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Sustainable Textiles for Sustainable Development

Occupational Health and Safety in the Textile Industry

A Study of Low Cost Technological Solutions for Safe and Sustainable Textile Production

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Occupational Health and Safety in the Textile Industry:

A Study of Low Cost Technological Solutions for Safe and Sustainable Textile Production

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PREFACE

This document is intended to help initiate an understanding about the hazards and the occupational health and safety (OHS) issues prevailing in the unorganised textile sector. It focuses on the impact of the weaving and printing processes on the environment and their mitigation in the two selected areas of Bagru, Rajasthan and Pochampally, Andhra Pradesh.

It is not intended to be a step-by-step guide on the usage of the recommended low cost technological solutions. Though these have been tested in the field in the areas under the study, suitable local modifications and adjustments may be required to suit individual needs. It is recommended that this document be used as a guide on the types of hazards prevalent in the processes and as an introduction to the concept of low cost technological solutions to prevent these hazards. Further information on the recommended solutions may be obtained from the vendors directly or the project team.

This document would go a long way in strengthening, not only the functioning of the Sustainable Textiles for Sustainable Development Project, India, but would also serve as an essential reference guide for policy makers, academicians, health specialists, labour organisations, government agencies and the affected artisans themselves.

ACKNOWLEDGEMENTS

The project team wishes to express its gratitude to the European Commission for commissioning this study; to Traidcraft for extending their unstinting support and for offering valuable suggestions in this endeavour; and to the Consortium of Textile Exporters (COTEX), Jaipur, especially Rahul Duggal and Vikram Joshi, for facilitating and supporting this study. A sense of gratitude for Adarsh Kumar, Hon. Member, All India Artisans and Craftworkers Welfare Association (AIACA) Governing Board for his invaluable guidance and support. Heartfelt thanks for all partners without whose commitment and dedication this document would not have attained the level that it has today.

A word of appreciation for Savender Juneja, Co-ordinator, Jaipur Integrated Textile Park Private Limited, for his untiring co-ordination and field facilitation of the study. A special mention for Sanchal Foundation which has been instrumental in preparing this document.

The project team would specially like to acknowledge the significant support of the individuals and the artisans in the clusters of Pochampally, Andhra Pradesh and Bagru, Rajasthan for their eager and enthusiastic participation.

ABBREVIATIONS AND ACRONYMS

Abbreviation / Acronym	*Full Form*
AIACA	All India Artisans and Craftworkers Welfare Association
AIMO	All India Manufacturers Organisation
AITUC	All India Trade Union Congress
ASSOCHAM	Associated Chambers of Commerce and Industry of India
BMI	Body Mass Index
BMS	Bharatiya Mazdoor Sangh
CBI	CBI Concrete Research Institute, Stockholm
CBWE	Central Board of Workers Education
CIE	Confederation of Indian Employers
CII	Confederation of Indian Industry
CIP	Clean in Place
CITU	Centre of Indian Trade Union
COTEX	Consortium of Textile Exporters, Jaipur, Rajasthan
CSIR	Council of Scientific and Industrial Research
CTD	Cumulative Trauma Disorders
DDE	Dichloro Dipheny Dichloroethylene
DDT	Dichloro Diphenyl Trichloroethane
DGFASLI	Directorate General of Factory Advice Service and Labour Institutes
DMC	Development of Mega Cluster
EDTA	Ethylene Diamine Tetra Acetic acid
EC	European Commission
FICCI	Federation of Indian Chambers of Commerce and Industry
GDP	Gross Domestic Product
GI	Geographical Indication
HDPE	High-density polyethylene
HEPC	Handloom Export Promotion Council
HGM	Hand Grip Meter
HMS	Hind Mazdoor Sangh
IAOH	Indian Association of Occupational Health
IIHT	Indian Institute of Handloom Technology
IIT	Indian Institute of Technology
IITR	Indian Institute of Toxicology formerly, Industrial Toxicology Research Centre, Lucknow
INTUC	Indian National Trade Union Congress
IR	Infrared
ISDS	Integrated Skill Development Scheme
LUB	Laghu Udyog Bharati
MoLE	Ministry of Labour and Employment
MSDS	Material Safety Data Sheet

ABBREVIATIONS AND ACRONYMS

Abbreviation / Acronym	*Full Form*
NABL	National Accreditation Board for Testing and Calibration Laboratories
NGO	Non-Governmental Organisation
NHDC	National Handloom Development Corporation
NIFT	National Institute of Fashion Technology
NIOH	National Institute of Occupational Health
NSC	National Safety Council
NTA	Nitrilo Triacetic Acid
OHS	Occupational Health and Safety
OSHA	Occupational Safety and Health Administration
PCP	Phencyclidine
PFT	Pulmonary Function Test
PPE	Personal Protective Equipment
PPP	Public Private Partnership
PVA	Polyvinyl acetate
PVC	Polyvinyl chloride
SCP	Sustainable Consumption and Production
SIDA	Swedish International Development Agency
SITP	Scheme for Integrated Textile Parks
SME	Small and Medium Enterprises
SS	Suspended Solids
TMTT	Technology Mission of Technical Textiles
TX	Traidcraft Exchange, UK
TUFS	Technology Upgradation Fund Scheme
UV	Ultraviolet Radiation
WHS	Workplace Health and Safety
WSC	Weavers' Service Centres

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1. INTRODUCTION

1.1 CONTEXT

The Indian textile and craft sector is one of the largest contributor to the country's Gross Domestic Product (GDP); yet, its progress is conditioned by the numerous challenges it faces in terms of environmental and social performance. The situation has been further compounded by the lack of targeted efforts to study and address problems relating to the general environmental impact of textile and crafts production processes as well as the health and safety of workers. A pro-active approach to improving environmental, health and safety measures has been envisaged as a key step in ensuring long-term competitiveness of this sector.

A detailed study concerning occupational health and safety in the Indian textile sector specifically the handloom and the handicrafts component has long been overdue.

1.2 GENESIS OF THIS STUDY

In this context, the European Commission (EC) launched the SWITCH-Asia Programme, as a grants programme funded through its Development Co-operation Instrument. The programme aims to promote the adoption of Sustainable Consumption and Production (SCP) and brings together a range of partners, including technical service providers, textile producer groups and small and medium enterprises (SMEs) to conduct action research for providing low cost technological solutions which can help reduce pollution from textile production activities. The programme also addresses the level of policy-making by supporting formulation and implementation of SCP related policies. For more information, please visit http://www.switch-asia.eu/

The All India Artisans and Craftworkers Welfare Association (AIACA), New Delhi is spearheading the four-year Sustainable Textiles for Sustainable Development project, under the SWITCH-Asia programme.

Traidcraft Exchange (TX), one of the leading fair trade organisations of the UK, is the lead partner for the project. The Consortium of Textile Exporters (COTEX), Jaipur is an associate partner.

TRAID, UK has co-funded the project for developing a toolkit on Low Cost Technological Solutions for Textile Production and conduct research on Occupational Health and Safety gear.

The project seeks to promote sustainable production (i.e. development of less polluting and resource efficient products and processes) and sustainable consumption patterns in the crafts and textile industry in India through awareness raising, capacity building and policy research.

A baseline study on the environmental and occupational health impacts was conducted in 2009-10 covering six different cottage industry clusters spread across three states of Rajasthan, Andhra Pradesh and Orissa in India.

The study was carried out by the Hazards Centre and included: **i)** Hand Block Printing cluster in Bagru, Rajasthan; **ii)** Blue Pottery cluster in Jaipur, Rajasthan; **iii)** Leather work cluster in Ajmer and Jaipur, Rajasthan; **iv)** Ikat Weaving cluster in Pochampally, Andhra Pradesh; **v)** Dhokra cluster in Orissa; and the **vi)** Bell Metal cluster in Orissa. This baseline study is one of the few studies in India which researched and analysed the inter-linkages between creating safe work conditions, ensuring a healthy environment, promoting and consideration for workers' health, and the reduction of point sources of occupational hazards.

The current project, a sequel to a baseline study conducted in 2009-10, carried out a more elaborate review, with specific emphasis on assessing the handloom and handicraft production processes, their associated hazards, and low-cost technical solutions for the prevention of hazards and to ensure the safety of artisans at the work-place. The study specifically focused on the two major clusters of Hand Block Printing in Bagru, and Ikat Weaving, Pochampally, in the states of Rajasthan and Andhra Pradesh, respectively.

This document incorporates the compiled results of the feedback obtained, specifically highlighting the various hazards involved in the production processes, their related health concerns, and the specific mitigation efforts including the laws and rules for their prevention, and innovative methods if any to control them at the source.

This document is part of a series of project related documents including "Domestic Market Research on Eco-Friendly and Sustainable Textile Products in India", "Baseline Study on Environment, Occupational Health and Safety Issues in the Crafts Sector" and "Occupational Health and Safety Manual for Artisans". These are available on http://www.aiacaonline.org/policy-switch-asia-reports.asp

Another component of this project included the testing of water at various locations in the two areas and the effluent treatments being carried out. However, after the study of the processes, it was recommended to have secondary Effluent Treatment Plants (ETPs). As this requires further detailed study, this aspect of the project would be covered in detail in the "Toolkit for Sustainable Textile Production".

1.3 METHODOLOGY ADOPTED

As weaving and printing practices form the foundation of the textile industry, the processes involved in these two sectors were taken up for detailed assessment. These units, as they are mostly in the unorganised sector, have a greater relevance with regards to occupational health and safety (OHS) and thereby, apt for devising and recommending low cost solutions for effective adoption.

Bagru and Pochampally are the two major clusters for Block Printing and Weaving, respectively, and are also two of the major focus areas for AIACA.

As the current study built upon the baselines recorded in the 2009-10 study, it utilised the already documented general production process in both clusters. In addition, data on the health status of workers collected from a random sample (through a series of simple tests) was also used in the current study.

Refer ***Annexure 1*** for the survey questionnaire which was used to obtain the relevant information about OHS practices in these areas.

Based on this data, the research team used the methodology outlined in the following sections.

1.3.1 Research and Documentation of Existing Production Process through Field Visits

The research team first studied each step of the documented general production processes in detail and prepared a list of the materials and equipment used by the workers. These analyses and observations were discussed with technical experts in New Delhi in the context of possible hazards and alternative technologies, materials and equipment. The research team then spent an additional week each at Pochampally and Bagru to substantiate their findings and prepared intensive documentation (both textual and audio visual) of discussions with artisans at work, entrepreneurs and of the potential hazards observed and safety measures adopted in the two clusters. They also documented the possible health impacts from handling of materials and equipments involved in each stage of production.

1.3.2 Recommendation of Affordable Safety Measures

After the field visits, the various physical, chemical, ergonomic, and other occupational hazards prevalent in the two clusters were listed. The visual documentation and consultation with experts in the relevant fields further helped to categorise the specific nature of the hazards. Subsequently, possible safety measures like hand gears and gloves, ankle cap, mixer, and loom modification were designed.

Some of these were specially designed by the project team and a few, which were already available in the market, were studied for suitability. Numerous alternatives were suggested with regard to the working pattern of the artisans, their comfort index, low cost, and the benefits over the long run.

Working models were also formulated to suggest improvements in the equipment and gear so as to reduce occupational health hazards of textile workers with specific focus on textile production and dyeing activities. Attempt was also made to highlight their role in reducing the environmental impacts.

1.3.3 Trial Run of the Safety Measures

The next step was to test the suitability and adequacy of the suggested improvements in protecting the artisans from the hazards, and also to assess the acceptability and affordability to the users. Getting the feedback from the user groups, especially the artisans and workers, on the proposed modifications also formed an important component of this step.

The scope of the study also provided for conducting trial runs and thematic workshops with the artisans. The feedback from these workshops was very important and has served as a key input for this document. The details of the workshops organised are provided in the table below:

Table 1: Trial Runs and Thematic Workshops conducted in Clusters

S.No.	Place organised	Time	No. of participants	Highlights	Remarks
1.	Bagru	May 2011	4	Poor/ Safety gear could be tested only for a very brief period of time	Feedback was very unsatisfactory due to low participation
2.	Pochampally (Ikat weavers)	June 2011	24	Organised as a trial run with dissemination in regional languages	Workshop was successful as some self-innovations were also developed by the artisans themselves
3.	June 2011	June 2011	47	The tests conducted here have not been included in this study as Bhuj was not a selected location for this study.	Good feedback received; enthusiastic participation
4.	July 2011	July 2011	Representatives of six partner organisations of AIACA	Presentation of the findings of the surveys and the proposed models	Participants were very enthusiastic and willing to carry out similar studies in their respective areas

Source: Organisational interventions taken from past reports and field activities of the Research Team in the field.

Demo loom acting as a poster display stand, Pochampally

Trial Run, Pochampally

Note: It is important to note there that the testing of the tools has been done in select locations but all the tools have not been tested across all locations. Multi-level testing has not been carried out which would establish the recommended gear as the fool-proof tested solution. These are recommendations of low cost technologies which could help reduce hazards and increase OHS of the artisans.

1.3.4 Preparation of the Final Document

The final stage in the methodology was the preparation of this document.

The study was commissioned in March 2011. The Bagru and Pochampally clusters were identified and a study of the existing processes and field visits were carried out. The identification and finalisation of the safety measures took a few months. The trial runs were carried out during May-July 2011 and the final documentation preparation was completed by December 2012.

Continuous feedback and learning were key ingredients of the methodology adopted. At each stage of the study, a 'look back' ensured that the learnings were incorporated and carried forward into the next stage, not just from the point of view of the study outcomes but also in terms of the processes followed for the study itself.

1.4 STRUCTURE OF THIS DOCUMENT

This document comprises eight sections (including this one) and four annexures.

Section 1: Introduction outlines the ***context and genesis of this study***, followed by the methodology.

Section 2: Study Clusters: A brief glimpse ***describes the craft forms and the processes used*** in Block Printing in Bagru, Rajasthan and Ikat Weaving in Pochampally.

Section 3: Types of Hazards provides information on the different types of hazards faced by the artisans practising these two crafts.

Section 4: Innovative and Low Cost Methods to Control Hazards lists the different technological solutions offered to alleviate the identified hazards and reduce health and environmental problems.

Section 5 provides detailed information on ***occupational and personal hygiene measures.***

Section 6 talks about ***the laws of the Government of India*** in this context and the available institutional support.

Section 7 details the ***issues observed and the recommendations*** thereof.

Annexures 1 to 5 provide additional reference information including specifications and costs of the prototype safety equipment, state pollution control guidelines, a list of harmful dyes, pigments, etc. and relevant Government laws and regulations.

2. PRINTING AND WEAVING PROCESSES

2.1 BLOCK PRINTING IN BAGRU, RAJASTHAN

The beautiful art of block printing involves wooden blocks to print designs and patterns by hand on the fabric. The uniqueness lies in the fact that the design has to be created before the printing begins and it is carved onto the block by hand. The colours used are normally vegetable dyes, though now mineral and non-toxic chemical dyes are also being used. The carved block is dipped into the required colour, and then it is used to print designs on the fabric.

The traditional process of hand block printing on textiles, with rich natural colours, has been known for many centuries, beginning perhaps around 450 years back. Excavations of dyed and printed fabric have traced the origin of block printing to the 17th century in Gujarat. From Gujarat, the art spread to Rajasthan. Here, colourful prints of birds, animals, human figures, Gods and Goddesses are more popular. The important centres for this form of hand printing are Jaipur, Bagru, Sanganer, Pali and Barmer. Today, block printing is practiced in numerous centres all over India.

Bagru has a community of Chhipas who came from Sawai Madhopur, Alwar, Jhunjhunu, and Sikar districts of Rajasthan. Chhipas are the traditional craft communities who printed fabrics by hand[1] . Earlier there were about 3000 households who were engaged in the craft and used only vegetable dyes. However, now production has been diversifying from screen printing to digital printing according to market demands which involves mechanisation requiring lesser manpower and yielding faster production, and also involving the use of chemical dyes. This has led to the decline in the traditional hand block printing practice in Bagru with only 600-800 households practicing at present. However, in contrast, screen printing has spread to a greater extent in the urban neighbourhoods of Sanganer and Jaipur.

2.1.1 Process Description

Prior to printing, the fabric is washed several times to remove starch, in order to make it softer and more absorbent for dyeing and printing. The fabric is washed either by hand or in the machine. This process of washing is also known as bleaching when mild caustic soda and hydrogen peroxide are used. This is followed by printing which is done once the fabric has been sun dried. Various types of dyes are used for the printing process:

- Vegetable dyes, along with which mordant is used to make the colour permanently fixed to the cotton fabric.
- Rapid dyes are used for negative designs. They are mixed with water and boiled with caustic soda and gum paste. For these dyes, the true colour appears only after the fabric has been printed and washed with mild sulphuric acid solution.
- Discharge dyes are used when printing has to be done on a dark background. When exposed to heat they concurrently bleach the colour from the dyed background of the fabric and print the desired colour in its place.

The process of preparation of dyes is similar irrespective of the printing process. Whether it is block printing, screen printing or resist printing (daabu) the process is the same. In Bagru, mainly block printing and daabu printing are practiced.

[1] http://www.msmefoundation.org/folder/Article/58.pdf

Direct or Block printing: In this process the master printer develops the main pattern using an outline block with a single colour. He is then followed by a series of assistant printers who use filler blocks with different colours to produce the final pattern.

Resist printing: Daabu or resist printing involves the application of a mixed mud paste on the fabric by means of filler or outline blocks. Since this paste does not dry immediately, it may be sprinkled over with sawdust which acts as an absorbent. After drying, when the fabric is immersed in a dyeing vat, the colour is not taken up by the areas where the paste has been applied. Although women have traditionally done daabu printing, men are now also involved in this craft.

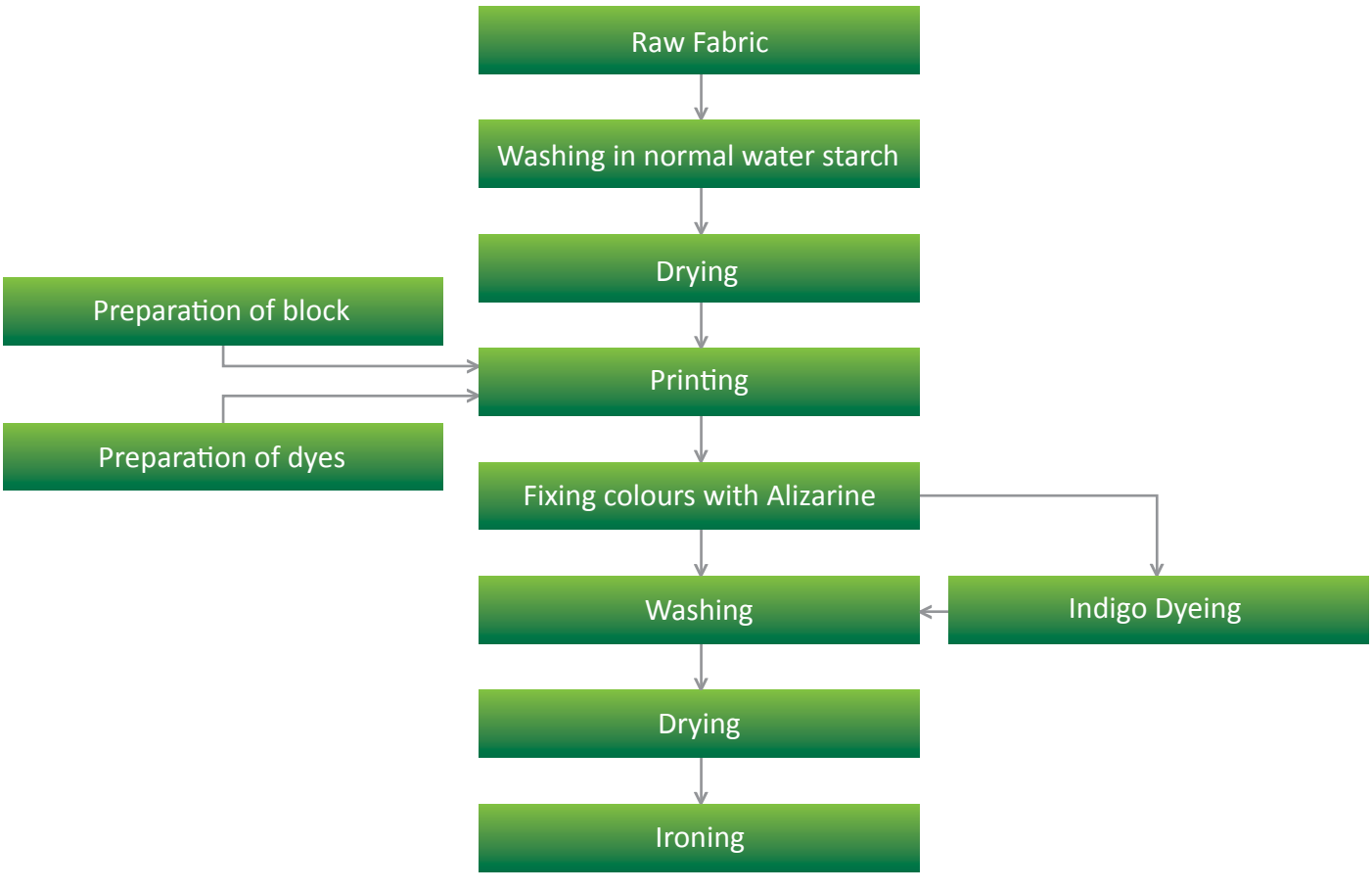
After the printing process, the fabric is sun dried. The colours are then matured and fixed by dipping the fabric for about 4-5 hours in alizarine and sakura flowers contained in a heated copper vessel (tamra).

Sometimes, a blue background is also given to the fabric specifically in the case of resist printing. A two metre deep sunken vat (math) is prepared and is filled with indigo, lime, molasses and water. The cloth is dipped a few times for getting varying shades of blue. In case of daabu, the cloth is first dyed with a lighter shade, and after the application of mixed mud it may be re-dyed to acquire a deeper hue.

After the printing and the dyeing of the cloth, it is hand-washed, sun dried, and ironed to heat-treat the colours, before packing for the market.

2.1.2 Process Flowchart

The following diagram represents the processed involved in block printing:



Flow Chart of Block Printing

2.2 IKAT WEAVING IN POCHAMPALLY, ANDHRA PRADESH

Pochampally is a small town in Nalgonda district of Andhra Pradesh, a centre known for its handloom silk sarees and its unique Ikat designs. Pochampally gained prominence in the 1900s, through the indigenously produced tie-and-dye rumals (handkerchiefs) and scarves (recognized widely as Asia rumals, sobiyani rumals, jananilu, etc.). Besides being popular in and around Hyderabad, these were also exported to Pakistan, Afghanistan and other Arab countries, where they were mostly used as keffiyeh /shemagh /ghutra (traditional head dress typically worn by Arab men).

During the end of the Nawab's rule (1948), the handloom business of Pochampally was in distress because of the collapse of the Hyderabadi business elite. However, as handlooms were accorded the second highest priority in the 1st Five Year Plan, it provided an impetus to the handloom sector becoming more organised. A co-operative society was initially developed in Koyalagudem located about 20 km away from Pochampally. However, difficulty in transport of raw materials and the finished products persuaded the weavers to open a local branch at Pochampally in 1952, which later on became an autonomous "Pochampally Handloom Weavers' Co-Operative Society Limited" in 1960. Gradually but progressively, Pochampally developed as a centre of handloom silk in the entire country.

At present, there are about 5,000 weavers who weave the handloom with the traditional design called Ikat. These weavers are mostly Hindus of the Padmasali or Devang communities who have been residents of the area for long and have adopted the local dialect and social norms. They produce Ikat textiles with geometrical designs but have also recently started experimenting with other Indian styles[2] .

In principle, Ikat or resist dyeing, involves the sequence of tying (or wrapping) and dyeing exposed sections of bundled yarn to a pre-determined colour scheme prior to weaving. The patterns formed on the yarn are then configured into the woven fabric.

The designs in various colours may be formed on the fabric either by warp threads or weft threads (single Ikat) or by both (double Ikat). In single Ikat, the tie-and-dye warp or weft threads are positioned accurately on the woven fabric through a predetermined sequence of weaving. In case of double Ikat, not only are the warp and weft threads individually positioned but the relative position of each is also accurately ensured to give the final design. In these textiles, the forms are deliberately feathered so that their edges appear hazy and fragile by the use of very fine count yarn, tied-and-dyed in very small sets. Increasing the number of colours for bringing out the figures increases the number of tying-and-dyeing operations.

2.2.1 Process Description

A single yarn is made from a group of filament or staple fibres twisted together. About 15 different types of fibres are used to make yarn. The process of making this craft starts with removing fats and oils (gums) from the yarn which is called yarn de-gumming. The artisans of Pochampally follow the water de-gumming process in which a water bath is heated to a temperature of about 70-90°C by burning firewood. The yarns are subsequently dipped and washed in the bath with the help of a bamboo. After de-gumming, the yarn is hung on a bamboo pole for complete drying under a shelter. Sun-drying is not carried out as it can affect the colour of the yarn. The skein of the yarn is then tightly fixed in a wooden wheel from which it is wound onto a piece of PVC pipe attached to a rim. Thus by rotating the rim with a hand pedal, the yarns are wound from the skein of yarn.

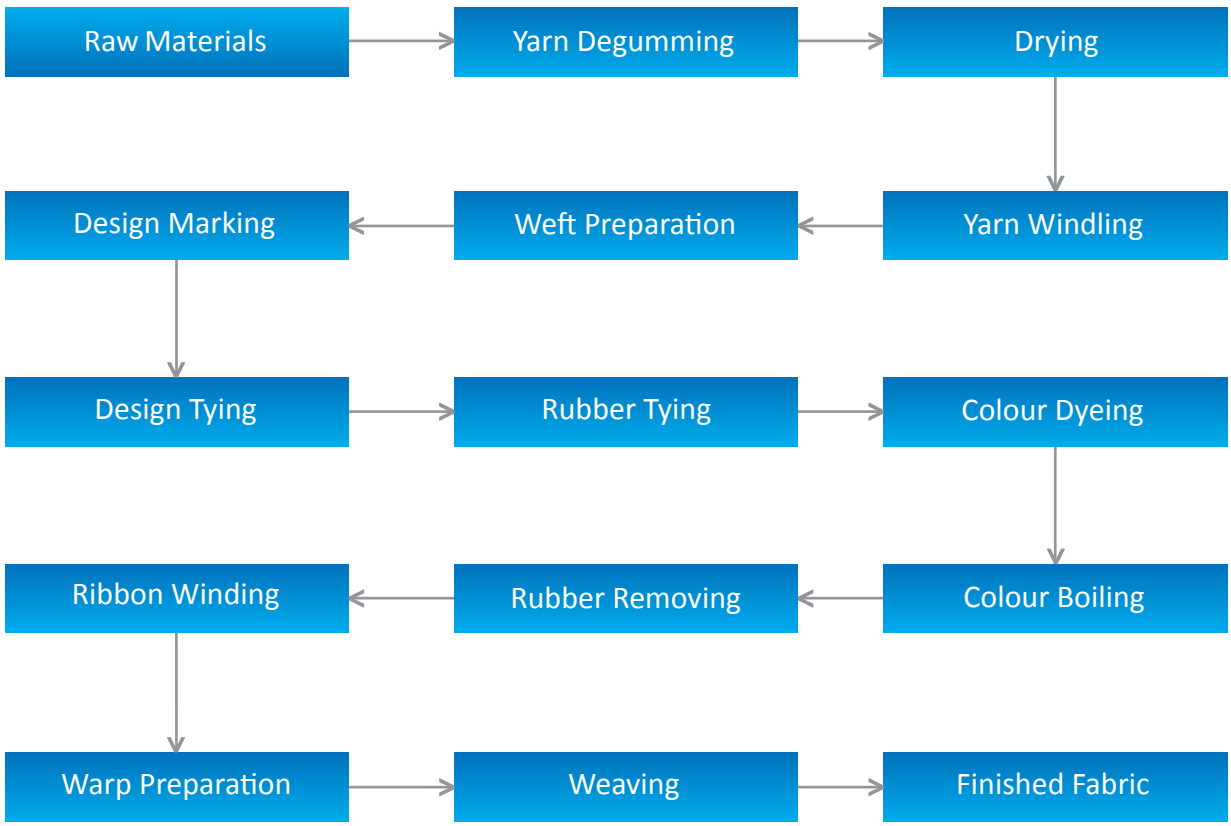
[2] http://textilescommittee.nic.in/pochampally-GI.pdf

From the winding ball, the yarns are then horizontally coiled into a bunch of yarns called wefts and the process is thereby referred to as weft preparation. On the weft threads, design is marked with pen or pencil and after marking, they are tied with the help of threads in the marked portions. Rubber tubes of bicycle are also used for tying which are wrapped onto the portion of weft threads where dyeing is not required. The weft threads are then dipped in the dye bath where Naphthol or Vat dyeing is done, according to the requirement of yarn that is to be dyed. The number of tying-and-dyeing operations increases with the number of colours to be used for a particular design. After tying-and-dyeing, the wax is removed by boiling and this gives a multi-coloured and motif piece of art fabric. Then the rubbers are removed from the wefts, the threads are straightened, and the process is repeated with a different dye.

The yarns are then wound on a bobbin by using the spinning wheel. Simultaneously, warp preparation is carried out where the yarn is transferred from single packages to an even sheet representing hundreds of ends and then wound onto a warp beam. Finally weaving is done with the help of a loom. This process requires the setting up of the loom and installation of the warp on the loom. The warp is passed through the heddle, separated into two sets of warp, and the weft is then passed manually through these sets with the use of a shuttle. As a result, a final woven piece of fabric is produced. This could be used as a readymade garment or a final print raw material that may be used by tailors to make customised products.

2.2.2 Process Flowchart

The following diagram represents the processes involved in Ikat:



Process Flow Chart of Ikat

3. TYPES OF HAZARDS

Workplace hazards as observed and analysed during the course of the study in both clusters can be broadly classified as:

- Chemical,
- Physical, and
- Ergonomic

Each of these hazards are detailed in the following sections.

3.1 CHEMICAL HAZARDS

Chemicals are not hazardous by themselves but become hazardous when they are in the wrong place in the wrong amount or when they are produced synthetically and humans do not know how to handle them properly. The toxicity of the chemicals is relative and is dependent on their concentration, duration of exposure, resistivity of the exposed and their magnification.

Chemical hazards may vary in form (solid, liquid or gas) concentrations and in their manifestation which may range from minor illnesses like skin irritation or breathing problems to major issues which may be oncogenic and may induce mutational changes in the body. These can also become genetic i.e. can be passed on to future generations.

Chemical hazards fall into five main categories[3] :

Poisonous or toxic: These chemicals having toxic effects on human health and are manifested either as immediate effects such as unconsciousness, skin rashes, breathing problems or as long term physiological effects which may be fatal and/or may lead to body deformities including alimentary tract infections and even cancer.

These usually gain entrance into the body either through the skin or through breathing. The study of toxic effects and how the body reacts to different chemicals is called toxicology.

Corrosive: These chemicals (such as sulphuric acid or by caustic soda) cause corrosive or burning effects. Contact of the eye with such chemicals can lead to permanent blindness.

Irritants: These chemicals irritate the skin and lungs, causing dermatitis (inflammation of the skin) and bronchitis (inflammation of the respiratory tract).

Sensitizers: These chemicals induce allergic reactions (sensitisation) leading to skin effects (contact dermatitis) and lung effects (asthma).

Explosive or flammable: These chemicals (like petroleum) can cause major explosions. Other chemicals can burn, causing devastation with their flames and heat or, more indirectly, through their toxic fumes.

In order to cause damage, toxic materials must first enter the body. Entry occurs primarily in three ways: ingestion, absorption and inhalation.

[3] Mathews John "Health and Safety at Work", Australian Trade Union Safety Representative Handbook, Pluto Press Australia Limited, 1985, Chapter 9

The following table details the three types of entry routes.

Table 2: Route of Entry of Chemicals in the Human Body

Ingestion	*Absorption*	*Inhalation*
Eating, smoking or drinking while working Through soiled hands Biting nails Accidental swallowing of contaminated food Dust trapped by mucous and transported back to the throat from where it enters the stomach	Skin has a barrier of wax, oils and dead cells on the surface which are destroyed by the chemicals to pave their entry Cuts, abrasions, burns, rashes, etc. on the skin allow chemicals to enter the blood stream and transported throughout the body Eyes may also absorb chemical substances, either from splashes or from vapours	Breathing leads to the entry of the chemical through the nose and sinuses to the lungs Some are absorbed by the lungs and then transported via blood to other organs Other substances are deeply inhaled and remain in the lungs for a lifetime and lead to chronic respiratory tract infections.

3.1.1 Block Printing

In earlier times, vegetables dyes were used in block printing. But now-a-days different chemical dyes and pigments are in use. Several factors are accountable for the replacement of vegetable dyes with chemicals, such as:

- Cost of the chemical dyes being low in comparison to vegetable dyes.
- More time is required to extract the dyes from nature whereas chemical dyes are easily accessible.
- Durability of the finished products of chemical dyes is better than the vegetable dyes.

Moreover, the cost of the products is more in case of vegetable dyes and hence the markets automatically trend towards the low-cost products which are of course, made of chemical dyes.

Different Types of Chemical Dyes

In the study area of Bagru, most of the artisans still prefer to use vegetable dyes although they are being impacted adversely by the market demand. Hence, the artisans are forced to leave the traditional craft and shift to daily wage work either under a contractor or in other printing units. Some of the artisans are also given the impression that due to the minimal use of chemicals in the small units as compared to the amounts being used in the large scale industries, their effects should also be negligible – and this is a matter of concern from the perspective of ignorance of long-term effects (chronic problems).

New chemicals are being introduced into the workplace at an increasing pace besides a number of chemicals already being used and posing significant hazards. The working spaces in the block printing units are confined and gases and vapours can steadily build up to cause severe health hazards. Fumes from acids can cause blindness with terrifying burns and flammable liquids can leak into undetected areas and catch fire or explode. Sometimes chemicals can be used and handled for years without any obvious problem and suddenly the workers are seized by cancer or chronic liver or kidney diseases.

New chemicals are being introduced into the workplace at an increasing pace besides various chemicals already being used. This is alarming as this not only affects the health of the workers and their families, but also progressively degrades the environment with the release of toxic materials and gases, in addition to an over-exploitation of the natural resources.

The following table lists the various chemicals used in block printing and related hazards

Table 3: Chemicals used in the Block Printing Process and Related Hazards

S.No.	Chemical	Hazards
1.	Sulphuric acid[4]	• Very hazardous, corrosive, irritant and penetrative in nature. • In case of skin contact, it causes skin inflammation characterised by itching, burning, scaling, reddening and blistering. • Liquid or spray mist may produce tissue damage particularly on mucous membranes of eyes, mouth and respiratory tract characterised by coughing, choking and shortness of breath. • It is carcinogenic and toxic to kidneys, lungs, heart, eyes, teeth, cardiovascular system and upper respiratory tract. • Severe over-exposure can result in death.
2.	Alizarin[5]	• Very hazardous in case of ingestion. • Causes eye and skin irritation. • Inhalation of dust may cause respiratory tract irritation. • It is toxic to lungs and mucous membranes. • Repeated or prolonged exposure to the substance can produce damage in target organs.
3.	Lime[6]	• Severe irritation of mucous and skin, removes natural skin oils. • Severe irritation, intense watering, possible lesions in eyes if exposed for prolonged periods. • Irritation in respiratory tract, coughing and sneezing, if inhaled in the form of dust. Excessive inhalation leads to silicosis, pneumoconiosis and pulmonary fibrosis. • If ingested, it causes pain, blood vomiting, diarrhoea and drop in blood pressure. • Repeated and prolonged contact causes redness, peeling of the skin, and fissures.
4.	Adhesive[7]	• Long exposure may cause skin irritation. • Breathing high concentration of vapour may have an effect on the central nervous system with vomiting, headache and dizziness. • Long and frequent exposure may cause anaemia, hepatic disorders and effects on the nervous system. • May be harmful if swallowed. Vapour may be irritating to the eyes and the respiratory system.
5.	Alum[8]	• May cause irritation to eyes, skin and mucous membranes. • Ingestion may cause gastric problems, irritation, and vomiting. • Astringent property may cause tightening of the skin.
6.	Dyestuff[9]	• Causes skin irritation, skin rash, scaling and bleeding, often on the hands and forearms. • Itchy or stinging noses; sneezing and blocked nose; and sore and watery eyes. • Some people develop an allergy to certain reactive dyes. • Usually this affects the airways and causes respiratory sensitisation leading to unusual breathlessness or wheezing. • A small number of dyes, based on the chemical benzidine, are thought to possibly cause cancer.

[4] http://cartwright.chem.ox.ac.uk/hsci/chemicals/sulfuric_acid.html

[5] http://www.sciencelab.com/msds.php?msdsId=9922824

[6] http://www.lhoist.us/pdf/Lime-SparBlend042908.pdf

[7] http://www.c-sgroup.com/files/tech-center/acrovyn/msds/pdf/ex-85m003002_10.pdf

[8] http://www.jmloveridge.com/cosh/Alum per cent20 per cent28Potash per cent29.pdf

[9] http://www.atul.co.in/colors/msds/sulphurdyes.pdf

7.	Caustic soda[10]	• Eye contact can cause severe damage including burns and blindness. • Exposure to vapour, mist or liquid can produce burns of the respiratory tract and severe lung damage. • Contact with skin may cause burns and tissue destruction. Prolonged or repeated contact causes high degree of tissue destruction. • Ingestion causes severe burns and complete tissue perforation of mucous membranes of mouth, throat, and stomach.
8.	Hydrogen peroxide[11]	• Very hazardous in case of skin and eye contact • Exposure may damage mucous membranes of eyes, mouth, and respiratory tract • Prolonged exposure causes skin burns and ulcerations

Sources: As mentioned in the footnotes against each item

Areas of Concern

Washing: Washing is one of the most important steps in both, block printing and screen printing processes. In block printing, washing is done twice; first for the removal of starch and then after printing for the removal of excess colour. This is very tedious and is to be repeated 2-3 times each for the removal of starch and the extra colour. Washing to remove the excess colour is an occupational hazard as the artisans have not only to stand in the water tank and beat the cloth several times, but the procedure has to be followed in 3-4 different tanks for the complete removal of excess colour. The chemicals washed during the process can become toxic for artisans due to persistent exposure.

Washing of fabric after printing

Colourisation and pigmentation in different parts of the body of the artisans was a common observation in the study area. Moreover, the untreated discharge is also damaging for the environment. This may be mitigated substantially by reducing the excess colour, water requirement and by also redesigning the washing tank.

Mixing of chemicals and dyes: This is commonly done in a small bucket with the help of a wooden stick. The toxicity of the fumes generated during mixing varies with the chemicals used and their concentration. The work environment, especially the ventilation facilities, play a major role in the extent of the effect of the fumes. If a large amount of chemical is mixed in a closed environment then the artisans will suffer from asphyxiation. On the other hand, if the amount of chemicals used is less, then the vapour or fumes will rise less and remain undetected. But if the worker follows the same procedure in close proximity for longer periods of time then it may lead to chronic toxicity leading to

Mixing of chemicals and dyes in block printing

[10] http://www.mvc.com.ph/pdf/MSDS-NaOH.pdf

[11] http://www.sciencelab.com/msds.php?msdsId=9924299

diseases like cancer. In either case, inadequate ventilation is a matter of concern for block printing units. This hazard can be substantially controlled through proper ventilation and a careful selection of the equipment. Storage and clear labelling of hazardous chemicals along with regular health checks of the workers will also be helpful in reducing the impacts of the fumes and vapours.

Printing: The hand pressing of the block dipped in colour is a continuous process. The cloth from which the colour is transferred to the block is wetted periodically by pouring dyes on it. The tray is placed on a movable table at a height equivalent to the height of the table on which the fabric is kept for printing. Thus, there is a continuous odour of the dyes during printing which is undesirable for the artisans in a closed room. Another concern is that the printing is done mostly in the summer for better fixing of the dyes onto the cloth but, according to the artisans, they cannot use the fan as the dyes dry quickly due to air circulation.

Block printing

The absence of proper exhaust system for ventilation and poor lighting further add to eye strain for the workers. This can be easily reduced by proper designing of the workplace with proper ventilation and natural illumination. Back pain from repetitive work can be reduced through regular rest breaks and more ergonomic table design; and injuries to the hand, fingers, arms, wrists may be prevented by the adoption of protective gear. Thus, there are significant hazards that may result from the use of chemicals in a closed environment and can also lead to chronic toxicity for the artisans.

3.1.2 Ikat Weaving

The following table lists the various materials used in Ikat and related hazards:

Table 4: : Materials in Ikat Weaving Process with their Hazards

S.No.	*Chemical and Dust*	*Hazards*
1.	Cotton dust[12]	• Difficulty in breathing or perhaps tightness across the chest. • Prolonged exposure causing chronic obstructive lung diseases like bronchitis, asthma, emphysema, and byssinosis.
2.	Naphthol dye[13]	• Irritation to eyes and respiratory system. • Skin problems like contact dermatitis. • May cause cancer.
3.	Acetic acid[14]	• Exposure to vapour irritates the membranes of nose, throat, lungs, and eyes. • Severe irritation in respiratory tract leads to coughing, choking, or shortness of breath. • Liquid or vapour may cause severe eye damage, irritation, burning, and watering of the eyes. • Skin contact may produce burns, itching, scaling, reddening, and occasionally blistering. • Repeated or prolonged contact with spray mist may produce chronic eye irritation, severe skin irritation and respiratory tract irritation leading to frequent attacks of bronchial infection.

[12] http://www.garryson.com/Library/MSDS_AbrasiveCottonFibreProducts.pdf, http://www.cdc.gov/niosh/75-118.html

[13] http://www.pburch.net/dyeing/naphtholdyes.shtml

[14] http://www.sciencelab.com/msds.php?msdsId=9922769

4.	Hydrochloric acid[15]	• Can cause tissue damage by liquid or spray mist. • Skin contact may produce burns, itching, scaling, reddening, and blistering. • Inhalation of the spray mist may produce severe irritation of respiratory tract, characterised by coughing, choking, shortness of breath, and swelling in the lungs. • Inflammation of the eye is characterised by redness, watering, and itching. • Repeated or prolonged exposure to dilute solutions may result in skin disease and discolouration of the teeth. • Severe over-exposure can result in death.
5.	Hydrogen peroxide[16]	• Skin contact causes irritation, blister, and whitening of skin. • Inhaling mist or vapour irritates the mucous membrane of the respiratory system. • Ingestion causes internal damage, gastric distension, nausea, vomiting, and internal bleeding. • Eye contact may cause eye irritation, burning sensation or watering, even blindness.
6.	Wetting agents[17]	• Inhaling mist causes irritation in the respiratory tract. Over-exposure may lead to coughing, shortness of breath, dizziness, and intoxication. • Ingestion leads to moderate irritation in mouth, throat, gullet, and stomach; nausea, vomiting, and diarrhoea. • Skin contact causes redness, itching, and pain. • Eye contact leads to discomfort and irritation. • Repeated or prolonged contact leads to progressive skin disease, aggravates asthma, and liver and kidney damage.

Sources: As mentioned in the footnotes against each item

Areas of Concern

Colour preparation: In Pochampally, chemicals are used in the process of Ikat weaving. Once the design is prepared, artisans use different colours according to the design pattern. The colours are prepared in a small pan by mixing different chemicals. For cotton cloth naphthol base, caustic soda, alum, hydrochloric acid, and sodium nitrate are used which is known as Naphthol Dyeing. For silk cloth, a mixture of synthetic powder, soda-ash, acetic acid, and water is used, the process known as Vat Dyeing. It was observed that the artisans used their hands for mixing different chemicals, without using any protective mechanism. This mixing was carried out in the open with ample space for the diffusion of chemicals.

Mixing of dyeing powder for Ikat weaving

However, prolonged exposure increased the chances of their getting affected by the chronic toxicity, despite the small quantity of the chemicals. Mitigation is possible through designing of better mixing equipment and substituting the hazardous chemicals. Storage and labelling of hazardous chemicals, and regular health checks, can help to restrict the harmful effects of the chemical dyes.

[15] http://www.ee.iitb.ac.in/~nanoe/msds/Hydrochloric_acid-9924285.pdf, http://www.sciencelab.com/msds.php?msdsId=9924285

[16] http://www.sciencelab.com/msds.php?msdsId=9924299

[17] http://www.ofite.com/msds/280-00.pdf

Dyeing: In most of the places in Pochampally, individual artisans use a small pan for dyeing. However for preparing large quantity of yarn, 2-3 artisans are required for the dyeing. A big tub containing dyes is used and the bunch of yarn is dipped in it several times.

Though the gases and fumes cannot be observed visually in the dyeing process, the strong odour indicates the possible release of fumes and fine particulate matter which may get inhaled by the artisans. Artisans engaged in the dyeing process were observed to have coloured nails, hands and feet causing skin irritation.

Dyeing the yarn for Ikat

Despite the observance of the symptoms, most of the artisans believe that the traditional ways of craft processing are not at all harmful to their health and that the use of protective gear creates obstruction in their work and may slow down their efficiency. Improvement may be affected through use of natural vegetable dyes. Health checks of workers would also act as early warning indicators of higher emissions.

Tie-and-Dye: This process follows the pattern of design on the cloth. The portion of the cloth where the colour is not required is tightly tied during the dyeing procedure.

This causes the tied portion to remain uncoloured. As was observed from the study area, strips of old bicycle tyre tubes are generally used for tying.

This was done primarily because of two reasons:

a) For giving proper firmness, and

b) For leaving the fabric unaffected

Rubber tying in Ikat

The strips are removed after dyeing in boiled colouring solution and drying the untied portion of the fabric. This process of using bicycle tyre strips is conventional and has been used by the artisans since ages. However, an important health concern in this process is the leaching of the toxic synthetic chemicals like butadiene and styrene from the rubber tubes.

Since these are environmentally persistent compounds they tend to biomagnify in the food chain and may lead to chronic long term and sometimes fatal ailments. Substitutes of rubber may be used to avoid the same. Injuries to the back, ankles and fingers may be prevented by the use of appropriate protective gear.

Colour boiling: After tying-and-dyeing, the wax is removed by boiling. This gives a multi-coloured and motif piece of art fabric. Even though the process is carried out into the open area, the prolonged exposure to the hot fumes which are released during the process may lead to the chronic respiratory ailments in the long run.

Adopting forced ventilation would significantly help in reducing the exposure to these fumes. The impact of heat from the vat can also be reduced through better insulation and shorter exposures.

Removal of wax

Weaving: Weaving process follows the dyeing and the washing, which forms the most important part in the Ikat printing process. In general, for completion of a saree, weaving is done for 4-5 days at a pace of 6-8 hours daily. The Ikat fabric is either made of cotton or silk.

In relation to silk, working with cotton releases very fine particles which if inhaled can induce allergic reactions in the body of the artisans. Prolonged inhalation to these particles, may lead to byssinosis, a chronic ailment of the lungs caused by the prolonged inhalation of the cotton fibre particles.

An Ikat weaving loom

The release of fine particles from cotton is greater as compared to silk. Moreover, bad working postures of the artisans may also lead to body ache. Developing better ergonomically looms would help in the reduction of the body ailments, while the use of face masks could help reduce the inhalation of the cotton fibres.

3.2 PHYSICAL HAZARDS

The hazards occurring due to unsafe conditions in any workplace are termed as Physical Hazards. The main factors responsible for these hazards may be the lack of knowledge (not always recognised as a hazard), neglecting any improvement due to high costs, or simply delaying the required changes. Some examples are[18] :

Noise: Noise may be defined as unwanted sound. Sound is an energy which is propagated through a medium (air, water) as a succession of small and rapid variations in pressure. The quality of sound depends on its frequency and intensity. Frequency refers to the number of times these fluctuations occur in a given time period and it is usually given as cycles per second which is called as Hertz (Hz). The human ear can respond to frequencies in the range of 20 to 20,000 Hz. Intensity refers to the size of the pressure fluctuations reaching the ear and is measured by the energy content of the noise. Technically, it is the energy input per unit area and per unit time, measured in terms of watts per square meter.

[18] Mathews John "Health and Safety at Work", Australian Trade Union Safety Representative Handbook, Pluto Press Australia Limited, 1985, Chapter 6&7

- The exposure to noise above prescribed limits may lead to serious physiological and neural disorders. Besides leading to hypertension, prolonged exposure to noise may also cause partial or complete deafness depending upon the frequency, heart disease and other physiological disorders related to sleep disorders. A noisy environment also reduces concentration thus raising the risk of accidents.
- Exposure to excessive noise for a short period of time can cause temporary hearing loss.
- Over a longer time period of exposure to noise of high intensity, permanent noise-induced hearing loss or deafness can be caused.
- Noise not only damages hearing sensitivity but can also give rise to tinnitus, a disturbing ringing sound in the ear. This usually persists and is especially worrisome at night when it can prevent an individual from going to sleep.
- Very loud noise from explosions can cause a special form of damage termed as acoustic trauma.

Vibration: Vibration is the rapid to and fro movement of an object. The damage that vibration may do to the human body depends on three main factors. These are:

- The length of time for which a worker is exposed (i.e. exposure duration) – the longer the duration of exposure, the more would be the damage
- The frequency, measured in vibrations per second or Hertz (Hz) – The human body is affected differently by various frequencies. In industry, frequencies from 1 Hz to 5,000 or 10,000 Hz are common.
- The amplitude of the vibration – The vibrations of an object can be measured in terms of displacement, velocity, and acceleration, each of which is simply related to the other.

It is convenient to split the effects of vibration on the human body into two areas which can also overlap:

- Whole body vibration: This occurs when a worker's whole body is shaken up and down (vertically), side to side (transversely) or front to back (horizontally). This type of vibration occurs near moving machinery.
- Hand-arm vibration: This occurs, as the name suggests, to the hands and arms, while using equipment or tools that vibrate.

Heat: An excess or deficit of heat is termed as thermal stress. Environmental factors that determine the level of heat stress include:

- Air temperature
- Relative humidity
- Air movement
- Radiant temperature of the surroundings

Working with heat induces heat stress when more heat is being absorbed into the body than can be dissipated. The short term effects of heat stress are:

- Reduces concentration and thus an increased proneness to accidents
- Aggravates effects of other workplace hazards
- Induces heat illness

The long-term effects of heat stress include:

- Heat rash (prickly heat)
- Chronic heat exhaustion
- Birth deformities and other reproductive problems

Light: Light occurs in many forms from very short waves of ultraviolet light, through visible light, to infrared or heat radiation.

Table 5: Regions of the Optical Radiation Spectrum

Region	***Wavelength Range nanometres (nm)***	***Effects***
Ultraviolet (UV)	100 to 380-400	Severe eye damage, cancer
Visible (light)	380-400 to 760-780	Eye strain, if either too much or too little light is present during work
Infrared (IR)	760-780 to 1,000,000	Burns the skin and forms cataracts in the eyes from the heat produced in the body

Natural light from the sun contains a wide spectrum of visible, ultraviolet, and infrared rays. Artificial light contains a more limited array of light waves. It is well known that ultraviolet rays from the sun can damage the skin and eyes, and can even cause skin cancer.

Artificial light also contains a wide spectrum of light. Incandescent bulbs, computer monitors, and most of the small bulb-sized fluorescent lights usually do not produce ultraviolet light in amounts sufficient to be resulting in any risk. Large fluorescent lights, halide and mercury vapour lights; however, can produce ultraviolet radiation in quantity sufficient to be harmful. Fixtures containing these types of bulbs should have glass or plastic radiation shields.

The manufacturer's directions should be followed for the specific types of bulbs being used. Eye strain can be caused if the work area has either too much or too little light or if the lighting produces a glare on the object being crafted. This eye strain can lead to fatigue and accidents.

The best workplace lighting is usually diffused overhead lighting for general illumination combined with a smaller direct light on the task at hand. Light from computer monitors is associated with eye strain. Crafters who also use computers for long hours are recommended to get regular eye examinations and take frequent breaks from the work.

Two common sources of Ultraviolet (UV) Radiation are sunlight and welding. Skin cancer can occur in welders and people exposed to too much sunlight. Ultraviolet light from welding is also known to cause eye damage, even leading to blindness.

Simply walking past someone who is doing arc welding can result in a painful flash burn which feels as if sand has been put in the eye. It may take several days for a flash burn to heal. In rare cases, permanent damage has been caused by flash burns. The precise type of shade or lens must be chosen for each type of welding.

3.2.1 Block Printing

Noise: The process of starch removal in most units of block printing is tedious and is done mechanically through machines. This technique though advantageous with reference to the time and manpower and hence the efficiency, yet presents an important concern in producing noise induced ailments in the exposed workers.

This is generally due to the improper maintenance of the machines, leading to a temporary loss in hearing amongst the artisans. The noise of the motor can be however kept below the limits through better maintenance.

Wax removal machine in Ikat

Height: The fabric is sun-dried after printing and washing. Special bamboo roofs are made especially for the purpose (as shown in the picture).

The height of the roof varies from 15 to 20 feet and artisans have to climb up repeatedly for hanging the material on it.

On doing so, the probability of falling from the roof is high, leading to a high possibility of accidents.

Working at a height in block printing

Light: Improper light is one of the major problems in most of the units. As the process is meticulous and requires persistent focus by the artisan, provision of proper lighting becomes one of the fundamental necessities for the industry.

Though in some of the units, provision of proper artificial light is seen but in some of the homes in Bagru, the artisans have to work in natural light due to inadequate supply of electricity. Hence, artisans undergo more strain on their eyes and problems like watering, burning sensation, etc. are commonly reported.

Improper ventilation: Improper ventilation is seen in most of the block printing units. Excessive dependence on chemical dyes and their inter-mixing is done to prepare different colour combinations for printing.

During the study, it was observed that the mixing of chemicals is done in a closed room without any precautions. The artisans cannot use fans as the dyes dry rapidly due to air circulation and hence, these might cause a severe problem to the health of the artisans in prolonged exposures.

3.2.2 Ikat Weaving

Heat: Boiling the fabric at very high temperatures to remove the starch and the grease is called degumming. The fabric is put in a cauldron containing boiling water and continuously whisked and stirred for about 1-2 hours. From the study done in Pochampally, it was observed that most of the artisans preferred to be engaged with tie-and-dye and weaving, and the degumming process is usually outsourced to other artisans who are specially engaged in this process. Consequently, the artisans employed with the degumming process have to do so in bulk for the whole day which increases their exposure to super temperatures, thereby making them prone to heat related ailments.

High temperatures for boiling in Ikat

Light: The three major work processes in Ikat weaving viz. marking, tying and weaving requires proper light facility. These processes require more time and attention, mainly for detailing purposes.

However, because of inadequate power supply and poor lighting conditions, artisans suffer from many eye problems regardless of their span of work.

3.3 ERGONOMIC HAZARDS

Any adverse effect on the musculo-skeletal system (muscles, joints, bones, and related structure) of workers at the workplace, because of structural inadequacies are included under ergonomic hazards.

These hazards are the most harmful since they are not noticed immediately or ignored at the beginning stages, which aids to the increase in the intensity of the damage at the later stages.

Short-term exposure may result in 'sore muscles' the next day or in the days following exposure, but long term exposure can result in serious long-term injuries. Ergonomic hazards impact employers, workers, and their families.

Poor workplace design, awkward body mechanics or postures, repetitive movements and other ergonomic hazards induce or contribute to a staggering number of Cumulative Trauma Disorders (CTD) that affect hands, wrists, elbows, arms, shoulders, the lower back, and the cervical spine area. Structures involved include tendons, muscles, bones, nerves, and blood vessels.

One can plan strategies for abatement by learning to recognise the hazards that contribute to CTD. OSHA (Occupational Safety and Health Administration) in the USA has published the Economic Program Management Guidelines that are of significant value. According to the guidelines, a complete ergonomic assessment has to be developed, followed by a well written ergonomic plan. Ergonomic abatement will decrease the costs associated with CTD and ultimately impact the economic 'bottom line'.

In general the ergonomic hazards depend on[19] :

- Tools and equipments
- Work Stations
- The work-process, and
- The workplace as a whole

Ergonomic hazards include:

- Improperly adjusted workstations and chairs
- Frequent lifting of weights
- Poor posture
- Awkward movements, especially if they are repetitive
- Repeating the same movements over and over
- Having to use too much force and frequently

3.3.1 Block and Screen Printing

Shoulder (high hand force): The processes involve working with the hand above the head or the elbow above the shoulder.

The practice is seen among the screen and block printing artisans when they lift the screen and for hanging the cloth for drying.

These are repetitive processes that cause shoulder pain among the artisans.

Strain on shoulder in block printing

Back (highly repetitive): The work involves working with the back bent forward at an angle of more than 30º (without support or the ability to vary posture).

According to the breadth of the fabric, artisans for block printing have to bend forward frequently for printing. Moreover, as most of the artisans are on contractual basis, their daily wages are dependent on the metres of cloth printed by them.

Hence, they work as much as they can print and it varies from 6 -9 hours daily.

Strain on back in block printing

[19] http://employment.alberta.ca/documents/WHS/WHS-PUB-BCL002.pdf

Fingers, arms, wrists (highly repetitive): The pinching of the wooden block with two fingers (thumb and index finger) and other fingers for proper adjustment of the block is in practice for block printing process.

The shape and the size of the blocks change, according to the design of the print. Weight of the block varies from 200-1000 grams.

Thus, this repetitive pinching and printing work causes harmful effects on the body of artisans and they suffer from pain in arms, wrists and hands.

Strain on fingers in block printing

Whole body (high body force): Power intensive work (in regular periods or in continuum) could also cause muscular aches, sprains and strains.

Artisans have to frequently transport the fabric from place to place, like from printing place to washing tanks, washing tanks to drying yard, and drying yard to ironing machine, for which trolleys are generally used.

In addition to loading and unloading, an artisan has to exert great force for pulling the trolley. There are other factors like uneven pathways which increases their susceptibility for ailments.

Strain on the body in block printing

Hand (highly repetitive): Along with the frequent lifting of the block, the artisans have to press the block on the fabric for printing the design.

While one hand is used for placing the block in an appropriate position, the other hand is used for hitting the block for pressing the design in the fabric. Consequently, the risk factor is greater for artisans who do this work repetitively.

Corns on the palm of the artisans are a common problem which is caused due to the hitting procedure on the block.

Strain on hands in block printing

3.3.2 Ikat Weaving

Tie-and-dye: At each step of tie-and-dye, there is the possibility of different ergonomic problems due to difficult postures and prolonged working hours. In various processes like design marking, design tying, rubber tying, yarn winding, bobbin winding, and weft preparation, artisans have to sit on the ground without any back support for long duration and hence, back and knee are two main parts of the body that are most prone to muscular strains.

Prolonged sitting in Ikat tying

Sometimes it also leads to muscular spasms as was reported by the artisans interviewed in the study area. Likewise, artisans also have to bend their necks for extended durations.

The hands on the other hand, are engaged with repetitive work which also leads to muscular fatigue. Moreover, while working on the floor, artisans crawl from one end of the yarn to the other, leading to cracks in the feet and callus in the ankles.

Weaving: There are two types of loom used for weaving purposes in Pochampally: pit loom and free loom.

Pit loom is one of the traditional ways of weaving in Pochampally and weavers associated with it have reported backache problems. Routine work for more than 6 hours daily in weaving leads to muscular fatigue in different muscles of the body.

Sitting posture and bending of their back leads to back pain.

Continuous and rigorous up and down movements of arms during shuttle movements in weaving result in severe pain in forearms and elbows.

For more smooth movements of the pedals to push the heddle frame in up and down direction, weavers generally sit in such a way that maximum pressure (weight) of the body is exerted on the waist and abdomen and it sometimes leads to fatigue of abdominal and knee muscles.

Furthermore, frequent movement towards left and right for adjustment of the heddle frame causes ache in the shoulder.

Prolonged sitting during Ikat weaving

3.4 OTHER HEALTH PROBLEMS

Apart from the above, there are also other health problems related to the occupation in the craft sectors. Other than chemical, physical, and ergonomic hazards, the craftpersons are exposed to many other problems, only some of which are immediately visible.

Cuts and Wounds: This type of hazard is more significant with the tie-and-dye workers (Ikat), where the weavers have to tie the bundle of yarn prior to dyeing. Manual tightening is indispensable for giving proper firmness for the tie.

However, the continuous friction with the thread and rubber leads to abrasions and cuts in the fingers. Furthermore, the craftsperson also find no suitable remedial measures as gloves and other protection hinder their efficiency and the same traditional methods are followed without any prevention or protection in their activities.

Cuts on fingers of craftsman

Effects due to Habits: The habits of artisans and workers further increase their susceptibility to the health hazards and also aggravates the potency of the affecting hazards.

During the study, the artisans in both the study areas are addicted either to smoking, drinking and tobacco.

It was further observed that the workers resort to these addictions mainly and importantly to save themselves from the work fatigue and to ease their prolonged working.

Bidi butts sprinkled around the work area indicating adverse habits

4. INNOVATIVE AND LOW COST METHODS TO CONTROL HAZARDS

The main environmental and occupational hazards afflicting the textile industry, specifically the handloom and the handicrafts sector have been identified as the part of the present study. Case specific measures have also been recommended to reduce the potency of the hazards and the workers/artisans' susceptibility to those hazards. These recommendations have been made with due considerations to the requirements/ safety precautions as mandated under various legal provisions.

Control of hazards through engineering methods is considered to be the most reliable method. However, it is expensive for the artisans to carry out such changes by themselves. In addition, they are also reluctant to introduce changes in their traditional practices. A better alternative therefore, is to develop small adaptive strategies which can help reduce the risks artisans face. One such strategy is to develop/identify inexpensive protective gear which could be readily accepted by the artisans. It has been observed during the current study that a few artisans have also evolved some basic protective measures on their own. Refer to Annexure 2 for specifications and costs of the prototype safety equipment.

4.1 BLOCK PRINTING

4.1.1 Hand Gear and Gloves

Cuts ***Wrist pain*** ***Callus*** ***Hardening***

Suede protector for cuts *Hard edge support* *Palm protection*

How does it help?

- Suede between thumb and palm prevents cuts
- Firm edge supports the wrist while carrying loads and cushions the hand while hitting the block
- Glove protects the palm from calluses
- Cut-away glove ensures free movement of fingers
- Cotton layer inside the gloves acts as sweat absorbent

Design Changes

- The firm edge should have a soft inner to ensure that no pain is caused to the worker, while repeatedly using the glove to hit the block. In present form, the hard outer layer of the edge causes the impact to be concentrated at a point on the base of the hand, leading to pain
- The surface of the edge should be rougher to prevent slippage
- The gloves should not cover the thumb as this causes inconvenience, and reduces the free movement of the hand
- There should be a cushion between the thumb and the forefinger which supports the block

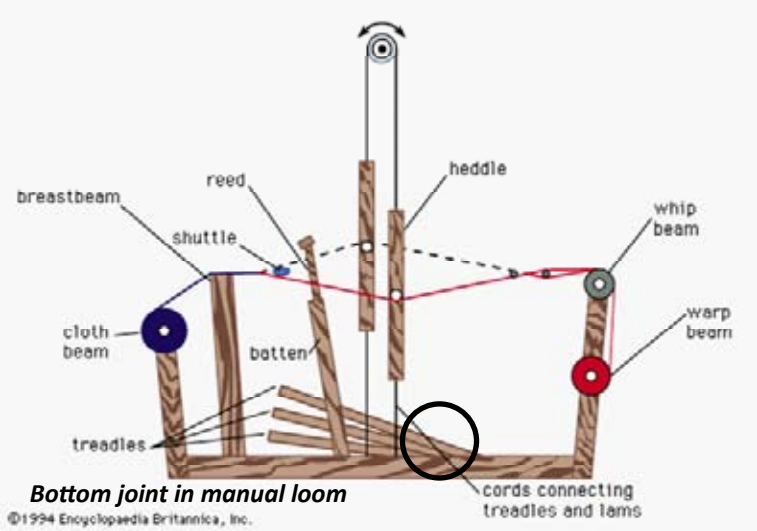
4.2 IKAT WEAVING

4.2.1 Modification in the Loom

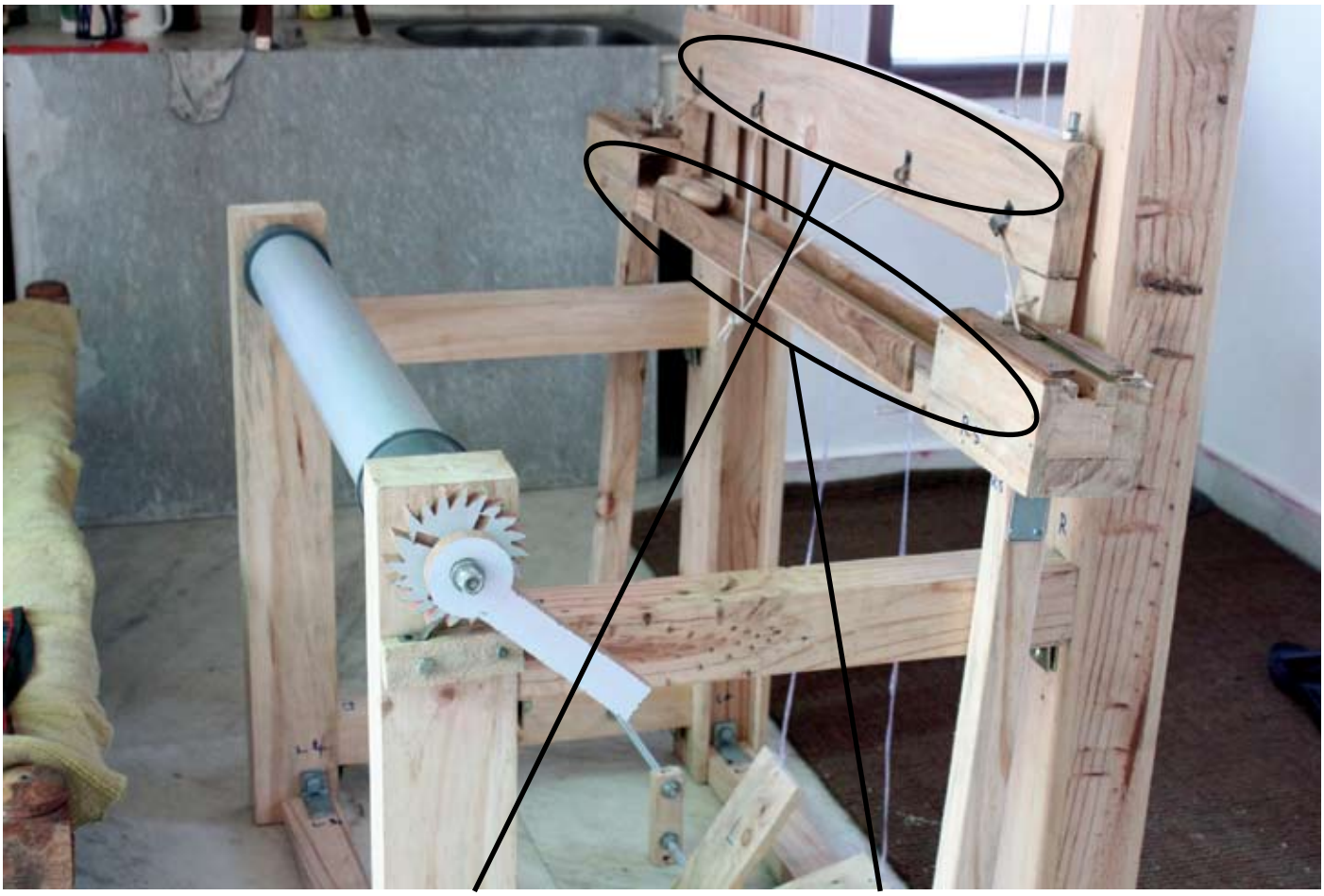
Top joint & high loom *Top joint makes for bad posture and prevents easy access to heddles*

Stick used as an anti-rolling device, length depends upon height of loom

Manual loom



Bottom joint in manual loom



Broader frame at top for good hold *Shuttle box to carry shuttle*

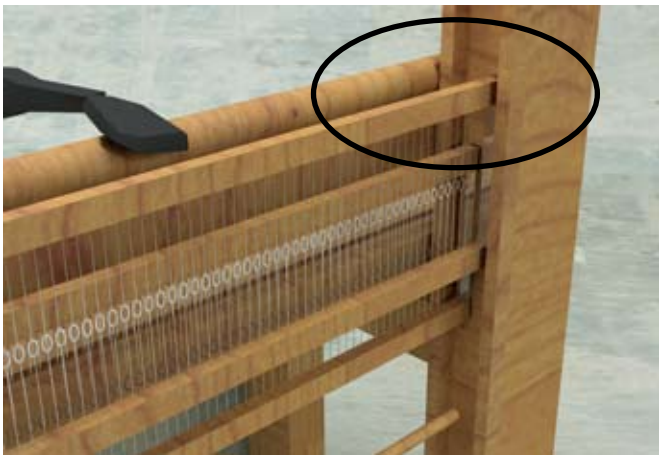
The bottom joint concept has been taken from the manual loom but the batten and the reed frames are modified by broadening the top of the reed frame to provide a good hold and adding on a shuttle box for the shuttle to ride in.

Bottom joint

Lower height

Better hold & access

Good posture



C-section holds heddle frames

Ratchet lock

How does it help?

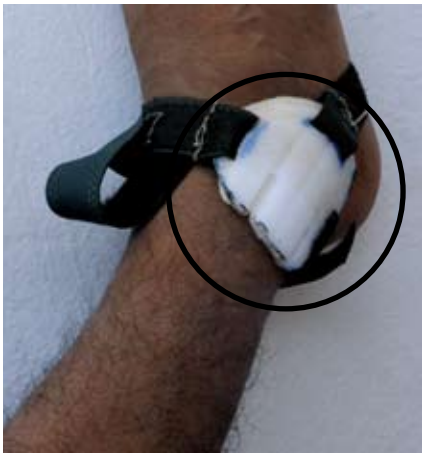
- In the top joint loom the batten and reed frame come in the way of access to the broken threads in the heddle frames behind the reed frame
- The weaver has to reach out awkwardly from his seat to access the heddles
- The bottom joint for the batten lowers the height of the loom
- The broader bar at the top of the reed frame provides for better hold
- It also allows for easy access behind the reed frame
- This improved reach and an appropriate slope of the seat helps in better posture
- The breast beam does not prevent the artisan from reaching out to the heddles
- The addition of a shuttle box on the reed frame permits easy shuttle movement
- The hand movement for the shuttle changes from up and down to to-and-fro
- The C-Section keeps the heddle frames in place and reduces cotton dust
- Ratchet locking system helps in better treadle movement and tensioning of the cloth

Suggestions from artisans:

- The bottom joint is more useful for cotton weaving as compared to silk
- The heddle frames should be lighter and be placed further apart.
- The height of the reed frame should be the same as that of the roller
- The reed frame could be in the fashion of a sliding door because the swing of the frame on the bottom joint may affect the weaving and there is a risk of breaking threads
- The distance to the treadles is too much, preventing application of sufficient power
- The lams should be indirectly connected with the treadles as otherwise there is the possibility of the heddles shifting and errors creeping into the weave
- The shuttle box should be of polished teak for smooth movement of the shuttle

4.2.2 Ankle Guards

Rubbing of ankle on the floor causes callus formation



Hard cap

Rubber sole

Adjustable straps

Several Design Changes

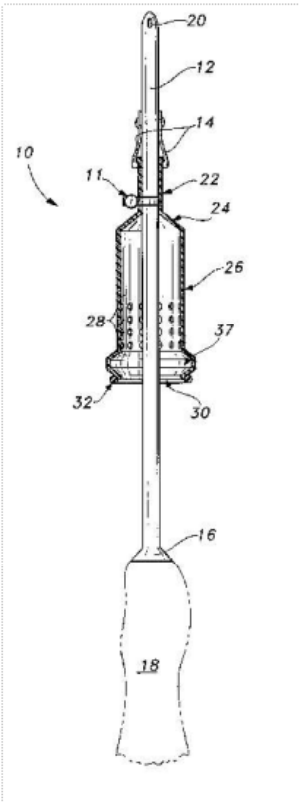
- The hard cap protects the ankle when it is dragged along the floor
- It can either be just a cap that can be strapped on or part of an anklet
- A rubber sole could prevent the foot from being exposed to other hazards
- Different sizes of feet can be accommodated through adjustable straps

Suggestions from artisans:

- The footwear is useful for them provided it is affordable
- They were not much in favour of a rubber sole as they felt that would add to the discomfort on hot days
- The strap-on cap was also preferred over the anklet

4.2.3 Mechanical Wringers for Yarn

Manual wringing of wet fabric requires a lot of effort



How does it help?

- The perforated wringer (26) is mounted on a hollow tube (16) that is capped on to the yarn (18) and when twisted by the handles (14) it wrings the yarn
- When passed through rollers the yarn is wrung dry, but the rollers have to be soft enough not to damage the yarn
- Both reduce the effort required to wring the cloth

4.2.4 Dust Removal in Pit Looms

Dust and cotton fibres accumulate in the pit where the weaver sits

How does it help?

- The dust pan can be easily lowered into the pit
- The rubber piece helps to sweep up the fibres and dust with a broom
- The slot provided in the pan helps to collect the dust and fibres into the pan
- Regular maintenance will keep the area dust free and protect the worker

4.2.5 Chemical Reduction

The following table provides a list of chemicals and possible remedies for reduction in their use. Refer ***Annexure 3*** for the Rajasthan State Pollution Control Board Guidelines and ***Annexure 4*** for a list of harmful dyes, pigments and other chemicals and their alternatives.

Table 6: Remedies for Chemical Reduction

S.No.	Hazard	Possible Remedies for Reduction
1	Cotton dust	Redesigning heddle frame for smooth passage of the yarn
2	Naphthol dye	Substituted by traditional non-toxic vegetable or fibre-reactive dyes
3	Caustic soda	Use measured quantities so that the excess is known
4	Sulphuric acid	Use exact quantity that will neutralise the caustic soda
5	Acetic acid	Use exact quantity that will neutralise the soda ash
6	Hydrochloric acid	Use exact quantity that will neutralise the caustic soda
7	Hydrogen peroxide	Procure non-starched cloth directly from the mills
8	Alizarin	Non-polluting if used in required quantities
9	Lime	Non-polluting if used in required quantities
10	Alum	Non-polluting if used in required quantities

How does it help?

- The toxic chemical is substituted so the hazard is eliminated
- Exact quantities of chemicals are used so that they react with each other and leave behind no toxic residues

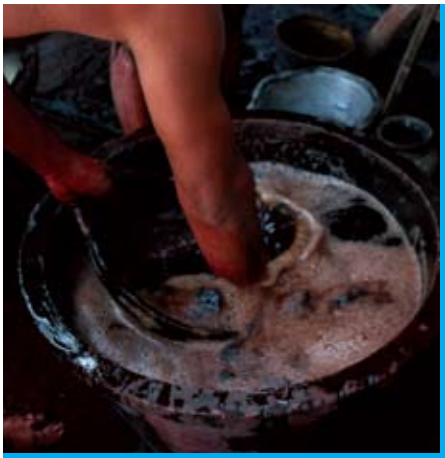
This reduces the hazard to which the artisan is exposed and also decreases environmental pollution.

Suggestions from artisans/owners:

Discussions with both the owner-entrepreneurs and the artisans indicate that the cost of substitution does not favour eco-friendly measures being adopted.

4.3 METHODS FOR BOTH CRAFTS

4.3.1 Mixers



Mixing

Spills

Discolouration

Acid dye

Disc mixer with adjustable handle

Hand mixer with collar and finger placers

Stick mixer

How does it help?

- Disc mixer prevents direct contact of the hand with the chemicals
- It provides for faster mixing in both sitting and standing positions
- The length of the handle can be adjusted for sitting or standing
- The disc can be replaced with one of suitable size for the mixing vessel
- The hand mixer has finger placers for better hold
- The collar on the hand mixer prevents contact of the hand with the chemical
- The rotating stick mixer gives a better grip with both hands
- A transparent cover can be placed above the mixing vessel to prevent fumes and vapours escaping into the air

How to Use?

Long handle for standing

Short handle for sitting

Protective collar

Hand protected by collar

Stirrer mixing

Suggestions from artisans:

- The disc mixer should be strong, lightweight and not reactive with the dyes
- The joint between the disc and the handle should not break under shear

4.3.2 Concrete/Tiled Pathways

Rinsed cloth and heavy drums have to be transported along uneven paths

How does it help?

- The effort in pulling heavy loads is reduced substantially
- There is less possibility of heavy loads toppling off the trolley and causing injuries
- Proper drainage ensures that wash water containing toxic chemicals and dyes does not come in contact with skin

4.4 WATER CONSERVATION

The following water conservation methods can be adopted in textile units depending on the processes being used and size of the unit:

- Installing water meters to monitor water use
- Using automatic shut-off nozzles and marking hand-operated valves in such a way that open, close and directed-flow positions are easily identified
- Using high-pressure, low volume-cleaning systems, such as CIP (clean in place) for washing equipment
- Installing liquid level controls with automatic pump stops where overflow is not likely to occur
- Recycling water used in cooling through cooling towers
- Minimizing spills on the floor which in turn minimizes floor washing in the dye house
- Repairing leaks in the water pipe network
- Handling solid waste in dry form
- Condensing and recycling steam, whenever possible
- Using technologies which do not require large quantities of water, such as low dye bath ratio, high pressure steam washing and plasma cleaning of fabrics

Significant savings can be made in textile processing industries by recovering and re-using of water in the processes itself. Few areas where these options can be examined by the units are outlined here:

- Recycling of final wash water after H_2O_2 (hydrogen peroxide) bleaching as a wash water for second scouring step or for earlier bleaching steps
- Reusing wash water from bleaching process to start another bleaching batch
- Reusing hot bleach water for starting optical brightening batch
- Reusing wash water from optical brightening process to start another batch of optical brightening batch
- Further using final wash water from cone scouring and bleaching as wash water for scouring and bleaching
- Using cold rinse water used after scouring (for sulphur black dyeing) for the reduction step
- Reusing hydrosulphite wash water for another batch of hydrosulphite batch
- Reusing wash water from clarified print in washing and blankets and screens of the print machine

5. OCCUPATIONAL HEALTH AND SAFETY

Occupational Health and Safety (OHS) is the discipline that measures and evaluates hazards, and develops procedures for their control.

5.1 CONTROL MEASURES

5.1.1 Chemical Hazards[20]

Through substitution: It is a concrete step in which toxic chemicals which are more hazardous in nature can be substituted by use of non-toxic chemicals. In the textile sector the chemical dyes and pigments can be replaced with natural or vegetable dyes.

Through dilution: In some methods where the use of a toxic chemical is important, (as for instance treatment with acid for giving durability to the final product), the dilution of the acid can minimize the risk to the workers associated with the use of these chemicals.

Through insulation: Insulation means isolating a substance which is hazardous for the artisans. For example, mixing of volatile chemicals in an enclosed container.

Through ventilation: Ventilation is a means of removing contaminated air and replacing it with fresh or re-circulated air. It is used to remove dusts, fibres, particulate matter, chemical fumes, and heat.

A number of technical issues arise in the design of a ventilation system, like the location and strength of the exhaust system, the extent of contamination, etc. A competent ventilation engineer or occupational hygienist is needed for this task.

Through wet method: Water sprays are used to suppress dust and fumes produced from the mixing of chemicals. Wet methods are simple and inexpensive, but there are pitfalls that should be considered:

- Contaminated water has to be properly disposed off after use.
- Slippery conditions produced by water sprays must be taken care of.

There are many general precautions which should be taken in all craft shops with respect to the storage of chemicals:

- ***Store minimum quantities:*** Do not stock more than a year's supply of chemicals. Amount of chemicals that can be used up in 3 months are recommended. Do not purchase larger quantity than needed – it will increase the potential hazards, take up valuable space, and could result in a costly disposal problem.
- ***Use unbreakable containers:*** Such as plastics whenever possible.
- ***Do not use hands while mixing chemicals:*** Use mixing equipment wherever possible.
- ***Chemicals in the storage area:*** Store as few chemicals in the work area as possible, and it should be usually one day's supply. Chemicals should be put back into the storeroom at the end of the workday; storage area must be separate from processing / handling area. Store the reactive chemicals separately and check MSDS of each chemical. Keep all the containers closed.

[20] Mathews John "Health and Safety at Work", Australian Trade Union Safety Representative Handbook, Pluto Press Australia Limited, 1985, Chapter 9

- ***Access:*** Unauthorised access to the storage area must be prevented.
- ***Proper placement:*** Containers of chemicals should not be crowded in one place. Access to one container should not require the movement of other containers. Store chemicals below the eye level but racks should be used for storage (avoid storing on the floor) and containers should not be stacked on top of one another.
- ***Proper labelling:*** Every bottle, box, or gas cylinder and chemical must be properly labelled, with information about its content; all appropriate supplier information, the date received and the expiry date if applicable. Labels should be waterproof, easily legible, and periodically checked to ensure that the labels are not falling off.

Table 7: Different colour codes used for identification

Class	*Hazards*	*Colour Code*
Class – I	Explosives	Orange
Class – II GASES	Non-flammable, non poisonous, non-corrosive	Green
	Poisonous	White
	Flammable	Red
	Oxidizing	Yellow
Class – III	Flammable liquids	Red
Class – IV	Flammable solids	Red/white
	Spontaneous combustible	Red/white
	Substances that emit flammable gas in contact with water	Blue
Class – V	Oxidizing substances, organic peroxide	Yellow
Class – VI	Poisonous and infectious substance	White
Class – VII	Radioactive materials	Yellow/white
Class – VIII	Corrosive	Black/white

Source: http://www.fsi.illinois.edu/awareness/hazmat/classroom/ch4les10.html

5.1.2 Physical Hazards

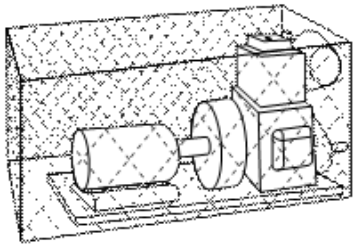
Noise: Noise survey should be done to assess the noise level and focus attention on the areas that are contributing the most to the problem. The options available for reducing the noise levels at the worker's ear are threefold:

- **Control at source:** Controlling at source means reducing the noise output of the machines and which should be the first line of defence.
- **Control of noise path:** Controlling the noise path means placing shields and baffles between the noise source and operator.
- **Enclosure of operator:** Finally, only when all else fails, there is enclosure of the operator, either in a sound-proof booth or with ear protection through ear plugs and ear muffs.

Vibration: Most machines vibrate due to careless or irresponsible design, or to the fact that it is required to run at faster and faster rates. Common sources of vibration are machine tools (for example, grinding), pumps, generator, forging hammer, and fans. The vibrating machinery can interact with other hazards, producing a

compound effect, for example, noise and vibration which often go together are worse at damaging hearing than noise on its own. The most common way of reducing vibrations emitted from established machines is to insulate the machine from the surrounding surface. This may be done in several ways:

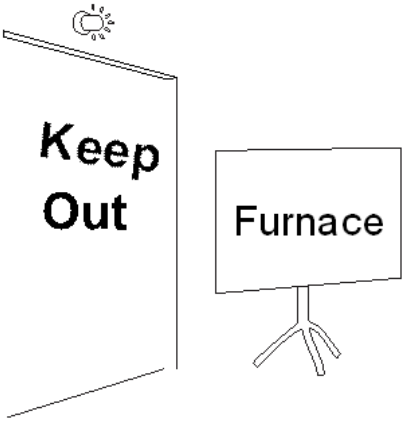
- By mounting on a heavy base.
- By using insulating mountings.
- By using the above and sinking the machine into a pit.



Moreover, a wide range of vibration isolation equipment is also available from a number of suppliers.

Heat and cold: The range of thermal control for humans has been found to be 190°C to 300°C. Control of heat and cold should aim to lower and raise working temperature to within this range. Measures that are available include:

- Insulation
- Ventilation
- Isolation
- Shielding the source from the operator
- Job modification and job rotation
- Protective clothing



For indoor workers, the most desirable working environment is one which is air conditioned and temperature controlled. In case of unfeasibility of air conditioning, other methods that can be used are:

- Insulation or shielding of sources of heat. For example, engines, oven, etc.
- Roof and wall insulation of the working area for protection from the heat of the sun.
- Ducting of hot exhaust outside the factory.
- Installation of fans or ventilators to increase air movement.

Outdoor control measures for heat and cold are not a matter of concern for artisans who are home based workers.

Illumination and ventilation: Proper design of the craft shop is required for enhancing the quality of illumination and ventilation for the artisans.

5.1.3 Ergonomic Hazards

Engineering controls are the most preferred method for controlling ergonomic risk factors because they are more permanent and effective. Engineering controls include modifying, redesigning or replacing of:

- Work stations and work areas
- Materials/objects/containers design and handling
- Hand tools used
- Equipment

Proper investigation and competent personnel from designing / engineering are required for the application of engineering controls. However, for prevention of ergonomic hazards, artisans must pay careful attention to their bodies for signs of

fatigue, pain, changes in endurance, weakness, and the like. In other words, listen to your body while it is still whispering rather than waiting until pain shouts for attention. Certain good work habits can help to resolve early symptoms. Some of these are[21] :

Keep good posture: Appropriate posture is necessary while working for a prolonged duration. Proper design can reduce or eliminate awkward posture associated with extended reaches, bending or twisting when handling materials, tools or other objects.

Take frequent rest and bathroom breaks: Sufficient and frequent breaks in between work should be in practice that can reduce the fatigue. During breaks, movement of muscles in different directions can help artisans to deal with fatigue.

Job rotation and enlargement: This involves rotating workers through different jobs or enlarging jobs to rest the different muscle groups of the body, reduce repetition, and reduce mental demands.

Warm up muscles before work; move and stretch muscles during breaks: Ease back slowly into heavy work schedules rather than expecting to work at full capacity immediately after holidays or periods away from work.

Increase the number of employees: This method certainly helps to reduce the exposure limit of posture problems to a specific individual and distribute the work load among others.

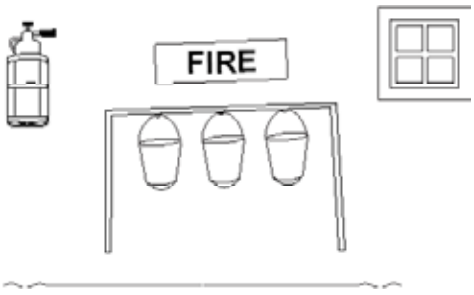
Training in safe working postures and techniques is important, along with monitoring, to make sure that proper work practices are being followed.

5.2 GENERAL PRECAUTIONS

5.2.1 Housekeeping

This means not only cleanliness but also orderly arrangement of operation tools, equipments, storage facilities, and supplies. The term housekeeping signifies “a place for everything and everything in its place”. General provisions that can maintain adequate housekeeping are:

- Daily removal of dirt and refuse
- Keep tools in boxes, racks, or trays when not in use
- Do not let materials such as scrap lumber, metal, and debris accumulate which might cause a tripping hazard
- Weekly washing of floor. Keep the aisle clear for safe passage of people and material
- Sharp objects like nails, pieces of wood with protruding nails, and others should not be left on floors and walkways; store them where they cannot be stepped on
- Effective drainage of floor
- Regular painting of walls, partitions, and ceilings



[21] http://employment.alberta.ca/documents/WHS/WHS-PUB-BCL002.pdf

- Keep exits clear; keep fire extinguishers readily accessible and free of obstruction
- Store flammable and combustible materials in proper containers and in flammable liquid storage cabinets
- Make effective arrangements for treatment of wastes and effluents to render them harmless and for their final disposal

Water Spills and Leaks: Do not allow spills of water or other liquids to remain on floors, making them slippery. Cleanup any water spills around sinks, dye pots, and potters wheels. When water cannot be removed immediately, special mats or slatted flooring should be installed so that people do not slip. Failure to address water in the workplace can also result in the growth of moulds and bacteria, some of which cause disease. Clean and disinfect areas where mould is seen or bacterial odours are noted. If mould is a regular problem, a dehumidifier can be installed. Mould will not grow and becomes dormant when humidity is low. Even opening windows or turning on ventilation systems can reduce mould growth. If there is severe water damage, such as from a flood or major plumbing leak, discard carpet, wall board, or other porous materials that have been soaking wet for more than 48 hours to prevent mould and bacterial growth.

5.2.2 Personal Hygiene

One of the simplest and most neglected methods of avoiding exposure to toxic substances is to practice good hygiene in the workplace. Studies show that tiny amounts of toxic substances left on the skin, or brought home on clothing can affect even the workers' families. Some basic hygiene rules include the following:

- Do not eat, drink or smoke at the workplace, shop floors, or in other environments where there is a possibility of the presence of toxic materials. Dust settled on food, fumes and vapours absorbed and adsorbed by food, and soiled hands can contaminate food and also cigarettes. Smoking is especially hazardous because some substances inhaled through a cigarette can be converted by the heat to more hazardous forms.
- Wear work clothes and, if possible, change clothes and leave the work clothing in the shop. Wash work clothes frequently and separately from other clothing. If the workplace is dusty, wear some hair covering. And for safety as well as hygiene, tie back long hair, do not wear loose clothing, scarves or ties, or jewellery.
- Wash hands carefully before eating and after the work, using the washroom, and also after applying make-up.

5.2.3 Protective Clothing and Equipment

For some managers, and even some workers, health and safety begins and ends with use of protective clothing and equipment. But every piece of protective clothing and equipment that workers have to use is a burden which reduces the efficiency of work and production. Hence, use of personal protective equipment (PPE) should always be seen as a last resort, to be employed only when all other methods have been tried and found ineffective. In a properly controlled working environment, a worker should not need any PPE at all.

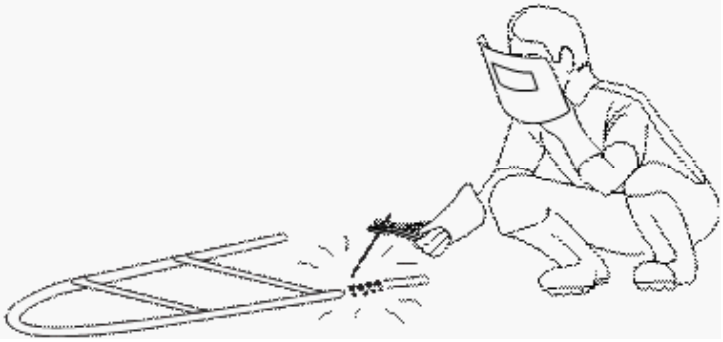


Table 8 gives a listing of various hazards to different parts of the body and the PPEs required for protecting them. As may be seen, if the worker were to wear all these PPEs, he / she would barely be able to move, far less work!

Table 8: Types of Personal Protective Equipment

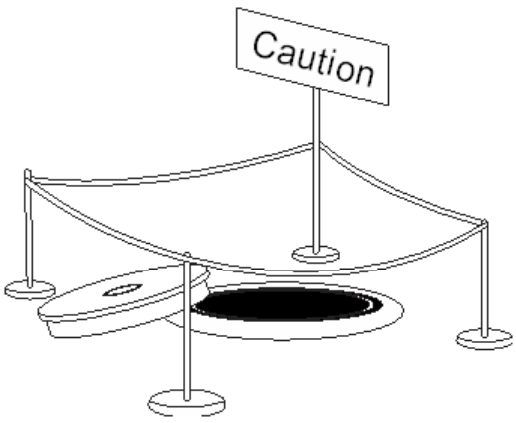
Organs	*Sensitive to*	*Types of PPEs*
Eye	Bright light, particles, dust, fumes	Goggles, spectacles, shields, dust screen, wire mesh, lenses
Ears	Noise and sound	Ear muffs and ear plugs
Face	Particles, chemicals, liquids, fumes, gases etc.	Face shield, helmets
Nose, lungs, respiratory system	Chemical fumes, dust, poisonous gases	Respirators, gas mask, airline helmet, hoods, chemical cartridge, mechanical filter
Head, neck and torso	Falling objects, accidental hitting	Head safeguards, hard hats, protective caps
Arms, hands, fingers	Accidental hitting, insertion in moving parts	Finger coats or stalls, gloves, band cuff
Legs and feet	Sensitive to falling objects and chemicals	Shoes, chaps, guards, safety shoes
Body	Electric shock, heat and cold	Aprons and protective costumes
Skin	Heat and cold	Aprons
Safety against fall		Safety belts

Source: http://www.asminternational.org/content/TSS/pics/safety/safety1.pdf, http://www.statonco.com/SafetyManual.pdf, http://agsci.oregonstate.edu/sites/default/files/FST_manual/02-04.pdf

5.2.4 Administrative Controls

Hazards can be reduced and controlled, not only by modifying the process (engineering control) or protecting the worker through PPE but by modifying the job procedures as well. This again is a way of managing work and it does not involve any expense at all. This can be done by:

- Job rotation (reducing time of operation)
- Limited entry locations (reducing area of exposure)
- Permit to work systems (total procedural control)
- Job exclusion of groups of vulnerable workers



Job rotation: Job rotation is a method of reducing risk by reducing an individual worker's exposure time to hazards. It is used by mutual agreement. For example, for stress related work (weaving, washing) and job in noisy areas. Although job rotation practices reduce the exposure level, yet there are a number of drawbacks from the workers' point of view, some of which may be enumerated as below-

- The hazard still exists.
- The time of exposure might still be sufficient to cause damage.
- Job rotation might be used to 'burn out' workers, that is, to expose them to the allowed limit and then move them on.
- The responsibility for control is passed to the workers.

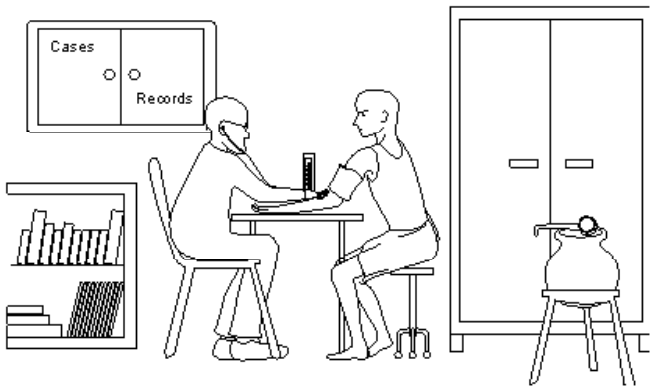
Control of job rotation can add another element of discipline to work. Therefore, the call for job rotation can only be as a backup to other forms of control.

Limited entry areas: This is an alternative to job rotation, in that it does not reduce the time, but the exposure of workers to hazards gets restricted. Limited entry areas can be characterised by signs saying 'danger', 'entry by authorised employees only'.

Permit to work system: A permit to work is essentially a legal document which sets out work to be done, the hazards involved, and precautions to be taken. It predetermines a safe procedure and is a record that all foreseeable hazards have been considered in advance and precautions taken. It is generally applicable in a large production unit. Some of the areas where permit to work systems might operate include:

- Repair and maintenance of machinery
- Work on high voltage electric equipment
- Work in confined space in a chemical plant

Medical check-up: Regular check-up from a physician is an important factor for early recognition of occupational disease and its prevention. Two most useful tests are regular lung function test for artisans exposed to dusts and particulate matter and the blood or urine test for those artisans working with metal containing materials.



6. GOVERNMENT POLICY, LAWS AND INSTITUTIONAL SUPPORT

The government has taken several initiatives to strengthen the textile industry, to provide funds for modernization and technology upgradation and to operationalise Textile Parks. Several initiatives have also been taken for capacity development, skill enhancement and to bring about the social welfare of artisans. There are numerous institutions that are working towards the development of the textiles sector and providing support in technology upgradation as well as OHS. Some of these are discussed below.

6.1 GOVERNMENT SUPPORT

OHS is one of the subjects allotted to the Ministry of Labour and Employment (MoLE) under the Government of India Allocation of Business Rules. The MoLE and Labour Departments of the States and Union Territories are responsible for ensuring the safety and health of the workers. The Directorate General of Factory Advice Service and Labour Institutes (DGFASLI) is an attached office of the MoLE and serves as a technical arm to assist the Ministry in formulation of national policies and technical aspects of OHS in factories and ports. It is also responsible for co-ordination and implementation of the measures under the Factories Act, 1948 by the State Governments and the formulation of Model Rules. It also undertakes research and consultancy studies in Industrial Safety, Occupational Health, Industrial Hygiene, Industry Psychology and Industrial Physiology, in addition to safety audits. It provides training to the Inspectors of Factories (Enforcement Authorities) and various target groups from the factories including statutory long duration courses for safety officers, factory medical officers and supervisors engaged in hazardous process industries.

There are also many other national level autonomous bodies, institutes and non-Governmental organisations (NGOs) engaged in OHS activities. Three such prominent autonomous organisations of national repute are the National Safety Council (NSC), the Central Board of Workers Education (CBWE) and the National Institute of Occupational Health (NIOH).

The National Safety Council (NSC) was set up in 1966 with the objective to generate, develop and sustain a voluntary movement of Safety, Health and Environment at the national level. The NSC carries out the various activities for industries, trade unions and other safety professionals by carrying out specialised training programmes, conferences, seminars, workshops, safety audits, safety awareness, survey and other consultancy services. The NSC also brings out various publications on OHS such as periodicals, industrial safety chronicles, technical manuals/booklets, etc.

The National Institute of Occupational Health (NIOH) was set up with the objective to provide safe, healthy and comfortable environment for work and living, through a multidisciplinary approach. The Institute has been functioning with the objective to carry out research in the field of epidemiological and environmental monitoring and corollary toxicological studies in hazardous occupations for recognition and evaluation of risk factors; development of tools for early detection of health impairment and design of appropriate intervention measures for the prevention of hazards at work places.

The Central Board of Workers Education (CBWE) is an autonomous body under the MoLE. It is registered under the Societies Registration Act, 1860. Started in 1958, the Workers Education Scheme in India has been playing a very significant role in national development; creating an enlightened and disciplined work force and bringing about desirable behavioural changes in the workforce in the organised, unorganised and rural sectors. The Scheme aims at achieving the objectives of creating and increasing awareness and educating

the workforce for their effective participation in the socio-economic development of the country. To achieve these objectives, various training programmes are conducted by the CBWE for the workers of formal and informal sectors at national, regional and unit levels.

With the objective of accelerating growth in the textiles sector the Government has also taken steps for piloting technology upgradation. Various schemes such as Technology Upgradation Fund Scheme (TUFS), Scheme for Integrated Textile Parks (SITP), Development of Mega Cluster (DMC), Integrated Skill Development Scheme (ISDS), Technology Mission of Technical Textiles (TMTT), etc. have been launched with the objective of accelerating growth in exports and investment in the textile sector. Some of these initiatives are discussed below.

- TUFS is an important tool to infuse financial support to the textiles industry and help it capitalize on the vibrant and expanding global and domestic markets, through technology upgradation, cost effectiveness, quality production, efficiency and global competitiveness.
- SITP was brought in with the primary objective to provide the industry with world-class infrastructure facilities for setting up their textile units. The scheme facilitates textile units to meet international environmental and social standards.
- DMC is for providing a holistic support to mega clusters to overcome functional and structural bottlenecks and also to enable institutional development. The mega clusters would be identified in the various parts of the country and comprehensive development plans would be drawn up and implemented on the Public Private Partnership (PPP) mode. It is projected that each Mega cluster would cover 25,000 looms. The important components of the project include formation of consortiums of weavers, mobilization of weavers, technology upgradation, design development and product diversification, support for raw material, credit support, and market linkages, the schemes including product development. The scheme also targets improving the social security of the weavers through providing infrastructural support, capacity building and skill up-gradation, design inputs, health facilities etc.
- ISDS addresses the needs of trained manpower in textiles and related segments by developing a cohesive and integrated framework of capacity building and skill enhancement trainings based on the industry requirements. The initiatives through this scheme help artisans and weavers to produce diversified products and improved quality to meet changing market trends.
- TMTT works with the objective to standardize, create common testing facilities with national/ international accreditation, indigenous development of prototypes and resource centre with I.T. infrastructure.

6.2 TECHNICAL INSTITUTIONS AND EXPERTS

Some of the organisations associated with the improvement of OHS in India are:

- Confederation of Indian Industry (CII)
- All India Manufacturers Organisation (AIMO)
- Confederation of Indian Employers (CIE)
- Federation of Indian Chambers of Commerce and Industry (FICCI)
- Associated Chambers of Commerce and Industry of India (ASSOCHAM)
- Laghu Udyog Bharati (LUB)
- Bharatiya Mazdoor Sangh (BMS)

- Indian National Trade Union Congress (INTUC)
- All India Trade Union Congress (AITUC)
- Hind Mazdoor Sangh (HMS)
- Centre of Indian Trade Union (CITU)

These organisations and federations have been actively involved in the various activities of DGFASLI specifically with regards to opinion building, policy related research, capacity building, skill enhancement, and facilitating workshops, conferences and meetings specifically with a thematic focus on improving the social security of the weavers and towards improving safety and health of workers.

Weavers' Service Centres (WSCs) play a vital role in imparting training to weavers, upgrading their skills and hence their qualitative and quantitative productivity. This has helped in not only reviving the traditional practices but has also instilled development of new and innovate concepts for product enhancement. WSCs also render extension services which involve transfer of design inputs, skills and technology to weavers.

The Indian Institutes of Handloom Technology (IIHTs) provide qualified and trained manpower to the handloom sector and undertake experimental and research programmes on all aspects of the handloom industry.

National Institute of Fashion Technology (NIFT) set up under the aegis of the Ministry of Textiles; Government of India is a premier Institute of Design, Management and Technology. NIFT has been granted statutory status under the act of Parliament of India in 2006, empowering the Institute to award degrees and other academic distinctions. NIFT has set academic standards and excelled in providing thought leadership through a pool of creative genius and technically competent professionals. The Institute provides a common platform for fashion education, research and training. The institute also extends research and technical support to the Government and other institutions in the field of design, capacity building, technological upgradation and marketing. It also undertakes projects with an objective to impart knowledge to artisans related to crafts, market intelligence and market requirements.

The Indian Institutes of Technology (IITs) bears the responsibility of providing the road map for the growth of other textile institutes in India. The institutes undertake need based research and product development initiatives for the benefit of the industry and Government agencies. The projects are related to the areas of Fibre, Yarn, Fabric Manufacturing, and their Chemical Processing. They may involve development of new functional materials; development of processes and technology, design and fabrication of equipments and parts thereof, application of information technology to textile operations, and simulation and modelling for optimization.

National Handloom Development Corporation (NHDC) was set up to assist the speedy development of the Handloom Sector by coordinating all action covering the procurement and supply of inputs at reasonable prices, augmenting the marketing efforts of State, upgrading the technology in the Handloom Sector and improving productivity.

Handloom Export Promotion Council (HEPC) facilitates the upgrading, popularisation and adoption of technology, quality and design improvement, standards and specifications, product development, diversification and innovations, etc.

6.3 OTHER RESEARCH INSTITUTES AND NGOS

Indian Institute of Toxicology formerly, Industrial Toxicology Research Centre, Lucknow (IITR), is a constituent laboratory of the Council of Scientific and Industrial Research (CSIR). This multi-disciplinary research institute with the motto "Safety to Environment and Health and Service to Industry" addresses problems critical to human health and environment. IITR is a NABL accredited laboratory for biological and chemical testing.

Indian Association of Occupational Health (IAOH) is India's leading NGO in occupational and environmental health. It has over 2000 occupational health physicians, industrial hygienists, safety professionals, social workers and counsellors. Besides creating awareness about health, safety and environmental hazards of industrial processes they provide trainings and research in the field of occupational and environment safety, expertise in establishing Occupational Health Centres in and around industrial zones and in creating relevant protocols for health screening and for standards of fitness for work, and all other activities which enables to attain occupational and environmental safety to the work force of the country.

6.4 SAFETY LAWS AND LEGISLATION IN INDIA

During field interactions with the artisans and entrepreneurs, it was observed that many of them, particularly the unit owners, were uncertain about the necessity of technical innovations, health and safety measures and related statutory requirements. Therefore, it was agreed that Indian laws and rules related to OHS would also be presented at the workshops to indicate the statutory requirements for the proposed safety measures. A small booklet and a pamphlet on these laws were prepared in simple Hindi and English meant especially for dissemination among the artisans. Some of these have been encapsulated in this section.

6.4.1 General Guidelines

Numerous laws have been passed in India with regards to OHS for workers working in notified hazardous industries. The Factory Act, 1948 is the primary legislation formulated In India and keeping in mind the interests of the workers. It is applicable to "factories"

"whereon ten or more workers are working, or were working on any day of the preceding twelve months, and in any part of which a manufacturing process is being carried on with the aid of power, or is ordinarily so carried on, or

whereon twenty or more workers are working, or were working on any day of the preceding twelve months, and in any part of which a manufacturing process is being carried on without the aid of power, or is ordinarily so carried on[22]"

Though the legislations formulated on the subject of labour and employment in India have been comprehensive enough with regards to provide a set of limits or minimum standards of protection for workers' health and safety, yet they have fallen short on meeting their envisaged objectives. There may be two factors that may be adjudged for this –

a.) Faulty Implementation **b.)** Lack of awareness and information

It is hence envisaged that if there is proper information available to the workers about the related provisions of the existing legislations, the misuse and the no use of the legislations may be avoided in future. Moreover, the legislations should be broad and rather enabling in character, with clearly defined roles and responsibilities and also including the redressal mechanisms.

[22] http://pblabour.gov.in/pdf/acts_rules/factories_act_1948.pdf

Regulations, on the other hand, are drawn up under powers conferred by legislation. They are normally more detailed than the legislation and apply to a specific industry or hazard. Legislations and regulations together make up the law which must be complied with. Thus, it becomes a mandatory requirement for the employer to regulate work conditions such that the workers are not subjected to any type of unsafe environment, and breaches if any can also be prosecuted and penalised.

6.4.2 Safety Laws

There are certain laws that are relevant to the issues of workplace hazards and safety, but the main provisions with respect to health, safety, welfare, etc., that need to be ensured by the contractor or employer or occupier emerged from a thorough understanding of The Factories Act, 1948. In addition to this, textile manufacturing also needs to comply with all applicable Indian legislations and statutory norms for ensuring better health and safety management at production units. The list of applicable laws and statutes is provided here:

- Workmen's Compensation Act, 1923
- Employees' State Insurance Act, 1948
- Employer's Liability Act, 1938
- Trade Union Act, 1926
- Industrial Disputes Act, 1947
- Contract Labour (Regulation and Abolition) Act, 1970
- Inter-state Migrant Workmen (Regulation of Employment and Condition of Service) Act, 1979
- Bonded Labour System (Abolition) Act, 1976
- Child Labour (Prohibition and Regulation) Act, 1986
- Children (Pledging of Labour) Act, 1933
- Minimum Wages Act, 1948
- Payment of Wages Act, 1936
- Equal Remuneration Act, 1976
- Payment of Gratuity Act, 1972
- Payment of Bonus Act, 1965
- Employees' Provident Fund and Miscellaneous Provisions Act, 1952
- Maternity Benefit Act, 1961
- Public Liability and Insurance Act, 1991

Refer ***Annexure 5*** for details of the relevant sections of the above mentioned laws.

Worker Protection Rules

This is now part of the regulations in almost every country in the developed world and is also known as "the right to know" or "hazard communication[23] ". These rules give workers the right to know what chemicals are in the products they use on the job, the hazards of those chemicals, and how to protect themselves. The rules usually require employers to provide this information in the form of proper labelling and Material Safety Data Sheets (MSDSs).

[23] www.dep.state.fl.us/admin/safety/Presentations/hazcom.ppt

MSDSs and Labels

The MSDSs are forms provided by the manufacturers of chemicals and other toxic materials. MSDSs provide data on a product's hazards and the precautions required for its safe use. Most countries' laws including India require employers to have MSDSs readily available and to provide each worker with training to enable them to understand the terminology of the MSDSs. Labels must provide safety warnings and advice for users, although the requirements for proper labelling also vary greatly from country to country. And since different languages are spoken in various countries, many manufacturers add symbols on the MSDSs and labels that will identify the product's hazards. One commonly used set of symbols are those of the European Commission.

One problem is that many workers do not know their rights and many employers either do not know they are supposed to have MSDSs and train their workers, or they have decided not to comply with these laws. Usually employers are not called to account for breaking these laws until someone is hurt or there is a complaint about conditions. However, complying with these regulations is good for, both, workers and employers. A knowledgeable worker is one who will follow safety rules because he/she understands the consequences of chemical exposure. It also means, years later, workers will not develop diseases that can be traced back to the hazardous conditions at the work place.

7. CONCLUSIONS AND RECOMMENDATIONS

The main environmental and occupational hazards afflicting the textile industry specifically the handloom and the handicrafts sector have been identified as the part of the present study. Case specific measures have also been recommended to reduce the potency of the hazards and the workers/artisans' susceptibility to those hazards. These recommendations have been made with due considerations to the requirements/ safety precautions as mandated under various legal provisions.

7.1 ISSUES AND SOLUTIONS

7.1.1 Block Printing

Washing: Handling and removal of the excess chemical dyes is an important issue observed, both, from the perspective of occupational hazards as well as ecological sustainability at the micro level because of the indiscriminate discharge of waste water. It is recommended that the excess application and use of chemical dyes may be reduced, with the reduction in the overall water requirements and also through the proper designing and maintenance of the washing tank.

Mixing of chemicals and dyes: Prolonged exposure to the toxic fumes and vapours released have serious temporary ailments which may prove fatal in the long run. It is recommended that this could be mitigated by use of non-toxic chemicals, having better mixing equipment so as to reduce the amount and the exposure to the fumes evolved, and ensuring proper ventilation. Storage and clear labelling of hazardous chemicals along with regular health checks of the workers will also help to control releases beyond the exposure limits.

Printing: The printing process in principle requires higher temperatures for better fixing of the dyes onto the cloth. In addition, the artisans cannot use fans as air circulation dries the dyes faster than required. A possible remedy would be to set in place a suitable exhaust system for proper ventilation. In addition, poor and inadequate lighting further add to the eye strain for the workers and can be addressed by design of the roof for better natural illumination. Back pain from repetitive work can be reduced through regular rest breaks and more ergonomic table designs. Physical injuries to the hand, fingers, arms, wrists may be prevented by adoption of protective gear.

7.1.2 Ikat Weaving

Colour preparation: Several toxic chemicals are used for Naphthol and Vat dyeing of the cotton and silk cloth respectively, and these have adverse effects on the health of the workers particularly during the mixing process. Mitigation is possible through design of better mixing equipment and substituting the hazardous chemicals with the non toxic ones or the ones with the reduced potency. Storage and labelling of hazardous chemicals, along with regular health checks, can further help to reduce the related hazards.

Dyeing: The toxic vapours and fumes released from the chemicals specifically during the mixing process, prove hazardous to the artisans when inhaled, while working in poorly ventilated and closed conditions. It is essential that necessary steps be taken to improve the equipment and ventilation. Use of natural dyes and regular/periodic health checks would further help in mitigating the toxic effects of the chemicals.

Colour boiling: Prolonged exposure to the hot vapours released in this process could lead to severe respiratory ailments. Forced ventilation would be one of the options to reduce the effects of the chemical fumes. The impact of heat from the vat can also be reduced by better insulation and limited exposures.

Tie-and-Dye: The leaching of toxins from the rubber strips during the boiling process is a strong concern and may directly affect the artisans exposed to them. This may be avoided by adopting suitable substitutes for the synthetic rubber. Physical injuries to back, ankles, and fingers may be further prevented by the use of appropriate protective gear.

Weaving: Working with cotton has the potential danger of inhaling its particles which may result in allergic reactions and in cases of prolonged exposure may cause a severe ailment of bysinnosis. Working in bad body postures further lead to muscular spasms/sprains and strains that may prove hazardous in the long run if ignored. Designing of the loom with a better ergonomic design could be a better safety provision.

7.1.3 Investigation, Reporting and Analysis of Risk

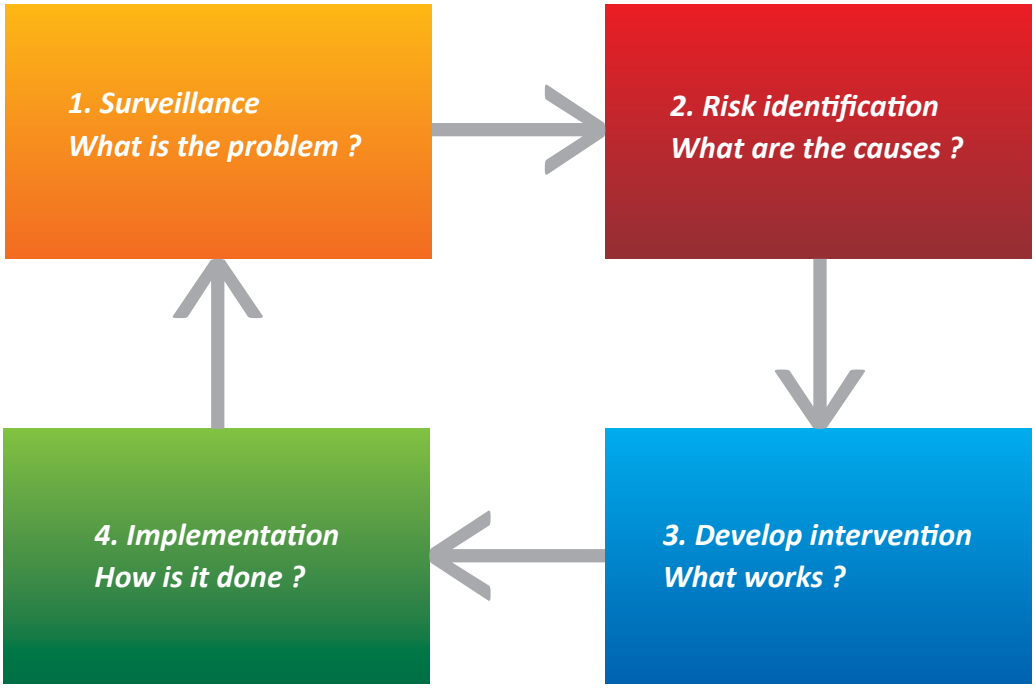
In most industries, it is relatively easy to identify potential risks in the workplace because of the structural advantages and in-house evaluation processes, to assess and evaluate the magnitude of impact on the health of the workers. For example, the documentary record of the accident rate in a particular job gives an indication of the magnitude of hazard relative to the work.

But in home-based industries representing the unorganised structure, finding the causes of the hazards is difficult because of the lack of documentation and complimented by the predominance of the traditional work patterns. The hazards in this sector assume chronic proportions before they get identified. The relative number of accidents may be small or negligible but the severity rate is increased manifold due to prolonged and continued exposure to the hazard and also because of the negligence of the weaver communities. In other words, accidents are low but the diseases are more. For example, the general condition of artisans is much better than other industrial workers with respect to cuts, wounds and major accidents which lead to death, but chronic effects due to chemical exposure and ergonomic problems may be significantly high, particularly because of the changes in production processes in response to market demands.

Table 9: Indicators of Occupational Health Problems in Home-based Industries

Index	*Description*	*Use and limitations*
Number of affected population	Absolute figure indicates the number of people affected, whether chronic or acute, and the need for treatment.	Useful for the planning of adequate medical services at the local level.
Rate of severity due to traditional work pattern	Absolute figure indicates the number of people who suffer more and are more prone to a particular hazard.	Gives a partial estimate of the magnitude of the safety problem. Useful for planning of best practices that can reduce the rate or use of alternative methods.
Severity rate due to machine or tool	Shows the ratio of occupational health problems with respect to the use of tools and machinery.	Useful for comparing the hazards with alternative tools through proper design without compromising the efficiency.
No. of workers affected among 100 workers	A means of personal safety or the average probability of an individual being affected in a particular cluster.	Shows the impact of work pattern as a health burden on human population at a particular cluster. Used for comparing the relative seriousness of the problem at different clusters.

There are 4 steps in approaching the problem for investigation:



These four steps may be described as:

Determination of the magnitude, scope, and characteristics of the problem. Defining the problem goes beyond simply counting cases, it includes delineating deaths, injuries and disease, and risk taking behaviour. This step includes obtaining information on the socio-economic characteristics of the person involved, the time and place of the incident, the circumstances under which it occurred, and the severity and cost of the injuries.

Identification of the factors that increase the risk of injury or disability, and the determination of those factors which may be modified to reduce its hazard potential. Whereas the first step looks at "who, when, where, what and how", the second step looks at "why". It may also be used to define populations at high-risk for accidental injuries and to suggest specific interventions.

Assessing the preventive measures to be taken by using the information about causes and risk factors to design, pilot test, and the evaluation of the interventions.

Implementation of interventions that have been proven or are highly likely to be effective on a broad scale. In both instances, it is important that data be collected to evaluate the programme's effectiveness.

The first three steps have been almost completed in the two study areas within the scope of the present study. However, the evaluation in the third step and Implementation in the fourth step are yet to be achieved.

7.2 RECOMMENDATIONS

7.2.1 Information Analysis and Dissemination

This document, containing safety guidelines, protective measures, and legal provisions, should be made widely available in local languages to employers, artisans, and workers in the industry.

A systematic schedule of training workshops with groups working with artisans and craftspersons could be designed and pursued so as to make the artisans aware of the environmental and occupational hazards and to elicit their willing co-operation in future activities. These training workshops should preferably be conducted in the local language.

- Data collected from primary or secondary sources needs to be analysed to answer such questions as:
- What are the most common causes and types of health effects in different age groups?
- What are the characteristics of persons who are most likely to be affected?
- What are the circumstances under which effects are most likely to occur?
- What policies and programmes can reduce the likelihood and severity of health problems in a community?

Analysing data, producing regular outputs, and disseminating information on OHS are all considered as vital activities. It is essential to share and disseminate data and evidence on causes and remedial measures of the problems to artisans, researchers, policy makers, academia and the community at the local and national levels for envisaging opinions, feedback and suggestions.

7.2.2 Equipment Testing and Tracking

The safety gear designed during this study should be comprehensively tested through repeated trial runs over reasonable time periods in different clusters and the suggestions made by workers should be incorporated for better, more user-friendly designs.

Subsequent innovations by the workers themselves should be recorded systematically and studied for their impact on safety, for subsequent modification and adoption.

7.2.3 Health Check-Ups

Monitoring protocols for regular health check-ups and regulating safety measures could be developed and conducted by associations interested in the welfare of the industry.

Trained occupational hygienists should be recruited to assist in investigating, reporting, and analysing risks, and suggesting remedial measures for specific problems in the work place.

As already stated in the previous sub-section, assessment of the root problems of the hazards is difficult in the case of home-based industries.

It is thus envisaged that a self-assessment health kit may be developed through which a surveillance of the present health status of the workforce may be done.

This would assume further importance if it may be designed in such a way that the artisan himself/herself should be able to carry out the risk assessment of his/her health problems through the kit.

Some additional tests for evaluating occupational health problems are:

- BMI (Body Mass Index) test, for the general health of an artisan
- PFT (Pulmonary Function Test), to measure the effective function of the lungs
- HGM (Hand Grip Meter) test, to assess the muscle tone
- Eye test, through the Snellen Chart
- Recording of observations of damage
- Recording of occupational history and symptoms

7.2.4 Systems Approach to OHS

The conventional form of analysis and review involves the independent examination of the user, the technology and the environment. There is also a tendency amongst the researchers and practitioners to analyse just one or a few factors instead of assessing the entire problem holistically and studying their cross-linkages, if any.

It is essential to adopt a systems approach instead, where not only are the underlying factors taken into consideration, but their inter-linkages and the role of different agencies and actors in prevention efforts are also considered.

Though the conventional approach may be useful in devising measures separately for each problem, assessing their inter-linkages would help in devising mitigatory measures holistically. It would also help to study and assess the feasibility and replicability of the interventions across multiple clusters.

7.2.5 Further Studies

The substitution of hazardous substances and chemicals by eco-friendly ones is often made impossible by the higher costs involved. Therefore, a detailed study of the economics of concealed subsidies and externalities would be valuable for the entire industry.

7.3 CONCLUSION

The Indian textile industry is a dynamic industry with numerous crafts and multiple processes spread across innumerable clusters across the country. All of these processes have their associated hazards and health problems which affect the production efficiency and thereby the contribution of an artisan to the community at large.

This study, though focus on the occupational hazards of the Block Printing and the Ikat Weaving sectors, serves to highlight similar problems faced across different sectors and the different craft patterns.

Generally, artisans practice the traditional skills in textile processing and are aware of the associated hazards. Yet they do not readily accept any modification or change in the processes due to various reasons, prominent among them being the costs involved; the barriers in process modification due to the new tools added and the difficulty in improvising the traditional perfection.

The main apprehension behind the reluctance to adopt both the processes and the tool modifications seems to be the perceived loss of traditional processing techniques and the immediate reduction in their production capacities.

Promoting new and safe technologies thus continues to be a big challenge. Other key concerns in the sector are regarding the unorganized welfare operations and the need for instilling a change in the behavior towards occupational health and safety.

The study despite its numerous limitations (with regards to its coverage) has been able to highlight the need for better working conditions and what is essentially required for their adoption. It also highlights some of the no-cost to low cost solutions available in the market for enabling a safer and a healthier working environment for the artisans. Solutions to mitigate hazards at source are however, seen to be an area for further study, which demands acceptance by the artisans for a change in traditional processes.

The study would like to conclude by providing an open platform for the readers to suggest, adopt, adapt and promote new or revised technologies for promoting efficiency while simultaneously safeguarding occupational health and safety of the artisans. That would be the most important contribution towards ensuring Sustainable Production and Consumption Practices for Sustainable Development.

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Material Safety Data Sheet, Lime-Spar, Chemical Lime Company, KSA, USA, http://www.lhoist.us/pdf/Lime-SparBlend042908.pdf

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Textile Industry Report, Dun & Bradstreet India, http://www.legalpundits.com/Content_folder/THETEXTILEINDUSTRYREPORT290710.pdf

Trade Union Act, 1926, http://pblabour.gov.in/pdf/acts_rules/trade_unions_act_1926.pdf

Workmen's Compensation Act, 1923, http://pblabour.gov.in/pdf/forms_procedures/procedure07_workmens_compensation_act_1923.pdf

Workplace Health and Safety Bulletin, Lifting and Handling Loads, Part2, Government of Alberta, http://employment.alberta.ca/documents/WHS/WHS-PUB-BCL002.pdf

Annexure 1. QUESTIONNAIRE FOR OCCUPATIONAL HEALTH SURVEY

1. Place:

2. Craft: 3. Date:

4. Name:

5. Age: 6. Sex:

7. Years working in craft: 7A. Employed/Self-employed:

8. Main tasks of work:

9. Inspection (mention parts of the body):

Callus	Cuts	Burns	Spots	Tremors	Skin

10. Reported Symptoms/Illness:

(a) Eyes	
(b) Ears	
(c) Aches	
(d) Lungs	
(e) Other	

11. Habits (tick):

Paan	Smoking	Tobacco	Alcohol	Ghutka	Ganja	Bhang

12. Tests:

(a) Height	(b) Weight	(c) Eyesight	(d) Hand grip		(e) Peak flow (avg. of 3 readings)
			Left	Right	

13. Comment on safety equipment, precautions, condition of work, ventilation and light:

.....

.....

14. Case History:

.....

.....

Sanchal Foundation, 92H, 3rd floor, Pratap Market, Munirka, New Delhi

Phone: 011-26714244/26187806, Email: hazardscentre@gmail.com, www.hazardscentre.com

Annexure 2. SPECIFICATIONS AND COSTS OF PROTOTYPE SAFETY EQUIPMENT

Note: All prices are from New Delhi as of November 2011 and are subject to change.

The contact details of the respective vendors are available at

http://aiacaonline.org/policy-sustainable.asp?links=policy4.

A2.1 DYE MIXER

Dimensions	Perforated disc of 10" diameter Mixer handle, 25mm diameter, 44" in length, made of two pieces, each 22" long, with a threaded joint at one end.
Materials and Costs	
Iron	Rs 875/- Would reduce to Rs 550/- for bulk production. Iron is relatively cheap and robust but will be corroded by both acids and bases.
Aluminium	Rs 905/- Costs will vary on a per day basis (Rs 115 per kg in Nov 2011). Light weight but may be attacked by chemicals and dyes. Fabrication on a bulk scale will require a die, which may cost up to Rs 45,000; cannot be welded if broken.
Stainless Steel	Magnetic SS: (Weak, non-durable but cheaper) Rs 2200/- Pure SS: (Long lasting, but expensive) Rs 2500/- Costs will vary on a per day basis (Rs 135 per foot in Nov 2011). Stainless Steel is heavy but extremely durable and non-corrosive, as it does not react with acids and dyes. If it breaks it can be welded; can also be made by local vendors.
Plastic (HDPE):	Rs 850/- Plastic is relatively cheap but is structurally weak and will be corroded by both acids and bases.
Copper	Rs 2500/- Light weight but may be attacked by chemicals and dyes.

A2.2 BOTTOM JOINT LOOM

Dimensions	6' wide x 6.5' long x 5' high: the size is actually determined by the Reed frame which is manufactured by a single agency in Mumbai who has distributors all over the country
Materials and Costs	Total cost of the loom will vary from Rs 16,000 to Rs 22,000 per loom Hardwood is required for the construction of the Reed frame (Beater), Shuttle box, C-section support columns, and the Heddle frames Burma teak: Rs 2600 to Rs 3200 per sq.ft. Nagpur teak: Rs 2100 to Rs 2700 per sq.ft. Sheesham: Rs 1575 to Rs 2200 per sq.ft. Babool: Rs 1200 to Rs 1500 per sq.ft.

A2.3 HAND SAFETY GEAR

Dimensions	Medium size available in the local market
Materials and Costs	Mesh / Polyester wash-proof leather half gloves cost between Rs 130 to Rs 240 per pair Shin Guards of HDPE with ribs and foam inner padding, for making the hard edge, cost Rs 180 to Rs 375 per pair Velcro strips for straps cost Rs 30 to Rs 42 per metre Total cost for a Medium size Glove, including materials and labour) would be about Rs 700 per piece

A2.4 FOOT SAFETY GEAR

Dimensions	Foot size of 9 (Indian Standard)
Materials and Costs	Velcro strips for straps: Rs 30 to Rs 42 per metre Shin Guards (HDPE with ribs and foam inner padding) for making the ankle cap cost Rs 180 to Rs 375 per pair Total cost for a Size 9 Ankle Guard would vary between Rs 400 to Rs 500 per piece For bulk orders, costs should generally come down by more than 25-30 per cent, depending upon the vendor selected and the number of pieces that could be extracted out of the raw material, thus cutting down the wastage. There are no existing commercial vendors for such supplies and local entrepreneurs would have to be sought out at each location to make these items. But this would be imperative to assess its feasibility and modifications on first extensive testing of each safety gear in order to ensure its improved usage.

Annexure 3. STATE POLLUTION CONTROL GUIDELINES

Guidelines of Rajasthan State Pollution Control Board[24]

The recovery and re-use of chemicals are to be explored in the following areas:

- The re-use of dye solutions from the dye bath;
- The recovery of caustic after the mercerizing process;
- The recovery of size in cotton processing (in practice this is limited to integrated operations which apply and remove size)

In conventional dyeing, usually only the dye and a few specialty chemicals are totally consumed during the process. Most of the chemicals remain in the dye bath and are discarded with it. The feasibility of reusing the dye bath depends on dye, colour, shade and whether dyeing process is carried out in batches or in continuum. In some cases, dye baths can be re-used at least 5 - 10 times (in other cases up to 25 times) until the build-up of impurities limits further re-use.

[24] 210.212.96.131/rpcb/Guidelines/textile_guidelines_final.pdf

Annexure 4. LIST OF HARMFUL DYES, PIGMENTS AND OTHER CHEMICALS AND THEIR ALTERNATIVES

Table 10: Usage of Alternative Dyes

Banned	*CI Number*	*Alternative*	*CI Number*
Safer Alternatives for Banned Disperse Dyes			
Disperse Yellow 7	23660	Disperse Yellow 15	
Disperse Yellow 23	22130	Disperse Orange 102	29156
Disperse Blue 12	3900	Disperse Red 81	28160
Disperse Orange 50	22145	Disperse Red 120	25275
Disperse Yellow 24	29185	Disperse Yellow 23	29160
Disperse Yellow 46	23050	Disperse Yellow 31	29100
Disperse Yellow 62	29175	Disperse Yellow 4	29165
Disperse Yellow 1	22570	Disperse Violet 66	29120
Disperse Yellow 2	22311	Disperse Yellow 112	29166
Disperse Yellow 29	22580	Disperse Yellow 51	27720
Safer Alternatives for Banned Acid Dyes			
Acid Orange 45	22195	Acid Orange	1914690
Acid Red 4	14710	Acid Red 157	17990
Acid Red 5	14905	Acid Red 191	14730
Acid Red 24	16140		17900
Acid Red 26	16150	Acid Red	24785
Acid Red 115	27200	Acid Red 37	17045
Acid Red 49	42640	Acid Violet 72	42665
Acid Red 12	18075	Acid Violet 13	16640
Acid Black 94	30336	Acid Black 24	26370
Safer Alternatives for Banned Direct Dyes			
Direct Yellow 48	23660	Direct Yellow 15	
Direct Orange 8	22130	Direct Orange 102	29156
Direct Red 2	23900	Direct Red 81	28160
Direct Red 10	22145	Direct Red 120	25275
Direct Red 24	29185	Direct Red 23	9160
Direct Red 46	23050	Direct Red 31	29100
Direct Red 62	29175	Direct Red 4	29165
Direct Violet 1	22570	Direct Violet 66	29120
Direct Brown 2	22311	Direct Brown 112	29166
Direct Black 29	22580	Direct Black 51	22720

Source: Environmental Quick Scan Textiles, complied for CBI and SIDA by Consultancy and Research for Environmental Management, Published by CBI, SIDA, VIVO, 1996

Table 11: Use of Alternative Pigments in Printing

Suspected Pigment	*CI Number*	*Alternative*	*CI Number*
Pigment Orange 50	20170	Pigment Orange 38	
Pigment Yellow 12	21090	Pigment Yellow 147	12367
Pigment Yellow 63	21091	Pigment Yellow 148	50600
Pigment Yellow 126	21101	Pigment Yellow 5	11660
Pigment Red 39	21080	Pigment Red 87	73310
Pigment Yellow 176	21103	Pigment Yellow 101	48052
Pigment Yellow 114	21092	Pigment Yellow 10	12710

Source: Environmental Quick Scan Textiles, complied for CBI and SIDA by Consultancy and Research for Environmental Management, Published by CBI, SIDA, VIVO, 1996

Table 12: Chemical Substitution

Process	*Chemical*	*Substitute*
Sizing	Starch based wrap sizes by PVA	Acrylates or partial Substitution
Desizing Scouring	Acid	Hydrogen Peroxide & Enzymes
Aqueous Scouring	AlkylphenolEthoxylates TSP, NaOH	Fatty alcohol ethoxylates Sodium Carbonate
Detergent Souring	Alkyl benzene sulphonates	Fatty alkyl sulphates Polyglycolether
Light Scouring	NTA, EDTA	Zeolites (sodium aluminium Silicate)
Bleaching	Reductive sulphur bleaches	Peroxide bleaches
	Chlorine compounds	Peroxide Bleaches
Dyeing	Benzidine based dyestuffs and other amine releasing dyes	Mineral/pigment dyes single class dyes like indigsol, pigments, reactives
	Dichromate used for oxidation in vat and sulphur dyes	Peroxide, air oxygen, metal free agents
	Acetic acid in the dyeing bath	Formic acid
	Dispersants for dyes and chemicals	Water based system
	Copper sulphate used to treat direct dyes	Polymeric compounds
	Dye powder in automatic injection	Liquid dyes
	Sodium hydrosulphite	Stabilized sodium hydrosulphite
	Aldehyde and toxic metallic salts used as auxiliaries	High molecular weight polymeric auxiliaries
	Sodium sulphide	Glucose based reducing Agents
Printing	Kerosene or white spirit	Water based systems
Finishing	Formaldehyde	Poly carboxylic acid
	Alkyl phenol	Fatty alcoholethyoxylates
Anti-wrinkle finishing	Dimethyloldihydroxyethylene urea	(Poly carboxylic acids mainly 1,2,3,4 butane tetra carboxylic acid) Glyoxales
Flame retardant finishing	Asbestos, Halogenated compounds like, bromated diphenylethers (PBDEs) and heavy metal containing compounds	Inorganic salts and Phosphonates
Preservation finishing	Biocides such as chlorinated phenols (PCP), metallic salts (As, Zn, Cu or Hg), DDE, DDT, Benzothiazole	UV Treatment, mechanical or enzymatic finishing

Source: Textile Sector Part A (http://www.eeaa.gov.eg.seam/Manuals/TextilesectorReport/content.htm)

Annexure 5. GOVERNMENT LAWS AND RULES

A5.1 WORKMEN'S COMPENSATION ACT, 1923 AND WORKMEN'S COMPENSATION RULES, 1924

http://workmenscompensationact1923.blogspot.in/2011/04/workmens-compensation-rules-1924.html

http://www.indiankanoon.org/doc/1806623/

The objective of this Act is that in the case of an employment injury compensation be provided to the injured workman and in case of his death to his dependants.

Schedule 2 Section (3) of the Act states that "The State Government, after giving, by notification 8[in the Official Gazette, not less than three months' notice of its intention so to do, may, by a like notification, add to Schedule II any class of persons employed in any occupation which it is satisfied is a hazardous occupation, and the provisions of this Act shall thereupon apply within the State to such classes of persons: Provided that in making such addition the State Government may direct that the provisions of this Act shall apply to such classes of persons in respect of specified injuries only."

Section 3 of the Act further provides for Employer' s liability for compensation to be paid to workers employed in hazardous industries.

A5.2 EMPLOYEES' STATE INSURANCE ACT, 1948

http://esic.nic.in/Publications/ESIAct1948Amendedupto010610.htm

The promulgation of Employees' State Insurance Act, 1948 envisaged an integrated need based social insurance scheme that would protect the interest of workers in contingencies such as sickness, maternity, temporary or permanent physical disablement, death due to employment injury resulting in loss of wages or earning capacity. The Act also guarantees reasonably good medical care to workers and their immediate dependants.

Chapter 5 of the Act talks about the Benefits provided to the Artisans under the scheme.

A5.3 EMPLOYER'S LIABILITY ACT, 1938

http://www.legalindia.in/the-employers-liability-act-1938

Section 3 of the Act provides for the 'Defence of common employment barred in certain cases', and the liability of the employer in cases where personal injury is caused to a workman -

(a) by reason of the omission of the employer to maintain in good and safe condition any way, works, machinery or plant connected with or used in his trade or business, or by reason of any like omission on the part of any person in the service of the employer who has been entrusted by the employer with the duty of seeing that such way, works, machinery or plant are in good and safe condition; or

(b) by reason of the negligence of any person in the service of the employer who has any superintendence entrusted to him, whilst in the exercise of such superintendence; or

(c) by reason of the negligence of any person in the service of the employer to whose orders or directions the workman at the time of the injury was bound to conform and did conform, where the injury resulted from his having so conformed; or

(d) by reason of the act or omission of any person in the service of the employer done or made -

(i) in the normal performance of the duties of that person; or

(ii) in obedience to any rule or bye-law of the employer (not being a rule or bye-law which is required by or under any law for the time being in force to be approved by any authority and which has been so approved); or

(iii) in obedience to particular instructions given by any other person to whom the employer has delegated authority in that behalf; a suit for damages in respect of the injury instituted by the workman or by any person entitled in case of his death shall not fail by reason only of the fact that the workman was at the time of the injury a workman of, or in the service of, or engaged in the work of, the employer.

Section 3A in addition provides for contracting out which provides that "Any provision contained in a contract of service or apprenticeship, or in an agreement collateral thereto, shall be void in so far as it would have the effect of excluding or limiting any liability of the employer in respect of personal injuries caused to the person employed or apprenticed by the negligence of persons in common employment with him".

A5.4 TRADE UNION ACT, 1926

http://labour.nic.in/upload/uploadfiles/files/ActsandRules/LawsRelatedtoIndustrialRelations/The%20Trade%20Unions%20Act,%201926.pdf

An Act to provide for the registration of Trade Unions and in certain respects to define the law relating to registered Trade Unions was enacted as ACT NO. 16 OF 1926 on 25th March, 1926

An important and relevant highlight of the Act is the Chapter 3, which provides for the RIGHTS AND LIABILITIES OF REGISTERED TRADE UNIONS, and mentions under Section 15 (g) that the liability of the registered trade unions stays on " the issue of, or the undertaking of liability under, policies of assurance on the lives of members, or under policies insuring members against sickness, accident or unemployment;"

A5.5 INDUSTRIAL DISPUTES ACT, 1947

http://labour.nic.in/upload/uploadfiles/files/ActsandRules/LawsRelatedtoIndustrialRelations/THE%20INDUSTRIAL%20DISPUTES%20ACT,%201947.pdf

The objective of the Industrial Disputes Act is to secure industrial peace and harmony by providing machinery and procedure for the investigation and settlement of industrial disputes by negotiations. The Industrial Disputes Act extends to whole of India and applies to every industrial establishment carrying on any business, trade, manufacture or distribution of goods and services irrespective of the number of workmen employed therein. Every person employed in an establishment for hire or reward including contract labour, apprentices and part time employees to do any manual, clerical, skilled, unskilled, technical, operational or supervisory work, is covered by the Act.

Chapter 1, Clause 5(k) provides "industrial dispute" means any dispute or difference between employers and employers or between employers and workmen, or between workmen and workmen, which is connected with the employment or non-employment or the terms of employment or with the conditions of labour, or of any person;

Chapter 2, Section 7 of the Act provides for the setting up of Labour Courts for the adjudication of industrial disputes relating to any matter specified in the Second Schedule and for performing such other functions as may be assigned to them under this Act.

A5.6 CONTRACT LABOUR (REGULATION AND ABOLITION) ACT, 1970

http://pblabour.gov.in/pdf/acts_rules/contract_labour_regulation_and_abolition_act_1970.pdf

The main objective of this act is to regulate the contract labour and abolish it in certain cases. It applies to every establishment in which twenty or more workmen are employed or were employed on any day of the preceding twelve months as contract labour;

CHAPTER 5 of the Act specifically provides for the WELFARE AND HEALTH OF CONTRACT LABOUR hired in establishments including the liabilities and the responsibilities of the employers.

A5.7 INTER-STATE MIGRANT WORKMEN (REGULATION OF EMPLOYMENT AND CONDITION OF SERVICE) ACT, 1979

http://labour.nic.in/upload/uploadfiles/files/ActsandRules/Service_and_Employment/The%20Inter-State%20Migrant%20Workmen%20(Regulation%20of%20Employment%20and%20Conditions%20of%20Service)%20Act,%201979.pdf

An Act to regulate the employment of inter-State migrant workmen and to provide for their conditions of service and for matters connected therewith, ad specifically includes the CHAPTER IV concerning with the Duties and Obligations of Contractors with regards to ensuring the welfare of the workers and CHAPTER V for just and equitable Wages, Welfare and other Facilities to be provided to Inter-State Migrant Workman.

A5.8 BONDED LABOUR SYSTEM (ABOLITION) ACT, 1976

http://dc-siwan.bih.nic.in/bonded_labour_system_abolition_act_1976.pdf

The object of the Act is to provide for the abolition of bonded labour system with a view to preventing the economic and physical exploitation of the weaker sections of the people and for matters connected therewith or incidental thereto.

A5.9 CHILD LABOUR (PROHIBITION AND REGULATION) ACT, 1986

http://pblabour.gov.in/Pdfs/Child%20Labour%20_Prohibition%20_%20Regulation_%20Act,%201986.pdf

An Act to prohibit the engagement of children in certain employments and to regulate the work conditions of children in certain other employments.

Where the PART II of the Act provides for the PROHIBITION OF EMPLOYMENT OF CHILDREN IN CERTAIN OCCUPATIONS AND PROCESSES, the Part 3 of the Act provides for the REGULATION OF CONDITIONS OF WORK OF CHILDREN

PART IV of the Act with the title MISCELLANEOUS under Section 14 (1) of the Act specifically mentions on PENALTIES and provides that “Whoever employs any child or permits any child to work in contravention of the provisions of section 3 shall be punishable with imprisonment for a term which shall not be less than three months but which may extend to one year or with fine which shall not be less than ten thousand rupees but which may extend to twenty thousand rupees or with both.”

A5.10 CHILDREN (PLEDGING OF LABOUR) ACT, 1933

http://labour.nic.in/upload/uploadfiles/files/ActsandRules/SectionoftheSociety/The%20Children%20(Pledging%20of%20Labour)%20Act,%201933.pdf

An Act to prohibit the pledging of the labour of children was enacted as ACT NO. 2 OF 1933 dated 24th February, 1933

Some highlights of the Act include:

Section 4 of the Act provides the "Penalty for parent or guardian making agreement to pledge the labour of a child.- Whoever, being the parent or guardian of a child,makes an agreement to pledge the labour of that child, shall be punished with fine which may extend to fifty rupees."

Section 5 provides for "Penalty for making with a parent or guardian an agreement to pledge the labour of a child.- Whoever makes with the parent or guardian of a child an agreement whereby such parent or guardian pledges the labour of the child shall be punished with fine which may extend to two hundred rupees."

Section 6 provides for "Penalty for employing a child whose labour has been pledged.- Whoever, knowing or having reason to believe that an agreement has been made to pledge the labour of a child, in furtherance of such agreement employs such child, or permits such child to be employed in any premises or place under his control, shall be punished with fine which may extend to two hundred rupees."

A5.11 MINIMUM WAGES ACT, 1948

http://www.ilo.org/dyn/travail/docs/623/Minimum%20Wages%20Act%201948.pdf

An Act to provide for fixing minimum rates of wages in certain employments.

Some highlights of the Act are as

Section 3. Fixing of minimum rates of wages- "The appropriate Government shall, in the manner hereinafter provided, fix the minimum rates of wages payable to employees employed in an employment specified in Part I or Part II of the Schedule and in an employment added to either Part by notification under section 27:

Section 4 (1). Minimum rate of wages-"Any minimum rate of wages fixed or revised by the appropriate Government in respect of scheduled employments under section 3 may consist of--

(i) a basic rate of wages and a special allowance at a rate to be adjusted, at such intervals and in such manner as the appropriate Government may direct, to accord as nearly as practicable with the variation in the cost of living index number applicable to such workers (hereinafter referred to as the "cost of living allowance"); or

(ii) a basic rate of wages with or without the cost of living allowance, and the cash value of the concessions in respect of supplies of essential commodities at concession rates, where so authorized; or

(iii) an all-inclusive rate allowing for the basic rate, the cost of living allowance and the cash value of the concessions, if any.

Section 11. Wages in kind.

(1) Minimum wages payable under this Act shall be paid in cash.

(2) Where it has been the custom to pay wages wholly or partly in kind, the appropriate Government being of the opinion that it is necessary in the circumstances of the case may, by notification in the Official Gazette, authorize the payment of minimum wages either wholly or partly in kind.

(3) If the appropriate Government is of the opinion that provision should be made for the supply of essential commodities at concession rates, the appropriate Government may, by notification in the Official Gazette, authorize the provision of such supplies at concession rates.

(4) The cash value of wages in kind and of concessions in respect of supplies of essential commodities at concession rates authorized under sub-sections (2) and (3) shall be estimated in the prescribed manner.

A5.12 PAYMENT OF WAGES ACT, 1936

http://pblabour.gov.in/pdf/acts_rules/payment_of_wages_act_1936.pdf

The Payment of Wages Act, 1936 is a central legislation which has been enacted to regulate the payment of wages to workers employed in certain specified industries and to ensure a speedy and effective remedy to them against illegal deductions and/or unjustified delay caused in paying wages to them. It applies to the persons employed in a factory, industrial or other establishment or in a railway, whether directly or indirectly, through a sub-contractor. Further, the Act is applicable to employees drawing wages upto Rs. 1600/- a month.

The Central Government is responsible for enforcement of the Act in railways, mines, oilfields and air transport services, while the State Governments are responsible for it in factories and other industrial establishments.

The basic provisions of the Act are as follows:-

1. The person responsible for payment of wages shall fix the wage period upto which wage payment is to be made. No wage-period shall exceed one month.
2. All wages shall be paid in current legal tender, that is, in current coin or currency notes or both. However, the employer may, after obtaining written authorisation of workers, pay wages either by cheque or by crediting the wages in their bank accounts.
3. All payment of wages shall be made on a working day. In railways, factories or industrial establishments employing less than 1000 persons, wages must be paid before the expiry of the seventh day after the last date of the wage period. In all other cases, wages must be paid before the expiry of the tenth day after the last day of the wage period. However, the wages of a worker whose services have been terminated shall be paid on the next day after such termination.
4. Although the wages of an employed person shall be paid to him without deductions of any kind, the Act allows deductions from the wages of an employee on the account of the following:- (i) fines; (ii) absence from duty; (iii) damage to or loss of goods expressly entrusted to the employee; (iv) housing accommodation and amenities provided by the employer; (v) recovery of advances or adjustment of over-payments of wages; (vi) recovery of loans made from any fund constituted for the welfare of labour in

accordance with the rules approved by the State Government, and the interest due in respect thereof; (vii) subscriptions to and for repayment of advances from any provident fund;(viii) income-tax; (ix) payments to co-operative societies approved by the State Government or to a scheme of insurance maintained by the Indian Post Office; (x) deductions made with the written authorisation of the employee for payment of any premium on his life insurance policy or purchase of securities.

The Act also prescribes the following rules for fines:

a) Fines shall be imposed for approved list of acts and omissions.

b) A notice specifying such list shall be exhibited in the prescribed manner on the premises in which the employment is carried on or at the prescribed places in case a person is employed in railways.

c) No fine shall be imposed on any employed person until he has been given an opportunity of showing cause against the fine, or other-wise, than in accordance with such procedure as may be prescribed for the imposition of fines.

d) The total amount of fine which may be imposed in any one wage period on any employed person shall not exceed an amount equal to three per cent of the wages payable to him in respect of that wage-period.

e) No fine shall be imposed on any employed person who is under the age of fifteen years.

f) No fine imposed on any employed person shall be recovered from him by installments or after the expiry of sixty days from the day on which it was imposed.

g) All fines and all realizations thereof shall be recorded in a register to be kept by the person responsible for the payment of wages.

h) Hence, the main object of the Act is to eliminate all malpractices by laying down the time and mode of payment of wages as well as securing that the workers are paid their wages at regular intervals, without any unauthorised deductions. The Act was amended by the Payment of Wages (Amendment) Act, 2005 Rs. in order to enlarge its scope and provide for more effective enforcement. The main amended provision is the enhancement of wage ceiling from 1600/-per month to Rs. 6500/-per month for the applicability of the Act as well as empowering the Government to enhance the ceiling by notification in future.

A5.13 EQUAL REMUNERATION ACT, 1976

http://labour.nic.in/upload/uploadfiles/files/ActsandRules/EmpowermentofWomen/The%20Equal%20Remuneration%20Act,%201976.pdf

Equal Remuneration Act, 1976 is an Indian Industrial Law brought into force to provide for the payment of equal remuneration to men and women workers and for prevention of discrimination, on the ground of sex, against women in the matter of employment and for matters connected therewith, or incidental to.

The CHAPTER II of the Act provides for the PAYMENT OF REMUNERATION AT EQUAL RATES TO MEN AND WOMEN WORKERS AND OTHER MATTERS

The Section 4 of the Act emphasizes on the “Duty of employer to pay equal remuneration to men and women workers for same work or work of a similar nature.”

Read more: http://www.lawnotes.in/Equal_Remuneration_Act,_1976#ixzz2HX8Ga821

A5.14 PAYMENT OF GRATUITY ACT, 1972

http://indiacode.nic.in/fullact1.asp?tfnm=197239

An Act to provide for a scheme for the payment of gratuity to employees engaged in factories, mines, oilfields, plantations, ports, railway companies, shops or other establishments and for matters connected therewith or incidental thereto. It shall apply to - (a) every factory, mine, oilfield, plantation, port and railway company; (b) every shop or establishment within the meaning of any law for the time being in force in relation to shops and establishments in a State, in which ten or more persons are employed, or were employed, on any day of the preceding twelve months; (c) such other establishments or class of establishments, in which ten or more employees are employed, or were employed, on any day of the preceding twelve months

Important Sections of the Act are:

- **Section 4** of the Act provides for the Payment of gratuity
- **Section 9 (2)** An employer who contravenes, or makes default in complying with, any of the provisions of this Act or any rule or order made thereunder shall be punishable with imprisonment for a term 5*[which shall not be less than three months but which may extend to one year, or with fine which shall not be less than ten thousand rupees but which may extend to twenty thousand rupees, or with both]. Provided that where the offence relates to non-payment of any gratuity payable under this Act, the employer shall be punishable with imprisonment for a term which shall not be less than 5*[six months but which may extend to two years] unless the court trying the offence, for reasons to be recorded by it in writing, is of opinion that a lesser term of imprisonment or the imposition of a fine would meet the ends of justice.

A5.15 PAYMENT OF BONUS ACT, 1965

http://pblabour.gov.in/pdf/acts_rules/payment_of_bonus_act_1965.pdf

The Payment of Bonus Act, 1965 was enacted to provide for the payment of bonus to persons employed in certain establishments on the basis of profits or productivity and for the matters connected therewith. The Act applies to:- (i) every factory as defined under the Factories Act, 1948; and (ii) every other establishment in which twenty or more persons are employed on any day during an accounting year. However, the Government may, after giving two months' notification in the Official Gazette, make the Act applicable to any factory or establishment employing less than twenty but not less than ten persons.

The Act is enforced through the Central Industrial Relations Machinery (CIRM). CIRM is an attached office of the Ministry of Labour and is also known as the Chief Labour Commissioner (Central) [CLC(C)] Organisation. It is headed by the Chief Labour Commissioner (Central).

The key provisions of the Act are:-

- An employee is entitled to be paid by his employer a bonus in an accounting year subjected to the condition that he/she has worked for not less than 30 working days of that year.
- An employer shall pay minimum bonus at the rate of 8.33% of the salary or wages earned by an employee in an year or one hundred rupees, whichever is higher. Here it is not required that the employer has any allocable surplus in the accounting year. However, where an employee has not completed fifteen years

of age at the beginning of the accounting year, the minimum bonus payable is 8.33% or sixty rupees, whichever is higher.

- In any accounting year, if the allocable surplus exceeds the amount of minimum bonus payable to the employees, the employer shall in lieu of such minimum bonus, be bound to pay bonus (maximum bonus) equivalent to the amount which shall not exceed 20% of the salary or wages earned by employees.
- All amounts payable to an employee by way of bonus under this Act shall be paid in cash by his employer within a month from the date on which the award become enforceable or the settlement comes into operation, in respect of any dispute regarding payment of bonus. But, in any other case, it shall be paid within a period of eight months from the close of the accounting year.
- However, the Government may order, upon receiving application made to it by the employer and for sufficient reasons, to extend the said period of eight months to such further period or periods as it thinks fit, such that that the total period so extended shall not, in any case, exceed two years.
- An employee shall be disqualified from receiving bonus if he/ she is dismissed from service for:- (i) fraud; or (ii) riotous or violent behaviour while on the premises of the establishment; or (iii) theft, misappropriation or sabotage of any property of the establishment.

A5.16 MATERNITY BENEFIT ACT, 1961

http://www.ilo.org/dyn/travail/docs/678/Maternity%20Benefits%20Act%201961.pdf

The object of the Maternity Benefit Act, 1961: The Object of the Act is (1) to provide for maternity benefit to women workers in certain establishments; (2) to regulate the employment of women workers in such establishments for certain period before and after child birth.

Restrictions placed by the Act on the employment of women: The restrictions placed by the Act on the employment of women are as follows:

The employer is prohibited from knowingly employing a woman in any establishment during the six weeks immediately following the day of her delivery or her miscarriage;

A woman also, on her part, is required to abstain from working in any establishment during the said period;

A pregnant woman can also request her employer not to give her any work which is of an arduous nature or which involves long hours of standing, etc. during the period of one month immediately preceding the period of six weeks, before the date of her expected delivery or any period during the said period of six weeks for which the pregnant woman does not avail of leave of absence, under the Act. On such a request being made by her, the employer shall not give her such work during such period. {Section 4}

To whom maternity benefit is payable in case of death of a woman?: If a woman entitled to maternity benefit dies before receiving such benefit, the employer shall pay such benefit to the person nominated by the woman and in case there is no such nominee, to her legal representative. {Section 7}

Restrictions placed by the Act on the termination of employment of a woman: When a woman absents herself from work in accordance with the provisions of the Act, it shall be unlawful for her employer to discharge or dismiss her during or on account of such absence. {Section 12}

Time for payment of maternity benefit: The amount of maternity benefit for the period preceding the date of her expected delivery shall be paid in advance to the woman on production of proof that the woman is pregnant and the amount due for the subsequent period shall be paid to the woman within 48 hours of production of proof that the woman has been delivered of a child. {Section 6}

A5.17 PUBLIC LIABILITY AND INSURANCE ACT, 1991

The main objective of the Public Liability Insurance Act 1991 is to provide for damages to victims of an accident which occurs as a result of handling any hazardous substance. The Act applies to all owners associated with the production or handling of any hazardous chemicals.

3. (1)Where death or injury to any person (other than a workman) or damage to any property has resulted from an accident, the owner shall-be liable to give such relief as is specified in Schedule for such death, injury or damage.

4. (1) Every owner shall take out, before he starts handling any hazardous substance, one or more insurance policies providing for contracts of insurance thereby he is insured against liability to give relief under sub-section (1) of section 3;

Provided that ally owner handling any hazardous substance immediately before the commencement of this Act shall take out such insurance policy or policies as soon as may be and in any case within a period of one year from such commencement.

http://210.212.96.131/rpcb/Notifications/public_liability_act.pdf: Lit of chemicals with quantities for application of Public Liability Insurance Act

NOTES

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