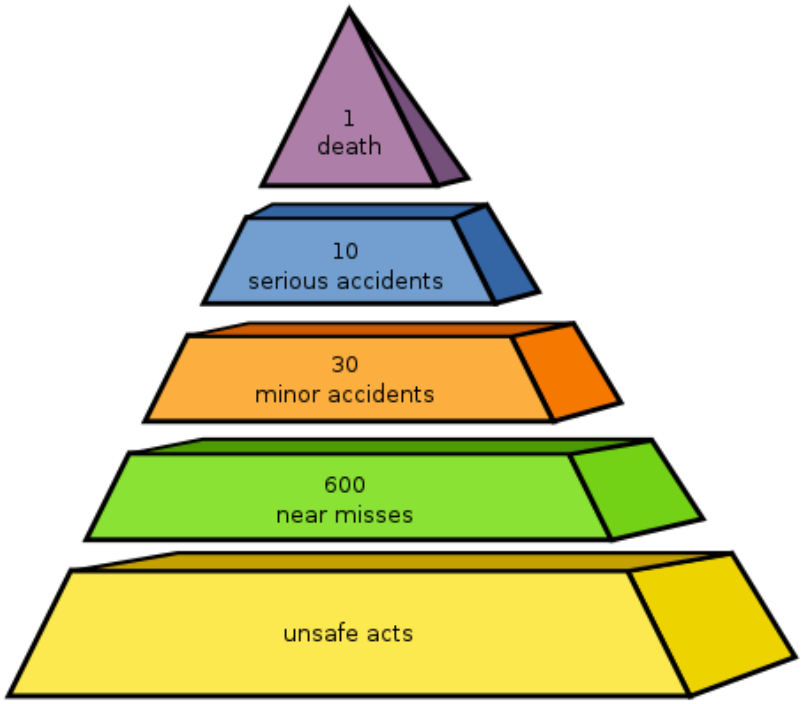


FIGURE 6: ACCIDENT TRIANGLE

Herbert Heinrich and Frank Bird illustrates the relationship between serious accidents, minor accidents and near misses using accident triangle. It is proposed that if the number of minor accidents is reduced then there will be a corresponding fall in the number of serious accidents. It was observed during the surveys that the selection of PPE was done based on surface cause of the accident and the hearsay evidence (such as hazardous gases leading to death due to suffocation and not the root cause as to why the worker was exposed to the gases).

2.5.1 Findings based on the Survey

Following are the critical observations made from the survey and visit to treatment plants and desludging operators;

Incorrect choice of PPE

The PPE which are used currently are required for intentional touch with hazardous waste and not incidental contact. As shown in Figure 7, PPE used most of the jobs in FSSM were – chemical resistant gloves and PVC safety shoes or gum boots. Chemical resistant gloved as well as PVC safety boots are made liquid resistant on purpose and hence possess very little breathability. This causes perspiration and discomfort to the user upon its prolonged use.

FIGURE 7: INAPPROPRIATE SELECTION OF PPE AS SEEN DURING SURVEYS

Inadequate use PPE

As shown in Figure 7 and Figure 8, body protection was limited to high visibility jacket or an apron. Workers wore their usual clothes (mostly cotton based fabric) underneath the jacket or apron. These clothes are not designed to resist penetration of hazardous liquid, fire or even dust even in case of incidental contact due to spill.

As shown in the second picture from right in Figure 8, body protection, ear plugs or muffs were not used by workers while using pressurized water jets for cleaning the portable toilets. As shown in the last picture of Figure 8, although the treatment plant has two storey and hazards of either falling of persons or tools was possible, helmets were not used.

FIGURE 8:INAPPROPRIATE USE OF PPE

The first two pictures in Figure 8 also shows that workers were asked to wear the PPE while performing job non-hazardous activities such as cleaning the premise and trimming the plants.

Incorrect use of PPE

During the survey it was observed that the different sizes of PPE were not procured and hence, the fit of the PPE was not correct (Third picture in Figure 8). The N 95 masks as shown in the picture needs to fit perfectly over the nose, chin and the cheeks, with one elastic band going over the ears and the other over back of the neck. Using wrong size of chemical resistant gloves affects the dexterity while performing the job.

2.5.2 Findings based on Consultation

The investigation with the PPE manufacturers, QHSE experts and desk research has led to the following specific findings;

Certification of PPE

1. Most of the industries such as manufacturing, food – beverage, pharmaceuticals etc where management is sensitive about OHS or have quality control ratings such as International Organization for Standardization (ISO) or Technischer Überwachungsverein (TUV) etc use the PPE conforming to international standards.
2. Most of the Indian Standards (also known as IS Codes) laid down by Bureau of Indian Standards (BIS) for PPE were drafted and published before 1990s. The list of the IS Codes has been attached in *Annexure 5.2*.
3. Unlike International Standards *(European Standards (Annexure 5.3), British Standards (Annexure 5.4) and American Standards (Annexure 5.5))*, the IS codes have not been revised taking in to consideration the research and development in the field of material science. Hence, there is lot of variations and qualities possible when the PPE conforms to Indian Standards. However, **not all BIS certified PPE might be equally effective and reliable in case of a hazard.**

Supply and Demand

Most of the premier brands of PPE manufactured in India (Ex. Karam, Malcom etc) are as per European Standards for following reasons;

1. European standards are updated and gives details on each aspect of specific PPE.
2. PPE conforming to European standards are accepted by most of the industries such as automobile manufacturing, oil and gas, pharmaceuticals, food and beverage and construction who are the major revenue source for PPE manufacturers.
3. PPE manufactured in India as per the European standards is also exported largely to other countries outside India to industries such as oil and gas, construction, manufacturing etc.

User experience

1. The primary objective of PPE is to provide safety even if it comes at the cost discomfort and hence there is no PPE available in the market which provides utmost safety and comfort equally.
2. In general, use of PPE is uncomfortable for first few weeks as it affects the movement and dexterity on the job. However, these issues can be overcome by choice of appropriate PPE and on the job training.
3. Workers should not be compelled to wear PPE (except primary body protection - coveralls) during non-hazardous activities on the job such as driving a truck (seat belt provides adequate safety).
4. Prolonged use of PPE leads to higher discomfort which reduces the acceptability by the workforce. Hence, Manual Scavenging Rules (2013) states that the hazardous cleaning activity should not exceed 90 min at a stretch. There shall be a mandatory interval of 30 min during two stretches.
5. PPE made as per European standards is mostly suitable to their climatic conditions and hence might not be comfortable to the users in India, especially in the industries where workers are exposed to natural environment such as construction and FSSM.

Price point

1. The cost of PPE conforming to Indian standards has lot of variations in quality and is most of the cases it is significantly cheap as compared to the PPE conforming to international standards.
2. The reasons for higher price point for PPE conforming to international standards is;

a. Resources are invested in research and development for materials and design of PPE by international brands such as 3M and Dupont.
b. The manufacturers need to go for quality control ratings in order to be able to export and sell their products overseas.
c. They need to get their products approved from international agencies to be certified as per the international standards.

3 MAINSTREAMING OHS IN FSSM

The recommendations are made for mainstreaming OHS in FSSM in India after discussions with the HSE experts and FSSM experts in India. The recommendations are preparation of different type of advocacy material for the national and state government and programs to be run through Technical Support Units and Project Management Units appointed at state level. It also involves promoting research and development for improving the Indian Standards for PPE so as to remove the ambiguity in the type and specification of the material to be used for manufacturing PPE.

Later these recommendations are classified depending on their importance and urgency for mainstreaming OHS in FSSM sector using a prioritization matrix. The use of prioritization matrix helps to understand the approach in which members of NFSSM Alliance can capitalize different advocacy material to expedite the process of mainstreaming OHS in FSSM Sector.

3.1 Recommendations

The arrays of recommendations have been drafted keeping in mind different stakeholders for mainstreaming OHS in sanitation sector. The final outcome is to improve dignity of work among the sanitation workers and to raise the social profile of sanitation workers among the civilians. Each stakeholder plays a significant role in mainstreaming and without addressing each one of them, it will be difficult to achieve the final outcome. Table 1 provides the list of recommendations, its objective and targeted stakeholder. Each recommendation has been detailed out with respect to its content in the next section.

TABLE 1: LIST OF RECOMMENDATIONS AND ITS TARGET STAKEHOLDER AND OBJECTIVE

Nº.	Recommendation	Target stakeholder	Objective
1	Policy Brief on Manual Scavenging Act and Rules (2013)	Ministry of Social Justice and Empowerment	To include the appropriate combinations of PPE and their specifications with details pertaining to when to use the PPE.
2	IEC Program (in collaboration with Ministry of Labour and Employment, National Human Rights Commission of India and National Safai Karamchari Commission)	Employers and employees of sanitation industry.	To sensitize the implementers and the sanitation workers pertaining to Manual Scavenging Act and Rules (2013).

3	Guidelines for OHS program	State Government	To enable the link between the policy and rules to be implemented through a state wide program prioritizing OHS in sanitation sector.
4	OHS Rules for Sanitation Services	ULBs and Parastatal bodies	To provide a standard framework (part of administrative controls) to the implementing authorities to mainstream OHS in sanitation sector.
5	Handbook for Desludging Operators	Small Enterprises - Desludging Services	To handhold the small enterprises involved in providing desludging services at the ULB level- enabling them to meet legal requirements of Manual Scavenging Act and Rules (2013).
6	ICT Platform for Desludging Businesses	ULBs and Small Enterprises - Desludging Services	ICT platform which optimizes the emptying and conveyance of the sludge, thus making it more affordable to the households. The contractual transactions can be simplified between the ULBs and the desludging operators, making the service legal and safer.
7	OHS Indicators for Ratings	Central Government	To develop an indicator-based assessment cum rating system to be incorporated in Swachh Survekshan.
8	Capacity Building in OHS for FSSM	ULBs, Parastatal bodies and enterprises	To build capacities of the employees in OHS for FSSM based on the guidelines, rules and the handbook mentioned above.
9	Behaviour Based Safety in FSSM	Small Enterprise Owners, ULB Officials, Parastatal officials	To develop a comprehensive program in order to generate data for further analysis and refining OHS programs across India.
10	Research on Material and design of PPE	Product design consultants and PPE manufacturers	To develop PPE suitable in Indian context (climatic conditions) which are comfortable yet affordable.

Following is the description of each recommendation made for mainstreaming OHS in FSSM sector.

3.1.1 Policy Brief on Manual Scavenging Act and Rules (2013)

The policy brief will supplement the Manual Scavenging Act and Rule of 2013. The policy brief will focus on safety equipment, combination of PPE and their specifications in order to remove the ambiguity around which equipment to use and when. This policy brief will also be

complimenting the advisory and guidelines released by Ministry of Housing and Urban Affairs and Central Public Health and Environmental Engineering Organization[6] which lack this key information. The information is critical in order to reduce the ambiguity regarding safety equipment and PPE among the enterprises involved in this work and monitoring agencies who are involved in identifying and persecuting the offenders of the Manual Scavenging Act and Rules (2013).

3.1.2 IEC Program

The Information, Education and Communication (IEC) Program should be carefully crafted for the employers (ULB officials, desludging services owners, labour contractors, treatment plant operating company owners etc) and employees (people working as sanitation workers, sewage workers or any person employed for undertaking the task of manging human waste). These programs should clearly convey the implications of not following the Manual Scavenging Acts and Rules (2013) and the rights of the sanitation / sewage workers on the job.

3.1.3 Guidelines for OHS Program

The guidelines for OHS program will be in line with the national action plan being drafted by national government to eliminate manual scavenging in India. Avoiding human contact with hazardous waste while servicing the septic tanks and sewers is impossible for various reasons and hence it is important to introduce the aspect of OHS in sanitation sector to eliminate the concept of hazardous cleaning.

These guidelines will introduce the hierarchy of control measures and provide a framework working its way from the safe designing down to PPE. This will include developing guidelines for making the work place safe and introduce administrative controls such as licensing of enterprises providing desludging services and mechanism for local authorities to be able to monitor and report compliance of rules and regulations. Lastly, it will also connect to the Manual Scavenging Act and Rules of 2013 and will serve as a guiding document for the state officials to instate chain of commands and understand the roles and responsibilities of various committees and individuals.

[6] Emergency Response Sanitation Unit: Technical and managerial interventions for ensuring safety during sewer and septic tank cleaning – An Advisory
Standard Operating Procedure for Cleaning of Sewers and Septic Tanks

3.1.4 OHS Rules for Sanitation Services

OHS rules will be a focussed document which will in detail cater to when and how OHS needs to be prioritized in sanitation services such as desludging of onsite sanitation units and servicing sewer appurtenances. The requirement of such rules has been identified looking at the SWM Rules 2016. These Rules helped the ULBs to streamline the collection conveyance and handling of the waste during its complete cycle until the reuse. This document will be supplementary to the Guidelines for OHS program as it will be directing employers (officials from ULBs and parastatal bodies involved in FSSM) on the OHS management aspects for implementing it at local level, record and monitor the progress in eliminating hazardous cleaning of septic tanks and sewerage systems.

3.1.5 Handbook for Desludging Operators

The small handbook for desludging operator will be targeted to the small enterprise owners providing the desludging services. Private desludging operators are one of the most important stakeholders in FSSM in India and since licensing is not regularized in most of the ULBs it is still largely an informal sector. Monitoring of this informal sector is biggest challenge with the local authorities. This handbook will provide handholding to the enterprise owners by providing them SOP for desludging of septic tank. This will help them to prioritize OHS in their business there by supporting the monitoring of desludging services by the local authorities.

3.1.6 ICT Platform for Desludging Operators[7]

The ICT platform will be run by a private or government entity which simplifies the process of formalizing the desludging operators' business by registering them on the platform. The platform links Guidelines (section 3.1.3), Rules (section 3.1.4) and Handbook (section 3.1.5). The platform will also function as technological program to gather information of the operators and the households, monitoring the vehicles and reduce hazardous cleaning of septic tanks and indiscriminate dumping. It will also provide online payment platform for ease of doing business and maintaining its integrity. The platform will help to log the data which can later be utilized for optimizing the desludging operations, make desludging affordable and shift towards scheduled desludging which is key for integrated wastewater and septage management at city level.

[7] Framework for an ICT enabled platform idea was selected for IHU WASH challenge and its viability has been evaluated through program hosted by UC Berkley and Haas Business School. Currently the project is pre funding phase.

3.1.7 OHS Indicators for Ratings

OHS indicators should be defined and included in to Service Level Benchmarking or San Benchmarks. Swachh Survekshan 2019 and 2020 saw inclusion of indicators prioritizing FSSM. Hence, the extension of the OHS indicators should also be recommended to Swachh Survekshan 2021.

In this way, the ULBs will have to document and report the statistics based on the OHS indicators. The guidelines and the rules will assist the ULBs to understand the documentation process.

3.1.8 Capacity Building in OHS for FSSM

There is need of developing capacities of the people working in operation and maintenance of FSSM – ULB and parastatal officials, Treatment plant operators, NGOs or CBOs. An introductory module (one day) on OHS in FSSM should be integrated into the Sanitation Capacity Building Platform.

Separate training needs to be developed for Behaviour Based Safety (BBS) in FSSM, in order to be able to implement the OHS planning in FSSM. The objective of this training will be developing the capacities of the participants to the level that they can apply the knowledge on the field and practice. Hence, this training will have to be extensive (2 – 3 days with on-field exercises).

3.1.9 Behaviour Based Safety Program in FSSM

During the consultative process, it was observed that the QHSE experts are not aware with the processes and activities in sanitation sector. Many experts were not aware about FSSM as a concept and activities involved in it. It was observed that QHSE experts were more aware about OHS in industries (automobile, construction, oil and gas, shipping, pharmaceuticals, food and beverage etc) where either the laws are available (such as shipping and mining) and enforcement is done (multinational companies in automobile and manufacturing) or job prospects (such as construction) for these professionals is high. Due to paucity of the information with experts and data, the standard approaches for OHS planning cannot be applied in FSSM and hence there is requirement of engaging QHSE experts to develop data and tools through research on BBS Program in FSSM.

3.1.10 Research on Material and design of PPE

A research program can be developed for undertaking material research, design and development of PPE suitable for Indian climatic conditions. The research should be ideally

conducted by a consortium of organizations such as – material research institutes, product design institutes, QHSE and FSSM experts. This will ensure that the holistic research will result into a minimum viable product. The data generated through such research will develop a strong base for revision of IS codes for BIS. At the same time, the minimum viable product design can be adopted by the PPE manufacturers for refining it into marketable and affordable product for various industries in India.

3.2 Prioritization Matrix

The Prioritization Matrix classifies the recommendations based on its urgency (need of implementing the recommendation) and importance (its impact on mainstreaming PPE in FSSM sector). **In this case the classification is based on relative urgency and importance and does not mean in absolute sense.** Table 2 illustrates the prioritization matrix for the above described recommendations.

As per the prioritization matrix illustrated in Table 2, the activities stated under quadrant I are recommended to be completed within 3 months. This includes drafting the policy brief along with its facilitation with Ministry of Social Justice and Empowerment.

The activities mentioned in the quadrant III are urgent and relatively less important. These activities can be completed by conceptualising them into short duration projects and outsourcing them to relevant organizations. The activities are recommended to be completed over a period of 3 – 6 months. Most of the activities under the urgent category does not require travelling and can be completed based on the desk research and peer review process.

The activities mentioned in the quadrant II are the most important activities to drive the agenda of mainstreaming OHS from the top. These activities are recommended to be scheduled and completed over a period of 6 – 9 months.

The activities mentioned in the quadrant IV are time consuming since collaboration between different intuitions is required. Research and development in itself are a time-consuming process and developing a minimum viable product (PPE in this case) requires extensive interaction with the users of the PPE and manufacturers of PPE.

TABLE 2: PRIORITIZATION MATRIX FOR RECOMMENDED TASKS

	URGENT	NOT SO URGENT
IMPORTANT	**Quadrant I** • Policy brief complimenting Manual Scavenging Act and Rules published in 2013.	**Quadrant II** • Guidelines for conducting Occupational Health and Safety program at state level for eliminating manual scavenging. • Occupational Health and Safety Rules for Sanitation Services. • ICT platform for Desludging Operators. • Occupational Health and Safety indicators for assessment and rating through Swachh Survekshan.
NOT SO IMPORTANT	**Quadrant III** • IEC Program on Occupational Health and Safety in sanitation sector based on Manual Scavenging Act and Rules (2013). • Handbook for Desludging Operators: Meeting legal requirements of Manual Scavenging Act and Rules (2013). • Capacity building on Occupational Health and Safety in FSSM. • Behaviour based safety program in FSSM	**Quadrant IV** • Research on material and design of PPE.

4 CONCLUSION AND WAY FORWARD

Importance of PPE has been highlighted due to recent COVID 19 pandemic. Given the precedence that lack of sanitation gives rise to and accelerates the spread of water borne diseases, it will not be wrong to say that OHS needs to be prioritized in sanitation sector even in the normal situation. The very first objective of environmental sanitation is to reduce transmission of pathogens from hazardous human waste to water, food or a new host. However, in absence of an OHS program, sanitation workers are directly exposed to these pathogens. Multiple studies have suggested that the sanitation workers suffer from multiple health issues to mild but daily exposure to the hazardous conditions on the job. Hence, mainstreaming of OHS in Sanitation Sector especially in FSSM is utmost important. FSSM is a service-based industry which is largely characterised by informal septic tank desludging operators. Sewage workers also remain an important category which falls under definition of manual scavengers.

Surveys conducted by Safai Karmachari Andolan suggests that manual scavenging as an activity is still thrusted on people from specific vulnerable communities. Hence, the profession as a sanitation worker is looked down upon by the civilians. The mission of people like Bezwada Wilson which started in 1986 is still not being able to see light at the end of the tunnel. OHS of sanitation workers has been highly neglected for decades by the local authorities in terms of implementation and enforcement. This is proven by the lower number of cases registered against non-compliance of The Employment of Manual Scavengers and Construction of Dry Latrines (Prohibition) Act of 1993 and lack of progress of states such as Maharashtra and Gujrat in complying to the instructions of The Prohibition of Employment as Manual Scavengers and their Rehabilitation Act & Rules (2013)[8].

Looking at the current pandemic situation, safety of sanitation workers has gathered momentum and hence the need for OHS program in sanitation sector is need of the hour. This will also largely contribute to the goal announced by GoI to make India manual scavenging free by 2020. The multi-pronged recommendations made in this document, if implemented will contribute in totality to final outcome of improving dignity of work among the sanitation workers and raising the social profile of sanitation workers among the civilians.

[8] https://www.thehindu.com/data/manual-scavenging-exists-in-india-despite-being-outlawed-in-2013/article29508476.ece

5 ANNEXURE

5.1 List of experts consulted during the project

Sr. No.	Name	Industry
1	Ms. Amrita Verma	EHS lead, Automobile
2	Mr. Ashish Waghe	Senior Manager, HR and HSE Department, Manufacturing
3	Mr. Bala Garu	HSE Consultant
4	Mr. Bharat	Safety Officer, Construction
5	Ms. Bhuvaneshwari Ravi	HSE Consultant
6	Mr. Deepak Pande	HSE Officer, Fertilizer
7	Ms. Mamta Gautam	Senior Faculty, National Institute of Design
8	Dr. Mamta Mantri	Design Researcher
9	Ms. Mugdha Kulkarni	EHS Manager, Electronics
10	Mr Nilesh Patil	Assistant Manager, Construction
11	Mr. Prasenjit Ghosh	Manager, PPE Manufacturing
12	Mr. Pratish Lotlikar	HSE expert, Pharmaceuticals
13	Mr. R. Ahirrao	HSE Manager, Construction
14	Mr. Rahul Dane	HSE Officer, Construction
15	Mr. Rajaram Choudhary	General Manager, Department of Health and Safety, Cement
16	Mr. Ranjit Kamble	Safety Manager, Construction
17	Mr. Ravindra Mali	Chief Manager, HSE Department, Manufacturing
18	Mr. Sachin Kulkarni	HSE Officer, Manufacutring
19	Mr. Sandeep	EHS Manager, Automobile
20	Mr. Sandeep Gholkar	Assistant General Manager – HSE, Chemical
21	Mr. Sunil Chougule	Assistant Manager - EHS, Food & Beverage
22	Mr. Vinay Joshi	HSE Officer, Cement

5.2 List of IS Codes for PPE

HEAD PROTECTION

- IS CODE 2745: 1983 – Specification for non-metal helmet for firemen and civil defense personnel.
- IS CODE 2925: 1984 – Specification Industrial safety helmet.
- IS CODE 4151: 1993 – Specification for protective helmets for scooter and motorcycle riders.

BODY PROTECTION

- IS CODE 3521: 1999 – Industrial safety belt and harness.
- IS CODE 4501: 1981 – Specification for aprons.
- IS CODE 6153: 1971 – Protective leather clothing.
- IS CODE 7352: 1974 – X-ray lead protective aprons.
- IS CODE 8519: 1977 – Guide for selection industrial safety equipment for the body.
- IS CODE 8990: 1978 – Code of practice for care and maintenance of industrial safety clothing.

EAR PROTECTION

- IS CODE 6229: 1980 – Methods for measurement of real-ear protection of hearing protectors and physical attenuation of ear muffs.
- IS CODE 8520: 1977 – Guide for selection of industrial safety equipment for eye, face and ear protection.
- IS CODE 9167: 1779 – Specification for ear protectors.

EYE AND FACE PROTECTION

- IS CODE 1179: 1967 – Equipment for eye and face protection during welding.
- IS CODE 5983: 1980 – Eye Protector.
- IS CODE 7524: 1980 – Method of test for eye protectors: -non optical tests. (part -1)
- IS CODE 2521: 1977 – Industrial safety face shield with plastic visor (part – 1)
- IS CODE 2521: 1994 – Industrial safety face shield with wire mesh visor (part – 2)
- IS CODE 8940: 1978 – Code of practice for maintenance and care of industrial safety equipment for eyes and face protection.
- IS CODE 9973: 1981 – Specification for the visor for scooter helmets.

- IS CODE 9995: 1981 – Specification for the visor for non-metal police and firemen helmets.
- IS CODE 14352: 1996 – Miner's safety goggles – Specification.

FEET AND LEG PROTECTION

- IS CODE 1989: 1986 – Specification for leather safety boots and shoes – for miners (part – 1).
- IS CODE 1989: 1986 – Specification for leather safety boots and shoes -for heavy metal industries (part – 2)
- IS CODE 3737: 1966 – Leather safety boots for workers in heavy metal industries.
- IS CODE 3738: 1998 – Rubber boots – Specification.
- IS CODE 3976: 2003 – Protective rubber canvas boots for miners – Specification.
- IS CODE 4128: 1980 – Specification for fireman leather boots.
- IS CODE 5557: 1999 – Safety rubber boots.
- IS CODE 5852: 1996 – Steel toe safety shoes.
- IS CODE 6519: 1971 – Code of practice for selection, care, and repair of safety footwear.
- IS CODE 7329: 1974 – Metal last for safety rubber canvas ankle boots.
- IS CODE 10348: 1982 – Safety footwear for the steel plant.
- IS CODE 10665: 1982 – Safety rubber ankle boots for miners.
- IS CODE 10667: 1983 – Guide for selection for industrial safety equipment for the protection of foot and leg.
- IS CODE 11225: 1985 – Leather safety shoes for women workers in mines and steel plants.
- IS CODE 11226: 1993 – Leather safety footwear having direct molded rubber sole – Specification.
- IS CODE 11264: 1985 – Code of practice for manufacture of safety rubber footwear for miners.
- IS CODE 13295: 1992 – Code of practice for manufacture of leather safety boots and shoes for workers in mines and sea, metal industry.
- IS CODE 14544: 1998 – Leather safety footwear wit& directly molded PVC soles – specification.
- IS CODE 15298: 2002 – Safety, protective and occupational footwear for professional use -Specification for safety footwear.

HAND PROTECTION

- IS CODE 2573: 1986 – Specification for leather, gauntlets and mittens.
- IS CODE 4770: 1991 – Rubber Gloves – electrical purposes – specification.
- IS CODE 6994: 1973 – Specification for safety gloves –leather and cotton gloves (part – 1).
- IS CODE 8807: 1978 – Guide for selection of industrial safety equipment for the protection of arms and hands.

RESPIRATORY PROTECTION

- IS CODE 8318: 1977
  – Colour identification markings for air purifying canisters and cartridges.
- IS CODE 8347: 1977 – Glossary of terms relating to respiratory protective devices.
- IS CODE 8522: 1977 – Respirators chemical cartridge.
- IS CODE 8523: 1977 – Respirators canister type gas masks.
- IS CODE 9473: 2002 – Respiratory protective devices -filtering half masks to protect against particles – specification.
- IS CODE 9563: 1980 – Carbon monoxide filter self-rescuers.
- IS CODE 9623: 1980 – Recommendations for selection use and maintenance of respiratory protective devices.
- IS CODE 10245: Part 1 to 46 – Breathing apparatus.
- IS CODE 15322: 2003 – Particle filters used in respiratory protective equipment – Specification.
- IS CODE 15323: 2003 – Gas
  filters and combined filters used in respiratory protective equipment -Specification.

5.3 List of European Regulations for PPE

HEAD PROTECTION

- CEN EN 397:2012+A1:2012- Industrial safety helmets
- CEN EN 443:2008- Helmets for firefighting in buildings and other structures
- CEN EN 812:2012- Industrial bump caps
- CEN EN 14052:2012+A1:2012- High performance industrial helmets
- CEN EN 16473:2014- Firefighters helmets — Helmets for technical rescue

BODY PROTECTION

- CEN EN 342:2017- Protective clothing — Ensembles and garments for protection against cold
- CEN EN 343:2003+A1:2007, EN 343:2003+A1:2007/AC:2009- Protective clothing — Protection against rain
- CEN EN 381-5:1995- Protective clothing for users of hand-held chain saws — Part 5: Requirements for leg protectors
- CEN EN 381-7:1999- Protective clothing for users of hand-held chainsaws — Part 7: Requirements for chainsaw protective gloves
- CEN EN 381-9:1997- Protective clothing for users of hand-held chain saws — Part 9: Requirements for chain saw protective gaiters
- CEN EN 381-11:2002- Protective clothing for users of hand-held chainsaws — Part 11: Requirements for upper body protectors
- CEN EN 469:2005, EN 469:2005/A1:2006, EN 469:2005/AC:2006- Protective clothing for firefighters — Performance requirements for protective clothing for firefighting
- CEN EN 943-1:2015- Protective clothing against dangerous solid, liquid and gaseous chemicals, including liquid and solid aerosols — Part 1: Performance requirements for Type 1 (gas-tight) chemical protective suits
- CEN EN 1073-2:2002- Protective clothing against radioactive contamination — Part 2: Requirements and test methods for non-ventilated protective clothing against particulate radioactive contamination
- CEN EN 1149-5:2008- Protective clothing — Electrostatic properties — Part 5: Material performance and design requirements
- CEN EN 1150:1999- Protective clothing — Visibility clothing for non-professional use — Test methods and requirements
- CEN EN 1486:2007- Protective clothing for fire-fighters — Test methods and requirements for reflective clothing for specialised fire-fighting

- CEN EN ISO 12402-5:2006, EN ISO 12402-5:2006/AC:2006, EN ISO 12402-5:2006/A1:2010- Personal flotation devices — Part 5: Buoyancy aids (level 50) - Safety requirements (ISO 12402-5:2006)
- CEN EN ISO 12402-6:2006, EN ISO 12402-6:2006/A1:2010- Personal flotation devices — Part 6: Special purpose lifejackets and buoyancy aids — Safety requirements and additional test methods (ISO 12402-6:2006)
- CEN EN ISO 13688:2013- Protective clothing — General requirements (ISO 13688:2013)
- CEN EN ISO 12402-8:2006, EN ISO 12402-8:2006/A1:2011- Personal flotation devices — Part 8: Accessories — Safety requirements and test methods (ISO 12402-8:2006)
- CEN EN 13034:2005+A1:2009- Protective clothing against liquid chemicals — Performance requirements for chemical protective clothing offering limited protective performance against liquid chemicals (Type 6 and Type PB [6] equipment)
- CEN EN ISO 13982-1:2004, EN ISO 13982-1:2004/A1:2010- Protective clothing for use against solid particulates — Part 1: Performance requirements for chemical protective clothing providing protection to the full body against airborne solid particulates (type 5 clothing) (ISO 13982-1:2004)
- CEN EN ISO 13998:2003- Protective clothing — Aprons, trousers and vests protecting against cuts and stabs by hand knives (ISO 13998:2003)
- CEN EN 14126:2003, EN 14126:2003/AC:2004- Protective clothing — Performance requirements and tests methods for protective clothing against infective agents
- CEN EN 14605:2005+A1:2009- Protective clothing against liquid chemicals — performance requirements for clothing with liquid-tight (Type 3) or spraytight (Type 4) connections, including items providing protection to parts of the body only (Types PB [3] and PB [4])
- CEN EN ISO 15027-1:2012- Immersion suits — Part 1: Constant wear suits, requirements including safety (ISO 15027-1:2012)
- CEN EN ISO 15027-2:2012- Immersion suits — Part 2: Abandonment suits, requirements including safety (ISO 15027-2:2012)
- CEN EN ISO 20471:2013, EN ISO 20471:2013/A1:2016- High visibility clothing — Test methods and requirements (ISO 20471:2013)
- CEN EN ISO 27065:2017- Protective clothing — Performance requirements for protective clothing worn by operators applying pesticides and for re-entry workers (ISO 27065:2017)

EAR PROTECTION

- CEN EN 352-1:2002- Hearing protectors — General requirements — Part 1: Ear-Muffs
- CEN EN 352-2:2002- Hearing protectors — General requirements — Part 2: Ear-plugs
- CEN EN 352-3:2002- Hearing protectors — General requirements — Part 3: Ear-muffs attached to an industrial safety helmet
- CEN EN 352-4:2001, EN 352-4:2001/A1:2005- Hearing protectors — Safety requirements and testing — Part 4: Level-dependent ear-muffs
- CEN EN 352-5:2002, EN 352-5:2002/A1:2005- Hearing protectors — Safety requirements and testing — Part 5: Active noise reduction ear-muffs
- CEN EN 352-6:2002- Hearing protectors — Safety requirements and testing — Part 6: Ear-muffs with electrical audio input
- CEN EN 352-7:2002- Hearing protectors — Safety requirements and testing — Part 7: Level-dependent ear-plugs
- CEN EN 352-8:2008- Hearing protectors — Safety requirements and testing — Part 8: Entertainment audio ear-muffs

EYE AND FACE PROTECTION

- CEN EN 166:2001- Personal eye-protection — Specifications
- CEN EN 169:2002- Personal eye-protection — Filters for welding and related techniques — Transmittance requirements and recommended use
- CEN EN 170:2002- Personal eye-protection — Ultraviolet filters — Transmittance requirements and recommended use
- CEN EN 172:1994, EN 172:1994/A1:2000, EN 172:1994/A2:2001- Personal eye protection — Sun glare filters for industrial use
- CEN EN 174:2001- Personal eye-protection — Ski goggles for downhill skiing
- CEN EN 175:1997- Personal protection — Equipment for eye and face protection during welding and allied processes
- CEN EN 207:2017- Personal eye-protection equipment — Filters and eye protectors against laser radiation (laser eye-protectors)
- CEN EN 208:2009- Personal eye-protection — Eye-protectors for adjustment work on lasers and laser systems (laser adjustment eye-protectors)
- CEN EN 379:2003+A1:2009- Personal eye-protection — Automatic welding filters
- CEN EN 1731:2006- Personal eye protection — Mesh eye and face protectors

- CEN EN ISO 12312-1:2013, EN ISO 12312-1:2013/A1:2015- Eye and face protection — Sunglasses and related eyewear — Part 1: Sunglasses for general use (ISO 12312-1:2013)
- CEN EN 13356:2001- Visibility accessories for non-professional use — Test methods and requirements

FEET AND LEG PROTECTION

- CEN EN 13832-2:2006- Footwear protecting against chemicals — Part 2: Requirements for footwear resistant to chemicals under laboratory conditions
- CEN EN 13832-3:2006- Footwear protecting against chemicals — Part 3: Requirements for footwear highly resistant to chemicals under laboratory conditions
- CEN EN 15090:2012- Footwear for firefighters
- CEN EN ISO 17249:2013, EN ISO 17249:2013/AC:2014- Safety footwear with resistance to chain saw cutting (ISO 17249:2013)
- CEN EN ISO 20345:2011- Personal protective equipment — Safety footwear (ISO 20345:2011)
- CEN EN ISO 20346:2014- Personal protective equipment — Protective footwear (ISO 20346:2014)
- CEN EN ISO 20347:2012- Personal protective equipment — Occupational footwear (ISO 20347:2012)

HAND PROTECTION

- CEN EN ISO 374-1:2016- Protective gloves against dangerous chemicals and microorganisms — Part 1: Terminology and performance requirements for chemical risks (ISO 374-1:2016)
- CEN EN ISO 374-5:2016- Protective gloves against dangerous chemicals and microorganisms — Part 5: Terminology and performance requirements for micro-organisms risks (ISO 374-5:2016)
- CEN EN 388:2016- Protective gloves against mechanical risks
- CEN EN 407:2004- Protective gloves against thermal risks (heat and/or fire)
- CEN EN 420:2003+A1:2009- Protective gloves — General requirements and test methods
- CEN EN 421:2010- Protective gloves against ionizing radiation and radioactive contamination
- CEN EN 511:2006- Protective gloves against cold

- CEN EN 659:2003+A1:2008, EN 659:2003+A1:2008/AC:2009- Protective gloves for firefighters
- CEN EN 1082-1:1996- Protective clothing — Gloves and arm guards protecting against cuts and stabs by hand knives — Part 1: Chain mail gloves and arm guards
- CEN EN 1082-2:2000- Protective clothing — Gloves and arm guards protecting against cuts and stabs by hand knives — Part 2: Gloves and arm guards made of material other than chain mail
- CEN EN 16350:2014- Protective gloves — Electrostatic properties
- CEN EN ISO 10819:2013- Mechanical vibration and shock — Hand-arm vibration — Measurement and evaluation of the vibration transmissibility of gloves at the palm of the hand (ISO 10819:2013)
- CEN EN 14328:2005- Protective clothing — Gloves and armguards protecting against cuts by powered knives — Requirements and test methods
- CEN EN 14387:2004+A1:2008- Respiratory protective devices — Gas filter(s) and combined filter(s) - Requirements, testing, marking

RESPIRATORY PROTECTION

- CEN EN 136:1998, EN 136:1998/AC:2003- Respiratory protective devices — Full face masks — Requirements, testing, marking
- CEN EN 137:2006- Respiratory protective devices — Self-contained open-circuit compressed air breathing apparatus with full face mask — Requirements, testing, marking
- CEN EN 140:1998, EN 140:1998/AC:1999- Respiratory protective devices — Half masks and quarter masks — Requirements, testing, marking
- CEN EN 142:2002- Respiratory protective devices — Mouthpiece assemblies — Requirements, testing, marking
- CEN EN 143:2000, EN 143:2000/AC:2005, EN 143:2000/A1:2006- Respiratory protective devices — Particle filters — Requirements, testing, marking
- CEN EN 144-1:2000, EN 144-1:2000/A1:2003, EN 144-1:2000/A2:2005- Respiratory protective devices — Gas cylinder valves — Part 1: Thread connections for insert connector
- CEN EN 144-2:1998- Respiratory protective devices — Gas cylinder valves — Part 2: Outlet connections
- CEN EN 144-3:2003, EN 144-3:2003/AC:2003- Respiratory protective devices — Gas cylinder valves — Part 3: Outlet connections for diving gases Nitrox and oxygen

- CEN EN 145:1997, EN 145:1997/A1:2000- Respiratory protective devices — Self-contained closed circuit breathing apparatus compressed oxygen or compressed oxygen-nitrogen type — Requirements, testing, marking
- CEN EN 148-1:1999- Respiratory protective devices — Threads for facepieces — Part 1: Standard thread connection
- CEN EN 148-2:1999- Respiratory protective devices — Threads for facepieces — Part 2: Centre thread connection
- CEN EN 148-3:1999- Respiratory protective devices — Threads for facepieces — Part 3: Tread connection M 45 x 3
- CEN EN 149:2001+A1:2009- Respiratory protective devices — Filtering half masks to protect against particles — Requirements, testing, marking
- CEN EN 250:2014- Respiratory equipment — Open-circuit self-contained compressed air diving apparatus — Requirements, testing and marking
- CEN EN 402:2003- Respiratory protective devices — Lung governed demand self-contained open-circuit compressed air breathing apparatus with full face mask or mouthpiece assembly for escape — Requirements, testing, marking
- CEN EN 403:2004- Respiratory protective devices for self-rescue — Filtering devices with hood for escape from fire — Requirements, testing, marking
- CEN EN 404:2005- Respiratory protective devices for self-rescue — Filter self-rescuer from carbon monoxide with mouthpiece assembly
- CEN EN 405:2001+A1:2009- Respiratory protective devices — Valved filtering half masks to protect against gases or gases and particles — Requirements, testing, marking
- CEN EN 1146:2005- Respiratory protective devices — Self-contained open-circuit compressed air breathing apparatus incorporating a hood for escape — Requirements, testing, marking
- CEN EN 1827:1999+A1:2009- Respiratory protective devices — Half masks without inhalation valves and with separable filters to protect against gases or gases and particles or particles only — Requirements, testing, marking
- CEN EN 12021:2014- Respiratory equipment — Compressed gases for breathing apparatus
- CEN EN 12083:1998, EN 12083:1998/AC:2000- Respiratory protective devices — Filters with breathing hoses, (Non-mask mounted filters) - Particle filters, gas filters, and combined filters — Requirements, testing, marking
- CEN EN 12941:1998, EN 12941:1998/A1:2003, EN 12941:1998/A2:2008- Respiratory protective devices — Powered filtering devices incorporating a helmet or a hood — Requirements, testing, marking

- CEN EN 12942:1998, EN 12942:1998/A1:2002, EN 12942:1998/A2:2008- Respiratory protective devices — Power assisted filtering devices incorporating full face masks, half masks or quarter masks — Requirements, testing, marking
- CEN EN 13794:2002- Respiratory protective devices — Self-contained closed circuit breathing apparatus for escape — Requirements, testing, marking
- CEN EN 13949:2003- Respiratory equipment — Open-circuit self-contained diving apparatus for use with compressed Nitrox and oxygen — Requirements, testing, marking
- CEN EN 14143:2013- Respiratory equipment — Self-contained re-breathing diving apparatus
- CEN EN 14435:2004- Respiratory protective devices — Self-contained open-circuit compressed air breathing apparatus with half mask designed to be used with positive pressure only — Requirements, testing, marking
- CEN EN 14529:2005- Respiratory protective devices — Self-contained open-circuit compressed air breathing apparatus with half mask designed to include a positive pressure lung governed demand valve for escape purposes only
- CEN EN 14593-1:2005- Respiratory protective devices — Compressed air line breathing apparatus with demand valve — Part 1: Apparatus with a full face mask — Requirements, testing, marking
- CEN EN 14594:2005, EN 14594:2005/AC:2005- Respiratory protective devices — Continuous flow compressed air line breathing apparatus — Requirements, testing, marking
- CEN EN 15333-1:2008, EN 15333-1:2008/AC:2009- Respiratory equipment — Open-circuit umbilical supplied compressed gas diving apparatus — Part 1: Demand apparatus
- CEN EN 15333-2:2009- Respiratory equipment — Open-circuit umbilical supplied compressed gas diving apparatus — Part 2: Free flow apparatus

Fall Protection

- CEN EN 353-1:2014+A1:2017- Personal fall protection equipment — Guided type fall arresters including an anchor line — Part 1: Guided type fall arresters including a rigid anchor line
- CEN EN 353-2:2002- Personal protective equipment against falls from a height — Part 2: Guided type fall arresters including a flexible anchor line
- CEN EN 354:2010- Personal fall protection equipment — Lanyards
- CEN EN 355:2002- Personal protective equipment against falls from a height — Energy absorbers

- CEN EN 358:1999- Personal protective equipment for work positioning and prevention of falls from a height — Belts for work positioning and restraint and work positioning lanyards
- CEN EN 360:2002- Personal protective equipment against falls from a height — Retractable type fall arresters
- CEN EN 361:2002- Personal protective equipment against falls from a height — Full body harnesses
- CEN EN 362:2004- Personal protective equipment against falls from a height — Connectors
- CEN EN 365:2004, EN 365:2004/AC:2006- Personal protective equipment against falls from a height — General requirements for instructions for use, maintenance, periodic examination, repair, marking and packaging
- CEN EN 795:2012- Personal fall protection equipment — Anchor devices
- CEN EN 813:2008- Personal fall protection equipment — Sit harnesses
- CEN EN 1497:2007- Personal fall protection equipment — Rescue harnesses
- CEN EN 1891:1998- Personal protective equipment for the prevention of falls from a height — Low stretch kernmantel ropes
- CEN EN ISO 12401:2009- Small craft — Deck safety harness and safety line — Safety requirements and test methods (ISO 12401:2009)
- CEN EN 12841:2006- Personal fall protection equipment — Rope access systems — Rope adjustment devices

5.4 British Standards for PPE

Protective helmets

- BS 6658:1985- Protective Helmets for Vehicle Users
- BS EN 4110:1979- Visors for Vehicle Users
- BS EN 397:2012+A:2012- Industrial Safety Helmets
- BS EN 812:2012- Industrial Bump Caps
- PAS 017:1995- Riot Helmets for Police use
- BS EN 1078:2012- Helmets for Pedal Cyclists and for users of Skateboards
- PAS 028:2002- Marine Safety Helmets
- UN ECE Regulation 22.05- Protective Helmets for drivers and passengers of mopeds and motor cycles with or without side-car and for visors fitted to such helmets or intended to be added to them
- AS/NZS 1801:1997- Occupational protective helmets

Impact protection for body

- BS EN 1177:1998- Impact absorbing playground surfacing
- IRB/REG12/Iss 1/2005- Specific items for rugby players' clothing (headgear, shoulder padding & banned items)

Respiratory products

- BS EN 140:1999- Half/Quarter masks
- BS EN 14387:2004+A1:2008- Gas Filters and Combined Filters
- BS EN 143:2000- Particle Filters
- BS EN 149:2001+A1:2009- Filtering half masks to protect against particles
- BS EN 1827:2009+A1:2009- Half masks separable filters to protect against gases or gases and particles
- BS EN 12941:1998+A2:2008- Powered Hoods and Helmets
- BS EN 12942:1998+A2:2008- Powered air for full/half masks
- BS EN 136:1998- Full face masks – Class 1, 2, or 3
- BS EN 405:2001+A1:2009- Valve Combined Filtering Half Mask
- BS EN 137:2006- Self Contained Breathing Apparatus
- BS EN 138:1994- Fresh Air Hose for use with face mask
- BS EN 14594:2005- Continuous Flow Compressed Airline Breathing Apparatus
- BS EN 402:2003- Self Contained Breathing Apparatus Escape Mask

- BS EN 1146:2005- Self Contained Open-Circuit Compressed Air Breathing Apparatus with Escape Hood
- BS EN 14683- Surgical Masks
- AS/NZS 1716:2012- Respiratory protective devices

Hearing protection

- BS EN 352-1:2002- Earmuffs
- BS EN 352-2:2002- Earplugs
- BS EN 352-3:2002- Earmuffs on safety helmets
- BS EN 352-4:2001- Level Dependent Earmuffs
- BS EN 352-5:2002- Active Noise Reduction Earmuffs
- BS EN 352-6:2002- Earmuffs with electrical audio input
- BS EN 352-7:2002- Level dependent earplugs
- AS/NZS 1270:2002 (R2014)- Acoustics - Hearing protectors

Eye protection

- BS EN 166:2002- Personal Eye Protection
- BS EN 175:1997- Welders eye and face protection
- BS 4110:1979- Visors for Vehicle Users
- BS EN 169:2002- Welding filters
- BS EN 170:2002- Ultraviolet filters
- BS EN 171:2002- Infrared Filters
- BS EN 172:1995- Sun glare filters for industrial use
- BS EN 1731:2006- Mesh face screens
- BS EN ISO 12312-1: 2014- Eye and face protection. Sunglasses and related eyewear. Sunglasses for general use
- BS 5883:1996- Swimming goggles
- AS/NZS 1337.1:2010- Eye and face protectors for occupational applications

Glove protection

- BS EN 60903:2003- Live working: Gloves of insulating materials
- BS EN 659:2003+A1:2008- Protective gloves – Firefighters
- BS EN 374-1:2016- Protective Gloves – chemicals and micro organisms
- BS EN 374-2:2014- Protective gloves – micro organisms
- BS EN 16523-1:2015- Determination of material resistance to permeation by chemicals

- BS EN 374-4:2013- Protective gloves against chemicals and micro-organisms. Determination of resistance to degradation by chemicals
- BS EN ISO 379-5: 2016- Protective plans against dangerous chemicals and micro-organisms
- BS EN 388:2016- Protective gloves – mechanical risks
- BS EN 407:2004- Protective gloves – heat and fire
- BS EN 420:2003+A1:2009- Gloves – general requirements
- BS EN 511:2006- Protective gloves – cold

Protective footwear

- BS EN 15090:2012- Footwear for firefighters
- BS EN ISO 20345:2011- Safety footwear
- BS EN ISO 20346:2014- Personal protective equipment Protective footwear
- BS EN ISO 20347:2012- Occupational footwear

High visibility clothing

- BS EN ISO 20471:2013- High visibility clothing

Protective clothing

- BS EN 464:1994- Protection against liquid and gaseous chemicals, including aerosols and solid particles
- BS EN 14605:2005+A1:2009- Protection against liquid chemicals with liquid tight connections (Type 3 Equipment)
- BS EN ISO 17491- 4:2008 + A1:2016- Protection against liquid chemicals
- BS EN 469:2014- Protective clothing for firefighters
- BS EN 510:1993- Protective clothing for use with risk of entanglement with moving parts
- BS EN 530:2010- Abrasion resistance of protective clothing materials
- BS EN ISO 11612: 2015- Protective clothing to protect against heat and flame
- BS EN ISO 15025: 2016- Protective clothing against heat and flame
- BS EN ISO 14116: 2015- Protective clothing against heat and flame
- BS EN ISO 12127-1: 2015- Protective clothing against heat and flame
- BS EN 943-1:2002- Protective clothing against liquid and gaseous chemicals, aerosols and solid particles
- BS EN 943-2:2015- Protective clothing against liquid and gaseous chemicals
- BS EN 1073-1:2016- Protective clothing against radioactive contamination

- BS EN 1073-2:2002- Protective clothing against radioactive contaminations
- BS EN 1149-1:2006- Protective clothing – electrostatic properties
- BS EN 1149-2:1997- Protective clothing – electrostatic properties
- BS EN ISO 6529:2001- Protection against permeation by liquids and gasses (ISO 6529:2001)
- BS EN ISO 10819:2013- Mechanical vibration and shock. Hand-arm vibration. Measurement and evaluation of the vibration transmit ability of glove at the palm of the hand
- BS EN ISO 13995:2001- Protection against mechanical properties (ISO 13995:200)
- BS EN ISO 13997:1999- Resistance to cutting by sharp objects (ISO 13997:1999)
- BS EN 342:2004- Protection against cold
- BS EN 343:2003+A1:2007- Protection against foul weather

Fall arrest equipment

- EN 341:2011- Descender Devices
- BS EN 360:2002- Retractable type fall arresters
- BS EN 361:2002- Full Body Harnesses
- BS EN 362:2004- Connectors
- BS EN 795:2012- Anchor points
- BS EN 813:2008- Sit harnesses
- BS EN ISO 12401:2009- Deck safety harness and safety line for use on recreational craft
- BS EN 1496:2017- Rescue lifting devices
- BS EN 1497:2007- Rescue harnesses
- BS EN 1498:2006- Rescue loops
- BS EN 358:2000- Work positioning belts
- BS EN 1891:1998- Low stretch kemmantel ropes

5.5 American Standards for PPE

- 29 CFR 1910.132 General Requirements
- 29 CFR 1910.133 Eye and Face Protection
- 29 CFR 1910.134 Respiratory Protection
- 29 CFR 1910.135 Head Protection
- 29 CFR 1910.136 Foot Protection
- 29 CFR 1910.137 Electrical Protective Equipment
- 29 CFR 1910.138 Hand Protection
- 29 CFR 1910.140 Personal Fall Protection Systems

The original standards were drafted and published in 1910, however amendments are released for these standards based on advancement and development of newer materials. The latest American National Standards for PPE are as follows;

- ANSI/ISEA 101-2014, American National Standard for Limited-Use and Disposable Coveralls – Size and Labeling Requirements.
- ANSI/ISEA 105-2016 American National Standard for Hand Protection Classification
- ANSI/ISEA 107-2015 American National Standard for High-Visibility Safety Apparel and Accessories
- ANSI/ISEA 113-2013 American National Standard for Fixed and Portable Decontamination Shower Units
- ANSI/ISEA 121-2018 American National Standard for Dropped Object Prevention Solutions
- ANSI/ISEA 138-2019 American National Standard for Performance and Classification for Impact-Resistant Gloves
- ANSI/ISEA 201-2019 American National Standard for Insulation and Wash Durability Classification of Apparel Used in Cold Work Environments
- ANSI/ISEA 203-2018, American National Standard for Secondary Flame-Resistant Protection Clothing for Use Over Primary Flame-Resistant Clothing
- ANSI/ISEA 207-2011 American National Standard for High Visibility Public Safety Vests
- ANSI/ISEA Z308.1-2015 Workplace First Aid Kits and Supplies
- ANSI/ISEA Z358.1-2014 Emergency Eyewash and Shower Equipment
- ANSI/ISEA Z87.1-2020 American National Standard for Occupational and Educational Personal Eye arnd Face Protection Devices
- ANSI/ISEA Z89.1-2014 (R2019) American National Standard for Industrial Head Protection