ENVIRONMENTAL SAFETY THROUGH STANDARDS

INTERNATIONAL ORGANISATION FOR STANDARDISATION (ISO)

IT IS A WORLD WIDE FEDERATION OF NATIONAL STANDARD$ BODIES WITH A OBJECT TO PROMOTE THE DEVELOPMENT OF STANDARDISATION AND RELATED ACTIVITIES IN THE WORLD WITH A VIEW TO FACILITATING INTERNATIONAL EXCHANGE OF GOODS AND SERVICES AND TO DEVELOP CO-OPERATION IN VARIOUS SPHERES.

ISO 14000

THEY ARE A SERIES OF INTERNATIONAL, VOLUNTARY ENVIRONMENTAL MANAGEMENT STANDARDS

DEVELOPED UNDER ISO TECHNICAL COMMITTEE 207, ADDRESSES THE FOLLOWING ASPECTS:

- ⇨ ENVIRONMENTAL MANAGEMENT SYSTEM (EMS)
- ⇨ ENVIRONMENTAL AUDITING AND RELATED INVESTIGATIONS (EA&RI)
- ⇨ ENVIRONMENTAL LABELS AND DECLARATIONS (EL)
- ⇨ ENVIRONMENTAL PERFORMANCE EVALUATION (EPE)
- ⇨ LIFE CYCLE ASSESSMENT (LCA)
- ⇨ TERMS AND DEFINITIONS (T&D)

BENEFITS OF AN EMS

- ASSURING CUSTOMERS OF COMMITMENT TO DEMONSTRABLE ENVIRONMENTAL MANAGEMENT
- MAINTAINING GOOD PUBLIC / COMMUNITY RELATIONS
- SATISFYING INVESTOR CRITERIA AND IMPROVING ACCESS TO CAPITAL
- OBTAINING INSURANCE AT REASONABLE COST
- ENHANCING IMAGE AND MARKET SHARE
- MEETING VENDOR CERTIFICATION CRITERIA
- REDUCING INCIDENTS THAT RESULT IN LIABILITY
- IMPROVING COST CONTROL
- DEMONSTRATING REASONABLE CARE
- CONSERVING INPUT MATERIALS AND ENERGY
- FACILITATING THE ATTAINMENT OF PERMITS AND AUTHORISATIONS
- FOSTERING DEVELOPMENT AND SHARING ENVIRONMENTAL SOLUTIONS
- IMPROVING INDUSTRY – GOVERNMENT RELATIONS

- PROVIDES A MEANS TO REDUCE ENVIRONMENTAL LIABILITY AND RISK AND IMPROVE BUSINESS PERFORMANCE

- ENCOURAGES CO-OPERATION BETWEEN GOVERNMENT AND INDUSTRY

- PROVIDES A MEANS TO SHOW DUE 'DILIGENCE' THEN GAIN ACCESS TO SUSTAIN A CUSTOMER BASE PROVIDES A MEANS TO ATTAIN A MARKETING EDGE

LIMITATIONS OF ISO 14001

- IT IS NOT A PERFECT ANSWER TO ALL ENVIRONMENTAL NEEDS

- IT WILL NOT GUARANTEE COMPLIANCE OR FREE COMPANIES FROM COMPLIANCE REQUIREMENTS

- WILL NOT PROVIDE IMMUNITY FROM PROSECUTION AND LIABILITY

- PROCEDURES TO ENSURE THE TRAINING, COMPETENCY CHECKS AND ENVIRONMENTAL AWARENESS ARE CONTINUALLY REVIEWED AND UPDATED

- A PROCEDURE TO MONITOR THE EMS TO ENSURE CONFORMANCE WITH ISO 14001 REQUIREMENTS

- PROCEDURES TO PERFORM TIMELY CORRECTIVE AND PREVENTATIVE ACTIONS

- PROVISIONS FOR TOP MANAGEMENT TO REVIEW ALL ASPECTS ON A REGULAR BASIS

BENEFITS OF ISO 14001

- PROVIDES ASSURANCES TO STAKE HOLDERS THAT THE BUSINESS IS ENVIRONMENTALLY RESPONSIBLE

- PROVIDES A PLATFORM TO DEMONSTRATE COMMITMENT TO ENVIRONMENTAL AWARENESS, COMPLIANCE, WASTE REDUCTION AND CONTINUAL IMPROVEMENT

- PROMOTES CONSISTANCY AND PREDICTABILITY

REQUIREMENTS OF ISO 14000

- TOP MANAGEMENT SUPPORT (PROACTIVE MANAGEMENT) DOCUMENTED, COMMUNICATED, IMPLEMENTED AND MAINTAINED ENVIRONMENTAL POLICIES, PROCEDURES, OBJECTIVES AND TARGETS THAT HAVE CLEAR COMMITMENT TO CONTINUAL IMPROVEMENT, POLLUTION PREVENTION AND REGULATORY COMPLIANCE

- PROCEDURES AND WORK INSTRUCTIONS THAT REFLECT THE NATURE OF ENVIRONMENTAL POLICIES

- PROCEDURES FOR THE IDENTIFICATION, MAINTENANCE AND DISPOSITION AND PROTECTION OF EMS DOCUMENTS AND RECORDS

- PROCEDURES FOR THE COMMUNICATION OF THE EMS TO THE EMPLOYEES, CLIENTS, CONTRACTORS, SUPPLIERS AND OTHER INTERESTED PARTIES

- CLEARLY DEFINED, DOCUMENTED AND COMMUNICATED ROLES, RESPONSIBILITIES AND AUTHORITY FOR THOSE WHOSE WORK MAY HAVE SIGNIFICANT ENVIRONMENTAL IMPACTS

ISO 14000 – PRINCIPLES

- THEY MUST RESULT IN BETTER ENVIRONMENTAL MANAGEMENT
- THEY MUST APPLICABLE IN ALL NATIONS
- THEY SHOULD PROMOTE THE BROAD INTERESTS OF THE PUBLIC AND THE USERS OF THE STANDARDS
- THEY SHOULD BE COST EFFECTIVE, NON-PRESCRIPTIVE, FLEXIBLE TO ALLOW THEM TO MEET THE DIFFERING NEEDS OF ORGANISATIONS OF ANY SIZE WORLD WIDE
- AS PART OF THEIR FLEXIBILITY THEY SHOULD BE SUITABLE FOR INTERNAL / EXTERNAL VERIFICATION
- THEY SHOULD BE SCIENTIFICALLY BASED
- THEY SHOULD BE PRACTICAL, USEFUL AND USABLE

HAZARDS IN PETROLEUM REFINARIES

HAZARDOUS SITUATION GENERALLY GET CREATED DURING

- START-UPS
- SHUT DOWNS
- PLANT OPERATION EMERGENCIES
- DUE TO INSTRUMENT OR UTILITIES FAILURE

TYPES OF HAZARDS

- RELEASE OF UNCONTROLLED
- HYDROCARBONS
- FORMATION OF EXPLOSIVE MIXTURES
- CREATION OF IGNITION SOURCES

AREAS OF SAFETY CONCERN

- DISPOSAL SYSTEMS
- SAFETY VALVES
- DISCHARGE TO ATMOSPHERE
- VENTS STACKS
- CONDENSABLE AND NON-CONDENSABLE BLOW DOWNS TO FLARE

- ⇨ FLARE - HEIGHTS, LOCATIONS, SIZE
- ⇨ REMOTE DE-PRESSURING
- ⇨ INSURATING AND FIRE PROOFING
- ⇨ FAIL SAFE TRIPS
- ⇨ STATIC ELECTRICITY

- ✯ TOXIC CHEMICALS – AROMATIC PRODUCTS SUCH AS BENZENE, TOULENE, BY-PRODUCTS LIKE COH_2S AND ADDITIVES LIKE TETRAETHYLE LEAD

LAYOUT OF REFINERY

EQUIPMENT WITHIN THE PROCESS BLOCK
UTILITIES

TANKAGE AND LOADING GANTRIES

OPERATING PROCEDURES

1) DISCIPLINE TO FOLLOW PROCEDURES

2) GOOD OPERATING PRACTICES

STATIC EQUIPMENT

- CRUDE CONTAINING NAPTHA AND RELATED ACIDS AFFECT TRANSFER LINES
- VESSELS AND PIPING ARE SUSCEPTABLE FOR CRACKING
- ALL ACCESSORIES HAVE TO BE CHECKED FOR CORROSION

FIRE IN PETROLEUM INDUSTRY

- SPARK PROVIDED BY ELECTRIC CIRCUIT
- HOT WORK WELDING
- OIL DRIPPING ON A HOT SURFACE
- OIL REACHING ITS AUTO IGNITION TEMPERATURE
- USE OF ORDINARY TOOLS, INSTEAD OF NON SPARKING TOOLS
- STORAGE VESSELS NOT EARTHED PROPERLY
- VEHICLES WITHOUT FLAMES SPARK ARRESTORS

- INCINERATORS, FLARES ARE IN CLOSE PROXIMITY OF THE PROCESS UNIT
- DRAINING OF HYDROCARBON LIQUIDS IN OPEN STORMWATER DRAIN

HEALTH HAZARDS

- CAN BE CAUSED DUE TO AIR, WATER, THERMAL AND NOISE POLLUTION
- H_2S, SO_2, NH_3, NO_X, Cl_2, HIGHER THAN ACCEPTABLE LIMITS
- SOLID CATALYST DUST AND SOLID SULPHUR PARTICLES
- ACID AND ALKALI BURNS DUE TO HANDLING OF ACIDS AND ALKALIES
- LEAKAGES / SPILLAGE OF TOXIC CHEMICALS

SAFETY PRACTICES

1) NEVER DRAIN WATER FROM A HYDROCARBON TANK

2) NEVER DRAIN HYDROCARBON INTO AN OPEN RAIN WATER SEWER

3) IT SHOULD ALWAYS BE DRAINED IN A CLOSED OILY WATER SEWER

4) NEVER BYPASS AN 'ALARM' OR 'TRIP SYSTEM' IN AN OPERATING PLANT

5) ANY LEAKAGES / SPILLAGES MUST BE ATTENDED TO IMMEDIATELY

6) ALL HYDROCARBON / GAS DETECTORS, EXPLOSION METERS SHOULD BE CALIBRATED REGULARLY

7) ALL GASES FROM SAFETY RELEASE VALVES SHOULD BE CONNECTED TO FLARE HEADERS OR TO A SAFE LOCATION

8) USE ALWAYS NON-SPARKING TOOLS

9) ROTARY EQUIPMENTS SHOULD HAVE GUARDS

10) GOOD HOUSEKEEPING SHOULD BE STRICTLY FOLLOWED

11)OTHER SAFETY AIDS SUCH AS

PORTABLE HYDROCARBON DETECTORS

PORTABLE EXPLOSIVE METERS

POTABLE FLUE GAS ANALYSERS

EXCELLENT COMMUNICATION FACILITIES

POTENTIAL HAZARDS

1. PHYSICAL PROPERTIES OF THE MATERIAL IN THE SYSTEM
2. KNOWN REACTIONS INVOLVED – EXOTHERMIC AND ENDOTHERMIC
3. UNKNOWN AND OBSERVED REACTIVITY
4. QUANTITY OF HYDROCARBON INVOLVED
5. FIRE PRECAUTIONS

SAFETY AT CONSTRUCTION SITES AND BUILDINGS

HAZARDS PREVENTION / SIGN POSTING

- STANDARD SAFETY SIGNS SHOULD BE USED IN THE WORKSITE

PREVENTIVE MEASURES AGAINST SPECIFIC HAZARDS

- ALL OPEN SITES OF BUILDINGS SHOULD BE COVERED OR BARRICADED
- SAFETY NETS SHOULD BE INSTALLED
- SAFETY BELTS WITH SECURE ANCHORAGE POINTS MUST BE PROVIDED
- FOR ELEVATED PLACES SECURE ACCESS AND FOOT HOLD SHOULD BE PROVIDED

FALLING MATERIAL HAZARDS

STRUCTURAL FAILURE PREVENTION

REFUSED DISPOSAL

VENTILATION, LIGHTING AND NOISE CONTROL

- ⇨ ENCLOSED WORK PLACES SHOULD BE ADEQUATELY VENTILATED
- ⇨ LIGHTING SHOULD BE PROVIDED IN DARK PASSAGE WAYS. LOW VOLTAGE LIGHTING SHOULD BE USED
- ⇨ AIR COMPRESSORS AND GENERATORS MAKING LOUD NOISES MUST BE LOCATED AWAY FROM THE CONCENTRATION OF WORKERS

FIRE PROTECTION

FIRE EXTINGUISHERS SHOULD BE PROVIDED WHERE COMBUSTIBLE MATERIALS ARE STORED

PERSONAL PROTECTIVE EQUIPMENT

- HELMETS SHOULD BE PROVIDED FOR ALL WHO ARE EXPOSED TO THE DANGERS OF FALLING MATERIALS
- SUITABLE EYE PROTECTION SHOULD BE PROVIDED FOR THOSE WHO ARE EXPOSED TO FLYING PARTICLES, HARMFUL GLARE AND DANGEROUS SUBSTANCES
- GLOUSE SHOULD BE PROVIDED FOR HANDLING ROUGH OBJECTIVES
- SAFETY FOOTWEAR SHOULD BE PROVIDED TO ALL WHO ARE EXPOSED TO FOOT INJURY
- SAFETY BELTS SHOULD BE PROVIDED
- CATCH NETS MUST BE USED
- RESPIRATORY PROTECTION SHOULD BE PROVIDED

SCAFFOLD

- SCAFFOLDS SHOULD BE PROVIDED FOR WORKERS WORKING AT HEIGHT
- SCAFFOLDS SHOULD BE CONSTRUCTED IN ACCORDANCE WITH GOOD ENGINEERING PRACTICE
- ADEQUATE BRACINGS MUST BE PROVIDED
- INSPECTION OF THE SCAFFOLD SHOULD BE CARRIED OUT BEFORE IT IS USED
- LIFTING APPLIANCES SHOULD NOT BE ATTACHED TO THE SCAFFOLD AS A RULE
- STEEL TUBULAR SCAFFOLDS MUST BE RUST REE, STRAIGHT AND FREE FROM DEFECTS
- SCAFFOLDS FRAMES SHOULD HAVE LOCKING STUDS TO ALLOW FOR FITTING CROSS BRACINGS
- SUSPENDED SCAFFOLD SHOULD BE DESIGNED ACCORDING TO FAIL SAFE DESIGN NORMS

LIFTING EQUIPMENT

- ALL LIFTING EQUIPMENT SHOULD BE LOAD TESTED BY COMPETENT ENGINEERS BEFORE USE
- MATERIAL HOIST SHOULD BE PROVIDED WITH INTERLOCKING SYSTEMS
- A SECONDARY BRAKE SYSTEM MUST BE INCORPORATED IN HOISTS AND LIFTS
- ALL LIFTING MACHINES SHOULD BE PROVIDED WITH SAFETY DEVICES
- STANDARD SIGNALS SHOULD BE IMPLEMENTED FOR EASY UNDERSTANDING
- WORKERS SHOULD NOT BE ALLOWED UNDER SUSPENDED LOADS

CONSTRUCTION MACHINERY

WOOD WORKING MACHINERY

ELECTRICAL SAFETY

STEEL STRUCTURE ERRECTION

FIRE SAFETY IN HIGH-RISE BUILDINGS

- STAIRCASES ONLY TO BE USED FOR EVACUATION
- LIFT SHOULD NOT BE USED
- EXIT DOORS SHOULD BE CLOSED AFTER GETTING OUT OF FIRE ZONES
- GO DOWN THE STAIRCASES TO THE GROUND, DO NOT GO UP TO THE ROOFS
- DO NOT TAKE REFUGE IN THE TOILET
- WALK, DO NOT RUN
- IF HEAVY SMOKE IS ENCOUNTERED CRAWL ON THE FLOOR, DO NOT TALK, COVER THE NOSE AND MOUTH WITH WET CLOTH IF POSSIBLE
- FIRE RETARDANT MATERIALS FOR INTERIORS, FURNISHING, FALSE CEILING, ETC., SHOULD BE USED
- ALL ELECTRICAL WIRING MUST BE CLOSED IN METAL CONDUITS
- THE FIRE FIGHTING UNITS SHOULD POSSESS SNORKEL TYPE FIRE FIGHTING CRANES

SAFETY IN IRON AND STEEL INDUSTRY

1) MANUFACTURE OF WROUGHT IRON
2) MANUFACTURE OF CARBON STEEL

PROBLEMS

- HIGH TEMPERATURE (100 – 500^{0}C)
- NUMBER OF DIFFERENT SUBSTANCES
- NOISE POLLUTION
- USE OF ORGANIC SOLVENTS
- AIR POLLUTION

FOUNDRIES

- IRON AND STEEL FOUNDRIES
- VARIOUS PROCESSES INDUCE INJURY TO THE SKIN
- HAZARD DUE TO GASES AND VAPOURS
- USE OF PHENOLS AND PHENOLIC COMPOUNDS
- HIGH TEMPERATURE EFFECT
- AIR POLLUTION

SAFETY IN PHARMACEUTICAL INDUSTRY

1) BULK DRUG MANUFACTURING
2) DRUGS MANUFACTURING

PROBLEMS

- ⇨ CHEMICAL POLLUTION
- ⇨ TOXIC POLLUTION
- ⇨ TOXIC GASES
- ⇨ HAZARDOUS WASTES
- ⇨ NOISE POLLUTION

GENERAL SAFETY MEASURES INCLUDING PERSONAL PROTECTION EQUIPMENT MUST BE FOLLOWED

SAFETY IN TEXTILE INDUSTRIES

1) COTTON TEXTILE MILLS
2) SYNTHETIC TEXTILE MILLS
3) SILK TEXTILE MILLS
4) RAYON / FABRIC MILLS

PROBLEMS

- AIR POLLUTION
- RESPIRABLE DUST POLLUTION
- NOISE POLLUTION
- CHEMICAL POLLUTION - TOXIC CHEMICALS
- COLOUR PROBLEM
- ODOUR NUISANCE

GENERAL SAFETY MEASURES INCLUDING PERSONAL PROTECTION EQUIPMENT MUST BE FOLLOWED

LPG BOTTLING PLANTS

- HUGE STORAGE TANKS
- VOLATILITY PROBLEMS
- FIRE HAZARDS
- EXPLOSION HAZARDS

- FIRE FIGHTING SYSTEM MUST BE IN PLACE
- FIRE RETARDENTS MUST BE USED
- FIRE PROTECTION GEARS MUST BE SUPPLIED
- FIRE PROTECTION CLOTHING MUST BE USED

EMERGENCY RESPONSE

KEY TERMS

EMERGENCY – IS A SITUATION OF PROCESS DEVIATION THAT IF UNCONTROLLED MAY LEAD TO A MAJOR ACCIDENT / DISASTER WITH POTENTIAL SHORT-TERM AND LONG-TERM RISK OF DAMAGE

DISASTER – A CATASTROPHIC CONSEQUENCE OF A MAJOR EMERGENCY / ACCIDENT THAT LEADS TO EXTENSIVE DAMAGE TO LIFE AND PROPERTY BUT ALSO DISRUPTS ALL HUMAN ACTIVITY

INCIDENT – IS AN EMERGENT SITUATION OF ANY CRITICAL DEVIATION IN THE PROCESS CONTROL OR OTHERWISE THAT MAY LEAD TO A MAJOR ACCIDENT

HAZARD – THE POTENTIAL OF AN ACCIDENT

ACCIDENT – AN UNDESIRABLE AND UNPLANNED EVENT WITH OR WITHOUT MAJOR OR MINOR DAMAGE CONSEQUENCE TO LIFE AND PROPERTY

RISK – THE CHANCE OR PROBABILITY OR LIKELYHOOD OF AN ACCIDENT BEING CAUSED IN A MAN-MATERIAL-MACHINE SYSTEM

VULNERABILITY – THE ZONE OF INLFUENCE OF AN EMERGENCY IN AND AROUND THE FACILITY CONCERNED

NATURE OF AN EMERGENCY / DISASTER

1) TOXIC / FLAMMABLE GAS / VAPOUR RELEASE / PUFF FROM PIPELINE / FITTING FAILURES / TANK RUPTURES, ETC.

2) SPILL OF A TOXIC / FLAMMABLE LIQUIDS

3) DISPERSAL OF TOXIC PLUMES AND PUFFS

4) EVAPORATION AND DISPERSION OF TOXIC VAPOURS FROM LIQUID SPILL POOLS

5) IGNITION OF FLAMMABLE GASES, VAPOURS AND LIQUIDS LEADING TO FIRES

6) IGNITION OF FLAMMABLE GASES, VAPOURS AND LIQUIDS LEADING TO UNCONFINED VAPOUR CLOUD EXPLOSION (UVCE)

7) BOILING LIQUID EVAPORATING VAPOUR EXPLOSION (BLEVE)

CAUSES OF AN EMERGENCY

- EQUIPMENT FAILURES DUE TO NATURAL CAUSES
- ACCIDENTAL MISSILE HITS, METEOR HIT, PLANE CRASH, LANDING OF FIRE CRACKERS
- EQUIPMENT FAILURES DUE TO MECHANICAL BREAKDOWNS, CORROSION, POOR MAINTENANCE, DESIGN DEFICIENCY
- EQUIPMENT FAILURES DUE TO INSTRUMENT / HUMAN FAILURES OR BOTH
- SUBOTAGE TERRORISM, CIVIL COMMOTION, ETC.

MAIN COMPONENTS OF A GOOD EMP

- SCENARIOS, VULNERABILITY ZONES, CONSEQUENCES, ISO RISK CURVES
- ATMOSHERIC STABILITY CLASS PREVALENCES AND WIND VELOCITY ORIENTATION AND PERCENT PREVALENCES
- EMERGENCY ORGANISATION
- EMERGENCY CONTROL CENTRES (MAIN AND ALTERNATE), THEIR LOCATIONS, SIRENS, ASSEMBLY POINTS, ESCAPE, EVACUATION AND RESCUE, FIRST AID, MEDICAL AND TRANSPORT
- DECLARATION OF EMERGENCY AND COMMUNICATION SYSTEM
- ACTION ON-SITE AND OFF-SITE
- ROLES AND RESPONSIBILITIES OF ESSENTIAL PERSONS
- CHECK LIST SEQUENCE OF EMERGENCY SHUT DOWN
- SITE AND AREA MAPS

EMERGENCY ORGANISATION

IT IS A NETWORK SYSTEM WITH FOCUS ON THE EMERGENCY CONTROL CENTRE (ECC), THE INCIDENT CONTROLLER (IC) AND THE INCIDENT SITE (IS)

PERSONNEL OF THE EMERGENCY RESPONSE TEAM

- SITE MAIN CONTROLLER (SMC) – THE TOP EXECUTIVE IN-CHARGE OF THE UNIT
- INCIDENT CONTROLLER (IC) – THE SHIFT IN-CHARGE
- DEPUTY INCIDENT CONTROLLER (DY-IC) – IS A SHIFT PERSON NEXT TO IC
- ESSENTIAL WORKMEN (EW) – ARE THE SHIFT PEOPLE FROM VARIOUS DEPARTMENTS
- OTHER KEY PERSONS – KEY HEADS OF VARIOUS DEPARTMENTS

ROLES AND RESPONSIBILITIES

- INCIDENT CONTROLLER – CONTROL THE INCIDENT AND PREVENT AN EMERGENCY
- IF INCIDENT CONTROL FAILS AN EMERGENCY SITUATION COMES
- FIRST AND FOREMOST TO SAVE HUMAN LIVES IN DANGER
- DIRECT RESCUE AND FIRE FIGHTING
- TAKE CHARGE OF THE EMERGENCY AND ACT TO CONTAIN ITS SPREAD AND IMPACT
- SEND MESSAGE TO SITE MAIN CONTROLLER
- DIRECT SAFE EMERGENCY SHUTDOWN OF PLANTS
- ARRANGE FIRST AID, HOSPITALISATION TO VICTIMS
- PRESERVE EVIDENCES FOR INVESTIGATION

CYBERNETIC INFLUENCE DIAGRAM OF EMERGENCY CONTROL SYSTEM

- CONTROL LINKS AND INFORMATION LINKS
- ESCAPE ROUTES
- SAFE ASSEMBLY POINTS
- EMERGENCY SIREN CODE
- OFF-SITE EMERGENCY PLAN

THIS WOULD BE PREPARED UNDER THE GUIDANCE AND INITIATIVE OF THE DISTRICT AUTHORITY WITH THE CO-OPERATION OF ALL THE INDUSTRIAL AND HAZARDOUS CHEMICAL STORAGE HANDLING AND TRANSPORTATION AGENCIES

THIS IS TO PROTECT THE LIFE AND PROPERTY OF THE NEIGHBOURHOOD AREAS IN CASE OF EMERGENCY

- OFF-SITE EMP INCLUDES
  - EVACUATION AND RESCUE PLAN
  - TRANSPORTATION TO SAFE PLACES
  - FIRST AID AND MEDICAL ARRANGEMENTS
  - REHABILITATION PROGRAMME

⇨ OFF-SITE EMP REQUIRES

1. DISTRICT ADMINISTRATIVE AUTHORITIES
2. POLICE, HOME GUARDS, RTO, VOLUNTARY ORGANISATIONS
3. EDUCATIONAL INSTITUTIONS
4. PUBLIC CHOULTRIES
5. GOVERNMENT AND PRIVATE MEDICAL PRACTIONERS
6. SCIENTIFC AND ENGINEERING EXPERTS
7. MUTUAL AID PARTNERS

Occupational Health Akshata Gururaj

(Work place hazards)*Occupational Hazard Recognition & Control*

Introduction

Working in a health care environment can present hazards to your health. Health care workers have suffered from back, neck and shoulder injuries, skin, respiratory, cardiac and infectious diseases. Many of these ailments have beer caused or aggravated, directly or indirectly, by the places and conditions under which they work.

This pamphlet presents information that will assist you, the worker to:

- recognize the hazards present in the health care work environment.
- locate sources of information to control or eliminate hazards.
- recognize, report and record occupational illnesses and injuries.

Keys to Controlling Workplace Hazards

- Commitment on the part of workers and managers to identify and control hazards.
- Education to recognize hazards and understand the control process.
- Assessment of the work environment for Hazards.
- Worker health surveillance programs.

Personal Responsibility

- Become safety conscious for yourself and others.
- Know your work environment/recognize hazards.
- Attend occupational safety and health educational programs.
- Follow protocols to control hazards.
- Report unsafe conditions.

Recording and Reporting

Recognition
An injury or illness occurs that is attributable to an event or process within the work environment may be an occupational illness or injury.

Reporting
Report exposure to workplace hazards or injury immediately to the supervisor and the person responsible for employee health and safety.

Recording
A permanent written record of the date, event and symptoms should be made. The recording form should be the OSHA 101 form or a Massachusetts Department of

Ergonomic: Lifting, bending, pushing, pulling and static pressure.

Measuring Workplace Hazards

Dose
What quantity of a hazardous substance is the worker exposed to?

Duration/Frequency
How often and for what amount of time is the person exposed?

Toxicity
How toxic is the hazardous substance?

Personal Characteristics
What is the sensitivity, age, sex and health of the person working with the hazardous substance?

Contact vs. Exposure
Are adequate hazard control measures in place to prevent exposure?

Contact with hazardous materials occurs when the product is used in a manner that protects the health and the safety of the worker - adequate hazards control measures are in place.

Exposure occurs when the use of a material or product results in an adverse health effect. Hazard controls are not in place or are not followed.

Controlling Workplace Hazards

Methods to control hazards include:

- **Elimination** of hazardous materials and dangerous activities.
- **Substitution** of less hazardous materials and modification of actions to eliminate danger.
- **Engineering Controls** provide mechanical equipment to contain hazardous materials or actions.
- **Administrative Controls** provide policies which limit workers exposure to hazards.
- **Personal Protection Equipment (PPE)** provides barriers and filters to hazardous materials and substances. PPE may be used in conjunction with other types of controls.

An example of biological hazard control includes handwashing, and universal precautions.

Sources of Information in the Workplace

- Department Supervisors
- Safety Directors
- Safety Committees
- Material Safety Data Sheets (MSDS)
- Product Information
- Professional Journals

Worker Protection

Policies/Protocols

Policies are formulated by the employer, It is the employers responsibility to review, update and promulgate policies as they are created, as well as to provide the training, safety equipment, information required by the policy. It is the employees responsibility to work according to the policy and to notify appropriate supervisory personnel when the policy cannot be followed or applied. It is the employees right to know about workplace hazards to have appropriate training, equipment and resources to do their jobs safely.

Workers' Compensation

Workers' Compensation is an insurance system that subsidizes part of your wages if you are injured on the job or contract a work-related illness. It is a no-fault system, which means that you do not have to prove negligence to collect wage and medical benefits. However, the burden is on you to prove that your disability is work-related. You must file a first report of injury as soon as you are aware of being injured, whether or not you are able to continue working. Since the regulations concerning Workers' Compensation are complex and subject to change, you may consider hiring an attorney familiar with this area of the law to represent you through the various phases.

Hazard Control

Employers have a legal and moral duty to protect the health and safety of workers by preventing workplace injuries and illness. Workers have a duty to help with prevention efforts.

Workplace injuries and illnesses can be prevented if unsafe work practices are corrected and workplace hazards are identified and dealt with. Every workplace, large or small, should have a system in place to **identify hazards, assess the risk** of those hazards and make the necessary changes to **control risk**.

Occupational hazards are divided into two broad categories: health hazards and safety hazards.

Generally health hazards cause occupational illnesses (e.g. respiratory problems caused by exposure to chemical substances, noise induced hearing loss, repetitive strain injuries).

Safety hazards cause physical harm such as cuts, broken bones, strains and sprains.

What is an occupational health hazard?

The term "hazard" refers to the potential to cause harm. In the case of a workplace health hazard, the harm is to a worker's health and usually takes the form of an illness. Occupational illness is defined in OHSA Section 1 as a condition that results from exposure in a workplace to a physical, chemical or biological agent to the extent that the normal physiological mechanisms are affected and the health of the worker is impaired.

Hazards also include an occupational disease for which a worker is entitled to benefits under the Workplace Safety and Insurance Act, 1997. An occupational health hazard can therefore be thought of as something in the workplace that is capable of making a worker sick. The "sickness" can vary in severity from a headache or skin rash to a fatal illness such as cancer.

What is an occupational hazard?

An occupational hazard is a thing or situation with the potential to harm a worker. Occupational hazards can be divided into two categories: safety hazards that cause accidents that physically injure workers, and health hazards which result in the development of disease. It is important to note that a "hazard" only represents a potential to cause harm. Whether it actually does harm will depend on circumstances, such as the number of workers exposed and the degree and duration of exposure. Hazards can also be rated according to the severity of the harm they

cause – a significant hazard being one with the potential to cause a critical injury or death.

An ***occupational health hazard*** is any material or condition that may cause occupational injuries and/or illness. It may produce serious and immediate effects and/or long term problems. Someone with an occupational illness may not recognize the symptoms immediately.

Occupational health hazards include:

- chemicals (e.g. battery acid, solvents)
- biological hazards (e.g. bacteria, viruses, dusts, molds)
- physical agents (e.g. energy sources strong enough to harm the body, such as electric currents, heat, light, vibration, noise, radiation)
- ergonomic hazards (e.g. poor work station design)
- other stress agents (e.g. violence and harassment)

There are three basic steps in controlling the risk from those hazards:

1. **eliminate hazards** posed by equipment and work processes at their source (e.g. redesign the work process, substitute a safer chemical for a hazardous chemical, use new equipment)
2. if it is not practical to eliminate hazards, **control the hazard** to reduce the risk to workers (e.g. machine guards, noise enclosures, ventilation to dilute the concentration of a hazardous substance)
3. if it is not practical to control the hazard, **protect workers from the hazard** by using tools such as administrative controls, safe work procedures, effective safety training, proper supervision, or personal protective equipment

How can the risks posed by health hazards be controlled?

The best methods of controlling exposure to a particular hazard will depend on what it is. In general, methods of control can be placed in four categories:

- Engineering controls are methods of designing or modifying plants, processes and equipment so as to minimize workers' exposure to the hazard. They are preferred because they work independently of workers.
- Work and hygiene practices are on-the-job activities that reduce the potential for exposure.
- Administrative controls are things like job rotation schedules, work-rest cycles and timing of maintenance procedures, which can be used to limit the amount of time an individual is exposed to a hazard.
- Personal protective equipment includes items like respirators, hearing protectors, safety clothing and protective clothing. It can reduce a worker's exposure but must be used properly to be effective.

What kind of health effects can exposure to workplace hazards lead to?

Most workplace health hazards target a particular part of the body such as the lungs, skin or liver. A large number of workplace diseases and disease agents are recognized. Virtually any part of the body can be affected in some way by some workplace health hazard. An important consideration is how exposure occurs.

For some hazards, there can be one type of effect from a single, high exposure (an acute effect) and a quite different result when exposure is at a low level, but repeated regularly over a prolonged time period (chronic effect). Acute effects depend on the degree of exposure.

It is therefore relatively easy to control exposure (keep it at a low enough level) to avoid acute effects. Or, to put it another way, if workers are experiencing acute effects, they know exposure to the hazard is not being properly controlled. With chronic effects there is no immediate warning. Where long-term exposure is known to cause disease without any warning of the hazard, it may be necessary to control worker exposure through regulations that prescribe occupational exposure limits (OELs).

Personal Protective Equipment (PPE)?

Although there is no general requirement in the Ministry of Labour's legislation an employer to provide workers with personal protective equipment (PPE) practical terms, this means PPE should be provided to workers wherever the health (or safety) risks that cannot be adequately controlled in other ways.

PPE can reduce or prevent a worker's exposure to a health hazard in the workplace and can include respirators, hearing protectors, protective clothing, footwear and face and eye shields.

Common workplace hazard groups

- Biological agents
- Chemical agents, including
  - solvents
- Heavy metals
- Physical agents, including
  - noise
  - vibration
  - ionizing radiation
- Physical hazards
  - Slips and trips
  - Falls from height
  - Workplace transport
  - Dangerous machinery
  - Poor lighting
  - Electricity
- Reproductive hazards
- Work related stress causal factors
  - Overtime
  - Overwork
  - emotional, verbal, and psychological abuse
  - Sexual harassment
- Workplace comfort (ergonomics)
  - Temperature, humidity, lighting, welfare and the avoidance of musculoskeletal disorders by the employment of good ergonomic design

What are engineering controls?

Engineering controls are the preferred method of controlling exposure to workplace hazards. They can be placed in three categories:

Substitution includes the use of a less hazardous material, a change in the process equipment used, or a change in the process itself. Care must be taken to ensure that the substitution actually does result in less hazardous conditions.

Isolation is a method of limiting exposure to those employees who are working directly with the hazard, often by enclosing them within a containment structure. While isolation will reduce the risk to those outside the isolated area, it should be accompanied by appropriate controls to ensure that those within are not faced with an increased exposure to the hazard.

Ventilation is most important for the control of airborne hazards. It involves the removal (from the workplace) of air that contains a hazardous contaminant and its replacement with uncontaminated outside air. There are two types: local exhaust and general dilution. A properly designed local exhaust system can capture a contaminant where it is generated and remove it before it is dispersed into the work environment.

What is a Job Hazard Analysis?

One way to increase the knowledge of hazards in the workplace is to conduct a job hazard analysis on individual tasks. A job hazard analysis (JHA) is a procedure which helps integrate accepted safety and health principles and practices into a particular operation. In a JHA, each basic step of the job is examined to identify potential hazards and to determine the safest way to do the job. Other terms used to describe this procedure are job safety analysis (JSA) and job hazard breakdown.

Some individuals prefer to expand the analysis into all aspects of the job, not just safety. This approach, known as total job analysis, job analysis or task analysis, is based on the idea that safety is an integral part of every job and not a separate entity. In this document, only health and safety aspects will be considered.

The terms "job" and "task" are commonly used interchangeably to mean a specific work assignment, such as "operating a grinder," "using a pressurized water extinguisher," or "changing a flat tire." JHAs are not suitable for jobs defined too broadly, for example, "overhauling an engine"; or too narrowly, for example, "positioning car jack."

What are the benefits of doing a Job Hazard Analysis?

The method used in this example is to observe a worker actually perform the job. The major advantages of this method include that it does not rely on individual memory and that the process prompts recognition of hazards. For infrequently performed or new jobs, observation may not be practical. With these, one approach is to have a group of experienced workers and supervisors complete the analysis through discussion. An advantage of this method is that more people are involved allowing for a wider base of experience and promoting a more ready acceptance of the resulting work procedure. Members of the joint occupational safety and health committee should participate in this process.

Initial benefits from developing a JHA will become clear in the preparation stage analysis process may identify previously undetected hazards and increase the job knowledge of those participating. Safety and health awareness is raised, communi between workers and supervisors is improved, and acceptance of safe work proce promoted.

The completed JHA, or better still, a written work procedure based on it, can form the basis for regular contact between supervisors and workers on health and safety. It can serve as a teaching aid for initial job training and as a briefing guide for infrequent jobs. It may be used as a standard for health and safety inspections or observations and it will assist in completing comprehensive accident investigations.

What are the four basic steps?

Four basic stages in conducting a JHA are:

- selecting the job to be analyzed
- breaking the job down into a sequence of steps
- identifying potential hazards
- determining preventive measures to overcome these hazards

Hazard analysis

In development of avionics, a **hazard analysis** is used to characterize the elements of risk. A hazard analysis is one tool within the discipline of system safety engineering. The results of a hazard analysis will drive the methods used for development of a system, both hardware and software.

The term is also used in other fields including chemical process safety and food safety. Alternative definitions include:

Identification, studies and monitoring of any hazard to determine its potential, origin, characteristics and behaviour.

The process of collecting and evaluating information on hazards associated with the food under consideration to decide which are significant and must be addressed in the HACCP plan. [2]

An analysis or identification of the hazards which could occur at each step in the process, and a description and implementation of the measures to be taken for their control. [3]

Occupational Disease

The Factories Act requires notification of occupational diseases to the government, but they are hardly reported, allowing official statistics to compare well with industrialised countries.

However independent studies report the existence of many occupational diseases, most notably respiratory diseases due to dust. Agriculture is India's largest employer. Workers are exposed to a wide variety of dust in its fields and factories.

The most common disease is bysinossis caused by cotton dust in the textile industry.

Asthma and allergies are common among workers in grain and tea production. Chronic lung diseases such as silicosis and pneumoconiosis are due to mineral dust.

Heavy metal poisoning especially lead, chromium, pesticide and other chemical poisoning are quite common.

Deafness, largely undiagnosed and unreported, is very common in industries like engineering, heavy machinery, textile and manufacturing.

Few doctors are able to diagnose occupational disease. Silicosis and bysinossis are often diagnosed as tuberculosis. Doctors are not trained in occupational disease. Due largely to poverty workers continue to work even when sick or injured.

Human error analysis

The role of the individual is increasingly recognised as being of paramount importance in assessing operations, risk issues and losses in many industries. Although the greater automation designed into many facilities has reduced the potential for operation outside defined limits, there has been a corresponding increase in human-computer interactions, information handling requirements, operations and emergency procedures.
Research indicates that 30-70% of all incidents and near misses are due to human error.

HUMAN ERROR ANALYSIS

- Identification and quantification of human error using techniques such as HEART (Human Error Assessment and Reduction Technique) and THERP (Technique for Human Error Rate Prediction).
- Assessment of safety case requirements on operator actions against proven human performance:
  - assessment of the level of safety culture
  - identification of implicit claims made upon the operator
  - acceptability of operator actions modelled, e.g. procedures, indications, practicality
  - quantification of operator actions
  - dependency between multiple operator actions
  - practicality of plant configurations.

Hazard control measures in: General: Potential hazards in relation to at least following should be considered:

— materials and ingredients;

— physical characteristics and composition of the product;

— processing procedures;

— microbial limits, where applicable;

— premises;

— equipment;

— packaging;

— sanitation and hygiene;

— personnel;

— risk of explosions;

— mix-ups.

Health and safety hazards of Industrial activities

Importance of health at work: Effect of health on work, Health promotion at work place, Effect of work on health ,Pre-employment medical examinations, Periodic medical examination

Physical hazards at work : Effect of thermal environment, Light and work, Effect of noise and vibration, Noise control & hearing protection, Exposure to radiation, Changes in pressure

Chemical hazards at work: Effects of chemicals, Identification of chemicals, Protection of workers, Effects of heavy metals, Effects of solvents, Effects of pesticides, Effects of mineral dust, Effects of vegetable dust

Mechanical hazards: Machinery, Hand Tools, Lifting and hoisting mechanism, Pressure vessels, Gas welding

Electrical hazards: Electrical shock, Electrical burns, High voltage, Electrically powered hand tools

Biological hazards, Psychosocial hazards in the work place, Ergonomics, Safe work place, hazard control measures

Pharmaceutical industry

1. Process safety issues primarily relate to the risks of fire or explosion during pharmaceutical manufacturing of dosage forms. Many of these operations (e.g., granulation, blending, compounding and drying) use flammable liquids, which may create flammable or explosive atmospheres. Pharmaceutical dusts are highly explosive.
2. Industrial chemicals are used in researching and developing active drug substances and manufacturing bulk substances and finished pharmaceutical products. Many of these materials may be hazardous to workers.

3. Safety hazards (i.e., thermal burns and scalding) are posed by the large volumes of pressurized steam and hot water associated with fermentation operations.

4. Acute and chronic health risks may result from worker exposures to hazardous chemicals during synthesis operations. Chemicals with acute health effects can damage the eyes and skin, be corrosive or irritating to body tissues, cause sensitization or allergic reactions or be asphyxiants, causing suffocation or oxygen deficiency. Chemicals with chronic health effects may cause cancer, or damage the liver, kidneys or lungs or affect the nervous, endocrine, reproductive or other organ systems.
5. Health and safety hazards may be controlled by implementing appropriate control measures (e.g., process modifications, engineering controls, administrative practices, personal and respiratory protective equipment).

6. Some workers may develop allergic and/or skin irritation from handling certain plants. Animal matter may be contaminated with infectious organisms unless appropriate precautions are taken.

7. Workers may be exposed to solvents and corrosive chemicals during biological and natural extraction operations.

8. Moving mechanical parts (e.g., exposed gears, belts and shafts) ; hot steam, water, surfaces and workplaces; and high noise levels are risks to worker safety.

Control measures

Fire and explosion prevention and protection;

process containment of hazardous substances, machine hazards and high noise levels; dilution and local exhaust ventilation (LEV);

use of respirators (e.g., dust and organic vapour masks and, in some cases, powered air-purifying respirators or air-supplied masks and suits) and personal protective equipment (PPE); and

worker training on workplace hazards and safe work practices are workplace c
measures applicable during all of the various pharmaceutical manufacturing ope
described below.

Specific issues involve substituting less hazardous materials whenever possible du
drug development and manufacturing. Also, minimizing material transfers, unseale
open processing and sampling activities decreases the potential for worker exposu

The engineering design and features of facilities, utilities and process equipment can prevent environmental pollution and reduce worker exposures to hazardous substances.

Modern pharmaceutical manufacturing facilities and process equipment are reducing environmental, health and safety risks by preventing pollution and improving the containment of hazards. Worker health and safety and quality control objectives are achieved by improving the isolation, containment and cleanliness of pharmaceutical facilities and process equipment. Preventing worker exposures to hazardous substances and pharmaceutical products is highly compatible with the concurrent need to prevent workers from accidentally contaminating raw materials and finished products. Safe work procedures and good manufacturing practices are complementary activities.

Construction

Residential construction has less restrictive building codes than commercial construction. This gives builders the flexibility to build homes to the homeowners' specifications. With so many ways to build a house, residential construction workers face a unique set of hazards and safety considerations.

Electrical Safety

Fall Protection

Fire Safety

Forklifts

Hand and Power Tools

Lockout/Tagout (Control of Hazardous Energy)

Noise and Hearing Conservation

Personal Protective Equipment (PPE)

Respiratory Protection

Scaffolding

Silica, Crystalline

Stair ways and ladders

Trenching and Excavation

Occupational safety and health in the textiles sector

The textiles industry in Europe

The textiles and clothing sector is a large, diverse sector across all Member States and with a turnover of over EUR 200 billion. An industry with a long history, the products manufactured range from hi-tech synthetic yarns to wool fabrics, cotton bed linen to industrial filters, nappies to high fashion. The sector employs over 2.5 million workers, many of them women. In some states, women form the majority of workers in the sector.

The industry can be split into a number of sub sectors:

- the treatment of raw materials, i.e. the preparation or production of various textiles fibres, and/or the manufacture of yarns such as through spinning
- "natural" fibres, including cotton, wool; and silk
- "man-made" fibres, including cellulosic fibres such as viscose, synthetic fibres such as polyester, and fibres from inorganic materials such as glass
- the production of knitted and woven fabrics (i.e. knitting and weaving)
- finishing activities such as bleaching, printing, and dyeing
- the transformation of the fabrics into goods, including the "clothing" industry, carpets and other textile floor covering manufacture, the production of home textiles such as bed linen, and the manufacture of technical or 'industrial' textiles.

The textile and clothing sector in Europe is changing as a result of developing technology and economic conditions, with businesses restructuring, modernising, and adapting to technological change. There is a trend of moving away from mass production of simple products towards a wider variety of products with a higher added value. The technical and industrial product subsector in particular is an area where European producers are world leaders. These developments have also had an impact on employment in the sector, with changes in employment models (e.g. subcontracting), and as a result of the techniques involved, on the hazards and risks to which workers are exposed.

Hazards and risks in the textiles sector

The textiles sector contains many hazards and risks to workers, ranging from exposure to noise and dangerous substances, to manual handling and working with dangerous machinery. Each processing stage — from the production of materials to the manufacturing, finishing, colouring and

packaging [illegible] risks for workers, and some of these are particularly dangerous for women's health.

This short document cannot cover all the hazards and risks in all the parts of the textiles sector, but highlights some of the key issues, particularly to women workers, and how worker safety and health can be managed.

Musculoskeletal disorders

Musculoskeletal disorders (MSDs) are the most common work-related health problem in Europe, with almost one in four workers reporting backache and one in five complaining of muscular pains. Manual handling, the lifting, holding, putting down, pushing, pulling, carrying or movement of a load, is the largest cause of injury in the textiles sector. Manual handling can cause either cumulative disorders from the gradual deterioration of the musculoskeletal system, such as lower pack pain, or acute trauma such as cuts or fractures due to accidents.

In the textiles sector, risk factors for MSDs include:

- Working in awkward postures, such as during spinning, cutting, product control, and packaging,
- Repetitive movements, such as during spinning, cutting, product control, and packaging,
- Fatigue from manual handling, during the storage, inspection, treatment, shipping, finishing, and cutting of textiles.

Exposure to chemical agents

Many different groups of chemical substances are used in the textiles sector, including dyes, solvents, optical brighteners, crease-resistance agents, flame retardants, heavy metals, pesticides, and antimicrobic agents. They are used in dyeing, printing, finishing, bleaching, washing, dry cleaning, weaving slashing/sizing, and spinning.

Respiratory and skin sensitisers can be found in the textiles industry, for example textiles fibres, reactive dyes, synthetic fibres, and formaldehyde. The textile industry has been evaluated as a sector with an increased carcinogenic risk. Several studies have showed an increased risk of nasal, laryngeal and bladder cancer in women.

Exposure to dusts and fibres

The exposure of workers to dusts from material such as silk, cotton, wool, flax, hemp, sisal, and jute can occur during weaving, spinning, cutting, ginning, and packaging. Division of tasks along gender lines may mean that women are exposed to organic dusts more than men, with respiratory diseases being diagnosed more often in women than men. Exposure to fibres and yarns may cause nasal or bladder cancer.

Exposure to biological agents

In some activities, such as carding and willowing, workers may be exposed to biological agents such as *anthrax*, *clostridium tetani* (the causative agent for tetanus), and *coxiella burnetti* (which causes Q fever). Exposure to biological agents can result in allergies and respiratory disorders.

Exposure to physical agents

Workers may be exposed to noise and vibrations, for example during weaving, spinning, sewing, twisting, and cutting. Exposure to loud noise can result in permanent hearing damage such as noise-induced hearing loss and tinnitus. Exposure to vibration, particularly together with risk factors for MSDs, can lead to long-term harm. Electromagnetic fields may also be found in some workplaces in the textiles sector.

Accidents in the textiles sector

The textiles sector has many hazards that can cause injury to workers, from transport in the workplace (lift truck), dangerous large work equipment and plant, to the risk of slips from a wet working environment. Workers being struck by objects, such as moving machinery parts and vehicles are a significant cause of injury in the sector. There also exists the risks of fire and explosions, for example from heating plants used for vapour generation.

Psychosocial issues in the textiles sector

Work-related stress has been defined as being experienced when the demands of the work environment exceed the workers' ability to cope with or control them. Work-related stress may be an issue in some areas of the textiles sector, being associated for example with repetitive and fast paced work, and where the worker has no influence on how the job is done.

Legislation

Much of Europe's legislation for protecting the safety and health of workers is based on a common structure. This is a series of directives made up of council directive 89/391 (the "framework directive") and its "daughter directives" on a range of more specific subjects such as noise, chemical agents, and manual handling. The directives, transposed into law in all Member States set minimum standards, so check with the relevant national enforcing authorities. These directives take the same approach to prevention; risk assessment followed by prevention measures based upon the following common principles of prevention:

- avoiding risks
- evaluating the risks which cannot be avoided
- combating the risks at source
- adapting the work to the individual
- adapting to technical progress

- replacing the dangerous by the non-dangerous or the less dangerous
- developing a coherent overall prevention policy
- giving collective protective measures priority over individual protective measures
- giving appropriate instructions to the workers

Risk assessment step by step

The legal requirement for risk evaluation or assessment applies to all employers. The process for carrying out a risk assessment can be broken down into a series of steps:

Step 1 Identifying hazards and those at risk

Looking for those things at work that have the potential to cause harm, and identifying workers who may be exposed to the hazards. Using workers' knowledge helps to ensure hazards are spotted and workable solutions implemented. Consultation encourages workers to commit themselves to health and safety procedures and improvements.

A risk assessment should cover all workers regardless of whether they are employed on long- or short-term contracts. Where there are persons employed by another organisation on site, there is a duty on the two employers to cooperate and safeguard the health and safety of workers.

Risk assessment should take account of differences in workers, such as by gender, age, or disability. For example, older employees may learn differently than a younger worker, and also have different concepts of risk due to a lack of experience. Different prevention measures may be required for these worker groups. Work, its organisation and the equipment used should be adapted to the worker, not the other way around. This principle is enshrined in EU legislation.

Workers with disabilities should be considered specifically in the risk assessment process. For example, people with disabilities may be subjected to bullying, which can lead to work-related stress. Consultation with workers with disabilities is vital to ensure a risk assessment is appropriate.

Step 2 Evaluating and prioritising risks

Evaluate how likely it is that the hazard will lead to harm or injury, and how severe that injury is likely to be. Consider what control measures are in place and whether they are sufficient. It is essential that the work to be done to eliminate or prevent risks is prioritised. The focus for cost-effective and sustainable risk management should be on collective protection and preventative measures.

Step 3 Deciding on preventive action

Identifying the appropriate measures to eliminate or control the risks. List the preventive measures needed in order of priority, then take action, involving the workers and their representatives in the process. Targeting the underlying problems is the most cost-effective method of risk management.

Step 4 Taking action

Risk assessment is the first step to successful risk management. Put in place the preventive and protective measures through a prioritisation plan (most probably all the problems cannot be resolved immediately) and specify who does what and when, when a task is to be completed, and the means allocated to implement the measures.

Interventions should be agreed with the workforce, either directly or through worker safety representatives. The agreed solutions should be carefully implemented, monitored and evaluated. The information arising from the risk assessment must be shared with the appropriate persons. Action should be supported by appropriate training.

Step 5 Monitoring and reviewing

The assessment should be reviewed at regular intervals to ensure it remains up to date. It has to be revised whenever significant changes occur in the organisation or as a result of the findings of an accident or "near miss" investigation.

Checklist – a simple tool for risk assessment

Checklists can be useful tools as part of the risk assessment process, when they can be used to identify hazards. They can also be used in monitoring the performance of control measures. The checklist below cannot cover all hazards and risks, and readers are recommended to identify other relevant tools on the web pages of national safety and health authorities and inspectorates.

Managing the safety and health of women in the textiles sector

Occupational safety and health should be managed in a gender sensitive way, being aware that there may be differences in the exposure of women to risks compared to men. Gender sensitive interventions should be participatory, involving the workers concerned, and based on an examination of the real work situation. There has to be a real commitment from management to take safety and health and gender issues seriously, and no assumptions should be made about who is at risk from what hazards.

At each step of the risk assessment process described above, gender issues should be considered. For example:

- Ask both male and female workers what problems they have in a structured way,
- Take care of unintentional gender bias when "grading" risks as high, medium, or low,
- Ensure that reproductive health issues are included when seeking to eliminate risk at source or when trying to substitute substances,
- Ensure that monitoring of the performance of preventive measures covers tasks carried out by both men and women.

Workers who are pregnant or nursing mothers are protected by a specific directive, Council Directive 92/85/EEC, which establishes minimum standards and is transposed into every Member States. The directive requires employers to carry out a specific risk assessment to the workers covered, and highlights in particular

- exposure to chemical, physical and biological agents,
- physical movements and postures,
- mental and physical fatigue and other types of physical and mental stress.

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OSH005 – 18001 Ashagururaj

7:40

What is ISO?

ISO (International Organization for Standardization) is a worldwide association of national standards bodies, at present comprising 140 members, one in each country.

The object of ISO is to promote the development of standardization and related activities in the world with a view,

⇒ to facilitating international exchange of goods and services, and
⇒ to developing cooperation in the spheres of intellectual, scientific, technological and economic activity.

The results of ISO technical work are published as International Standards

What is ISO 14000?

ISO 14000 is a series of international standards on environmental management. It provides a framework for the development of an environmental management system and the supporting audit programme.

The ISO 14000 series, currently being developed by the International Organisation for Standardisation (ISO), is a collection of voluntary standards that assists organisations to achieve environmental and financial gains through the implementation of effective environmental management. The standards provide both a model for streamlining environmental management, and guidelines to ensure environmental issues are considered within decision making practices.

= model for streamlining
= guidelines to ensure
Environ issues

What is ISO 14001?

ISO 14001 is the corner stone standard of the ISO 14000 series. It specifies a framework of control for an Environmental Management System against which an organization can be certified by a third party.

Why have these standards ?

A set of international standards brings a world-wide focus to the environment, encouraging a cleaner, safer, healthier world for us all. The existence of the standards allows organizations to focus environmental efforts against an internationally accepted criteria.

At present many countries and regional groupings are generating their own requirements for environmentla issues, and these vary between the groups. A single standard will

The ISO 14001 standard, like most management systems standards, includes the following elements:

- Policy
- Organizational structure and responsibilities
- Standard Operating Procedures
- Controls for Critical Operations
- Document Control
- Training
- Record keeping Systems
- Internal Audits
- Corrective Action Systems
- Management Review Processes for Ensuring Continual Improvement

What are some of the potential benefits of an EMS based on ISO 14001?

- Improvements in overall environmental performance and compliance
- Provide a framework for using pollution prevention practices to meet EMS objectives
- Increased efficiency and potential cost savings when managing environmental obligagtions
- Promote predictability and consistency in managing environmental obligations
- More effective targeting of scarce environmental management resources
- Enhance public posture with outside stakeholders

Some of the benefits of implementing an Environmental Management System (EMS) in accordance with the ISO14000 standards, include:

⇒ identifying areas for reduction in energy and other resource consumption and their associated costs,
⇒ reducing environmental liability and risk,
⇒ helping to maintain consistent compliance with legal & regulatory requirements,
⇒ potentially faster permitting processes with state agencies,
⇒ benefiting form regulatory incentives that reward companies showing environmental leadership through certified compliance with environmental excellence,
⇒ preventing pollution and reducing waste, both of which reduces costs,
⇒ responding in a positive fashion to pressure from customers and shareholders,
⇒ improving community goodwill,

ensure that there are no conflicts between regional interpretations of good environmental practice.

The fact that companies may need environmental management certification to compete in the global marketplace could easily overshadow all ethical reasons for environmental management. Within Europe, many organizations gained ISO9000 Registration primarily to meet growing demands from customers. ISO 9000 quality registration has become necessary to do business in many areas of commerce. Similarly, the ISO 14000 management system registration may become the primary requirement for doing business in many regions or industries.

Benefits of International Certification

The benefits of having ISO 14001 certification are mainly realised by large organisations, as Small to Medium Enterprises (SMEs) have a smaller turnover and thus a correspondingly small return on the costs of certification.

Although a fully certified ISO EMS may not be suitable for smaller organisations, it does provide guidelines that assist organisations to consider all the relevant issues, and thus gain the most benefit from their EMS, even without certification. SMEs can therefore use ISO 14001 as a model for designing their own EMS.

However, larger organisations may find certification more valuable when considering the potential trade and market advantages of an internationally recognised and certified EMS. This was a significant factor for companies seeking certification under the ISO 9000 quality assurance standards, and is likely to be a factor in decisions regarding ISO 14001 certification.

The Benefits of implementing ISO 14001

Implementing an Environmental Management System is a systematic way to discover and control the effects your company has on the environment. Cost savings can be made through improved efficiency and productivity. These are achieved by detecting ways to minimise waste and dispose of it more effectively and by learning how to use energy more efficiently. It verifies compliance with current legislation and makes insurance cover more accessible.

Other ISO14000 Series Standards

Other standards in the series are actually guidelines, many to help you achieve registration to ISO 14001.

⇒ profiting in the market for "green" products, and generally achieving a market advantage,
⇒ lower insurance costs by demonstrating proof of good management before pollution-incident coverage is issued, and
⇒ demonstrating commitment to high-quality.

What Are The Benefits of ISO 14001 For Your Company?

There are a number of reasons for committing to the implementation of ISO 14001, some of which can be accomplished through implementing an environmental management system, whether or not the organization pursues certification or "registration" by a recognized outside organization. However, some benefits of implementing a formal EMS will only be realized through the formal registration process. The following information will assist in determining if pursueing ISO 14001 makes sense for your company:

Cost Control. Environmental management costs associated with waste management, disposal, and site remediation as well as the costs associated with raw materials and energy consumption can be reduced or eliminated.

Customer Assurance. The needs or concerns of ownership/management, customers, suppliers, regulatory agencies, the community, and insurance companies regarding the organization's environmental practices may be satisfied having an EMS in place.

Reductions in Audits and Paperwork. The organization may eliminate its external demands for costly, time-consuming specialized audits by satisfying these needs through the ongoing and systematic management of the environmental program.

Insurance Premium Reductions. Insurance companies may reduce coverage premiums if environmental risk is controlled and reduced. In addition, long term costs associated with liability and risk may also be reduced.

Increases in Employee Efficiency and Involvement. Environmental management systems can also facilitate more consistent, efficient, and effective internal operations due to greater employee involvement in operations. An effective EMS can result in more effective communications both inside and outside the organization.

These include the following:

- ISO 14004 provides guidance on the development and implementation of environmental management systems
- ISO 14010 provides general principles of environmental auditing (now superseded by ISO 19011)
- ISO 14011 provides specific guidance on audit an environmental management system (now superseded by ISO 19011)
- ISO 14012 provides guidance on qualification criteria for environmental auditors and lead auditors (now superseded by ISO 19011)
- ISO 14013/5 provides audit program review and assessment material.
- ISO 14020+ labeling issues
- ISO 14030+ provides guidance on performance targets and monitoring within an Environmental Management System
- ISO 14040+ covers life cycle issues

What are ISO, ISO 14000, and ISO 14001?

ISO stands for the International Organization for Standardization, located in Geneva, Switzerland. ISO promotes the development and implementation of voluntary international standards, both for particular products and for environmental management issues. ISO 14000 refers to a series of voluntary standards in the environmental field under development by ISO. Included in the ISO 14000 series are the ISO 14001 EMS Standard and other standards in fields such as environmental auditing, environmental performance evaluation, environmental labeling, and life-cycle assessment. The EMS and auditing standards are now final. The others are in various stages of development.

Environmental Management Systems (EMS)

An Environment Management System (EMS) is a tool for managing the impacts of an organisation's activities on the environment. It provides a structured approach to planning and implementing environment protection measures.

An EMS monitors environmental performance, similar to the way a financial management system monitors expenditure and income and enables regular checks of a company's financial performance. An EMS integrates environmental management into a company's daily operations, long term planning and other quality management systems.

Components of an EMS

To develop an EMS, an organisation has to assess its environmental impacts, set targets to reduce these impacts, and plan how to achieve the targets.

The most important component of an EMS is organisational commitment. For an effective EMS to be developed and implemented, you need commitment from the very

top of the organisation, as well as all staff. Following are more examples of components that should be considered when developing an EMS.

Environmental Policy: this is a statement of what an organisation intends to achieve from an EMS. It ensures all environmental activities are consistent with the organisation's objectives.

Environmental Impact Identification: identification and documentation of the actual and potential environmental impacts of an organisation's operations need to be undertaken. This can be achieved through undertaking an environmental audit.

Objectives and Targets: an environmental audit forms the basis of determining an organisation's environmental objectives and targets. An organisation can find benefits in adopting more stringent longer term objectives to encourage it to improve its performance. To continually improve, targets should be regularly reviewed.

Consultation: staff and community consultation should be undertaken before, during and after establishment of an EMS. This is necessary to ensure that all staff are involved in, and committed to the EMS. It can also help to improve public perception of the company, one of the benefits of implementing an EMS.

Operational and Emergency Procedures: all procedures should be reviewed to ensure they are compatible with the organisation's environmental objectives and targets. Any changes should be included with the documentation.

Environmental Management Plan: this details the methods and procedures which an organsation will use to meet its objectives and targets.

Documentation: all objectives, targets, policies, responsibilities and procedures should be documented along with information on environmental performance. Documentation is useful for verifying environmental performance to staff, regulators and the community.

Responsibilities and Reporting Structure: responsibilities need to be allocated to staff and management to ensure the EMS is implemented effectively.

Training: staff should undergo environmental awareness training to familiarise them with their responsibilities for implementing the EMS and with the overall environmental policy and objectives of the organisation. This provides staff with the necessary skill and motivation for the effective implementation of the EMS.

Review Audits and Monitoring Compliance: review audits should be undertaken regularly to ensure the EMS is achieving its objectives and to refine operational procedures to meet this goal. In order to ensure regulatory and other requirements are being met, it is often necessary to undertake regular environmental monitoring.

Continual Improvement: an important component is continual improvement. An EMS comes into its best use when used to review progress towards the targets and objectives set by a company to protect the environment. The procedures set in place to meet these objectives should be constantly examined to see if they can be improved or if more effective systems can be introduced.

Benefits of an EMS

An EMS can assist a company in the following ways:

- minimise environmental liabilities;
- maximize the efficient use of resources;
- reduce waste;
- demonstrate a good corporate image;
- build awareness of environmental concern among employees;
- gain a better understanding of the environmental impacts of business activities; and
- increase profit, improving environmental performance, through more efficient operations.

An EMS can be a powerful tool for organisations to both improve their environmental performance, and enhance their business efficiency. An EMS is not prescriptive, rather, it requires organisations to take an active role in examining their practices, and then determining how their impacts should best be managed. This approach encourages creative and relevant solutions from the organisation itself.

Although the implementation of an EMS is essentially a voluntary initiative, it can also become an effective tool for governments to protect the environment as it can assist regulation. For example, regulatory systems can encourage organisations to use EMS to meet standards, by providing incentives for strong environmental performance.

Likewise, organisations can use EMS to ensure that their performance is within regulatory requirements, and to keep ahead of more stringent regulations which might be introduced in the future.

How does EMS Relate to ISO 14001?

ISO 14001 and any EMS should focus on the evaluation of environmental impacts to determine the requirements of the system and required procedures for conducting day-to-day operations and for responding to emergencies. The result of this requirements-driven EMS will be to minimize the environmental impacts of business activities, and to ensure that management systems are in place to efficiently and effectively manage the applicable requirements. The ISO 14001 standard includes the basic elements of a formal environmental management system (EMS).

Public Image. An improved public image can be critically important for winning the support of the neighborhood and community alike. Increased International *Competiveness. Registration to ISO 14001 may help your company have a* competitive edge in expanding their market either regionally or internationally. Evolution of ISO 14001 registration acceptance may follow the trend set by ISO 9000, where some companies may prefer or require their suppliers to be ISO 14001 registered.

The Process Flow Diagram For a typical aluminum die casting operation illustrates the increasing complexities associated with managing the entire environmental system. EMS helps to organize an operation.

ISO 9000 : It is primarily concerned with quality management.

Purpose :- to enable companies to demonstrate that they are in a position to provide products or services that meet customer expectations and are focussed on Total Customer satisfaction

Ashaguruaj

Occupational health and safety requirements

To reduce the risks listed above, waste workers must wear protective clothes, boots, and gloves. At waste disposal sites, facemasks or simple scarves wrapped around the face should be used. Incinerator operators must also be protected against excessive noise and temperature. Waste workers should receive health education and be trained in accident prevention and emergency measures. They should have access to showers and cleaning facilities after their work shift and be immunised against tetanus and hepatitis B. Periodic medical examinations or screening should also be carried out on waste workers.

Where affordable, there should be separate collection of domestic chemical waste and waste with high heavy metal content, such as batteries, broken thermometers, and infectious and other toxic health care wastes. Used syringes should be packed in tamper-proof, puncture-resistant plastic containers of metal containers before being placed into a trash container. In countries and health care facilities that can afford it, segregation and separate collection of infectious waste should be employed to reduce to a minimum the quantities of infectious waste that require management and to render the waste more suitable for disinfection or sterilisation at a designated infectious waste disposal facility.

Toxic Infectious Materials

Waste managers in developing countries may also wish to use chemical encapsulation to encapsulate and immobilise discarded sharps, and to serve as a form of protection against the risk of injury and infection to humans. In this process, sharps are placed into a metallic barrel or a tough plastic drum. When this container is approximately 70% full, fluid cement mortar is poured into the container until all of the sharps are engulfed. After the mortar has solidified, the sharps are immobilised and the container may be disposed in a landfill. After a few weeks, due to natural mortality of microbiological pathogens, the sharps so treated will have lost their infective nature. In case hazardous waste or health care wastes are intended for composting, it is necessary to collect the biodegradable materials separately or to carefully monitor for and segregate any hazardous chemical waste or infectious waste that could adversely affect the bacteriological processes during composting and/or the characteristics, quality, and use of the compost. These admonitions limit the exposure of the compost facility operators, the public, and the environment to dangerous and toxic waste. The segregated hazardous waste and infectious waste must then be properly collected, treated, and disposed.

Warning

Handling MSW & its effect

Municipal solid waste includes commercial and domestic wastes generated in municipal or notified areas in either solid or semi-solid form excluding industrial hazardous wastes but including treated bio-medical wastes. Manual handling of waste shall be prohibited. If unavoidable due to constraints, manual handling shall be carried out under proper precaution with due care for safety of workers.

Non-biodegradable solid waste (NBDSW) or refuse is a carpet word. It covers a variety of materials ranging from asbestos to Zinc batteries. Polythene and its related compounds are the most commonly found solid waste materials in urban environs.

Many non-biodegradable solid waste materials are known to cause considerable environmental hazards when released into land, water and atmosphere.

The implications of inadequate municipal waste management upon the health of the public are serious and they cannot be ignored.

Various problems are faced due to solid wastes disposal.

1. Workers and other persons who manually collect and process solid waste regularly are especially at risk. waste workers are exposed to a multitude of health hazards that result from direct handling of and contact with waste.

2. The first type of health impact is accidental injuries, such as cuts and punctures from sharp objects in the waste.

3. The combined effects of casual disposal of wastes, insufficient waste collection service, and inadequate waste disposal facilities have always had serious, adverse implications for public health.

4. Among these are the direct transmission of diseases and the spread of epidemics, degradation of the quality of the urban and natural environments and, most importantly, the social reinforcement of poor hygienic habits and practices, all of which compose a vicious cycle.

5. The potential spread of infectious diseases (AIDS) through the discharge of health care wastes into the general urban waste stream is a continuous and growing threat.

6. Waste operators and scavengers are effected by infectious, toxic, and cancer-causing materials.

7. Fires in collected and disposed waste also represent potential health and safety hazards to workers as well as the public.

8. Another hazard is that which manifests itself when large volumes of disposed waste become unstable and, in the process, collapse and bury workers, scavengers, or shacks on or near the site containing their inhabitants.

9. Small amounts of hazardous chemical waste in garbage may result in accidental injuries, but may also lead, in some extreme cases, to poisoning

10. The second type of health impact is infections caused by exposure of humans to solid waste or its products of decomposition. Blood borne infections such as tetanus, resulting from injuries caused by infected sharp items in the waste, are common. Ophthalmologic and dermatological infections from exposure to contaminated dust are also possible

11. Many tropical diseases transmitted by vectors such as mosquitoes have their origins in breeding ponds created by indiscriminate waste disposal.

12. The inclusion of relatively small quantities of infectious and toxic waste, such as bottles containing hazardous types of pharmaceutical products, photographic material, batteries, infectious health care wastes and sharps (e.g., syringe needles and scalpels), excreta, and other such substances, can turn seemingly benign domestic waste into potentially dangerous waste, with attendant serious public health impacts.

13. Dumping of solid wastes in the open could create aesthetic problems as the beauty of a place is destroyed.

14. The garbage forms a source of food for rats, flies, mosquitoes and the like. Hence typhoid, plague, dysentery, diarrhoea epidemics could occur.

15. Toxic hazardous substances in the wastes would be harmful to human and animal health.

16. The plastics if eaten by cows could be fatal. Solid wastes could also pollute water and their burning could lead to air pollution.

17. While picking through waste, the rag pickers puts themself at a great risk and is always prone to disease as the waste that they rummages through can be infected.
look through

18. Waste from urban areas and the industrial units contains diverse types of materials that include toxic and hazardous constituents.

19. Workers at composting facilities, when poorly protected, are exposed to infection from dust inhalation and to infective wounds from sharps. They are also exposed to occupational accidents during waste shredding operations

20. All chemicals should be handled with great care. Most are toxic at some level and even though short-term exposure may not be particularly harmful, long-term exposure can cause serious health problems. Acute / Chronic

21. Fumes should not be inhaled, nor should the chemicals be allowed to enter the eyes or mouth, since many household chemicals are poisonous in sufficient amounts.

SWM

Accidents

-Muscular-skeletal disorders resulting from the handling of heavy containers

-Wounds, most often infected wounds, resulting from contact with sharp waste

-Intoxication and injuries resulting from contact with small amounts of hazardous chemical waste collected with garbage

-Trauma, burns, and other injuries resulting from occupational accidents at waste disposal sites, or from methane gas fires or explosions at landfill sites

Infections

-Dermal and blood infection resulting from direct contact with waste and from infected wounds

-Ophthalmologic and respiratory infections resulting from exposure to infected dust, especially during landfilling operations

-Zoonosis resulting from bites by wild or stray animals feeding on wastes

Enteric infections transmitted by insects feeding on wastes

Chronic diseases

-Incineration operators are especially exposed to chronic respiratory diseases resulting from exposure to dust, to toxic and carcinogenic risks resulting from exposure to hazardous compounds, to cardiovascular disorders and heat stress resulting from exposure to excessive temperature and to loss of hearing function due to exposure to excessive noise

Discuss 1970 OSH act

Occupational Safety and Health (OSH) is a cross-disciplinary area concerned with protecting the safety, health and welfare of people engaged in work or employment. As a secondary effect, OSH may also protect co-workers, family members, employers, customers, suppliers, nearby communities, and other members of the public who are impacted by the workplace environment.

The Occupational Safety and Health Act of 1970 (Public Law 91-596) assures as far as possible every working man and woman in the Nation safe and healthful working conditions. The act charges the National Institute for Occupational Safety and Health (NIOSH) with recommending occupational safety and health standards and describing exposures that are safe for various periods of employment, including but not limited to the exposures at which no worker will suffer diminished health, functional capacity, or life expectancy as a result of his or her work experience.

The **Occupational Safety and Health Act** is a United States federal law signed into law by President Richard M. Nixon on December 29, 1970.

The Act can be found in the United States Code at title 29, chapter 15. The Occupational and Safety Health Act was created to protect worker and workplace safety. Its main aim was to ensure that employers provide their workers with an environment free from dangers to their safety and health, such as exposure to toxic chemicals, excessive noise levels, mechanical dangers, heat or cold stress, or unsanitary conditions.

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Occupational health and safety considerations in wwtp's

Sewage is the used water of a community and can include domestic wastewater and industrial wastewater. Combined sewer systems will include storm water such as road runoff which carries oils, salts, metals, and asbestos. Many systems, especially older ones, will receive infiltration which can carry pesticides and herbicides from soil application.

For many years, work in the wastewater treatment field was considered the most hazardous, especially due to deaths involving confined space entry. These experiences occur in specific incidents involving chemicals in the sewer system and in regular work exposures throughout the plant and its processes.

2 Some chemically-related health complaints are acute in nature, involving short-term exposures and complaints such as irritations of the eyes, nose or throat. Other problems are chronic in which repeated exposures, sometimes over several years, have caused effects upon internal organs or have involved occupationally-related allergies.

2 The primary route of exposure for workers is probably inhalation. Wastewater treatment plant workers may be exposed to chemicals or organisms by direct contact with wastewater and sludges, or by inhalation of gases, particles, aerosols, vapors, or droplets. These hazards may enter the plant in soluble form or attached to suspended solids. Disease causing organisms have been found in sewage sludge; therefore, sewage workers may be at increased risk of infection or diseases. 2

Control measures

How can exposure to chemicals and diseases be reduced?

Administrative controls can be used for rotating personnel among the various treatment plant operations. This would reduce inhalation of airstripped chemicals and aerosols, and may help development of immunity to diseases by keeping exposure low/ perhaps too low for a disease-causing dose to be inhaled.

Engineering controls involve the use of ventilation for processes located within building, as well as splash guards where appropriate for dewatering equipment, and a variety of design or operational features to reduce airstripping and aerosols of disease potential.

Some of the controls as reported in the technical literature are described below.

A. Enforce pre-treatment regulations to reduce air-strippable chemicals at the source.

B. Plant trees around the aeration basin to capture the droplets and particles.

C. Reduce the amount of air-stripping and aerosol formation by using finer bubbles for aeration.

D. Reduce air-stripping and aerosols by using diffused aeration rather than mechanical aeration.

E. Some researchers have theorized that it should be possible theoretically to reduce the size of the bubble for aeration so that eventually the resulting droplets and particles would be too small to carry any microorganisms, but unfortunately this does not appear to be a very practical solution.

F. Reduction of aeration rate, if possible. Certainly your process control strategy may not allow this.

G. Consider floating covers on the mixed liquor of the aeration basin. Some plants have had success with:
. Biodegradable oils
. Collapsingfoam- detergents
. Permanentfoam- Polyurethane sheets
. Ping-pong balls - floating on the surface

H. Consider suppressing the droplets just above the surface by using these methods:
. Single layer screen - 100-200mesh, Multiple layer or knitted mesh screen,Fiber beds, Foam or granular bed, Flat plate or slats over the tank, Water spray to beat down the wastewater droplets, Rotating brush
1. Consider collecting the droplets by: Sedimentation, Multiple cyclone, Scrubber, Electrostatic precipitator, Fabric Filtration
J. Consider disinfecting the airborne particles by using:
: Ultraviolet lights
K. Cover the primary clarifier weir area. Shield the weir area from wind. Use submerged effluent collector (such as pipes with orifices) rather than welrs.
L. Avoid handling screenings by hand to prevent needlestick injuries.
M. Label piping so that potable and nonpotable water are clearly distinguished.
N. Processes to significantly reduce pathogens are treatment processes such as aerobic and anaerobic digestion, air drying, low temperature composting, lime stabilization or other techniques giving equivalent pathogen reduction.
O. wastewater worker be immunized to reduce the risk of infection

Worker exposure can also be reduced by the use and proper care of protective clothing and equipment.

. Heavy duty rubber gloves and boots can be used to prevent skin contact with wastewater and sludges. Especially cover any skin trauma such as cuts and abrasions to prevent infection. *V* se protective clothing and goggles to prevent contact with spray and splashes.
. Remove contaminated clothing after completion of a job. Avoid laundering ~~work~~, of these clothes at home. If they are cleaned at home, place them in a bag and leave them bagged until they are actually to be placed in the washing machine. Wash them separately form other clothing with the hot water cycle. Consider using chlorine bleach if appropriate for the fabric; if not, use a nonchlorine.
Shower at work and change into clean clothes and shoes.
. Wash hands with soap and water before eating or smoking and whenever hands come in contact with wastewater and sludge. Care for cuts. ~~and~~

Generally, all waste-water treatment works, irrespective of their size, have to comply with strict governmental safety and regulations acts. It is the responsibility of the owner or local authority to be fully acquainted with all aspects of the safety guidelines for waste-water treatment operations. The potential danger of an explosion of biogas and air mixtures cannot be over- emphasised, therefore units such as the waste gas burner should preferably be situated at least 15 m away from the gas holder; digester(s) or any buildings, together with due consideration to the prevailing wind.

The health hazards associated with the treatment of waste-water and specifically sludge handling should not be under-estimated. It is the responsibility of the supervisor and the operating staff to acquaint themselves of the dangers and to take the necessary steps to avoid them.

A wide variety of disease-causing organisms are present in both the liquid phase and the sludge stage. Amongst these are salmonella, shigella and vibro that cause diarrhoea and other intestinal tract problems. Viruses are also usually present in waste-water sludges. Amongst these are viruses causing infectious hepatitis, poliomyelitis, sore throats, gastroenteritis and the human immunodeficieney virus (HIV), which can cause AIDS. Protozoa such as entamoeba and giardia that cause intestinal distress are also common in waste-water treatment works. Helminths, such as ascaris (roundworm), taenia (tapeworm) and trichuris (whipworm) are also part of the bio-breakdown process but the ova of these can pass through the body and are fairly resistant to normal treatment processes including anaerobic digestion. Very high counts are usually found in sludge. The ova can survive in sol for several years.

Basic health hygiene rules apply when working in waste-water treatment plants; always wash up properly after working or handling any part of the waste-water treatment system or products. Try to avoid touching your face without washing your hands. Refrain from smoking whilst on the works, it is very easy to ingest disease-causing organisms. Protective clothing is an absolutely essential while working in a waste-water treatment plant especially while working with liquid sludges. Most of the guidelines associated with waste-water treatment are common sense. If one is not sure, every plant should have a code of health and hygiene that can be checked upon to see every health aspect associated with the waste plant.

All waste-water treatment works are classified as factories and must have first aid kit available in-case of accidents. The location of these first aid kits should be prominently displayed as well as the name of the first aid officer assigned to a specific section. It is recommended that all senior operating staff must have completed a basic first aid course. All open wounds should be treated by a doctor and it is important to receive a tetanus injection occasionally due to the types of bacteria workers are exposed to. As a general rule no scratch or cut is too minor to receive proper treatment.