

# HEALTH SANITARY INSPECTOR

NSQF LEVEL - 3

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**TRADE THEORY**

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**SECTOR : HEALTHCARE**

**(As per revised syllabus September 2022 - 1200 Hrs)**



Directorate General of Training

**DIRECTORATE GENERAL OF TRAINING  
MINISTRY OF SKILL DEVELOPMENT & ENTREPRENEURSHIP  
GOVERNMENT OF INDIA**



**NATIONAL INSTRUCTIONAL  
MEDIA INSTITUTE, CHENNAI**

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Post Box No. 3142, CTI Campus, Guindy, Chennai - 600 032

**Sector : Healthcare**

**Duration : 1 - Year**

**Trades : Health Sanitary Inspector - Trade Theory - NSQF Level - 3 (Revised 2022)**

**Developed & Published by**



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## FOREWORD

The Government of India has set an ambitious target of imparting skills to 30 crores people, one out of every four Indians, by 2020 to help them secure jobs as part of the National Skills Development Policy. Industrial Training Institutes (ITIs) play a vital role in this process especially in terms of providing skilled manpower. Keeping this in mind, and for providing the current industry relevant skill training to Trainees, ITI syllabus has been recently updated with the help of Media Development Committee members of various stakeholders viz. Industries, Entrepreneurs, Academicians and representatives from ITIs.

The National Instructional Media Institute (NIMI), Chennai, has now come up with instructional material to suit the revised curriculum for **Health Sanitary Inspector Trade Theory in Healthcare Sector under Yearly Pattern**. The NSQF Level - 3 (Revised 2022) Trade Practical will help the trainees to get an international equivalency standard where their skill proficiency and competency will be duly recognized across the globe and this will also increase the scope of recognition of prior learning. NSQF Level - 3 (Revised 2022) trainees will also get the opportunities to promote life long learning and skill development. I have no doubt that with NSQF Level - 3 (Revised 2022) the trainers and trainees of ITIs, and all stakeholders will derive maximum benefits from these Instructional Media Packages IMPs and that NIMI's effort will go a long way in improving the quality of Vocational training in the country.

The Executive Director & Staff of NIMI and members of Media Development Committee deserve appreciation for their contribution in bringing out this publication.

Jai Hind

**SHRI.ATUL KUMAR TIWARI., I.A.S.,**

Secretary  
Ministry of Skill Development & Entrepreneurship  
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New Delhi - 110 001

## PREFACE

The National Instructional Media Institute (NIMI) was established in 1986 at Chennai by then Directorate General of Employment and Training (D.G.E & T), Ministry of Labour and Employment, (now under Directorate General of Training, Ministry of Skill Development and Entrepreneurship) Government of India, with technical assistance from the Govt. of Federal Republic of Germany. The prime objective of this Institute is to develop and provide instructional materials for various trades as per the prescribed syllabi under the Craftsman and Apprenticeship Training Schemes.

The instructional materials are created keeping in mind, the main objective of Vocational Training under NCVT/NAC in India, which is to help an individual to master skills to do a job. The instructional materials are generated in the form of Instructional Media Packages (IMPs). An IMP consists of Theory book, Practical book, Test and Assignment book, Instructor Guide, Audio Visual Aid (Wall charts and Transparencies) and other support materials.

The trade practical book consists of series of exercises to be completed by the trainees in the workshop. These exercises are designed to ensure that all the skills in the prescribed syllabus are covered. The trade theory book provides related theoretical knowledge required to enable the trainee to do a job. The test and assignments will enable the instructor to give assignments for the evaluation of the performance of a trainee. The wall charts and transparencies are unique, as they not only help the instructor to effectively present a topic but also help him to assess the trainee's understanding. The instructor guide enables the instructor to plan his schedule of instruction, plan the raw material requirements, day to day lessons and demonstrations.

IMPs also deals with the complex skills required to be developed for effective team work. Necessary care has also been taken to include important skill areas of allied trades as prescribed in the syllabus.

The availability of a complete Instructional Media Package in an institute helps both the trainer and management to impart effective training.

The IMPs are the outcome of collective efforts of the staff members of NIMI and the members of the Media Development Committees specially drawn from Public and Private sector industries, various training institutes under the Directorate General of Training (DGT), Government and Private ITIs.

NIMI would like to take this opportunity to convey sincere thanks to the Directors of Employment & Training of various State Governments, Training Departments of Industries both in the Public and Private sectors, Officers of DGT and DGT field institutes, proof readers, individual media developers and coordinators, but for whose active support NIMI would not have been able to bring out this materials.

**Chennai - 600 032**

**EXECUTIVE DIRECTOR**

## ACKNOWLEDGEMENT

National Instructional Media Institute (NIMI) sincerely acknowledges with thanks for the co-operation and contribution extended by the following Media Developers and their sponsoring organisation to bring out this IMP for the trade of **Health Sanitary Inspector Trade Theory - NSQF LEVEL - 3 (Revised 2022)** under the **Healthcare** Sector for ITIs.

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NIMI records its appreciation of the Data Entry, CAD, DTP Operators for their excellent and devoted services in the process of development of this Instructional Material.

NIMI also acknowledges with thanks, the invaluable efforts rendered by all other staff who have contributed for the development of this Instructional Material.

NIMI is grateful to all others who have directly or indirectly helped in developing this IMP.

# INTRODUCTION

## TRADE PRACTICAL

The trade practical manual is intended to be used in workshop . It consists of a series of practical exercises to be completed by the trainees during the one year course of the **Health Sanitary Inspector Trade** supplemented and supported by instructions/ informations to assist in performing the exercises. These exercises are designed to ensure that all the skills in compliance with NSQF LEVEL - 3 (Revised 2022).

The manual is divided into Ten modules.

Module 1	-	<b>Food and Nutrition</b>	50 Hrs
Module 2	-	<b>Water Pollution</b>	50 Hrs
Module 3	-	<b>Waste Management &amp; Air and Noise Pollution</b>	121 Hrs
Module 4	-	<b>Waste Water Mangement</b>	88 Hrs
Module 5	-	<b>Community Health - Occupational health</b>	78 Hrs
Module 6	-	<b>Biological Health Environment</b>	84 Hrs
Module 7	-	<b>Behavioral Science &amp; First Aid</b>	67 Hrs
Module 8	-	<b>Communicable &amp; Non-communicable diseases</b>	71 oHrs
Module 9	-	<b>Personal Hygiene</b>	20 Hrs
Module 10	-	<b>Demography</b>	52 Hrs
<b>Total</b>			<b>681 Hrs</b>

The skill training in the shop floor is planned through a series of practical exercises centred around one practical project. However, there are few instances where the individual exercise does not form a part of project.

While developing the practical manual a sincere effort was made to prepare each exercise which will be easy to understand and carry out even by below average trainee. However the development team accept that there is a scope for further improvement. NIMI, looks forward to the suggestions from the experienced training faculty for improving the manual.

## TRADE THEORY

The manual of trade theory consists of theoretical information for the one year course of the Health Sanitary Inspector Trade. The contents are sequenced according to the practical exercise contained in the manual on Trade practical. Attempt has been made to relate the theoretical aspects with the skill covered in each exercise to the extent possible. This co-relation is maintained to help the trainees to develop the perceptual capabilities for performing the skills.

The Trade theory has to be taught and learnt along with the corresponding exercise contained in the manual on trade practical. The indicating about the corresponding practical exercise are given in every sheet of this manual.

It will be preferable to teach/learn the trade theory connected to each exercise atleast one class before performing the related skills in the shop floor. The trade theory is to be treated as an integrated part of each exercise.

The material is not the purpose of self learning and should be considered as supplementary to class room instruction.

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## LEARNING / ASSESSABLE OUTCOME

On completion of this book you shall be able to

S.No.	Learning Outcome	Ref. Ex.No.
1	<p><b>Make a nutrition plan for all age groups under given conditions following safety precautions.</b></p> <p><b>Design a balanced diet as per the requirement under given conditions.</b></p> <p><b>Calculate and suggest the calorie and nutrition requirements as per the specific requirements of the person.</b></p> <p><b>Identify diseases that occur due to various deficiencies.</b></p> <p><b>Assess disease symptoms.</b></p> <p><b>Inspect and report various food adulterations.</b></p> <p><b>Suggest different food preservation techniques for various types of food.</b></p>	1.1.01 - 1.1.15
2	<p><b>Identify and understand water and its properties and causes of water pollution.</b></p> <p><b>Summarize water supply system with water treatment in the city/ country etc.</b></p> <p><b>Assemble plumbing system for Conservation of water.</b></p> <p><b>Develop rain water harvesting technique.</b></p> <p><b>Identify and understand the water purification process.</b></p>	1.2.16 - 1.2.35
3	<p><b>Handle the night soil of a city/ town with protection of environment and human being.</b></p>	1.3.36 - 1.3.42
4	<p><b>Plan solid waste management system in an area or a small town.</b></p>	1.3.43 - 1.3.52
5	<p><b>Practice Bio Medical and E- waste management system.</b></p>	1.3.53 - 1.3.57
6	<p><b>Identify air pollution sources and suggest the suitable remedies.</b></p> <p><b>Interpret the effects of global warming and identify the remedial measures.</b></p> <p><b>Suggest the measures to minimize the noise pollution.</b></p> <p><b>Plan and suggest the ventilation requirements of a particular area.</b></p>	1.3.58 - 1.3.65
7	<p><b>Illustrate concept of liquid waste and disposal. Know the types of sewer Health hazards due to liquid waste.</b></p> <p><b>Plan and help in construction and maintenance of sewers, traps, plumbing tools etc.</b></p>	1.4.66 -1.4.73
8	<p><b>Suggest disposal methods for dead animals and humans.</b></p> <p><b>Identify different types of soil, its importance in relation to public health and reclamation of land.</b></p>	1.4.74 - 1.4.77



## LEARNING / ASSESSABLE OUTCOME

On completion of this book you shall be able to

S.No.	Learning Outcome	Ref. Ex.No.
9	Plan and suggest sanitary prescription of medical measures in housing and fairs & festivals.	1.5.78 - 1.5.81
10	Identify occupational health hazards. Follow safety rules. Prevent occupational diseases.	1.5.82 - 1.5.84
11	Prepare and control of biological environment and different parts of spraying equipment.	1.6.85 - 1.6.90
12	Generate awareness programmes for masses on health education.	1.6.91 - 1.6.98
13	Illustrate importance of right behaviour and personal hygiene, learn its direct impact on their personal life & society.	1.7.99 - 1.7.102
14	Perform first- aid treatment to tackle medical emergency situation.	1.7.103 - 1.7.110
15	Assess intensity of any disease, recognize the disease and provide first-aid treatment on time to contain the disease. Follow the given immunization schedule and understand its importance. Identify disinfection and its importance to control diseases. Carry out sterilization.	1.8.111 - 1.8.115
16	Perform basic personal hygiene and interpret its impact on a person's health and personality.	1.9.116 - 1.9.120
17	Recognize various factors like death rate, birth rate, morbidity, MMR, IMR etc., analyze importance of census survey and data collection. Categorize health survey. Familiarize with vocabulary and terminology of different acts.	1.10.121 - 1.10.131

## SYLLABUS

Duration	Reference Learning Outcome	Professional Skills (Trade Practical)with Indicative hours	Professional Knowledge (Trade Theory)
Professional Skill 50Hrs; Professional Knowledge 24 Hrs	<p>Make a nutrition plan for all age groups under given conditions following safety precautions.</p> <p>Design a balanced diet as per the requirement under given conditions.</p> <p>Calculate and suggest the calorie and nutrition requirements as per the specific requirements of the person.</p> <p>Identify diseases that occur due to various deficiencies.</p> <p>Assess disease symptoms.</p> <p>Inspect and report various food adulterations.</p> <p>Suggest different food preservation techniques for various types of food.</p>	<ol style="list-style-type: none"> <li>1. Point out the requirement of nutrition. (03 hrs)</li> <li>2. Demonstrate on charts of various deficiency diseases. (04 hrs)</li> <li>3. Nutrient requirement of infant, wearing pregnancy, location, preschool child, school going child. (04 hrs)</li> <li>4. Survey of nutrition education &amp; its importance. (03 hrs)</li> <li>5. Preparation of diet menu for hypertensive, diabetic nephritis &amp; heart patients. (03 hrs)</li> <li>6. Images of patients suffering from diseases. (03 hrs)</li> <li>7. Audio-video aids. (04 hrs)</li> <li>8. Tabular differentiation of types of malnutrition. (03 hrs)</li> <li>9. Importance of health education to overcome the problem of malnutrition. (04 hrs)</li> <li>10. Display videos (Audio-video) on malnutrition. (04 hrs)</li> <li>11. Demonstration of sources of Hb by pictorial chart. (03 hrs)</li> <li>12. Demonstration of spoilage of some food items. (03 hrs)</li> <li>13. Application of common salt &amp; sugar to increase shelf life of many food items. (04 hrs)</li> <li>14. Cleanliness of Kitchen equipment and cooking utensils (04 hrs.)</li> <li>15. Operation and Usage procedures of storage Equipment like Refrigerators (04 hrs.)</li> </ol>	<p>Food (definition) &amp; function of food &amp; introduction of nutrition &amp; nutrients.</p> <p>Classification of food, their sources, nutrient diets proteins, fat, vitamins &amp; minerals – sources, function, deficiency excess &amp; daily requirement.</p> <p>Balanced diet- definition &amp; importance</p> <ul style="list-style-type: none"> <li>- Factors to be considered on planning meals.</li> <li>- Nutrient requirement of different age group</li> <li>- Diet survey</li> </ul> <p>Family assessment – clinical examination of all members –height &amp; weight BMI [Body mass index], Head circumference, -Blood test for Hb.</p> <p>Nutrition education malnutrition-causes prevention, low birth weight (LBW), causes of LBW, prevention of LBW, special care to be given to malnourished children.</p> <p>Therapeutic Diet: Introduction for balanced diet, weight reducing diet- low fat diet, bland diet, cirrhosis of liver, renal stone</p> <p>Food Preservation: definition &amp; methods, household &amp; industrial method of preservation, self-line, Pasteurization: methods, types &amp; importance.</p> <p>Refrigeration: Prevents spoilage.</p>
Professional Skill 50 Hrs; Professional Knowledge 12 Hrs	<p>Identify and understand water and its properties and causes of water pollution.</p> <p>S u m m a r i z e water supply system with water treatment in the city/ country etc.</p>	<ol style="list-style-type: none"> <li>16. Draw a chart showing various environmental factors. (03 hrs)</li> <li>17. Tabulate various types of water with their properties. (03 hrs)</li> <li>18. Classify water resources (surface water and ground water). (06 hrs)</li> <li>19. Prepare a pie chart of total availability of water on the earth (Fresh water, saltwater, potable water etc.) (02 hrs)</li> </ol>	<p>WHO's definition for environmental sanitation.</p> <p>Safe and wholesome water.</p> <p>Sources of water. Various uses of water and its needs.</p> <p>Water borne diseases.</p> <p>Conservation sources of water.</p> <p>Quality of water.</p> <p>Physical, chemical and biological standard for portable water.</p>

	<p>A s s e m b l e plumbing system for Conservation of water.</p> <p>Develop rain water harvesting technique.</p> <p>Identify and understand the water purification</p>	<p>20. Tabulate the per capital water demand for domestic purpose. (02 hrs)</p> <p>21. Prepare a chart of water demand in different areas such as hospitals, hotels, industries, schools etc. (01 hrs)</p> <p>22. Prepare a chart for impact of polluted water on human health, animals, plants etc. (03 hrs)</p> <p>23. Tabulate the different methods for conservation of water in different areas. (03 hrs)</p> <p>24. Draw and sketch a picture of rainwater harvesting. (01 hrs)</p> <p>25. Identify the difference between portable water, safe and wholesome water. (03 hrs)</p> <p>26. Prepare a chart for physical, chemical and bacteriological quality of water. (02 hrs)</p> <p>27. Explain the disinfection with various disinfectant for well disinfection (02 hrs)</p> <p>28. Prepare the list of sources of water pollution with their different characteristics. (02 hrs)</p> <p>29. Visit to a water treatment plant. (02 hrs)</p> <p>30. Make a diagram of water treatment plant with different process of water purification. (04 hrs)</p> <p>31. Collection and dispatch of water sample for chemical and bacteriological examination. (02 hrs)</p> <p>32. Prepare and construct a purification system in the rural areas. (02 hrs)</p> <p>33. Calculate the chlorine demand and prepare the graph also for residual chlorine in water. (01 hrs)</p> <p>34. Collect the water sample from the domestic taps, surface and ground water resources. (02 hrs)</p> <p>35. Perform the practical for physical and chemical parameters of given water sample in testing labs</p> <ul style="list-style-type: none"> <li>- pH</li> <li>- Turbidity</li> <li>- Chlorine</li> <li>- Hardness</li> <li>- TDS</li> <li>- Acidity</li> <li>- Alkalinity etc. (05 hrs)</li> </ul>	<p>Public health aspect of very hard water.</p> <p>Steps of disinfection of well.</p> <p>Sources and nature of pollution of water.</p> <p>Purification of water:</p> <ul style="list-style-type: none"> <li>i) Large Scale</li> <li>ii) Small Scale</li> </ul> <p>Prepare of a sanitary well and tube well.</p> <p>Plumbing system and its maintenance.</p> <p>Water supply and storage system at the community and domestic.</p> <p>Pot method of Chlorination.</p> <p>Swimming pool.</p> <p>Water testing labs. (12 hrs.)</p>
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Professional Skill 40Hrs; Professional Knowledge 12Hrs	Handle the night soil of a city/town with protection of environment and human being.	36. Show the difference between water and sewage with given samples in the bottles in the testing labs. (02 hrs) 37. Categorises the numerous impacts of night soil on the water bodies, atmosphere, soil etc. (06 hrs) 38. Tabulate numerous impacts of food chain and impact of food contamination on human bodies. (02 hrs) 39. Prepare a chart for various diseases due to unsanitary disposal of night soil. (02 hrs) 40. Describe the construction and maintenance of service and non-service type latrines bore hole, dug well, RCA, septic tank, sulabh souchalaya. (13 hrs) 41. Visit to sulabh souchalaya. (17 hrs) 42. Demonstrating the construction and maintenance of trenching ground. (08hrs)	<u><b>Night soil disposal</b></u> Sewage in liquid waste containing human excreta. Numerous impacts of night soil on the environmental factors. Faucal borne disease due to unsanitary disposal of night soil. Different types of latrines in use principal of construction of sanitary latrines and their uses. i) Bore hole ii) Dug well iii)RCA iv) Septic tank latrines.(12 hrs.)
Professional Skill 46Hrs; Professional Knowledge 12Hrs	Plan solid waste management system in an area or a small town.	43. Identify resources of increasing solid waste. (02 hrs) 44. Tabulate the category of solid waste based on sources. (02 hrs) 45. Classify solid waste according to their different properties such as medical, municipal, commercial, construction. (02 hrs) 46. Demonstration of collection methods of solid waste. (02 hrs) 47. Prepare a plan chart of solid waste management in a city. (02 hrs) 48. Prepare pie chart composition of MSW. (02 hrs) 49. Explain the disposal methods of solid waste in sanitary methods. (12 hrs) 50. Illustrate the bad effects of solid waste disposal in a chart. (04 hrs) 51. Compare the different methods of collection and transportation of solid waste with diagrams. (02 hrs) 52. Visit disposal site. i. Sanitary landfills ii. Composting iii. Incineration iv. Biogas plant (16 hrs)	<u><b>Solid waste disposal</b></u> - Source, generation, storage, collection and disposal methods of solid waste. - Classification of solid waste in community. - Polluting effects of different types of solid waste. - System of collection of solid waste from the houses & streets. - Sanitary transportation of solid waste. - Sanitary process of disposal of solid waste such as composting, sanitary land filling, incineration etc.
Professional Skill 80Hrs; Professional Knowledge 20 Hrs	P r a c t i c e Bio Medical and E-waste management system.	<u><b>Bio Medical Waste Management</b></u> 53. Techniques of segregation, packaging, storage, transport of infectious waste. (15 hrs.) 54. Techniques of Biomedical waste management. (12 hrs.)	<u><b>Bio Medical Waste Management</b></u> - Definition of Bio Medical Waste - Sources of Bio Medical Waste - Waste minimisation - BMW – segregation, collection,

		<p>55. Treatment method- Autoclave, Hydroclave, Microwave, Chemical Disinfection, Solidification and stabilization, Bioremediation, (20 hrs.)</p> <p>56. Accumulation and storage of hazardous waste, (12 hrs.)</p> <p>57. Land disposal of hazardous waste, (17 hrs.)</p>	<p>transportation, treatment and disposal (including color coding)</p> <ul style="list-style-type: none"> <li>- Liquid BMW, Radioactive waste, Metals/Chemicals/Drug waste</li> <li>- BMW management and method of disinfection</li> <li>- Modern technology for handling BMW</li> <li>- Use of personal protective equipment (PPE)</li> <li>- Monitoring and controlling of cross infection (protective devices)</li> <li>- Identifying the risk of Bio Medical Waste</li> <li>- E-waste: Introduction, toxicity due to hazardous substances in e-waste and their impacts, domestic e-waste disposal, e-waste management, technologies for recovery of resource from electronic waste, guidelines for environmentally sound management of e-waste, occupational and environmental health perspectives of recycling e-waste in India.</li> </ul>
<p>Professional Skill 35Hrs; Professional Knowledge 14 Hrs</p>	<p>Identify air pollution sources and suggest the suitable remedies.</p> <p>Interpret the effects of global warming and identify the remedial measures.</p> <p>Suggest the measures to minimize the noise pollution.</p> <p>Plan and suggest the ventilation requirements of a particular area.</p>	<p>58. Demonstration of humidity and temperature. (04 hrs)</p> <p>59. Point out sources of air pollution.(02 hrs)</p> <p>60. Prepare charts or posters of Global warming. (03 hrs)</p> <p>61. Prepare posture on prevention techniques for Air pollution. (03 hrs)</p> <p>62. Demonstration of an AC plant for thermal comfort. (03 hrs)</p> <p>63. Point out types of ventilation. (03 hrs)</p> <p>64. Measurement of noise level. (06 hrs)</p> <p>65. Process to control noise pollution (12 hrs.)</p>	<p><b>Air pollution</b></p> <ul style="list-style-type: none"> <li>- Introduction of air pollution.</li> <li>- Composition of air.</li> <li>- Sources and nature of air pollution.</li> <li>- Effect of air pollution on health.</li> <li>- Prevention and controlling methods for air pollution.</li> <li>- Explain global warming and its impact.</li> <li>- Concept of temperature, humidity, radiation, thermal comfort, evaporation etc.</li> <li>- Methods of air purification.</li> <li>- Air disinfection.</li> <li>- Definition of ventilation.</li> <li>- Concept and importance of adequate ventilation.</li> <li>- Types of ventilation</li> </ul> <p><b>Noise pollution</b></p> <ul style="list-style-type: none"> <li>- Introduction.</li> <li>- Sources.</li> <li>- Health Impacts.</li> <li>- Preventive measures for controlling Noise pollution. (06 hrs.)</li> </ul>

<p>Professional Skill 48Hrs</p> <p>Professional Knowledge 14Hrs</p>	<p>Illustrate concept of liquid waste and disposal. Know the types of sewer Health hazards due to liquid waste.</p> <p>Plan and help in construction and maintenance of sewers, traps, plumbing tools etc.</p>	<p>66. Point out the sewage treatment plant. (04 hrs)</p> <p>67. Inspection of flushing tank, manholes etc. (05hrs)</p> <p>68. Demonstration of various traps 'p' trap, 's' trap, 'q' trap etc. (10 hrs)</p> <p>69. Demonstration of manholes by video calls. (10 hrs)</p> <p>70. Demonstration of various plumbing tools like hacksaw, pipe cutter, pipe vice, pipe wrench set of spanners etc. (06 hrs)</p> <p>71. Inspection and maintenance of sewage treatment plant. (06 hrs)</p> <p>72. Identify various equipment of sewage disposal. (02hrs)</p> <p>73. Identify pollution of water from sewage. (02 hrs)</p>	<p><b>Liquid waste disposal</b></p> <ul style="list-style-type: none"> <li>- Definition of liquid waste and its sources.</li> <li>- Human waste management system.</li> <li>- Various methods for liquid waste disposal.</li> <li>- Pollution of water due to sewage.</li> <li>- Health hazard associated with liquid waste.</li> <li>- Sewers and its types.</li> <li>- Methods of laying sewers.</li> <li>- Construction and maintenance of sewers.</li> <li>- Sewer appurtenances.</li> <li>- Traps introductions.</li> <li>- Types of traps.</li> <li>- Definition of plumbing.</li> <li>- Plumbing tools and operations.</li> </ul> <p><b>Sewage disposal</b></p> <ul style="list-style-type: none"> <li>- Definition and types of sewage system.</li> <li>- Sewage farming and land treatment.</li> <li>- Sewage disposal by biogas plant.</li> <li>- Methods of disinfecting sewage.</li> <li>- Sewage farming.(12 hrs.)</li> </ul>
<p>Professional Skill 43Hrs;</p> <p>Professional Knowledge 12 Hrs</p>	<p>Suggest disposal methods for dead animals and humans.</p> <p>Identify different types of soil, its importance in relation to public health and reclamation of land.</p>	<p>74. Visit to burial ground, proper process of disposal of dead bodies and maintenance of records as per legal provisions.(17 hrs)</p> <p>75. Identify soil sample equipments. (09 hrs)</p> <p>76. Sampling for assessment of soil pollution. (09 hrs)</p> <p>77. Treatment of soil after the PH and disinfection. (08 hrs)</p>	<p><b>Burial and Cremation</b></p> <ul style="list-style-type: none"> <li>- Introduction</li> <li>- Disposal of dead.</li> <li>- Types of disposal methods.</li> <li>- Methods of preservation of dead.</li> <li>- Commonly and less commonly used methods for disposal of dead.</li> <li>- Basic requirements for burial and cremation grounds.</li> <li>- Health hazards associated with unsanitary disposal of dead bodies.</li> </ul> <p><b>Soil sanitation</b></p> <ul style="list-style-type: none"> <li>- Introduction and importance of soil.</li> <li>- Classification of soil.</li> <li>- Classification from the view point of importance in public health.</li> <li>- Reason of excessive moisture in the soil.</li> <li>- Reclamation of land.</li> <li>- Soil health.</li> </ul>

<p>Professional Skill 43Hrs; Professional Knowledge 12Hrs</p>	<p>Plan and suggest sanitary prescription of medical measures in housing and fairs &amp; festivals.</p>	<p>78. Visit of housing for assessing sanitary standards and prescription of remedial measures. (15 hrs) 79. Classify the overcrowding. (04 hrs) 80. Inspection and preparation of fairs and festivals. (14 hrs) 81. Preparation of sanitary arrangements associated with natural calamities. (10 hrs)</p>	<p><b>Housing</b></p> <ul style="list-style-type: none"> <li>- General principle of healthy housing.</li> <li>- Home sanitation.</li> <li>- Utility services of house.</li> <li>- Sanitary standards for construction of house.</li> <li>- Food hygiene at home.</li> <li>- Specification for healthy housing.</li> </ul> <p><b><u>Sanitation in fairs and festivals</u></b></p> <ul style="list-style-type: none"> <li>- Sanitation management at fairs and festivals.</li> <li>- Sanitary problems associated with human gatherings and temporary settlements.</li> <li>- Alternative emergency sanitary provisions to prevent sanitation crisis for food, housing, water supply, lighting.</li> <li>- Disposal of community waste and prevention of outbreak of epidemics.(12 hrs.)</li> </ul>
<p>Professional Skill 35Hrs; Professional Knowledge 12Hrs</p>	<p>Identify occupational health hazards. Follow safety rules. Prevent occupational diseases.</p>	<p>82.Visit various trade premises (diary, bakery etc.) (12 hrs) 83.Visit to a factory for survey of sanitation problems of workplace. (18 hrs) 84.Identification of danger zones and adequacy of safety arrangements.(12 hrs)</p>	<p><b><u>Occupational health</u></b></p> <ul style="list-style-type: none"> <li>- Introduction</li> <li>- Occupational environment measures.</li> <li>- Occupational diseases.</li> <li>- State the importance of safety and health at work place.</li> <li>- State the role of employer, trade union and employees for health and safety program.</li> <li>- Measures for health protection workers.</li> <li>- Prevention of occupational diseases.</li> <li>- Provision- benefit to employees.</li> <li>- Occupational health in India.(12 hrs.)</li> </ul>
<p>Professional Skill 60Hrs; Professional Knowledge 16Hrs</p>	<p>Prepare and control of biological environment and different parts of spraying equipment.</p>	<p>85. Identification and use of insecticides, pesticides and disinfectants. (02 hrs) 86. Application of techniques of sterilisation and disinfection of various articles.(04 hrs) 87. Identification of different part of spraying equipment. (04 hrs) 88. Identify and use of larvicides. (04 hrs) 89. Operation and maintenance of spraying equipment. (06 hrs) 90. Identify and use of rodenticides. (04 hrs)</p>	<p><b><u>Control of biological environment</u></b></p> <ul style="list-style-type: none"> <li>- Introduction</li> <li>- Study on insecticides, pesticides and disinfections.</li> <li>- Sterilisation and disinfection of different articles.</li> <li>- Various spraying equipment.</li> <li>- Uses of rodenticides and larvaecidals.</li> <li>- Principal of arthropod control.(06 hrs.)</li> </ul>

Professional Skill 60Hrs; Professional Knowledge 16 Hrs	Generate awareness programmes for masses on health education.	91. Designing of posters on Malaria. (10 hrs) 92. Designing of posters on roles and responsibilities of a health inspector. (10 hrs) 93. Demonstration of health awareness program as a class activity. (06 hrs) 94. Designing environmental sanitation posters. (08 hrs) 95. Designing posters on balanced diet. (06 hrs) 96. Designing poster on basic hygiene practices. (04 hrs) 97. Preparing power point presentation on health awareness. (10 hrs) 98. Demonstration of preparation of ORS. (06 hrs)	- Definition of health - Content of health education. - Principal of health education. - Health education opportunities for health inspector in his work place. - Use of audio-visual aids and media. - Health education approach. - Planning health education activities, education in relation to environmental sanitation. - Awareness on need of sanitation amenities. - Health education material. - Contribution of public health centres in health education. - Utilising community resources for health education. - Benefits of personal contract group meetings to provide health education.(18 hrs.)
Professional Skill 51Hrs; Professional Knowledge 16 Hrs	Illustrate importance of right behaviour and personal hygiene, learn its direct impact on their personal life & society.	99. Preparing charts on personal hygiene habits. (22 hrs) 100. Designing posters on Do's and Don'ts in a social behaviour. (11 hrs) 101. Demonstration of hand washing and caring. (09 hrs) 102. Demonstration on oral hygiene. (09 hrs)	<b>Behavioral Science</b> - Definition of behavioural science. - Importance of behavioural science. - Impact of behaviour on personal hygiene. - Basic hygiene practices. - Habits and customs affecting personal hygiene. - Caring sense organs. - Oral hygiene. - Factors influencing human behaviour, change of behavioural pattern in different age groups. - Interpersonal relations and defence mechanism. (18 hrs.)
Professional Skill 95Hrs; Professional Knowledge Professional	Perform first-aid treatment to tackle medical emergency situation.	103. Dressing of wounds, bandages. (08 hrs) 104. Management of bone injuries with splints, slings. (10 hrs) 105. Transportation of injured and unconscious cases and their management. (09 hrs) 106. Diagnosis and treatment of minor ailments, cough, fever, bleeding, toothache etc. (15 hrs) 107. Poisoning case managements (08 hrs) 108. Management in case of heat attack, sun stroke, haemorrhage, burns, electrical injuries etc. (20 hrs) 109. Training on artificial respiration. (10 hrs) 110. Arranging first-aid treatment in various emergency cases. (15 hrs)	<b>First-Aid</b> - Aim of first-aid. - Principles and practice of first-aid. - Contents of a basic first-aid box. - CPR - Types of dressing and bandages. - Types of wounds. - Miscellaneous conditions. - Approach to a casualty. - Psychological first-aid. - Handling multiple casualties. - Types of injuries like road accidents, factories accidents and disaster injuries. - Transportation of victims and proper care provided.(36 hrs.)



<p>Skill 71 Hrs;  Professional Knowledge 20 Hrs</p>	<p>Assess intensity of any disease, recognize the disease and provide first-aid treatment on time to contain the disease.</p> <p>Follow the given immunization schedule and understand its importance.</p>	<p>111. Demonstration on communicable and non-communicable diseases symptoms and their control measures. (20 hrs)</p> <p>112. Preparation of immunisation programme (15 hrs)</p> <p>113. Conducting health and general survey and report making. (20 hrs)</p> <p>114. Videos on disinfection and sterilisation techniques. (08 hrs)</p> <p>115. Various chemicals uses with safety for disinfection through videos. (08 hrs)</p>	<p><b>Communicable diseases</b></p> <ul style="list-style-type: none"> <li>- Definition and introduction on communicable disease.</li> <li>- Air-borne and transmission of diseases through contact.</li> <li>- Symptoms of diseases.</li> <li>- Explain in detail various communicable diseases like Swine Flu, T.B., AIDS, Diphtheria, Polio, measles, diarrhoea etc.</li> <li>- General measures for prevention and control of communicable diseases.</li> </ul> <p><b>Non- communicable diseases</b></p> <ul style="list-style-type: none"> <li>- Introduction of non-communicable disease.</li> <li>- Explain in detail diseases like cancer, hypertension, cardiac disease, diabetes etc.</li> <li>- In detail symptoms, prevention and control of non-communicable diseases.</li> </ul> <p><b>Immunity and immunisation</b></p> <ul style="list-style-type: none"> <li>-Importance of immunity and immunisation</li> <li>-Types, purpose and effect of immunisation.</li> <li>- National immunisation schedule.</li> <li>-Measles, typhoid vaccines and pentavalent vaccine.</li> </ul> <p><b>Disinfection and sterilisation</b></p> <ul style="list-style-type: none"> <li>- Need of disinfection and sterilisation.</li> <li>-Importance of disinfection and sterilisation in hospitals.</li> <li>-Introduction and uses of various disinfection agents like Halogen, KMnO<sub>2</sub> solution, solid and liquid agents.</li> <li>-Effective disinfectants like formaldehyde, sulphur, chlorine gases etc.</li> <li>- Use of UV radiation and ozone as disinfectant.(30 hrs.)</li> </ul>
<p>Professional Skill 20 Hrs;  Professional Knowledge 10 Hrs</p>	<p>Perform basic personal hygiene and interpret its impact on a person's health and personality.</p>	<p>116. Making posters on dental care. (06 hrs)</p> <p>117. Making posters on skin and hair hygiene. (04 hrs)</p> <p>118. Making posters on basic hygiene habits. (03 hrs)</p> <p>119. Demonstration on right method for hand washing. (03 hrs)</p> <p>120. Demonstration on oral health. (04 hrs)</p>	<p><b>Personal hygiene</b></p> <ul style="list-style-type: none"> <li>- Need and importance of personal hygiene in daily life.</li> <li>- Factors influencing health and hygiene habits.</li> <li>- Maintaining basic hygiene habits of skin, hair, oral, nails etc.</li> <li>- Developing dental care, care of hands, washing etc.</li> <li>- Importance of regular exercise and nutritious food.</li> </ul>

Professional Skill 52Hrs; Professional Knowledge 12 Hrs	Recognize various factors like death rate, birth rate, morbidity, MMR, IMR etc., analyze importance of census survey and data collection.  Categorize health survey.  Familiarize with vocabulary and terminology of different acts.	121. Data collection from hospitals for Malaria cases. (05 hrs) 122. Data collection from hospitals for Dengue cases. (05 hrs) 123. Health survey of people of a locality. (05 hrs) 124. Vaccination survey in a locality. (05 hrs) 125. Design and prepare population control measures on chart.(05 hrs) 126. Collection and dispatch of food samples for analysis preparation of papers for legal proceeding. (06 hrs) 127. Performance of simple household tests to identify adulteration in milk, ghee, oil, sugar, tea etc. (07 hrs) 128. Acquaintance with registration of acts. (06 hrs) 129. Prepare reporting of different acts. (06 hrs) 130. Documentation process for implementation of different acts. (05 hrs) 131. Prepare a chart of pollution levels of toxins of different industries in an area. (05 hrs)	<u><b>Demography and health survey</b></u> - Definition and introduction of demography. - Factors of demography. - Various stage of demo. 1. High stationary 2. Early expending 3. Late expending 4. Low stationary - Health survey includes birth rate, death rate, morbidity, IMR, MMR etc. - Population control measures.  <u><b>Public Health Act</b></u> - Definition, introduction and importance of acts. - Indian Epidemic Disease Act. - Explain endemic, pandemic with examples. - Define epidemiology. - Air and Water Pollution Control Act. - Prevention of Food Adulteration Act. - Birth and Death Registration Act. - M.T.P. Act. - Suppression of Immoral Traffic Act (SITA). - Municipal and Local Body Acts related to Housing Sanitation Act. - Factory Act and ESI Acts. (12 hrs.)

**Food and Nutrition**

**Objectives:** At the end of this lesson you shall be able to

- state the significance of food and nutritional requirements for our daily needs
- cultivate the knowledge on the importance of malnutrition and balanced diet
- inculcate knowledge on the food preservation methods

**Definition of Food**

Food is any substance consumed to provide nutritional support for an organism. Food is usually of plant, animal or fungal origin, and contains essential nutrients, such as carbohydrates, fats, proteins, vitamins, or minerals.

**Functions of food**

Food is important for life. To be healthy and active, we should certainly have enough food. The food we eat should be safe and rich in all the nutrients for our body needs. We should choose from a wide variety of foods and we should eat them regularly, every day. Do not forget that we should also enjoy the food that we eat; it should look, smell and taste good. Without good nutrition, children and young people cannot develop their potential to the full and adults will have difficulty in doing their best.

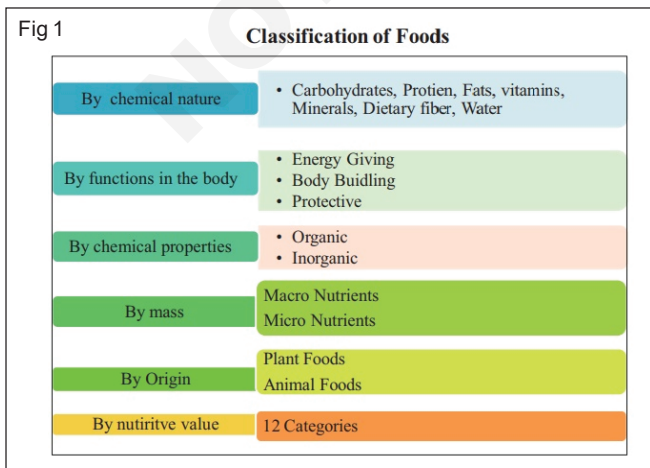
Food provides our body with what they need to

- Stay alive, be active, move and work;
- Build new cells and tissues for growth;
- Stay healthy and heal themselves;
- Prevent and fight infections.

**Nutrient**

A nutrient is a substance used by an organism to survive, grow, and reproduce. The requirement for dietary nutrient intake applies to animals, plants, fungi, and protists. Nutrients can be incorporated into cells for metabolic purposes or excreted by cells to create non-cellular structures, such as hair, scales, feathers, or exoskeletons.

**Nutrition** is the process of taking in food and converting it into energy and other vital nutrients.

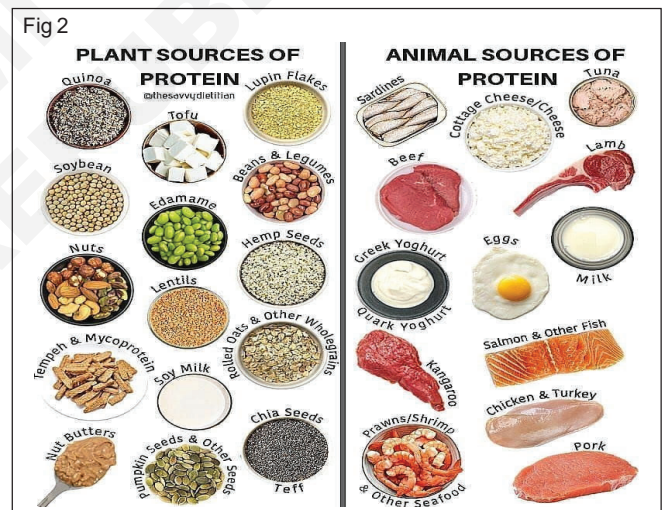


**Classification of food**

**Food can be classified** in accordance to their chemical property, to their function, to their essentiality, to their concentration and to their nutritive value.

**Protein:** Proteins are large, complex molecules that play many critical roles in the body. They do most of the work in cells and are required for the structure, function, and regulation of the body's tissues and organs. **Proteins** are made up of hundreds or thousands of smaller units called amino acids, which are attached to one another in long chains.

**Sources of Protein**



**Protein Deficiency**

Protein deficiency can lead to malnutrition, such as kwashiorkor and marasmus, which can be life threatening.

**Excess of Protein**

Extra protein is **not used efficiently by the body** and may impose a metabolic burden on the bones, kidneys, and liver. Moreover, high-protein/high-meat diets may also be associated with increased risk for coronary heart disease due to intakes of saturated fat and cholesterol or even cancer.

**Vitamins and Minerals**

The **vitamins** are natural and essential nutrients, required in small quantities and play a major role in growth and development, repair and healing wounds, maintaining healthy bones and tissues, for the proper functioning of an immune system, and other biological functions.

### Sources of Vitamin:

Water-soluble vitamins travel freely through the body, and excess amounts usually are excreted by the kidneys. The body needs water-soluble vitamins in frequent, small doses. These vitamins are not as likely as fat-soluble vitamins to reach toxic levels. But niacin, vitamin B6,

folate, choline, and vitamin C have upper consumption limits. Vitamin B6 at high levels over a long period of time has been shown to cause irreversible nerve damage. A balanced diet usually provides enough of these vitamins. People older than 50 and some vegetarians may need to use supplements to get enough B12. Table 1 - Water-soluble vitamins.

**Table 1 - Water-soluble vitamins**

Nutrient	Function	Sources
Thiamine (vitamin B1)	Part of an enzyme needed for energy metabolism; important to nerve function	Found in all nutritious foods in moderate amounts: pork, whole grain foods or enriched breads and cereals, legumes, nuts and seeds
Riboflavin (vitamin B2)	Part of an enzyme needed for energy metabolism; important for normal vision and skin health	Milk and milk products; leafy green vegetables; whole grain foods, enriched breads and cereals
Niacin (vitamin B3)	Part of an enzyme needed for energy metabolism; important for nervous system, digestive system, and skin health	Meat, poultry, fish, whole grain foods, enriched breads and cereals, vegetables (especially mushrooms, asparagus, and leafy green vegetables), peanut butter.
Pantothenic acid	Part of an enzyme needed for energy metabolism	Widespread in foods
Biotin	Part of an enzyme needed for energy metabolism	Widespread in foods; also produced in intestinal tract by bacteria
Pyridoxine (vitamin B6)	Part of an enzyme needed for protein metabolism; helps make red blood cells	Meat, fish, poultry, vegetables, fruits
Folic acid	Part of an enzyme needed for making DNA and new cells, especially red	Leafy green vegetables and legumes, seeds, orange juice, and liver; now added to most refined grains
Cobalamin (vitamin B12)	Part of an enzyme needed for making new cells; important to nerve function	Meat, poultry, fish, seafood, eggs, milk and milk products; not found in plant foods
Ascorbic acid (vitamin C)	Antioxidant; part of an enzyme needed for protein metabolism; important for immune system health; aids in iron absorption	Found only in fruits and vegetables, especially citrus fruits, vegetables in the cabbage family, cantaloupe, strawberries, peppers, tomatoes, potatoes, lettuce, papayas, mangoes, kiwifruit.

### Fat-soluble vitamins

Fat-soluble vitamins are stored in the body's cells and are not excreted as easily as water-soluble vitamins. They do not need to be consumed as often as water-soluble vitamins, although adequate amounts are needed. If you

take too much of a fat-soluble vitamin, it could become toxic. A balanced diet usually provides enough fat-soluble vitamins.

**Table 2 -Fat-soluble vitamins**

<b>Nutrient</b>	<b>Function</b>	<b>Sources</b>
Vitamin A (and its precursor*, beta-carotene) *A precursor is converted by the body to the vitamin.	Needed for vision, healthy skin and mucous membranes, bone and tooth growth, immune system health	Vitamin A from animal sources (retinol): fortified milk, cheese, cream, butter, fortified margarine, eggs, liver  Beta-carotene (from plant sources): Leafy, dark green vegetables; dark orange fruits (apricots, cantaloupe) and vegetables (carrots, winter squash, sweet potatoes, pumpkin)
Vitamin D	Needed for proper absorption of calcium; stored in bones	Egg yolks, liver, fatty fish, fortified milk, fortified margarine. When exposed to sunlight, the skin can make vitamin D.
Vitamin E	Antioxidant; protects cell walls	Polyunsaturated plant oils (soybean, corn, cottonseed, safflower); leafy green vegetables; wheat germ; whole-grain products; liver; egg yolks; nuts and seeds
Vitamin K	Needed for proper blood clotting	Leafy green vegetables such as kale, collard greens, and spinach; green vegetables such as broccoli, Brussels sprouts, and asparagus; also produced in intestinal tract by bacteria

### Minerals

A mineral is a naturally occurring inorganic solid, with a definite chemical composition, and an ordered atomic arrangement. This may seem a bit of a mouthful, but if you break it down it becomes simpler. Minerals are naturally occurring. They are not made by humans. Minerals are inorganic.

#### Sources of Minerals:

**Table 3 - Mineral sources**

<b>Nutrient</b>	<b>Function</b>	<b>Sources</b>
Sodium	Needed for proper fluid balance, nerve transmission, and muscle contraction	Table salt, soy sauce; large amounts in processed foods; small amounts in milk, breads, vegetables, and unprocessed meats
Chloride	Needed for proper fluid balance, stomach acid	Table salt, soy sauce; large amounts in processed foods; small amounts in milk, meats, breads, and vegetables
Potassium	Needed for proper fluid balance, nerve transmission, and muscle contraction	Meats, milk, fresh fruits and vegetables, whole grains, legumes
Calcium	Important for healthy bones and teeth; helps muscles relax and contract; important in nerve functioning, blood clotting, blood pressure regulation, immune system health	Milk and milk products; canned fish with bones (salmon, sardines); fortified tofu and fortified soy milk; greens (broccoli, mustard greens); legumes

Nutrient	Function	Sources
Phosphorus	Important for healthy bones and teeth; found in every cell; part of the system that maintains acid-base balance	Meat, fish, poultry, eggs, milk, processed foods (including soda pop)
Magnesium	Found in bones; needed for making protein, muscle contraction, nerve transmission, immune system health	Nuts and seeds; legumes; leafy, green vegetables; seafood; chocolate; artichokes; "hard" drinking water
Sulfur	Found in protein molecules	Occurs in foods as part of protein: meats, poultry, fish, eggs, milk, legumes, nuts

**Table 4 -Deficiency of vitamins and minerals**

Fig 3

Vitamin/Mineral	Deficiency disease/disorder	Symptoms
Vitamin A	Loss of vision	Poor vision, loss of vision in darkness (night), sometimes complete loss of vision
Vitamin B1	Beriberi	Weak muscles and very little energy to work
Vitamin C	Scurvy	Bleeding gums, wounds take longer time to heal
Vitamin D	Rickets	Bones become soft and bent
Calcium	Bone and tooth decay	Weak bones, tooth decay
Iodine	Goiter	Glands in the neck appear swollen, mental disability in children
Iron	Anaemia	Weakness

#### Fats:

Fats are nutrients that give you energy. Fats have 9 calories in each gram. Fats help in the absorption of fat-soluble vitamins A, D, E, and K. Fats are either saturated or unsaturated, and most foods with fat have both types. But usually there is more of one kind of fat than the other.

#### Sources of Fats:

- Red meat (beef, lamb, pork)
- Chicken skin.
- Whole-fat dairy products (milk, cream, cheese)
- Butter.
- Ice cream.
- Lard.
- Tropical oils such as coconut and palm oil.

#### Excess fat:

Eating too much saturated fats in your diet can raise "bad" LDL cholesterol in your blood, which can increase the risk of heart disease and stroke. "Good" HDL cholesterol has a positive effect by taking cholesterol from parts of the body where there's too much of it to the liver, where it's disposed of.

#### Fat deficiency:

If you don't get enough fat in your diet, you may notice symptoms such as **dry rashes**, hair loss, a weaker immune system, and issues related to vitamin deficiencies. To help maintain good health, most of the fats you eat should be monounsaturated or polyunsaturated fats.

#### Daily requirement of protein and vitamin

Table - Recommended Dietary Allowance

SCHS -Symbiosis Centre for Health Skills

US RDA - United States Recommended Dietary Allowance

#### Balanced diet

A balanced diet provides all the nutrients a person requires,

Fig 4

Nutrient	SCHS		US RDA	
	Men	Women	Men	Women
Protein intake (g/day)	65	54	56	46
Thiamin (B1) (mg/day)	1.0	0.8	1.2	1.1
Riboflavin (B2) (mg/day)	1.0	0.9	1.3	1.1
Niacin (B3) (mg/day)	12.3	9.8	16.0	14.0
Pyridoxine (B6) (mg/day)	1.2	1.0	1.7	1.5
Folate (B9) (µg/day)	169	145	400	400
Cobalamin (B12) (µg/day)	2.6	2.2	2.4	2.4

without going over the recommended daily calorie intake. By eating a balanced diet, people can get the nutrients and calories they need and avoid eating junk food, or food without nutritional value.

#### Importance of balanced diet

- Eating a healthy diet is all about feeling great, having more energy, improving your health, and boosting your mood. Good nutrition, physical activity, and healthy body weight are essential parts of a person's overall health and well-being.
- There's no questioning the importance of healthy food in your life. Unless you maintain a proper diet for a healthy body, you may be prone to diseases, infection, or even exhaustion. The importance of nutritious food for children especially needs to be highlighted since otherwise they may end up being prone to several growth and developmental problems. Some of the most common health problems that arise from lack of a balanced diet are heart disease, cancer, stroke, and diabetes.
- Being physically active manages many health problems and improves mental health by reducing stress, depression, and pain. Regular exercise helps to prevent metabolic syndrome, stroke, high blood pressure, arthritis, and anxiety.

## Factors to be considered on planning meals

In the planning of meals, the following factors should be considered:

- Nutritional adequacy - or the provision of palatable foods that are rich in essential nutrients. Nutrients needs of an individual are affected by age, sex, body build and activities engaged in by the individual.
- The Food Budget - The food budget is influenced by the family income, knowledge of the market shopper's shopping skills, family food likes and dislikes and their goals and values.
- Differences in food habits - This includes the dietary habits of nationality groups, regional food patterns, cultural and religious food patterns and the socio-economic background.
- The time and skill of the meal manager - The length of meal preparation, the amount of experience and the time available are to be considered.
- Suitability, availability and quality of the food to be served.
- Aesthetic and psychological aspects of food - or the proper combination of flavour, texture and shapes as well as variety in color, form and arrangement.
- Equipment available for food preparation

## Nutrient requirement of different age groups

**Fig: Recommended Daily nutritional requirements of different age groups**

### Diet Survey

Dietary survey is done to assess the quantities of food items and nutrients consumed by the family or an individual. The nutrition composition is calculated using tables of nutritive value of common foods.

There are various methods of dietary survey. Each is suitable for a different set of circumstances.

- Weighment of raw foods: The survey team visits the household and weighs all the food that is going to be cooked and eaten. Also the amount which is left over or discarded is weighed. A surveyor needs to make at least two visits prior to the main meals being cooked.
- Weighment of cooked foods: Cooked food is weighed instead of the raw materials. In Indian homes, this is not a very acceptable thing. Hence, this is more appropriate for dietary assessment of institutions, hostels, etc.
- Food frequency questionnaire method: This is for assessing how frequently an item is consumed during a fixed time period, e.g., in a week. It is more suitable for studying the diet patterns and dietary habits of a population.
- Food balance sheet method: This method is suitable when information regarding the availability and consumption of food is required at a macro level like at the global, national, region, or state levels.

## Family Assessment:

Family health assessment gives caregivers a clear picture of an individual's measures for his family wellbeing. The

Fig 5

Category	Age (years)	Protein (g)	Fat (g)	Calories (kcal)	Calcium (mg)	Iron (mg)
Children	2-3	16.7	27	1060	600	9
Children	4-6	20.1	25	1350	600	13
Children	7-9	29.5	30	1690	600	16
Boys	10-12	39.9	35	2190	800	21
Boys	13-15	54.3	45	2750	800	32
Boys	16-17	61.5	50	3020	800	28
Adult (males)	Above 18	25	60	2320	600	17

tool used for the family health assessment is Gordon's Health Pattern Assessment. This health-promoting assessment framework contains four essential components: **(a) listening to the family;** **(b) participatory dialogue;** (c) recognizing patterns; and (d) envisaging action and positive change.

## Clinical Examination of all members

A clinical examination comprises three components: the history, the examination, and the explanation, where the doctor discusses the nature and implications of the clinical findings. A patient seeks medical help for three main reasons: diagnostic purposes, treatment or reassurance, or a combination of these factors. In a physical examination, medical examination, or clinical examination, a medical practitioner examines a patient for any possible medical signs or symptoms of a medical condition. Together, the medical history and the physical examination help to determine a diagnosis and devise the treatment plan.

## Measuring Weight

- Use a digital scale. ...
- Have the child or teen remove shoes and heavy clothing, such as sweaters.
- Have the child or teen stand with both feet in the center of the scale.
- Record the weight to the nearest decimal fraction (for example, 55.5 pounds or 25.1 kilograms).

## Measuring Height

- Height measurements are usually taken using a **drop down measure attached to a scale or wall.**
- The patient should remove their shoes, be positioned directly underneath the drop down measuring device stand straight and look directly forward.
- Lower the measuring device until it rests gently on the top of the head.

Fig 6

	Duplicate diet approach	Food consumption record	24-Hour dietary recall	Dietary record	Dietary history	Food frequency questionnaire
Methods	Collection of duplicate diet sample and direct analysis	Objective observation by trained staff at the household level	Subjective measure using open-ended questionnaires administered by a trained interviewer	Subjective measure using open-ended, self-administered questionnaires	Subjective measures using open- and closed-ended questionnaires administered by a trained interviewer	Subjective measure using a predefined, self- or interviewer-administered format
Collected data	Actual intake information throughout a specific period	Actual intake information throughout a specific period	Actual intake information over the previous 24 hours	Actual intake information throughout a specific period	Usual intake estimates over a relatively long period	Usual intake estimates over a relatively long period (e.g., 6 months or 1 year)
Strengths	Measurement of dietary exposures possible (e.g., environmental contaminants)	Ease of application among those with low literacy or those who prepare most meals at home	Provides detailed intake data; relatively small respondent burden (literacy not required)	Provides detailed intake data; no interviewer required; no recall bias	Assesses usual dietary intake	Assesses usual dietary intake simply; cost-effective and time-saving; suitable for epidemiological studies
Limitations	Not suitable for large-scale studies	Individual dietary consumption not accurate; Not suitable among those frequently eat outside the home	Possible recall bias; trained interviewer required; possible interviewer bias; expensive and time-consuming; multiple days required to assess usual intake; possible changes to diet if repeated measures	Relatively large respondent burden (literacy and high motivation required, possible under-reporting); expensive and time-consuming; multiple days required to assess usual intake; possible changes to diet if repeated measures	High cost and time-consuming; not suitable for epidemiological studies	Specific to study groups and research aims; uses a closed-ended questionnaire; low accuracy (recall bias); requires accurate evaluation of developed questionnaires

Fig: Dietary Assessment Procedures

**Body Mass Index (BMI)**

Body Mass Index (BMI) is a **person's weight in kilograms divided by the square of height in meters.**

A high BMI can indicate high body fatness. BMI screens for weight categories that may lead to health problems, but it does not diagnose the body fatness or health of an individual. BMI is a measurement that takes into account your height, and weight to produce a calculation. This calculation is a measurement of your body size and can be used to determine how your body weight is related to your height.

BMI is not a diagnostic tool nor is it a measurement of body fat percentage. A high BMI may or may not be an indicator of high body fat, but it doesn't necessarily mean that a person is overweight or obese and it alone is not a direct indicator of health.

In some populations, BMI has been found to be a fairly reliable indicator of body fat measures. But the calculation is less effective in other groups, such as bodybuilders and older adults. There are other methods that are more accurate in estimating body fat.

**How BMI Is Measured**

BMI is calculated using your height and weight. It can be a starting point for understanding the way your body fat may impact your overall health. You can use the number

along with other health measurements to begin a conversation with your healthcare provider about ways to reduce your risk for disease and improve your overall wellness.

Imperial

- Formula: weight (lb) / [height (in)]<sup>2</sup> x 703
- Example: weight = 150 lbs, height = 5'5" (65")
- BMI calculation: [150 / (65)<sup>2</sup>] x 703 = 24.96

Metric

- **Formula:** weight (kg) / [height (m)]<sup>2</sup>
- **Example:** weight = 68 kg, height = 165 cm (1.65 m)
- **BMI calculation:** 68 / (1.65)<sup>2</sup> = 24.98

Note that BMI is interpreted differently in children. Growth charts and percentiles are used. If children are at or above

BMI Measurement	Weight Category
Below 18.5	Underweight
18.5 - 24.9	Normal weight
25.0 - 29.9	Overweight
30.0 and above	Obese



the 95th percentile of children their age, they are considered obese.

For adults, BMI results are interpreted as follows.

**Table - BMI chart**

**Head Circumference**

Head circumference is a measurement of a person's head around its largest area. It measures the distance from above the eyebrows and ears and around the back of the head. Head circumference is measured with a tape measure extending from the middle of the forehead to the farthest part in the rear of the head. Measurement should be done using a strong flexible tape measure, though a paper tape measure may be used until an infant has substantial hair. Macrocephaly usually denotes a head circumference greater than the 97th percentile. Enter the head circumference in the program at the top of this page to calculate the percentile.

**Table - Height-weight chart for kids**

**Blood Test for Haemoglobin**

The haemoglobin blood test used to measure the concentration of haemoglobin in the blood. (Hb) is a protein found in the Red blood cells (RBC).

The normal range of haemoglobin in males and females is as follows.

- **Haemoglobin range in Males:** 13 to 17 g/dl.
- **Haemoglobin range in females:** 12 to 16 g/dl.

**Note: The different level of Haemoglobin in males and females is due to a different level of hormones. This difference can be due to the menses cycle in females.**

Fig 7

Age	Head Circumference	When to Stop Increasing	Hat Height (To Mid-Ear)
Preemie 30 - 35 weeks Gestation	11 - 12.5"	3.5 - 3.9"	4"
Newborn 36 - 40 weeks Gestation	12.5 - 13.5"	4.0 - 4.2"	4.25"
0 - 3 Months	13.5 - 15.5"	4.3 - 4.7"	4.5"
3 - 6 Months	15 - 17"	4.8 - 5.1"	5"
6 - 12 Months	16 - 18"	5.1 - 5.4"	5.5"
1 - 3 Years	17.5 - 19.5"	5.6 - 5.9"	6"
3 - 5 Years	19 - 20"	6.1 - 6.3"	6.5"
6 - 10 Years	20 - 21"	6.4 - 6.6"	7"
Teen / Small Adult	21 - 22"	6.7 - 6.9"	7.25"
Medium Adult	22 - 23.5"	7 - 7.4"	7.5"
Large Adult	23.5 - 25"	7.5 - 7.8"	7.75"

**Table - Average head circumference for all age groups**

Fig 8

Months	Length (cm) 3rd to 97th percentile	Weight (kg) 3rd to 97th percentile	Head circumference (cm)3rd to 97th percentile
0	46.3 - 53.4	2.5 - 4.3	32.1 - 36.9
1	51.1 - 58.4	3.4 - 5.7	35.1 - 39.5
2	54.7 - 62.2	4.4 - 7.0	36.9 - 41.3
3	57.6 - 65.3	5.1 - 7.9	38.3 - 42.7
4	60.0 - 67.8	5.6 - 8.6	39.4 - 43.9
5	61.9 - 69.9	6.1 - 9.2	40.3 - 44.8
6	63.6 - 71.6	6.4 - 9.7	41.0 - 45.6
7	65.1 - 73.2	6.7 - 10.2	41.7 - 46.3
8	66.5 - 74.7	7.0 - 10.5	42.2 - 46.9
9	67.7 - 76.2	7.2 - 10.9	42.6 - 47.4
10	69.0 - 77.6	7.5 - 11.2	43.0 - 47.8
11	70.2 - 78.9	7.4 - 11.5	43.4 - 48.2
12	71.3 - 80.2	7.8 - 11.8	43.6 - 48.5

**Malnutrition**

**Objectives:** At the end of this lesson you shall be able to

- state differentiation of types malnutrition
- state health education to overcome problems of malnutrition
- state methods of prevention and videos displayment

**Nutrition Education**

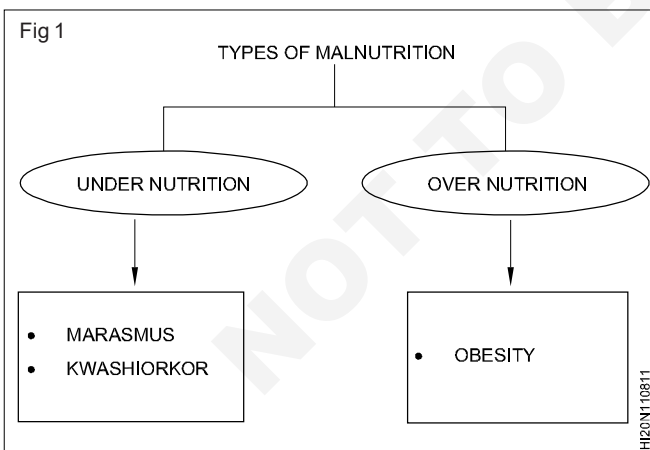
Nutrition education is a set of learning experiences designed to assist in healthy eating choices and other nutrition-related behaviour. It includes any combination of educational strategies, accompanied by environmental supports, designed to facilitate voluntary adoption of food choices and other food and nutrition-related behaviours conducive to health and well-being. Nutrition education is delivered through multiple venues and involves activities at the individual, community, and policy levels.

**Malnutrition**

Malnutrition refers to deficiencies, excesses or imbalances in a person's intake of energy and/or nutrients. The term malnutrition covers 2 broad groups of conditions. One is 'under nutrition'-which includes stunting (low height for age), wasting (low weight for height), underweight (low weight for age) and micronutrient deficiencies or insufficiencies

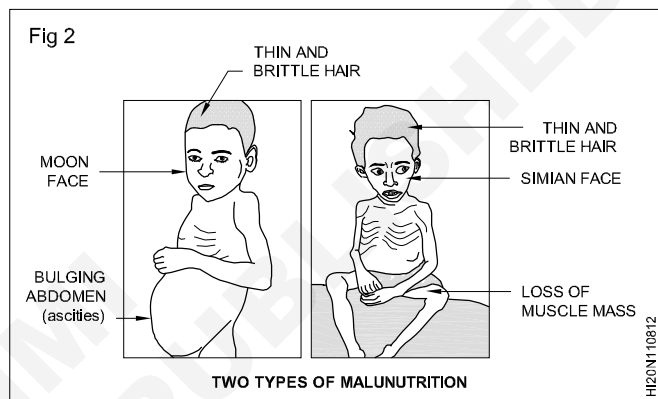
**Causes**

- Malnutrition can be caused due to either environmental or medical conditions:
- Reduced food intake
- Social and mobility problems leading to difficulty in preparing or finding meals



- Lack of breastfeeding
- Mental health problems like schizophrenia, depression, dementia and anorexia nervosa
- Digestive disorders and stomach conditions like ulcerative colitis
- Alcoholism
- The population at risk of malnutrition include:

- Older people, especially those who are hospitalised or in long-term institutional care
- Those who have difficulty absorbing nutrients
- Socially isolated individuals



- People with chronic eating disorders
- People who are recovering from a serious illness or condition

**Prevention**

- Promotion of breastfeeding, particularly in developing countries where safe alternatives to human milk are unavailable
- Counselling of parents by health care providers on the nutritious supplemental foods to eat in malnutrition
- Eating a healthy, balanced diet
- Emphasis on prenatal nutrition and good prenatal care

**Low Birth Weight**

Low birth weight is a term used to describe babies who are born weighing less than 5 pounds, 8 ounces (2,500 grams). Babies weighing less than 3 pounds, 5 ounces (1,500 grams) at birth are considered to be the low birth weight in your child is more important than the actual weight itself. This is because the cause determines your baby's health as he grows up.

**Causes of low birth weight**

The following are the top 12 causes for low birth weight in children:

- **Preterm birth:** If your baby is born before completing 37 weeks inside you, then he will most likely be underweight

- **Multiple pregnancy:** If you are having more than one baby, i.e. if you are having twins or triplets or more, then again individual weight of each of your children might be below 2.5 kg. This because more babies stretch the uterus and compete for limited nutrients, putting extra strain on the mothers' body, which can further cause certain deficiencies
- **Intrauterine Growth Restriction (IUGR):** These babies are born full-term but still are "small-for-gestational" age. They are most likely healthy, especially if the lower birth weight is due to genetics. Birth weight. Low birth high blood pressure in mother: If mother has high BP, then the blood flow to the baby from the placenta is impacted, resulting in low birth weight
- **Substance abuse by mother:** If mother smokes or uses illegal drugs or alcohol, it can restrict the baby's growth and hence impact his weigh. Harmful chemicals are released in the placenta which results in reduced supply of oxygen to the baby, and thus inhibiting the growth and development
- **Placenta related problems:** If the mother is affected by any of the placenta-related problems (e.g. pre-eclampsia or placenta previa), then the flow of blood and nutrients to the baby is impacted, resulting in lower weight.
- **Diabetes:** While diabetes is known for resulting in a big baby, it can also result in preterm birth which will impact baby's weight
- **Most Uterus Abnormalities:** Sometimes the baby cannot grow big due to the restrictions imposed by the uterus, such as fibroids and uterine malfunctions
- **Cervix abnormalities:** If the mother has cervix abnormalities, it can also result in low birth weight. An incompetent cervix may spur a premature delivery and birth as it gets pressurized to open as the baby grows. Circulate, a stitch on the cervix is generally put and the mother is advised complete bed rest in many cases.
- **Lack of nutrition:** If the mother has not gained enough weight during pregnancy due to malnutrition or imbalanced diet, it can affect baby's weight. A baby needs a constant supply of nutrients to grow and develop, and mother's diet is the primary source of nutrition for her. Not eating a balanced and a healthy diet can increase the chances of having a low birth weight baby
- **Infections during pregnancy:** Infections and the drugs used to fight infections can impact baby's weight gain.
- **History:** Prior pre term deliveries or low birth deliveries will increase the probability of a low birth delivery subsequently

#### **Prevention of low birth weight:**

- Take daily prenatal vitamins containing folic acid and iron

- Keep your stress levels as low as possible
- Do 150 minutes of moderate exercise per week
- Schedule regular check-ups with your doctor to ensure you're health during your pregnancy
- Avoid unhealthy behaviours
- Get your diabetes under control.
- Treat toxoplasmosis, if you have it.
- Take proper steps to lower your blood pressure if necessary

#### **Treatment of Malnutrition in Kids**

In order to treat malnutrition, it is important to identify the root cause first. Once the root cause is established, the doctor will suggest specific changes to the diet plan to include supplements and correct quantities of food items to rectify under or over nourishment. Many of the adverse effects of malnutrition can be rectified and reversed if action is taken in time. Here are some ways malnutrition in kids can be treated.

##### • **Home Remedies**

During the initial stages of malnutrition, proper care and consumption of a balanced and nutrient-rich diet at home will help your child recover from the condition. Some home remedies to recover from malnutrition include:

- Consuming nutritious food at regular intervals.
- Ensuring a balanced diet for your child.
- Following the diet plan suggested by the doctor.
- Drinking more than 1.5 litres of water daily.

##### • **Medication**

Depending on the severity and cause of malnutrition, the doctor will suggest necessary steps to recover from the condition. Some of them are:

- Medication and dietary supplements for the child.
- Usage of feeding tubes for kids who are unable to eat on their own.
- Intensive care and continuous monitoring in case of severely malnourished kids.

##### • **How to Avoid Malnutrition in Kids**

- The most common root cause for malnutrition in kids is insufficient intake of nutrients and lack of exercise. For the prevention of malnutrition in children, parents must:
- Ensure that infants receive enough breast milk.
- Any lactation issues should be treated immediately, or the baby's meals should be supplemented with formula milk.
- Ensure that the child receives the right balance of nutrients through healthy food intake and dietary supplements.
- Ensure that the child is physically active.

To ensure your child is healthy, you need to include significant nutrients in his diet. Read below to know these nutrients and how you can prevent malnutrition in your child.

### Significant Nutrients Needed to Prevent Malnutrition

Your child's diet must include the following nutrients to prevent malnutrition:

- Carbohydrates
- Protein
- Iron
- Vitamins
- Fats
- Calcium

Foods that can help to prevent Malnourishment in Children

- Fruits and vegetables
- Dairy products such as milk, cheese, and yoghurt
- Rice, potato, cereals and other food items with starch.
- Meat, fish, eggs, beans and foods that are rich in proteins
- Fats - oils, nuts, seeds

Now you know the foods you need to include in your child's diet to prevent malnourishment. Let's also take a look at the daily nutritional needs to ensure your child gets the right amount of nourishment every day.

### Daily Nutritional Needs of Children

Following are the daily nutritional needs of children:

- Two servings each day of fruits and vegetables.
- Four servings of whole grain food such as buckwheat, brown bread or multi-grain bread.
- Three servings of a full glass of milk. Cheese, puddings, curd can be some of the alternatives.
- Two servings of protein-rich food such as eggs, fishes, and lentils.
- Daily supplements of vitamins and minerals as prescribed by the medical consultant.

### Therapeutic diet

A diet is all that we consume in a day. And a balanced diet is a diet that contains an adequate quantity. It is a diet that contains all the vital nutrients required by the human body is called a balanced diet. A balanced diet comprises vital nutrients like carbohydrates, fats, vitamins, minerals, proteins, and fibre. Sufficient and nutritious food that ensures good health is included in a balanced diet.

A healthy and balanced diet helps to reduce the risk of diseases and improves overall health.

- Aim to eat at least five portions of fruit and vegetables each day.
- Drink plenty of water (six to eight glasses is recommended, though this will vary).

- Try to include at least two portions of fish every week.
- Get into the habit of eating breakfast daily; it can help reduce snacking later on.
- Adults are advised to conduct 150 minutes of moderate exercise every week

### Weight reducing diet

#### • Low fat diet

Everyone differs in terms of their metabolism and hence may react differently to this diet too. Super foods are the biggest key to quick and healthy weight loss. Super foods are nothing but regular foods that have concentrated with nutrients. They could be millets, seeds, certain grass varieties, or even fibre-rich food.

#### • Leafy Greens

Leafy greens contain virtually no fat and are loaded with beneficial minerals and vitamins, including calcium, potassium, folate and vitamins A and K.

#### • Fruits

Fruits are an excellent option if you're looking for a sweet, low-fat snack. Almost all fruits are low in fat and high in vitamins, minerals and fiber.

#### • Beans and Legumes

Legumes - also known as pulses - are a class of vegetable that includes beans, peas and lentils.

#### • Sweet Potatoes

The sweet potato is a hearty, low-fat root vegetable. One medium sweet potato contains only 1.4 grams of fat.

#### • Cruciferous Vegetables

Cruciferous vegetables are a robust source of nutrients, including fiber, folate, other minerals, as well as vitamins C, E and K (23).

Some common cruciferous vegetables include:

- Broccoli
- Cauliflower
- Brussels sprouts
- Cabbage
- Bok choy
- Turnips

#### • Mushrooms

Mushrooms are a delicious, fat-free food with many purported health benefits.

#### • Garlic

Garlic's bold flavor and aroma make it a popular ingredient. What's more, it has very few calories and almost no fat.

#### • White, Lean Fish

White, lean fish includes haddock, cod, perch and pollock. These types of fish are low in fat, contain very few calories and are an excellent source of high-quality protein.

- **Chicken Breast**

Chicken breast is a popular, low-fat food that provides an impressive amount of high-quality protein in just one serving.

- **Low-Fat Dairy**

Low-fat dairy includes skim or fat-free milk and low-fat varieties of yogurt and cottage cheese.



- **Egg Whites**

While whole eggs are not considered a low-fat food,

**Bland diet**

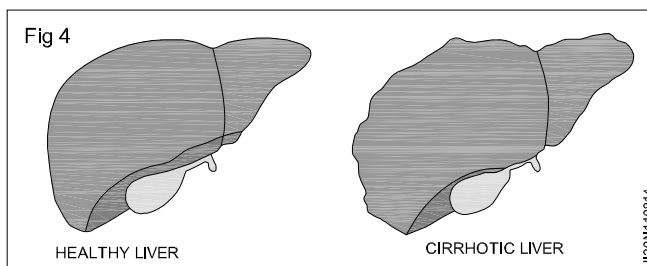
A bland diet is an eating plan that emphasizes foods that are easy to digest. If you're following this diet, you should choose foods that are low in fat, low in fiber, and easy to chew. And as the name implies, the bland diet calls for foods that are mild in flavor.

Foods you can eat on a bland diet include:

- I. Milk and other dairy products, low-fat or fat-free only
- II. Cooked, canned, or frozen vegetables
- III. Potatoes
- IV. Canned fruit as well as apple sauce, bananas, and melons
- V. Fruit juices and vegetable juices (some people, such as those with GERD, may want to avoid citrus and tomato)

**Cirrhosis of liver**

Cirrhosis is a **slowly developing disease in which healthy liver tissue is replaced with scar tissue**. The scar tissue blocks the flow of blood through the liver and slows the liver's ability to process nutrients, hormones,



drugs and natural toxins (poisons). It also reduces the production of proteins and other substances made by the liver. Cirrhosis eventually keeps the liver from working properly.

**Fig: Cirrhosis of liver**

**Symptoms**

Cirrhosis is usually asymptomatic especially in the initial stages. Symptoms are seen in advanced stages after extensive liver damage. When symptoms do occur, they are often non-specific like:

- Weakness
- Fatigue
- Muscle cramps
- Weight loss
- Nausea
- Vomiting
- Upper abdominal pain

Other symptoms include:

- Easy bruising and bleeding
- Jaundice
- Swelling of legs
- Reduction in breast size
- Irregular periods in women

**Prevention**

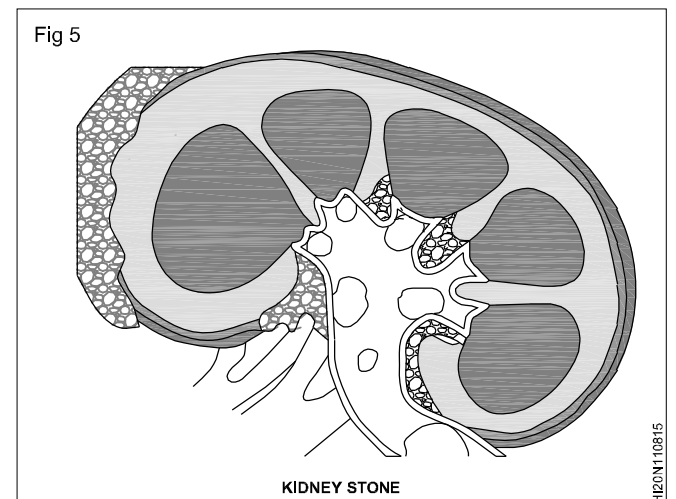
- Limit alcohol consumption
- Exercise regularly
- Have a healthy diet and maintain the right bodyweight
- Get vaccination against Hepatitis A & B

**Renal stone**

Kidney stones (also called renal calculi, nephrolithiasis or urolithiasis) are hard deposits made of minerals and salt that form inside your kidneys.

**Symptoms**

If you have a very small kidney stone that moves easily through your urinary tract, you may not have any symptoms, and may never know that you had a kidney stone.



If you have a larger kidney stone, you may notice any of the following symptoms:

- Pain while urinating
- Blood in your urine
- Sharp pain in your back or lower abdomen
- Nausea and vomiting

### Fig: Kidney Stone

#### Causes and risk factors

- Anyone can get a kidney stone, but some people more likely than others to have them. Men get kidney stones more often than women do. Kidney stones are also more common in non-Hispanic white people than in people of other ethnicities. You may also be more likely to have kidney stones if:
  - You have had kidney stones before.
  - Someone in your family has had kidney stones.
  - You don't drink enough water.
  - You follow a diet high in protein, sodium and/or sugar.
  - You are overweight or obese.
  - You have had gastric bypass surgery or another intestinal surgery.
  - You have polycystic kidney disease or another cystic kidney disease.
  - You have a certain condition that causes your urine to contain high levels of cystine, oxalate, uric acid or calcium.
  - You have a condition that causes swelling or irritation in your bowel or your joints.
  - You take certain medicines, such as diuretics (water pills) or calcium-based antacids.

#### Prevention

- **Drink lots of water.** Stay hydrated, especially when you exercise.
- **Check food labels.** Read the ingredients. Avoid or cut back on foods with high amounts of ingredients like sodium chloride, monosodium glutamate (MSG), and sodium nitrate.
- **Choose foods wisely.** Usually it's good to get more spinach and nuts in your diet. But if you have calcium oxalate stones, which are the most common type, your doctor may tell you to avoid or limit foods high in oxalates:
  - Nuts, including almonds, cashews, pistachios, and peanuts
  - Soy products, including soy burgers, soy milk, and soy cheese
  - Chocolate
  - Oat and oat bran
  - Red kidney beans, navy beans, and fava beans
  - Beets, spinach, kale, and tomato
  - Grapes, melons, bananas
  - Cucumbers, cauliflower, cabbage, peas
  - Cheese, milk, butter

- Beef, bacon, chicken, ham
- **Eat citrus fruits.** Lemons and limes are high in citrate, which helps prevent kidney stones.
- **Get plenty of calcium.** Not enough calcium in your diet can lead to kidney stones. It's better if you get it from food, like low-fat dairy products, rather than supplements.

#### Food Preservation

**Food preservation** is a form of processing of **food** to prevent it from spoilage and making it possible to store in a fit condition for future use. It may be as simple as boiling of milk or complicated like pickling of mango or lemon. By preserving foods, we are also increasing their shelf life.

#### Methods of Preservation

For thousands of years, humans have been using various methods to prolong the freshness and safety of their food to stabilize their food supply. While some of these methods are relatively new, many of them date back to ancient times. We may have refined the processes and come to better understand the mechanisms, but the basic concepts remain the same today. Here are a few of the most common ways to preserve food.

## Spoilage of food item - Application of common salt & sugar

**Objectives:** At the end of this lesson you shall be able to

- define spoilage of food items
- state application of salt and sugar

### Chemical Method

Salt and edible oils are two main preservatives which are used since ages to prevent microbial growth. This is why we add extra oil to pickles. Preservation by salt is known as salting. Salting helps to preserve fruits for a long term. Meats and fishes can also be preserved by salting.

Other synthetic preservatives include vinegar, sodium benzoate, sodium meta-bisulphite, etc.



Fig: Preservation using salt

### a Sugar

Sugar is another common preservative used in jams and jellies. Sugar is a good moisture absorbent. By reducing moisture content, it restrains the microbial growth.



Fig: Preservation using Sugar

### b Heat and Cold Methods

Boiling and refrigeration prevent around 70 percent of microbial growth. Boiling kills the microorganisms that cannot tolerate extreme temperatures. Thus, it helps in food preservation. Refrigerators have very low temperatures. Since microbes do not get optimum temperature they need for growth, their growth is inhibited. Pasteurization developed by Louis Pasteur is used until today to preserve milk.

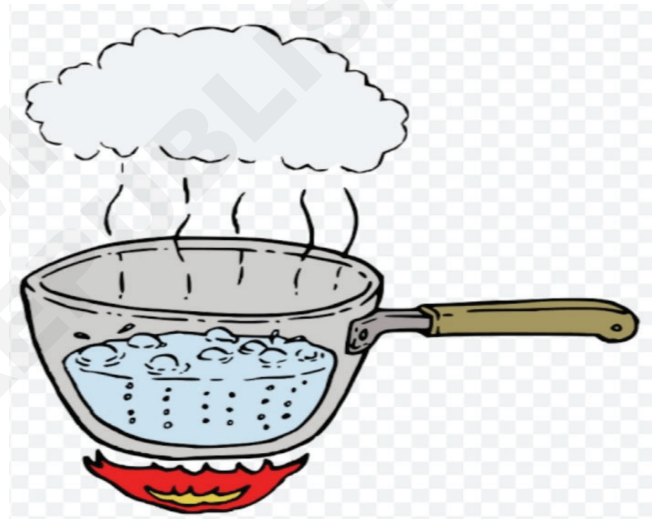


Fig: Preservation using heat and cold

### c Smoking

Smoking prevents dehydration in fish and meat and thus prevents spoilage. The wood smoke contains a large number of anti-microbial compounds that slow the acidification of animal fats.



**Fig: Smoking**



**Fig: Dehydration**

**d Canning**

The food contents are sealed in an airtight container at high temperatures. Meat, fish, fruits are preserved by canning.



**Fig: Canning**

**e Sterilization**

This method is carried out to remove microbes from food. For e.g., milk sterilization at 100°C kills the microbes.



**Fig: Sterilisation**

**f Dehydration**

It is the process of removal of water from food. It is the simplest method and prevents food spoilage by removing water.

**g Lyophilisation**

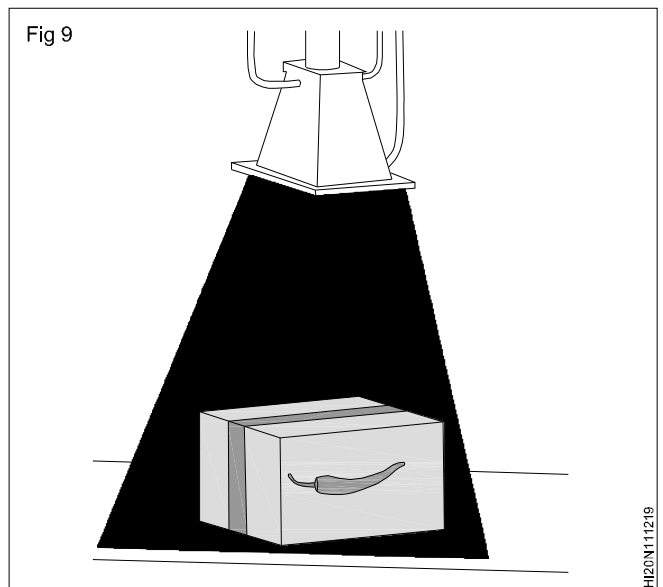
This is the process of freezing and dehydration of the frozen product under vacuum.



**Fig: Lyophilisation**

**h Radiation**

This method is also known as cold sterilization. The UV rays, X rays, gamma rays kill all the unwanted microbes present in food.



**Fig: Radiation**



## Pasteurization

Pasteurization or pasteurisation is a process in which packaged and non-packaged foods (such as milk and fruit juice) are treated with mild heat, usually to less than 100 °C (212 °F), to eliminate pathogens and extend shelf life. The process is intended to destroy or deactivate organisms and enzymes that contribute to spoilage or risk of disease, including vegetative bacteria,



Fig: Pasteurisation

### Methods and Types:

Initially, the target organism was the bacterium that caused tuberculosis (*Mycobacterium bovis* or *M. tuberculosis*). In the 1950's, the minimum pasteurization temperature was increased to destroy a slightly more heat-resistant organism that was associated with raw milk, *Coxiella burnetii*, which causes Q-fever.

- **Thermization:** Heat the milk to between 57°C to 68°C and hold for 15 minutes. Thermization targets pathogenic bacteria while leaving the good bacteria in the product. The low temperatures do not alter the structure and taste of the milk.
- **Batch pasteurization:** Also known as low-temperature long time (LTLT) pasteurization. Heat the milk to 63°C for 30 minutes. The extended holding time causes the alteration in the milk protein structure and taste.

Batch (Vat) Pasteurization	
Temperature	Time
63°C (145°F)*	30 minutes
Continuous Flow (HTST and HHST) Pasteurization	
Temperature	Time
72°C (161°F)*	15 seconds
89°C (191°F)	1.0 second
90°C (194°F)	0.5 seconds
94°C (201°F)	0.1 seconds
96°C (204°F)	0.05 seconds
100°C (212°F)	0.01 seconds

Fig: Pasteurization method

- **Flash pasteurization:** Also known as high-temperature short time (HTST) pasteurization. Heat the milk to between 72°C to 74°C for 15 to 20 seconds.
- **Ultra-high temperature (UHT) pasteurization:** Heat the milk to between 135°C to 140°C for 2 to 4 seconds. The extreme heat targets *Coxiella burnetii*, which causes Q-fever. The heat kills all the vegetative forms of bacteria and the milk can survive for 9 months.
- **Canned sterilization:** This is a wet treatment of canned milk products in an autoclave/specialized treatment chamber. Heat to between 115°C to 121°C for 10 to 20 minutes.

### Importance of Pasteurization

Pasteurization has several important benefits when used to prepare foods and semi-solids for distribution. Six of those include the benefits discussed below.

#### • Prolonged shelf life

Keeping product fresh long enough for it to make it to market and then on to consumers' pantries is key. Some bacteria and other microorganisms can cause food products to deteriorate faster than it takes for the end consumer to purchase it, so pasteurization is vital to making your food products viable.

#### • Preventing disease

Diseases are found in many food products, and removing the organisms that cause those diseases is critical to ensuring your product is safe for general consumption. For example, eggs are known to spread salmonella and avian flu, and pasteurization kills the organisms that cause those diseases. Some food products are breeding grounds for microbes, which means that as sterile as your processing plant may be, there may be a chance your product would cause disease later on if it's not pasteurized.

#### • Quick and safe sanitation

There are many ways to sanitize food products, but few are as quick or as safe as pasteurization. With pasteurization, the temperature of the product is simply raised enough to destroy any microorganisms that may be present. Other methods may involve chemical treatments or radiation, and may not be the safest to use.

Pasteurization is also faster than most methods that rely on filtration or other means.

#### • Consistent product quality

By eliminating volatile contaminants, the product becomes more stable, therefore the quality of your product is more consistent. A more consistent product means your customers know what to expect from your production lines, and it's easier to provide reliable results.

#### • Potential improvements in flavour and scent

In some cases, the pasteurization process can improve the smell and taste of your product. Often, foods and other products may have bacteria that produce unpleasant

smells over time but do not necessarily impact the product's quality besides. Removing those bacteria can create a more consistently pleasant experience for the consumer.

#### • **Regulatory compliance**

Numerous laws are in place that require certain food products to be pasteurized or otherwise treated to remove bacteria and viruses. For example, the FDA requires that pasteurized eggs or egg products should be used instead of raw eggs in certain products when serving populations such as school children and nursing home patients.

#### **Refrigeration:**

The term refrigeration means cooling a space, substance or system to lower and/or maintain its temperature below the ambient one.

#### **Prevent spoilage using refrigeration**

Refrigerators decrease the food temperature which slows down the growth of bacteria, mold, and viruses... The colder the temperature, the slower they reproduce. Food that is frozen can last decades, but the cold temperatures will cause "freezer burn" and may change the way the food tastes.

#### **Food Hygiene and Cleanliness of Kitchen equipment and cooking utensils**

A lot of people believe that harmful food-poisoning bacteria come from direct consumption of food, when in fact these germs also spread to and from our hands. Eliminating the risk of this is simple if you wash your hands thoroughly and regularly as hand washing significantly reduces the spread of E. Coli, salmonella and several other types of harmful bacteria.

You should wash your hands before and after food handling, especially raw meats, fish and eggs, and ALWAYS after a trip to the bathroom. 'Proper' hand washing requires using hot soapy water and scrubbing for at least 20 seconds, something we should all be used to by now - thanks, corona. Hands should then be dried in a hygienic manner such as an air dryer or paper towel.

Food handlers should refrain from wearing rings, watches and bracelets when in a catering kitchen as they become a breeding ground for germ build-up which can then be transferred to food. Avoiding other external hazards such as heavy makeup, strong perfumes or aftershaves and nail varnish etc. is also highly advised.

#### **Concepts of Safe Food Hygiene**

How you store your food in a professional kitchen is just as important as cooking and serving methods. Safe food storage includes:

- Allowing food to cook thoroughly before it is stored in a fridge or cold room
- A rule of thumb is if you cannot store it cool or hot; don't keep it. Food kept at room temperature prior to or after cooking is more prone to bacteria
- Never store food in cold storage for more than 7 days

- Don't leave food items on your kitchen counter, unless they are dry foods and it is safe to do so
- All raw foods should be well covered or wrapped - open food is also prone to bacteria
- Organise your cold room or food storage according to use-by date of products and ensure proper stock rotation
- Store animal products on the bottom shelves of your fridge to prevent cross-contamination and food poisoning

#### **Carefully Preparing Food**

Proper food preparation is another key ingredient for operating a hygienic kitchen or takeaway business. Taking precautionary steps during prep will also help to prevent food poisoning and ensure food is safe to eat.

- Wash all fruits and vegetables before cooking or serving
- Use different colour chopping boards for meats, vegetables, fish, poultry or eggs
- If not, wash chopping boards carefully in hot, soapy water between uses
- Prevent cross-contamination by keeping these foods away from others
- Check food is cooked thoroughly and to a safe temperature using a food thermometer
- Store food in a cold room or fridge within two hours of buying or preparation
- Buy meat, poultry and fish from providers who don't use antibiotics
- Try to buy organic foods where possible

#### **Concepts of cleanliness of kitchen equipment and cooking utensils**

In any commercial kitchen, you should keep your work area clean-as-you-go and the kitchen should receive a deeper top-to-bottom clean at the end of every workday.

Cutting corners might seem appealing at the end of a busy shift. However, the average chopping board has more bacteria than the average toilet seat, so your cleaning process and food hygiene rule in the kitchen should be a top priority.

Damp cloths, sponges and brushes are havens for bacteria, so using prime hygiene products and cleaning chemicals to regularly clean surfaces helps to reduce cross-contamination and food-borne illnesses quite drastically.

- Keep surfaces, crockery, cutlery, chopping boards and utensils clean using hot soapy water
- Wipe all surfaces and food preparation areas multiple times throughout the day

- Air dry all kitchen equipment or use disposable towels and paper towels
- Tea towels should be kept clean, air-dried when possible and in a fit state
- Repair scourers, dish-washing sponges and cleaning clothes regularly
- Wash and disinfect the sink at least once a day - including plug, plug chain and taps
- Wipe the oven after every use and a full clean at the end of every shift

### **Avoid Cross-Contamination**

Preventing cross-contamination is one of, if not THE biggest, commercial kitchen food hygiene rules to enforce in your space. Avoiding cross-contamination helps to eradicate the spread of harmful bacteria, food poisoning and other food-borne illness, but also it is important to remember that cross-contamination is detrimental to vegetarian or plant-based diets, too.

Avoiding cross-contamination can be simple if you stay on top of it, keep an organised kitchen and clean as you go.

The most effective ways to prevent cross-contamination include when you handle food:

- Cleaning work surfaces immediately after fish, eggs, poultry and raw meat have been prepared or handled
- Using colour-coded cutting boards for preparing the above items, farm produce and cooking foods
- Keeping separate cleaning cloths for use on surfaces where different meats, fish and poultry are handled
- Separating kitchen equipment and utensils used to prepare raw meats and poultry away from other foods
- Wash and disinfect utensils regularly throughout the day - and after every use, if you cannot keep separate utensils for raw meats
- Disinfect cleaning clothes regularly throughout the day
- Clean work surfaces as you go and keep a high standard of cleanliness in the kitchen
- Maintain high standards of personal hygiene

### **Effects on various health issues**

#### **• Prevent the Spread of Infection**

Bacteria can spread anywhere in the kitchen. So it's important to wash your hands and kitchen surfaces before and after making food. Bacteria can spread from one surface to another without you knowing it. If the bacteria get into food, they can cause foodborne illnesses.

#### **• Sources of contamination**

Hand-to-hand or hand-to-food contact. Most viruses and bacteria that cause colds, flu, and foodborne illnesses are spread this way. People with hepatitis A, noroviruses, salmonella, or the bacteria staphylococcus and streptococcus can pass these illnesses on to others by handling food.

- Raw meats, poultry, and fish. These carry many harmful bacteria. One of the most serious is E.coli. This is the organism found mostly in undercooked hamburger. It is one of the most common causes of foodborne illness, according to the CDC. This type of bacteria causes haemolytic uremic syndrome. This is an often-deadly disease that strikes mostly children. Older adults are also at high risk.
- Chicken, turkey, and poultry. These are linked to shigella, salmonella, and campylobacter. These are bacteria that cause diarrhea, cramping, and fever. Most meat can be contaminated with toxoplasmosis. This is a parasitic disease dangerous to both pregnant women and unborn babies.
- Seafood, particularly oysters, clams, and other shellfish. These can be contaminated with the vibrio species of bacteria that causes diarrhea. Or they can be contaminated with hepatitis A virus.
- Unpasteurized cheese and some meat. These can be contaminated with a strain of bacteria (*Listeria monocytogenes*) that can cause disease in people. It can also cause miscarriage or damage to a developing baby during pregnancy. *Listeria* is often found in soft cheeses such as brie. It's found more often in imported cheeses than in U.S. cheeses. *Listeria* is one of the few bacteria that grow well in the 40°F (4°C) temperature of a refrigerator.

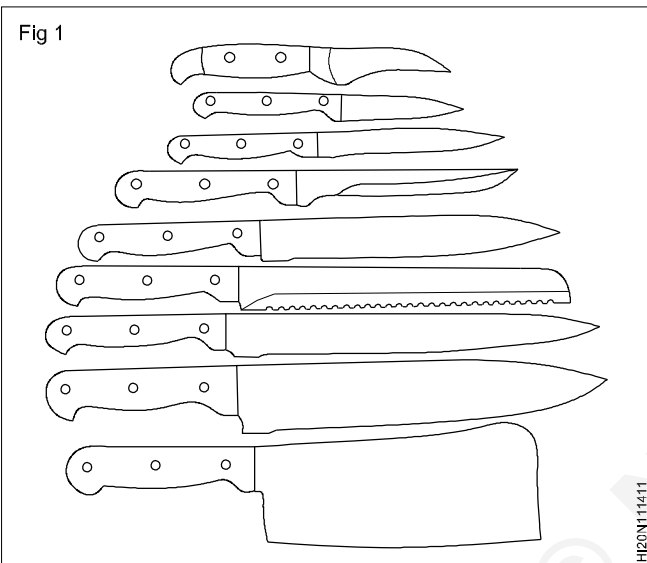
**Spoilage of food item - Kitchen equipment and storage equipment**

**Objectives:** At the end of this lesson you will be able to

- state about the cleanliness kitchen equipments
- state operation and usage of storage equipment like refrigerator
- state about FASSI Regulation

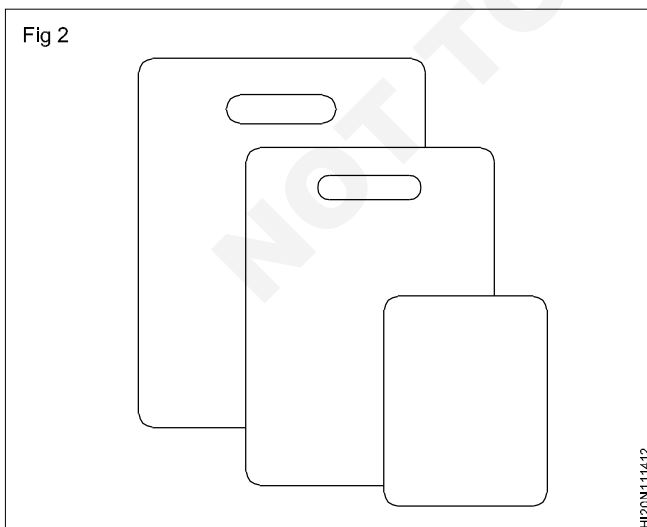
• **Best Kitchen Knife**

The knife is one of the needful equipment in a kitchen. No cooking is completed without the knife.



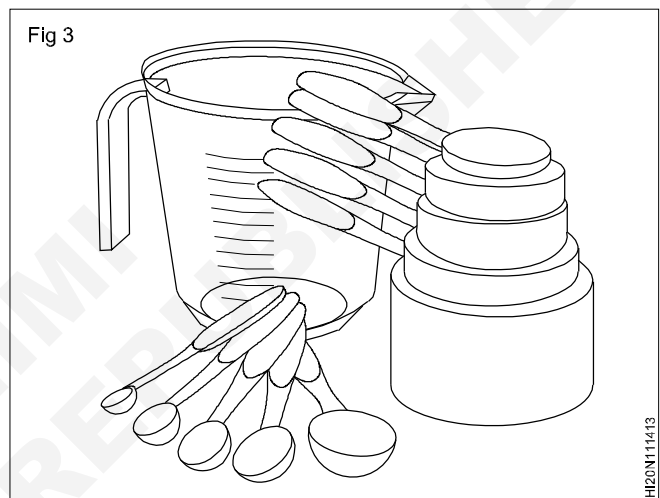
• **Cutting Board**

Cutting board is an important tool for a kitchen. It's really great for cutting vegetables, fish, chicken, beef, etc with a knife. It's very important tools for the kitchen. We need a quality-full cutting board. Which will well-built and sturdy. You can easily cut any things by using this cutting board.



• **Measuring Spoons**

Measuring spoons are specially used to measure cooking ingredients. It's essential equipment in the kitchen. We can't measure the right amounts of liquid or solid cooking ingredients without measuring spoons. It plays an important role in measuring cooking ingredients.



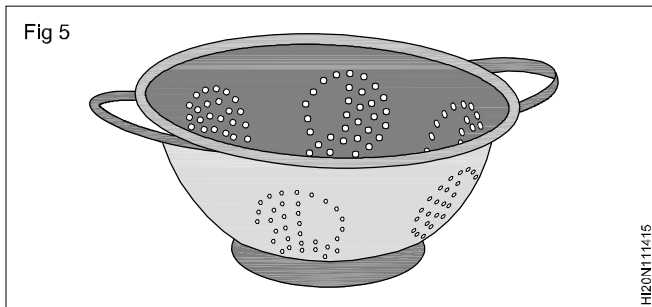
• **Mixing Bowls**

The mixing bowl is great for mixing together salad dressings, spice rubs, marinades, sauces, and even for storing leftovers. A bowl is essential equipment in the kitchen. We can't mix any cooking things without mixing bowls.



- **Colander**

The colander is very necessary equipment in a kitchen. It's really great for washing vegetables and salad greens etc. A colander is an essential thing for draining pasta. No kitchen can't complete without a colander.



- **Kitchen Pan**

Pan is great kitchen equipment for making any foods. Such as burgers, roasted salmon, meatballs, and marinated vegetables, etc. Pan plays a vital role in our daily life. So, everyone should a perfect pan for a kitchen.



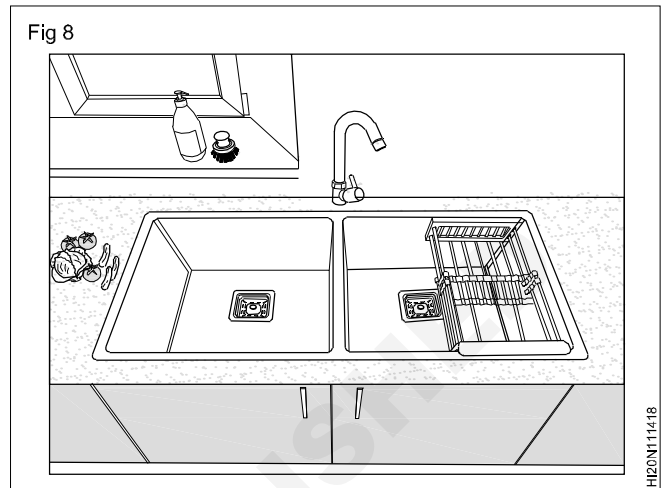
- **Blender**

Blender is essential equipment for making juice. You can make fruit juice easily by using a blender. You also can make smoothies, sauces, dips, or soups by using the blender. It's very necessary for making juice.



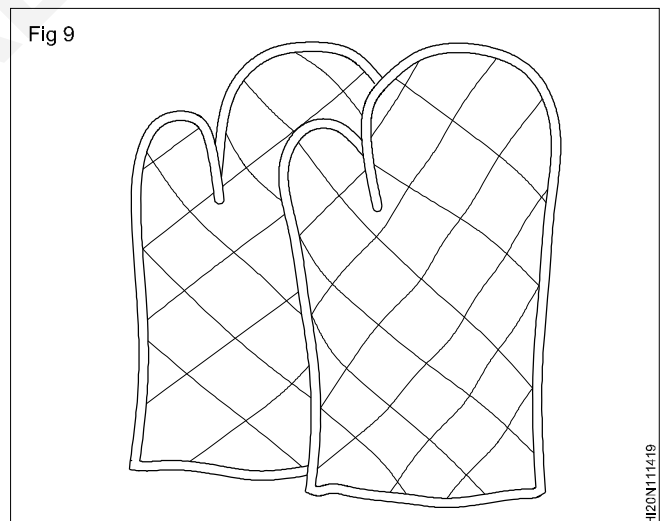
- **Kitchen sink**

The kitchen sink is an all-important and integral part of every kitchen. A fully functional and perfectly fitted kitchen sink makes a difference in your cooking time. Kitchen sinks are made up of various materials. They are available in stainless steel, copper, fireclay, brass, acrylic, and even marble.



- **Oven Mitts**

Oven mitts are great kitchen equipment for catching oven. It is used to protect your hands from being burned when transferring hot food from the oven. No longer will you have to wrap your hand in a tea towel and try not to spill your dish as you pull it out one hand.



- **Dish Rack**

Dish rack is important equipment for the kitchen. This rack can help you for arranging your cooking tools. Such as plates, bowls, and cups, etc.

- **Splatter Guard**

Splatter guard is kitchen equipment. It is placed on top of sauté pans during high heat cooking in order to stop splattering hot oil and food from coating your stovetop.



- **Splatter Guard**

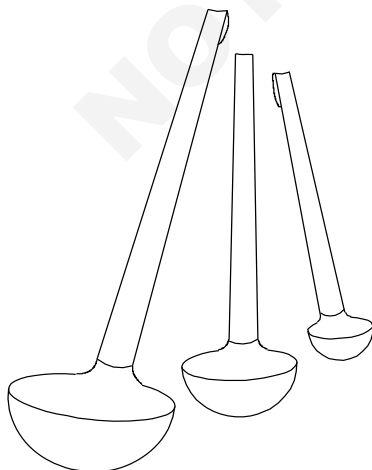
Splatter guard is kitchen equipment. It is placed on top of sauté pans during high heat cooking in order to stop splattering hot oil and food from coating your stovetop.



- **Ladle**

The ladle is important kitchen equipment which is very essential for a large, long-handled spoon. It is used for serving liquid dishes like soups, stews, and sauce etc. Another one is Tongs. It is essential kitchen equipment which is used to flipping meats and vegetables. It's really necessary equipment for cooking.

Fig 12

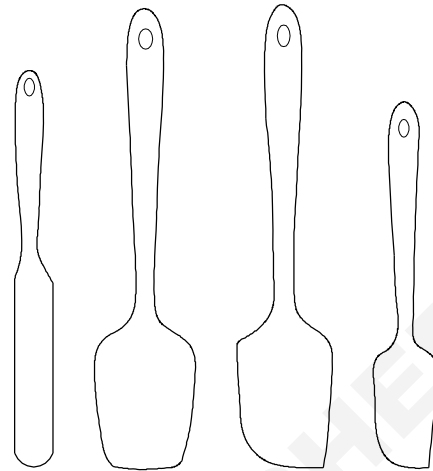


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- **Spatula**

Spatula is a kitchen implement which is used for mixing, spreading, and turning. It's common equipment for a kitchen. You need a spatula for your every cooking time.

Fig 13



HI20N1141D

- **Stockpot**

The stockpot is essential equipment for the kitchen. Anytime you have to need an extra meal for your guest then you can use Stockpot for making food. It also used for making Steam and Boil Seafood, Crawfish, Clams, Deep Fry Chicken, Fish, Hushpuppies and Vegetables etc.

Fig 14



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- **Storage Equipment**

The first principle to storage is to know what, where, when it is needed by the user. Food service operations store raw or cooked ingredients for different length of time and at different temperature to pre-serve their wholesomeness till required for preparation and service. Storage helps to minimize material handling and helps to maintain compactness in work section by limiting the volume stored. The food items purchased should be stored properly in first sequence to avoid food spoilage, pilferage and labour. Products piled without any logical arrangements may be subject to loss in addition to posing safety hazards. It is advisable to set limits on the number of persons who have access to storage areas.

Storage areas should have easy access from the receiving area and from the preparation and production area. Storage areas should be clean, well ventilated and dry with adequate space for a smooth flow of work.

### Types of Storage

In any type of food service operation three different storages are essential.

- Dry storage
- Refrigerated storage
- Frozen storage
- **Dry Storage**

Foods normally stored in dry storage include rice, dhal, flour, sugar, spices and canned foods. Normal room temperature for dry storage area should range from 100 to 210C. Care should be taken to see that there is enough air circulation with adequate ventilation and desired humidity. The food products should not be affected in any way by being exposed to direct sunlight near fire places, drainage or other utility pipes. Storage areas should be kept clean by following regular cleaning schedules.

- **Shelving Units**

Shelving units are used to store various dry goods prior to use.

Different types of shelving units are as follows

- 6 feet tall stainless steel wire shelving units.
- Corner shelves
- Overhead shelves
- Shelves designed to hold canned goods
- **Speed Rack**

It is made of metals and have slots into which food handlers have slide sheeting pans. Heights of shelves can be adjusted depending on the need.

- **Refrigerated Storage**

A refrigerated storage is a storage space planned and maintained at a temperature between 0 deg C and 40 deg C. It can be in the form of a complete room (walk in cooler) or a cabinet which is free standing or fixed in the wall. Refrigerator storage is used for storing raw and cooked food. Care should be taken that there are no leakages from the containers in which these items are placed.

- **Frozen Storage**

The most perishable foods like milk and milk products, cakes, meat and fish are placed under frozen storage. Many items are readily available in the market in the frozen form making it important for a food service operation to have adequate frozen storage. Freezer space is also needed to store large quantities of item purchased.

### Cleaning methods of Refrigerators

Let's begin with the step by step process of cleaning the fridge. The best time to clean your refrigerator is when

your fridge is nearly empty, or your grocery shopping is due. If your fridge has a bad odor, try to put some baking soda on the fridge shelves and leave it for 30 minutes, and then you can start cleaning your refrigerator. Baking Soda works wonders in removing bad smells. If there is any spillage in the fridge, use the paper towel to remove all the remains from the fridge before starting the cleaning process.

### Step by Step Fridge cleaning process

**Step 1:** The first step is to switch off the supply and disconnect the power chord. Now, let's start emptying the fridge by removing all the food items from the primary fridge and door shelves and keeping them nearby. It's a good idea to clean the freezer at the end so that the food items stay cold for the longest time.

**Step 2:** Start removing shelf liners from all the shelves and remove dirt from them. After that, remove all the shelves from the refrigerator.



**Step 3:** Now sprinkle the dish soap spray mixed with water in all the inner parts of the fridge except the vents. Then use a micro-fabric cloth to wipe out all the dish soap from the fridge gently. Use a new spray for the remaining portions. Now spray some liquid on the cloth and clean the area around the vents.

**Step 4:** Clean the main shelf glasses with the vinegar and water solution to just clean and wipe. Now clean the crisper box using the same spray.

**Step 5:** Wash the chiller tray and shelf liners in the kitchen sink with dish soap and tap water.

**Step 6:** Leave all the shelves and trays for 30 minutes to get them air-dried.

**Step 7:** Start putting back all the shelves and trays once they are dried. First of all, put all the main shelves, crisper box and the chiller tray at the original positions.

**Step 8:** Place back all the shelf liners on the surface of the fridge. These liners are efficient in keeping the fridge cleaner for a more extended period. If any spillage happens, then wipe off the stains or remove the liners and get it cleaned. They save time, energy, and help in rapid cleaning.

**Step 9:** Start organizing all the items back to the fridge as they were previously arranged. Try to wipe off all the food items before you store them again in the refrigerator and remove all the expiry date items as it can also destroy the nutritional value of other food items.

**Step 10:** Now let's move to the freezer section, we have to apply the same method to clean the freezer as we used the main fridge area.

**Step 11:** Use the toothbrush and ear-buds for the area around the vents where all the dirt and food is accumulated for good cleaning effect.

**Step 12:** Now clean the rubber gasket, which is ignored by many people. Spray the cleaning solution and use the ear-buds to remove all the accumulated dirt and food particles from the rubber gasket. Use a soft toothbrush for the tough stains and wipe it off with the kitchen towel.

**Step 13:** Now, put the rack and other pieces of equipment in the freezer section. It completes the inner cleaning of the fridge, and now let's go to the outer section of the refrigerator.

**Step 14:** Remove any stickers and magnets from the door of the refrigerator. Spray the cleaner on the surface of the fridge and wipe it off with a towel and use the same process for the rest of the outer body of the refrigerator.

**Final Step:** Put the plug back in and switch on the fridge.

#### Non-vegetarian Products Preparation and Handling Methods

- Keep separated raw and processed meat from other foods and surfaces.
- Use separate items like cutting boards, dishes, knives and different preparation area for raw meats, poultry and marine products so there is no cross contamination.
- Wash hands thoroughly when switching from the preparation of non-vegetarian items to other items or other food preparation activity.
- Cook non-veg. items fully so that heat penetrates into the deepest part of the product.
- Wash used surfaces with antibacterial cleaning agent, rinse properly with water and sanitise surfaces after preparing raw meat, fish or poultry.
- Thaw frozen products well in time so they are ready for cooking in a way that heat penetrates to the core.
- Electric grinding equipment and even chopping, cutting produce heat and so non-vegetarian products must either be immediately cooked or placed in temperatures that do not allow microorganisms to grow.

#### FASSI Regulations

The Act reinforced the laws relating to Food and established the Food Safety and Standards Authority of India for laying down science based standard for the food articles and regulate their manufacture, storage, distribution, sales, and import, to availability of safe and wholesome food for human consumption. Food Safety and Standards Authority of India (FSSAI) is a statutory body established under the Ministry of Health & Family

Welfare, Government of India. FSSAI is responsible for protecting and promoting public health through the regulation and supervision of food safety.

The Food Safety and Standards Authority of India (FSSAI) is a legal authority that offers a food license to all food business operators (FBO) in India. All the FBOs must follow all the rules and regulations of FSSAI for food quality control. An FBO requires a FSSAI License or Registration and it all depends upon certain factors like the size of production, managing nature of food business activities, and range of operations. In the FSSAI Registration process, the FBO will get a 14 digit number that needs to be printed on food packages.

FSSAI Registration ensures the security of food products and it is essentially a food safety certificate circulated by the food authority in India. All the manufacturers, traders, restaurants, grocery shops, importers and exporters, etc. are eligible for issuing a FSSAI Licence. FSSAI Licensing assures that food products undergo specific quality checks, thereby decreasing the cases of adulteration, substandard products.

FSSAI online registration and licenses can help you to get a FSSAI License which can enhance the quality of your food if you are interested in the food business.

- Expert Advice and FSSAI eligibility consultation
- Application Drafting for FSSAI Registration
- 14-Digital FSSAI License number
- Product Category clarification
- Timely Follow-up With FSSAI Department
- FSSAI Renewal before the expiry
- Legal documentation on a need basis
- Open to offer Basic Registration, State Registration, and Central Registration



## Water Pollution

**Objectives:** At the end of this lesson you will be able to

- state the significance of water and its properties and causes of water pollution
- state to cultivate the knowledge on the various types of water, water supply system with water treatment in the city/country
- identify the classification of water reduces (surface water on grow water)
- state others factors involved in water storage - rainwater harrvesting portable water etc.

### WHO'S definition for environmental sanitation

- Environmental sanitation includes human excreta control, managing solid waste and wastewater, and pest and vector control. Sanitation and environmental hygiene issues must be analyzed during the initial assessment.
- In CEs considerations for sanitation needs are included during the camp planning and layout. As with the other sectors, refugees/IDPs and community leaders should be consulted and involved at every level of planning.
- Advice from sanitation engineers and experts regarding appropriate sanitation facilities is solicited as necessary. Health education programs should be in place early to prevent outbreak of diseases especially among children.
- Wastewater treatment requires proper drainage be put in place to prevent water from stagnating around distribution points.
- Stagnated wastewater can be a breeding place for vectors like mosquitoes. Channelling water away from homes into kitchen gardens is most ideal. Sufficient tools are provided to families for maintaining the drainage systems as necessary.

### Safe and Wholesome Water

Safe and wholesome water is defined as that which is

- free from pathogenic agents
- free from harmful chemical substances
- pleasant to taste, colourless and odourless
- usable for domestic purposes

If water does not fulfil the above criteria it is said to be polluted or contaminated. Water Pollution is a growing hazard in many developing countries owing to human activity. It is not possible to provide positive health to the community without ample and safe drinking water

### Sources of water

Water is an essential for life on earth. In fact, around two thirds of the human body is made up of water - that is how important it is for us. We use water to drink, to wash and to cook with. Without sources of water near to us, we would really struggle. There are various different sources of water out there in the world, and below you will find in depth information on our main water sources.

#### • Rivers and streams

Rivers and streams are a source of fresh (i.e. not salty) water. Collecting water from rivers is still a widespread practice. Often it will need to be treated to be safe for drinking. The rivers that we see above ground originate underground, and burst through to the surface of the earth as springs. River water is generally safest to drink.

#### • Lakes

Lakes are still bodies of (usually fresh) water. They are replenished by the rain and often by rivers and streams, too. Some lakes are natural lakes, forming in valleys in hilly or mountainous regions.

#### • The sea

The sea's water is salty. Our oceans and seas are, combined, very much the largest water source on earth. Home to many weird and wonderful creatures and ripe for exploration, the sea is essential for biodiversity on earth. Though drinking salty water in large quantities is usually harmful to humans, it is possible to drink sea water if it is first treated in a desalination plant.

#### • Rainwater

Rainwater falls naturally over all of our planet, except in the very harshest and driest deserts. Rainwater in rural areas is usually safe to drink, though in the cities rainwater can be contaminated by the pollutants found in vehicle and factory fumes rendering it highly acidic. Nevertheless, rainwater is an abundant source of water for watering plants and crops. Many people use rainwater as a free source of water for washing their cars, too. Rainwater can be collected in water butts or simply in tubs left on the roof or outside the window. Rainwater is sometimes referred to as 'grey water'. People who go traveling in camper vans or who stay in tents often collect rainwater and sterilize it either by boiling it or by mixing it with sterilizing tablets so that they can use it for drinking and brushing their teeth with.

#### • Wells

Water from wells tends to be very fresh and clean, and they have been a source of water for many centuries. Usually man made, wells are deep shafts dug into the earth until water is found. Well water is generally thought to be clear and uncontaminated - as long as the well is dug down very deep. It is accessed by lowering a bucket

on a rope down to the bottom of the well, letting the bucket fill with water and then hauling it back up again. However, adequate precautions need to be taken to protect the well water from contamination.

- **Reservoirs**

Reservoirs are like artificial lakes created by humans to collect either rain water or river water. The water in a reservoir is typically treated in a water treatment plant until it is safe to drink and then piped off to people's homes for them to use in the form of tap water. Reservoirs may look like natural bodies of water - they may be cut in to a hillside, for example and reinforced with concrete or stone. Or, they may simply be large metal structures that are able to hold huge amounts of water - ready to be piped over to your bathroom or kitchen whenever you feel that you need a glass of water to drink.

- **Recycling water**

Did you know that much of the water than you drink has been recycled, whether it comes in bottled form or out of the tap? Sewage and tap water than runs down the sink (for instance when you brush your teeth) can be cleaned and sterilized and made ready for people to drink it once more. There is nothing dangerous about this - in fact, you may well have been drinking recycled water all of your life without realizing it.

**Uses of water and its needs**

Water is stored in various parts of the world but not evenly distributed all over the earth. It is said to be a universal solvent. Various sources of water are - sea, lake, rain,

well, stream, borehole and pond. It is used for washing, drinking, generating electricity etc. Below are the **different uses of water** in various fields:

- Domestic uses of water
- Water use for agriculture
- Industrial uses of water

**Domestic uses of water:** 15 % of water is consumed for domestic purpose. Water is used for drinking, bathing, cooking food and washing dishes, clothes, fruits, vegetables and brushing teeth.

**Water use for agriculture:** Agriculture is the largest consumer of water. About 70% of water is used for irrigation. Water is necessary for gardening, farming and fisheries. Plants require water to grow. During the process of photosynthesis, they consume water. To yield crops, fruits, flowers, vegetables they need sufficient water, manure, sunlight and oxygen.

**Industrial uses of water:** It is either used in creating or to cool the equipment used for creating the product. Industrial water is used for washing, cooling, processing, transporting, diluting or fabricating of a product. The maximum amount of water is used in the production of chemical, paper and food.

**Other uses are** - it is used in transportation, manufacturing, hydroelectric power, removal of body wastes, tourism and recreation.

**Water Borne Diseases - Conservation Sewage Water - Symptoms - Prerations**

**Objectives:** At the end of this lesson you will be able to

- state different water borne diseases
- state different symptoms and prerations of diseases

**Waterborne Diseases**

Waterborne diseases are primarily caused by the pathogenic microbes that enter the human body through contaminated water. The infected water could come from drinking, food preparation, or washing clothes. For instance, many countries do not have proper water treatments that make it easy for water-borne diseases to develop.

- **Typhoid Fever**

The highly contagious Typhoid fever is generally spread through unsafe water, contaminated food, and poor sanitation.

**Symptoms of Typhoid**

- Slowly progressing fever
- Muscle aches
- Fatigue
- Sweating
- Diarrhea or constipation

- **Prevention**

Avoid drinking unsafe water and drink water from the sealed bottles. Also, abstain from eating foods from hygienic places.

- **Cholera**

The areas where poverty and poor sanitation are rampant, cholera disease can be easily seen there. Again, the main cause of this waterborne condition is contaminated water. It causes severe dehydration and diarrhea.

**Symptoms of Cholera**

- Nausea
- Vomiting
- Diarrhea
- Muscle cramps

**Prevention**

To prevent this waterborne illness, you should:

- Wash your hands frequently
- Eat properly cooked food
- Drink safe water
- Eat peeled-off fruits like banana, oranges

- **Giardia**

The cause of Giardia is contaminated water. This is mostly through ponds and streams and sometimes the town's water supply or swimming pools. This waterborne disease is caused by a parasite.

**Symptoms of Giardia**

- Abdominal pain
- Cramps and bloating
- Diarrhea
- Nausea
- Weight loss

**Prevention**

For waterborne disease infection preventions can be:

- Wash your hands with soap and water
- Don't swallow water while swimming
- Drink sealed water

- **Dysentery**

Dysentery is an intestinal infection that is marked by severe diarrhea as well as blood or mucus in the stool. Bacteria, viruses, or parasites in unsafe food and water can cause this waterborne condition. Similarly, if the person comes in contact with faecal matter, it can cause dysentery.

**Symptoms of Dysentery**

- Stomach cramps and pain
- Diarrhea
- Fever
- Nausea
- Vomiting & Dehydration

**Prevention**

This disease mainly spreads due to poor hygiene, thus, you must maintain hygiene to prevent water-borne disease. Moreover, follow the given below points:

- Frequently wash your hands
- Do not drink juice with ice from the street corners
- Avoid eating food from street vendors

- **Escherichia Coli (E. coli)**

The main cause of Escherichia Coli is E. coli bacteria. The animal waste or strains of E. coli in producing farmland spreads through the process of making ground beef. Thus, when the person consumes this food, he/she could experience symptoms of the waterborne illness. This bacteria can be presented in unsafe water sources.

**Prevention**

- Avoid contaminated water
- Avoid drinking water from ponds, rivers, and swamps
- Wash fruits and vegetables before eating
- Drink plenty of safe water

- **Hepatitis A**

This is a liver infection that occurs when you consume infected food and water. Coming into contact with an infected person can also spread and cause Hepatitis A.

Symptoms of Hepatitis A

- Fatigue
- Clay-colored bowel movements
- Jaundice
- Nausea and vomiting
- Abdominal pain, especially near your liver
- Loss of appetite
- Sudden fever

**Prevention**

The most preferable and effective way to prevent hepatitis A is a Vaccine. Therefore, vaccinate against Hepatitis A to prevent this condition occurrence.

- Eat properly cooked and hot food & don't eat food at room temperature

**Conservation sources of water**

Conservation of Water refers to preserving, controlling and developing water resources, both surface water and groundwater, and preventing water pollution. Water conservation is known as using water efficiently to reduce unnecessary water usage and avoid its wastage. We should understand the importance of water.

**Need of Water Conservation**

Water is used in all day-to-day activities. We need to conserve water for the following reasons:

- To ensure continuous water supply to our future generations, we need to conserve water today.
- Because water is so crucial to our health, we must conserve fresh and potable water while also protecting it from contamination, as we only have a finite amount of fresh water on the planet.
- Water conservation is also important to ensure food

security for all the living organisms on the Earth. Without water, plants and crops cannot grow on which we survive later and treat it as an asset to our planet.

**Measures for Water Conservation**

Conservation of water is needed in all directions of life. We should conserve water at the domestic, industrial as well as at agricultural levels. Some of the measures for water conservation are discussed below:

- **Water Conservation in Domestic Uses**

- (a) **Use water judiciously** - It is very important for all of us to take responsibility for water conservation in our household works even if we are not facing any water shortage. Do not overuse water for washing clothes and dishes; close the taps when not in need.
- (b) Check for any **leaks** in your toilets or kitchen pipes. Fix them as soon as possible as these small leakages can waste 100 gallons of water per day.
- (c) Take showers with a minimal quantity of water required.
- (d) Use a broom to clean your house instead of washing floors.
- (e) Turn off the tap water while brushing your teeth and shaving.
- (f) Wash your vehicles with a minimum quantity of water required.
- (g) Do not water plants unnecessarily. Use showers or mugs to water your plants instead of using flowing water pipes.

**Methods of Irrigation that Conserve Water**

- (a) **Drip Irrigation** - Drip irrigation is a type of micro-irrigation system that has the probability of saving water and nutrients by allowing water to drip slowly directly to the roots of plants.



**Fig: Drip Irrigation**

- This method aims to supply water directly into the root zone of plants and minimise evaporation. By drip irrigation, there is no water loss due to seepage, run-off or evaporation. This has emerged as a very efficient method of irrigation.

(b) **Sprinkler Irrigation** - Water is distributed through a pipe system, and is sprayed into the air and irrigates in most of the soil types as it has a wide range of discharge capacity.



**Fig: Sprinkler Irrigation**

(c) **Night Irrigation** - During night-time, humidity is high, which results in a reduced evaporation rate. Since there is no sun, solar radiation does not contribute to water evaporation, which minimises water loss.



**Fig: Night Irrigation**

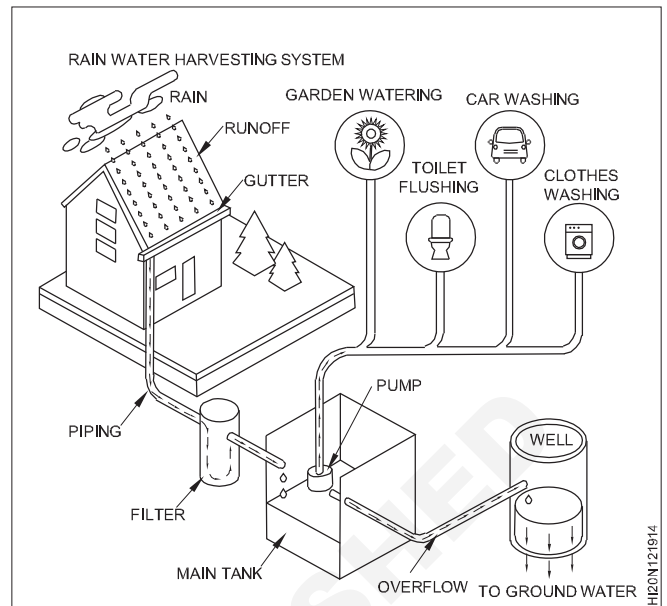
### Modern Methods of Water Conservation

Modern water conservation methods are more accessible and more effective, such as water conservation methods at home and on the farm.

#### (a) Rainwater Harvesting

- Rainwater harvesting is the process of collection and storage of rainwater rather than allowing it to run off.
- The importance of rainwater harvesting is that it can be stored for future use as rainwater is pure and fresh; it can be used directly for many domestic purposes such as cleaning, washing, and gardening.
- The stored rainwater also checks and revitalises the ground level water and improves its quality. Harvesting rainwater also checks surface water run-off and reduces soil erosion.
- Use your washing machine for full loads only while washing clothes. Every time you use a washing machine, you use a lot of water. Therefore, try to wash your clothes once in bulk instead of small parts when needed.
- Protection of water from pollution - As we all know that fresh water is present in minimal quantity; hence, we should try not to pollute them by minimising the use of

fertilisers, pesticides, and other chemicals in fields. As run-off water from fields can pollute water bodies near them.



**Fig: Rainwater Harvesting**

- **Protection of water from pollution** - As we all know that fresh water is present in minimal quantity; hence, we should try not to pollute them by minimising the use of fertilisers, pesticides, and other chemicals in fields. As run-off water from fields can pollute water bodies near them.
- **Wastewater Recycling by Sewage Treatment Plants:** Most of the water that is drained after bathing or cleaning can be reused for gardening. But sewage water can be recycled and used for irrigation after treatment in sewage water treatment plants, followed by removal of solid wastes, aeration, disinfection and filtration.

#### Benefits of Water Conservation

Water conservation is of utmost importance to meet the demand of an exponentially growing population. Various benefits of water conservation are listed below:

- **Minimised effects of drought and water shortage:** With time, our need for fresh water sources is constantly increasing because of the growing population and industrial growth, but the freshwater supply stays constant. Thus, by reducing the amount of water we use, we can protect our Earth against future drought years.
- **It preserves our environment and energy:** Reducing our water usage, and going forward to better water management, reduces the energy required to process and deliver it to homes, farms, agriculture fields, and communities by using pumps. This, in turn, helps to reduce pollution and conserve fuel resources. As a result, our environment is protected.
- **Saves money:** If we fail to conserve water, this can

eventually lead to a lack of adequate water supply, which can have drastic consequences.

- It makes freshwater available for recreational purposes: We need freshwater not only in swimming pools, spas, and golf courses but are also used for beautifying our surroundings by watering lawns, trees, flower gardens, and vegetable gardens, as well as filling public fountains at parks. If we fail to conserve water now, we may lose these beauties later on.
- If an ample amount of fresh water is present in the environment, it will reduce the need for new wastewater treatment facilities
- Conservation of water saves aquatic habitat to a great extent.
- Rainwater harvesting increases the water table by increasing the level of underground potable water.

### Quality of drinking water

There was a time when the common and safe sources of drinking water were the local wells and ponds. With the advancement in technology and increase in population, the water bodies have become polluted to the extent that they are not entirely safe even for washing purposes! Considering the detrimental effects the natural water can have on human health, certain parameters have been defined by several health organizations.

Some quality parameters are set for drinking water which must be met as per the International Standards for drinking water. We will talk about them in this article.

### International Standards for Drinking Water

The International Standards for drinking water which must be followed are:

- **Fluoride:** Deficiency of fluoride causes tooth decay in humans. Water fluoridation is a method which ensures controlled the addition of soluble fluoride to the drinking water supply to bring its concentration up to 1 ppm. However, excess fluoride causes mottling of teeth and bone defects; so it is added only up to the safety limits.
- **Lead:** The water supply pipes, plumbing fittings, solders, etc. either contain lead or are made up of it. Excess lead has certain neurological effects. Long-term exposure can create health risks for pregnant women and infants. It can also damage the liver, kidney, etc. Thus, the permissible limit for lead concentration is 50 ppb only.
- **Sulphate:** Sulphate is often used for the control of algae in public water supply pipes. They are also discharged from mines into the water. Some sulphates are highly soluble in water. So even after water treatment, they may still be present in water. Although it is harmless at a moderate level, if its concentration exceeds 500 ppm in water, it can cause dehydration, diarrhoea, certain laxative effects and gastrointestinal problems.
- **Nitrate:** Nitrates are used in fertilizers. They can reach surface and groundwater from agricultural fields. If the concentration of nitrates exceeds 50 ppm in water, the

digestive system is affected. It also causes methemoglobinemia, commonly called the blue baby syndrome.

- **Other metals:** There are some other metals such as iron, copper, aluminium, zinc, etc., which have the permissible concentration of 0.2 ppm, 3 ppm, 0.2 ppm and 5 ppm respectively.

### Drinking Water Standards recommended by the WHO (Substance/ Parametric Value)

• Arsenic	10µg/l
• Barium	10µg/l
• Boron	2400µg/l
• Chromium	50µg/l
• Fluoride	1500µg/l
• Selenium	40µg/l
• Uranium	30µg/l

Organic species:	
• Benzene	10µg/l
• Carbon tetrachloride	4µg/l
• 1,2-Dichlorobenzene	1000µg/l
• 1,4-Dichlorobenzene	300µg/l
• 1,2-Dichloroethane	30µg/l
• 1,2-Dichloroethane	50µg/l
• Dichloroethane	20µg/l
• Di(2-ethylhexyl)phthalate	8µg/l
• 1,4-Dioxane	50µg/l
• Edetic acid	600µg/l
• Ethylbenzene	300µg/l
• Hexachlorobutadiene	0.6µg/l
• Nitrilotriacetic acid	200µg/l
• Pentachlorophenol	9µg/l
• Styrene	20µg/l
• Tetrachloroethene	40µg/l
• Toluene	700µg/l
• Trichloroethene	20µg/l
• Xylenes	500µg/l

The pH level of the water sources should be between 6.5 and 8.5 on a scale ranging from 0 to 14. The best pH for drinking water sits at a 7 right in the middle.

### Public Health Aspect of Very Hard Water

Water is essential for hydration and therefore, for life. It is also very important drinking water is consumed not only as water per se but also in beverages and incorporated in food stuffs. In response to increasing global and local water scarcity, there is an increasing use of sources such as recovered/recycled water, harvested rainwater, and

desalinated water food preparation and cooking, sanitation and hygiene, and a wide range of other uses. Among them a good percentage consumes hard water, which is considered to be a significant etiological factor around the globe causing many diseases, reproductive failure, neural diseases, and renal dysfunction and so on. Hard water is usually defined as water, which contains a high concentration of calcium and magnesium ions. However, hardness can be caused by several other dissolved metals.

**Potential Health Effects:** The health effects of hard water are mainly due to the effects of the salts dissolved in it, primarily calcium and magnesium. One of the most severe effects of hard water is an increased risk of cardiovascular disease. According to several international studies, both heart disease and high blood pressure can be caused by drinking hard water. In adults, there is an increased risk of reproductive failure. In children, there is a correlation between hard water and growth retardation. There is also an increased risk of certain types of cancer for those who drink hard water. Gastric, colon, ovarian and oesophageal cancer risks increase with hard water. Even diabetes and neural diseases have been linked to drinking hard water.

### Skin Problems and Hard Water

One of the most noticeable effects of hard water is skin irritation. Eczema in children has been linked to hard water. Many people who bathe with hard water notice dry skin and even hard or bumpy patches of skin caused by dryness and irritation from skin and hair products. The many minerals that are present in hard water means that the cleansing products used while showering don't dissolve well in the water. This can lead to them irritating the skin when they don't rinse off the skin well. Using a water softener can get rid of some of the minerals dissolved into the water and make it easier for shampoos and soaps to dissolve in the water and rinse cleanly from the skin.



**Fig: Skin problems due to Hard Water**

### Steps of disinfection of well

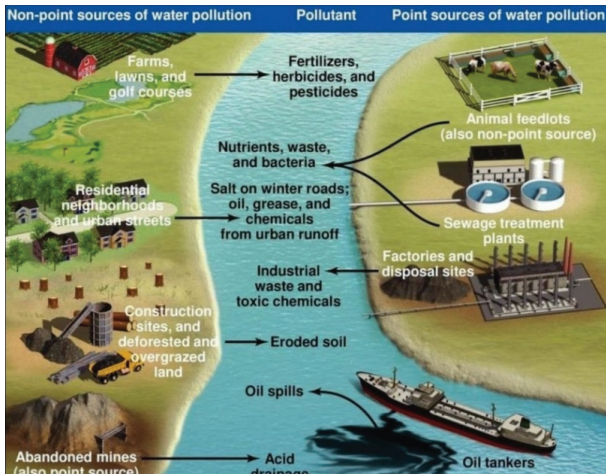
- Bypass the water softener, other filters or purification equipment.
- Remove the cap or seal from the casing and, if possible, measure the depth of the water in the well to determine how much sanitizer should be used. In some instances, removing the seal to measure the water can be a difficult task. It may be easier to estimate well and water depth from well logs or other records.

As a general rule, it is better to use too much sanitizer than too little. If too much sanitizer is used, it will simply take longer for the taste and odor to leave the system.

- Use a pipe to get by any restriction in the well, a 10 ft length of 3/4-in. PVC is usually ideal. (If it is not possible to remove the well cap, remove vent or sanitation access plug.)
- Drop one tablet into the well and listen to hear if it hits the water. If the tablet hits the water, drop one-half of the determined amount of sanitizer tablets needed into the well. These will sink to the bottom and sanitize the lower portion of the well.
- Mix half of the determined amount of granules in a clean, plastic five gal container of water. Pour the solution down the well to sanitize the upper portion of the well.
- It is necessary to recirculate the water in the well to mix the sanitizer thoroughly throughout the entire water system. Connect a hose to an outside silcock that is located after the pressure tank and run water back down the well (this also rinses the upper portion of the well). After about 15 minutes of recirculating the water, a strong chlorine odour should be present; if not, repeat steps 4 and 5.
- Allow the sanitized water to stand in the system for at least six hours-preferably over-night. Open an outside faucet and flush the system until the water runs chlorine free (until you don't smell any chlorine). Repeat flush operation on each faucet in the system. 1
- Return all equipment to service position.
- After two to three weeks test the water. If bacteria, iron bacteria, sulphur or other problems recur, further treatment is required.

### Sources and Nature of Water Pollution

- Sewage: Emptying the drains and sewers in fresh water bodies causes water pollution. The problem is severe in cities.
- Industrial Effluents: Industrial wastes containing toxic chemicals, acids, alkalis, metallic salts, phenols, cyanides, ammonia, radioactive substances, etc., are sources of water pollution. They also cause thermal (heat) pollution of water.
- Synthetic Detergents: Synthetic detergents used in washing and cleaning produce foam and pollute water.
- Agrochemicals: Agrochemicals like fertilizers (containing nitrates and phosphates) and pesticides (insecticides, fungicides, herbicides etc.) washed by rain-water and surface runoff pollute water.
- Oil: Oil spillage into sea-water during drilling and shipment pollute it.



**Fig: Sources of Water Pollution**

**Radioactive Wastes:** Radioactive elements, such as uranium and radium, possess highly unstable atomic nuclei. This disintegration results in radiation emission which may be highly injurious. Eventually, some of the radioactive material, such as Strontium 90 (which can cause bone cancer), percolates down through the soil into groundwater reservoirs or is carried out into streams and rivers.

**Thermal Pollution:** Most of the thermal and electric power plants also discharge considerable quantities (about 66%) of hot effluent/water into nearby streams or rivers. This has resulted in thermal pollution of our water courses.

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**Purifications - Large Scale - Small Scale - Plumping Systems - Pot Method - Etc**

**Objectives:** At the end of this lesson you will be able to

- state purification of net -large and small scale
- state pot method of chlorination
- water testing labs

**Purification of water:** Water purification is the process of removing undesirable chemicals, biological contaminants, suspended solids, and gases from water. The goal is to produce water fit for specific purposes. Most water is purified and disinfected for human consumption, but water purification may also be carried out for a variety of other purposes, including medical, pharmacological, chemical, and industrial applications.

**(i) Large Scale**

Water is purified on large scale for supply to a city or a town. It is also purified on small scale for domestic use. In the purification of water on large scale following methods are used:

- Slow sand filtration (biological filtration).
- Rapid sand filtration (mechanical filtration).
- **Slow Sand Filtration**

This system was first introduced in England about more than a century ago and still commonly used. Hence it is also known as English system. In slow sand filtration following stages are involved: (a) Storage, (b) Filtration & (c) Chlorination

**(a) Storage**

The raw water from the source, usually a river, canal or a stream is collected in natural or artificial large open reservoirs known as settling tanks. The water is allowed to remain there for 1 to 2 days. During this short period of storage natural purification takes place. About 90 percent suspended impurities settle down by gravity. The organic matter present in the water is oxidised by bacteria with the help of dissolved oxygen present in water. The number of micro-organisms present also decreases considerably. The turbidity due to mud etc. also decreases. At this stage the quality of water improves to a great extent and water becomes much clearer in appearance.

**(b) Filtration**

Filtration is the second stage in the purification of water and is very important stage because about 99 percent bacteria are removed at this stage. During filtration the clarified water from storage tanks is now admitted to the slow sand filters. The filter beds are water tight rectangular tanks made up of concrete. Usually they are arranged side by side and generally kept open. At least two filtration beds must be constructed so that one must remain in

function when the other one is being cleaned. The size of the tanks depends on the requirement of water to be supplied to the community. These beds are generally 2.5 to 4 meters deep. The filtration bed or sand bed is the most important component because the water is to be filtered through this bed.

**They are filled from bottom to upward as follows:**

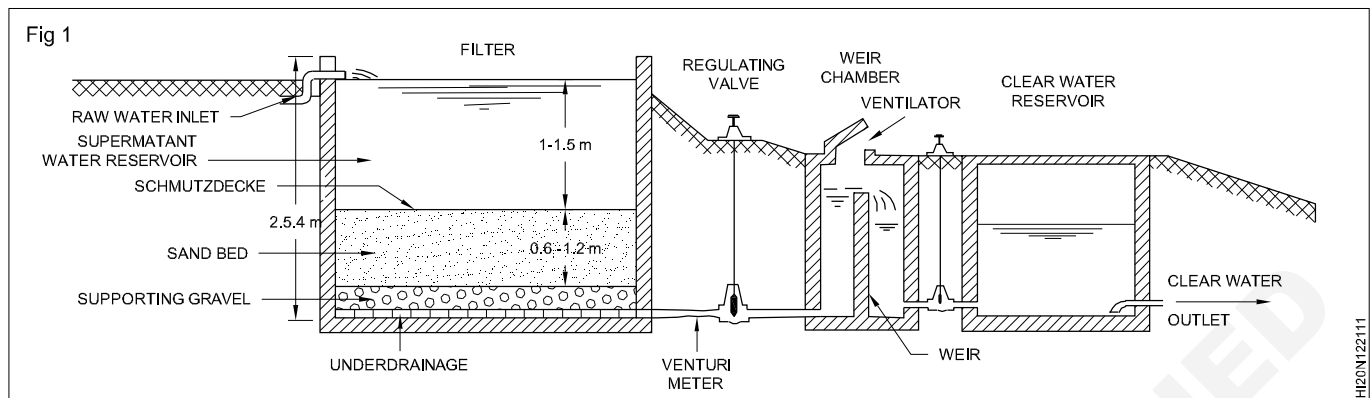
- (i) The lowest layer consists of 4 cm size gravel or broken stones.
- (ii) Above this layer there is fine gravel. The total thickness of gravel layer is 15-30 cm.
- (iii) The third layer above the fine gravel is of coarse sand. The thickness of this layer should be 15 to 30 cm. The gravel layer gives support to the sand layer.
- (iv) The fourth layer above the coarse sand layer is of fine sand. The thickness of this layer should be from 60 to 90 cm. As the particles of sand are very small and large in number, they provide large surface area for the water to pass through. Apart from mechanical straining, oxidation, sedimentation and removal of bacteria also takes place.
- (v) On the top of these layers there is layer of clarified water from settling tank, about 1.5 to 1.8 meters in height. The inlet of water is controlled by valves fitted at the top of the filter bed. At the bottom of the bed a number of perforated pipes are fitted to collect the filtered water. No doubt all the components of filter bed especially the sand play a great role in the filtration of water but the vital layer which is formed at the surface of sand plays the greatest role in the purification of water.

This is a thin green slimy gelatinous layer which consists of numerous forms of plant and animal life e.g. algae, fungi, protozoa and bacteria. The process of formation of vital layer is known as "ripening" of the filter. This layer is formed within 2-3 days on a new filter bed and when fully formed it is about 2-3 cm in thickness. As the thickness of this vital layer goes on increasing, with the passage of time, the filtration goes on decreasing. After sometime when the thickness increases to a great extent (about 4

feet) and filtration reduces then cleaning of the filter is done. For cleaning, the top sand layer is scraped off. This process of cleaning the filter is repeated periodically.

feet) and filtration reduces then cleaning of the filter is done. For cleaning, the top sand layer is scraped off. This process of cleaning the filter is repeated periodically. When after repeated cleanings the thickness of sand layer reduces to about 30-40 cm, the plant is closed down and a new bed is prepared. This is usually done after an interval of three years.

The new filter takes about 3 days to work effectively because it takes 2-3 days for the vital layer to form. So the water received during first three days should be allowed to go waste and purified water should be supplied only when bacteriological examination of water shows that efficient filtration is taking place.



### Advantages of Slow Sand Filters:

Slow Sand Filters have the Following Advantages:

(iii) They are more practicable for filtration of water in developing countries with minimum filtration. They were first used in 1804 in Scotland. Even today they are accepted as standard method of purification of water all over the world.

(iv) They yield 98-99% bacteria free water.

### Disadvantages:

(i) More land is required for their construction so initial cost is much more than rapid sand filters.

(ii) They require periodical cleaning.

### 2 Rapid Sand Filtration (Mechanical Filtration):

Rapid sand filters were first introduced in 1885 in U.S.A. Since then they have gained considerable popularity and are still commonly used.

#### Types of Rapid Sand Filters

There are two types of rapid sand filters:

(i) Gravity type e.g. Paterson's filter.

(ii) Pressure type e.g. Candy's filter.

The Paterson's rapid filter is more commonly used. During rapid filtration 5 steps are involved which are discussed below:

- (a) Coagulation
- (b) Mixing
- (c) Flocculation
- (d) Sedimentation
- (e) Filtration

**(a) Coagulation:** The water from the setting tanks is led continuously into the plant. Here the water is treated with a chemical coagulant such as alum to remove turbidity

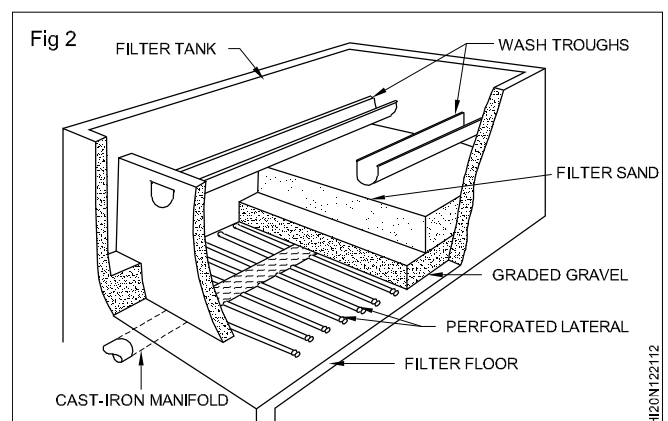
and colour. The amount of alum used is 5 to 40 mg per litre, depending upon the amount of turbidity present in the water.

**(b) Mixing:** The alum treated water is then agitated mechanically in a mixing chamber for a few minutes so as to dissolve the alum and the impurities get precipitated.

**(c) Flocculation:** The water is then passed into the flocculation chamber where it is stirred at a slow speed for about half an hour so as to form floccules of aluminium hydroxide.

**(d) Sedimentation:** The coagulated water is then led to the settlement tank where the precipitates are allowed to settle at the bottom of the settlement tank. The water is allowed to remain there for 2 to 6 hours. During this time the precipitates along with suspended matter and bacteria settle at the bottom and the supernatant water now looks very clear in appearance. The flocculated material from the settlement tank is removed from below.

**(e) Filtration:** Filtration is the most important step in the rapid sand filtration process. The clarified water is led to the rapid sand filter which purifies water from 98-99 percent. In rapid sand filters the medium of filtration is like that of slow sand filtration i.e. sand and gravel. The filter is made up of concrete chamber about 7 feet deep which contains filtering medium i.e. sand supported by gravel.



The thickness of filtering medium should be 4 to 5 feet. The filtered water is collected through a network of perforated pipes attached at the bottom of the filter.

**Cleaning of the Filters:** As the filtration proceeds, after 6-7 days, a layer similar to vital layer in slow sand filters develops due to collection of floccules which were not sedimented; suspended matter and bacteria. As a result of continuous filtration the filter bed becomes dirty and requires cleaning of filters. For cleaning the filters washing process known as 'back washing' is done. During this process the inlet and outlet valves are closed. A backflow of purified water from the clean reservoir is made through the bottom of sand bed with simultaneous stirring of the upper layer of sand by means of rotator metal arms or a blast of compressed air. In this way the deposited layer of floccules and suspended matter will be dislodged and removed with wash water. When the sand looks clear the washing should be stopped. The entire process of washing takes about 15 to 20 minutes and the filters are ready for use again within another 20 minutes. This is an advantage over slow sand filtration where the entire bed needs reconstruction.

**Advantages:**

- (i) Very little space is required.
- (ii) Initial cost is less.
- (iii) They are suitable for turbid water.
- (iv) Water is filtered rapidly.
- (v) Cleaning the filter is easy.
- (vi) There are no chances of contamination by the labourers.

**Disadvantages:**

- (i) Running costs are high.
- (ii) A chemical coagulant such as alum is required.
- (iii) Results of purification are not good so chlorination of water is required.

**ii) Small scale**

Water on small scale such as for domestic purposes can be purified as follows:

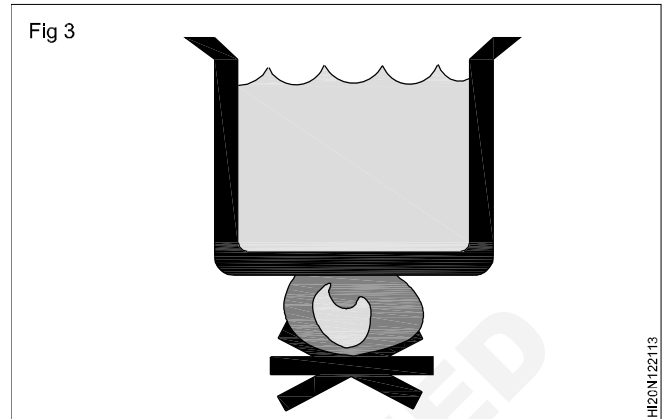
- (i) Boiling
- (ii) Distillation
- (iii) Filtration through muslin cloth.
- (iv) Three pitcher system.
- (v) Chemicals.
- (vi) Domestic filters

**(i) Boiling:** Boiling is the oldest and satisfactory method of purification of water on small scale. Boiling for 5 to 10 minutes kills bacteria, spores, cysts and ova of intestinal parasites.

**(ii) Distillation:**

Distillation is also a good method of purification of water. During this method all kinds of dissolved impurities can be removed even the volatile one as well. It also removes hardness of water and soft water is produced.

Fig 3



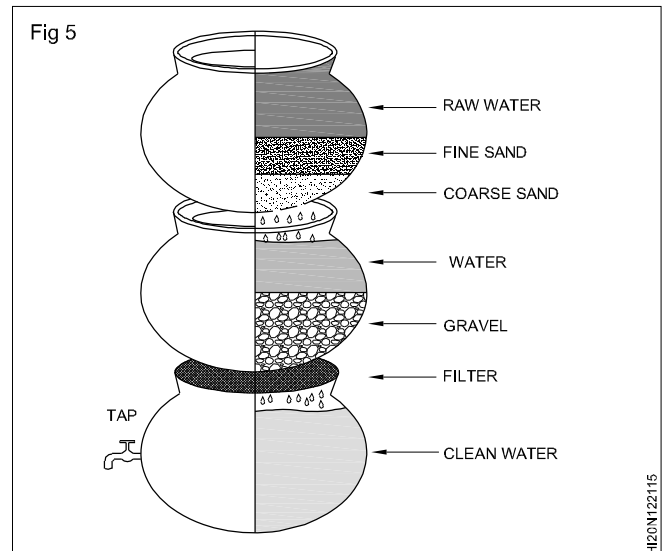
**(iii) Filtration through Muslin Cloth:** Muslin cloth acts as a coarse filter which can remove the suspended materials. So water filtered through muslin is not fit for drinking purposes though it can be used for other household purposes like bathing, washing the clothes etc.

Fig 4



**(iv) Three Pitcher System:** This is very old system of purification of water. In this system three pitchers are

Fig 5

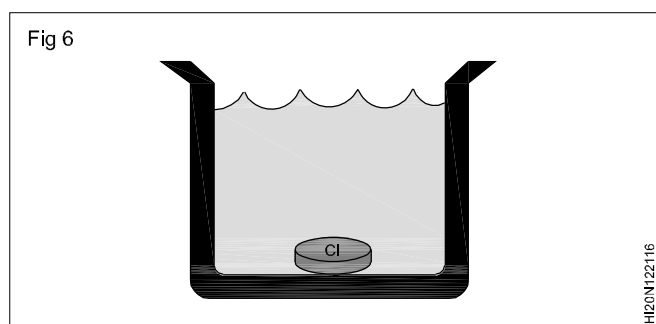


used which are kept one above the other on a wooden stand. The top Picher contains sand, second charcoal and sand; and the lowest collects the purified water. The raw water is filled in the first pitcher from where it percolates through a hole into the 2nd pitcher. From here the water further percolates through the hole to the third pitcher.

**(v) Chemicals:**

Various types of chemical agents used for disinfection of water are discussed as follows:

- (a) Bleaching Powder (Chlorinated Lime)
- (b) Chlorine tablets
- (c) Quick Lime (Calcium Oxide):
- (d) High Test Hypochlorite (HTH)
- (e) Alum
- (f) Potassium Permanganate



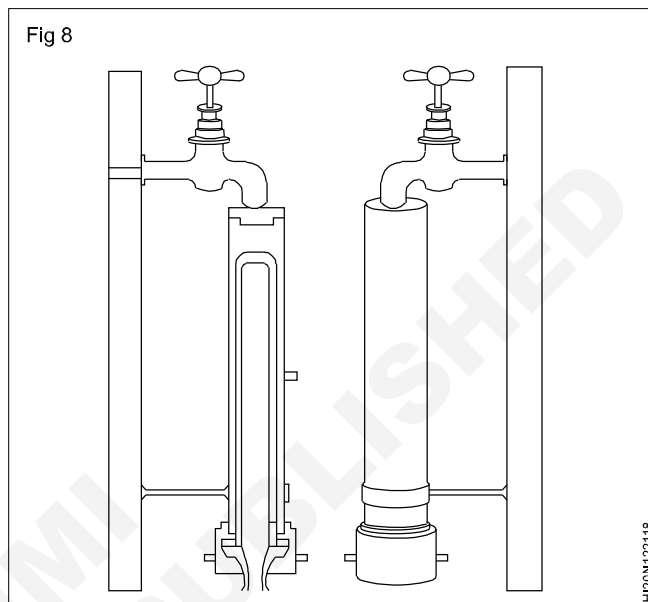
**(vi) Domestic Filters:** Water for drinking purposes can be purified by means of domestic filters which are discussed below:

**(a) Berkefeld Filters:** These are cylindrical filters known as 'filter candles' or 'ceramic candles'. When water is purified through these candles the pores get clogged which need cleaning from time to time at least once a week by scrubbing with a hard brush and passing the water under pressure from inside to outside direction which will remove the entangled particles from the interstices.



**Fig: Berkefeld Filters**

**(b) Pasteur's Chamber land Filter:** It is made up of unglazed porcelain tubes which can be screwed on to a water tap. They work only under pressure and muddy water cannot be filtered through it because the pores will be immediately blocked. Therefore such water must be cleaned to remove mud. For cleaning the filters they are scrubbed from outside with a hard brush and water is made to pass under pressure from inside to outside. They are quick and reliable as they make the water free from all kinds of impurities including bacteria.



**Fig: Pasteur's Chamber land Filter**

## Waste Management & Air and Noise Pollution

**Objectives:** At the end of this lesson you will be able to

- Understand the night soil of a city/town with protection of environment and human being
- Recognise various waste materials and plan solid waste management system in an area or a small town
- Different types of latrines in use
- state the significance of bio-medical waste and e-waste management
- state to Cultivate the knowledge on various factors influencing bio-medical and e-waste
- state the possible ways to help environment and manage eco-system

### Sewage in liquid waste containing human excreta

Sewage is wastewater released by homes, industries, hospitals, offices and other users. It also includes rainwater that has run down the street during a storm or heavy rain. The water that washes off roads and rooftops carries harmful substances with it. Sewage is a liquid waste. Most of it is water, which has dissolved and suspended impurities.

We know that sewage is a complex mixture containing suspended solids, organic and inorganic impurities, nutrients, saprophytes and disease causing bacteria and other microbes. These include the following.

- Organic impurities - Human faeces, animal waste oil, urea (urine), pesticides, herbicides, fruit and vegetable waste, etc.
- Inorganic impurities - Nitrates, Phosphates, metals. Nutrients - Phosphorus and Nitrogen.
- Bacteria - Such as vibrio cholera which causes cholera and salmonella paratyphi which causes typhoid.
- Other microbes - Such as proto-zones which cause dysentery.

### Numerous impact of night soil on the environmental factors

**Night soil** is a historically used euphemism for human excreta collected from cesspools, privies, pail closets, pit latrines, privy middens, septic tanks, etc. This material was removed from the immediate area, usually at night, by workers employed in this trade. Sometimes it could be transported out of towns and sold on as a fertilizer.

Night soil was produced as a result of a sanitation system in areas without sewer systems or septic tanks. In this system of waste management, the human feces are collected without dilution with water.

### Uses in agriculture

Human excreta may be attractive as fertilizer because of the high demand for fertilizer and the relative availability of the material to create night soil. In areas where native soil is of poor quality, the local population may weigh the risk of using night soil. The use of unprocessed human feces as fertilizer is a risky practice as it may contain disease-causing pathogens. Nevertheless, in some developing nations it is still widespread.

Common parasitic worm infections, such as ascariasis, in these countries are linked to night soil use in agriculture, because the helminth eggs are in feces and can thus be transmitted from one infected person to another person (fecal-oral transmission of disease).

These risks are reduced by proper fecal sludge management, e.g. via composting. The safe reduction of human excreta into compost is possible. Some municipalities create compost from the sewage sludge, but then recommend that it only be used on flower beds, not vegetable gardens. Some claim that this is dangerous or inappropriate without the expensive removal of heavy metals.

### Faecal borne disease due to unsanitary disposal of night soil

Faecal-oral diseases are diseases that occur when the causative organisms which are excreted in the stools of infected persons (or less commonly animals) gain entry into the human host via the mouth. Therefore, the organisms have to pass through the environment from the faeces of an infected person to the digestive system of a susceptible person. This is known as the faecal-oral transmission route.

Faecal-oral transmission of organisms causing disease occurs mostly through faecal contamination of food, water, and hands which is not at all apparent. Very small amounts of faeces can carry enough organisms to establish infection. Seemingly sparkling clear water may be dangerously polluted. Contaminated food may smell, look and taste normal and yet harbour infective organisms. Clean-looking hands may carry and transmit enough micro-organisms to spread disease.

### Clinical Presentation of Faecal-oral Disease

Diarrhoea is the commonest manifestation for the majority of the faecal-oral diseases. Diarrhoea causes loss of body fluids, leading to dehydration. In mild dehydration the child presents with thirst and on physical examination will be alert or restless. However, with moderate to severe dehydration, the child may present with:

- Thirst, lethargy and irritability or even drowsiness;
- Rapid and weak pulse due to poor perfusion;
- Anterior fontanel sunken (it closes at about 18 months of age). This reflects depletion in cerebrospinal fluid;

- Skin retracts slowly on being pinched due to decreased interstitial fluid;
- Sunken eyes, reflecting decreased vitreous humour;
- Mucus membranes are dry, reflecting reduced trans-cellular fluids;
- Urine flow is reduced; Poor capillary refill >2 seconds.

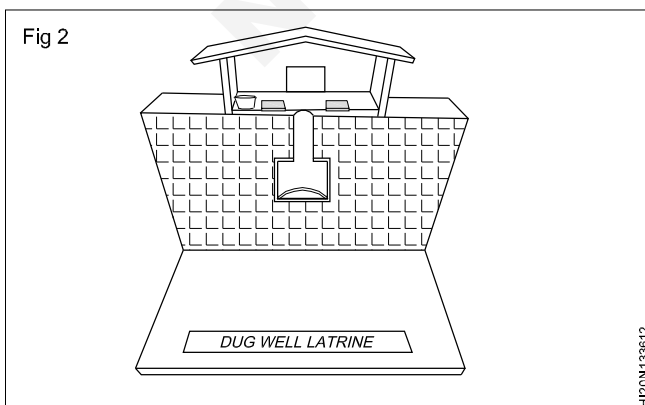
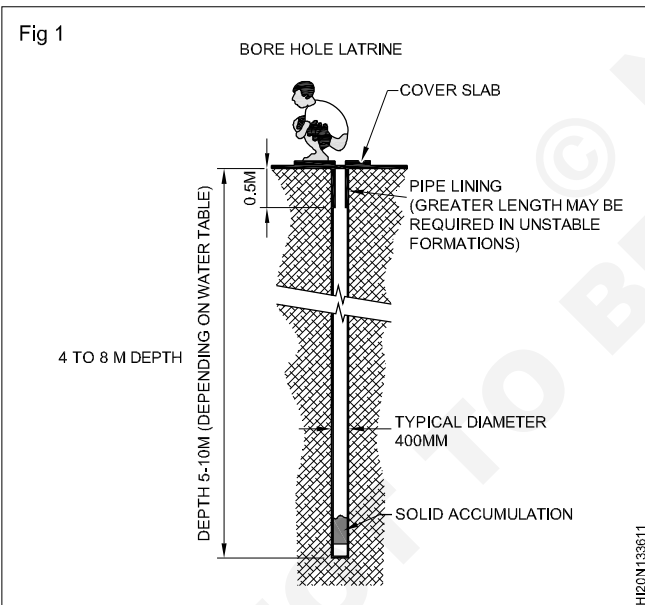
### Different types of latrines in use principal of construction of sanitary latrines and their uses

#### i) Bore hole

Borehole Latrines are mainly provided in the acute response phase, when a large number of latrines are required quickly and the site conditions do not allow for the excavation of bigger pits. A borehole driller is the main requirement for implementation.

Borehole Latrines are usually temporary solutions but depending on diameter, depths and number of users they can also be considered a longer-term solution with a potential life span of several years. The hole is bored using either a mechanical or manual auger or a drilling machine.

The latrine consists of a circular hole 30 to 40 cm in diameter, dug vertically into the ground to a depth of 20 ft. with the help of a special equipment known as auger. The night soil undergoes purification by anaerobic digestion and is eventually converted into a harmless mass.



**ii) Dug well latrine:** It is an improvement over the bore hole latrine. A circular pit about 75 cm in diameter and 12 ft deep is dug into the ground for the reception of the night soil. The action of the dug well latrine is the same as bore hole latrine, i.e., anaerobic digestion.

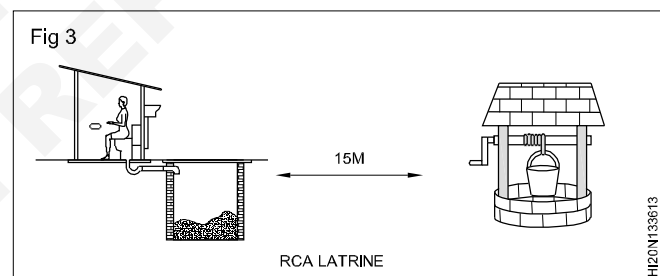
#### iii) RCA

Features of RCA latrine:

1. The squatting plate;
2. The pan
3. The trap
4. Connecting pipe
5. Pit or dug well
6. Superstructure

#### LOCATION:

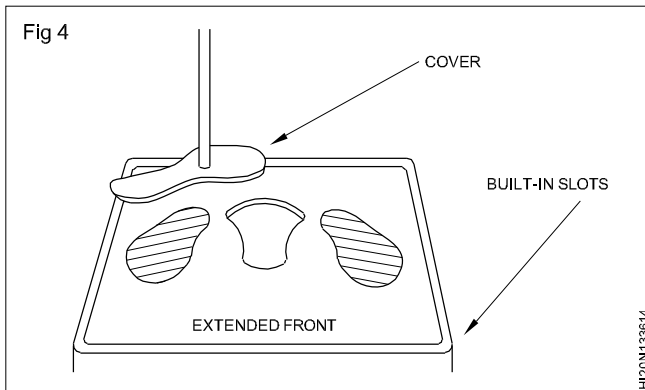
- The safe distance between the latrine and a source of water supply will depend upon the porosity of the soil, level of ground water, its slope and direction of flow.
- In general, it may be stated, that latrines of any kind should not be located within 15 m (50 ft) from a source of water supply, and should be at a lower elevation to prevent the possibility of bacterial contaminate On of the water supply.
- Where possible, latrines should not be located in areas usually subject to flooding.



#### SQUATTING PLATE

- The squatting plate or slab is an important part of a latrine. It should be made of an impervious material so that it can be washed and kept clean and dry.
- If kept dry, it will not facilitate the survival of hookworm larvae.
- In recommending squatting plates, due consideration should be paid to the habits of Indian people who defecate in the squatting position and use water for anal washing.
- The slab of the RCA latrine has been designed to meet the above needs.
- It is made of cement concrete with mm1 mum dimensions of 90 cm (3 ft) square and 5 cm (2 in.) thickness at the outer edge.
- There is a slope 1/2 inch towards the pan. This allows drainage into the latrine of the water used for ablution or cleansing purposes.

- A circular squatting plate of 90 cm (3 ft.) diameter and of 5 cm (2 in.) uniform thickness, has also been found satisfactory. For the convenience of the users, raised footrests are included in the squatting plate.



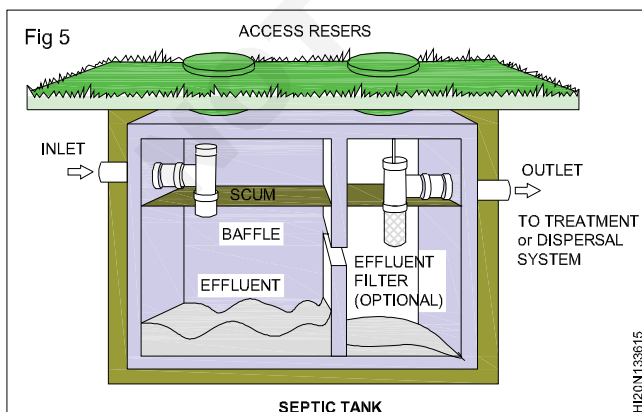
#### PAN

- The pan receives the night soil, urine and wash water.
- The length of the pan is 42.5 cm (17 in.).
- The width of the front portion of the pan has a minimum of 12.5 cm (5 in.) and the width at its widest portion is 20 cm (8 in.).
- There is a uniform slope from front to back of the pan. The pan is given a smooth.

#### iv) Septic Tank

A septic tank can be defined as primary sedimentation tank with large detention time (12 to 36hrs against a period of 2hrs in an ordinary sedimentation tank). In un-sketched rural and urban areas septic tanks are suitable for disposal of night soil. But sufficient water should be available as water is required for flow of the night soil from latrine to the septic tank and for proper functioning of the septic tank.

The size of the septic tank is so designed that the sewage is retained in the tank for 24hrs during which certain biological decomposition by the action of anaerobic bacteria takes place which liquefies and breaks the night soil leaving small quantity of soil which is known as sludge and settles at the bottom of the tank and clear water known as effluent flows out of the tank



#### Sources of Solid Wastes

The main sources of solid wastes are as follows:

- (i) Municipal solid wastes (ii) Industrial Solid Wastes

- (iii) Mining solid wastes (iv) Fertilizers (v) Pesticides and Biocides (vi) Excretory products of humans and livestock (vii) Electronic wastes (viii) Hospital Wastes.

#### (i) Municipal solid wastes:

These are solid wastes from home, offices, stores, schools, hospitals, hotels etc. These domestic solid wastes are usually thrown in municipal garbage collecting cans or on road side open waste lands.

#### (ii) Industrial Solid Wastes

Most of the toxic industrial wastes are dumped on waste lands for slow and gradual decomposition.

#### (iii) Mining solid wastes:

They include mine dust, rock tailing, slack and slag.

#### (iv) Fertilizers:

Chemical fertilizers increase soil fertility and give better crop yield in lesser time. Shortly, the land becomes saline, acidic or alkaline and loses fertility.

#### (v) Pesticides and Biocides:

These toxic chemicals are used in crop fields which are not ecofriendly.

#### (vi) Excretory products of humans and livestock

In underdeveloped and developing countries, the poor sanitary conditions aggravate soil pollution.

#### (vii) Electronic wastes

The latest solid waste that has appeared in last twenty years commonly known as e-wastes is no less harmful. Irreparable computer and electronic goods.

#### (viii) Hospital Wastes

Hospitals generate hazardous wastes that contain disinfectants, other harmful chemicals and pathogenic microorganisms.

#### Generation of Solid Waste

Generation of solid waste is a result of natural, human and animal activities. Knowledge of generation of solid waste is important in the planning, designing and operation of solid waste management system. Generation of solid waste has two aspects: One is the **quality of solid waste** and the other is the **quantity of solid waste**. Quality includes the sources, types and typical composition of solid waste along with its properties whereas the quantity represents the generation rates and total quantities and volumes of waste generated.

#### Quantity of the Solid Waste

Determination of the generation rate of solid waste is the most important parameter required in the design of management and subsystems. Solid waste is usually quantified in terms of generation rate i.e. amount of waste generated by a person or a facility in one day. The estimated generation rate for municipal solid waste of Peshawar as reported is 0.65 kg/capita/day.

## Quality of Solid Waste

The quality of solid waste not only encompasses different types and sources of solid waste but also include its physical chemical and biological characteristics.

## Measures of Quantities

- Volume measurement
- Weight measurement

## Factors Affecting Generation Rates

Factors that affect the generation rate of solid waste include:

- Geographical location - related primarily to the different climate and also the culture that can influence both the amount generated and collection operation.
- Season of the year.
- Frequency of collection of solid waste.
- Characteristics of population: e.g. Income and education levels, also profession classes.
- Extent of salvage and recycling of wastes.
- Legislation regarding solid waste generation, collection and its disposal.
- Public attitude towards solid waste.

## Collection and disposal methods of solid waste

- **Types of Solid Waste Collection Systems:** Essentially there are up to five basic alternatives for collection systems, depending upon the level of effort required from the waste generators.
- **Community Bins:** This is by far the most common collection method in all developing countries, particularly in Pakistan.
- **Block collection:** This is essentially the same system as above with the exception that no community bins are provided.
- **Curbside collection:** This system of collection requires a regular service and a fairly precise schedule. ...
- **Door to door collection:** In this system the householder does offers minimal participation in the collection process.

## Methods of Solid Waste Disposal and Management

Solid waste disposal management is usually referred to the process of collecting and treating solid wastes. It provides solutions for recycling items that do not belong to garbage or trash. Solid waste.

Here are the methods of solid waste disposal and management:

- (i) Solid Waste Open Burning
- (ii) Sea dumping process
- (iii) Solid wastes sanitary landfills

- (iv) Incineration method
- (v) Composting process
- (vi) Disposal by Ploughing into the fields
- (vii) Disposal by hog feeding
- (viii) Salvaging procedure
- (ix) Fermentation/biological digestion

### (i) Solid Waste Open Burning

Solid waste open burning is not the perfect method in the present scenario.

### (ii) Sea Dumping Process

This sea dumping process can be carried out only in coastal cities. This is very costly procedure and not environment friendly.

### (iii) Solid wastes sanitary landfills

Solid wastes sanitary landfills process is simple, clean and effective. In this procedure, layers are compressed with some mechanical equipment and covered with earth, levelled and compacted.

### (iv) Incineration method

Incineration method is suitable for combustible refuse. High operation costs and construction are involved in this procedure. This method would be suited in crowded cities where sites for land filling are not available.

It can be used to reduce the volume of solid wastes for land filling.

### (v) Composting process

Composting process is similar to sanitary land-filling and it is popular in developing countries. Decomposable organic matter is separated and composted in this procedure. Yields are stable end products and good soil conditioners. They can be used as a base for fertilizers.

Two methods have been used in this process:

- a) Open Window Composting
- b) Mechanical Composting

### (vi) Disposal by Ploughing into the fields

Disposal by ploughing into the fields are not commonly used. These disposals are not environment friendly in general.

### (vii) Disposal by hog feeding

Disposal by hog feeding is not general procedure in India. Garbage disposal into sewers including BOD and TSS increases by 20-30%. Refuse is ground well in grinders and then fed into sewers.

### (viii) Salvaging procedure

Materials such as metal, paper, glass, rags, certain types of plastic and so on can be salvaged, recycled, and reused.

### (xi) Fermentation/biological digestion

Biodegradable wastes are converted to compost and



recycling can be done whenever possible. Hazardous wastes can be disposed using suitable methods.

### **Classification of solid waste in community**

#### **(i) Municipal Waste**

Municipal waste includes waste resulting from municipal activities and services such as street wastes, dead animals, market wastes and abandoned vehicles.

#### **(ii) Domestic Residential Waste**

This category of waste comprises the solid wastes that originate from single and multi-family household units. These wastes are generated as a consequence of household activities such as cooking, cleaning, repairs, hobbies, redecoration, empty containers, packaging, clothing, old books, paper and old furnishings.

#### **(iii) Commercial Waste**

Included in this category are solid wastes that originate in offices, wholesale and retail stores, restaurants, hotels, markets, warehouses and other commercial establishments.

#### **(iv) Garbage**

Garbage is the term applied to animal and vegetable waste resulting from the handling, storage, sale, cooking and serving food.

#### **(v) Rubbish**

Rubbish is a general term applied to solid wastes originating in households, commercial establishments and institutions, excluding garbage & ashes.

#### **(vi) Institutional Waste**

Institutional wastes are those arising from institutions such as schools, universities, hospitals and research institutes.

#### **(vii) Ashes**

Ashes are the residues from the burning of wood, coal, charcoal, coke and other combustible materials for cooking and heating in houses, institutions and small industrial establishments.

#### **(viii) Bulky Wastes**

In this category are bulky household wastes, which can't be accommodated in the normal storage containers of households. For this reason they require special collection. In developed countries residential bulky wastes include household furniture and "white goods" appliances such as stoves, washing machines and refrigerators, mattresses and springs, rugs, TV sets, water heaters, tires, lawn mowers, auto parts, tree and brush debris, and so forth.

#### **(xi) Street Sweeping**

This term applies to wastes that are collected from streets, walkways, alleys, parks and vacant lots.

#### **(x) Dead Animals**

This term is applied to dead animals that die naturally or accidentally killed.

#### **(xi) Construction and Demolition Wastes**

Construction and demolition wastes are the waste materials generated by the construction, refurbishment, repair and demolition of houses, commercial buildings and other structures.

#### **Polluting effects of different types of solid waste**

Effect of Solid Waste Pollution Solid waste can pollute air, water and soil, and leave various environmental impacts, and cause health hazard, due to improper handling and transportation

#### **Environmental impacts**

- (i) Leachates from refuse dumps percolates into the soil and contaminate underground water.
- (ii) Scavengers and stray animals invade the roadside garbage and litter the waste over large area causing much aesthetic damage to the atmosphere
- (iii) Waste products when burnt like plastic and rubber pollute the atmosphere with noxious fumes
- (iv) Organic solid wastes emit obnoxious odor on their decomposition and make the environment polluted.

#### **Health hazards**

- (i) Vectors like rats and insects invade refuse dumps and spread various diseases.
- (ii) During handling and transfer of hospital and clinic wastes, disease transmission may take place.
- (iii) Water and food contamination through flies causes various diseases in humans as dysentery, diarrhea and amoebic dysentery.
- (iv) Rats dwelling with infectious solid wastes may spread diseases like plague, salmonellosis, trichinosis, endemic typhus etc.
- (v) Water supply, if gets contaminated with pathogens present in solid wastes, may result in cholera, jaundice, hepatitis, gastro enteric diseases etc.
- (vi) Choking of drains and gully pits by the solid wastes results in water logging which facilitates breeding of mosquitoes and results in the spread of diseases like malaria and plague.

#### **System of collection of solid waste from the houses and streets**

(i) **Door Step Collection through Containerized Handcarts:** A bell may be affixed to the handcart given to the sweeper or a whistle may be provided to the sweeper in lieu of a bell. Each sweeper may be given a fixed area or beat for sweeping plus a fixed number or stretch of houses for collection of waste.

(ii) **Role of Sweeper:** The sweeper should ring the bell or blow the whistle indicating his arrival at the place of his work and start sweeping the street. The people may be directed through adequate publicity campaign that on hearing the bell or whistle they should deposit their domestic biodegradable waste into the handcart of the sweeper.

**(iii) Collection through Motorised Vehicles:** Local bodies as an alternative to doorstep collection through containerised handcarts may deploy motorised vehicles having unconventional/sounding horn for doorstep collection of waste. Driver of the vehicle should intermittently blow the horn announcing his arrival in different residential localities and on hearing this, the householders should deposit their domestic waste directly into such vehicle without loss of time.

**(iv) Primary Collection of Waste from Societies/ Complexes:** In private societies, complexes and multi storied buildings, normally no sweepers are provided by local bodies, hence private sweepers are generally engaged. It may therefore be made compulsory for the management of the societies, complexes and multi-storeyed builders, to keep community bins or containers in which dry and wet waste may be separately stored by their residents.

To facilitate collection of waste from societies or commercial complexes, the local bodies should by a rule, make it obligatory for them to identify a 194 appropriate site within their premises for keeping such bin/container for the storage of waste.

**(v) Collection of Waste from Slums:** Local bodies should collect waste from slums by bell ringing/whistle system along their main access-lanes. Residents should bring their wastes from their houses to hand carts.

**(vi) Collection-at-the Doorstep in Posh Residential Areas:** In posh residential areas where the residents as a whole might not be willing to bring their waste to the municipal handcart/ tricycle, system of collection from the-door step on full cost recovery basis may be introduced. This service can be contracted out by the local body or NGOs or contractors registered with the local body may be encouraged to provide such service in the areas where it is found economically viable to introduce door to door waste collection service.

**Transportation of Solid Waste**

- Objectives:** At the end of this lesson you will be able to
- state the different methods of transporting solid waste
  - state the processing disposal solid waste

**Transportation of Solid Waste**

There is many methods to transport the solid waste, some of them are given below-

**(i) Hand Cart**

The use of traditional hand carts should be discontinued and instead, hand carts having 4-6 detachable containers of capacity ranging from 30-40 liters i.e. 0.03-0.04 cum each should be used. The containers should be of steady material preferably strong polyethylene/plastic with a handle on top and rim at the bottom for easy handling of the container. The handcarts should have preferably three wheels and sealed ball bearing. There should be a locking arrangement with a chain and a lock. These are generally used to collect waste door to door.



**(ii) Tri-Cycle**

Local bodies can use tri-cycles instead of handcarts in the area which are spread out and distances are long. The tri-cycles could have 8 containers of 0.04 cum (40 litre) capacity. These containers should also be detachable from the tri-cycle and should have a locking arrangement. These are also used to pick waste door to door where handcarts can't be used because of avoid walking.



**(iii) Animal Cart**

These are preferred in small towns where road surfaces

are not good. Bullock/ Buffalo/ Horse are used. Person driving the cart transfers materials from bins to cart.



**(iv) Tripper Truck**

The tipper shall be useful for transportation and refuse collection from narrow lanes, individual houses to its disposal point shall be hydraulic. The capacity of container shall be approximately 1.5cum.



**(V) Dumper Placer**

The twin dumper placer shall be useful for transportation of refuse, silt, grit or any other waste from the collection point to its disposal point by two containers at a time.



### (vi) Bulk Refuse Carrier

It is usually picked-up regularly in many countries from the streets or pavements of the area. The service is provided free of charge in many places but often a fee has to be paid.



### (vii) Railroad Transport

Waste by rail is a long-haul transportation system that provides municipalities, manufacturers, environmental firms, commercial entities and other major waste producers with convenient and efficient access to specially equipped landfills.



### (viii) Water Transport

The transportation of waste is the movement of waste over a specific area by trains, tankers, truck or other vehicles.



### Process of disposal of solid waste

**(i) Landfill:** In this process, the waste that cannot be reused or recycled are separated out and spread as a thin layer in low-lying areas across a city. A layer of soil is added after each layer of garbage. However, once this process is complete, the area is declared unfit for construction of buildings for the next 20 years. Instead, it can only be used as a playground or a park.

**(ii) Incineration:** Incineration is the process of controlled combustion of garbage to reduce it to incombustible matter such as ash and waste gas. The exhaust gases from this process may be toxic, hence it is treated before being released into the environment. This process reduces the volume of waste by 90 per cent and is considered as one of the most hygienic methods of waste disposal. In some cases, the heat generated is used to produce electricity. However, some consider this process, not quite environmentally friendly due to the generation of greenhouse gases such as carbon dioxide and carbon monoxide.

**(iii) Waste Compaction:** The waste materials such as cans and plastic bottles are compacted into blocks and sent for recycling. This process prevents the oxidation of metals and reduces airspace need, thus making transportation and positioning easy.

**(iv) Biogas Generation:** Biodegradable waste, such as food items, animal waste or organic industrial waste from food packaging industries are sent to bio-degradation plants. In bio-degradation plants, they are converted to biogas by degradation with the help of bacteria, fungi, or other microbes. Here, the organic matter serves as food for the micro-organisms. The degradation can happen aerobically (with oxygen) or anaerobically (without oxygen). Biogas is generated as a result of this process, which is used as fuel, and the residue is used as manure.

**(v) Composting:** All organic materials decompose with time. Food scraps, yard waste, etc., make up for one of the major organic wastes we throw every day. The process of composting starts with these organic wastes being buried under layers of soil and then, are left to decay under the action of microorganisms such as bacteria and fungi. This results in the formation of nutrient-rich manure. Also, this process ensures that the nutrients are replenished in the soil. Besides enriching the soil, composting also increases the water retention capacity. In agriculture, it is the best alternative to chemical fertilizers.

**(vi) Vermicomposting:** Vermicomposting is the process of using worms for the degradation of organic matter into nutrient-rich manure. Worms consume and digest the organic matter. The by-products of digestion which are excreted out by the worms make the soil nutrient-rich, thus enhancing the growth of bacteria and fungi. It is also far more effective than traditional composting.

## State Techniques of Segregation - Packing and Bio-Medical Waste

**Objectives:** At the end of this lesson you will be able to

- introduction to bio-chemical waste
- state characteristics of bio - medical waste
- state techniques of bio - medical waste management
- treatment method of bio - medical waste

### E - Waste - Introduction

#### a) Introduction to Biomedical-waste

**Biomedical waste** or **hospital waste** is any kind of waste containing infectious (or potentially infectious) materials. It may also include waste associated with the generation of biomedical waste that visually appears to be of medical or laboratory origin (e.g. packaging, unused bandages, infusion kits etc.), as well research laboratory waste containing biomolecules or organisms that are mainly restricted from environmental release.

#### b) Sources, composition and characteristic of hazardous waste

Biomedical waste may be solid or liquid. Examples of infectious waste include discarded blood, sharps, unwanted microbiological cultures and stocks, identifiable body parts (including those as a result of amputation), other human or animal tissue, used bandages and dressings, discarded gloves, other medical supplies that may have been in contact with blood and body fluids, and laboratory waste that exhibits the characteristics described above.

Biomedical waste is generated from biological and medical sources and activities, such as the diagnosis, prevention, or treatment of diseases.

Biomedical waste is distinct from normal trash or general waste, and differs from other types of hazardous waste, such as chemical, radioactive, universal or industrial waste.

#### Characteristics of Bio-medical waste

Disposal of this waste is an environmental concern, as many medical wastes are classified as infectious or biohazardous and could potentially lead to the spread of infectious disease. The most common danger for humans is the infection which also affects other living organisms in the region. Daily exposure to the wastes (landfills) leads to accumulation of harmful substances or microbes in the person's body.

#### c) Techniques of bio-medical waste management

Biomedical waste must be properly managed and disposed of to protect the environment, general public and workers, especially healthcare and sanitation workers who are at risk of exposure to biomedical waste as an occupational hazard. Steps in the management of biomedical waste include generation, accumulation, handling, storage, treatment, transport and disposal.

Disposal occurs off-site, at a location that is different from the site of generation. Treatment may occur on-site or off-site.

Off-site treatment and disposal involves hiring of a biomedical waste disposal service (also called a truck service) whose employees are trained to collect and haul away biomedical waste in special containers (usually cardboard boxes, or reusable plastic bins) for treatment at a facility designed to handle biomedical waste.

#### Generation, accumulation and collection of biomedical waste

Biomedical waste should be collected in containers that are leak-proof and sufficiently strong to prevent breakage during handling.

#### Storage & Handling of biomedical waste

Storage refers to keeping the waste until it is treated on-site or transported off-site for treatment or disposal. There are many options and containers for storage.

#### d) Treatment of bio-medical waste

Biomedical waste is often incinerated. An efficient incinerator will destroy pathogens and sharps. Source materials are not recognizable in the resulting ash. Alternative thermal treatment can also include technologies such as gasification and pyrolysis including energy recovery with similar waste volume reductions and pathogen destruction.

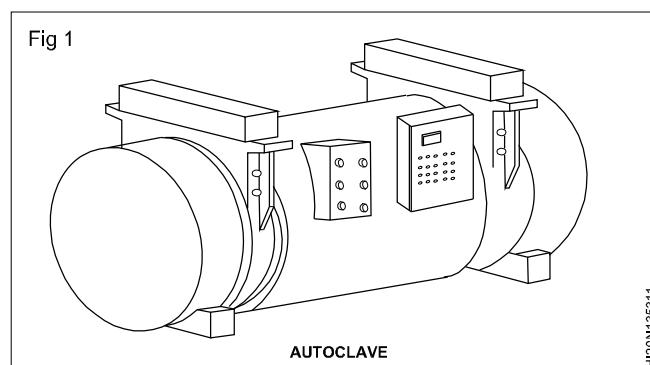
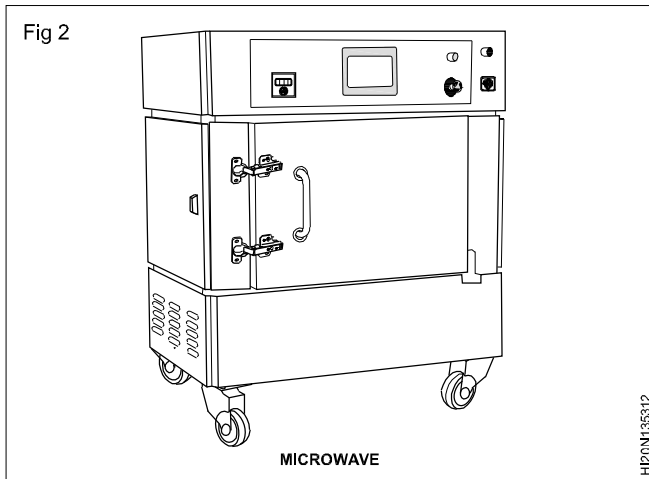


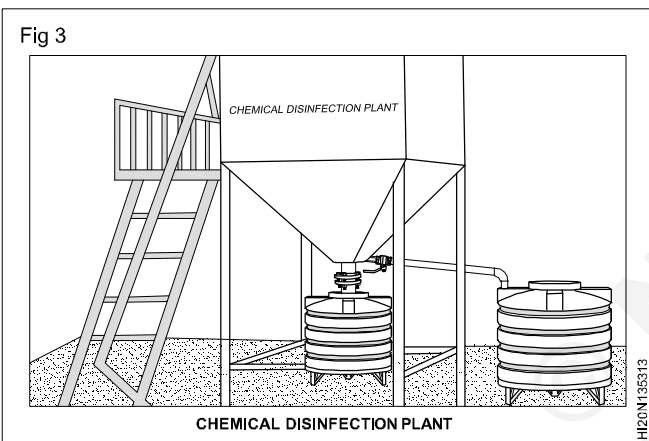
Fig 1 -Autoclave

Microwave disinfection can also be employed for treatment of biomedical wastes. Microwave irradiation is a type of non-contact heating technologies for disinfection.



**Fig 2 - Microwave**

For liquids and small quantities, a 1-10% solution of bleach can be used to disinfect biomedical waste. Solutions of sodium hydroxide and other chemical disinfectants may also be used, depending on the waste's characteristics.



**Fig 3 -Chemical disinfection plant**



**Fig 4 -Hydroclave**

Other treatment methods include heat, alkaline digesters and the use of microwaves. For autoclaves and microwave systems, a shredder may be used as a final treatment step to render the waste unrecognizable. Some autoclaves have built in shredders.

The latest guidelines for segregation of bio-medical waste recommend the following color coding:

- **Red Bag** - Syringes (without needles), soiled gloves, catheters, IV tubes etc. should be all disposed of in a red colored bag, which will later be incinerated.
- **Yellow Bag** - All dressings, bandages and cotton swabs with body fluids, blood bags, human anatomical waste, body parts are to be discarded in yellow bags.
- **Cardboard box with blue marking** - Glass vials, ampules, other glass ware is to be discarded in a cardboard box with a blue marking/sticker.
- **White Puncture Proof Container (PPC)** - Needles, sharps, blades are disposed of in a white translucent puncture proof container.
- **Black Bags** - These are to be used for non-bio-medical waste.

#### Methods of biomedical waste incineration

The three type of medical waste incinerators are controlled air, excess air, and rotary kiln. Controlled air is also known as starved-air incineration, two-stage incineration, or modular combustion. The second type of incineration is the excess air process. In a rotary kiln, the process is similar to the two mention above, however, it is more versatile in terms of being able to mix wet and dry waste components and viewed by many waste engineers as being the most environmentally friendly.

#### Impact on the environment

Post incineration process, toxic ash residue is produced and is often disposed at landfills. These landfills are not protected by any barrier and the residue has the potential of reaching underground water that is often exposed to human use.

#### (e) E-waste

**Electronic waste** or **e-waste** describes discarded electrical or electronic devices.Used electronics which are destined for refurbishment, reuse, resale, salvage recycling through material recovery, or disposal are also considered e-waste. Informal processing of e-waste in developing countries can lead to adverse human health effects and environmental pollution.

#### Significance of e-waste

E-waste or electronic waste is created when an electronic product is discarded after the end of its useful life. The rapid expansion of technology and the consumption driven society results in the creation of a very large amount of e-waste.

These include used electronics which are destined for reuse, resale, salvage, recycling, or disposal as well as re-usables (working and repairable electronics) and

secondary raw materials (copper, steel, plastic, etc.).

The term "waste" is reserved for residue or material which is dumped by the buyer rather than recycled, including residue from reuse and recycling operations, because loads of surplus electronics are frequently commingled (good, recyclable, and non-recyclable).

### Benefits of recycling

Benefits of recycling are extended when responsible recycling methods are used. In the U.S., responsible recycling aims to minimize the dangers to human health and the environment that disposed and dismantled electronics can create. Responsible recycling ensures best management practices of the electronics being recycled, worker health and safety, and consideration for the environment locally and abroad

### Health hazards of e-waste

Exposure to e-waste can cause serious health problems to children. Children's exposure to developmental neurotoxins containing in e-waste such as lead, mercury, cadmium, chromium and PBDEs can lead to a higher risk of lower IQ, impaired cognitive function, and other adverse effects.

### E-waste recycling workers

The complex composition and improper handling of e-waste adversely affect human health. A growing body of epidemiological and clinical evidence has led to increased concern about the potential threat of e-waste to human health, especially in developing countries such as India and China.

**Table 1 -Environmental impact of e-waste**

E-Waste Component	Electric Appliances in which they are found	Adverse Health Effects
Americium	The radioactive source in smoke alarms.	It is known to be carcinogenic.
Lead	Solder, CRT monitor glass, lead-acid batteries, some formulations of PVC. A typical 15-inch cathode ray tube may contain 1.5 pounds of lead, <sup>[4]</sup> but other CRTs have been estimated as having up to 8 pounds of lead.	Adverse effects of lead exposure include impaired cognitive function, behavioural disturbances, attention deficits, hyperactivity, conduct problems, and lower IQ. These effects are most damaging to children whose developing nervous systems are very susceptible to damage caused by lead, cadmium, and mercury.
Mercury	Found in fluorescent tubes (numerous applications), tilt switches (mechanical doorbells, thermostats) and ccfl backlights in flat screen monitors.	Health effects include sensory impairment, dermatitis, memory loss, and muscle weakness. Exposure in-utero causes fetal deficits in motor function, attention, and verbal domains.  Environmental effects in animals include death, reduced fertility, and slower growth and development.
Cadmium	Found in light-sensitive resistors, corrosion-resistant alloys for marine and aviation environments, and nickel-cadmium batteries. The most common form of cadmium is found in Nickel-cadmium rechargeable batteries. These batteries tend to contain between 6 and 18% cadmium. The sale of Nickel-Cadmium batteries has been banned in the European Union except for medical use. When not properly recycled it can leach into the soil, harming microorganisms and disrupting the soil ecosystem. Exposure is caused by proximity to hazardous waste sites and factories and workers in the metal refining industry.	The inhalation of cadmium can cause severe damage to the lungs and is also known to cause kidney damage. <sup>[112]</sup> Cadmium is also associated with deficits in cognition, learning, behavior, and neuromotor skills in children.

Hexavalent chromium	Used in metal coatings to protect from corrosion.	A known carcinogen after occupational inhalation exposure. There is also evidence of cytotoxic and genotoxic effects of some chemicals, which have been shown to inhibit cell proliferation, cause cell membrane lesion, cause DNA single-strand breaks, and elevate Reactive Oxygen Species (ROS) levels.
Sulfur	Found in lead-acid batteries.	Health effects include liver damage, kidney damage, heart damage, eye and throat irritation. When released into the environment, it can create sulfuric acid through sulfur dioxide.
Brominated Flame Retardants (BFRs)	Used as flame retardants in plastics in most electronics. Includes PBBs, PBDE, DecaBDE, OctaBDE, PentaBDE.	Health effects include impaired development of the nervous system, thyroid problems, liver problems. Environmental effects: similar effects as in animals as humans. PBBs were banned from 1973 to 1977 on. PCBs were banned during the 1980s.
Perfluorooctanoic acid (PFOA)	Used as an antistatic additive in industrial applications and found in electronics, also found in non-stick cookware (PTFE). PFOAs are formed synthetically through environmental degradation.	Health effects include impaired development of the nervous system, thyroid problems, liver problems. Environmental effects: similar effects as in animals as humans. PBBs were banned from 1973 to 1977 on. PCBs were banned during the 1980s.
Beryllium oxide	Filler in some thermal interface materials such as thermal grease used on heatsinks for CPUs and power transistors. <sup>[116]</sup> magnetrons, X-ray-transparent ceramic windows, heat transfer fins in vacuum tubes, and gas lasers.	Occupational exposures associated with lung cancer, other common adverse health effects are beryllium sensitization, chronic beryllium disease, and acute beryllium disease.
Polyvinyl chloride (PVC)	Commonly found in electronics and is typically used as insulation for electrical cables. <sup>[118]</sup>	In the manufacturing phase, toxic and hazardous raw material, including dioxins are released. PVC such as chlorine tend to bioaccumulate. Over time, the compounds that contain chlorine can become pollutants in the air, water, and soil. This poses a problem as human and animals can ingest them. Additionally, exposure to toxins can result in reproductive and developmental health effects

**Table 1 - Components of e-waste**

E-Waste Component	Process Used
Aluminium	nearly all electronic goods using more than a few watts of power (heatsinks), ICs, electrolytic capacitors.
Copper	copper wire, printed circuit board tracks, ICs, component leads.
Germanium <sup>[107]</sup>	1950s-1960s transistorized electronics (bipolar junction transistors).



Gold	connector plating, primarily in computer equipment.
Lithium	lithium-ion batteries.
Nickel	nickel-cadmium batteries.
Silicon	glass, transistors, ICs, printed circuit boards.
Tin	solder, coatings on component leads.
Zinc	plating for steel parts.

**Table 2 - Hazards applicable to recycling**

Hazards	Details
Slips, trips, and falls	They can happen during collecting and transporting e-wastes.
Crushing hazards	Workers can be stuck or crushed by the machine or the e-waste. There can be traffic accidents when transporting e-waste. Using machines that have moving parts, such as conveyors and rolling machines can also cause crush accidents, leading to amputations, crushed fingers or hands.
Hazardous energy released	Unexpected machine startup can cause death or injury to workers. This can happen during the installation, maintenance, or repair of machines, equipment, processes, or systems.
Cuts and lacerations	Hands or body injuries and eye injuries can occur when dismantling e-wastes that have sharp edges.
Noise	Working overtime near loud noises from drilling, hammering, and other tools that can make a great noise lead to hearing loss.
Toxic chemicals (dusts)	Burning e-waste to extract metals emits toxic chemicals (e.g. PAHs, lead) from e-waste to the air, which can be inhaled or ingested by workers at recycling sites. This can lead to illness from toxic chemicals.

**Table 3 -Hazard prevention of e-waste**

Hazards	What must employers do	What should workers do
General	<p>Actions include:</p> <ul style="list-style-type: none"> <li>determine the hazards in the workplace and take actions to control them;</li> <li>check and make correction to the workplace condition regularly;</li> <li>supply safe tools and PPE to workers;</li> <li>provide workers with training about hazards and safe work practice;</li> <li>a written document about injury and illness prevention.</li> </ul>	<p>Suggestions include:</p> <ul style="list-style-type: none"> <li>wear PPE when working;</li> <li>talk with employers about ways to improve working conditions;</li> <li>report anything unsafe in the workplace to employers;</li> <li>share experience of how to work safely with new workers.</li> </ul>
Dust	<p>Actions include:</p> <ul style="list-style-type: none"> <li>offer a clean eating area, cleaning area and supplies, uniforms and shoes, and lockers for clean clothes to the workers;</li> <li>provide tools to dismantle the e-waste.</li> </ul>	<p>Protective measures include:</p> <ul style="list-style-type: none"> <li>clean the workplace regularly, and do not eat or smoke when dealing with e-waste;</li> <li>don't use brooms to clean the workplace since brooms can raise dust;</li> <li>before going home, shower, change into clean clothes, and separate the dirty work clothes</li> </ul>

	<p>If the dust contains lead or cadmium:</p> <ul style="list-style-type: none"> <li>• measure the dust, lead and cadmium level in the air;</li> <li>• provide cleaning facilities such as wet mops and vacuums;</li> <li>• provide exhaust ventilation. If it is still not sufficient to reduce the dust, provide workers with respirators;</li> <li>• provide workers with blood lead testing when lead level is not less than 30 mg/m<sup>3</sup>.</li> </ul>	<p>and clean clothes;</p> <ul style="list-style-type: none"> <li>• test the blood lead, even if the employers don't provide it;</li> <li>• use respirator, check for leaks every time before use, always keep it on your face in the respirator use area, and clean it properly after use.</li> </ul>
Cuts and lacerations	Protective equipment such as gloves, masks and eye protection equipments should be provided to workers	When dealing with glass or shredding materials, protect the hands and arms using special gloves and oversleeves.
Noise	<p>Actions include:</p> <ul style="list-style-type: none"> <li>• measure the noise in the workplace, and use engineering controls when levels exceed the exposure limit;</li> <li>• reduce the vibration of the working desk by rubber matting;</li> <li>• provide workers with earmuffs when necessary.</li> </ul>	Wear the hearing protection all the time when working. Ask for the employer about the noise monitoring results. Test the hearing ability.
Lifting injuries	Provide facilities to lift or move the e-waste and adjustable work tables.	When handling e-waste, try to decrease the load per time. Try to get help from other workers when lifting heavy or big things.

## Air and Noise Pollution

**Objectives:** At the end of this exercise for you will be able to

- state introduction to air pollution & types of air pollution
- state composition of air and other components of air
- state source and nature of air pollution
- state global warming and its impact
- state the concept of ventilation
- process to control noise pollution

### Introduction of air pollution

Air pollution refers to any physical, chemical or biological change in the air. It is the contamination of air by harmful gases, dust and smoke which affects plants, animals and humans drastically. There is a certain percentage of gases present in the atmosphere. An increase or decrease in the composition of these gases is harmful to survival. This imbalance in the gaseous composition has resulted in an increase in earth's temperature, which is known as global warming.

### Types of Air Pollutants

There are two types of air pollutants:

**Primary Pollutants:** The pollutants that directly cause air pollution are known as primary pollutants. Sulphur-dioxide emitted from factories is a primary pollutant.

**Secondary Pollutants:** The pollutants formed by the intermingling and reaction of primary pollutants are known as secondary pollutants. Smog, formed by the intermingling of smoke and fog, is a secondary pollutant.

Element	Volume by %	Weight by %	PPM(Parts per Million) by Volume	Symbol of the Element	Molecular Weight of the element
Nitrogen	78.08	75.47	780790	N <sub>2</sub>	28.01
Oxygen	20.95	23.20	209445	O <sub>2</sub>	32.00
Argon	0.93	1.28	9339	Ar	39.95
Carbon Dioxide	0.040	0.062	404	CO <sub>2</sub>	44.01
Neon	0.0018	0.0012	18.21	Ne	20.18
Helium	0.0005	0.00007	5.24	He	4.00
Krypton	0.0001	0.0003	1.14	Kr	83.80
Hydrogen	0.00005	Negligible	0.50	H <sub>2</sub>	2.02
Xenon	8.7 x 10 <sup>-6</sup>	0.00004	0.087	Xe	131.3

### Other Components of Air

Some other components of air are mentioned below:

- Sulfur dioxide(SO<sub>2</sub>) - 1.0 ppm
- Methane(CH<sub>4</sub>) 2.0 ppm
- Nitrous oxide(N<sub>2</sub>O) - 0.5 ppm
- Ozone(O<sub>3</sub>) 0 to 0.07 ppm
- Nitrogen dioxide(NO<sub>2</sub>) - 0.02 ppm
- Iodine(I<sub>2</sub>) 0.01 ppm
- Carbon monoxide(CO) - 0 to trace ppm
- Ammonia(NH<sub>3</sub>) 0 to trace ppm

### Sources and nature of air pollution

Following are the important causes of air pollution:

**Burning of Fossil Fuels:** The combustion of fossil fuels emits a large amount of sulphur dioxide. Carbon monoxide released by incomplete combustion of fossil fuels also results in air pollution.

**Automobiles:** The gases emitted from vehicles such as jeeps, trucks, cars, buses, etc. pollute the environment. These are the major sources of greenhouse gases and also result in diseases among individuals.

**Agricultural Activities:** Ammonia is one of the most hazardous gases emitted during agricultural activities. The

insecticides, pesticides and fertilizers emit harmful chemicals in the atmosphere and contaminate it.

**Factories and Industries:** Factories and industries are the main source of carbon monoxide, organic compounds, hydrocarbons and chemicals. These are released into the air, degrading its quality.

**Mining Activities:** In the mining process, the minerals below the earth are extracted using large pieces of equipment. The dust and chemicals released during the process not only pollute the air, but also deteriorate the health of the workers and people living in the nearby areas.

**Domestic Sources:** The household cleaning products and paints contain toxic chemicals that are released in the air. The smell from the newly painted walls is the smell of the chemicals present in the paints. It not only pollutes the air but also affects breathing

### Effects of air pollution on health

There are many diseases that can bring about a host of potentially fatal illnesses. From chronic bronchitis to lung cancer, air pollution has the potential to raise the risk of illness.

Air pollution and its link to the respiratory system is quite obvious. However, air pollution is also known to affect the circulatory system and the nervous system. When particular matter enters the nasal cavity, the lining will get irritated and the body may mistake it for an infection, this causes an inflammatory response, which can result in the exacerbation of any pre-existing conditions.

What are the Effects of Air Pollution on Human Health?

- Human health is also severely affected by particulates in the atmosphere. The particulates can cause nasal irritation and swelling. It can also cause a running nose.
- Air pollution is also linked to lung damage and limited lung function
- Air pollution can also have an inflammatory effect on the heart - it can elevate blood pressure and aggravate pre-existing conditions of the heart.
- The risk of death significantly increases with long term exposure to polluted air. For instance, people susceptible to heart diseases are at higher risk.

### Prevention and controlling methods of air pollution

Following are the measures one should adopt, to control air pollution:

**Avoid Using Vehicles:** People should avoid using vehicles for shorter distances. Rather, they should prefer public modes of transport to travel from one place to another. This not only prevents pollution, but also conserves energy.

**Energy Conservation:** A large number of fossil fuels are burnt to generate electricity. Therefore, do not forget to switch off the electrical appliances when not in use. Thus, you can save the environment at the individual level. Use of energy-efficient devices such CFLs also controls

pollution to a greater level.

**Use of Clean Energy Resources:** The use of solar, wind and geothermal energies reduce air pollution at a larger level. Various countries, including India, have implemented the use of these resources as a step towards a cleaner environment.

Other air pollution control measures include:

- By minimizing and reducing the use of fire and fire products.
- Since industrial emissions are one of the major causes of air pollution, the pollutants can be controlled or treated at the source itself to reduce its effects. For example, if the reactions of a certain raw material yield a pollutant, then the raw materials can be substituted with other less polluting materials.
- Fuel substitution is another way of controlling air pollution. In many parts of India, petrol and diesel are being replaced by CNG - Compressed Natural Gas fueled vehicles. These are mostly adopted by vehicles that aren't fully operating with ideal emission engines.
- Although there are many practices in India, which focus on repairing the quality of air, most of them are either forgotten or not being enforced properly. There are still a lot of vehicles on roads which haven't been tested for vehicle emissions.
- Another way of controlling air pollution caused by industries is to modify and maintain existing pieces of equipment so that the emission of pollutants is minimized.
- Sometimes controlling pollutants at the source is not possible. In that case, we can have process control equipment to control the pollution.
- A very effective way of controlling air pollution is by diluting the air pollutants.
- The last and the best way of reducing the ill effects of air pollution is tree plantation. Plants and trees reduce a large number of pollutants in the air. Ideally, planting trees in areas of high pollution levels will be extremely effective.

### Global warming and its impact

Global warming is the phenomenon of a gradual increase in the temperature near the earth's surface. This phenomenon has been observed over the past one or two centuries. This change has disturbed the climatic pattern of the earth. There are several causes of global warming, which have a negative effect on humans, plants and animals. These causes may be natural or might be the outcome of human activities.

### Causes of Global Warming

Following are the major causes of global warming:

- **Man-made Causes of Global Warming**

**Deforestation:** Plants are the main source of oxygen.

They take in carbon dioxide and release oxygen thereby maintaining environmental balance. Forests are being depleted for many domestic and commercial purposes. This has led to an environmental imbalance, thereby giving rise to global warming.

**Use of Vehicles:** The use of vehicles, even for a very short distance results in various gaseous emissions. Vehicles burn fossil fuels which emit a large amount of carbon dioxide and other toxins into the atmosphere resulting in a temperature increase.

**Chlorofluorocarbon:** With the excessive use of air conditioners and refrigerators, humans have been adding CFCs into the environment which affects the atmospheric ozone layer.

**Industrial Development:** With the advent of industrialization, the temperature of the earth has been increasing rapidly. The harmful emissions from the factories add to the increasing temperature of the earth.

**Agriculture:** Various farming activities produce carbon dioxide and methane gas. These add to the greenhouse gases in the atmosphere and increase the temperature of the earth.

**Overpopulation:** Increase in population means more people breathing. This leads to an increase in the level of carbon dioxide, the primary gas causing global warming, in the atmosphere.

### Natural Causes of Global Warming

**Volcanoes:** Volcanoes are one of the largest natural contributors to global warming. The ash and smoke emitted during volcanic eruptions goes out into the atmosphere and affects the climate.

**Water Vapour:** Water vapour is a kind of greenhouse gas. Due to the increase in the earth's temperature more water gets evaporated from the water bodies and stays in the atmosphere adding to global warming.

**Melting Permafrost:** Permafrost is there where glaciers are present. It is a frozen soil that has environmental gases trapped in it for several years. As the permafrost melts, it releases the gases back into the atmosphere increasing the earth's temperature.

**Forest Blazes:** Forest blazes or forest fires emit a large amount of carbon-containing smoke. These gases are released into the atmosphere and increase the earth's temperature resulting in global warming.

### Effects of Global Warming

Following are the major effects of global warming:

**Rise in Temperature:** Global warming has led to an incredible increase in earth's temperature. Since 1880, the earth's temperature has increased by ~1 degrees. This has resulted in an increase in the melting of glaciers, which have led to an increase in the sea level. This could have devastating effects on coastal regions.

**Threats to the Ecosystem:** Global warming has affected the coral reefs that can lead to a loss of plant and animal lives. Increase in global temperatures has made the

fragility of coral reefs even worse.

**Climate Change:** Global warming has led to a change in climatic conditions. There are droughts at some places and floods at some. This climatic imbalance is the result of global warming.

**Spread of Diseases:** Global warming leads to a change in the patterns of heat and humidity. This has led to the movement of mosquitoes that carry and spread diseases.

**High Mortality Rates:** Due to an increase in floods, tsunamis and other natural calamities, the average death toll usually increases. Also, such events can bring about the spread of diseases that can hamper human life.

**Loss of Natural Habitat:** A global shift in the climate leads to the loss of habitats of several plants and animals. In this case, the animals need to migrate from their natural habitat and many of them even become extinct. This is yet another major impact of global warming on biodiversity.

### Concept of temperature, humidity, radiation, thermal comfort, evaporation etc...

#### Thermal comfort:

Thermal comfort is determined by the room's temperature, humidity and air speed. There are many additional factors such as activity level, clothing, age, gender and health status that affect your comfort. Radiant heat (hot surfaces) or radiant heat loss (cold surfaces) are also important factors for thermal comfort.

Relative humidity (RH) is a measure of the moisture in the air, compared to the potential saturation level. Warmer air can hold more moisture. When you approach 100% humidity, the air moisture condenses - this is called the dew point.

#### Concept of temperature:

The temperature in a building is based on the outside temperature and sun loading plus whatever heating or cooling is added by the HVAC or other heating and cooling sources.

Room occupants also add heat to the room since the normal body temperature is much higher than the room temperature. The relative humidity is based on the outside humidity plus whatever heating or cooling is added by the HVAC or other heating or cooling sources.

Room occupants also add considerable moisture to the room through exhaled air which is at 100% relative humidity. Since relative humidity depends on temperature.

Relative humidity of cold air from the outside decreases as it is warmed up. Refrigerated air conditioning often removes moisture from the air as it is cooled. Evaporative air conditioning adds moisture to the air.

#### Concept of radiation:

To radiate means to emit, and in physics terms, Radiation refers to energy in the form of waves or moving subatomic particles emitted by an atom or other body, as it changes from a higher energy state to a lower energy state. But none of you need to know that. Radiation is divided up

into two types - Ionizing radiation and Non-Ionizing radiation.

### **Concept of humidity:**

The amount of relative humidity to be present in our home will depend on the region and climate you live in. Mathematically, relative humidity is the gram-per-cubic-meter (g/m<sup>3</sup>) measure of the water vapour in the air divided by the gram-per-cubic-meter (g/m<sup>3</sup>) measure of the maximum amount of moisture the air can hold at a given temperature.

### **Concept of evaporation:**

- Evaporation is the procedure of a substance in a liquid state altering to a gaseous state.
- The water in the glass will be refrigerated by the evaporation until a balance is reached where the air supplies.

### **Methods of air purification**

The air purification uses an air filtration system to continuously purify the air in the external space through the air inlet, filter, and air purification filter. Then, it is put back into the air. It has reached the level of keeping the air in the space clean.

### **Air purification methods**

#### **a The overall purification**

There are two types for the overall purification: laminar flow type and turbulent flow type. Laminar flow means that the air flows from one side to the other at the same speed. The dust particles or bacteria generated in the room will not diffuse to the surroundings and will be pushed out of the outdoors, achieving a good sterilization effect.

#### **• High-efficiency filtration and sterilization technology**

Air cleaning mainly relies on high-efficiency or ultra-high-efficiency filtration equipment to deliver clean air to a specific environment and maintain the cleanliness of the air. Therefore, filtration and clean technology are the results of a comprehensive effect.

#### **• Filter structure**

Most of the filter materials used in biological cleanrooms are high-efficiency or ultra-high-efficiency filter materials. The filter materials mainly are glass wool filter material, high-grade pulp filter material, asbestos fiber filter material.

#### **b Partial air purification methods**

##### **• Laminar flow hood**

It is a local air purification device in the hospital. Generally, it can form a vertical laminar flow method with transparent curtains around it. It can maintain high cleanliness air, so it is great for the treatment and protection of patients with weakened immune function, so it is also called a sterile bed laminar flow hood.

##### **• Clean operation bench**

It can purify the air in the box, making the purification of air reach a high level.

##### **• Electrostatic adsorption sterilization purification technology:**

Electrostatic adsorption sterilization uses the principle of industrial electric dust removal, with innovations in miniaturization technology.

The above are several air purification methods for cleanrooms. In addition, there are three working ways of air purification system in a cleanroom: turbulent flows, laminar flow, and compound.

### **Air disinfection:**

Ultraviolet air disinfection is a highly effective way to destroy microorganisms including: virus, bacteria, and mold spores. As the air stream and surfaces are exposed to the germicidal ultraviolet light, the genetic material of the microorganism is destroyed or deactivated. This method of air purification is ideal for many applications because it is economical, safe, fast and easy with simple use and maintenance.

### **Applications for Ultraviolet Air Disinfection**

#### **• Ultraviolet Air Disinfection with Upper Air Disinfection Equipment (for use in commercial and industrial applications)**

When duct installation or room air sanitizers are not the most ideal, germicidal ultraviolet light can be utilized with fixtures designed for upper air disinfection. Ultraviolet upper air disinfection equipment is ideal for hospitals, laboratories, clean rooms, operating rooms, ICU's, burn centres, doctors' offices, and homeless shelters.

#### **• Ultraviolet Air Disinfection with Air Duct Systems (For use in residential, commercial and industrial applications)**

Ultraviolet air duct disinfection fixtures can be used in two types of applications in HVAC equipment: treatment of the airstream or treatment of the surfaces within the air-handler. With the proper system design and installation, the moving air can be disinfected with germicidal ultraviolet light. They deactivate airborne microbes inside the ducts so that the air entering the room is free of bacteria, mold, and virus.

#### **• Ultraviolet Air Disinfection with Room Air Sanitizers (For use in residential, commercial and industrial applications)**

Ultraviolet room air sanitizers can be mounted in a ceiling, on a wall, or are available for portable or mobile use. Air is drawn into the fixture through a washable, electrostatic, particulate filter and forced into an ultraviolet exposure chamber where it is irradiated by germicidal ultraviolet light. Ultraviolet room air sanitizers are excellent for homes, offices, food processing, pharmaceutical manufacturing facilities, dairy plants, bakeries, homeless shelters, prisons, auditoriums, waiting rooms, and hospitals.

## Ventilation:

Ventilation acts like the lungs of the building. It is the process of moving outdoor air into the building or a room and distributing it in the area. The fresh air will dilute the inside polluted air, and also it will be replaced by some of the contaminated air. The primary purpose of ventilation is to prepare healthy air for the breathing of people in that place.

### Concepts of ventilation

**Ventilation rate:** The amount of outside air supplied into space and the outside air quality. The ventilation rate is related to the quality and the amount of external air-ventilated in a particular space. Buildings must follow ventilation standards, which are usually different for residential and commercial buildings. The usual units employed in conveying the ventilation rate are cubic feet per minute (CFM), liters per second (L/s), and cubic meters per hour (m<sup>3</sup>/h). Each liter per second equals 3.6 cubic meters per hour. Also, each CFM is around 1.7 m<sup>3</sup>/hr. We can use these units interchangeably.

**Airflow direction:** The whole airflow direction. As its name implies, the airflow direction is where the ventilated air moves inside the room. In a perfect world, it should transfer from a clean area to a polluted one.

**Airflow pattern:** Airflow pattern or air distribution. It indicates that air should be circled in a way that it is delivered to each zone efficiently, and also the generated pollutants in the space should be sent away successfully.

To put these elements in mind, we can assess the performance of a ventilation system in four aspects:

- Does it pass the standards dealing with the ventilation rate? Or in other words, does it have enough ventilation rate?
- Is the flow direction from a clean zone to a dirty one?
- Does the fresh air arrive in all parts of the building and the room?
- Does the ventilation system send out the polluted air entirely from all parts of the room?

### BENEFITS OF ADEQUATE VENTILATION SYSTEMS

- **Control impurities:** You may think that the air quality where you live isn't great, especially if you live in a bustling city centre, but in many cases, the air inside can be more polluted than the air outside. A good ventilation system will help expel a build-up of pollutants, bacteria, moisture and unpleasant odours, such as body odour.
- **Air regulation:** Unless you have a good ventilation system in place, you have no control of the air flow in your building. Too much fresh air can mean costly energy bills, which is why good ventilation helps control the air, while regulating to the required health and safety levels.
- **Stop condensation:** Condensation can lead to mould

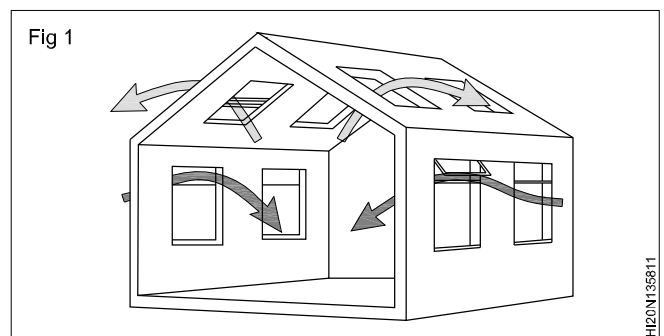
and rotten surfaces - which, naturally, is something you would want to avoid. Damp conditions and condensation can also cause health issues, such as allergic reactions and respiratory problems for many people. However, ensuring your company or organisation has good ventilation systems in place will help reduce these risks.

- **Reduce temperatures:** When there are lots of people in a confined space, whether is for work, conference or a public event, the environment can soon become hot and stuffy. A well-ventilated room will instantly be more comfortable - creating a more relaxed environment, while also making for a more productive workplace.
- **Health benefits:** Another benefit of good ventilation systems is the positive impact it has on health and well-being. Indoor air pollution coupled with bad ventilation can lead to a number of health problems including headaches, allergies, asthma, rashes and sinusitis. However, this can be avoided with the installation of a good ventilation system.

### Types of Ventilation

Ventilation can generally be categorized into five types: Natural, Mechanical, Hybrid, Spot, and Task-Ambient Conditioning (TAC). No matter the usage of your building or where it is located, you should consider one of these five types of ventilation systems in your building.

**Natural Ventilation:** Natural or traditional ventilation systems depend on natural forces such as wind and thermal buoyancy to drive outdoor air throughout the building's openings. Three factors play roles for natural ventilation to work. These factors are climate, human behavior, and building design.



**Mechanical Ventilation:** Mechanical fans conduct mechanical ventilation. Fans can be installed in windows or walls directly or in air ducts to supply air to or from the room.

The type of mechanical ventilation used depends on the weather.

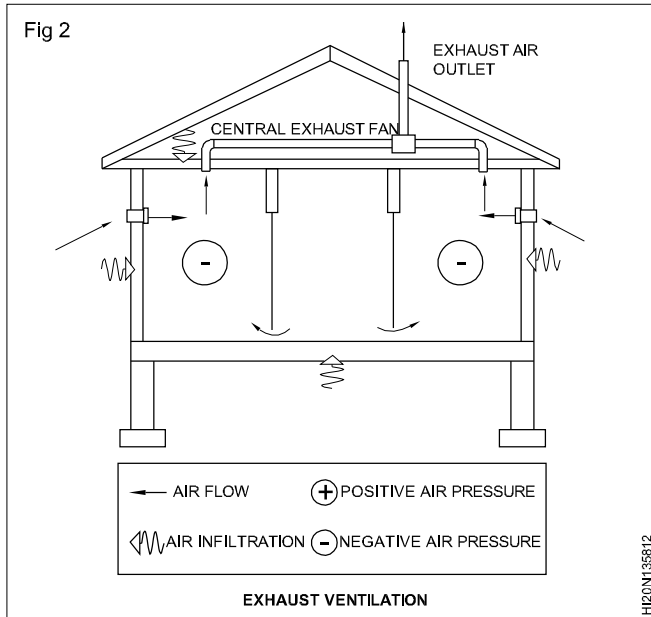
### Types of Mechanical Ventilation Systems

One of the types of ventilation is mechanical ventilation, which is classified into four types. Types of mechanical ventilation systems are described below:

#### Exhaust-Only Ventilation

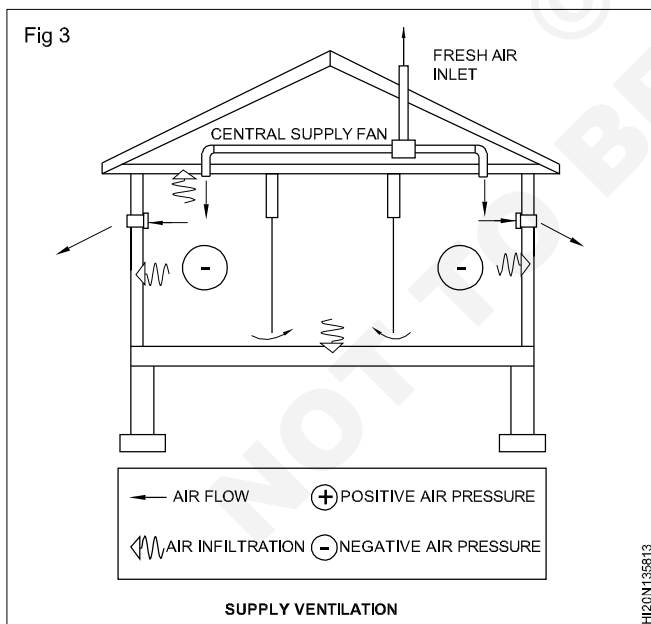
In these types of ventilation, exhaust ventilation is a subset

of mechanical ventilation. These systems work by reducing the pressure inside the building. It often does not have any special component to pull outside air into the room. The fresh air enters the building through leaks in a building's structure and balances the pressure.



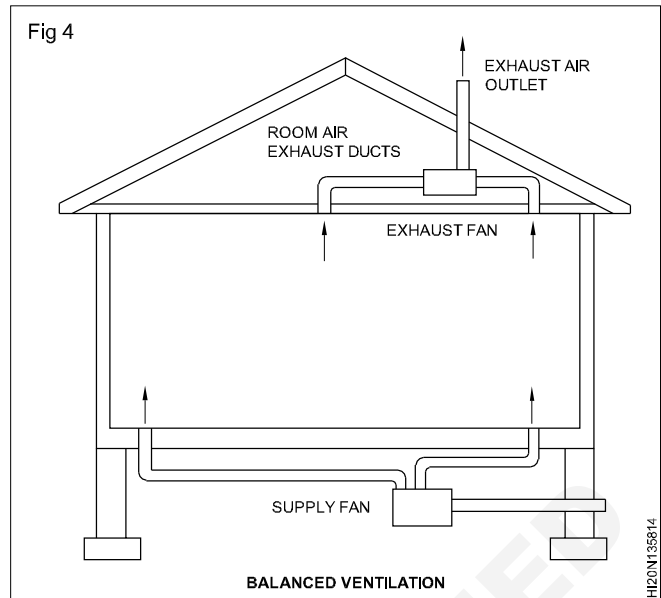
### Supply-Only Ventilation

In these types of ventilation, exhaust ventilation is a subset of mechanical ventilation. The supply ventilation system employs a fan to pressurize the room air and force the outdoor airflow inside. The inside air escapes outside through wall leaks and exhaust fan ducts.



### Balanced Ventilation

If exhaust-only and supply-only systems combine, the balanced system comes into existence. In this system, the airflow rate of indoor exhaust and outdoor supply is roughly equal.



### Energy-Recovery

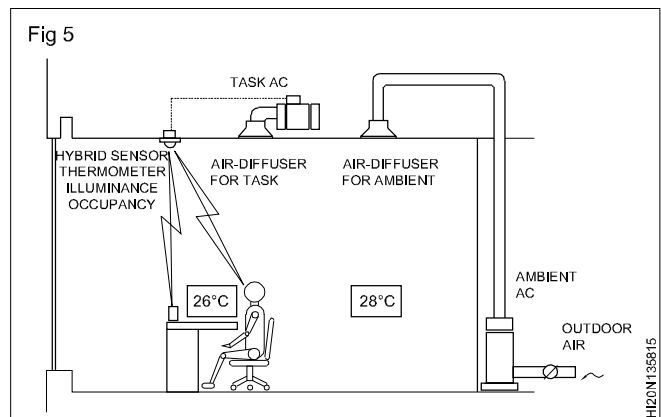
When we talk about types of ventilation, we should consider energy recovery, as well. Energy recovery ventilation prepares a controlled way of ventilation to minimize waste energy.

**Hybrid Ventilation:** Among various types of ventilation, Hybrid ventilation (mixed mode) depends on natural driving forces to prepare the desired flow rate (design flow rate).

When natural ventilation has a very low flowrate, the role of mechanical ventilation is prominent.

**Spot Ventilation:** Another kind of type of ventilation is spot ventilation. In order to improve the effectiveness of both natural and mechanical ventilation systems, spot ventilation came into existence. This involves deploying local exhaust fans, the same as those used in the bathrooms or kitchens. It removes the moisture and inside air pollution at its source, and as a result, it improves the usefulness of the ventilation system

**Task Ambient Conditioning (TAC):** Task Ambient Conditioning (TAC) is one of the other types of ventilation. The ideal temperature and comfort level depend on individuals.



### Greenhouse gases: An overview

Gases that trap heat in the atmosphere are called greenhouse gases. This section provides information on



emissions and removals of the main greenhouse gases to and from the atmosphere. For more information on the other climate forcers, such as black carbon, please visit the Climate Change Indicators: Climate Forcing page.

- **Carbon dioxide (CO<sub>2</sub>):** Carbon dioxide enters the atmosphere through burning fossil fuels (coal, natural gas, and oil), solid waste, trees and other biological materials, and also as a result of certain chemical reactions (e.g., manufacture of cement). Carbon dioxide is removed from the atmosphere (or "sequestered") when it is absorbed by plants as part of the biological carbon cycle.
- **Methane (CH<sub>4</sub>):** Methane is emitted during the production and transport of coal, natural gas, and oil. Methane emissions also result from livestock and other agricultural practices, land use and by the decay of organic waste in municipal solid waste landfills.
- **Nitrous oxide (N<sub>2</sub>O):** Nitrous oxide is emitted during agricultural, land use, industrial activities, combustion of fossil fuels and solid waste, as well as during treatment of wastewater.
- **Fluorinated gases:** Hydrofluorocarbons, perfluorocarbons, sulfur hexafluoride, and nitrogen trifluoride are synthetic, powerful greenhouse gases that are emitted from a variety of industrial processes. Fluorinated gases are sometimes used as substitutes for stratospheric ozone-depleting substances.

### Global warming

- 2011-2020 was the warmest decade recorded, with global average temperature reaching 1.1°C above pre-industrial levels in 2019.
- Human-induced global warming is presently increasing at a rate of 0.2°C per decade.
- In increase of 2°C compared to the temperature in pre-industrial times is associated with serious negative impacts on to the natural environment and human health and wellbeing, including a much higher risk that dangerous and possibly catastrophic changes in the global environment will occur.
- For this reason, the international community has recognised the need to keep warming well below 2°C and pursue efforts to limit it to 1.5°C

### Causes for rising emissions

- **Burning coal, oil and gas** produces carbon dioxide and nitrous oxide.
- Cutting down forests (deforestation). Trees help to regulate the climate by absorbing CO<sub>2</sub> from the atmosphere. When they are cut down, that beneficial effect is lost and the carbon stored in the trees is released into the atmosphere, adding to the greenhouse effect.
- **Increasing livestock farming.** Cows and sheep produce large amounts of methane when they digest their food.

- Fertilisers containing nitrogen produce nitrous oxide emissions.
- Fluorinated gases are emitted from equipment and products that use these gases. Such emissions have a very strong warming effect, up to 23 000 times greater than CO<sub>2</sub>.

### Components of Climate change

Climate change has already begun to impact our planet in more ways than we can think. Temperatures continue to rise throughout the planet and we are experiencing changes in precipitation patterns as we have never seen before. The main cause of these catastrophic effects on our planet is pollution.

### Harmful effect of Climate Change

The layer of Greenhouse Gases (GHG), including carbon dioxide (CO<sub>2</sub>), methane, nitrous oxide and others, in their optimum concentration in Earth's atmosphere, acts like a protective blanket which maintains its temperature and the natural ecosystem.

### Factors affecting climate change

Fortunately, there are always things that we can do to fight against climate change. Saving the environment starts with us and it is our responsibility to act against these terrible changes to preserve the planet for future generations.

### Prevention of climate change and best ways to help environment

- Make Your Commute Green

Millions of people drive to work every day. It is simply unavoidable in our modern-day society. However, the downside to this is that millions of cars emit greenhouse gases that destroy our atmosphere. Vehicle emissions are a close second when it comes to the top causes of climate change.

- Be More Conservative with Energy Usage

Becoming more energy efficient is a great way to prevent pollution. It causes the power plants to expend less energy that can lead to the production of greenhouse gasses.

- Get Active and Vote

One of the best ways to improve climate change is to help those who will fight against it get into office. This means voting for legislation and politicians that aid against the detrimental effects of climate change.

- Recycle

Manufacturing plants emit a large number of greenhouse gasses per year. It is unavoidable in the production of goods that we use on a regular basis. However, a cleaner alternative would be to invest in recycling.

- Educate Yourself and Others

The importance of educating others about climate change cannot be overstated in our modern society. There are

many platforms for us to utilize that can allow us to spread our message easily. Whether you use word of mouth or social media, there are always ways to educate others on what climate change is doing to our planet.

- Encourage the use of renewable energies

Focusing your efforts to spread awareness about renewable energy is the best way to create a positive impact in your community. By informing others about how renewable energy is better than utilizing fossil fuels, you will sway others into investing in the idea.

### Noise Pollution

The word noise is derived from a Latin word 'Nausea' which means sickness in which one feels the need to vomit. Noise is the unpleasant and undesirable sound which leads to discomfort in human beings. The intensity of sound is measured in decibels (dB). The faintest sound which can be heard by the Human ear is 1 Db. Due to increasing noise around the civilizations, noise pollution has become a matter of concern. Some of its major causes are vehicles, aircraft, industrial machines, loudspeakers, crackers, etc. Some other appliances also contribute to noise pollution like television, transistor, radio, etc. when used at high volume.

### Types of Noise Pollution

Following are the three types of pollution:

- Transport Noise
- Neighbourhood Noise
- Industrial Noise



### Types of Noise pollution

#### a) Transport Noise

It mainly consists of traffic noise which has increased in recent years with the increase in the number of vehicles. The increase in noise pollution leads to deafening of older people, headache, hypertension, etc.

#### b) Neighbourhood Noise

The noise from gadgets, household utensils etc. Some of the main sources are musical instruments, transistors, loudspeakers, etc.

#### c) Industrial Noise

It is the high-intensity sound which is caused by heavy industrial machines. According to many researches, industrial noise pollution damages the hearing ability to around 20%.

### (ii) Causes and Sources of Noise Pollution

Following are the causes and sources of noise pollution:

- Industrialisation: Industrialisation has led to an increase in noise pollution as the use of heavy machinery such as generators, mills, huge exhaust fans are used, resulting in the production of unwanted noise.
- Vehicles: Increased number of vehicles on the roads are the second reason for noise pollution.
- Events: Weddings, public gatherings involve loudspeakers to play music resulting in the production of unwanted noise in the neighbourhood.
- Construction sites: Mining, construction of buildings, etc add to the noise pollution.

### (iii) Noise Pollution Examples

Following are the examples of noise pollution:

- Unnecessary usage of horns
- Using loudspeakers either for religious functions or for political purposes
- Unnecessary usage of fireworks
- Industrial noise
- Construction noise
- Noise from transportation such as railway and aircraft

### (iv) Effects of Noise Pollution on Human Health

Noise pollution can be hazardous to human health in the following ways:

- Hypertension: It is a direct result of noise pollution which is caused due to elevated blood levels for a longer duration.
- Hearing loss: Constant exposure of human ears to loud noise that are beyond the range of sound that human ears can withstand damages the eardrums, resulting in loss of hearing.
- Sleeping disorders: Lack of sleep might result in fatigue and low energy level throughout the day affecting everyday activities. Noise pollution hampers the sleep cycles leading to irritation and an uncomfortable state of mind.
- Cardiovascular issues: Heart-related problems such as blood pressure level, stress and cardiovascular diseases might come up in a normal person and a person suffering from any of these diseases might feel a sudden shoot up in the level.

### (v) Prevention of Noise Pollution

Some noise pollution preventive measures are provided in the points below.

- Honking in public places like teaching institutes, hospital, etc. should be banned.
- In commercial, hospital, and industrial buildings,

- adequate soundproof systems should be installed.
- Musical instruments sound should be controlled to desirable limits.
  - Dense tree cover is useful in noise pollution prevention.
  - Explosives should be not used in forest, mountainous and mining areas

**Concept of liquid waste and disposal**

**Objectives:** At the end of this lesson you will be able to

- state the concept of liquid waste and disposal
- state the types of siners
- state the types of flushing tanks-manholes.

**Definition of liquid waste**

Wastes in the form of liquid or watery. i.e. oils, chemicals, polluted water from ponds or rivers etc.

Sources of liquid waste	Types of liquid waste
<ul style="list-style-type: none"> <li>• Residential areas</li> <li>• Commercial areas</li> <li>• Domestic and over populated areas</li> <li>• Industrial areas</li> <li>• Through natural disasters like flood, soil erosion, earthquake and tsunami are the sources of liquid waste.</li> </ul>	<ul style="list-style-type: none"> <li>- Waste water</li> <li>- Fats, oil, or grease</li> <li>- Sewage sludge</li> <li>- Hazardous household liquids</li> <li>- Organic wastewater</li> <li>- Inorganic wastewater</li> <li>- Storm water</li> <li>- Other liquid waste from residential, commercial and industrial areas</li> </ul>

**Human waste management system:**

**Human waste** (or **human excreta**) refers to the waste products of the human digestive system, menses, and human metabolism including urine and faeces. As part of a sanitation system that is in place, human waste is collected, transported, treated and disposed of or reused by one method or another, depending on the type of toilet being used, ability by the users to pay for services and other factors. Faecal sludge management is used to deal with fecal matter collected in on-site sanitation systems such as pit latrines and septic tanks.

**Methods of processing**

Methods of processing depend on the type of human waste:

- Sewage is treated via sewage treatment
- Sewage sludge is treated by sewage sludge treatment
- Fecal matter from dry toilets may undergo composting
- Fecal sludge from pit latrines is treated and managed with an approach called fecal sludge management

The amount of water mixed with human waste can be reduced by the use of waterless urinals and composting toilets and by recycling grey-water. The most common method of human waste treatment in rural areas where municipal sewage systems are unavailable is the use of septic tank systems. In remote rural places without sewage or septic systems, small populations allow for the continued use of honey buckets and sewage lagoons (see anaerobic lagoon) without the threat of disease presented by places with denser populations. Bucket toilets are used by rural villages in Alaska where, due to permafrost, conventional waste treatment systems cannot be utilized.

**Uses**

Human waste in the form of wastewater (sewage) is used to irrigate and fertilize fields in many parts of the developing world where fresh water is unavailable. There is great potential for wastewater agriculture to produce more food for consumers in urban areas, as long as there is sufficient education about the dangers of eating such food uncooked

**Various methods for liquid waste disposal:**

Liquid wastes are the liquid part of the waste material. Liquid waste includes effluents of industries, fertiliser and

pesticide solutions from agricultural fields, leachate from landfills, urban runoff of untreated waste water and garbage, mining wastes etc. The liquid waste may contain nontoxic inorganic substances or toxic organic substances.

### **Some important liquid waste management methods are**

#### **i Sewage treatment:**

The process of sewage treatment involves the following methodology:

##### **a Dilution:**

In this method, the sewage is subjected to perfect dilution so that the dissolved oxygen in natural water decomposes the organic wastes completely, thereby reducing the turbidity. The reduction of turbidity favours easier penetration of sun light and natural ecosystem is restored.

##### **b Mechanical treatments:**

The sewage is allowed to pass through different screens, filters, grit chambers, sedimentation basins etc. At first the sewage is filtered to remove suspended Particles. Then the sewage is subjected to grinding followed by some chemical treatment.

By this operation, the minute solid Particles present within the sewage get coagulated and settle at the bottom. The precipitates are separated either by filtration or by gravity settling. The sediments obtained above are then put in sludge digester where it is digested in absence of air to release biogas.

##### **c Biological treatments:**

In this method, the sewage is passed through trickling filters where aerobic bacteria degrade the sewages as it seeps through large vat beds filled with crossed stones covered with bacterial growth. Alternatively, the sewage is pumped into a large tank, mixed with bacteria rich sludge and agitated heavily in presence of sufficient amount of oxygen for several hours which causes bacterial degradation of organic waste.

The waste is then pumped into sedimentation tank where the suspended solids settle as sludge. The entire solution is filtered to separate sludge and effluent. The sludge is taken in an anaerobic digester and broken down. After suitable treatment, the sludge can be used as fertiliser. The effluent may be chlorinated to kill the pathogenic microbes and discharged in to water -bodies.

##### **d Chemical treatments:**

**The sewage obtained after mechanical or biological treatments is subjected to specific chemical treatment followed by some physical operation:**

**i Precipitation:** The sewage may be treated with calcium oxide to precipitate up to 90% of phosphates and suspended particles. The precipitate separates and settles at the bottom.

**ii Adsorption:** The effluent is treated with activated charcoal which adsorbs colour, odour and dissolved organic compounds.

**iii Osmosis:** The dissolved organic and inorganic substances can also be separated by the process of osmosis.

**iv Chemical oxidation:** The effluent may be subjected to oxidation in presence of ozone or hydrogen peroxide to remove dissolved organic compounds.

**v Removal of ammonia:** After the first operation, the waste water is introduced into a metal tower from which it trickles down over a series of plastic baffles plates and air is forced upwards which removes ammonia gas.

### **2 Removal of ammonia:**

The treatment of industrial effluents in 'Effluent Treatment involves chemical or primary treatment (by methods of neutralization, sedimentation, coagulation, precipitation etc.) followed by biological or secondary treatment (by activated sludge and trickling filter method) and tertiary treatment (by methods of ion exchange, reverse osmosis, chemical oxidation).

**iii** Effluent water can be used to grow algae and aquatic plants to produce biomass for biogas plants.

**iv** The effluents containing heavy metals like cadmium, mercury, lead etc. can be purified by growing water hyacinth plants.

**v** The sewage with organic nutrients is stored in specially constructed shallow ponds called as oxidising or stabilizing pond. In the pond, green algae and bacteria grow in presence of sun light, consuming organic nutrients. This water contains enough nitrogen, phosphorous and potassium and is highly helpful for the growth of plants.

### **Pollution of water due to sewage:**

Pollution caused by sewage water is one of the major problems in cities the world over. Sewage water is drained off into rivers without treatment. Careless disposal of sewage water leads to creation of a chain of problems like spreading of diseases, eutrophication, increase in Biological Oxygen Demand (BOD), etc.

The water used for domestic, industrial and other purposes gets converted into waste water. It is termed as sewage water. In ideal conditions, sewage water is channeled or piped out of cities so that it can be recycled. Sewage contains organic wastes as well as chemicals.

### **Main Causes of Sewage Water Pollution**

Improper handling of waste water is the main reason behind water getting polluted. Sewage is drained off in large quantities to rivers. It slows down the process of dilution of constituents of water; this in turn stagnates the river. It may also result into spread of diseases like diarrhea, typhoid, etc.

Draining off water without treatment is one of the major causes of pollution. Effluents present in sewage water contain innumerable pathogens and harmful chemicals. Detergents released in water contain phosphates and they allow the growth of algae and water hyacinths.

### III-effects of Sewage Pollution

The different ways in which sewage pollution affects our life can be found below. These details should offer insights on how to control the menace of water pollution caused by haphazard disposal of sewage into freshwater bodies and oceans.

#### Effects on Health

Pathogens present in sewage water are responsible for spreading different kinds of diseases. Stagnant water fosters the growth of mosquitoes, which in turn causes diseases like malaria. Another disease which originates from contaminated water is typhoid. Sewage water may also contain protozoans like *Cryptosporium* and *Giardia*. These pathogens pose a great risk to human health. Therefore, polluted water acts as a host to several pathogenic microbes.

#### Eutrophication

The process of excessive deposition of chemical nutrients in water bodies is termed as eutrophication. It is one of the many problems which have their origin in sewage water pollution. Increase in the concentration of phosphates, nitrates and other chemicals including organic wastes in water bodies causes excessive growth of algae and bacteria. Growth of such organisms is responsible for increase in BOD and thereby, reduction in the number of aquatic creatures. The growth of native plants is also hampered by excessive algal growth.

#### Harmful Effects on Environment

Toxins released in rivers through sewage water are consumed by fish and other aquatic organisms; thus, the possibility of toxins entering the food chain increases manifold. It is observed that coral reefs get affected by sewage pollution the world over. The sewage water dumped in oceans can affect the coral reefs to a great extent. The toxins present in polluted water inhibit the growth of corals.

#### Pollution of Drinking and Irrigation Water

Water bodies in their natural form contain small amounts of chemical compounds like bicarbonates, nitrates, chlorides, sulfates, etc. Rise in the amount of such compounds may cause many problems. For example, water becomes unsuitable for drinking and irrigation. Saline water is not considered suitable for irrigation either. Use of such kind of water for agricultural purpose leads to salinization of soil, which in turn causes soil erosion.

#### Health hazard associated with liquid waste

Waste that is not properly managed, especially excreta and other liquid and solid waste from households and the community, are a serious health hazard and lead to the spread of infectious diseases. Unattended waste lying around attracts flies, rats, and other creatures that in turn spread disease. Water pollution due to sewage and domestic waste is of major concern, because diseases such as typhoid, cholera, jaundice, dysentery, diarrhoea, etc. are infectious diseases which spread through contaminated water. Sometimes this leads to the outbreak of epidemics and mass illness.

### Sewers and its types:

Sewers and its types: an artificial usually underground conduit for carrying off sewage and rain water

- Asbestos Cement (AC) Sewer
- Brick Sewer
- Cement Sewer
- Cast iron (CI) Sewer
- Steel Sewers
- Plastic Sewers

#### i Asbestos Cement (AC) Sewer

Asbestos Cement (AC) Sewers are manufactured from a mixture of cement and asbestos fiber. Asbestos Cement (AC) Sewers are suitable for carrying domestic sanitary sewage.

#### Advantages of Asbestos Cement (AC) Sewer

- Smooth
- Light in weight
- Can easily be cut, fitted and drilled
- Durable against soil corrosion

#### Disadvantages of Asbestos Cement (AC) Sewer

- Brittle cannot withstand heavy loads
- They are easily broken in handling and transport.

#### ii Brick Sewers

Brick Sewers are made at site and used for construction large size sewer. Brick Sewers are very useful for construction of storm sewer or combined sewer. Nowadays brick sewers are replaced by concrete sewer.

#### iii Cement Concrete

- **PCC - for dia upto 60 cm** suitable for smallstormdrains. Not durable.
- **RCC - for dia > 60 cm**

They may be cast in situ or precast, resistant to heavy loads, corrosion and high pressure. These are very heavy and difficult to transport.

#### iv Cast Iron CI Sewers

These types of sewer are High strength and durability water tight. Cast Iron sewers can withstand high internal pressure and can bear external load. Cast Iron sewers are suitable for the following conditions.

- When the sewage is conveyed under high pressure
- When the sewer line is subject to heavy external load e.g. under railway line, foundation wall etc, below highways
- When there is considerable difference in temperature

## v Steel Sewers

Steel sewers are Impervious, light, resistant to high pressure, flexible, suitable when;

- The sewage is carried under pressure
- The sewage has to be carried across a river under water
- The sewer has to cross under a railway track
- They are generally used for outfall and trunk sewers

## vi Plastic Sewers

Nowadays PVC sewers are used for carrying sewage. Plastic sewers are resistant to corrosion. Such types of sewer are light in weight, smooth and can be bent easily. But Plastic sewers are having high co-efficient of thermal expansion and cannot be used in very hot areas.

## Other types of Sewer materials

- Wooden Sewers (Rare now)
- Stoneware Sewers

## Methods of laying sewers:

- Marking centre lines of sewers and locating the positions of sewer appurtenances.
- Excavation of trenches including removal of road pavement and disposal of excavated materials.
- Sheet piling, bracing and dewatering of trenches.
- Laying of pipe sewers and their jointing.
- Testing of sewer lines.
- Back filling of trenches.
- Check for obstruction.
- Removal of sheet piling

### i Marking Centre Lines of Sewers and Positions of Sewer Appurtenances:

The centre lines of sewers are marked on the streets and roads from the plans starting from the lowest point or the outfall of the main proceeding upwards. The setting out of work is done by means of chain and theodolite or compass.

### ii Excavation of Trenches:

The removal of the pavement is started from the lower end of the sewers and proceeds upwards. As the pavement also helps in supporting the trenches, it should be cut along the edges of the trenches. After removing pavements, the excavation of trench is started

### iii Bracing and Dewatering of Trenches:

In case of hard soils and rocks, the sides of the excavated trench will not collapse and will remain in cut position. But in case of made up soils and soft soils the trench sides require shoring and strutting to prevent their collapse till the sewers are laid and tested.

## The following are the functions of the timbering or shoring:

- To prevent the collapse of the sides of the trenches.
- To reduce the width of the trench at the top to the minimum possible.
- To prevent the seepage of ground water into the trench.

**iv Laying of Sewers and their Jointing:** Trenches are excavated with proper grade so that the sewage may flow in sewers due to gravitational flow only.

## Jointing of Sewers:

- Stoneware pipes
- Concrete pipes
- C.I. pipes

## v Hydraulic Testing of Pipes Sewers:

Following two tests are done for testing the pipe sewers:

- Water Test:
- Air Testing:

## vi Back-Filling of Trenches:

After testing and removing defects of pipe line, the trenches are back-filled with earth. Generally the excavated soil of trench is used for back-filling but before using it, the pebbles, stone-pieces and lumps must be removed from it.

## vii Check for Obstruction:

Immediately after laying and testing the sewer, a double disc or solid or closed cylinder, 75 mm less in dimension than the internal dimension of the sewer, is run through the stretch of the sewer to ensure that it is free from obstruction.

## viii Removal of Sheet piling:

Sheet piling driven below the spring line of a sewer shall be withdrawn a little at a time as the back-filling progresses. Some of the back-filled earth is forced into the void created by withdrawing the sheet piling by means of a water jet.

## Construction and Maintenance of Sewers

Maintenance of sewers consists mainly of the removal or prevention of stoppages, cleaning of sewers and other sewer appurtenances, and repair works. Maintenance of sewers becomes costly only when they are laid on flat gradients and tree roots find easy entrance in sewers through defective joints. The maximum expenditure in maintenance comes on the cleaning of sewers, which have been clogged due to deposition of silt, grease and oily materials.

For good maintenance up-to-date plans of sewers system showing location of manholes, and other appurtenances, direction of flow, house sewers, grades of sewer lines etc. are necessary. Before actual cleaning and repair work the inspection is done. In some cities inspections are

made and maintenance is done only when difficulties arise, whereas in other cities periodical inspection is done.

**The period of inspection is generally as follows:**

Sewers on flat grades - 3 months

Sewers troubled by roots - 3 months

Sewers having no trouble - 6 to 12 months

Intercepting sewers - 7 to 30 days

Flushing tanks - 1 month

Inverted siphons - 7 to 30 days

Storm water overflows - during rains.

During inspection the clogging of sewers, breakage of pipes etc. are noted and then the cleaning and repair works are done later on. In few cities trained gangs are given the duties of inspection and maintenance.

These gangs follow on inspection routine and cleaning and repairs according to the prearranged schedule. During inspection an explosion-proof lamp is lowered in the manhole and is seen from the manhole on either side to see if the sewer line is clean or not.

**Causes of Damage to Sewers:**

**Following are the main causes of damage to the sewers:**

- i Bad workmanship and use of low specification material.
- ii Faulty design.
- iii Excessive superimposed load.
- iv Settlement due to loose foundation or made up ground.
- v Too small cover at the top of sewer, which is insufficient to protect it from the impact and other loads, which sewer has to bear.
- vi Undermining of sewer due to any reasons.
- vii Explosion inside the sewer due to improper ventilation of the explosive gases inside the sewer.
- viii Deterioration of the sewer due to corrosive gases.
- ix Abrasion of sewer due to frictional movement of the solids present in the sewage.
- x Old age of the sewer.

**Problems in Sewer Maintenance:**

**Following are the main problems which are faced in maintenance of sewers:**

**a Clogging in Sewers:**

**Following factors are mainly responsible for the clogging of sewers:**

i deposition of grit or other detritus which causes stagnation, resulting in the putrefaction of organic matter giving rise to odours and poisonous gases; deposition of grease from hot liquid wastes from kitchen finding entry into sewers, getting cooled and deposited on the sides which in course of time clog the sewer;

ii Penetration of roots from nearby trees through the joints or cracks in the sewer which choke up the sewers;

iii Deposition of tarry materials assisting in binding the detritus and leading to their growth;

iv Growth of fungi forming a network of tendrils, which starts floating and obstructing the free flow of sewage;

v Stagnation of sewage in the sewers due to improper working of pumping units leading to settlement of grit and other materials and dumping of solid wastes in the manhole indiscriminately.

To avoid any damage to buildings, cables, gas mains, sewers, water mains, telephone cables etc. near the excavation or to avoid disturbance to the sewer already laid portions of the sheeting may be left in the trenches and buried.

**• Hazards**

Persons engaged in operations and maintenance of sewers; are exposed to occupational hazards likewise -

- Physical injuries
- Injuries caused by chemicals and radio-active wastes
- Infections caused by pathogens present in sewage
- danger due to deficiency of oxygen

**Safety precautions against gas hazards**

- While entering with manholes, the following precautions should take care of -
- Traffic warning signs should be there, thus to avoid accidents.
- No smoking / however open flames allowed nearby.
- Explosion proof electric lighting equipment or mirrors for reflection of light used only.
- Oxygen amount should be taken care of, thus no oxygen deficiency should be there.
- If any noxious gas is found, forced ventilation should be restored.
- Allow safety equipments.
- **When clearance of the inside atmosphere is not possible, or time-consuming, following precautions should be taken before entering the sewer:**

- i Traffic warning signs should be placed on road.
- ii No smoking or open flames should be allowed and sparks should be guarded.
- iii Only safety, explosion-proof electric lighting equipment or mirrors for reflection of light should be used.
- iv The atmosphere should be tested for the presence of noxious gases and oxygen deficiency.



- v When atmosphere is normal, the worker may enter in the manhole or sewer, with safety harness attached with two men available at the top.
- vi In-case oxygen deficiency or noxious gas is detected, forced ventilation should be resorted to using a portable blower.
- vii Frequent tests for oxygen deficiency and noxious gas should be done, even if the initial tests are satisfactory, because conditions may change during the working period inside the manhole and sewers.
- viii If forced ventilation is not possible or not satisfactory and men have to enter urgently, such as in case of saving the life of fallen persons, a gas mask should be worn and extreme care should be taken to avoid all sources of ignition if inflammable gas is present. Only permissible safety lights, rubbers or non-sparking shoes and non-sparking tools should be used.
- ix Only experienced personnel having experience of working under such conditions and fully equipped with the proper protective safety equipment should be allowed to enter the sewers.

### Safety Equipment:

Following are the common safety equipment's, which are used by the workers connected with sewer maintenance works:

- (i) Gas Masks
- (ii) Oxygen Breathing Apparatus
- (iii) Portable Lighting Equipment
- (iv) Portable Air Blowers
- (v) Non-Sparking Tools
- (vi) Inhalators
- (vii) Safety Belt

### Sewer Appurtenances

Sewer Appurtenances are those structures that are constructed at suitable intervals along with a sewerage system. These structures help in effective operation and maintenance of the sewerage system. These devices include the following.

- 1 Manhole
- 2 Drop Manhole
- 3 Lamp Holes
- 4 Clean-outs
- 5 Street Inlets
- 6 Catch Basins

## 7 Flushing Tank

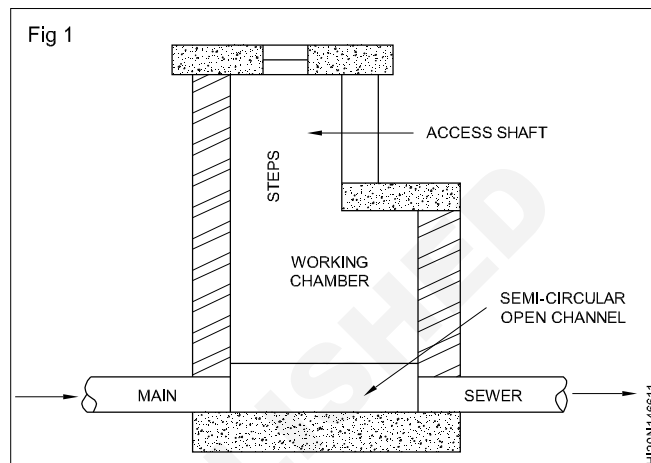
## 8 Grease and Oil Traps

## 9 Inverted Siphons

## 10 Storm Regulators

## 11 Ventilating Shaft

### 1 Manhole



Manholes are masonry or R.C.C chambers constructed at suitable intervals along the sewer lines for providing access into them.

### Location of Manhole

The manholes are provided at a specified interval, change of direction, change of grade, junction points, change of sewer dia, etc.

### Function of Manhole

The manholes help in joining sewer length. They also help in inspection, cleaning, and maintenance of sewers.

### Construction of Manhole

A manhole essentially consists of a working chamber, an access shaft and a strong cover over top.

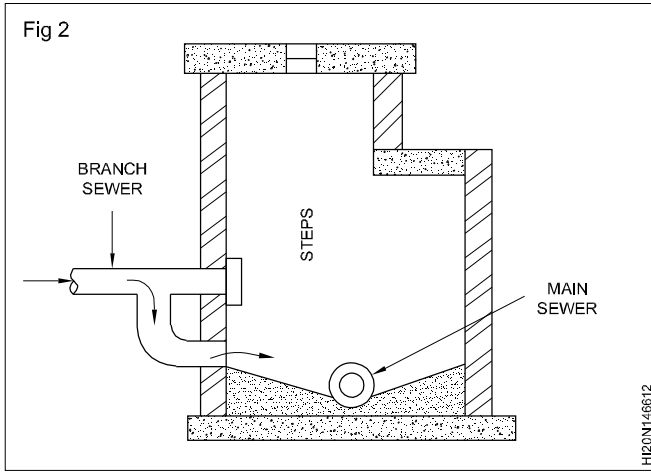
The lower portion of the manhole is known as the working chamber. It provides a working space for inspecting and cleaning operation of the sewer

The upper portion of a manhole is called access shaft. It provides access to the working chamber. This shaft is formed by corbelling or arching the working chamber. The manhole is provided with a Cast Iron cover and frame at its top. The manhole cover may be rectangular or circular.

The bottom portion of the manhole is constructed in cement concrete. A semi-circular or U shaped channel is provided at the bottom. **Cast Iron steps are provided** in the manhole for the entry and exit of workers into them.

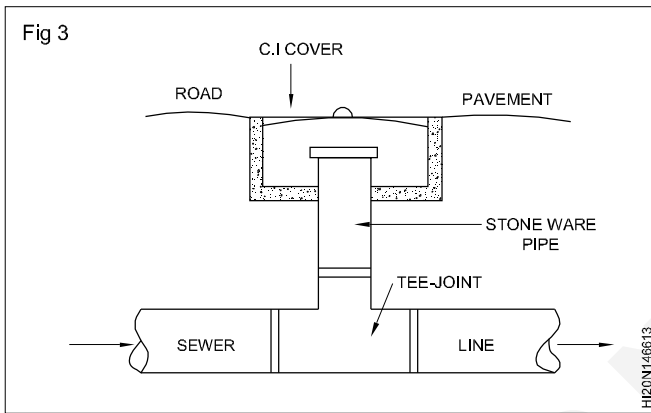
### 2 Drop Manhole

The manhole which is constructed to connect high-level branch sewer to the low-level main sewer with minimum disturbance is called drop manhole.



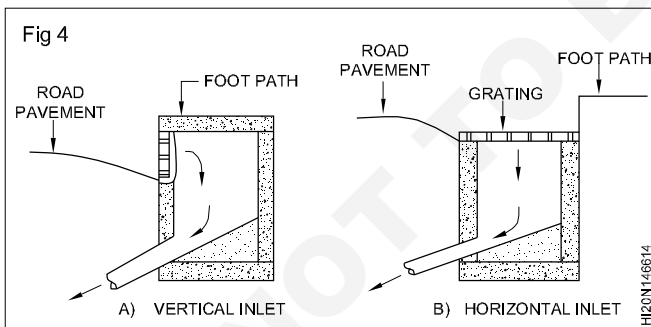
### 3 Lamp Holes

A lamp hole is a small opening on sewer for the purpose of lowering a lamp inside it.



### 4 Street Inlets (Gullies)

An inlet is an opening on the road surface through which storm water is admitted and conveyed to the underground storm water sewer or combined sewer

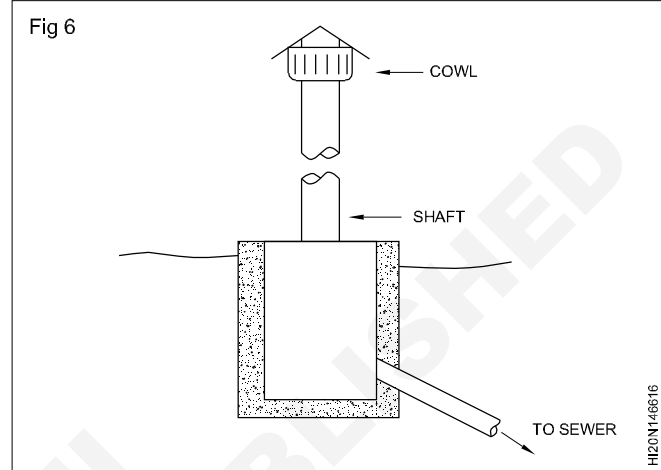
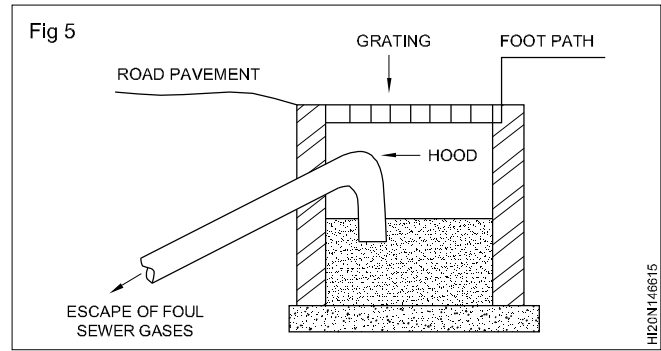


### 5 Catch Basins

Catch basins are rectangular chamber provided along the sewer line to admit clear rainwater free from silt, grit, debris, etc into the sewer.

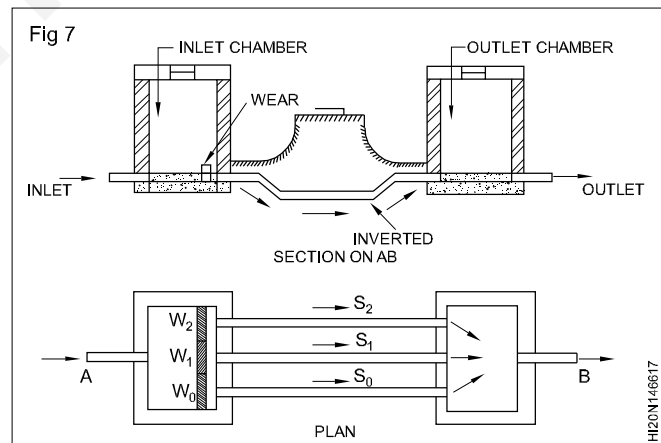
### 6 Ventilating Shaft

The ventilating shaft or column is a device provided along the sewer line for the ventilation of sewer.



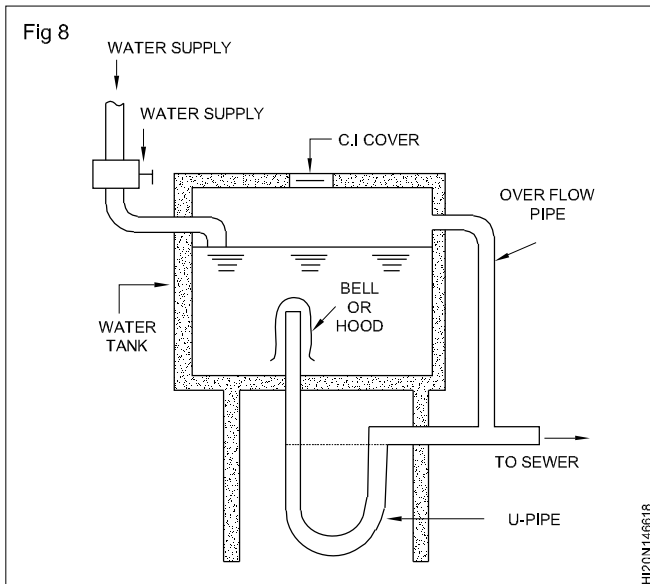
### 7 Inverted Siphons

When an obstruction is met by a sewer line, the sewer is constructed lower than the adjacent section to overcome the obstruction. Such a section of a sewer is termed as an inverted siphon or depressed sewer or a sag pipe. The sewage through such section flows under pressure.



### 8 Flushing Tank

The cleaning operation of a small sewer is generally done by flushing tanks. The flushing tank is a device that stores water temporarily and throws it into the sewer for the purpose of flushing and cleaning the sewer.



### The Function of Flushing Tank

It helps in flushing and cleaning of sewers. It is also used to store sewage temporarily at some places. A trap is a plumbing device used to prevent smell, bacteria, also insects entering your home.

Every water-using appliance or fitting has a drain line to flow out the waste-water, and you must have a trap in the pipe that seals the drain.

The seal is important to keep the environment fresh as it will prevent sewer gasses from entering the building. You can see traps equipped with varied plumbing fixtures like sinks, bathtubs, toilets, and washbasins.

With the help of several connections, you can install a trap which is usually located within a plumbing fixture.

Traps are designed in such a way that it retains some amount of water which indeed creates a seal for foul gasses and stops them from entering the property.

### Traps Introductions

Traps are designed to prevent sewer odours from entering the home through the plumbing fixtures. The seal in the trap is provided by the waste-water.

Every time we use a fixture, we flush out the water that is forming the trap seal and replace it with new water.

Traps are carefully engineered systems. They are designed to be self-scouring so that they don't collect debris yet retain water to form a seal. The velocity with which waste moves through a trap is important.

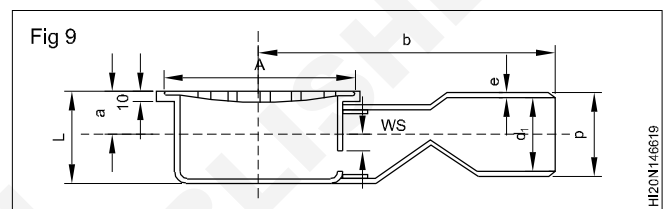
If it's too fast, the water that is supposed to remain in the trap will be siphoned down the drain. If it's too slow, solids will tend to get deposited in the bottom of the trap.

### Types of Traps

Different types of traps in plumbing are as follows.

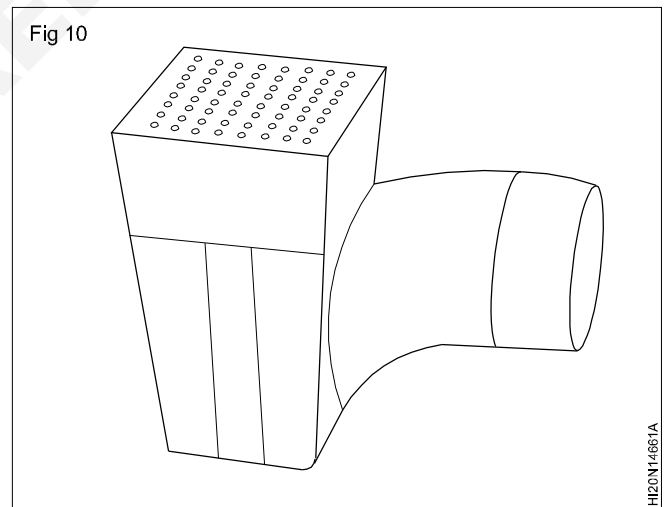
- 1 Floor Trap or Nahni Trap
- 2 Gully Trap

- 3 P Trap
- 4 Q Trap
- 5 S Trap
- 6 Intercepting Trap
- 7 Bottle Trap
- 8 Grease Trap
- 9 Drum Trap
- 10 Running Trap
- 11 Straight-Through Trap
- 12 Low-Level Bath Trap
- 13 Bell Trap
- 14 Building Trap
- 1 Floor Trap



This trap is provided on the floor to collect wastewater from the bathroom, sink, shower and washbasin, etc.....

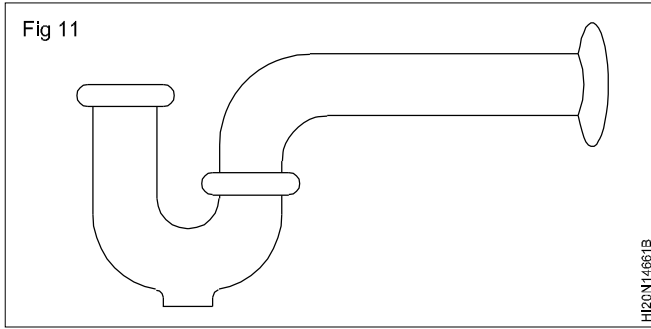
### 2 Gully Trap



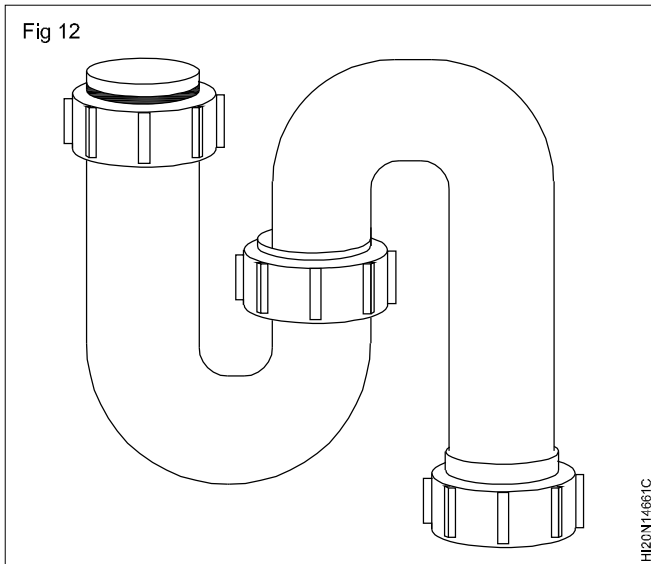
Gully Trap, also known as G.T. A Gully Trap, is provided outside the building before connecting it to the external sewerage line. It also collects wastewater from the kitchen sink, washbasins, bath, and wash area.

### 3 P Trap:

This trap is used with an Indian water closet. The traps are made from UPVC or cast-iron sheets. This trap also has a water seal and prevents entry of foul gasses to the house.

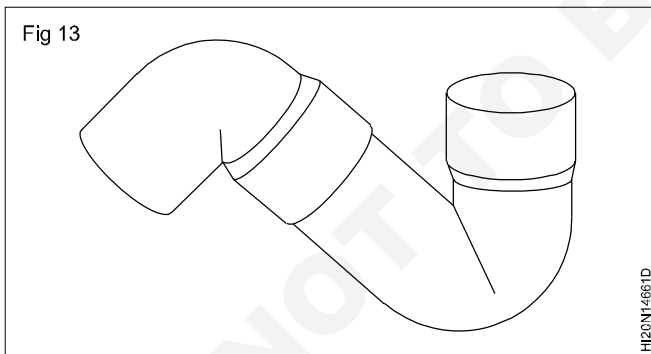


#### 4 S Trap



This trap is similar to the P trap and is used for fixing water closets in toilets. The only difference between the P trap and the S trap is that the P trap is used for an outlet through the wall, whereas S-trap is used for an outlet through the floor.

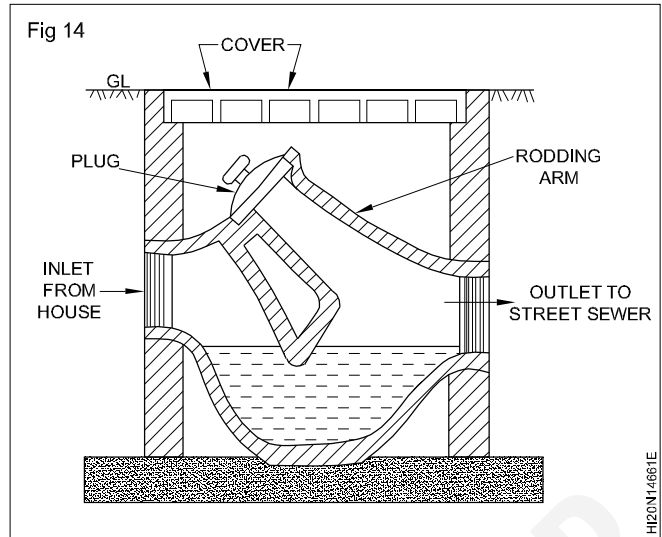
#### 5 Q Trap



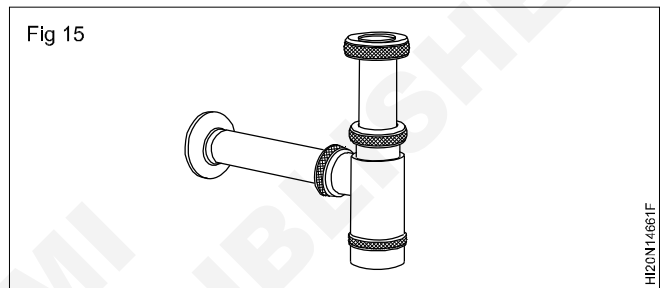
This trap is used in a toilet under-water closet. It is almost similar to the S trap and is used in the upper story other than the ground floor.

#### 6 Intercepting Trap

Intercepting trap is provided to prevent the foul gases from public sewers entering into the building sewer by providing water seal. Designed with a deep water seal of 100 mm, these traps are installed at the last main hole of building sewerage.

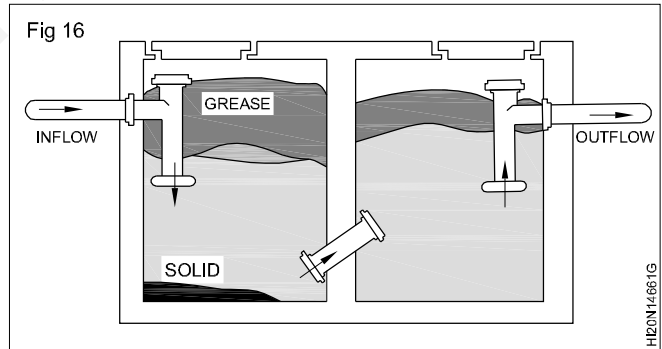


#### 7 Bottle Trap



In this type of trap, the waste pipe is fitted horizontally, and you need to unscrew the bottom to clean it. Ideal to be installed in limited spaces, the bottle traps are widely utilized at pedestal mounted sinks and basins to trap foul gasses.

#### 8 Grease Trap

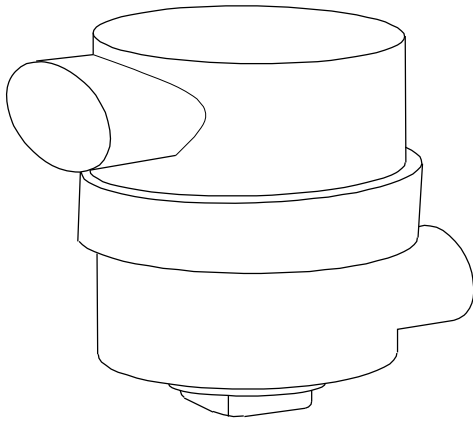


These traps are highly useful for food processing units as the trap is specially designed to collect grease content, and it is very easy to clean these traps from the surface.

#### 9 Drum Trap:

Drum traps, which resemble metal drums, are an important part of a home plumbing system because their large openings allow you to more easily locate and remove objects you need either to retrieve or to remove from the plumbing system. Their large caps also allow you to easily insert into the trap a plumbing snake you can use to remove clogs in your drain.

Fig 17

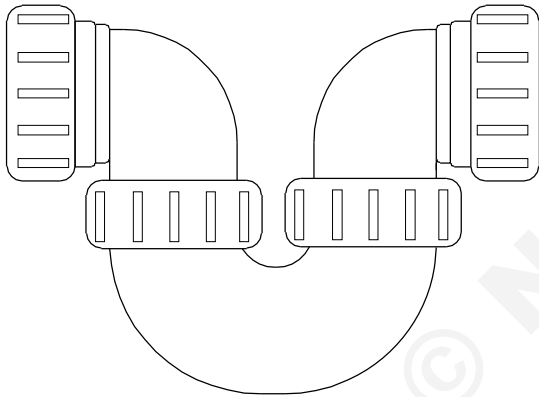


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### 10 Running Trap

You might see these used in public toilets where one running trap is used for a range of untrapped washbasins. On domestic installations, it could be used where a P or S trap arrangement is not possible.

Fig 18

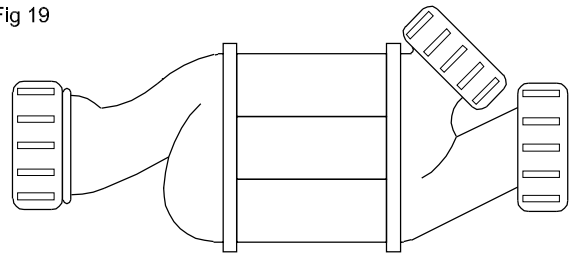


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### 11 Straight-Through Trap

These are used as an alternative to a trap where space is limited. They are also easier to hide behind pedestal basins.

Fig 19

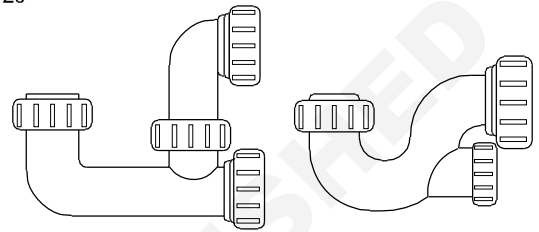


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### 12 Low-Level Bath Trap

These are used as an alternative to a trap where space is limited. They are also easier to hide behind pedestal basins.

Fig 20

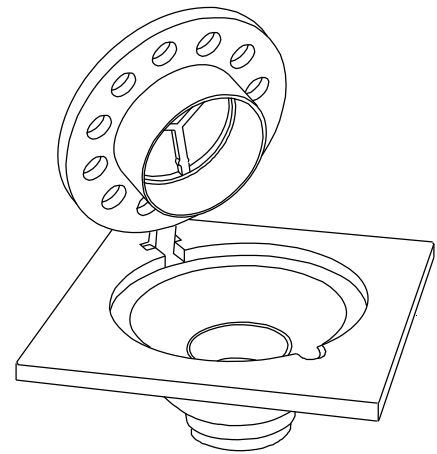


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### 13 Bell Trap

Bell Trap Drain is designed for use in the garage, patio, or other outdoor use. The water drains into a well in the drain unit that serves as a trap to contain sewer gas.

Fig 21



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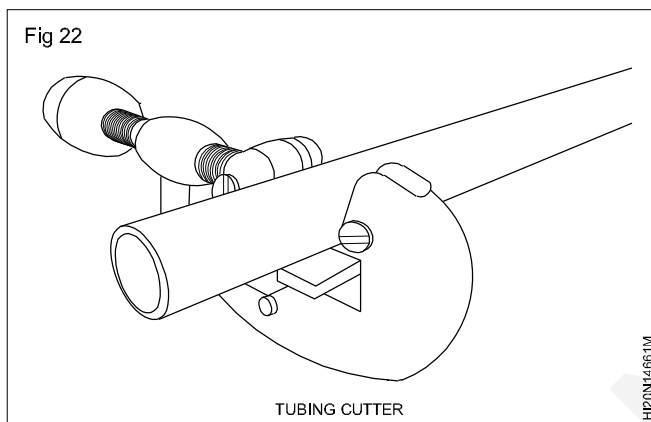
**Concept of liquid waste and disposal**

**Objectives:** At the end of this lesson you will be able to

- state the plumbing tools and its operation
- state the types of sewage system
- state the sewage disposal by biogas
- state the sewage faction.

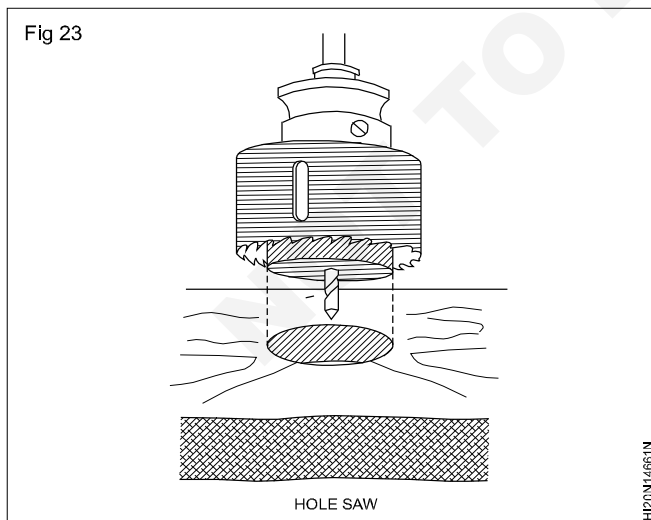
**Plumbing:** Plumbing, system of pipes and fixtures installed in a building for the distribution and use of potable (drinkable) water and the removal of waterborne wastes. It is usually distinguished from water and sewage systems that serve a group of buildings or a city.

**Plumbing tools and Operation**



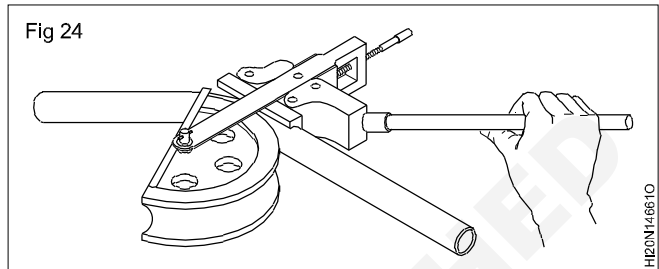
**Tubing Cutter** : A tool used by plumbers to cut through plastic tubing, with each one having its own cutting range.

**Hacksaw** : Plumbers typically carry hacksaws so that they can cut through a variety of items, including nuts, bolts, pipes, and screws. Make sure you keep spare blades around too!



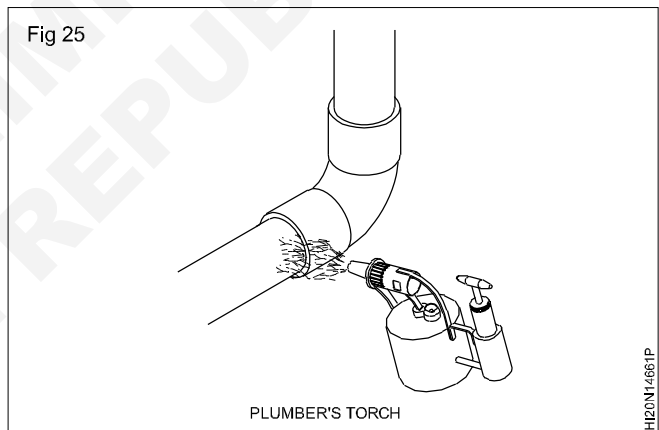
**Hole saw kit** : A hole saw is used to cut perfectly round holes in a variety of materials.

**Mole grips** : Used to hold metal parts in place during welding, such as when a plumber is using a plumber's torch to seal copper piping by soldering it.



**Pipe and tube benders** : A tool used to bend a range of piping and tubing instead of creating a fitting.

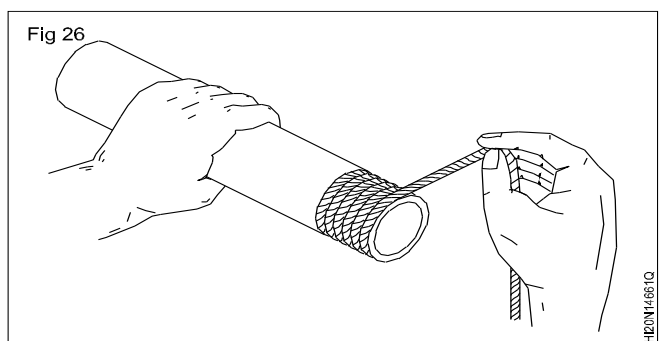
**Pliers** : These are used every day by plumbers. Easily tighten or loosen nuts and bolts that wrenches can't grab onto.



**Plumber's torch** : A plumber's torch is a handheld tool used to apply heat to a precise area of piping, allowing you to seal new piping for installs and replacements.

**Press fitting systems** : Iron Pipe Size (IPS) press fitting systems enable plumbers to press a connection onto a pipe, resulting in a watertight connection or seal.

**Flashlight** : Plumbers are commonly required to go into dark spaces, such as basements, so having a flashlight handy is always a good idea.



Thread sealing tape (“Plumber’s Tape”)

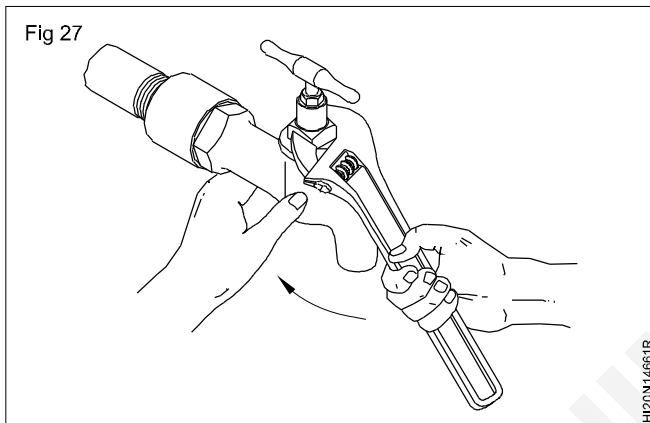
Thread sealing tape is used to patch or prevent leaks in piping.

A bucket: Even when the water is turned off in the home, there is still going to be some water leakage, so it’s smart to keep a bucket around.

Ratcheting pipe threader set: This tool allows you cut threads into pipe so that it can accept fittings when joining pipes together.

Plumber Wrenches

**Pipe wrench** : Plumbers use pipe wrenches to tighten and loosen nuts and fittings on pipes. Two of these are often used together, one for holding a pipe in place and the other for rotating a nut or fitting.



**Adjustable wrench** : Also known as an adjustable spanner or crescent, is a tool used to loosen or tighten a nut or bolt.

**Basin wrench (“Sink Wrench”)** : A T-shaped tool that plumbers use specifically on faucets. Its unique design allows plumbers to turn fasteners in confined spaces that would otherwise be impossible to reach.

**Faucet key** : An X-shaped tool that plumber’s use to open and close spigots and hillocks.

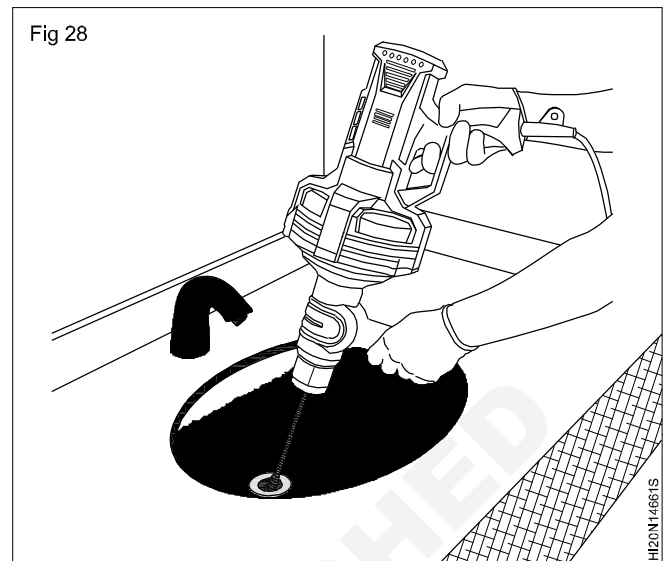
**Torque wrench** : A tool used to apply a specific torque to a nut or bolt.

**Internal pipe wrench** : Commonly used to remove old rusted fittings on galvanized pipe.

### Plumber Drain Cleaning Tools

**Plungers** : A tool used to clear up blockages in drains or pipes, commonly used in the household toilet.

**Hand auger** : A hand auger has a long, flexible metal wire with a corkscrew auger attached on the end used to unclog drain lines.



**Snake machine (“Plumber’s Snake”)**: A flexible and slender auger used to clear particularly difficult clogs.

**Drain inspection camera**: A camera that allows the plumber to see any issues with a specific pipe. Usually used on sewer lines.

**Hydro jetting machines**: An extremely effective method of clearing up drains and sewer lines. Comes with hose attachments that will blast water into drain lines and sewer lines.

### Sewage disposal:

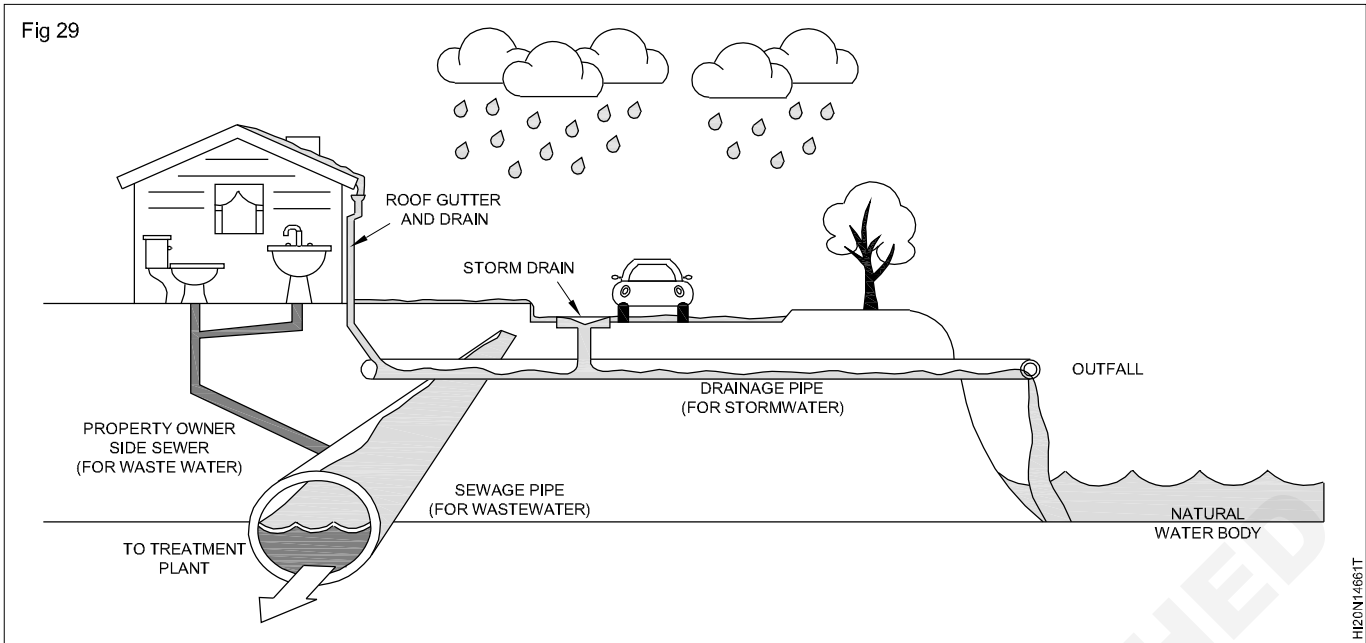
#### Definition and types of sewage system:

Sewerage is the system or infrastructure by which waste matter or sewage is carried away in sewers. There are 3 different types of sewerage systems

#### Type 1. Separate System

In this system two sets of sewers are provided-one for carrying domestic or sanitary sewage and industrial sewage, and the other for carrying storm water (or rain water). The sewage from the first set of sewers is carried to the treatment plant, and the storm water (or rain water) from the second set of sewers is directly discharged into a natural stream or river without any treatment.

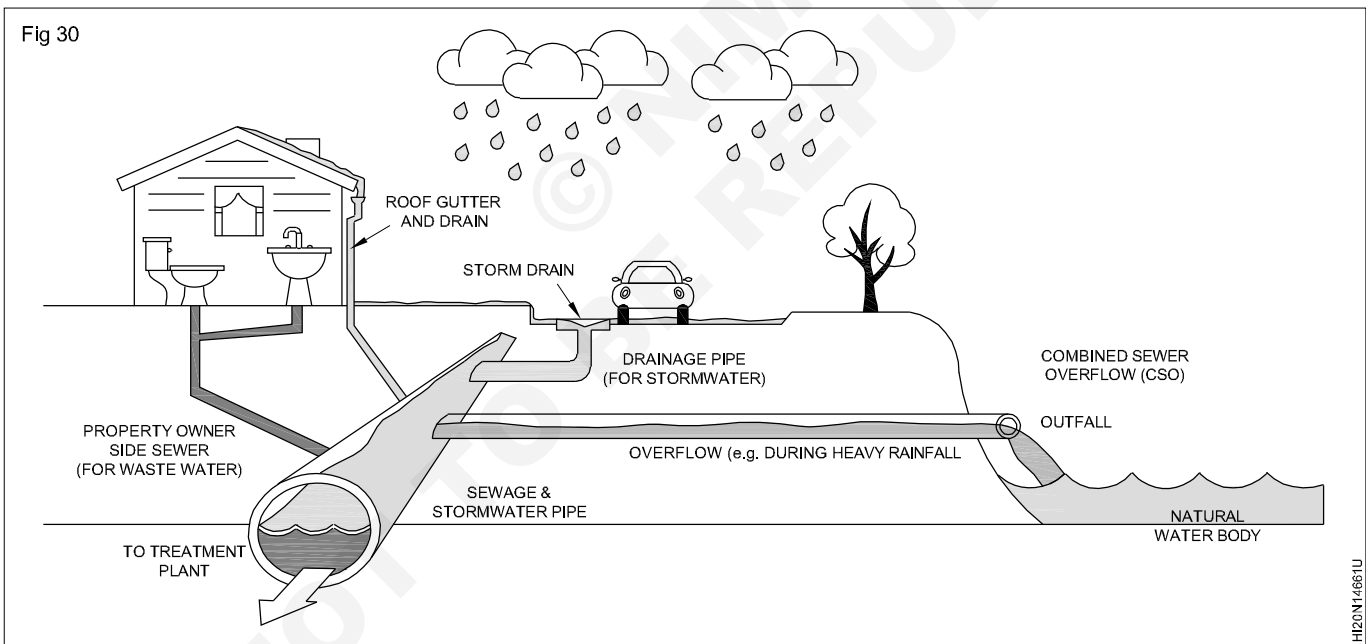
Fig 29



**Combined System of Sewage:**

When only one set of sewers are used to carry both sanitary sewage and surface water. This system is called combined system. Sewage and storm water both are carried to the treatment plant through combined sewers.

Fig 30

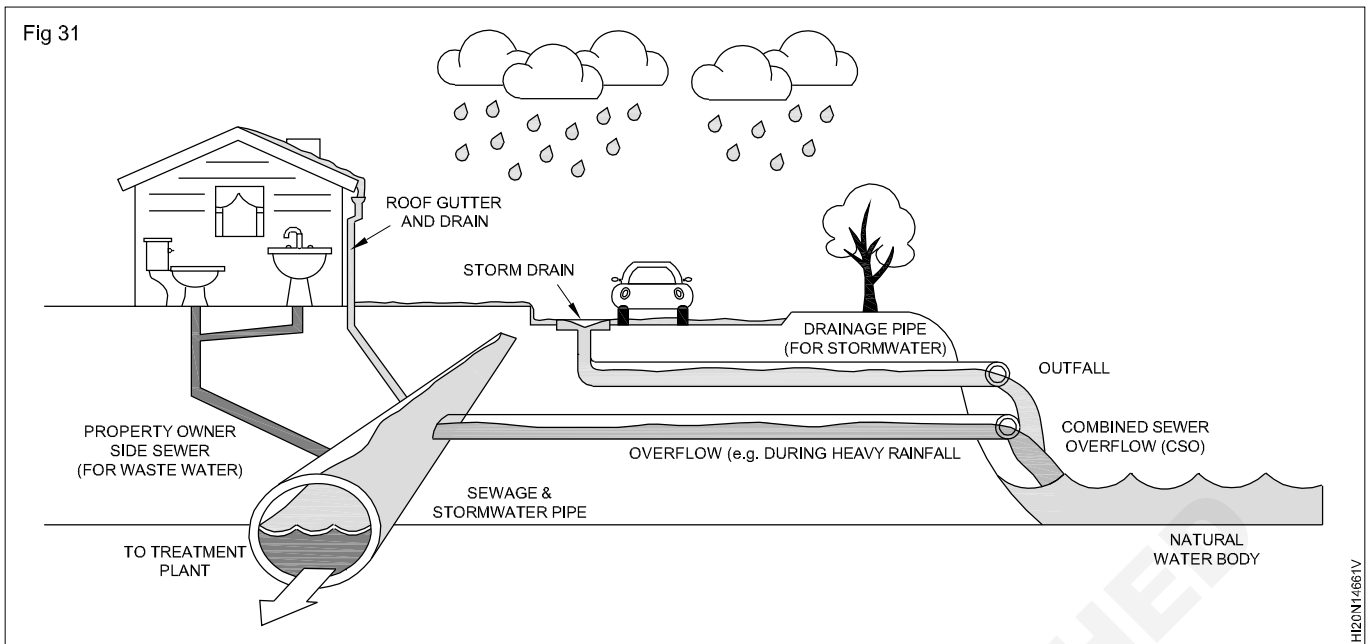


**Partially Combined or Partially Separate System :**

A portion of storm water during rain is allowed to enter sanitary sewer to treatment plants while the remaining storm water is carried through open drains to the point of disposal.



Fig 31



### Sewage farming:

In sewage farming, sewage is used for the irrigation of agricultural lands. This technique is common in warm and arid climates where sources of fresh water are scarce. This method not only helps in sewage getting disposed of but also helps in the increased crop yield as sewage contains a lot of nutrients. But one thing needs to be confirmed that the effluent is safe for irrigation.

### Advantages of Sewage Farming

- It helps in using irrigation of wastewater which would have otherwise been wasted.
- Some of the nutrients and organic solids in wastewater can be usefully incorporated into soil and agricultural products which would help in the growth of crops.
- If the agricultural lands are at a lower elevation than the sewage treatment plants then using wastewater for irrigation would be economical.

### Disadvantages of Sewage Farming

- The runoff obtained after sewage irrigation of fields may be polluted when precipitation exceeds evaporation and percolation capacity.
- The sewage is usually generated at a relatively constant rate, but irrigation is required only during dry weather so over-irrigation in wet periods might cause soils to become septic, sour, or sewage-sick.
- Arid climates will allow temporary storage of sewage in holding ponds while the soils dry out during non-growing seasons and such storage may cause odour and insect problems.
- In situations like irrigation of fruit trees with the flow in the surface, ditches may involve some risk of pathogen transfer from the sewage to the edible fruit by birds, insects, and similar vectors so the pathogen transfer is more likely to affect the consumers of the crops.

### Land treatment:

The process of land treatment is the controlled application of wastewater to soil to achieve treatment of constituents in the wastewater.

The land based treatment of wastewater based on how it is applied over land can be classified as:

1. Slow rate (SR) method
2. Rapid infiltration (RI)
3. Overland Flow (OF)

### Slow Rate Process

Slow rate (SR) land treatment is the controlled application of wastewater to vegetated land surface at a rate typically measured in terms of a few centimetres of liquid per week. Treatment occurs at the soil surface and as the wastewater percolates through the plant root-soil matrix. Depending on the specific system design, some to most of the water may be used by the vegetation, some may reach the groundwater, and some may be recovered for other beneficial uses. Off-site runoff of any of the applied wastewater is specifically avoided by the system design.

Slow rate land treatment can be operated to achieve a number of objectives including

- Treatment of the applied wastewater
- Economic return from the use of water and nutrients to produce marketable crops
- Exchange of wastewater for potable water for irrigation purposes in arid climates to achieve overall water conservation
- Development and preservation of open space and greenbelts

### RAPID INFILTRATION:

Rapid infiltration (RI) land treatment is the controlled application of wastewater to earthen basins in permeable soils at a rate typically measured in terms of meter of

liquid per week. . Any surface vegetation that is present has a marginal role for treatment owing to the high hydraulic loadings. However, vegetation is sometimes critical for stabilization of surface soils and the maintenance of acceptable infiltration rates. In these cases, water-tolerant grasses are typically used. Treatment in the RI process is accomplished by biological, chemical, and physical interactions in the soil matrix, with the near surface layers being the most active zone. The design flow path involves surface infiltration, subsurface percolation, and lateral flow away from the application site. A cyclic application is the typical operational mode with a flooding period followed by days or weeks of drying. This allows aerobic restoration of the infiltration surface and drainage of the applied percolate.

### **Overland Flow Process:**

Overland flow (OF) is the controlled application of wastewater to relatively impermeable soils on gentle grass covered slopes. The hydraulic loading is typically several inches of liquid per week and is usually higher than for most SR systems.

The design flow path is essentially sheet flow down the carefully prepared vegetated surface with runoff collected in ditches or drains at the toe of each slope. Treatment occurs as the applied wastewater interacts with the soil, the vegetation, and the biological surface growths. Many of the treatment responses are similar to those occurring in trickling filters and other attached growth processes. Wastewater is typically applied from gated pipe or nozzles at the top of the slope or from sprinklers located on the slope surface. Industrial wastewaters and those with higher solids content typically use the latter approach.

### **Sewage disposal by biogas plant:**

Biogas is a renewable energy source produced by the breakdown of organic matter by certain bacteria under anaerobic conditions. It is a mixture of methane, hydrogen, and carbon dioxide. It can be produced by agricultural waste, food waste, animal dung, manure, and sewage. The process of biogas production is also known as anaerobic digestion.

Biogas recycles the waste products naturally and converts them into useful energy, thereby, preventing any pollution caused by the waste in the landfills, and cutting down the effect of the toxic chemicals released from the sewage treatment plants.

Biogas converts the harmful methane gas produced during decomposition, into less harmful carbon dioxide gas. The organic material decomposes only in a wet environment. The organic matter or the waste dissolves in water and forms a sludge which is rich in nutrients and used as a fertilizer.

**Biogas Plant:** The biogas production is carried out in anaerobic digesters known as Biogas plant. These have five components:

- An inlet to feed the slurry
- The fermentation chamber where the biogas is produced with the activity of microorganisms,

- The gas storage tank to store the gas produced,
- The outlet for the used slurry,
- The exit pipe for removing the gas produced.

The organic matter is fed into the digesters which are completely submerged in water to provide it with an anaerobic environment. These digesters are hence called anaerobic digesters. The microorganisms breakdown the organic matter and convert it into biogas.

The biogas thus produced is supplied to the respective places through the exit pipes.

### **Breakdown of Organic matter**

- 1 The first stage involves the breakdown of organic polymers, such as carbohydrates, making it available to the next stage of bacteria known as the acidogenic bacteria.
- 2 The acidogenic bacteria then convert the sugar and amino acids into carbon dioxide, ammonia, hydrogen, and organic acids.
- 3 The organic acids are now converted into acetic acid, hydrogen, ammonia, and carbon dioxide.
- 4 These are finally converted into methane and carbon dioxide by the action of methanogens.

Methane is a combustible gas, i.e., it can be burnt. This gas is supplied to various places and is used in cooking and lighting. It is an eco-friendly gas and reduces various environmental problems like, it reduces the reliance on fossil.

### **Methods of disinfecting sewage**

Disinfection is a process where a significant percentage of pathogenic organisms are killed or controlled.

### **Wastewater Disinfection**

There are a number of chemicals and processes that will disinfect wastewater, but none are universally applicable. Most septic tanks discharge into various types of subsurface wastewater infiltration systems (SWIS), such as tile fields or leach fields. These applications rely on the formation of a biomass at the gravel-soil interface where "biodegradation and filtration combine to limit the travel of pathogens. "Aerobic treatment processes reduce pathogens, but not enough to qualify as a disinfection process". Chlorination/chlorination has been the most widely used disinfection technology ozonation and UV light are emerging technologies. Each of these three methods have different considerations for the disinfection of wastewater.

**Sewage farming** In sewage farming, sewage is used for the irrigation of agricultural lands. This technique is common in warm and arid climates where sources of fresh water are scarce. This method not only helps in sewage getting disposed of but also helps in the increased crop yield as sewage contains a lot of nutrients. But one thing needs to be confirmed that the effluent is safe for irrigation. Suspended solids present in the sewage will be converted to humus by microbes and bacteria in order to supply

nitrogen, phosphorus and other plant nutrients for crop growth.

### **Important considerations while sewage farming**

The following points must be kept in view while practising sewage farming:

- The effect of pathogenic should not spread among the farmworkers nor the consumers of sewage farm products.
- The groundwater should be prevented from contamination
- There should not be any deterioration of the soil properties.

### **Advantages of Sewage Farming**

- It helps in using irrigation of wastewater which would have otherwise been wasted.
- Some of the nutrients and organic solids in wastewater can be usefully incorporated into soil and agricultural products which would help in the growth of crops.
- If the agricultural lands are at a lower elevation than the sewage treatment plants then using wastewater for irrigation would be economical.
- Even though using sewage in farming is cheaper for farmers, yet not many farmers practice sewage farming.

### **Disadvantages of Sewage Farming**

- The runoff obtained after sewage irrigation of fields may be polluted when precipitation exceeds evaporation and percolation capacity.

- The sewage is usually generated at a relatively constant rate, but irrigation is required only during dry weather so over-irrigation in wet periods might cause soils to become septic, sour, or sewage-sick.
- Arid climates will allow temporary storage of sewage in holding ponds while the soils dry out during non-growing seasons and such storage may cause odour and insect problems.
- In situations like irrigation of fruit trees with the flow in the surface, ditches may involve some risk of pathogen transfer from the sewage to the edible fruit by birds, insects, and similar vectors so the pathogen transfer is more likely to affect the consumers of the crops.
- Sometimes, overuse of sewage may lead to a land condition called sewage sickness. Let's look into what the term means.

### **Sewage Sickness**

If sewage is applied continuously on a piece of land, pores or voids of soil are filled up or clogged, free circulation of air is prevented and anaerobic conditions develop. At this stage, the land is unable to take any further sewage load which causes the organic matter to decompose and foul-smelling gases are emitted from the land. This phenomenon of soil is known as sewage sickness of the land.

## Concept of liquid waste and disposal

**Objectives:** At the end of this lesson you will be able to

- understand the concept of disposal methods for dead animals and humans
- know the different types of soil, its importance in relation to public health and reclamation of land
- treatment of soil after the ph and disafication.

### Introduction to burial and cremation

Cremation is a centuries-old method for dealing with the passing of a loved one that involves burning their remains into fine ashes. As with a burial, the deceased is put into a casket. However, instead of burying it in the ground, the casket is inserted into a cremation chamber.

### Disposal of dead

**Burial** Practised by the Jews, Christians and Muslims- placing the corpses inside the earth in Coffins (wooden boxes / containers).

Fig 1



**Cremation** Practiced by the Romans, Greeks and Hindus- burning the corpses by fire, gas or electricity- burning the soft tissues and the most parts of the skeleton / bones.

Fig 2



**'Immurement'-Permanent storage** in 'Above the Ground Tombs' -called 'Mausoleums', - The dead bodies of many 'Historical Emperors of India have been kept in 'Mausoleums'. For instance, 'Taj Mahal' is a Mausoleum of Mum 'Taj Mahal', the beloved wife of Shah Jahan.

**Sky-Burial or Open Air-Disposal of Corpses** birds and animals would attack the parts of the dead bodies and eat the flesh-called 'Towers of Silence' -Practiced by Tibetan Buddhists and Zoroastrians,

**Natural Perishing of Corpses Method-** The dead bodies would be kept in the open and the soft tissues would be allowed to rot and perish, over a long period of time- similar to the 'sky burial' disposal - the remaining parts and the bones would be entombed.

**Disposal of the Dead Bodies of Military & Naval Personnel and the Persons dying in the ships on Long Voyages:**

**Sea Burial-** the dead bodies would be suitably packed with weight, to enable sinking into the deep sea- would be dropped into the sea from a ship or airplane- This method is used in the cases of deaths of military and naval personnel and in case of deaths in ships on Long Voyage

**Boat burial-** A form of 'sea burial', in which the dead body would be kept on a boat and left to get drowned into the sea and the dead body would get perished in the deep sea bed.

### Special Types of Disposal of Corpses:

**Resomation -Dissolution in acids or a solution of lye and disposal as a fluid-** Called 'Alkaline Hydrolysis' - an abnormal mode of disposal of the dead bodies and considered to be more 'environmental friendly' than the other methods, including burial and cremation and especially the open sky burials,

**Donation for Research and Study** to Medical Colleges and Institutes, where the dead bodies would be used for demonstrations, dissections, research and study and after some time the parts of the body would be cremated

**Mass Burials and Mass Cremations** of a number of dead bodies, during wars, 'genocides' and natural disasters such as tsunami and deaths due to epidemic diseases, when a large number of people would die,

**Dismemberment of the dead bodies** where the corpses are divided into various parts and the different parts would be disposed of separately.

### Methods of Preservation of dead

Whole dead bodies or some of the parts of the corpses may be preserved by some of the following methods:

**'Mummification'** A sophisticated method of preservation of the dead bodies, by removing the internal organs, dehydrating the bodies and wrapping and covering with linen cloth- practiced by ancient Egyptians,

**Stuffing and Preservation** The dead bodies of some well-known personalities have been stuffed with suitable material's after removing the inner parts and the body would be preserved by suitable chemicals,

Chemical Preservations of Parts of the Dead Bodies- Some parts of the dead bodies would be chemically preserved for a long time, such as those of some of the saints of the Roman Catholic Christianity, which are called 'Relics',

**Method of Plastination** The dead bodies would be 'embalmed' and preserved by dissection and slicing and replacing the fluids inside the body with inert plastic for anatomical study of the Medical students and for displaying in Museums,

Keeping Parts of the Dead Bodies in Chemical Preservative Liquids-Some of the parts of the human dead bodies would be kept within preservative chemical liquids in Museums and Medical College Laboratories.

#### **Commonly used methods for disposal of dead:**

- 1 Burial
- 2 Cremation

#### **Less commonly used methods for disposal of dead:**

- 1 Immurement
- 2 Sky-Burial or Open Air-Disposal
- 3 Sea Burial
- 4 Boat burial
- 5 Resomation
- 6 Mass Burial
- 7 Mass Cremation

#### **Basic requirements for burial and cremation grounds**

- 1 No new place for burying or burning the dead, whether private or public, shall be opened, formed, constructed or used, unless a licence has been obtained from the Village Panchayat on application.
- 2 Such application for a licence shall be accompanied by the plan of the place for which licence is required showing the locality, boundary and extent thereof, the name of the owner or person or community interested therein, the system of management and such further particulars as the Village Panchayat may require.
- 3 The Village Panchayat to which an application is made may- (a) grant or, if there is valid reason to be recorded in writing, refuse to grant a licence, or (b) postpone the grant of a licence until the objection, if any to the site has been cleared or any particulars called for by it have been furnished.
- 4 The Assistant Director (Panchayats) may cancel or modify any order passed by a Panchayat under sub-rule (3) : Provided that no order either on application

or suo motu prejudicial to the appellant shall be passed without giving reasonable opportunity of being heard to the appellant under this sub-rule or sub-rule (3).

#### **Registers to be maintained:**

- 1 A Register shall be maintained at the office of every Village Panchayat showing places provided, registered or licenced under Rules 3 to 5 and all such places provided, registered or licenced before the commencement of the Act which are used as burial or burning grounds.
- 2 A notice in Tamil and in English that such place has been provided, registered or licenced as aforesaid shall be displayed on some conspicuous place at or near the entrance to the burial or burning ground.

#### **Place for burial and burning grounds**

- 1 No person shall bury or burn or cause to be buried or burnt any corpse in any place within ninety metres of a dwelling place or source of drinking water-supply other than a place licenced as a burial and burning ground.
- 2 The person having control of a place for burying or burning the dead shall give information of every burial or burning of a corpse at such a place to any officer appointed by the Village Panchayat for this purpose.
- 3 If a Village Panchayat is satisfied- (a) that any registered or licenced place burying or burning of the dead is in such a state or situation as to be or likely to become dangerous to the health of persons living in the neighbourhood thereof ; or (b) that any burial ground is overcrowded with graves, and if in the case of a public burial or burning ground, another convenient place duly authorised for burying or burning of the dead exists or has been provided for the persons who would ordinarily make use of such place, it may with the previous sanction of the Assistant Director (Panchayats) give notice that it shall be not lawful after the expiry of a period of not less than two months to be specified such notice to bury or burn any corpse at such place.
- 4 Every notice given under sub-rule (3) shall be published by affixture to the notice board of the Village Panchayat and by beat of drum in the village.
- 5 No person shall in contravention of any notice under sub-rule (3) and after expiration of the period specified in such notice bury or burn or cause or permit to be buried or burnt any corpse at such place.
- 6 The Inspector may cancel or modify any notice issued by a Village Panchayat under sub-rule (3). (7) Whoever contravenes any of the provisions of these Rules shall be punishable with fine which may extend to one hundred rupees or in case of a continuing breach, with fine not exceeding fifteen rupees for every day during which the breach continues after conviction of the first breach: Provided that no prosecution shall be instituted for contravening the provisions of sub-rule (1) of Rule 7 without the written sanction of the

Executive Authority of the Village Panchayat, concerned.

Health hazards associated with unsanitary disposal of dead bodies

According to health professionals, the fear of spread of disease by bodies killed by trauma rather than disease is not justified. Among others, Steven Rottman, director of the UCLA Center for Public Health and Disasters, said that no scientific evidence exists that bodies of disaster victims increase the risk of epidemics, adding that cadavers posed less risk of contagion than living people. In disasters involving trauma where there is competition for resources, efforts should be focused on establishment of water supply, sanitation, shelter, warmth and hygienic food for the survivors, not digging mass graves.

Spraying is a waste of disinfectant and manpower. Indiscriminate burial of corpses demoralises survivors and the lack of death certificates can cause practical problems to survivors. Other considerations which are very important, but not directly relevant to the topic of health risks, include religious and cultural practices, the stench, and the effect on morale.

### Roots of incorrect notion

The incorrect notion that all dead bodies inherently cause diseases is consistent with

- The incorrect historical miasma theory of disease, which held that diseases are spread by foul air-in this case fouled by the stench of decomposing corpses.
- Confusion between normal decay processes and signs of disease; and the incorrect idea that microorganisms responsible for decomposition are dangerous to living people. "Microorganisms involved in the decay process (putrefaction) are not pathogenic".
- After a major disaster disease among survivors is indeed a problem, but is actually due to living in harsh conditions with poor sanitation. "Survivors present a much more important reservoir for disease [than cadavers]".
- Noting that corpses of those who died from certain contagious diseases (for example, in epidemics) do, indeed, spread disease, such as is the case with ebola, smallpox, and the 1918 flu, and incorrectly generalising this to all corpses.

According to the Pan American Health Organization (PAHO) "concern that dead bodies are infectious can be considered a 'natural' reaction by persons wanting to protect themselves from disease" although "the risk that bodies [of those killed in a natural disaster] pose for the public is extremely small".

### Actual Health risks

Contamination of water supplies by unburied bodies, burial sites, or temporary storage sites may result in the spread of gastroenteritis from normal intestinal contents. There is little evidence of microbiological contamination of groundwater from burial.

Where dead bodies have contaminated water supplies, gastroenteritis has been the most notable problem, although communities will rarely use a water supply where they know it to be contaminated by dead bodies. Microorganisms involved in the decay process (putrefaction) are not pathogenic.

To those in close contact with the dead, such as rescue workers, there is a health risk from chronic infectious diseases which those killed may have been suffering from and which spread by direct contact, including hepatitis B and hepatitis C, HIV, enteric intestinal pathogens, tuberculosis, cholera and others.

### Soil sanitation

The soil is a mixture that contains minerals, organic matter, and living organisms. But broadly speaking, soil can refer to any loose sediment. Typically, the soil consists of 45% minerals, 50% empty spaces or voids and 5% organic matter. Furthermore, soil performs many important functions such as:

- Providing a growth medium for the plants
- Acts a modifier of the earth's atmosphere
- One of the most crucial components of the biosphere
- Provides habitat for organisms

### Importance of Soil

Soil is an important element essential for the survival of living organisms. The importance of soil is mentioned below:

- The fertile soil helps in the growth and development of the plants. The plants thus produced are healthy and provide food, clothing, furniture, and medicines.
- It supports many life forms including bacteria, fungi, algae, etc. These microbes, in turn, maintain environmental balance by retaining the moisture and decaying the dead organisms.
- The topsoil supports certain life activities such as reproduction, hatching, nesting, breeding, etc. of a few organisms.
- The organic matter present in the soil increases the fertility of the soil which is responsible for the growth of the plants. It also contains certain minerals and elements that are necessary for the plants to carry out their cellular activities.
- Soil is used for making cups, utensils, tiles, etc. The contents in the soil such as gravel, clay and sand are used in the construction of homes, roads, buildings, etc.
- Useful mineral medicines such as calcium, iron, and other substances such as petroleum jelly for cosmetics are extracted from the soil.
- The soil absorbs the rainwater. This water is evaporated and released into the air during sunny days, making the atmosphere cooler.

**Classification of soil:**

**Soil is classified into four types:**

- 1 Sandy soil.
- 2 Silt Soil.
- 3 Clay Soil.
- 4 Loamy Soil.

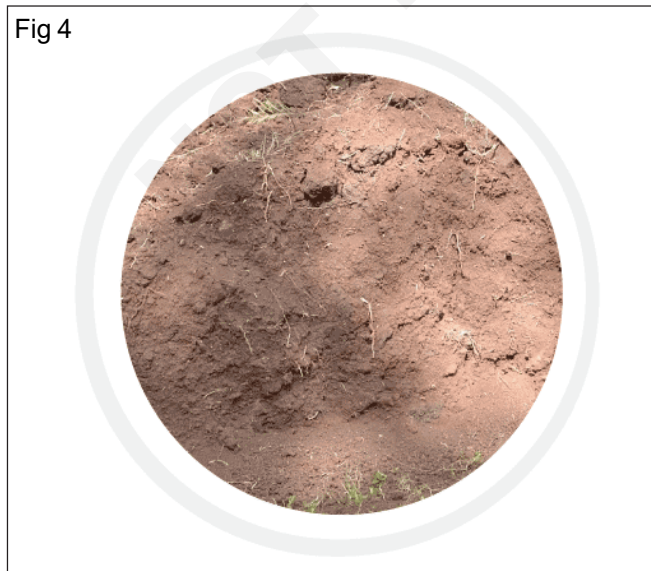
**Sandy Soil**

The first type of soil is sand. It consists of small particles of weathered rock. Sandy soils are one of the poorest types of soil for growing plants because it has very low nutrients and poor water holding capacity, which makes it hard for the plant's roots to absorb water. This type of soil is very good for the drainage system. Sandy soil is usually formed by the breakdown or fragmentation of rocks like granite, limestone and quartz.



**Silt Soil**

Silt, which is known to have much smaller particles compared to sandy soil and is made up of rock and other mineral particles, which are smaller than sand and larger than clay. It is the smooth and fine quality of



the soil that holds water better than sand. Silt is easily transported by moving currents and it is mainly found near the river, lake and other water bodies. The silt soil is more fertile compared to the other three types of soil. Therefore, it is also used in agricultural practices to improve soil fertility.

**Clay soil**

Clay is the smallest particle amongst the other two types of soil. The particles in this soil are tightly packed together with each other with very little or no airspace. This soil has very good water storage qualities and makes it hard for moisture and air to penetrate into it. It is very sticky to the touch when wet, but smooth when dried. Clay is the densest and heaviest type of soil which does not drain well or provide space for plant roots to flourish.



**Loamy Soil**

Loam is the fourth type of soil. It is a combination of sand, silt and clay such that the beneficial properties from each is included. For instance, it has the ability to retain moisture and nutrients; hence, it is more suitable for farming. This soil is also referred to as agricultural soil as it includes an equilibrium of all three types of



soil materials being sandy, clay, and silt and it also happens to have humus. Apart from these, it also has higher calcium and pH levels because of its inorganic origins.

### **Classification from the view point of importance in public health**

The purpose of the classification of soil is to arrange various types of soils into groups according to their engineering or agricultural properties and various other characteristics. For example, the agriculture departments undertake soil investigations from the point of view of the suitability, or otherwise, of the soil for crops and its fertility. However, from the engineering point of view, the classification may be done with the objective of finding the suitability of the soil for construction of dams, highways or foundations, etc.

For general engineering purposes, soils may be classified by the following systems:

- 1 Particle size classification of soil.
- 2 Textural classification of soil.
- 3 Highway Research Board (HRB) classification of soil.
- 4 Unified soil classification and IS classification system

#### **1 Particle Size Classification of Soil.**

In this system, soils are arranged according to the grain size. Terms such as gravel, sand, silt, and clay are used to indicate grain sizes.

#### **2 Textural Classification of Soil.**

Soils occurring in nature are composed of a different percentage of sand, silt, and clay size particles.

Soil classification of composite soils exclusively based on the particle size distribution is known as textural classification.

This classification is based on the percentages of sand, silt and clay Sizes making up the soil.

Such a classification is more suitable for describing coarse-grained soils rather than clay soils whose properties are less dependent on the particle size distribution.

#### **3 Highway Research Board (HRB) Classification of Soil.**

The Highway Research Board (HRB) classification system, also known as Public Road Administration (PRA) classification system, is based on both the particle-size composition as well as the plasticity characteristics. The system is mostly used for pavement construction.

#### **4 Unified Soil Classification System (USCS).**

According to the USCS, the coarse-grained soils are classified on the basis of their grain size distribution while the fine-grained soils, whose behavior is controlled by plasticity, are classified on the basis of their plasticity.

Various soils are classified into four major groups:

- 1 Coarse-grained.
- 2 Fine-grained.
- 3 Organic soils, and
- 4 Peat.

#### **5 Indian Standard Soil Classification System, ISCS (IS: 1498-1970).**

The ISCS classifies the soils into 18 groups as against 15 groups of USCS.

**Division.** Soils are broadly divided into three divisions.

**1 Coarse-grained soil.** In these soils, more than half the total material by mass is larger than 75-microns IS sieve size.

Coarse-grained soils are further divided into two subdivisions: **(a) Gravels (G), (b) Sands (S).**

**2 Fine-grained soils.** In these soils, more than half the material by mass is smaller than 75-microns IS sieve size.

Fine-grained soils are further divided into three subdivisions:

- a Inorganic silts and very fine sands.
- b Inorganic clays C.
- c Organic silts and clays and organic matter.

**3 Highly organic soils and other miscellaneous soil materials.** These soil contain large percentages of fibrous organic matter, such as peat, and the particles of decomposed vegetation.

In addition, certain soils containing shells, concretions, cinders and other non-soil materials in sufficient quantities are also grouped in this division.

#### **Reason of excessive moisture in the soil:**

Soils with excessive moisture have poor aeration because pore spaces are filled with water. Roots tend to grow near the surface in such soils. With poorly anchored roots, a tree is susceptible to wind throw. A tree may survive for a time, but the roots will eventually die and decay from lack of oxygen in the soil, leaving the tree without a way to absorb necessary water and nutrients. Too much water in the soil is often caused by construction and planting practices, such as the improper use of irrigation systems. However, some locations are naturally susceptible to saturated soil because of soil type, terrain, heavy rains, flooding, or a high water table. For example, soils with high clay content tend to have more drainage problems than sandy soils because they are more easily compacted.

- *Water Movement* — A large amount of water flowing quickly over soil may indicate saturated soil conditions. This can also cause erosion.
- *Standing Water* — Water left standing after a rain may also indicate excessive moisture in the soil.



*Soil Type* — The type of soil at a site influences moisture conditions. Sandy soils usually have a high infiltration rate with water moving quickly through, while clay soils tend to retain water.

- *Browning Leaf Edges* — Edges of leaves turning brown may indicate too much soil moisture.
- *Root Decay* — Waterlogged soils can cause root decay.

### Reclamation of land

Land reclamation is the process of creating new land by raising the elevation of a waterbed or low-lying land or by pumping water out of muddy morass areas.

Land reclamation can be achieved by poldering or by raising the elevation of a seabed or riverbed or low-lying land by:

- dry earth movement; or
- hydraulic filling

**POLDERING:** Pumping water out of muddy land or marshes is known as poldering. The area that is pumped dry is then enclosed by dikes.

**DRY EARTH MOVEMENT:** Dry earth movement for reclamation includes earth that is retrieved from land-based areas.

**HYDRAULIC FILL RECLAMATION:** Hydraulic fill reclamation has become more common in recent times and land reclamation sites can be found all over the world.

### USES OF LAND RECLAMATION

Whatever method is used to reclaimed land, it is usually part of a comprehensive project such as the construction or expansion of a port, of an airport, or of residential or commercial complexes. Reclamation is also used for beach replenishment and shore and dune replacements as well as to restore islands, for instances, in the Maldives, that have been ravaged by storms and erosion. Artificial islands have also been built with reclaimed fill as environmental compensation measures for migratory birds and marine life. It has also been used in the offshore gas and oil industry to build artificial islands for work installations.

### SOIL HEALTH

Healthy soil is the foundation of productive, sustainable agriculture.

### Principles to Improve Soil Health

**Minimize Disturbance:** From hooves to plows, soil is disturbed in many ways. While some disturbance is unavoidable, minimizing disturbance events across your operation builds healthier soils. To minimize disturbance of your soil, you can:

- 1 Limit tillage
- 2 Optimize chemical input
- 3 Rotate livestock

### Maximize Soil Cover

As a general rule, soil should be covered whenever possible. You can plant cover crops as part of both grazing and cropland operations.

To maximize soil cover year round, you can:

1. Plant cover crops
2. Use organic mulch
3. Leave plant residue

### Maximize Biodiversity

Increasing diversity across your operation can break disease cycles, stimulate plant growth, and provide habitat for pollinators and organisms living in your soil.

- 1 Plant diverse cover crops
- 2 Use diverse crop rotations
- 3 Integrate livestock

### Maximize Presence of Living Roots

Living roots reduce soil erosion and provide food for organisms like earthworms and microbes that cycle the nutrients you plants need.

- 1 Reduce fallow
- 2 Plant cover crops
- 3 Use diverse crop rotations

## Community Health

**Objectives:** At the end of this lesson you will be able to

- state the sanitary prescription of medical measures in housing, fairs and festivals
- identify the sanitary standards for construction of house.
- state the acquire knowledge on the disposal of community waste and prevention of outbreak of epidemics.

### General principle of healthy housing:

The fundamental needs include physiologic and psychologic needs, protection against disease, protection against injury, protection against fire and electrical shock, and protection against toxic and explosive gases.

### Fundamental Physiologic Needs

Housing should provide for the following physiologic needs:

- 1 protection from the elements,
- 2 a thermal environment that will avoid undue heat loss,
- 3 a thermal environment that will permit adequate heat loss from the body,
- 4 an atmosphere of reasonable chemical purity,
- 5 adequate daylight illumination and avoidance of undue daylight glare,
- 6 direct sunlight,
- 7 adequate artificial illumination and avoidance of glare,
- 8 protection from excessive noise, and
- 9 adequate space for exercise and for children to play.

### Fundamental Psychologic Needs

Seven fundamental psychologic needs for healthy housing include the following:

- 1 adequate privacy for the individual,
- 2 opportunities for normal family life,
- 3 opportunities for normal community life,
- 4 facilities that make possible the performance of household tasks without undue physical and mental fatigue,

- 5 facilities for maintenance of cleanliness of the dwelling and of the person,
- 6 possibilities for aesthetic satisfaction in the home and its surroundings, and
- 7 Concordance with prevailing social standards of the local community.

### Protection against Disease

Eight ways to protect against contaminants include the following:

- 1 provide a safe and sanitary water supply;
- 2 protect the water supply system against pollution;
- 3 provide toilet facilities that minimize the danger of transmitting disease;
- 4 protect against sewage contamination of the interior surfaces of the dwelling;
- 5 avoid unsanitary conditions near the dwelling;
- 6 exclude vermin from the dwelling, which may play a part in transmitting disease;
- 7 provide facilities for keeping milk and food fresh; and
- 8 allow sufficient space in sleeping rooms to minimize the danger of contact infection

### HOME SANITATION:

Sanitation refers to public health conditions related to clean drinking water and 'treatment and disposal of human excreta and sewage.' Preventing human contact with feces is part of sanitation, as is hand washing with soap. Sanitation systems aim to protect human health by providing a clean environment that will stop the transmission of disease, especially through the fecal-oral route.

## **Importance of Sanitation**

Sanitation is another very important aspect. Many of the common diseases mentioned earlier such as roundworms spread through the faeces of infected people. By ensuring that people do not defecate in the open, we can completely eliminate such diseases and even more severe ones such as the one caused by E. Coli.

The advancement in biology has given us answers to many questions, we are now able to identify the pathogen and treat an ailment accordingly.

## **How to Maintain Cleanliness at Home**

Empty dustbins regularly: A dustbin is the dirtiest place in the house, and it is likely to attract various pests like cockroaches and houseflies that lead to different infections and diseases. To keep them at bay, empty your dustbins on a regular basis.

### **Keep your house dust-free**

Dust-clad walls and ceilings are breeding areas of spiders and can make your house look creepy. Therefore, it is necessary to clean ceilings and walls on a periodic basis. Make sure to dust walls and corners, chandeliers, and ceiling fans at least once a week. Close the lid after each use to avoid flies.

### **Maintain your kitchen**

The kitchen is the heart of the home. Most often, it tends to get dirty due to the messy cooking process. Keeping your kitchen clean depends on your daily habits. You need to clean the kitchen countertop and sink after each meal.

### **Tidy up your living room**

The first thing to keep your living room clean is to organize your magazines and newspapers in a rack or shelving unit. Do spare some minutes to clean and declutter your coffee table daily.

### **Keep things in your bedroom organized**

It's pretty essential to keep the bedroom clean and tidy not only for a relaxing sleep but also for killer looks that impress anyone. Don't make it a storeroom; keep things that you require at night.

### **Keep your bathroom dry**

Bathroom is an essential part of your house which also needs attention. The bathroom floor, walls, tub, and

doors need to be wiped down thoroughly after each shower. You need to remove maximum water so that it dries soon.

### **Keep your yard in shape**

Grooming plants in your garden is an important part of maintaining cleanliness at home. You need to prune plants to prevent them from overgrowing.

### **Keep air vents and ducts clean**

It is important to keep air vents and ducts free of dust and other debris to facilitate the proper ventilation and functioning of an AC unit in the house.

### **Invest in a quality air purifier**

You cannot control air pollution outside your house but you can definitely maintain the indoor air quality using an air purifier. A good quality air purifier helps keep air quality within the house good and eliminates harmful gases and pollutants present in indoor air.

### **OTHER TIPS:**

- Wash curtains once every two months
- Get rid of pet hair
- Open windows for a limited time to prevent dust from entering into your home
- Dust doormats on a regular basis
- Keep your dresser area and combs hair-free
- Use a feather duster
- Keep things where they belong
- It is a collective effort. Hence, ensure the involvement of all family members.

### **Utility services of house:**

Utility Services means and includes electric, natural gas, water, waste-water, cable, telephone, or telecommunications services or the repair, location, relocation, improvement, or maintenance of utility poles, transmission structures, pipes, wires, fibers, cables, easements, rights of way, or associated infrastructure.

The following are common examples of a utility. Water services that connect to homes and businesses. Services that take back water that has been used such that it has become waste. Electricity generation and distribution with infrastructure known as a grid. In many cases, a rooftop solar system is also offered as a utility service.

Fig 1



i) Water closets (workers and staff) 	1 for up to 25	1 for up to 15	1 for up to 15	1 for up to 12
	2 for 26 to 35	2 for 16 to 25	2 for 16 to 35	2 for 13 to 25
	3 for 36 to 65	3 for 26 to 40	3 for 36 to 65	3 for 26 to 40
	4 for 66 to 100	4 for 41 to 57	4 for 66 to 100	4 for 41 to 57
		5 for 58 to 77		5 for 58 to 77
		6 for 78 to 100		6 for 78 to 100
For persons 101-200 add	3%	5%	3%	5%
For persons over 200 add	2.5%	4%	2.50%	4%
ii) Ablution tap	1 in each water closet	1 in each water closet	1 in each water closet	1 in each water closet
iii) Urinals	Nil up to 6	—	Nil up to 6	—
	1 for 7 to 20		1 for 7 to 20	
	2 for 21 to 45		2 for 21 to 45	
	3 for 46 to 70		3 for 46 to 70	
	4 for 71 to 100		4 for 71 to 100	
	From 101 to 200, add @ 3%		From 101 to 200, add @ 3%	
	For over 200, add @ 2.5%		For over 200, add @ 2.5%	
iv) Wash basins	1 per 25 or part thereof	1 per 25 or part thereof	1 per 25 or part thereof	1 per 25 or part thereof
Wash basins in rows or troughs and taps spaced 750 mm c/c				
v) Drinking water fountain	1 per every 100 or part thereof with minimum one	1 per every 100 or part thereof with minimum one	1 per every 100 or part thereof with minimum one	1 per every 100 or part thereof with minimum one

Fig: Standard requirements for sanitation at home

## Food hygiene at home:

### 1 Clean

**Always wash your food, hands, counters, and cooking tools.**

- Wash hands in warm soapy water for at least 20 seconds. Do this before and after touching food.
- Wash your cutting boards, dishes, forks, spoons, knives, and counter tops with hot soapy water. Do this after working with each food item.
- Rinse fruits and veggies.
- Do not wash meat, poultry, fish, or eggs. If water splashes from the sink in the process of washing, it can spread bacteria.
- Clean the lids on canned goods before opening.

### 2 Separate Keep Apart

**Keep raw foods to themselves. Germs can spread from one food to another.**

- Keep raw meat, poultry, seafood, and eggs away from other foods. Do this in your shopping cart, bags, and fridge.
- Do not reuse marinades used on raw foods unless you bring them to a boil first.
- Use a special cutting board or plate for raw foods only.

### 3 Cook

**Foods need to get hot and stay hot. Heat kills germs.**

- Cook to safe temperatures
- Use a food thermometer to make sure that food is done. You can't always tell by looking.

### 4 Chill

**Put food in the fridge right away.**

- 2-Hour Rule: Put foods in the fridge or freezer within 2 hours after cooking or buying from the store. Do this within 1 hour if it is 90 degrees or hotter outside.
- Never thaw food by simply taking it out of the fridge. Thaw food:
  - In the fridge
  - Under cold water
  - In the microwave
- Marinate foods in the fridge.

Fig 2

(Firouzjaye, 2014)

Variable	Dimensions	Indicator	Components
Health (dependent)	Indicators of Mental and Physical Health	Social	Value of emission , security sense, welfare sense, happiness and security , social support, keeping identity, individual behavior such as stability, adaptability, tolerance, control of anger, social level, marital status, marital affairs, social skills, individual recognition, social credit, socio-economic statue, leadership
		Cultural	Hygienic Information, relations , life control, life style and behaviors
		Environmental	Environmental relaxation, life style, security, welfare on the quarter, satisfaction of weather
	Indicators of Physical Health	Hygienic	Resistance against diseases, amount of effecting by the diseases, number of patients in the house, number of times of affecting in a year
		Physical	Physical disabilities, Physical actions and the old
		Infrastructural	Rural health insurance, access to the physician, satisfaction of insurance and hygienic services
		Genetic-biologic	Age, gender , hereditary attributes
Housing Quality (Independent)	Specifications of Quantitative Housing	Density of households in Residential Units	Sufficiency and shortage of number of available Residential Units related to the available households
		Density of person in Residential Units	Average number of person in the residential Units
		Proportionate of density of person with rooms	Welfare sense, independence sense of persons in the Residential Units
		Average of infrastructural level of Residential Units	Average level of the Residential Units- average useful spaces of the Residential Units- area of yard
	Physical Dimension of housing infrastructure	Durability of construction materials	Qualitative and durability of construction materials
		Technical standards and constructional engineering	Technical standards and constructional engineering
		Services and facilities	Social welfare and relaxation aspects of the housing- Welfare Facilities include piping, electricity, telephone, bathroom, kitchen, emergency door
		Neighborhood of housing utilities	Observing neighborhood of usable spaces related to the housing, satisfying location of different usable spaces
		Housing Architecture	Conformity of architecture with cultural conditions, climatic comfort in architecture, Common Beauty on the housing architecture
		Components and ordering of rural housing parts	Present of reception room, bedrooms, sanitary room, open kitchen, work room
		Amount of Distance and Accessibility	Distance from the main road, distance from city, accessing to other places and required services
	Socio-cultural Specifications	Satisfaction of general conditions of the rural housing	Satisfaction of the household from the new architecture, Satisfaction of location, Satisfaction of residential area and number of rooms
		Ownership	Method of owning residential units , owner, rent, title deeds
		Conformity with cultural conditions of household and society	External awareness, separating the parent room from child room, closed kitchen

**Management in Fairs and Festivals**

The maintenance of sanitation of fairs melas and religious festivals in India is very important and is a complicated task. During bathing festival people congregate by thousands along the banks of sacred rivers, which afford sufficient opportunity for pollution of Water and spread of diseases.

Secondly, pilgrims reach the place half starved, not used to any discipline and are also not in a mood to co-operate with the health authorities. This results in low resistance and increased spread of infection. Congregation of people in the melas is responsible for spread of diseases by the contamination of food and water.

## How to carry out these measures

Since different fairs vary greatly in size and character, it is not possible to formulate fixed rules which apply to all places under all conditions. So sanitary measures called for must depend upon the local condition.

- 1 Some persons or a body should be held responsible for the organization and control of fairs or melas.
- 2 The number of people approximately likely to be present in the melas is taken into account.
- 3 A plan of works should be prepared.
- 4 The area of the mela should be divided into isolated plots and each such plot placed in charge of one or more sanitary officers who should see that latrines are kept clean, that the lodging houses are free from sickness and kept in proper order.
- 5 The number of carts, sweepers, scavengers and inspectors necessary should be calculated beforehand on the basis of the number of people attending the mela.
- 6 All lodging houses should be registered, and a fixed number of lodgers should be accommodated.
- 7 Rules should be drawn up for the number of persons accommodated, cleanliness of the premises, protection of water supply, for both the staff and pilgrims. This should be enforced.

Majority of people attending the pilgrim centres travel by train. It is necessary that proper medical arrangements should be made by the railway authorities and there should be arrangement for medical inspection in important stations, so that patients suffering from infectious diseases may be removed without delay. The Public Health Authorities of adjoining states and Railway Health Authorities should meet before the fair and draw up a scheme for concerted action.

Advantages of getting the pilgrims vaccinated and inoculated should be borne in mind. A preliminary work should be done by drawing up a regular plan of work previously by constituting a responsible mela committee. Long before the opening of the mela, the pilgrims should be advised by posters and news paper advertisements.

The objects of mela sanitation are to maintain good sanitation of the mela ground to protect the health of the people coming to the mela. This is also possible by making satisfactory sanitary arrangements in the mela and also protecting the health of the people who came for the trade. It is better if the people are inoculated one week before they come to the mela ground. The expected number of pilgrims may be obtained from the previous years' records.

## Managing health risks during mass gatherings

Mass gatherings, like sporting events or religious pilgrimages, are highly visible events attended by tens of thousands of people. They can pose public health risks and strain the public health resources of the hosting

community, city or country. Mass gatherings, like the Olympics or Hajj, require considerable preparedness and response capabilities on the part of the host.

Globally, WHO collaborates with Member States and partners to improve planning for mass gatherings. Specific areas of WHO's work include:

- Ensuring that correct standards are applied to risk assessment, surveillance and response, including outbreak management, infection control and vaccination;
- Supporting planning for the management of mass casualties and emergencies in local communities, at event venues;
- Ensuring that adequate diagnostic capacities, including human resources, and transport procedures are in place;
- Ensuring that procedures are in place to provide updated health advice and guidance for visitors on topics such as vaccinations, food and water safety, and emergency contact numbers;
- Carrying out activities before and during mass gatherings to encourage healthy behaviors, such as increased physical activity, cessation of tobacco use, avoidance of excess alcohol and safe sex practices.

## Managing health risks during temporary settlements

Examples of many of these issues were found in a study of sanitation and related health risks in low-cost housing developments in Cape Town, South Africa. Most of these housing structures contained "informal dwellings" outside with more residents, which the owners of the houses viewed as sources of income. This set-up resulted in the severe overcrowding of an area that was already ill equipped to accommodate the residents.

Unsurprisingly, these temporary settlements began to see a rise in health hazards, many of which arose from the low quality construction combined with the dense population. Most homes had structural problems that the owners could not afford to repair, including cracks in the walls that caused leaking. The lack of maintenance subsequently induced immune problems among residents; poor construction, damp interiors, and overcrowding are known to facilitate the spread of diseases such as tuberculosis. Diarrhea was extremely widespread, in part due to limited water and sanitation resources. According to surveys of the settlements, 58% of the toilets did not function, 66% of the bathrooms substituted newspaper for toilet paper, and 82% of the bathrooms lacked soap.

With such infrastructural failure and the dearth of hygienic resources, the Cape Town settlements suffered from increased disease prevalence. Interestingly, most of these unhealthy practices did not emerge from a lack of knowledge. On the contrary, the study suggests that inhabitants had sufficient knowledge about sanitation. However, knowledge does not always translate into practice. This phenomenon indicates that efforts to improve conditions within these housing settlements

should focus less on awareness campaigns, and more on practical action, tailored to the layout and facilities of the housing structures.

### **Alternative emergency sanitary provisions to present situation crisis**

After most disasters, people need to be provided with temporary shelter; people in rural areas may want to take their livestock with them, and provision must be made for dealing with the resulting sanitation problems. There have been occasions when a nearby unaffiliated community or an undamaged part of a city has been able to shelter stricken people. Provision of shelter is the responsibility of relief and welfare authorities. The canvas tent is the most convenient and common type of emergency shelter. Aluminum prefabricated shelters have also been used in some countries for semi-permanent camps.

Recreational camp sites near the city or place of disaster frequently offer adequate conditions, as they normally have certain sanitary installations. The chief environmental health officer has the responsibility of seeing that the following points are observed when evacuees have to be accommodated for more than a few days.

#### **Housing**

- 1 The site should be away from mosquito breeding-places and garbage dumps. It should have good access to roads.
- 2 The topography of the land should permit easy drainage; the subsoil and ground water conditions should also be studied. Land covered with grass will prevent dust, but bushes and excessive vegetation that can harbor insects, rodents, reptiles, etc., should be avoided or cleared.
- 3 Wherever possible, the area should be naturally protected from adverse weather conditions; narrow valleys and ravines subject to floods should be avoided.
- 4 Areas adjacent to commercial and industrial zones, exposed to noise, odors, air pollution, traffic jams, and other nuisances, should also be avoided.
- 5 There should be ample space for the people to be sheltered and for all the necessary public facilities. Roughly speaking, this means 3- 4 hectares for every 1000 people 30-40 m<sup>2</sup> per person.
- 6 The site should be within reasonable distance of a good and ample source of water.
- 7 The tents should be arranged in rows on both sides of a road at least 10m wide to permit easy traffic. Between the edge of the road and the tent pegs there should be at least 2 m.
- 8 Inside the tent there should be a minimum floor area of 3 m<sup>2</sup> per person.
- 9 There should be a minimum distance of 8 m between tents, so that people can pass freely without being obstructed by pegs and ropes. This spacing also provides a safety measure against the spread of fire.
- 10 Small tents for a small number of occupants are preferable. This point should be taken into consideration when planning for emergencies.
- 11 The residential area of the camp should face the prevailing wind.
- 12 In cold weather kerosene stoves or other heating appliances should be provided, and people should be instructed in their use; every precaution should be taken to prevent fires and explosions.
- 13 Natural ventilation is adequate for the tents.
- 14 Wind-proof kerosene or oil lamps should be provided for lighting tents and roads. Lanterns with electric bulbs and dry batteries may also be provided.
- 15 Where there is no piped water, water tanks should be installed on both sides of the road. The tanks should have a capacity of 200 litres or more, depending on the frequency of refill, and should be so spaced that camp dwellers need not walk more than 100 m to draw water; several taps fixed to each tank may ease distribution. It is advisable to put the water tanks on wooden stands of a convenient height.
- 16 Garbage collection cans capacity 50-100 litres with tightly fitting lids should be provided for every 4-8 tents 25- 50 persons.
- 17 Privies or other types of excreta disposal installation should be located in blocks behind the tents
- 18 One double-sided ablution bench 3 m long should be provided for every 50 persons.
- 19 Drainage ditches should be dug round the tents and along the sides of roads. Water supply points should also have adequate drainage to avoid mud and sludge.
- 20 When camp sites are in use for long periods, the surface of loads should be sprinkled with oil to keep dust down.
- 21 Sanitation regulations should be laid down according to what is feasible in the particular situation and should be strictly observed.
- 22 The camp should be divided into two separate areas: a residential area and a community service area mass feeding centre, field hospital, recreation, etc..
- 23 For better management and control of communicable diseases, large camps should be avoided, or subdivided into independent units of no more than 1000 people.
- 24 The camp site should be cleaned regularly according to a prearranged schedule. Buildings If emergency shelter is provided within existing buildings, more attention should be given to ventilation and the removal of odours.

## Lighting

A temperature of 20°C is desirable, but lower temperatures can be tolerated with warm clothing.

The following points should be taken into consideration in relation to buildings used for shelter:

- 1 People sleeping on beds or mats should have a minimum floor area of 3.5 m<sup>2</sup> or 10 m<sup>3</sup> of air space. In rooms with high ceilings double bunks may be used.
- 2 A minimum distance of 0.75 m should separate beds or mats.
- 3 Emergency exits and fire escapes should be provided; the flues of stoves used for space heating should extend outside the building; overloading of electrical circuits should be avoided; lanterns and lamps should be so placed or suspended as to eliminate dangers; kerosene and gasoline should be stored outside buildings; clear instructions on fire hazards and safety practices should be displayed in conspicuous places; fire-fighting equipment should be properly maintained.
- 4 One wash basin should be provided for every 10 persons, or 4-5 m of wash bench for every 100 persons; there should be separate benches for men and women, and waste receptacles at each bench. One shower head is needed for every 50 persons in temperate climates and one for every 30 persons in hot climates. Floors must be disinfected daily.
- 5 For human waste disposal water-flushed toilets should be provided if possible see also page 64. Latrines should be located within 50 m of the building but away from the kitchen or dining hall.
- 6 One garbage can of 50-100 litres capacity, with a tightly fitting lid, should be provided for every 12-25 persons. Water supply Provision of a safe and adequate supply of water is essential, and it is the responsibility of the sanitary engineer or the sanitarian involved in emergency relief work to make certain that such a supply is available and readily accessible. The bacteriological, chemical, and physical condition of water for human consumption should comply with established standards.

## Water Supply

The following figures are intended as a guide in calculating minimum water requirements for drinking, cooking, and basic cleanliness

- 1 Field hospitals and first aid stations: 40--60 litres per person per day.
- 2 Mass feeding centres: 20--30 litres per person per day.
- 3 Temporary shelters and camps: 15-20 litres per person per day. Unless there are severe limitations on the supply of safe water, no restrictions should be placed on its use. If there is a shortage of water, rationing, close supervision of consumption, and other

water conservation measures should be practised. As soon as the early days of emergency have passed and the water supply has been increased restrictions should be lifted, since there is a correlation between water consumption and cleanliness on the one hand, and between cleanliness and the incidence of diseases on the other. With no restrictions the use of water may approach 100 litres per person per day.

## Food

The measures that can be applied in order to ensure good food sanitation include:

- 1 Quality control of incoming food in order to detect spoilage and contamination;
- 2 Quality control of water supplied to food-preparing centres;
- 3 control of insects and rodents in stores, kitchens, and feeding centres;
- 4 Provision for the proper storage and cooking of food;
- 5 Provision for the proper disposal of solid and liquid wastes;
- 6 Provision for the proper washing and sanitizing of utensils;
- 7 Supervision of food preparation;
- 8 Supervision of food serving;
- 9 Supervision of the cleaning of premises where foods are handled;
- 10 Management of food-handling personnel, which includes a health checks, b training, c ensuring that numbers are adequate, and d provision of adequate sanitary facilities.

Some important points to be borne in mind In the organization of mass feeding centres are listed below:

- 1 The location and layout of field centres for mass feeding should be selected and arranged in consultation with responsible sanitation officers so as to ensure reasonable sanitary safeguards. Whenever possible, use should be made of existing buildings, such as restaurants, hotel dining rooms, schools, public assembly halls, and churches, which offer suitable conditions for maintaining a satisfactory standard of cleanliness at all times and for preventing the invasion of rodents and insects.
- 2 Only potable water may be used in feeding premises. Where there is no piped supply, water must be transported, stored, and handled in a sanitary manner.
- 3 A sufficient number of basins, each with soap, nail brush and a clean towel, must be provided exclusively for the use of food handlers.
- 4 Separate basins must be provided for washing all sorts of eating and cooking utensils. Before washing, any grease or food scraps on the utensils should be scraped into a refuse bin; the utensils are then



washed in a basin with hot water and detergent, laid on wire baskets or trays, and immersed in boiling water for disinfection for 5 minutes. An alternative method of disinfecting utensils already washed is to immerse them in a sterilizing solution, preferably hot, of either chlorine 100 mg/litre for 30 seconds or quaternary ammonium compounds 200 mg/litre for 2 min. Wiping dry is unnecessary and undesirable, the baskets or trays being laid down for drying in a dust-free place.

- 5 Another basin should be provided for washing all fruits and vegetables before cooking. The serving of raw vegetables and soft-skinned fruits should be forbidden, unless this is unavoidable for dietary reasons; in such cases the vegetables and fruits must be thoroughly washed, immersed in a chlorine solution 100 mg/litre for 3 min, and rinsed until the smell of chlorine disappears.
- 6 Safe excreta disposal installations for the staff should be provided close to the mass feeding centre, it being assumed that people eating at the feeding centre can make use of the general facilities. Toilets and latrines must be kept in the best possible state of cleanliness at all times.
- 7 Liquid wastes from kitchens, if not discharged to public sewers, should be disposed of by other sanitary methods, such as a soakage pit or covered cesspool. A grease trap or strainer must always be provided and properly maintained to prevent choking.
- 8 Solid wastes from kitchens must be deposited immediately in refuse bins garbage cans, such as described on page 68. No filled bins may remain in preparation and cooking areas; they must be tightly covered and removed outside for collection and disposal.
- 9 A refuse removal service must be promptly started, as proper collection and disposal obviates many problems, particularly fly breeding, rodent invasion and fire risks. When this service is impracticable an attempt must be made to separate refuse into: a Inert refuse: mainly bottles and tins. When intact they could be salvaged; disaster victims can find many uses for tins. If damaged, they should be crushed or flattened and buried. b Combustible refuse: mainly wrappings, bags, boxes, etc. They could be burned in a kitchen incinerator. c Putrescible refuse: food wastes of all kinds. When there is sufficient combustible refuse this could be burned in the incinerator; otherwise it must be buried with inert refuse.
- 10 Basins, tables, chopping blocks, carving boards and all other furniture and equipment must be kept as clean as possible when in use and thoroughly cleaned after each meal.
- 11 Only food that is to be used the same day may be kept in the kitchen. Food not in the process of preparation or cooking must be kept in fly-proof cupboards and containers.

12 Where refrigeration facilities are non-existent or inadequate, perishable foods should be bought on a daily basis and cooked and served as soon as possible. The slaughtering of animals for consumption the same day could be considered when a veterinarian or a qualified meat inspector is available.

13 Condensed or powdered milk must be reconstituted with potable water only, and under the best possible sanitary conditions. If natural milk is available for infants and hospital patients, it must be boiled before use.

14 An adequate supply of detergents, disinfectants, brushes, cloths, brooms, and other housekeeping necessities must be provided.

15 Disposable plates, cups, etc. may be used in mass feeding centres and especially when disaster victims are on the march. Common drinking cups must not be tolerated.

### **Disposal of community waste and prevention of outbreak of epidemics**

Waste management is an invaluable public health service, especially during the current pandemic. Those of us privileged enough to have formal or informal waste management services right now are benefiting tremendously from avoiding the health risks of waste piling up. While waste workers across the world are protecting their communities, those in the informal sector face greater risk to their own health and livelihoods as countries lock down and economies slow down.

The International Labor Organization estimates that only 4 million of the 19 - 24 million people in the waste management and recycling sector are formally employed. The hazardous reality of the sector is that waste pickers often do not wear safety gear, which is particularly critical in the current health crisis, given the risks if infected materials are mixed in the general waste stream. Reacting to the rapidly evolving situation, waste picker organizations such as Asociación Nacional de Recicladores in Colombia and SWACH in India are promoting gloves and masks to prevent physical contact with trash and to keep a distance from people as well as from waste that is known to have been generated by the affected victims. The Global Alliance for Waste Pickers has been crowd sourcing global guidance and sharing best practices for waste pickers on their site. The South African Waste Pickers Association is asking people to separate their waste at the household level, and also to wrap tissues or contaminated waste in another layer of bags to limit the exposure to waste workers.

From an economic perspective, waste pickers are hit even more by global dynamics that are affecting recycling markets. Lower oil demand and prices will lower the price of virgin plastics further, hurting the competitiveness of recycled plastic. And with limits on cross-border movement, countries without developed recycling processes will likely dispose of their waste rather than recycle it. Shocks to global recycling

markets look set to affect the prices that waste pickers receive for recyclable material, further constraining their earnings in these trying times.

In parallel, countries are rolling back efforts to encourage waste separation at the household level because of health concerns. Some locations with recycling facilities are choosing to suspend operations during the pandemic to minimize the number of workers who come in contact with materials that might be infected. Italy is asking that all recyclables from quarantined households be collected as residual waste. Efforts to protect public health could, without remedial action, have significant, unintended impacts on waste workers across the world.

Waste pickers are in a fragile situation, with both their health and livelihoods threatened. Their work is even banned in some cases, preventing them from earning a living wage and serving their communities. Some communities have begun providing relief. For instance, although Ankara Municipality has banned waste picking, it is providing housing and food to waste pickers who would otherwise go homeless and hungry. However,

with the global lockdowns, the informal nature of waste picking, and the volatile recycling markets, joblessness is likely to be the reality for many. It's now more urgent than ever those countries and cities protect waste pickers' work in a safe manner, so that they can continue to serve communities — or that these governments provide a safety net to this vulnerable population. Some strategies to strengthen informal waste workers can be found in *What a Waste 2.0*.

Even when this crisis ends, waste management will remain a crucial tool to safeguard public health and provide livelihoods. And new approaches in a crisis can bring longer-term benefits. See how waste management investments that help stem Zika in Jamaica and Ebola in Liberia also resulted in improved solid waste management systems.

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## Occupational Health

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**Objectives:** At the end of this lesson you shall be able to

- identify the sanitary prescription of medical measures in housing, fairs and festivals
  - state the sanitary standards for construction of house
  - state the Acquire knowledge on the disposal of community waste and prevention of outbreak of epidemics
- 

### INTRODUCTION

Occupational health is an area of work in public health to promote and maintain highest degree of physical, mental and social well-being of workers in all occupations.

Its objectives are:

- the maintenance and promotion of workers' health and working capacity;
- the improvement of working conditions and the working environment to become conducive to safety and health;
- the development of work organization and working cultures that should reflect essential value systems adopted by the undertaking concerned, and include effective managerial systems, personnel policy, principles for participation, and voluntary quality-related management practices to improve occupational safety and health.

### OCCUPATIONAL ENVIRONMENTAL MEASURES

The "working environment" is understood in this report – as in the broader OECD framework on job quality – as a combination of job characteristics defining the setting where workers operate. The concept is multidimensional and encompasses a broad range of characteristics of a job, ranging from the nature of the work tasks assigned to each worker to the physical and social conditions under which these tasks are carried out, the characteristics of the firm or organisation where the work takes place, the scheduling of working time, the prospects that the job provides to workers and the intrinsic rewards associated with the job. The concept denotes those observable characteristics of the job as they are experienced by workers. Following this definition, a number of guiding principles for measurement follow.

Second, the focus should be on outcomes as experienced by individual workers rather than what is observed at the aggregate level. As the working environment differs across workers (even when employed by the same firm), its measurement should be individual based. Differences in the quality of the working environment are typically larger across workers within the same country than they are across countries. Lastly, quality measures should capture, as much as possible, objective aspects of the job rather than subjective evaluations of it, which nevertheless do provide useful complementary information. While the quality of the working environment

refers to a combination of objective job features, how workers evaluate their own job obviously varies from one worker to another.

However, the consequences (or subjective impacts) of a good or bad quality of the working environment are logically distinct from the quality of the working environment per se, as workers' evaluations and experiences of their job are shaped by factors other than the working environment itself (e.g. personal characteristics or family circumstances). For this reason, these Guidelines recommend focusing on objective aspects of the working environment, but also that surveys include – when space allows – questions on how the working environment impacts workers' subjective well-being and productivity.

### OCCUPATIONAL DISEASES

Any illness associated with a specific occupation or industry is referred to as an occupational disease. Such diseases are caused by a variety of biological, chemical, physical, and psychological factors that exist in the workplace or are encountered in the course of employment. Occupational medicine is concerned with the impact of all types of work on health, as well as the impact of health on a worker's ability and efficiency. Occupational diseases are largely preventable and can be traced back to poor working conditions. Controlling occupational health hazards reduces the occurrence of work-related diseases and accidents while also improving worker health and morale, resulting in lower absenteeism and increased worker efficiency. In most cases, the moral and financial benefits far outweigh the costs of removing occupational hazards.

### TYPES OF OCCUPATIONAL HAZARDS

According to their nature, occupational health hazards are classified into five categories:

- 1 Physical risks associated with noise, ionising radiation, and temperature.
- 2 Chemical hazards from exposure to gases, vapours, fumes, and chemicals
- 3 Biological hazards, such as exposure to viruses, bacteria, blood, and blood products
- 4 Ergonomic risks are those associated with the need

for incorrect posture, monotony, repetitiveness, work shifts, and stressful situations.

- 5 Accident risks, such as an unsuitable work environment, insufficient lighting, and potential electrical and fire accidents

### Examples of Occupational Health Hazards

#### 1 Mechanical Hazards

- Falls, cuts, abrasions, concussions, and contusions are all examples of injuries.
- Ergonomics is the science of adjusting man and machine.
- Ergonomic tools – Tools that reduce the stresses or problems that cause CTDs / MSDs.

#### 2 Psychosocial Hazards

- Lack of job satisfaction, insecurity, poor interpersonal relations, work pressure, and ambiguity are all examples of psychosocial hazards.
- Hostility, aggression, anxiety, depression, alcoholism, drug addiction, sickness absenteeism are all examples of psychological and behavioural changes.
- Psychosomatic disorders such as hypertension, headaches, body aches, peptic ulcers, asthma, diabetes, and heart problems are examples of psychosomatic disorders.

#### 3. Heat Illness

Excessive physical activity, extreme ageing, poor physical condition, fatigue, and excessive clothing Dehydration, Cardiovascular disease, Skin conditions, Obesity, and Phenothiazines, anticholinergics, diuretics, amphetamines, cocaine, MAOIs are all drugs.

#### Importance of health and safety at work place:

Workplace health and safety is all about sensibly managing risks to protect your workers and your business. Good health and safety management is characterised by strong leadership involving your managers, workers, suppliers, contractors and customers. In a global context, health and safety is also an essential part of the movement towards sustainable development.

#### Importance

**It's good to know the benefits, so we've listed 10 reasons why health and safety is important.**

- 1 It is morally right to ensure your workers return home safe and healthy at the end of every working day.
- 2 By protecting your workers, you reduce absences, ensuring that your workplace is more efficient and productive.
- 3 Research shows that workers are more productive in workplaces that are committed to health and safety.
- 4 Reducing down-time caused by illness and accidents means less disruption – and saves your business

money.

- 5 In some countries, health and safety legislation is criminal law and you are legally obliged to comply with it. Legal breaches can result in prosecution, fines and even imprisonment of senior executives.
- 6 To attract investors and partnerships you may need to demonstrate your commitment to sustainability and corporate social responsibility, which will include how you protect your workers.
- 7 Increasingly, customers want to buy products and services that are produced ethically – so you also need to think about the work practices throughout your supply chain and deal only with ethical suppliers that protect their workforce.
- 8 More and more, job hunters – particularly Millennials and Generation Z – seek roles with employers who share their values, so without strong corporate responsibility and sustainability practices you may struggle to attract or retain the best employees.
- 9 A good health and safety record is a source of competitive advantage: it builds trust in your reputation and brand, while poor health and safety performance will directly affect profitability and can result in loss of trade or even closure of the business.
- 10 Good health and safety at work secures **long-term benefits** for you, your business and the wider community.

#### Role of employees for health and safety program

The major rights as an employee to work in a safe and healthy environment are given to you by law and generally can't be changed or removed by your employer. The most important of these rights are:

- as far as possible, to have any risks to your health and safety properly controlled
- to be provided with any personal protective and safety equipment free of charge
- to stop work and leave your work area, without being disciplined if you have reasonable concerns about your safety
- to tell your employer about any health and safety concerns you have
- not to be disciplined if you contact the Health and Safety Executive for Northern Ireland (HSENI), or your local authority, if your employer won't listen to your concerns
- to have rest breaks during the working day
- to have time off from work during the working week
- to have annual paid holiday

#### Major responsibilities regarding safety and health

The most important responsibilities as an employee are:

- to take reasonable care of your own health and safety

- if possible to avoid wearing jewellery or loose clothing if operating machinery
- if you have long hair, or wear a headscarf, make sure it's tucked out of the way as it could get caught in machinery
- to take reasonable care not to put other people - fellow employees and members of the public - at risk by what you do or don't do in the course of your work
- to co-operate with your employer, making sure you get proper training and you understand and follow the company's health and safety policies
- not to interfere with or misuse anything that's been provided for your health, safety or welfare
- to report any injuries, strains or illnesses you suffer as a result of doing your job, your employer may need to change the way you work
- to tell your employer if something happens that might affect your ability to work, like becoming pregnant or suffering an injury - because your employer has a legal responsibility for your health and safety, they may need to suspend you while they find a solution to the issue or problem, but you will normally be paid if this happens
- if you drive or operate machinery, you have a responsibility to tell your employer if you take medication that makes you drowsy - if you have, they should temporarily move you to another job if they have one for you to do
- speaking to the employer about hazards at work and other health and safety issues
- Employers duties
- Your employer has a legal duty to:
  - consult about anything that may affect health and safety in the workplace
  - give you, if you are being consulted directly, or your SR or RoES, the chance to state their views
  - They must take account of these views when making a decision. Your employer must consult on:
    - changes in working practices or procedures that could affect your health and safety
    - arrangements for using qualified people to help the business comply with health and safety legislation
    - information to be made available on health and safety risks in the workplace
    - planning of health and safety training
    - health and safety issues with new technology

### Measures for health protection workers

Health is an important part of everyone's life. Being healthy does not only mean being 'disease free'. It includes physical, social, and mental health too. Maintaining sound health is undoubtedly a concern for everyone but it is more necessary for those who are constantly under threat of health hazards. These are the factory workers. They are constantly under the danger of health risks. Hence, it becomes necessary to concentrate on the health of the workers in the factories as well as people in society. In order to standardize the health measures and safety provisions, the Factories Act, 1948 lays down certain 'health measures'

### Health Measures and Safety Provisions as per Factories Act, 1948

### Role of Trade union health and safety representatives

If your employer recognises a trade union and the union has appointed a safety representative (SR), your employer must consult the SR. If there is no recognised union, your employer must either consult you directly or, if a representative of employee safety (RoES) has been elected, consult the RoES or you directly. Your SR will give you confidential help and advice. They can also help you solve problems and have legal duties, which include:

- representing workers in talks with the employer, or the Health and Safety Executive for Northern Ireland (HSENI), or other safety or environmental enforcement agencies
- investigating complaints, possible hazards and dangerous incidents
- carrying out regular inspections of the workplace
- taking part in workplace risk assessments

### Role of employer

A representative of employee safety has less legal authority than that of an SR. Their duties include:

- representing the interests of workers to the employer in consultation with the HSENI and other safety, or environmental enforcement agencies
- Section 11: Cleanliness in every factory
- Section 12: Disposal of effluents and wastes
- Section 13: Ventilation and Temperature
- Section 14: Dust and Fume
- Section 15: Artificial Humidification
- Section 16: Overcrowding
- Section 17: Lighting
- Section 18: Drinking Water
- Section 11: Cleanliness in Every Factory
- Under Section 11, every factory need to keep itself clean and free from effluvia arising from any drain, privy or other nuisance, and in particular-
  - Accumulation of dirt and refuse should be removed daily by any effective method from the floors of workrooms and from staircases and passages and disposed of in a suitable and efficient manner.

- In case the floor is subject to become wet during the working time, then they should take proper drainage process or steps.
- Clean the worker's floor every week with proper disinfectant or any other effective method of cleaning.
- Paint or repaint walls, ceilings, and staircases of the factory once in every 5 years.
- Repaint the walls once in every 3 years in case of washable water paints.
- Paint and varnish all doors and window-frames and other wooden or metallic framework and shutters at least once in a period of 5 years.

#### Section 12: Disposal of Effluents and Wastes

Under this section following things should be considered:

- a It is necessary for the factories to arrange proper and effective waste treatment and its disposal.
- b The State Government may make rules prescribing the arrangements for the disposal and treatment of waste and effluents.

#### Section 13: Ventilation and Temperature

This section states:

- Effective and suitable provisions should be made in every factory for securing and maintaining in every workroom proper ventilation by circulation of fresh air. It also involves providing an adequate temperature at the workplace. For this, they should select the material of the walls accordingly.
- The State Government may prescribe a standard of adequate ventilation and reasonable temperature for any factory or class or description of factories.
- Lastly, if it appears to the Chief Inspector that excessively high temperature in any factory can be reduced by the adoption of suitable measures, he can order them to use such a method.

#### Section 14: Dust and Fume

- This section states that: If dust and fume release in the manufacturing process of a factory then they should take effective measures to prevent its inhalation and accumulation in the workplace. For this, they should use proper exhaust appliances in the workplace.
- In any factory, no stationary internal combustion engine shall be operated unless the exhaust is conducted into the open air

#### Section 15: Artificial Humidification

- 1 In respect of all factories in which the humidity of the air artificially increases, the State Government may make rules,-
  - Firstly, prescribing standards of humidification;
  - Secondly, regulating the methods used for artificially increasing the humidity of the air;

- Directing tests for determining the humidity of the air for correct carrying out and recording.
  - Lastly, prescribing methods for securing adequate ventilation and cooling of the air in the workrooms.
- 2 In any factory in which the humidity of the air artificially increases, they should purify the water (drinking water) before the supply.

#### Section 16: Overcrowding

This section states:

- Firstly, no room in any factory shall be overcrowded to an extent injurious to the health of the workers employed therein.
- Secondly, a factory built after the commencement of this Act at least 14.2 cubic meters of space for every worker employed therein, and for the purposes of this subsection, no account shall be taken of any space which is more than 4.2 meters above the level of the floor of the room.
- If the Chief Inspector by order in writing, may or may not post a notice specifying the maximum number of workers who may be employed in the room.

#### Section 17: Lighting

This section states:

Firstly, There should be proper lighting in all the places of the factory from where the workers of the factory pass.

In every factory, effective provision shall, so far as is practicable, be made for the prevention of-

- glare, either directly from a source of light or by reflection from a smooth or polished surface;
- the formation of shadows to such an extent as to cause eye-strain or the risk of accident to any worker.

#### Section 18: Drinking Water

This section states that in every factory, there should be proper arrangements for a sufficient supply of wholesome drinking water and shall be legibly marked as "drinking water".

#### Section 19: Latrines and Urinals

This section states that every factory should make arrangements of latrine and urinals for the employees and the rules are laid down by the State Government in this behalf.

#### Section 20: Spittoons

There should be a sufficient number of spittoons in the factories for the employees and they should be in clean and hygienic condition according to this law.

### **PREVENTION OF OCCUPATIONAL DISEASES**

Prevention of occupational diseases includes policies and actions to eliminate or reduce occupational risk factors, thus reducing or eliminating occupational diseases and injuries, work-related diseases and premature deaths.

Several levels of prevention are defined. **Primordial prevention** includes elimination of any predisposing risk factor, for example substitution of asbestos with another less harmful substance in the production process. **Primary prevention** includes protection from exposure to an occupational factor, e. g. enclosed machinery that does not allow spread of solvents or use of adequate protective equipment. **Secondary prevention** includes the use of screening tests, for example detection of early signs of occupational exposures and symptoms during the preventive check-ups. **Tertiary prevention** includes interventions aimed at slowing the progress of already established occupational or work-related disease.

General measures.

This includes:

Think positive, try to solve the problems and responsibilities on time;

Have a healthy life style, including healthy foods, adequate amounts of water/day, regular physical exercises and a minimum of eight sleeping hours daily;

Try to create a balance between work and family life, social life, do not overload yourself, divide projects into smaller phases, and prioritize tasks, delegate responsibilities to colleagues working with you in certain projects;

Take short breaks throughout the day, to sit back and clear your mind;

Meditation, listening to music, walking for 5 minutes can improve your mood significantly;

Do not try to control the uncontrollable situations, adjust your standards, be realistic about what you can accomplish.

Educational Programs/Awareness Programs. Programs that address health & safety issues; occupational health diseases; hygiene in the workplace; as well as those that deal with where, when, why and how to use PPE can also help in preventing occupational health diseases.

## **PROVISION –BENEFIT OF EMPLOYEES**

Most employers offer employee benefits packages, which can include basic health coverage and retirement planning. In addition to basic health coverage, employers offer a variety of other perks, depending on the nature of their companies.

Employee benefits include non-wage compensation in addition to regular salary. Various types of employee benefits typically include medical insurance, dental and vision coverage, life insurance and retirement planning, but there can be many more types of benefits and perks that employers choose to provide to their employees.

### **Types of employee benefits and perks**

Many companies offer some of the following employee benefits and perks:

- 1 Medical coverage
- 2 Dental insurance

- 3 Vision insurance
- 4 Life insurance policies
- 5 Prescription and pharmacy benefits
- 6 Specialist services
- 7 Mental health coverage
- 8 Retirement planning
- 9 Paid time off
- 10 Paid vacation time
- 11 Paid sick leave
- 12 Extended leave
- 13 Family leave
- 14 Disability benefits
- 15 Workers' compensation
- 16 Living stipends
- 17 Student loan repayments
- 18 College grants and scholarships
- 19 Paid training and development
- 20 Continuing education
- 21 Travel and spending expenses
- 22 Company equipment
- 23 Company transportation
- 24 Remote work flexibility
- 25 Investment opportunities

### **Medical coverage**

The most common employee benefit that employers offer is medical or health coverage. Typically, employee medical insurance covers things like doctors' appointments, regular checkups, emergency room visits, basic medical procedures and many types of surgical procedures.

### **Dental insurance**

Many employers provide dental coverage as part of their overall employee medical benefits, but sometimes dental insurance is a separate benefit. .

### **Vision insurance**

Vision insurance is usually a separate insurance plan offered along with employee health benefits. Eye exams, prescription lenses, ocular procedures and routine checkups for eye health are typical procedures that a vision plan covers.

### **Life insurance policies**

Many employers provide life insurance plans as part of an employee benefits package.

Usually, the life insurance term lasts for as long as the employee works for their employer.

## **Prescription and pharmacy benefits**

Many health coverage plans offer prescription benefits, such as lower co-pays for medicines and even no-cost prescriptions.

Additionally, most prescription plans offer three different tiers of medication prices, with generic medications in the lowest cost options. The co-pay for certain prescription drugs can vary, depending on the tier the medicine is listed in.

## **Specialist services**

Specialist services, including referrals from primary care physicians, make up a portion of many employee benefits packages.

## **Mental health coverage**

Some employee health plans also include mental and emotional health coverage. Depending on the insurance plan, appointments with mental health practitioners, behavioural and cognitive therapy services, grief, divorce and family counselling and prescription coverage for medications for mental disorders can be covered in your health benefits.

## **Retirement planning**

Retirement options are available through most employers and often differ, depending on the company.

### **Paid time off**

In addition to health benefits, most employers offer paid time off, when employees can schedule personal days off of work. Typically, the amount of PTO increases by a set number of hours, which employees accrue each pay period.

### **Paid vacation time**

Generally, vacation time accrual is an employee benefit that may be offered in place of PTO. Employees who have vacation allowances accrue a certain number of hours each pay period, similar to paid time off allowances.

### **Paid sick leave**

In addition to PTO or a paid vacation allowance, many employers offer sick leave. Employees accrue a set number of hours each pay period, the same as PTO or paid vacation days, but sick days are usually a separate allowance combined with paid vacation.

### **Extended leave**

Extended leave is different from paid sick leave accrual, and it accounts for long periods away from work for medical reasons. Oftentimes, employers offer extended leave benefits that pay employees' salaries for time off over 15 consecutive days.

### **Family leave**

Along with extended leave, many employee benefits packages include a family leave plan. Depending on the employer, employees may take up to 12 weeks off

of work to stay with family and their infants.

## **Disability benefits**

Disability benefits ensure an employee's salary in the event they are injured or become ill and cannot work. Some employers may offer temporary disability insurance plans that provide income support to employees who have suffered an injury or illness outside of work.

## **Workers' compensation**

Workers' compensation plans are usually part of a typical employee benefits package if they aren't substituted with a disability benefit plan. Workers' compensation covers accidents, illness and injuries suffered on the job, and these benefits frequently offer coverage for up to 100 weeks, depending on the plan.

## **Living stipends**

Some employers offer living stipends as part of their benefits packages, especially if employees need to relocate in order to fill their position. Depending on the company, employees may receive monthly or yearly stipends that cover several living expenses such as moving fees, home office setup, utility coverage and even rent.

## **Student loan repayment**

Many employees who have recently graduated from college can have outstanding student loans they need to pay off. Employers who offer student loan repayment benefits offer to pay back the employee's student loan, usually at a set amount per month. The amount that employers contribute can depend on the loan amount and monthly payment minimum.

## **Paid training and development**

Many companies pay their employees to attend training and professional development. Additionally, new hires may typically be required to attend new employee training, which is often paid for by their employers.

## **Continuing education allowances**

Along with professional development and paid training, many employers offer paid allowances for employees who are required to obtain continuing education credit hours for their jobs.

## **Travel and spending expenses**

Many businesses employ executives and professionals who are required to travel in order to complete business assignments. In these cases, employers generally cover the costs of travel, lodging and spending costs for employees who travel long distances to perform their jobs.

## **Company equipment**

Depending on the role and industry, employers may also offer company equipment as part of their employee perks. Things like computers, cell-phones and tablets may be equipment that employers provide to their employees to perform their jobs.



## Company transportation

Some companies even provide company vehicles for employees to use. This perk is common among trade industries such as construction, where employees arrive to work in their personal vehicles then use the company's vehicles to complete their job duties.

## Remote work flexibility

Many companies are starting to offer remote work flexibility perks, where employees are allowed to work from home one or more days per week.

## Investment opportunities

Many corporate businesses and organizations offer ways for employees to invest in company stocks, shares or other profit-growing opportunities within their organization. Investing in your company means you can benefit from its growth and profitability while increasing your personal net worth.

## Occupational Health Legislation in India

There are presently 16 laws related to working hours, conditions at work and employment. There are two acts containing the main provisions for legal measures for the protection of health and safety of workers; they are the Factories Act (1948) and the Mines Act (1952). The Factories Act was amended in 1987 and stipulates pre-employment examination as a pre-placement procedure, statutory periodic medical examination for job in hazardous areas. In India, occupational health is under two ministries: 1) Labour and 2) Health and Family Welfare.

## Occupational Health Institutions

The National Institute of Occupational Health (NIOH) was established in 1970 at Ahmedabad, Gujarat, as a WHO collaborative and reference centre for occupational health, and it works closely with the Ministries of Labour, Health and Family Welfare, Environment and Forests, Agriculture etc.

The objectives of NIOH are: to promote intensive research to evaluate environmental stresses/factors at the workplace, to promote the highest quality of occupational health through fundamental and applied research, to develop control technologies and health programmes through basic and fundamental research and to generate human resources in the field. Two Regional Occupational Health Centres (ROHCs) have been set up in Bangalore and Calcutta.

The National Safety Council of India (NSCI) was established to promote safety consciousness among workers to prevent accidents, minimise dangers and risks and arrange related education and awareness programmes. The three main activities of the NSCI are: road transportation safety; safety of health in the construction sector; safety, health and environment in small – to medium-scale enterprises (SMEs).

Other public institutes include the Central Labour Institute (and its associated institutes) and the All India Institute of Hygiene and Public Health. The Indian Association

of Occupational Health (IAOH) is an association of over 3000 members comprising health professionals, industrial hygienists, safety professionals, social workers and others.

It aims to promote occupational health by various measures including conducting training courses, workshops and conferences, producing a journal with scientific articles, conducting research activities, collaborating with international agencies in the field and preparing a national registry of occupational health.

## National Policy on Occupational Health

The Ministry of Labour and Employment, Government of India, approved the national policy on safety, health and environment at workplaces in February 2009 [6] It provides guidelines for developing and maintaining safety culture and environment at workplaces for all stakeholders. It also deals with provision of a statutory framework, administrative and technical support services, providing incentives (both financial and non-financial) to employers and employees, developing research and development capabilities, prevention strategies and their monitoring and providing required technical manpower and inclusion of safety, health and environment improvement in other national policies.

## National Programme for Control and Treatment of Occupational Diseases

Occupational health was one of the components of the National Health Policy in 1983 and 2002. The Ministry of Health and Family Welfare, Government of India, launched a programme entitled "National Programme for Control and Treatment of Occupational Diseases" in 1998–99. The National Institute of Occupational Health, Ahmedabad, is the nodal agency for the same. The categories of major occupational diseases in India are: [7] occupational injuries, occupational lung diseases, occupational cancers, occupational dermatoses, occupational infections, occupational toxicology and occupational mental disorders.

A grouping of major occupational disorders in India according to the etiological factors includes – occupational injuries: ergonomics related; chemical occupational factors: dust, gases, acid, alkali, metals etc.; physical occupational factors: noise, heat, radiation etc.; biological occupational factors; behavioural occupational factors; and social occupational factors.

In India in 1998–99, the prevalence of silicosis was 6.2–34% in mica miners, 4.1% in manganese miners, 30.4% in lead and zinc miners, 9.3% in deep and surface coal miners, 27.2% in iron foundry workers, and 54.6% in slate-pencil workers. Prevalence of asbestosis was extended from 3% in asbestos miners to 21% in mill workers. In textile workers, byssinosis was as common as 28–47%. Nutritional status in terms of body mass indices (BMI) of the workers was also significantly low.

## Public Health and Emergency Situation Management

Public health and, of course, emergency management have long histories of engagement in disasters and

complex emergencies. Before public health practitioners worked from emergency operations centers (EOCs) or had even heard of an IMS, they were leading or supporting response efforts in numerous infectious disease emergencies, such as those caused by yellow fever, smallpox, and HIV/AIDS, as well as environmental and technological catastrophes, including hurricanes, floods, and industrial chemical releases. Similarly, the field of emergency management, defined here as “the managerial function charged with creating the framework within which communities reduce vulnerability to hazards and cope with disasters,” has long been oriented toward an array of emergencies, including but not limited to public health events.

Public health and emergency management have also come together in the professional associations of each field. For example, the International Association of Emergency Managers has organized several caucuses addressing the ramifications of a range of health-related emergencies. Similarly, the National Emergency Management Association has partnered with the Association of State and Territorial Health Officials to form a joint policy work group. This group coordinates federal grant program activities between emergency management agencies and public health departments and aligns exercise requirements across multiple programs, among other things. The National Association of City and County Health Officers, a leading policy and advocacy organization for local health departments in the United States, holds an annual conference focused on issues of public health and health care preparedness, response, and recovery.

A useful heuristic to understand the relationship between public health and emergency management is the emergency management cycle, which has been described in emergency management curricula, textbooks, and government sources using different models. We adopted a 4-stage model of this cycle that includes mitigation, preparedness, response, and recovery.

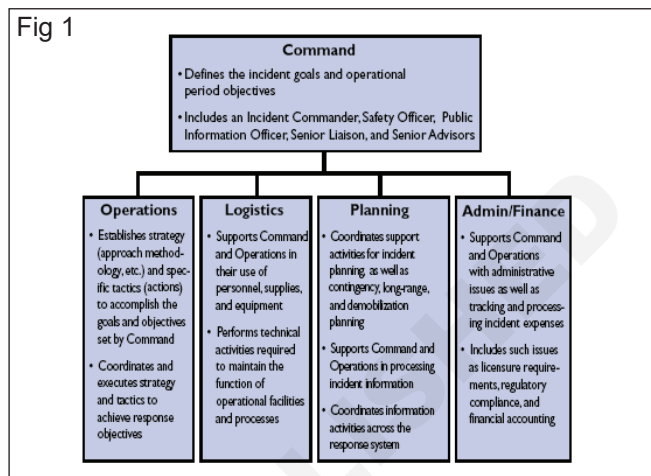
Mitigation focuses on reducing hazard losses or risk and controlling anticipated damage; activities in this phase can be carried out before, during, or after an event. “Mitigation” is an infrequently used term in public health or PHEM contexts. Examples of mitigation are targeted human and animal vaccination efforts, animal culling, and other public health control measures, including food safety and sanitation practices to reduce the impact of an infectious disease outbreak or environmental exposure risks in the context of a disaster (e.g., at a shelter or other congregate setting).

Preparedness activities occur before an event and center on building or maintaining staff, systems, and infrastructure capacity as well as carrying out the planning, training, and exercising necessary to identify gaps and improve emergency response capabilities. Examples are the development, testing, and evaluation of emergency response plans, notification and warning systems, and surge staffing procedures as well as

training staff and enhancing physical and information technology infrastructure such as EOCs and surveillance and reporting systems.

**Fig: Examples of Public Health Emergency Management (PHEM) activities across phases of the Emergency Management Cycle**

Response in the emergency management cycle occurs in recognition of a hazard that threatens to overwhelm day-to-day functions or capacities. In the public health



context, emergency response activities can vary widely but generally include the following:

- Coordinating select public health response functions across multiple entities or partners;
- Collecting, integrating, and analyzing epidemiologic, laboratory testing, and other data;
- sharing information with partners;
- Developing and disseminating guidance, emergency risk communication messages, and other recommendations to targeted audiences or at-risk populations; and
- Coordinating the implementation of control measures such as the distribution and dispensing of appropriate medical countermeasures.

Finally, the recovery phase occurs during and after the response and encompasses efforts to return or adapt to “new” normal conditions after an event. In the public health context, this may include efforts to implement an orderly transition of response-related activities to regular public health programs and functions, capacity-building efforts to reestablish or strengthen health systems.

The ICS provides guidance for how to organize assets to respond to an incident (system description) and processes to manage the response through its successive stages (concept of operations). All response assets are organized into five functional areas: Command, Operations, Planning, Logistics, and Administration/Finance.

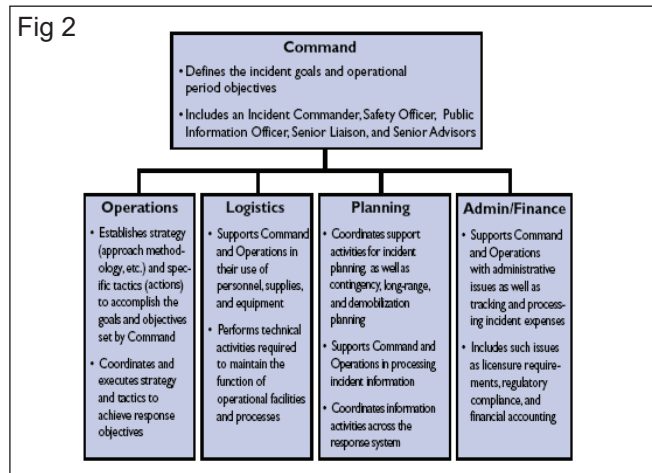
The ICS, as described in NIMS, refers to the combination of facilities, equipment, personnel, procedures, and communications operating within a common

organizational structure and designed to aid in the management of resources during incident response. The ICS is based on eight concepts that contribute to the successful application of this system.

**Fig: Incident Command System**

**Incident Command System Core Concepts**

- **Common terminology** - use of similar terms and definitions for resource descriptions, organizational



- **Manageable span of control**-response organization is structured so that each supervisory level oversees an appropriate number of assets (varies based on size and complexity of the event) so it can maintain effective supervision.
- **Consolidated action plans** - a single, formal documentation of incident goals, objectives, and strategies defined by unified incident command.
- **Comprehensive resource management** - systems in place to describe, maintain, identify, request, and track resources.
- **Pre-designated incident facilities** - assignment of locations where expected critical incident-related functions will occur.

For ICS to be effective, the incident must be formally defined so that there is clarity and consistency as to what is being managed. This may be best accomplished by defining the incident response through delineation of response goals and objectives, and by explaining response parameters through an Incident Action Plan (IAP)—the primary documentation that is produced by the incident action planning process.

functions, and incident facilities across disciplines.

- **Integrated communications** - ability to send and receive information within an organization, as well as externally to other disciplines.
- **Modular organization** - response resources are organized according to their responsibilities. Assets within each functional unit may be expanded or contracted based on the requirements of the event.
- **Unified command structure** - multiple disciplines work through their designated managers to establish common objectives and strategies to prevent conflict or duplication of effort.

## Study on Insecticides - Posticides - disinfection - Sterilization - Spraying equipment

**Objectives:** At the end of this lesson you shall be able to

- state insecticides and classification of insecticides
- state pesticide- types of pesticides-disinfection-types
- state different methods of sterilization
- identify various spraying equipment
- identify larvicidal and rodenticides
- state the principle of arthropod

### INTRODUCTION

Biological environment is the environment where life forms can exist. The sum of environments where life forms exist is called the biosphere, these includes a portion of land, water, and air.

### INSECTICIDES:

Substances which are used to kill insects are called insecticides. Insecticides have a wide application in the field of medicine, agriculture, and industry. They have the potential to alter ecosystem components majorly and are toxic to animals as well as humans. Some insecticides become concentrated as they spread in the food chain.

#### Classification of insecticide

- Based on chemical composition, it is classified as organic and inorganic.
- Based on the mode of entry in the insects, it is classified as contact poisons, fumigants poisons, stomach poisons, and systemic poisons.
- Based on the mode of action, it is classified as physical poisons, nerve poisons, respiratory poisons, protoplasmic poisons, general poisons, and chitin inhibitors.
- Based on toxicity, it is classified into four types:
  - Extremely toxic – Colour: red, symbol: skull and poison, oral LD50: 1-50
  - Moderately toxic – Colour: blue, symbol: danger, oral LD50: 501 – 5000
  - Highly toxic – Colour: yellow, symbol: poison, oral LD50: 51 – 500
  - Less toxic – Colour: green, symbol: caution, oral LD50: >5000
- Based on the stage of specificity, it is classified as ovicides, pupicides, larvicides, and adulticides.

#### Types of insecticides

There are three different types of insecticides. They are

- 1 Systemic – This type of insecticide is introduced into

the soil for it to get absorbed by the plant roots. Once the insecticide enters the roots, it moves to external areas such as leaves, fruits, twigs, and branches. It forms a layer on the plant surface area and acts as a poison to any insect that comes to chew the plant.

- 2 Ingested – Some examples of ingested pesticides are rat and roach.
- 3 Contact – These type of insecticides act like bullets that aim only at a particular target to kill insects by its application. Usually, household insect spray works like contact insecticides as it must directly hit the insect.

#### Disadvantages of insecticides

- 1 Non-target organisms – Insecticides can kill more than intended organisms and are risky to humans. Also, when insecticides mix with water sources through leaching, drift, or run off, they harm aquatic wildlife. When birds drink such contaminated water and eat affected insects, they die. Some examples of insecticides, like DDT, were banned in the US as it affects the reproductive abilities of predatory birds.
- 2 Resistance – Insects when repeatedly exposed to insecticides build up resistance until finally, they have little or no effect at all. The reproduction in insects is so quick that they produce a new generation every three to four weeks. Therefore, the resistance builds up rapidly.

### PESTICIDES:

Pesticides are chemical substances that are meant to kill pests. In general, a pesticide is a chemical or a biological agent such as a virus, bacterium, antimicrobial, or disinfectant that deters, incapacitates, kills, pests.

This use of pesticides is so common that the term pesticide is often treated as synonymous with plant protection product. It is commonly used to eliminate or control a variety of agricultural pests that can damage crops and livestock and reduce farm productivity. The most commonly applied pesticides are insecticides to kill insects, herbicides to kill weeds, rodenticides to kill **rodents**, and fungicides to control fungi, mould, and mildew.

## Types of Pesticides

These are grouped according to the types of pests which they kill:

Grouped by Types of Pests They Kill

- Insecticides – insects
- Herbicides – plants
- Rodenticides – rodents (rats & mice)
- Bactericides – bacteria
- Fungicides – fungi
- Larvicides – larvae

## Examples of pesticides

Examples of pesticides are fungicides, herbicides, and insecticides. Examples of specific synthetic chemical pesticides are glyphosate, Acephate, Deet, Propoxur, Metaldehyde, Boric Acid, Diazinon, Dursban, DDT, Malathion, etc.

## Benefits of Pesticides

The major advantage of pesticides is that they can save farmers. By protecting crops from insects and other pests. However, below are some other primary benefits of it.

- Controlling pests and plant disease vectors.
- Controlling human/livestock disease vectors and nuisance organisms.
- Controlling organisms that harm other human activities and structures.

## Effects of Pesticides

- The toxic chemicals in these are designed to deliberately released into the environment. Though each pesticide is meant to kill a certain pest, a very large percentage of pesticides reach a destination other than their **target**. **Instead**, they enter the air, water, sediments, and even end up in our food.
- Pesticides have been linked with human health hazards, from short-term impacts such as headaches and **nausea** to chronic **impacts** like cancer, reproductive **harm**.

- The use of these also decreases the general biodiversity in the soil. If there are no chemicals in the soil there is higher soil **quality**, and this allows for higher water retention, which is necessary for plants to grow

## Disinfections

A disinfectant can be defined as an antimicrobial agent that can be applied on the surface of some objects in order to destroy the microorganisms residing on it. A disinfectant is an antimicrobial agent. It is not necessary that a disinfectant will kill all the microorganisms. It is not as effective as sterilization. The process of sterilization kills all types of living forms but a disinfectant kills only certain types of microbes. It is generally applied to a floor or a drainage system. Most of the popularly used cleaning products used in homes and offices are nothing but disinfectants.

## Types of Disinfectants

Some common types of disinfectants include:

- **Air disinfectants:** It is defined as the chemical substances which are used to kill the microorganisms that are suspended in the air. It can also be called as a disinfectant spray.
- **Alcohol:** It is seen that alcohols are used as disinfectants. Ethanol is the most common example in this case. Some other examples of disinfectants are, chlorine when it is in the concentration of 0.2 to 0.4 in aqueous solution and sulphur dioxide, which acts as a disinfectant in small concentrations.

## Example of a disinfectant

Chlorine, calcium and sodium hypochlorite, iodophor, phenol, ethanol, and quaternary ammonium compounds are some of the most often used chemical disinfectants. Disinfectants differ from sterilants in that they have a lower efficacy against dormant bacterial endospores.

## Sterilisation and disinfection of different articles

### DIFFERENT METHODS OF STERILISATION WITH EXAMPLES

Methods of Sterilization	Example	Target	Application
High temperature	Steam, dry heat	All forms of microbes (vegetative and spore)	Heat-tolerant surgical instruments Semi critical patient care items
Low temperature	Ethylene oxide gas, hydrogen peroxide, ozone, gas plasma, gaseous chlorine dioxide, ionizing radiation, pulsed light	Gram-positive bacteria, gram-negative bacteria, mycobacteria, lipid-enveloped viruses, large no enveloped viruses, spores, cyst, trophozoite, coccidia	Heat-sensitive critical Semi critical patient care items
Liquid chemicals	Chemical sterilants	Prions (resistant to any form of sterilization)	Heat-sensitive critical items Semi critical patient care items (that can be immersed)
Others	Filtration		Serum Vaccines Antibiotics

### Different Methods of Disinfection with Examples

Methods of Sterilization	Example	Target	Application
HLD			
Heat	Pasteurization (~50 min)	All vegetative forms of microorganisms	Heat-tolerant semi critical patient care items (respiratory therapy equipment)
Chemicals	Chemical sterilants	Gram-positive bacteria, gram-negative bacteria, mycobacteria, lipid-enveloped viruses, large no enveloped viruses, spores, cyst, trophozoite, coccidian	Heat-sensitive semi critical patient care items (e.g., GI endoscopes, bronchoscopes)
Chemicals	EPA-registered with tuberculocidal activity (e.g., chlorine-based products, phenolic)	Gram-positive bacteria, gram-negative bacteria, enveloped and no enveloped viruses, mycobacteria	Soiled noncritical items Surfaces contaminated with blood Devices contaminated with body fluid/feces/sputum/ Mycobacterium
LLD			
Chemicals	EPA registered but without tuberculocidal activity (e.g., chlorine-based products, phenolic, quaternary ammonium compounds, 70–90% alcohol))	Vegetative forms of bacteria, lipophilic viruses and some fungi	Noncritical patient care items

The key difference between sterilization and disinfection is that sterilization is a process of killing all forms of microbial life including the spores present in an object while disinfection is a process of reducing or removing harmful microorganisms from the inanimate objects and surfaces.

### Various Spraying Equipment

Agricultural sprayers come in various design types, sizes, equipment and performance specifications. They range from small spot-spraying machines to very large sprayers with extensive land and plant coverage. Agricultural sprayers have been engineered to optimize their applicability and performance for the many purposes that the machines are put to, whether being used on crops, vegetation, or soil. Agriculture sprayers are often used for applying water and water/chemical solutions containing acids or caustic materials for crop-performance or pest-control; i.e. fertilizers and pesticides.

There are a number of agriculture sprayers designed for spraying applications and designed to be versatile and suitable for various uses from spot applications, gardens, crops, row crops, crop trees, fruit, groves, vineyards, perimeter maintenance, livestock needs, weed control, pastures and rangeland. Self-propelled sprayers help farmers improve spraying efficiency and productivity while taking full advantage of every minute they have in the field.

Examples of general sprayer types include:

- 1 Boom sprayer
- 2 Boomless sprayer nozzle
- 3 Mist sprayer
- 4 Three-point hitch sprayer
- 5 Truck-bed sprayer
- 6 Towing-hitch sprayer
- 7 UTV sprayer
- 8 ATV sprayer
- 9 Spot sprayer
- 10 Backpack sprayer

### Uses of larvicide

A larvicide is a type of insecticide used to control mosquitoes indoors and outdoors around your home. They work by killing mosquito larvae before they can grow into adults. Some formulations are activated when ingested by the mosquitoes, and some formulations work when they come into contact with the larvae.

### Forms of Larvicides

Larvicides come in many forms

Liquids – Liquid larvicide products are applied directly to water using backpack sprayers and truck- or aircraft-mounted sprayers. Dunks, tablets, bits, pellets, granules, briquettes – These forms of larvicide are also applied to areas where mosquitoes lay eggs.

### Rodenticides

Rodenticides are pesticides that kill rodents. Rodents include not only rats and mice, but also squirrels, woodchucks, chipmunks, porcupines, nutria, and beavers. Although rodents play important roles in nature, they may sometimes require control. They can damage crops, violate housing codes, transmit disease, and in some cases cause ecological damage.

### Principle of anthropod control

Environmental control

- 1 Elimination of breeding places
- 2 Filling and drainage operation
- 3 Carefully planned water management
- 4 Provision of piped water supply
- 5 Proper dispose of refuse and other wastes
- 6 Cleanliness in and around houses

### DEFINITION OF HEALTH:

“Health is a state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity.”

### Content of health education:

Today's state-of-the-art health education curricula reflect the growing body of research that emphasizes:

- Teaching functional health information (essential knowledge).
- Shaping personal values and beliefs that support healthy behaviours.
- Shaping group norms that value a healthy lifestyle.
- Developing the essential health skills necessary to adopt, practice, and maintain health-enhancing behaviours.

Less effective curricula often overemphasize teaching scientific facts and increasing student knowledge. An effective health education curriculum has the following characteristics:

- 1 An effective curriculum has clear health-related goals and behavioural outcomes that are directly related to these goals. Instructional strategies and learning experiences are directly related to the behavioural outcomes.
- 2 An effective curriculum fosters attitudes, values, and beliefs that support positive health behaviours. It provides instructional strategies and learning experiences that motivate students to critically examine personal perspectives, thoughtfully consider new arguments that support health-promoting attitudes and values, and generate positive perceptions about protective behaviours and negative perceptions about risk behaviours.

- 3 An effective curriculum builds on previously learned concepts and skills and provides opportunities to reinforce health-promoting skills across health topics and grade levels.
- 4 An effective curriculum is implemented by teachers who have a personal interest in promoting positive health behaviours, believe in what they are teaching, are knowledgeable about the curriculum content, and are comfortable and skilled in implementing expected instructional strategies.

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## Health Education

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**Objectives:** At the end of this lesson you shall be able to

- state the content of health education
  - state the principles of health education
  - state the types of audio- visual aids
  - identify methods of health education
  - state the education to environmental sanitation
  - state utilising community resources for health education
  - state the health education materials
- 

### Principles of health education

There are 12 known principles of health education which are listed below:

- Comprehension
- Credibility
- Feedback
- Good human relations
- Interest
- Known to unknown
- Leadership
- Learning by doing
- Motivation
- Participation
- Reinforcement
- Lead by example

A health inspector is a professional employed in various industries to oversee the standard health and sanitation conditions. Health inspector jobs are to visit various food facilities, public health nuisances to inspect that standard safety measures regularised by state government authority. Individuals pursuing career as health inspector works for both local as well as state government. His/her work involves inspecting restaurants, schools, public pools, nursing homes, and daycare centers. They ensure if the inspected public facilities require action to eliminate hazards. An individual who is pursuing career as health inspector also takes necessary actions on the complaints regarding health concerns such as sewage overflow, campground inspections, animal bites, increased flies, and parasite diseases in the area.

### Health Education Opportunities for Health Inspector in his workplace

An individual pursuing a career as health inspector is a professional healthcare officer who inspects public places and companies that are involved in manufacturing. Health inspector jobs are to spend most

of the time while traveling and inspecting public places. The inspector awards sanitation grades to businesses that determine the level of sanitation involved in the internal functioning of the places. He/She also imposes violations on the companies where their standard safety measures that impact the general people's health do not meet. A person who is pursuing a career as health inspector maintains the files and evaluate businesses to see improvement in sanitation. Health inspector jobs may also be required to present at court proceedings and present evidence of the establishment's violations of safety measures.

### Inspection

The primary responsibility of a health inspector is to ensure the standard sanitary conditions meet the level of the schools, restaurants, hotels, hospitals, and other public places. Duties of sanitary inspector in India, include ensuring the functioning of a public place in a hygienic environment. If he or she finds standard guidelines are not being followed, they are liable to terminate the working license of the organization.

### Ensuring safety

The duties of sanitary inspector includes ensuring that employees of an establishment work in a safe environment. He/she oversees the biological, physical, and chemical workplace hazards and reviews safety conditions. A sanitary inspector ensures that the health of workers or employees would not get affected by workplace routine or functioning.

### Resolve complaints

A career as health inspectors has to take necessary actions on received complaints regarding health and safety issues such as disease outbreaks, unhygienic conditions, exposure to harmful chemicals, and workplace accidents. A health inspector responds to the complaints and inspects the conditions of the workplace. He or she provides effective measures to the management of the organization of resolving the problems related to hygiene and workplace hazards.

## Shut down establishments

A career as health inspectors is responsible for canceling the license of the established company if found violating the standard measures of health and safety regularised by local or state government authority. A health inspector jobs are to provide the evidence on court proceedings describing the grounds for shutting down the establishment such as use of toxic substances in food products, or how the lives of employees were at risk while working with harmful chemicals. There could be several reasons for terminating the license.

## Training

A health inspector trains the employees and the general public about environmental protection, workplace safety, and public health. A health inspector ensures that the employees and the organizations follow the standard measures of safety and hygiene regulated by the state or local authorities. He or she instructs about the protocols of public health and ensures everyone within the organization follows it.

## Use of Audio-visual Aids and Media

Audio-visual aids play an important role in health education. They can be classified into three groups – purely auditory aids, purely visual and a combination of both auditory and visual aids

Media or materials in health education can be used for different purposes and for different groups of people. Learning and understanding seems to result when more senses, such as touch, sight and hearing are reached by the media. If used properly they create interest and motivate people to learn. Learning is made more permanent because these aids supply a concrete basis for learning rather than abstract thinking.

## Types of Audio – Visual Aids

No health education can be effective without audio – visual aids. Audio-visual aids can be classified into 3 groups – (1) purely auditory; (2) Purely visual; (3) combined audio-visual.



Fig 2



## Combined Audio-Visual Aids

- Sound films
- Slide tape combination
- Television
- Computer & Internet
- A Knowledge of the advantages, disadvantages and limitations of each audio-visual and is necessary in order to take proper use of them. Audio-visual aids are means to an end; not an end in themselves.

## Audio Visual Aids (Used in Mass Media

**1 Posters:** Posters are intended to attract public attention. Therefore, the material needs artistic preparation. The message on the poster should be short, simple, direct and one that can be taken at a glance and easy to understand. The life of a poster is usually short and needs frequent replacement. As a medium of health. Education, posters are not effective in changing human behavior.

**2 Health Magazines:** A good health magazine can be an important channel of communication. The material needs expert presentation.

The Swasth Hind from Delhi and World Health from WHO are important health magazines. The health magazines stimulate awareness among people.

**3 Press:** Newspapers are the most widely distributed of all forms of reading material. They are an important channel of communication to the people.

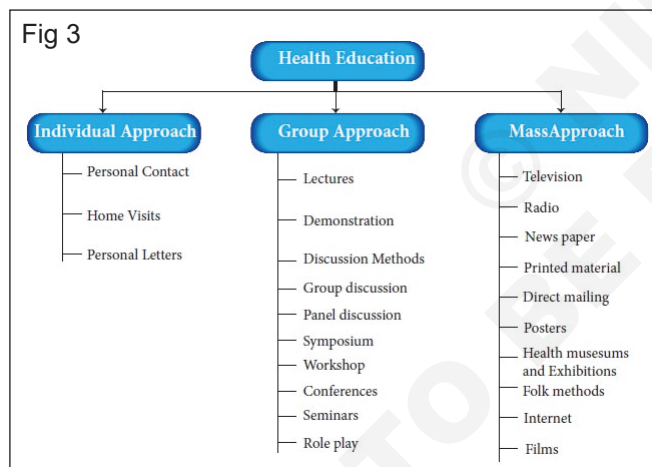
**4 Films:** Films are very expensive to produce, and they get out-of-date very quickly. But film-shows attract large gathering.

- 5 Radio and TV: These are found nearly in every home. They are potent instruments of education. Radio talks should not exceed 15 minutes.
- 6 Health Exhibitions: If properly organized, health exhibitions can attract large numbers of people. Health exhibitions are used in connection with key points of interest – e.g., fairs and festivals, mass campaigns, etc.
- 7 Health Museums: A good health museum can be a very effective mass media of education, such as the one at Hyderabad in Andhra Pradesh.
- 8 Indigenous Media: Indigenous Media like kathavartha, prabhat pheries, songs and dramas have roots in our culture. Health messages can be carried through these media.

### Criteria for selecting Audio-visual Aids

- 1 The facts should be scientifically accurate
- 2 Needed materials should be present
- 3 All the information should be pertinent
- 4 It should cover the entire requirements
- 5 All the ideas should be essential, significant and important to clear understanding

### Health Education Approach



### Methods of health education

Health education is carried out at 3 main levels;

- Individual Approach.
- Group Approach.
- General Approach/Mass.

### Individual Health Education:

Doctors and nurses, who are in direct contact with patients and their relatives, have opportunities for much individual health education.

### Group Health Education:

The groups are many – mothers, school children, patients, industrial workers – to whom we can direct health teaching.

### Methods of Group Teaching

These have been classified as below:

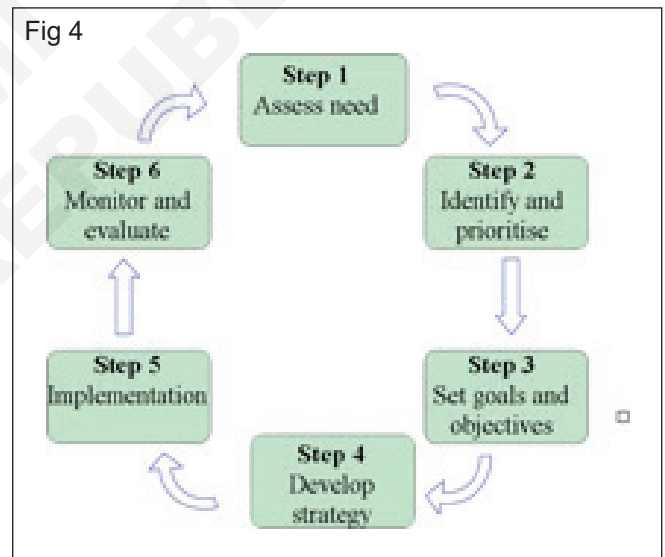
One – way or didactic methods:

- Lecture
- Films
- Charts
- Flannel graph
- Exhibits
- Flashcards

Two-way or Socratic Methods:

- Group discussion
- Panel Discussion
- Symposium
- Workshop
- Role playing
- Demonstration

### Planning health education activities



### EDUCATION IN RELATION TO ENVIRONMENTAL SANITATION

The key to a healthy and beautiful environment is based on preventive measures rather than curative services. Environmental sanitation, therefore, must go beyond spasmodic and sporadic clean-up exercise. There is no doubt that the clean-up campaigns and sanitation edicts have succeeded to some extent in instilling the required sense of cleanliness among Nigerians.

But Environmental Sanitation Education programme will serve to complement existing activities and strategies such as seminars, yearly world Environment Day Celebrations, Saturday Environmental Clean-up Exercises, environmental exhibitions, competitions, workshops and even award of cash prizes to the best and cleanest schools or communities.

These activities are necessary in order to effectively impart, sensitize and infuse in the citizens a sense of decency, discipline and responsibility towards the environment. Environmental Sanitation education as a progressive policy cannot be disputed, for it is only when the majority of the people are physically and philosophical involved that sustained environmental ethnics can be assured.

The importance of Environmental Sanitation and quality will be more fully appreciated when they form the foundation of a specific curriculum for Environmental Sanitation education. This curriculum will have a well-articulated set of objectives, content, implementation strategies and evaluation as suggested below:-

Objectives include:

- a Demonstration of good sanitary behaviour;
- b Description and operation of waste disposal systems;
- c Identification of the causes and consequences of air and water pollution
- d Justification of the need for timely collection and disposal of refuse or wastes;
- e Description of the mechanics associated with effective 230 Educ. Res. use of public lavatories and urinals;
- f Explanation of the relevance for a good and efficient system of drainage.

Since Environmental Education as an autonomous or distinct subject has not been fully developed at the primary and secondary school levels, the infusion or integrated approach is suggested. This means that Environmental Sanitation education will be integrated as part of Environmental education elements in the primary science core curriculum. This demands skills in the identification and integration of relevant aspects of Environmental Education concepts and calls for the retraining of existing personnel to meet the demands of the new programme.

#### **AWARNESS ON NEED OF SANITATION AMMENITIES:**

Hygiene: **Hygiene is a set of personal practices that contribute to good health. This includes washing hands, cutting hair/nails periodically, bathing, etc.**  
**SANITATION:**

Sanitation refers to public health conditions such as drinking clean water, sewage treatment, etc. All the effective tools and actions that help in keeping the environment clean come under sanitation.

#### **Importance of Hygiene and Sanitation**

Maintaining personal hygiene and sanitation is important for several reasons such as personal, social, psychological, health, etc. Proper hygiene and sanitation prevent the spread of diseases and infections. If every individual on the planet maintains good hygiene for himself and the things around him, diseases will eradicate to a great level.

#### **Importance of Hygiene**

Hygiene, as defined by the WHO refers to **“the conditions and practices that help maintain health and prevent the spread of diseases.”**

This means more than just keeping ourselves clean. This means shunning all practices that lead to bad health. Throwing garbage on the road, defecating in the open, and many more. By adopting such a practice, we not only make ourselves healthier but also improve the quality of our lives.

Personal hygiene means keeping the body clean, consumption of clean drinking water, washing fruits and vegetables before eating, washing one’s hand, etc. Public hygiene refers to discarding waste and excreta properly, that means, waste segregation and recycling, regular disinfection and maintenance of the city’s water reservoir. Quality of hygiene in the kitchens is extremely important to prevent diseases.

Diseases spread through vectors. Say the vector is contaminated water as in the case of typhoid, cholera, and amoebiasis (food poisoning). By drinking clean water, we can completely eliminate the chances of getting diseases.

Some diseases are caused by pathogens carried by insects and animals. For e.g., plague is carried by rats, malaria, filarial, roundworms by flies and mosquitoes, etc. Mosquitoes thrive in stagnant water and rats in garbage dumps and the food that is dumped out in the open. By spraying stagnant water bodies with kerosene or other chemicals, we can completely eliminate mosquitoes from our neighbourhood. If that is unfeasible, we can all use mosquito nets prevents us from mosquitoes while we’re asleep. This poses a physical barrier for the mosquito.

Rats thrive on unsystematic waste disposal. By segregating the waste we can ensure that we don’t leave food lying around for rats to eat. Close contact with sick people is also another way of contracting diseases.

A country has to strive to educate more doctors so that medical need of every citizen is taken care of. The importance of cleanliness should be inculcated in every citizen and this will in turn show in the cleanliness of the places we live in.

#### **Importance of Sanitation**

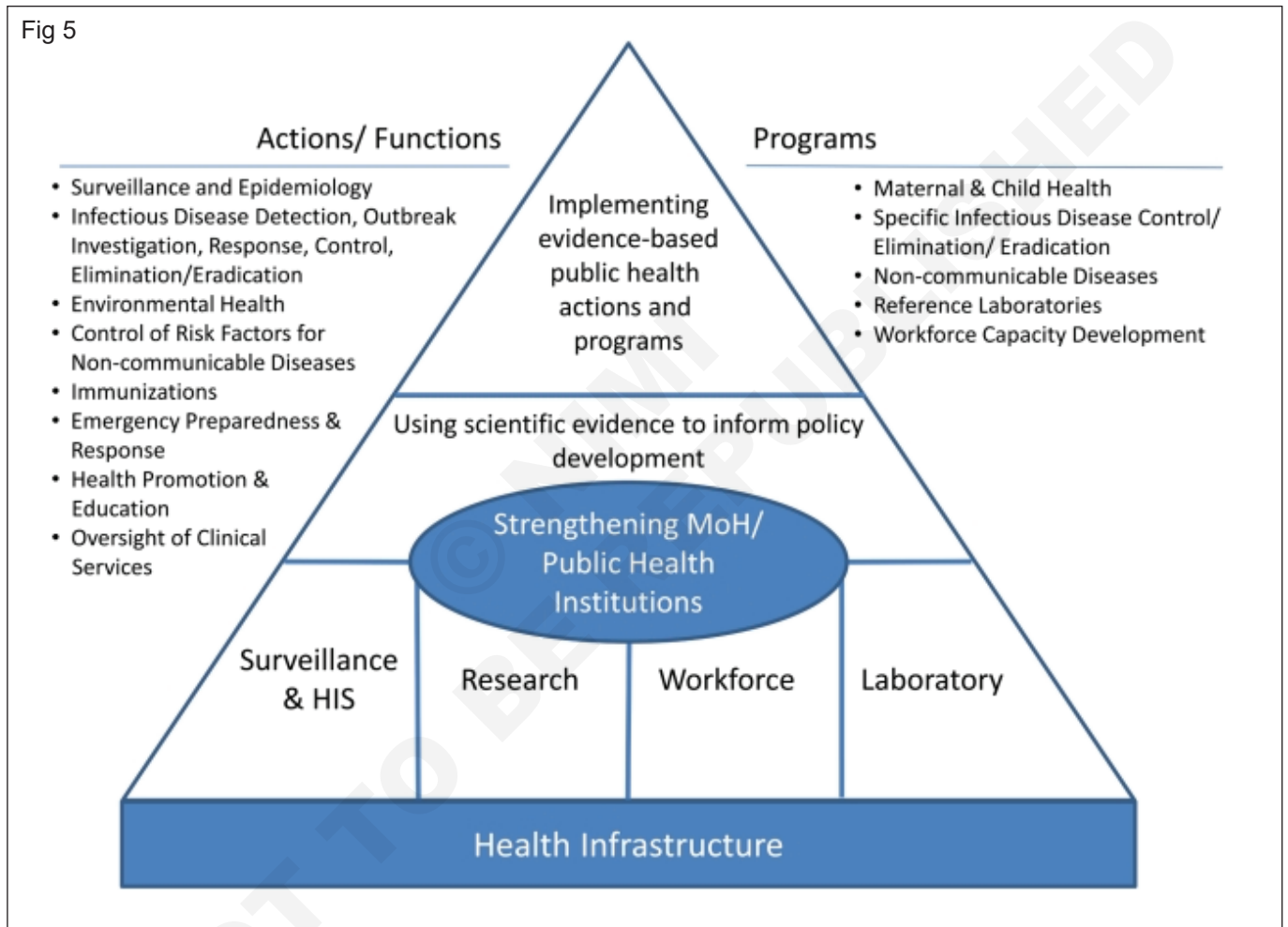
Sanitation is another very important aspect. Many of the common diseases mentioned earlier such as roundworms spread through the faeces of infected people. By ensuring that people do not defecate in the open, we can completely eliminate such diseases and even more severe ones such as the one caused by E. Coli. The advancement in biology has given us answers to many questions, we are now able to identify the pathogen and treat an ailment accordingly.

#### **HEALTH EDUCATION MATERIALS**

About the Materials

- **Comprehensive and evidence-based.** The materials are based on data from the NHLBI's decades of research on effective approaches to preventing and controlling heart disease risk factors and to promoting heart healthy behaviors.
  - **Great for adult education.** The format of these materials is based on research about how adults learn. The materials have activities that get people to work with and motivate each other. All the information and activities build on each person's life experiences, creating an open environment where everyone can teach, share, and learn.
  - **Culturally appropriate.** The materials showcase each ethnic community's ways of engaging in physical activity, heart healthy eating, food preparation, and overall wellness.
  - **Flexible.** CHWs may use one or more sets of the materials or may combine them in a way that best addresses their community's unique needs.
- The materials can be used by trained CHWs and other health professionals (such as dietitians, nurses, or health educators).

### Contribution of Public Health Centres in Health Education



#### Utilising community resources for health education:

Community participation is the active involvement of people from community's preparing for, or reacting to, disasters. True participation means the involvement of the people concerned in analysis, decision-making, planning, and programme implementation, as well as in all the activities, from search and rescue to reconstruction, that people affected by disasters undertake spontaneously without the involvement of external agencies

Health education: Health education is one important activity that is commonly undertaken to promote health. It is the communication of information that enables

people to make informed decisions about health-related activities at all stages of the disaster-management cycle. Health education might involve subjects such as the risk of flooding in areas where people are building houses, the location of earthquake shelters, or the areas where safe defecation is possible in a new emergency settlement.

#### Hygiene promotion and community participation in the disaster-management cycle:

Health promotion and community participation activities are important at all stages of the disaster-management cycle, before and after disaster events, as follows:  
Emergency prevention and preparedness: community

participation in assessing risks and vulnerability; promoting awareness of environmental hazards and safety consciousness; and strengthening community resilience and organization. Awareness raising and training are essential aspects of disaster mitigation and emergency preparedness. Emergency response and recovery: community participation in the response phase and in the communication of specific health messages in the immediate aftermath of a disaster; ensuring sustainable and incremental improvements in environmental health.

**Community participation:** The involvement of the community is essential for reducing vulnerability to disasters, for facilitating recovery after a disaster has struck, and for stimulating community organization that is the basis for sustainable development.

Communities should also be involved in planning environmental-management programmes that seek to reduce the risk of disasters. The best way for a community to increase its preparedness for, and recovery from, a disaster is to develop strong community organization and leadership with experience in mobilizing its members and coordinating programmes.

**Principles of community participation :**Community participation means the involvement of people from the earliest stages of the development process, as opposed to simply asking their opinion of project proposals that have already been developed, or for their contribution to the implementation of projects imposed from outside. The main principles are: Communities can and should determine their own priorities in dealing with the problems that they face. The enormous depth and

breadth of collective experience and knowledge in a community can be built on to bring about change and improvements. When people understand a problem, they will more readily act to solve it. People solve their own problems best in a participatory group process.

**Communication methods:** Communication of health information is most effective when a variety of methods, approaches and materials are used. Broadly speaking, there are three main approaches

- Person to person contact
- Teaching aids
- Using mass communication

#### **BENEFITS OF PERSONAL CONTRACT GROUP MEETINGS TO PROVIDE HEALTH EDUCATION**

- Help to identify expectations of one another, communicate those expectations, and practice articulating their expectations.
- Facilitate reflection on their past experiences and communications practices, important transferable skills for future work and personal relationships.
- Increase a sense of community and get to know and work with one another

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## **Distribution of Behavioral Science**

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**Objectives:** At the end of this lesson you shall be able to

- **state the importance of behaviour**
  - **state the impact of behaviour on personal hygiene**
  - **state the Acquire knowledge on the behavioural changes as per age groups**
  - **identity the concept of defence mechanism**
- 

### **Definition of behavioural science**

**Behavioural science**, any of various disciplines dealing with the subject of human actions, usually including the fields of sociology, social and cultural anthropology, psychology, and behavioural aspects of biology, economics, geography, law, psychiatry, and political science.

### **Importance of Behavioural Science**

Behavioural Science has also found a huge implication in the field of business management, where it takes into account the science studying behaviour and perception of the individuals to make proper decisions. It has become highly important in the field of anthropology as well. The domain is taken into consideration to study the behaviour of mankind, mainly the development of human beings and their culture based on all aspects. The concept of behavioural management theory helps to understand the various dimensions and relations of human beings to a huge extent. The few concepts, which are mainly taken into consideration as a key to understanding the behavioural concept of society, are motivation, attitude, and perception. Behavioural science also has a huge importance on health. The leading health concerns of the nation along with the causes, which include stroke, heart disease, pregnancy, drug abuse, depression, obesity, alcoholism, violence, neurological disorder, teen pregnancy, and accidents.

The study of behavioural science generally focuses on how the various concepts affect the social system and the human behaviour. It is a comprehensive study of the various mental states of the individuals during various periods of time and life cycle. It takes into consideration the underlying basics and theories of individuals, which can provide a framework to understand the processes of a social organization.

### **IMPACT OF BEHAVIOUR ON PERSONAL HYGIENE**

On a basic level, personal hygiene means cleaning and grooming your body, nails, hair, and teeth. It also

extends to your clothing and the tools that you use for cleaning and grooming. Keeping spaces like your bathroom clean is often an extension of good personal hygiene.

What many people don't often consider is how personal hygiene can affect numerous aspects of your life. It may improve health and limit the risk of illness or disease. It can also make you feel better about yourself, improve your work life, and make you more confident and approachable in social settings.

The effects go beyond physical health and socializing. Poor hygiene can cause or exacerbate depression or anxiety problems and make a person isolate themselves. Many people learn oral hygiene and bathing habits at a young age and shaving, laundry, and other practices when they get older. Because of this progression, poor personal hygiene is a sensitive topic. You may be reluctant to bring up issues because you do not want to offend the person or criticize them for not doing something they should have learned at a young age. However, this is an essential issue because hygiene choices have a profound impact on quality of life as well as mental and physical health.

### **Effects of Good Personal Hygiene**

Here are basic cleanliness practices necessary for general health, disease prevention, and confidence.

- **Bathing regularly:** A shower or bath is not only necessary to remove dirt, bacteria, and external substances. It also helps wash away natural oils and dead skin, which build up on the surface of your body.
- **Trimming your nails:** Keeping your fingernails and toenails trimmed and in good shape will prevent problems such as infected nails and digits. Also, bacteria can get stuck under nails, increasing the danger of illness or infection.
- **Brushing teeth:** Most dentists recommend brushing teeth two or three times per day. You should also floss to clean the area between teeth. Depending on your level of oral health, you may also need to use mouthwash daily. These practices help limit oral bacteria, prevent tooth decay, and fight low-grade infections in your gums.

- **Washing your hands:** Washing your hands keeps you from contaminating food or bringing unwanted bacteria or viruses to others. Hand washing is helpful before preparing or eating food, touching your face, or preparing your sleeping space.

These practices provide a solid base for a personal hygiene regimen. Here are some of the benefits of performing these tasks daily.

### Improves Overall Health and Wellness

Personal hygiene helps you protect against certain diseases. It also brings a higher level of overall health and wellness. Your immune system and other essential systems within your body can function better if they are not being bombarded by preventable infections caused by poor hygiene.

### Improves Personal and Professional Relationships

Poor hygiene may cause issues in social settings. Many people will find it unpleasant to be around someone with a bad body odour or breathe. Others may feel that being around someone with inadequate hygiene will reflect poorly on their image in a workplace or social group.

### Social and Professional Acceptance

Personal cleanliness alone will not get you more friends or make a job promotion more likely. However, you might consider it a prerequisite for social and professional acceptance. Whether it is fair or not, good hygiene will help create an acceptable image with friends, professional peers, and decision-makers at work.

Personal hygiene helps you protect against certain diseases. It also brings a higher level of overall health and wellness. Your immune system and other essential systems within your body can function better if they are not being bombarded by preventable infections caused by poor hygiene practices.

### Basic Hygiene Practices

One of the best ways to maintain good overall health and wellness is to maintain proper personal hygiene. Personal hygiene helps you to stay clean, giving you a boost in confidence and positively impacting personal relationships, as well as reduce the risk for disease and negative medical conditions that stem from bad hygiene

### Personal Hygiene Practices

- 1 **Wash Your Hands Frequently:** Washing your hands is one of the most effective ways to reduce the spread of disease. You should especially wash your hands before and after you eat, after going to the bathroom and when you come into contact with someone who is sick. In order to achieve effective results, make sure you wash your hands properly.
  - Wet your hands with clean water and apply soap.
  - Lather your hands by rubbing them thoroughly with soap.
  - Scrub your hands for at least 20 seconds.

- Rinse your hands well.

- Dry your hands with a towel or air dry.

- 2 **Bathe:** Cleaning your body washes away dead skin cells and dirt and helps fight the spread of disease. For older adults, it's recommended to shower or take a bath at least twice a week to achieve the positive effects.
- 3 **Brush Your Teeth Twice a Day:** Make sure you are brushing your teeth twice a day, once in the morning and once at night, to maintain good oral hygiene along with regular dental check-ups.
- 4 **Floss Your Teeth Daily:** In addition to brushing your teeth, floss your teeth once a day for optimal oral hygiene.
- 5 **Take Care of Your Nails:** Cleaning and trimming your nails reduces your risk of hangnails and infected nail beds.
- 6 **Wear Clean Clothes:** After you wear clothes, wash them with a detergent and dry them immediately upon rinsing. Dirty clothes can harbor bacteria that could lead to body odor or even skin irritations.
- 7 **Cover Your Mouth When Your Cough or Sneeze:** This is extremely important to avoid spreading germs to people around you.
- 8 **Get Restful Sleep:** Restful sleep is essential to wellbeing, no matter your age. It is recommended for all adults to sleep between seven to nine hours a night.
- 9 **Create a Routine:** Whatever your process may be to maintain good personal hygiene, make either a mental checklist or write it down. This way, you'll remember and keep up with the steps you need to take to stay clean and healthy.
- 10 **Visit the Doctor:** Maintaining regular healthcare appointments can help you catch infections and illnesses early, making it easier to treat them. Visit your healthcare provider when you have a concern and schedule routine check-ups.

### Habits and customs affecting personal hygiene

#### Physical Factors

In many cases, people understand the importance of good hygiene and wish to practice it, but are prevented from doing so by physical factors that make them unable to accomplish the mechanics of bathing. Hygiene Expert notes that temporary physical limitations on performing self-care -- such as post-operative incisions or plaster casts -- may follow an illness, injury or hospital stay; in these cases, family or friends can be of assistance.

#### Psychological Factors

**1 Mental and psychological issues can affect both a person's ability and motivation to perform basic hygiene. Social and Economic Factors**

Social and economic factors can have an impact on personal hygiene as well. Hygiene Expert says



some cases of poor hygiene can stem from lack of understanding or training in the fundamentals of hygiene. Financial hardships, such as the inability to pay a water bill or procure sufficient soap and towels, can also play a role.

## 2 Caring sense organs

**We should look after and take proper care of our sense organs. We must keep our sense organs clean and protect them from damage.**

### 2.1 The eyes:

- i Eyes are the most delicate organs. We should be careful to protect the eyes from injury.
- ii We should wash our eyes daily with fresh, clean water.
- iii We should not rub or touch the eyes with dirty fingers or a dirty handkerchief.
- iv Always study or read in proper light.

### 2.2 The ears:

- i We should not clean the ears with any sharp or pointed object. This could damage the eardrum.
- ii We should cover our ears if there is a very loud sound.

### 2.3 The nose:

- i When you wash your face every morning blow your nose to clean it.
- ii Always use a clean tissue paper or a handkerchief to clean your nose.

### 2.4 The tongue:

We should clean our tongue every morning when we brush our teeth.

### 2.5 The skin:

- i Clean every part of your body while taking a bath.
- ii Dry your body with a clean towel before you wear fresh clean clothes.
- iii Change undergarments daily.

### 2.6 Oral hygiene:

Good oral health helps you enjoy life. It lets you: speak clearly; taste, chew, and swallow delicious and nutritious foods; and show your feelings through facial expressions such as smiling.

If you protect your oral health with good oral hygiene practices (brushing and flossing), the odds are in your favor you can keep your teeth for a lifetime.

### 2.7 Brush Your Teeth

To keep your teeth healthy, it is important to remove dental plaque, a sticky, colorless film of bacteria. Plaque build-up can cause tooth decay and gum disease.

#### Brushing tips:

- Use fluoride toothpaste. **Fluoride** is what protects

teeth from tooth decay (cavities). It prevents decay by strengthening the tooth's hard outer surface, called enamel.

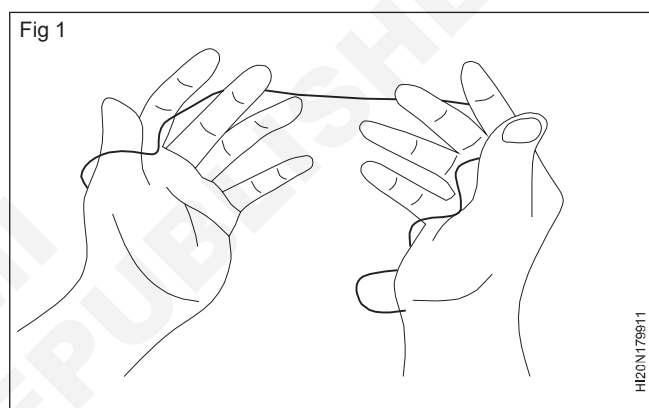
- Angle the bristles toward the gumline, so they clean between the gums and teeth.
- Brush gently using small, circular motions. Do not scrub hard back and forth.
- Brush all sides of each tooth.
- Brush your tongue.

#### Clean Between Your Teeth

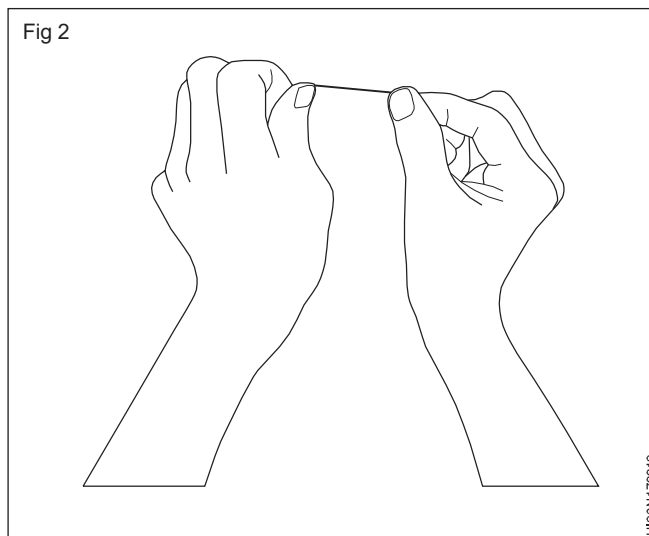
Cleaning between teeth to remove plaque is also part of a good oral hygiene routine.

Use a string of floss about two feet long. Wrap it around the middle finger of each hand.

Grip the floss between the thumb and index finger of



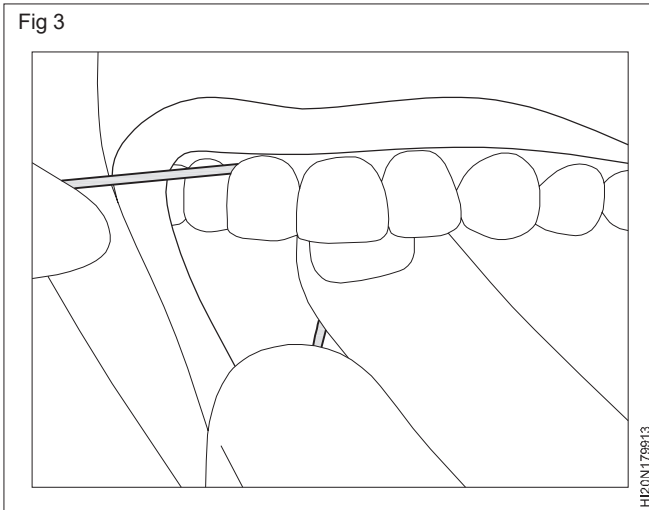
each hand.



Ease the floss gently between the teeth until it reaches the gum line (don't force the floss into place — this could harm the gums). Curve the floss like the letter "C" around the side of each tooth. Slide the floss up and down under the gum.

#### Factors that influence human behavior

Fig 3



### 1 Individual characteristics

Individual characteristics include things like knowledge, belief systems, personality characteristics, and general disposition. This also includes things like the person's learning history specifically as it relates to experiences with reinforcement and punishment.

### 2 Interpersonal factors

These are factors that relate to a person's social interactions. Examples of interpersonal factors include a person's social support network, relationships with other people, and a person's religious or spiritual relations. Rule-governed behavior may be influenced by social factors.

### 3 Institutional factors

These are factors that relate to the rules, regulations, and informal structures that exist within an organization or community that the client works or lives. Institutional factors can influence a person's behavior through the rules and expectations placed on them such as how to dress, how to interact with others, and expectations related to appropriate habits and behaviors.

### 4 Community factors

This relates to the environment where your client lives. People's behavior can directly or indirectly be influenced by the available resources in their community as well as by the norms placed upon them by society.

### 5 Public policy

This refers to factors that relate to the regulations and laws that influence a person's behaviors and lifestyle. This can influence behaviors in a variety of ways from parenting strategies used to views on disabilities and much more.

## BEHAVIOUR AT DIFFERENT AGES

### BEHAVIOUR OF A NEWBORN CHILD (BIRTH TO ONE MONTH)

Every new-born has a personality of her own. Hence, no two new-borns are the same, although all of them like to be cuddled and have their need to feel loved satisfied. They seek more attention, sleep less and cry more.

### BEHAVIOUR OF AN INFANT (FIRST YEAR)

At about 3 months, the child recognises her mother well. Between 3 and 6 months, she starts becoming aware of strangers. She may not respond to their overtures, or may even start crying as soon as she sees them. Consequently, she expects her parents, especially her mother, to be around.

She will start trusting people, will cherish your care and in turn, learn to care lovingly for others.

Your one-year-old infant may not understand the concept of this age, she may also throw things on the ground. This type of behaviour does not necessarily mean that she is being naughty or bad; she is learning the art of releasing objects and watching where they land.

### BEHAVIOUR OF A TODDLER (1 TO 3 YEARS)

First, the good news: At this age, your toddler wants to please you. She also wants to imitate you. The best approach is therefore to set a good example while she follows you and tries to win your approval. At times, she may be a bundle of joy who wants to help. For example, she may be very happy to bring the chapattis from the kitchen to the dining table or give a shopkeeper money on your behalf.

### BEHAVIOUR OF A PRESCHOOL CHILD (3 TO 6 YEARS)

Compared to a toddler, your preschool child is less self-centred, more helpful, more outgoing and friendly. She may even start seeing her mistakes. At 4 years, however, she may appear rude and may even swear, but she will be better behaved by about 5 years.

A preschool child also wants to please her parents and tries to imitate them. This puts an extra responsibility on parents to live right and provide role models of healthy and happy living.

### BEHAVIOUR OF A SCHOOL GOING CHILD (6 TO 12 YEARS)

On joining regular school, your child is likely to become closer to his peers. They will probably influence his behaviour more than you or your husband do. It is a normal phase of development.

When he joins a group of boys of his own age, he learns to lead and to be led. He shares responsibility and the group's workload. His group may be very creative, but there is always a possibility of getting into undesirable activities.

### BEHAVIOUR DURING ADOLESCENCE (12 TO 18 YEARS)

This is a tumultuous age, difficult both for your teenager as well as for those who have to interact with him. Rapid changes, both in physical and sexual growth, are taking place. By his behaviour, he is hinting to you that he is no longer a child and that he has become an adult. However, he often forgets that he is still passing through a phase of transition and that he has not yet become a

fully mature adult. You may hear him say, 'Leave me alone. I am no more a kid.' And yet, deep within, he may be expecting your continued guidance and support. His actions may declare, 'Get lost!', yet he often wants his parents to be around and to be available when he feels confused and is undecided about certain issues.

### **Interpersonal relations and defence mechanism**

Interpersonal relationships are the strong connections we feel with those closest to us. This could be:

- friends
- colleagues
- family members
- romantic partners

They're built on mutual respect, trust, and loyalty and they can provide us with support, care, and even love.

### **Defence Mechanisms in Interpersonal Relationships**

Defence mechanisms play an enormous role in determining the participants in and the nature of interpersonal relationships. To a great extent, they dictate both who we relate with and how we relate to them.

### **Avoidance**

When a perceived situation creates anxiety, one convenient option is sometimes to avoid it. Although avoidance can provide an escape from a particular event, it neglects to deal with the cause of the anxiety. The ego deals with the demands of reality, the id, and the superego as best as it can. But when the anxiety becomes overwhelming, the ego must defend itself. It does so by unconsciously blocking the impulses or distorting them into a more acceptable, less threatening form. The techniques are called the **ego defence mechanisms**.

According to Freud, defence triggered mechanisms help individuals to mediate their reactions to internal emotional conflicts by external stressors. Defence mechanisms are categorized into four levels: pathological, immature, neurotic, and mature defences.

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## **Principles and Practice of First Aid**

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**Objectives:** At the end of this lesson you shall be able to

- state the aim and practice of first aid
  - state the importance of CPR and performing the same
  - identify the significance of first aid box and types of bandages
  - Acquire knowledge on wound dressing and causalities
  - state the transportation and care of victims and first aid procedures in various conditions
- 

### **FIRST AID**

First aid is the first and immediate assistance given to any person suffering from either a minor or serious illness or injury, with care provided to preserve life, prevent the condition from worsening, or to promote recovery.

#### **The 5 main aims of first aid are:**

- Preserve life
- Prevent the escalation of the illness or injury
- Promote recovery
- Pain relief
- Protect the unconscious.

### **Principles of First Aid**

#### **Preserve Life**

The first aim of first aid is to **preserve life**, which involves the key emergency practices to ensure that the casualty isn't in any mortal danger. Remember though, this includes preserving your own life as you shouldn't put yourself in danger in order to apply first aid. It's at this stage where you should do a quick risk assessment to check for dangers to the injured person, yourself or bystanders which could cause the situation to escalate. If in doubt, do not attempt to apply first aid and immediately call for a medical professional.

#### **Prevent Deterioration**

Once you've followed all the steps associated with the first principle, your next priority is to prevent deterioration of the injured person's condition. Keeping a casualty still to avoid aggravating their injury, or from complicating any unseen issues, is crucial. This helps prevent further injuries, and clearing the area of any immediate dangers will help you to do so.

#### **Promote Recovery**

Finally, there are steps you should follow which will help

lessen the amount of time taken for a casualty to recover from an accident and aid in minimising lasting damage and scarring. The prime example of this is applying cold water to a burn as soon as possible to lower the chance of long-term scarring and helps speed up the healing process.

### **First Aid Practices**

#### **Taking immediate action**

This is the key to the 'Preserving Life' principle – a quick response to an accident can save lives and minimise the risk that things get worse. If someone needs help, either from an injury or sickness, you shouldn't hesitate to help if possible.

#### **Calming down the situation**

First aiders should be able to remain calm under pressure and help reduce the overall stress levels of the injured person as well as other people who may be concerned. Reassurance can provide more support that you might expect in an emergency situation and help people make the right decisions.

#### **Calling for medical assistance**

Make sure to get a hold of the emergency services by calling 999 as soon as possible, either by calling directly yourself or asking a bystander to do so if you're preoccupied handling the injury. This will ensure that a medical professional arrives quickly to handle the situation in a more comprehensive manner and provide more specialist treatment.

#### **Apply the relevant treatment**

Before a medical professional does arrive, you will need to apply first aid treatments in order to stabilise the condition of the injured person. This comes under the 'preserve life' banner, and follows this flow of procedures:

- Check for consciousness

- Open the airway
- Check for breathing Follow airway, breathing, of resuscitation, **administer CPR** if needed
- Check for circulation
- Check for bleeding, controlling any major bleeding

There are a number treatments which correspond to the different problems that might arise as you work through this list, e.g. CPR, applying a **tourniquet**, running a burn under cold water, etc.

## CONTENTS OF BASIC FIRST AID BOX

### First Aid Kit Content List:

- CPR Face Mask/Mouth barrier
- Thermal Blanket



- Burn Gel
- Cardboard Splint
- Cold Pack
- Trauma Dressings
- Triangular Bandages
- Sterile Water
- Gauze Rolls
- First Aid Tape
- Trauma Shears/Scissors
- Tweezer
- Antiseptic Wipes
- Vinyl Gloves

- Antimicrobial Wipes
- Band-Aids

## CPR

Cardiopulmonary resuscitation (CPR) is a lifesaving technique that's useful in many emergencies, such as a heart attack or near drowning, in which someone's breathing or heartbeat has stopped.

### Before you begin

Before starting CPR, check:

- Is the environment safe for the person?
- Is the person conscious or unconscious?
- If the person appears unconscious, tap or shake his or her shoulder and ask loudly, "Are you OK?"
- If the person doesn't respond and you're with another person who can help, have one person call the local emergency number and get the AED, if one is available. Have the other person begin CPR.

### Remember to spell C-A-B

Chest compressions

Open the airway

Rescue breathing

The American Heart Association uses the letters C-A-B to help people remember the order to perform the steps of CPR.

- 1 **C**: compressions
- 2 **A**: airway
- 3 **B**: breathing

### Compressions: Restore blood flow

Compressions means you'll use your hands to push down hard and fast in a specific way on the person's chest. Compressions are the most important step in CPR. Follow these steps for performing CPR compressions:

- 1 Put the person on his or her back on a firm surface.
- 2 Kneel next to the person's neck and shoulders.
- 3 Place the lower palm (heel) of your hand over the center of the person's chest, between the nipples.
- 4 Place your other hand on top of the first hand. Keep your elbows straight and position your shoulders directly above your hands.

- 5 Push straight down on (compress) the chest at least 2 inches (5 centimetres) but no more than 2.4 inches (6 centimetres). Use your entire body weight (not just your arms) when doing compressions.
- 6 Push hard at a rate of 100 to 120 compressions a minute. The American Heart Association suggests performing compressions to the beat of the song "Stay-in' Alive." Allow the chest to spring back (recoil) after each push.
- 7 If you haven't been trained in CPR, continue chest compressions until there are signs of movement or until emergency medical personnel take over. If you have been trained in CPR, go on to opening the airway and rescue breathing.

### Airway: Open the airway

If you're trained in CPR and you've performed 30 chest compressions, open the person's airway using the head-tilt, chin-lift maneuver. Put your palm on the person's forehead and gently tilt the head back. Then with the other hand, gently lift the chin forward to open the airway.

### Breathing: Breathe for the person

Rescue breathing can be mouth-to-mouth breathing or mouth-to-nose breathing if the mouth is seriously injured or can't be opened. Current recommendations suggest performing rescue breathing using a bag-mask device with a high-efficiency particulate air (HEPA) filter.

- 1 After opening the airway (using the head-tilt, chin-lift maneuver), pinch the nostrils shut for mouth-to-mouth breathing and cover the person's mouth with yours, making a seal.
- 2 Prepare to give two rescue breaths. Give the first rescue breath — lasting one second — and watch to see if the chest rises.
- 3 If the chest rises, give a second breath. If the chest doesn't rise, repeat the head-tilt, chin-lift maneuver and then give a second breath. Thirty chest compressions followed by two rescue breaths is considered one cycle. Be careful not to provide too many breaths or to breathe with too much force.
- 4 Resume chest compressions to restore blood flow.
- 5 As soon as an automated external defibrillator (AED) is available, apply it and follow the prompts. Give one shock, then resume chest compressions for two more minutes before giving a second shock.

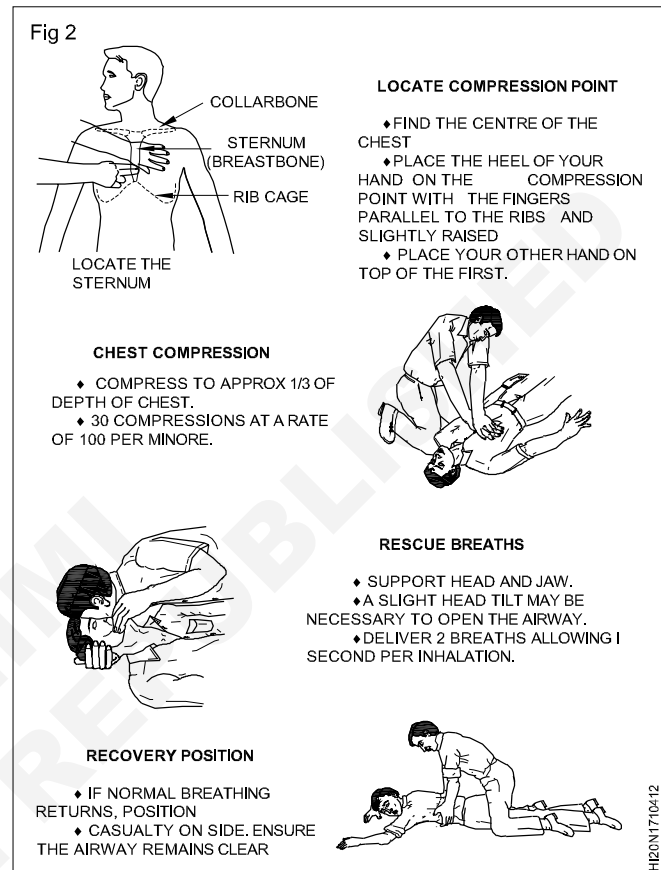
- 6 Continue CPR until there are signs of movement or emergency medical personnel take over.

## Types of Dressings & When to Use Them

### 1 Gauze Sponge

#### Type of wound used for: All wounds

Made from 100% cotton, gauze sponges absorb



drainage such as blood or other fluids making them a good, all-purpose wound dressing whether you need to clean, dress, pack, or prep a wound. This option is also economical.

### 2 Gauze Bandage Roll

#### Type of wound used for: All wounds

Gauze bandage rolls are made from 100% cotton and can be used as a first layer dressing or for an added layer of protection. This type of wound dressing is perfect for wounds on limbs or on the head, as well as wounds that are difficult to dress.

### 3 Non-Adherent Pads

#### Type of wound used for: Wounds with light to moderate drainage; works well for acute wounds and skin tears

This type of wound dressing protects wounds without sticking to the wound itself. It's an easy, all-in-one

dressing that can be placed over any minimally draining wound.

#### 4 Non-Adherent Wet Dressings

**Type of wound used for: Wounds with light to moderate drainage; works well with burns**

These dressings are ideal as a primary layer to keep the wound bed moist, which helps to promote cell migration. Non-adherent wet dressings conform to the wound without sticking to the surface.

#### 5 Foam Dressings

**Type of wound used for: Wounds with moderate to heavy discharge; works well with pressure injuries**

Foam dressings are ultra-soft and highly absorbent thanks to the foam material they are comprised of. This type of wound dressing helps to cushion and protect the wound while maintaining a healthy level of moisture.

#### 6 Calcium Alginates

**Type of wound used for: Wounds with moderate to heavy discharge; works well for arterial ulcers**

This type of wound dressing is highly absorbent and can hold as much as 20 times its weight in moisture. It is especially useful in wicking moisture out of deep tunnelling areas of a wound.

#### 7 Hydrogel Dressings

**Type of wound used for: Wounds that are dry or mostly dry; any wound with dead tissue**

Hydrogel dressings lend moisture to a wound which can help breakdown dry and dead tissue. By keeping the wound moisturized, it helps to promote cell growth.

#### 8 Transparent Dressings

**Type of wound used for: Securement layer**

Transparent dressings allow the transfer of moisture while offering a great securement layer as well as visualization of the wound. This is a great option for covering an IV.

#### 9 Alcohol Preps

**Type of wound used for: Use these for prepping, not for dressing the actual wound**

Alcohol preps aren't a type of wound dressing but are necessary when preparing to dress a wound. In a medical emergency, almost any clean linen can be used as a bandage because they are usually used as

the final wrap to keep other dressings or pads in place. The exception to this is the ambulance type bandages. They are sterile but unmediated bandage with a thicker pad for severe wounds where heavy blood loss occurs. These are WOUND DRESSINGS.

#### Types of Bandages

In terms of regular bandages, there are three types.

- 1 Roller bandages
- 2 Triangular bandages
- 3 Tubular bandages

**Roller bandages** have three main variations; crepe, cohesive and Conforming.

**Crepe** bandages are cotton, non-elastic but have elasticity to allow the bandage to be wrapped without difficulty over different body parts. They are washable and can be re-used many times. They often have metal clips to keep them in place but safety pins or tape works just as well.

**Cohesive**, also called the brand name 'Vetwrap' they provide compression and support without sticking to the skin. A rubber-like feel and grips to itself not to skin and hair. Hi-viz and bright coloured cohesive bandages are often seen on pets as well as race horses.

**Conforming** Bandages have high stretch properties and are mainly used for dressing retention and to support sprains and strains.

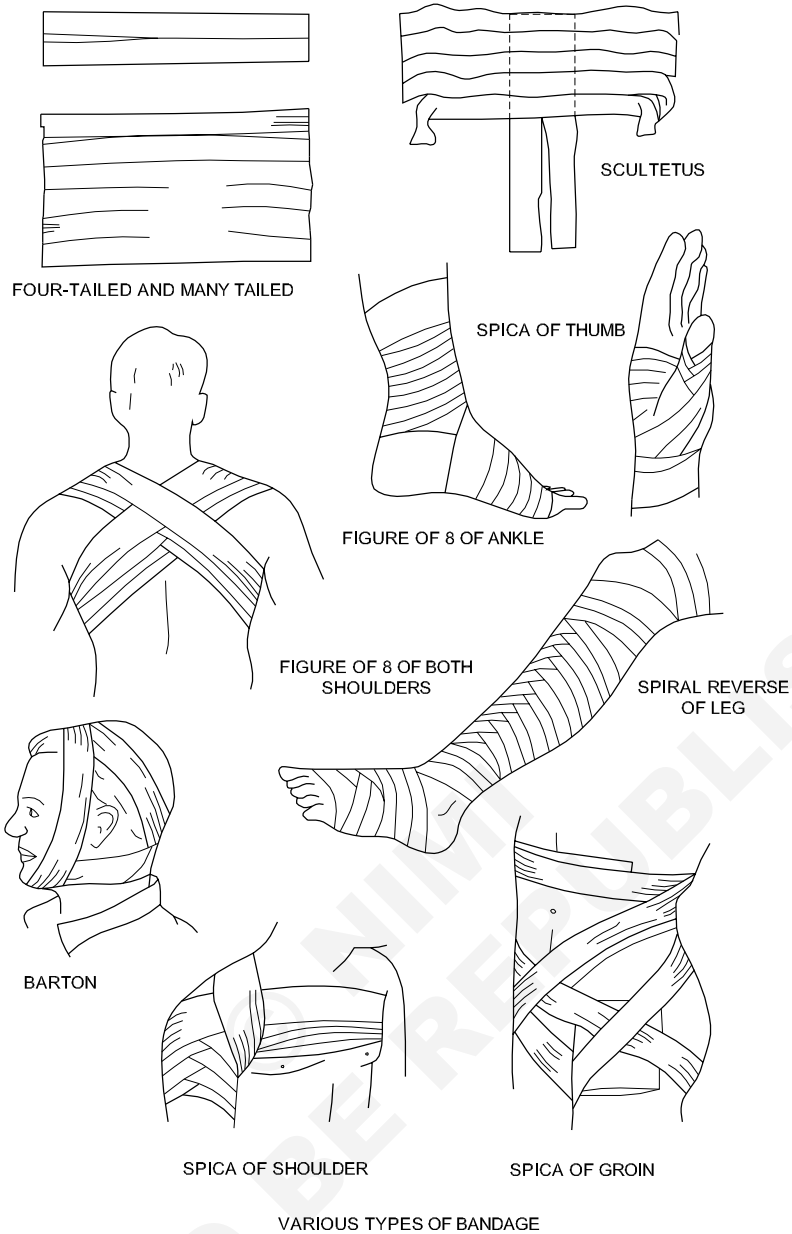
**Triangular bandages** are a multi-purpose dressing more often used as a sling but can be used to immobilise limbs, as a large dressing and head wounds.

Tubular bandages are used to provide support and secure dressings. These are applied using a hoop.

#### Types of Wounds (Classifications of Wounds based on nature of wound)

- 1 Open wounds
- 2 Closed wounds
- 3 Contusion (Bruise)
- 4 Laceration
- 5 Avulsions
- 6 Punctures
- 7 Perforating and penetrating wounds
- 8 Wounds however could be broadly classified as open or closed wounds

Fig 3



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## Open wounds

These are wounds in which there is loss of superficial surface covering the tissue such as loss of skin. Invasion by microorganisms is the main problem in open wounds.

### Sub classifications of Open wounds (Examples of open wounds)

- 1 Laceration
- 2 Abrasion
- 3 Avulsion
- 4 Perforations or Penetrating wounds
- 5 Punctured wound

## Contusion or Bruise

This type of wound results from injury to the

subcutaneous or sub mucous tissues and mostly results from direct blunt trauma.

## Abrasions

An abrasion occurs when there is mere loss of the superficial layers of the skin. Abrasion is the simplest form of open wound. This is called an Abrasion. Wound healing following an abrasion may occur rapidly as the underlying hair follicles and subcutaneous glands help to replace the thin epithelium that is lost.

## Puncture wounds

A puncture occurs when the point of entry of the mechanical agent causing the wound is small or pointed such as nail or narrow knife. In a puncture, the full thickness of the skin is penetrated and the wound is



deeper than an abrasion.

## Lacerations

This type of open wound occurs when the wound's point of entry is wider as compared to a puncture.

## Penetrating Wounds

A penetrating wound occurs when the wound passes through a body cavity such as the abdomen or chest or pelvis. When the wound passes through an organ instead of a body cavity, it is said to be a Perforation and occurs such as in wounds caused by missiles.

## Avulsion wounds

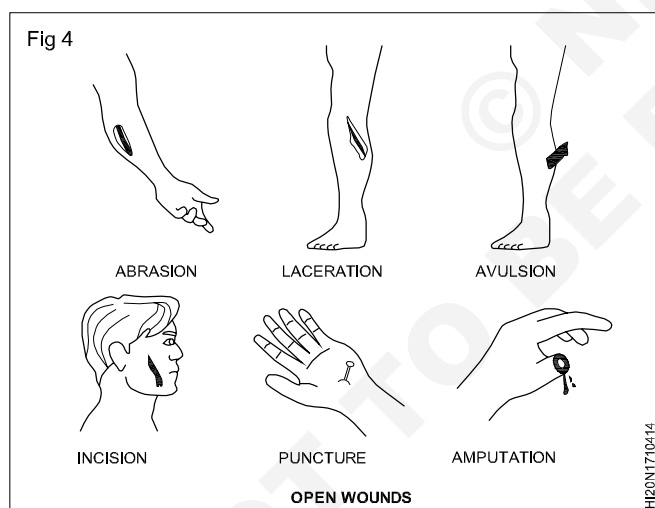
Avulsions are wounds in which there is tearing of some portions of the body. Avulsions have irregular edges and may occur in scalp injuries or the limbs.

## Miscellaneous Conditions

### 1 Treating Cuts and Scrapes

Blood is a vital component of our bodies. When someone is bleeding, you want to prevent as much blood from leaving their body as possible. Try and find a clean cloth or bandage. Then:

- 1 Apply gentle pressure for 20 to 30 minutes.



- 2 Clean the wound by gently running over it. Avoid using soap on an open wound.
- 3 Apply antibiotic to the wound, like Neosporin.
- 4 Cover the wound with a bandage.
- 5 If someone has a nosebleed, have the person lean forward. Press a cloth against the nostrils until the blood flow stops.
- 6 The body is usually very quick at patching up small cuts and scrapes. But deeper wounds may require medical attention. With deep wounds:
- 7 Apply pressure.

- 8 Don't apply ointments. Cover the area with loose cloth to prevent contaminants from infecting the wound.

- 9 Seek medical attention as soon as possible.

### 2 Treating Sprains

Sprains are usually an unalarming injury, and most of the time they'll heal on their own. But there are steps you can take to ease the swelling. Swelling is caused by blood flow to an injured area. You can reduce swelling by applying ice. Ice restricts the blood vessels, which reduces blood flow.

- 1 Keep the injured limb elevated.
- 2 Apply ice to the injured area. Don't apply ice directly to the skin. Wrap it in a cloth or put ice in a plastic bag.
- 3 Keep the injured area compressed. Put it in a brace or tightly wrap it. Don't wrap it so tight that it'll cut off circulation.
- 4 Ice for a while. Then compress. Repeat at intervals. Make sure the injured person avoids putting weight on the injured limb.

### 3 Treating Heat Exhaustion

Heat exhaustion occurs due to prolonged exposure to high temperatures, especially when the person is doing strenuous activities or hasn't had enough water. Symptoms of heat exhaustion include:

- 1 Cool, moist skin
- 2 Heavy sweating
- 3 Dizziness
- 4 Weak pulse
- 5 Muscle cramps
- 6 Nausea
- 7 Headaches

To treat someone with heat exhaustion:

- 1 Get the person to a shaded area that's out of the sun.
- 2 If there are no shaded areas available, keep the person covered by any available materials that can block sunlight.
- 3 Give the person water and keep them hydrated.
- 4 Place a cool cloth on their forehead to lower their body temperature.

### 4 Treating Hypothermia

Hypothermia is caused by prolonged exposure to cold temperatures. It begins to occur when your body temperature drops below 95 degrees Fahrenheit.

Symptoms of hypothermia include:

- Shivering
- Slurred speech or mumbling

- Weak pulse
- Weak coordination
- Confusion
- Red, cold skin
- Loss of consciousness

To treat hypothermia:

- Be gentle with the afflicted person. Don't rub their body and don't move their body in too jarring of a way; this could trigger cardiac arrest.
- Move the person out of the cold, and remove any wet clothing.
- Cover the person with blankets and use heat packs. Don't apply heat directly to the skin because this could cause major skin damage.
- Give the person warm fluids.

If you set the person on the ground, be aware that the ground may also be a cold source. Place warm materials on the ground that the person is going to lay on.

## 5 Treating Burns

Before you apply treatment to burns, you need to identify the burn type and the severity of the burn. There are four kinds of burns:

- First-degree burn: Only the outer layers of skin are burnt. The skin is red and swollen, and looks similar to a sunburn.
- Second-degree burn: Some of the inner layer of skin is burnt. Look for blistering skin and swelling. This is usually a very painful type of burn.
- Third-degree burn: All of the inner layer of skin is burnt. The wound has a whitish or blackened color. Some third-degree burns are so deep, there might not be any pain because the nerve endings are destroyed.
- Fourth-degree burn: A burn that has penetrated all tissues up to the tendons and bones.
- Additionally, there are two kinds of burn severities: a minor burn and a major burn.
- Minor burn: First-degree burns and mild second-degree burns.
- Major burn: Moderate second-degree burns to fourth-degree burns.

Minor burns don't usually need extensive treatment, but you could:

- Run cool water over the afflicted area (avoid icy or very cold water).
- Don't break any blisters.
- Apply moisturizer over the area, like aloe vera.
- Keep the burned person out of sunlight.
- Have the burned person take ibuprofen or acetaminophen for pain relief.

- Major burns are very serious injuries that require medical assistance. To help someone who has suffered from a major burn:
- Do not apply ointments.
- Cover wound with loose materials to prevent contaminants from infecting it.

## 6 Allergic Reactions

Allergic reactions occur when your body is hypersensitive to a foreign substance. Bee stings, certain foods, or drug ingredients can cause allergic reactions. Anaphylaxis is a life-threatening allergic reaction that can be caused by all of those mentioned allergens. The best way to treat an allergic reaction is to use an EpiPen. EpiPen, or "epinephrine autoinjector," is a small and ergonomic needle that's used to inject epinephrine (adrenaline) into someone suffering greatly from an allergic reaction. The epinephrine usually subdues the effects of the allergic reaction.

Fig 5



If someone is suffering from an allergic reaction:

- Keep the person calm. Ask if they use an EpiPen and have one with them.
- Have the person lie on their back. Keep their feet elevated 12 inches.
- Make sure the person's clothing is loose so they're able to breathe.
- Avoid giving them food, drink, or medicine.
- If appropriate, learn how to inject an EpiPen in someone having a reaction.
- Wait 5-15 minutes after using an EpiPen. If the allergic reaction isn't subdued, a second dose may be required.

## 7 Treating Fractures

Sometimes it's very easy to tell if someone has suffered a fractured bone. But sometimes it's not. If you suspect someone of having a fracture:

- Don't try to straighten a fractured limb.
- Use a splint or padding to stabilize the area and keep it from moving.
- Apply a cold pack to the area. Don't apply it directly to the skin. Wrap it in a cloth or put it in a plastic bag.
- Keep the area elevated, if possible.
- Give the person an anti-inflammatory drug, like

ibuprofen.

## 8 Heart Attack

If a person is having chest pain, even if there's a chance that he might not be suffering from a heart attack, he deserves the benefit of doubt. The first step is to help the patient relax. Loosen their clothes and open the windows. Next pop a tablet of aspirin into their mouth. Don't give it to them with water. Ask them to chew it instead. If that is not possible crush the tablet in a little water and give it to them. Another medicine you can use is sorbitrate. Place the tablet under the patient's tongue. You can give up to three sorbitrates in five minutes. Both aspirin and sorbitrate have anti-coagulant properties and help dissolve blood clots. However do not give sorbitrate to people who have low blood pressure or/and are sweating profusely.'

Apart from that, you shouldn't let them lie down flat. Ask them to either recline on a sofa or sit upright. Another thing you can do is ask them to cough out. This helps force air into their lungs.

Also, a heart attack victim should be taken to the hospital as soon as possible -- at least within one hour.

## 9 Stroke:

- If you're caring for someone else having a stroke, make sure they're in a safe, comfortable position. Preferably, this should be lying on one side with their head slightly raised and supported in case they vomit.
- Check to see if they're breathing. If they're not breathing, perform CPR. If they're having difficulty breathing, loosen any constrictive clothing, such as a tie or scarf.
- Talk in a calm, reassuring manner.
- Cover them with a blanket to keep them warm.
- Don't give them anything to eat or drink.
- If the person is showing any weakness in a limb, avoid moving them.
- Observe the person carefully for any change in condition. Be prepared to tell the emergency operator about their symptoms and when they started. Be sure to mention if the person fell or hit their head.

### Approach to a Casualty

Assessing the casualty is the primary step in performing first aid. Before you know what sort of care you need to provide, you must first decide exactly what is wrong with the casualty. Apply these steps to evaluate the casualty.

### Evaluating a conscious casualty:

- Approach casualty, and tell casualty not to move. Generally, introduce yourself, and inquire if you can be of assistance.
- If casualty says "yes," ask what occurred, if the casualty is having an issue with their breathing, and

if and where they are experiencing any pain.

- Examine victim's head, neck, legs, arms, stomach, and chest for injuries. Generally, look for blood loss, bruising, inflammation, or other noticeable injuries. Feel for any bumps or abnormalities on the legs or arms, but DO NOT move any part that is sore. Be certain to tell the casualty what you are going to do before you do it.
- If you think there is a back or neck injury, DO NOT shift the casualty or allow them to move. If no neck or back injury is present, have the casualty rest in a place that is comfy for them. In case the casualty is bleeding, place pressure to control the bleeding.

Fig 6



- Monitor the casualty's breathing

### Evaluating an unconscious casualty

- Approach the casualty, lightly tap the casualty's shoulder, and ask if they are fine. In case the casualty responds, apply the steps for a conscious casualty.
- Check airway, breathing, and circulation (ABC's).
- Look for any signs of bleeding.
- If no back or neck injury is assumed, place the casualty in the Recovery Position.

### Psychological First Aid (PFA)?

- PFA is an initial disaster response intervention with the goal to promote safety, stabilize survivors of disasters and connect individuals to help and resources. PFA is delivered to affected individuals by mental health professionals and other first responders. The purpose of PFA is to assess the immediate concerns and needs of an individual in the aftermath of a disaster, and not to provide on-site therapy.
- When you work with people during and after an emergency or disaster, you are working with people who may be having reactions of confusion, fear, hopelessness, sleeplessness, anxiety, grief, shock, guilt, shame, and loss of confidence in themselves and others. Your early contacts with them can help reassure them and alleviate their painful emotions

and promote hope and healing.

- Psychological First Aid is a humane, supportive and practical assistance to fellow human beings who recently suffered exposure to serious stressors, and involves;
- Non-intrusive, practical care and support,
- Assessing needs & concerns
- Helping people to address basic needs
- Listening but not pressuring people to talk.
- Comforting people and helping them to feel calm
- Helping people connect to information, services and social support
- Protecting people from further harm

### **Handling Multiple Casualties**

When you are dealing with a multiple casualty situation in a remote area, you may be required to make very difficult decisions about the treatment and evacuation of casualties. A multiple casualty situation where you need to deal with more than one person is also referred to as a major incident. How serious the situation is, will depend on many factors, including the number of people you are dealing with and the age of the people, the level of injuries, the number of rescuers, whether bystanders are available, the location, the environment and weather.

If you have to deal with multiple casualties it can be easy to be tempted to approach the first person making the most noise, delaying treating someone who needs your help more. What you need to do is to quickly assess everyone's injuries and put them into categories. This is also called triage.

There are 4 main categories, and the first is priority 1 or red group. These casualties need immediate treatment. These casualties have injuries that are life threatening or people with breathing, cardiac or circulation problems.

Priority 2 or yellow group are those who can be evacuated next. These people are those you think that you can manage until evacuation is possible. They could have serious injuries but they are stable and they are not immediately life threatening. Keep a watch over this group in-case they start getting worse, so reassess where possible.

Priority 3 or the green group are those who can be classified as walking wounded and these people may also be used to treat themselves or help treat others and they may be able to walk to safety. You would not want to waste your time with this group if there are more serious problems to deal with. They may be asking for help but you will need to be in control of the system to make sure you treat the people who need your help the most.

The final group is the dead group or white group. Unfortunately there may be someone who you cannot

help and they are not able to be resuscitated.

Giving first aid treatment immediately after an accident can help save lives and even prevent worse injuries or things like an amputation. One does not have to be a doctor or nurse or an emergency responder before they can give first aid. They just need to have the knowledge of what to do.

### **TYPES OF INJURIES LIKE ROAD ACCIDENTS**

Here, we would be looking at some first aid treatment you can give to victims of road accidents.

#### **1 Call a Hospital**

The first thing you should do before you even start attempting to help is to call the nearest hospital as soon as you spot a car crash. Understand that first aid is temporary treatment and that the victims would have to be rushed to the hospital after. So, between the times that the ambulance arrives, that is when you should perform the first aid.

#### **2 Check for Seriously Injured People**

Next, you should check for seriously injured people. Not every car crash results in serious injuries. Usually, seriously injured people are those who find it difficult to respond to calls. They may also be bleeding profusely and be groaning from immense pain. These are the people you give immediate attention to.

#### **3 Do Not Attempt To Move the Victims**

One thing you should avoid doing is trying to move the injured people. Moving or changing their positions would only cause more damage than you intended. Leave them in the exact position they are in. Instead, clear any obstruction or anything that could be causing discomfort to them. You can loosen their ties or open their shirts. But do not try to change the position of the people.

#### **4 First Aid Measures**

There are some first aid measures you can try to help keep the person alive. If the person has a problem with breathing you can try mouth-to-mouth or mouth-to-nose resuscitation (also known as CPR) to get the person's breathing under control. But you should only do this if you know how to.

#### **5 Stop the Bleeding**

One other thing you can do is to help stop the bleeding. You can tie a piece of cloth around the bleeding arm or leg with pressure. This would help get the bleeding under control. If you have a first aid box around you, you can attempt to sterilize the wounds with spirit, but only do this for minor bruises and cuts.

### **FIRST AID IN FACTORIES ACCIDENT:**

Despite our best attempts to prevent them, accidents happen in every factory. When they do, serious injuries may still be prevented if employers make sure workers receive regular trainings in first aid and have the

materials they need

### First aid when you breathe in a chemical

If a person has difficulty breathing, feels dizzy, confused, or nauseous, or if you see, smell, or feel a chemical release:

- 1 Remove the person from the work area or factory so they can get fresh air. Make sure your workplace has a plan about what to do if a worker cannot move or loses consciousness.
- 2 Help the person stay calm and comfortable.
- 3 Give oxygen from an oxygen tank if the person has inhaled chemicals that
- 4 Cause a severe asthma attack, such as iso-cyanates and some dyes.
- 5 Cause liquid to build up in the lungs (pulmonary edema), such as ammonia and chlorine.
- 6 Reduce oxygen in the air, such as methane and nitrogen.
- 7 Reduce oxygen in the blood, such as carbon monoxide and methylene chloride.

Fig 7



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- 8 Make it hard for the body to use oxygen, such as cyanide and hydrogen sulfide.
- 9 Take the person to a health worker, even if they feel better.
- 10 If the person has stopped breathing, begin rescue breathing (mouth-to-mouth breathing). Make sure your factory holds regular trainings on how to do rescue breathing.

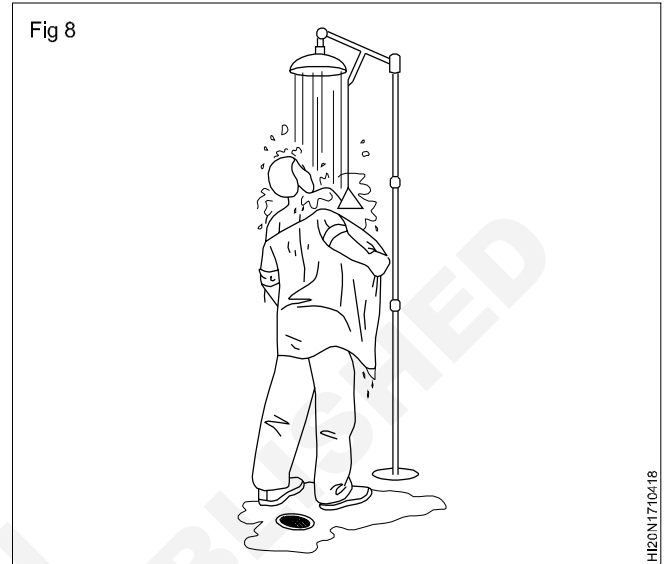
### First aid when a chemical touches your skin or eyes

Every work area where chemicals are used should have an emergency body shower and an emergency eye wash station with enough water to flow for at least 15 minutes. Most important, workers should be trained in first aid for the chemicals they work with.

### For chemicals on the skin:

- 1 Wash chemicals off immediately using lots of water for at least 15 minutes. The faster you begin pouring water over the area and the longer you do it, the more you will limit harm.
- 2 Chemicals that catch fire or absorb quickly through

Fig 8



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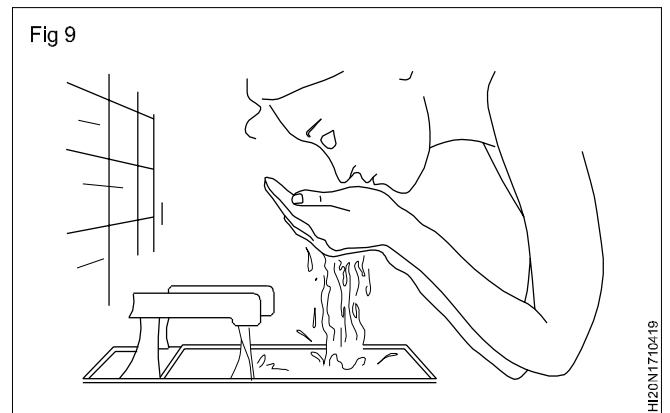
the skin must be washed for a longer time, 30 minutes to 1 hour.

- 3 After washing the chemicals off the skin, take the person to a hospital or clinic even if there are no signs of harm. Bring information about the chemical.
- 4 Burns from HF (hydrofluoric acid) must be treated with calcium gluconate.

### For chemicals in the eyes:

- 1 Stay calm.
- 2 Rinse the eye or both eyes immediately. Use lots of water and continue rinsing for at least 15 minutes.
- 1 If you have an emergency eye wash, turn it on and use your fingers to hold your lids open as you flush them.

Fig 9



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- 2 If you have to splash water on your eyes with your hands, hold your eyes open as you splash them. Ask for help keeping them open.
- 3 If you are unable to stand, a person can pour water on your eyes. If only one eye is affected, tilt your head so the water runs from the bridge of the nose, over the eye, and towards the ear. Don't let the water run from one eye to the other. If both eyes were splashed, lie down and tilt your head back, while the person pours water over the bridge of your nose so it runs down both eyes.
- 4 See a health worker as soon as you can.

### **First aid when chemicals get in the mouth**

- 1 Help the person stay calm.
- 2 Find the chemical label or any information about the chemical. Usually the label will include a first aid section, with instructions about "ingestion." There you will find whether the person should vomit up the chemical or not. It is very important to follow that advice.
- 3 The label may list an antidote if the chemical is ingested. If you have that antidote, give it.
- 4 Activated charcoal is a common and inexpensive treatment to help someone who has been poisoned. Unless the chemical label or SDS says not to, you can give the person activated charcoal.
- 5 Unless the label says not to, you can give a glass of water or milk. But do not give more.
- 6 After following the instructions on the label as best you can, quickly take the person to a clinic or hospital. Bring the name, the label, and any information about the chemical with you.
- 7 If the person is unconscious, lay her on her side so she does not choke on her vomit. Check her breathing. Quickly get help so she can be taken to a clinic.

### **What should be available in your factory**

- 1 A first aid committee and trainings so workers know how to respond to chemical emergencies, including how to give rescue breathing, how to operate emergency showers and eye washes, and how to get workers immediate medical attention.
- 2 First aid supplies for the chemicals used in your factory, such as oxygen tanks, activated charcoal, and calcium gluconate or other treatments needed for chemical burns.
- 3 Telephone numbers to quickly bring an ambulance and notify a clinic or hospital and the safety and health authorities in case of an accident.
- 4 Emergency showers and eye wash stations in all work areas where there are chemicals.
- 5 Air monitors with alarms to alert when chemical levels are high.

6 Clean water to drink.

7 Personal protective equipment for everyday use as well as in case of accident and for clean-up. There should also be extra clothing and shoes in a variety of sizes in case someone has to completely change their clothing.

## **First Aid and Disaster Management**

### **Wound Care**

When dealing with mild to moderate wounds, the first thing you're supposed to do is expose the injured area to examine how big the wound is and which type of wound you're dealing with. Thereafter, tell the patient to apply pressure onto the area to slow down bleeding and then apply a dressing to control the bleeding.

Every time you're dealing with such a situation, you need to maintain constant communication with the patient and find out how they're feeling.

After that, you need to cover the wound, but don't tie it too tight because it may impair the blood supply. Tie the knot directly on top of the wound to help apply pressure onto the area. Thereafter, the patient can safely travel to the hospital to further assess the wound and get a proper medical check-up.

### **Cardiopulmonary Resuscitation (CPR)**

If the person you're helping is already lying on the ground and you're not sure what is wrong, check for any danger, such as passing traffic, moving vehicles, or even unaware pedestrians. Once you're sure the coast is clear, check for a response by asking the patient a question or give them a command and then tap the shoulders gently.

If the patient doesn't respond, open the airways by placing their head in a tilted chin lift and check their breathing for 10 seconds. If you determine that breathing is present, check for a neck pulse. This should also take 10 seconds.

If the pulse is present, do a quick head-to-toe examination to try and determine what could have caused this person to be unresponsive or unconscious. Check the hands and shoulders one by one to determine if there are any broken bones.

Check the chest area and feel the spine gently. Keep checking your hands for any signs of bleeding. Check each leg by itself and loosen any tight shoelaces and belts. Don't forget to check the pockets as well.

If there are no visible injuries, start placing the patient in the recovery position. Take the closest hand to you and place it in a right angle, take the other hand and place it against the cheek. Thereafter, bend the knee furthest away from you and slowly turn the patient towards you, making sure that the head is tilted.

Check for breathing and circulation. Monitor vital signs at least every 10 minutes until help arrives.

### **Choking**

When you're dealing with a choking patient, the first thing you need to do is ask the person if they're choking and if they need your help. Thereafter, encourage the person to cough because choking can either be a partial or complete obstruction.

Ask them how they're feeling. If the obstruction is not yet out, give them up to 5 back blows. If the obstruction is still in place after the 5th back blow, administer up to 5 abdominal thrusts. The obstruction should come out after that. Seat the person down and give them water.

Keep in mind that abdominal thrusts should not be administered to infants, obese persons and expectant mothers.

### Disaster Readiness Medical Supplies

Some basic first aid medical supplies that you should have in your home in preparation for unexpected natural disasters include:

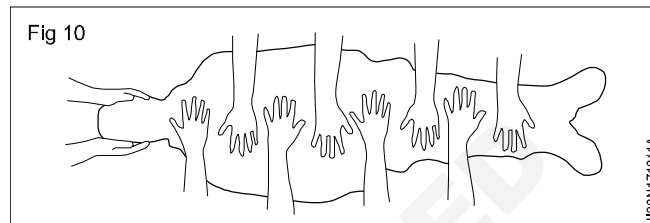
- 1 Rubbing alcohol
- 2 Hydrogen peroxide for cleaning out wounds
- 3 Iodine for wound cleaning
- 4 Triple antibiotic ointment for wound protection
- 5 Band-aids
- 6 Gauze
- 7 Bandages
- 8 Nasal decongestant
- 9 A good quality allergy medicine
- 10 Cough medicine
- 11 Ibuprofen always comes in handy

## Lifting and Moving Techniques

### Straight lift

If a person is seriously injured, profoundly weak, or unconscious, he should be lifted so that he remains motionless and with his spine in as straight an alignment as possible. This can be accomplished by five rescuers. The first kneels at the head, controls the victim's head and neck, and calls out commands. The other four rescuers kneel at the victim's sides, one at chest level and one at hip level on one side, and the

Fig 10

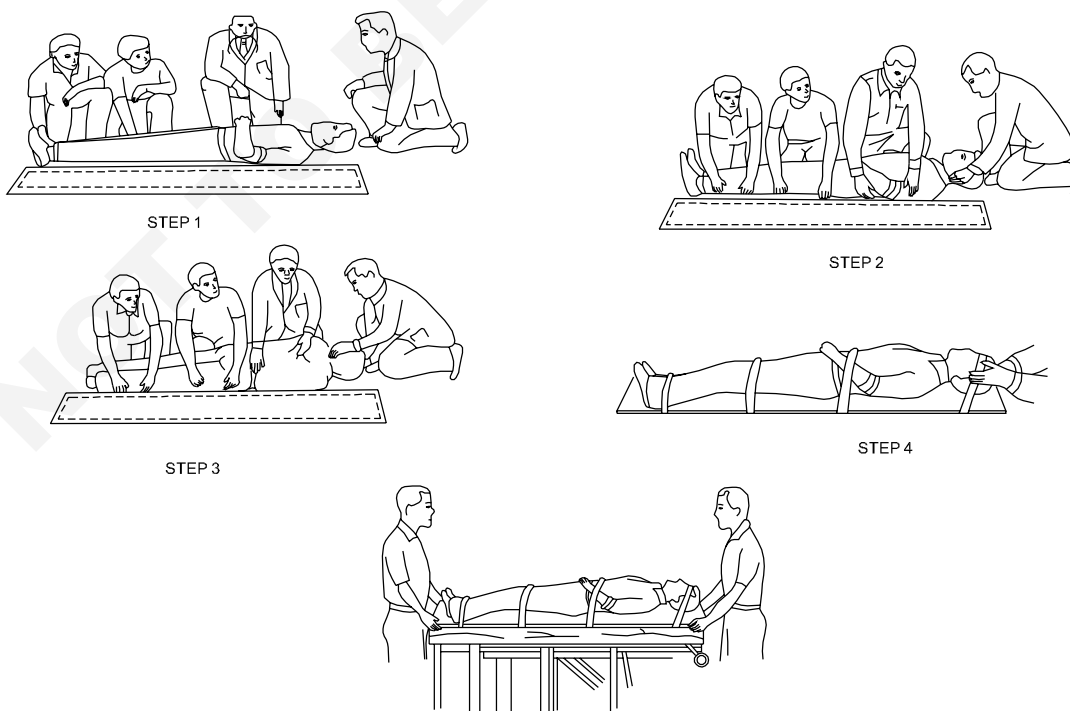


others at lower back level and leg level on the opposite side. In this way, they can slide their hands under the victim in a staggered fashion to provide a continuous chain of support. If necessary, the rescuer closest to the legs can free a hand to position a pad, backboard, or litter underneath the victim. The rescuers should lift the victim straight up into the air, taking care not to injure their backs.

### Logrolling the Victim

The best way to carry and immobilize a person who may have an injured spine is to use a scoop stretcher, or to slide a backboard underneath the victim. However, when these are not available and a spine-injured person must be turned, logrolling is the best alternative. It is also the preferred method to turn a victim on his side

Fig 11



STEP 5  
LOG ROLL IN SPINAL INJURY VICTIM

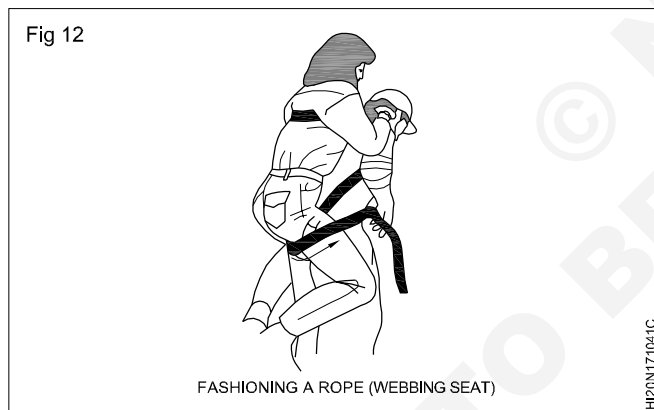
in order to slide a pad, board, or litter underneath him.

- 1 The first rescuer approaches the victim from the head, and keeps the head and shoulders in a fixed position (no neck movement).
- 2 The second rescuer extends the victim's arm (on the side over which the victim is to be rolled) above the victim's head. The first rescuer takes this arm and uses it to help support the head in proper position. If the arm is injured, it is maintained at the victim's side.
- 3 All rescuers work together to roll the victim, without moving his neck.

### Carries

If the victim has suffered an injury that does not allow him to walk out, mechanical transport must be improvised. A single person who cannot walk but who does not need to be on a litter (one with, for example, a broken ankle, mild exhaustion, or acute mountain sickness) may be carried on the back of a strong rescuer using a rope seat. This is fashioned by passing a long 1 in (2.5 cm) rope or strap across the victim's back and under his arms, then crossing the rope in front of his chest. The victim is loaded piggyback onto the rescuer's back, and the rope ends are passed forward over the shoulders of the rescuer, under his arms, and around to the rescuer's

**Fig: Fashioning a rope (webbing seat)**

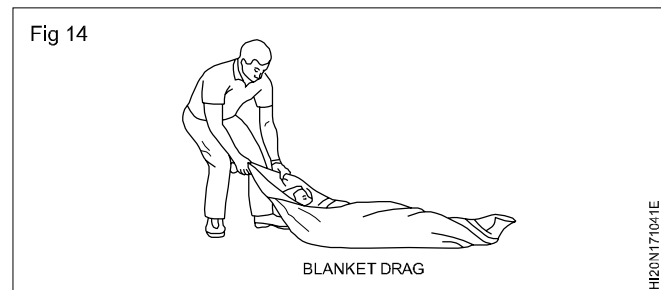


back, then between and through the victim's legs from



the front, and around the outside of the victim's legs just under the buttocks, to be tied snugly in front of the rescuer's waist. Such a rope seat is far preferable to a standard fireman's carry, which is very fatiguing. A blanket drag is only good for very short distances, such

as to pull a person quickly away from an immediate



hazard.

Other simple ways to carry a victim include the four-hand seat, backpack carry, ski pole or tree limb backpack carry, and coiled rope seat. In the first method, two rescuers interlock hands. Each rescuer first grasps his right wrist with his left hand. Holding the palms down, each rescuer then firmly grasps the left wrist or forearm of the other rescuer with his right hand, interlocking all four hands. The victim sits on the four-hand seat. In the second method, leg holes can be cut into a large backpack, so that a victim can sit in it like a small child would in a baby carrier. In the third method, two rescuers with sturdy backpacks stand side by side. Pack straps are looped down from each pack, and ski poles or tree limbs are slung across through the loops, or the poles are placed to rest on the padded hip belts. The poles should be padded so that the victim can sit on the rigid seat, steadying himself by draping his arms around the shoulders of his rescuers. The split-coil rope seat is created by coiling a rope, then fixing the coil at one segment. The coil's loops are split and used to position the victim on the rescuer's back.

### TRANSPORT OF THE INJURED VICTIM

- 1 Never move a victim unless you know where you are going. If you are lost and caring for an injured victim (or yourself), prepare a shelter. Try to position yourself so that visual distress signals can be fashioned in an open field, in the snow, or near a visible riverbank. Keep the victim covered and warm. Assume that the victim is frightened and needs frequent reassurance. If he cannot walk, you must attend to his bodily functions. A urinal can be constructed from a wide-mouthed water bottle. Defecation is more complicated, but may be assisted by cutting a hole in a blanket or sleeping pad placed over a small pit dug in the ground.
- 2 Unless you are in danger, never leave a victim who is unconscious or confused.
- 3 If possible, send someone for help and wait with the victim, rather than perform an exhausting and time-consuming solo or duo extrication. If someone is to be sent for help, choose a strong traveler and provide him with a written request that details your situation (number of victims, injuries, need for supplies, specific evacuation method required). While you certainly don't want to underestimate



the seriousness of the situation, don't request a helicopter evacuation for someone with a sprained ankle who can easily be carried out in a litter. Anyone sent to obtain assistance should contact the closest law enforcement agency, which will seek the appropriate rescue agency.

- 4 Conserve your strength. Don't create additional victims with heroic attempts at communication or feats of strength and exertion.
- 5 Attempt to transport a victim only if waiting for a rescue party will be of greater risk than immediate movement, if there are sufficient helpers to carry the victim (as a general rule, it takes six to eight adults to carry one injured victim), and if the distance is reasonable (under 5 miles, or 8 km). A victim who is carried on an improvised stretcher over difficult terrain usually gets a rough ride. Always test your carrying system on a non-injured person before you use it on the victim.

## **Disaster Management**

### **Earthquake**

#### **FIRST AID OF COMMON INJURIES AFTER AN EARTHQUAKE**

##### Open wounds

- 1 Disinfect your hands with alcohol or wash them.
- 2 Gently apply pressure with a bandage or clean cloth and elevate wound.

- 3 Wash the wound in clean water and apply a small amount of antibiotic cream.

- 4 Cover the wound with bandage or clean cloth.

##### Bruises

- 1 Elevate the bruised area.

- 2 Apply pressure with an ice pack in dampened cloth.

- 3 Rest the bruised area as much as possible.

##### Burns

- 1 Run the burn over cool water (not cold!) until the pain eases.

- 2 Apply moisturizer or gel to reduce pain and relieve the burned area.

- 3 Give necessary treatments.

## Communicable Diseases

**Objectives:** At the end of this lesson you shall be able to

- identify the symptoms of diseases and types of disease
- state the precautions and preventive measures for any disease
- state the age group for various immunisations
- state the importance of immunisation
- state the disinfection and sterilisation process in hospitals
- identify the various disinfection agents

### Definition and Introduction on communicable disease

A communicable disease is a disease that spreads from one person or animal to another. Pathogens such as viruses, bacteria, and fungi cause these diseases. Pathogens, including bacteria, viruses, fungi, and protozoa, cause communicable diseases.

A person may develop a communicable disease after becoming infected by the pathogen. This may happen through:

- direct contact with a person carrying the pathogen
- contact with contaminated fluids, such as blood, mucus, or saliva
- inhaling contaminated droplets from another person's cough or sneeze
- receiving a bite from an animal or insect carrying the pathogen
- consuming contaminated water or foods

### Airborne and transmission of diseases through contact:

Airborne disease can spread when people with certain infections cough, sneeze, or talk, spewing nasal and throat secretions into the air. Some viruses or bacteria take flight and hang in the air or land on other people or surfaces.

When you breathe in airborne pathogenic organisms, they take up residence inside you. You can also pick up germs when you touch a surface that harbour's them, and then touch your own eyes, nose, or mouth.

Because these diseases travel in the air, they're hard to control. Keep reading to learn more about the common types of airborne diseases and what you can do to protect yourself from catching them.

### Types of airborne diseases

Many diseases are spread through the air, including these:

The common cold

Coronavirus and COVID-19

Influenza

Chickenpox

Mumps

Measles

Whooping cough (pertussis)

Tuberculosis (TB)

Diphtheria

### Symptoms

Airborne diseases usually result in one or more of the following symptoms.

- inflammation of your nose, throat, sinuses, or lungs
- coughing
- sneezing
- congestion
- runny nose
- sore throat
- swollen glands
- headache
- body aches
- loss of appetite
- fever
- fatigue

### Various Communicable Diseases

#### SWINE FLU:

Swine flu, also known as the H1N1 virus, is a relatively new strain of an influenza virus that causes symptoms similar to the regular flu. Swine flu is very contagious. The disease is spread through saliva and mucus particles. People may spread it by:

- sneezing
- coughing
- touching a germ-covered surface and then touching their eyes or nose.

## Symptoms of swine flu

The symptoms of swine flu are very much like those of regular influenza. They include:

- chills
- fever
- coughing
- sore throat
- runny or stuffy nose
- body aches
- fatigue, diarrhea
- nausea and vomiting

## Treating swine flu

Most cases of swine flu don't require medication for treatment. You don't need to see a doctor unless you're at risk for developing medical complications from the flu. You should focus on relieving your symptoms and preventing the spread of the H1N1 to other people.

Two antiviral drugs are recommended for treating swine flu. People who are otherwise generally healthy and get swine flu will be able to fight the infection on their own.

## Preventing swine flu

The best way to prevent swine flu is to get a yearly flu vaccination. Other easy ways to prevent swine flu include:

- frequently washing hands with soap or hand sanitizer
- not touching your nose, mouth, or eyes (The virus can survive on surfaces like telephones and tabletops.)
- staying home from work or school if you're ill
- avoiding large gatherings when swine flu is in season

## TUBERCULOSIS:

Tuberculosis (TB) is generally defined as a dangerous bacterial infectious disease caused by Mycobacterium tuberculosis, which most often affects the lungs and later might spread to different parts of the body.

## Types of Tuberculosis (TB)

- Pulmonary Tuberculosis.
- Extrapulmonary Tuberculosis.

## Causes of Tuberculosis

- Tuberculosis is a contagious airborne disease, which can be acquired from close contact with an infected person.
- Mycobacterium Tuberculosis is one of the main causes of this dreadful infectious disease.
- Infants and aged people are at a greater risk of catching TB infections.
- Individuals with a weak immune system due to

HIV, diabetes are quickly exposed to this infectious disease.

- **Mycobacterium Tuberculosis** is a pathogenic bacterial species and mainly comprises of four other types of TB-causing bacteria namely.

Mycobacterium Bovis	Mycobacterium Canetti
Mycobacterium Microti	Mycobacterium Africanum

## Symptoms of Tuberculosis

TB bacteria or Mycobacterium tuberculosis most commonly grow in the lungs and can cause severe symptoms such as

Coughing with blood	Bad cough for more than 3 weeks	Fatigue & weakness
Night sweats	Chest pain	Weight loss
Loss of appetite	Sudden and random c hills	Fever

## Treatment for Tuberculosis

- Drug treatment is one of the most efficient ways to treat this infectious disease.
- For patients with Latent TB infections, doctors generally prescribe an antibiotic called isoniazid for preventing the latent infection from becoming active.
- Active TB Diseases will be deadly if it is left untreated.
- The procedure involves taking a combination of ethambutol, INH, prifin and pyrazinamide for a term of three months followed by a mix of INH and pyrazinamide for 12 months.

## AIDS

AIDS is a disease that can develop in people with HIV. It's the most advanced stage of HIV. HIV is a virus that damages the immune system. Untreated HIV affects and kills CD4 cells, which are a type of immune cell called T cell.

## HIV is transmitted through bodily fluids that include:

- blood
- semen
- vaginal and rectal fluids
- breast milk

The virus isn't transferred in air or water, or through casual contact.

If AIDS does develop, it means that the immune system is severely compromised, that is, weakened to the point where it can no longer successfully respond against most diseases and infections.

## That makes the person living with AIDS vulnerable to a wide range of illnesses, including:

- pneumonia
- tuberculosis

- oral thrush, a fungal condition in the mouth or throat
- cytomegalovirus (CMV), a type of herpes virus
- cryptococcal meningitis, a fungal condition in the brain
- toxoplasmosis, a brain condition caused by a parasite
- cryptosporidiosis, a condition caused by an intestinal parasite
- cancer, including Kaposi sarcoma (KS) and lymphoma

#### Early symptoms of HIV can include:

- fever
- chills
- swollen lymph nodes
- general aches and pains
- skin rash
- sore throat
- headache
- nausea
- upset stomach

#### Symptoms of AIDS can include:

- recurrent fever
- chronic swollen lymph glands, especially of the armpits, neck, and groin
- chronic fatigue
- night sweats
- dark splotches under the skin or inside the mouth, nose, or eyelids
- sores, spots, or lesions of the mouth and tongue, genitals, or anus
- bumps, lesions, or rashes of the skin
- recurrent or chronic diarrhea
- rapid weight loss
- neurologic problems such as trouble concentrating, memory loss, and confusion
- anxiety and depression

#### Treatment options for HIV

Treatment should begin as soon as possible after a diagnosis of HIV, regardless of viral load.

The main treatment for HIV is antiretroviral therapy, a combination of daily medications that stop the virus from reproducing. This helps protect CD4 cells, keeping the immune system strong enough to take measures against disease.

#### HIV prevention

Although many researchers are working to develop

one, there's currently no vaccine available to prevent the transmission of HIV. However, taking certain steps can help prevent the transmission of HIV.

#### Safer sex

The most common way for HIV to be transferred is through anal or vaginal sex without a condom or other barrier method

#### Other prevention methods

Other steps to help prevent the spread of HIV include

- Avoid sharing needles or other paraphernalia.
- HIV is transmitted through blood and can be contracted by using materials that have come in contact with the blood of someone who has HIV.
- **Consider PEP.** A person who has been exposed to HIV should contact their healthcare provider about obtaining post-exposure prophylaxis (PEP). PEP can reduce the risk of contracting HIV. It consists of three antiretroviral medications given for 28 days. PEP should be started as soon as possible after exposure but before 36 to 72 hours have passed.
- **Consider PrEP.** A person has a higher chance of contracting HIV should talk to their healthcare provider about pre-exposure prophylaxis (PrEP). If taken consistently, it can lower the risk of acquiring HIV. PrEP is a combination of two drugs available in pill form.

#### Diphtheria

Diphtheria is a severe communicable and bacterial infectious disease that causes inflammation of the mucous membranes by forming a false membrane in the throat which creates a problem while swallowing food and during breathing. It can also damage nerves by a bacterial toxin present in the blood

#### Symptoms of Diphtheria

The signs of diphtheria appear in a short period of time within three to five days after the infection has occurred. Some people do not feel any symptoms, while others do feel slight symptoms of a common cold. The most common and visible symptom of diphtheria is gray, thick covering on the tonsils and throat. Other usual symptoms include:

- Fever.
- A loud cough.
- Swollen neck.
- A sore throat.
- Feeling discomfort.

If the infection prolongs, further symptoms may develop.

- Difficulty in swallowing.
- Slurred speech.
- Sweating.
- Rapid heartbeat.
- Redness and ulcers in the affected region.

## Treatment of Diphtheria

The first step in treating diphtheria is an antitoxin injection. This is used to minimize the effect of toxin produced by the bacteria. The doctors also prescribe antibiotics, such as erythromycin and penicillin to clear the infection. During the treatment, patients are instructed to stay in the hospital in order to avoid the spread of infection to others.

## Preventions of Diphtheria

Diphtheria can be prevented to an extent by the use of vaccines and antibiotics. The vaccines for diphtheria is called DTaP. It's normally given in a single shot with vaccines for diphtheria, tetanus, and pertussis. The DTaP is given in five shots to the children of ages mentioned below:

- 6 months
- 12 to 18 months
- 4 to 6 years

## POLIO:

Poliomyelitis is nothing but the scientific term or synonym of the disease Polio. In very rare cases it causes muscle weakness resulting in an inability to move or paralysis. Poliovirus can spread from person to person or by food or water containing human faeces and less commonly from infected saliva.

## Signs and Symptoms of Poliomyelitis

As we discussed, there are three different types of polio, so the symptoms also vary. If a person is infected with Sub-clinical Polio then he can face the following symptoms

- Headache.
- Slight fever.
- Sore and red throat.
- General discomfort.
- Vomiting.

## The following are the symptoms of Non-paralytic Polio –

- Fever.
- A sore throat.
- Vomiting.
- Headache.
- Fatigue.
- Abnormal reflexes.
- Stiffness and pain in arm and leg pain.
- Problems with swallowing and breathing.
- Back pain, particularly neck stiffness.
- Muscle tenderness and spasms.

## Prevention & Treatment

There are two types of vaccine that can prevent polio:

- Inactivated poliovirus vaccine (IPV) given as an injection in the leg or arm, depending on the patient's age. Only IPV has been used in the United States since 2000.
- Oral poliovirus vaccine (OPV) is still used throughout much of the world.
- Polio vaccine protects children by preparing their bodies to fight the poliovirus. Almost all children (99 children to 100 out of 100) who get all the recommended doses of the inactivated polio vaccine will be protected from polio.

## MEASELS

Measles is also known as rubeola or red measles. It is a highly contagious respiratory infection caused by a virus which causes rashes all over the body.

## Causes of Measles

Measles is caused by a virus. It is a contagious disease that spreads through mucus and saliva. When the measles infected person sneezes or coughs, the virus is released into the air. Measles virus could travel through the air. So anyone in that proximity might be infected by that virus.

The symptoms of measles include:

- Fever
- Hacking cough
- Red eyes
- Muscle pains
- Running nose
- Sore throat
- Sores inside the mouth

Body rash appears within 4 – 5 days after the symptoms start. It might be accompanied by a high fever. These are the symptoms of measles.

## Treatment of Measles

There is no specific treatment for measles. The virus and symptoms generally disappear within two to three weeks but the doctor might recommend the following treatments:

- Medications that help to improve the immune system
- Medications to reduce a cough and sore throat
- Acetaminophen to reduce muscle pains and fever
- Foods that are rich in vitamin A

In the case of children, it is advised that they should be closely monitored by a doctor. Children should be placed in isolation until they are fully recovered.

## Prevention of Measles

As there is no specific treatment, it is advised to follow all necessary precautions which help to prevent measles.

Children should be vaccinated within 12 months of their birth and the second dose should be between the ages of 4 and 6. MMR is a vaccine that prevents three diseases like mumps, measles, and rubella. Treating the disease in early stages is also very important, especially for children.

Diarrhoea is a condition where an individual experiences a high frequency of loose and watery stools. Usually, it is not a life-threatening disease and the duration of its symptoms usually vary as there are many causal factors.

### Causes of Diarrhoea

Diarrhoea has many pathological factors and other factors such as:

- Intestinal disease.
- Diabetes.
- Alcohol consumption.
- Consuming food that affects the digestive system.
- Surgery to the digestive system
- Radiation therapy.
- Food poisoning.
- Skin cancers.

### Symptoms Of Diarrhoea

Symptoms of this disease include-

- Loose stools
- Vomiting
- Nausea
- Cramps
- The feeling of a bowel movement
- Abdominal pain
- Fever
- Bloody stools (rare cases)

### Treatment of Diarrhoea

Generally, acute diarrhoea will recede on its own, within 2 to 3 days without any treatment. But it is advised to consult the physician regardless.

Following are a few treatments that a doctor may suggest:

- Antibiotics may be helpful if the symptoms are caused by bacterial or parasitic infections
- Water that contains salt and electrolytes help in replacing the lost fluids
- Medications that treat symptomatically

### Prevention and Control of Communicable Diseases

In communicable disease prevention, the aim of controlling communicable diseases is to tip the balance against the agent. This can be done by:

1. Attacking the source

2. Treatment:- use of drugs to destroy the organism.
3. Isolation:- preventing infected person from getting close contact with other people except those who are providing care.
4. Reservoir control:- used in those diseases that have their main reservoir in animals

### 2. Interrupting transmission

- (a) Environmental sanitation:- faeco-oral route, refuse and dirty living conditions and people living in crowded rooms
- (b) Personal hygiene & behaviour change:-Improve personal hygiene and Changes in personal behaviour
- (c) Vector control:-transmission cycle may be affected if vectors are killed off or reduced. (Alter the environment, using toxic substances and using other living organisms that attack the vector).
- (d) Disinfection and sterilisation:- aimed at destroying the organism when it is in the environment. (Use of chlorine in wells, Boiling potentially contaminated water/food and Sterilising surgical instruments)

### 3. Protecting the host

- Immunisation:- increases host resistance by strengthening the internal defence system.
- Chemoprophylaxis:- use of drugs that protect the host by Suppressing the disease (use of SP in malaria) and preventing infection (meningitis, TB).
- Personal protection:- the spread of some disease can be limited by the use of barriers against infection. Eg shoes, bednets, insect repellents.
- Better nutrition

### Levels of Prevention

The levels of prevention are:

**Primordial prevention:-** Primordial prevention seeks to prevent, at the earliest possible stage, the

activities, which encourage the emergence of lifestyles, behaviours and exposure patterns that contribute to increased risk of disease. eg: heavily regulating and controlling the tobacco industry before it was established.

**Primary prevention:-** Primary prevention may be defined as the prevention of disease through the control of exposure to risk factors. Primary prevention of disease is preventing healthy people from becoming sick. Example: Use of condoms in the prevention of HIV infection.

**Methods of primary prevention are;**

- Immunisation.
- Provision of safe water supply.

- Health education
- Provision of adequate housing.
- Safe disposal of human excreta.
- Control of vectors of disease.
- Preventing exposure to lead in the environment.
- promoting non-smoking.

**Secondary prevention:-** Secondary prevention is the application of available measures to detect early departures from health and to introduce appropriate treatment to cure the patients and prevent chronic disease or disability.

Eg; malnutrition in children, anaemia.

**Tertiary prevention:-** Tertiary prevention is the prevention of more disability and death in a patient who cannot be cured

Tertiary prevention has two aims:

1. Treatment to prevent more disability and death.
2. New training and special education to help the patient to return to some useful work and life in the community.

Eg: blindness due to vitamin A deficiency, Diabetes and Stroke.

## HAND HYGIENE

Frequent hand-washing is one of the best ways to avoid getting sick and spreading illness. Find out when and how to wash your hands properly.

### When to wash your hands

As you touch people, surfaces and objects throughout the day, you accumulate germs on your hands. You can infect yourself with these germs by touching your eyes, nose or mouth, or spread them to others. Although it's impossible to keep your hands germ-free, washing your hands frequently can help limit the transfer of bacteria, viruses and other microbes.

### Always wash your hands before:

- Preparing food or eating
- Treating wounds or caring for a sick person
- Inserting or removing contact lenses

### Always wash your hands after:

- Preparing food
- Using the toilet, changing a diaper or cleaning up a child who has used the toilet
- Touching an animal, animal feed or animal waste
- Blowing your nose, coughing or sneezing
- Treating wounds or caring for a sick person
- Handling garbage
- Handling pet food or pet treats

Also, wash your hands when they are visibly dirty.

## How to wash your hands

It's generally best to wash your hands with soap and water. Over-the-counter antibacterial soaps are no more effective at killing germs than is regular soap.

### Follow these steps:

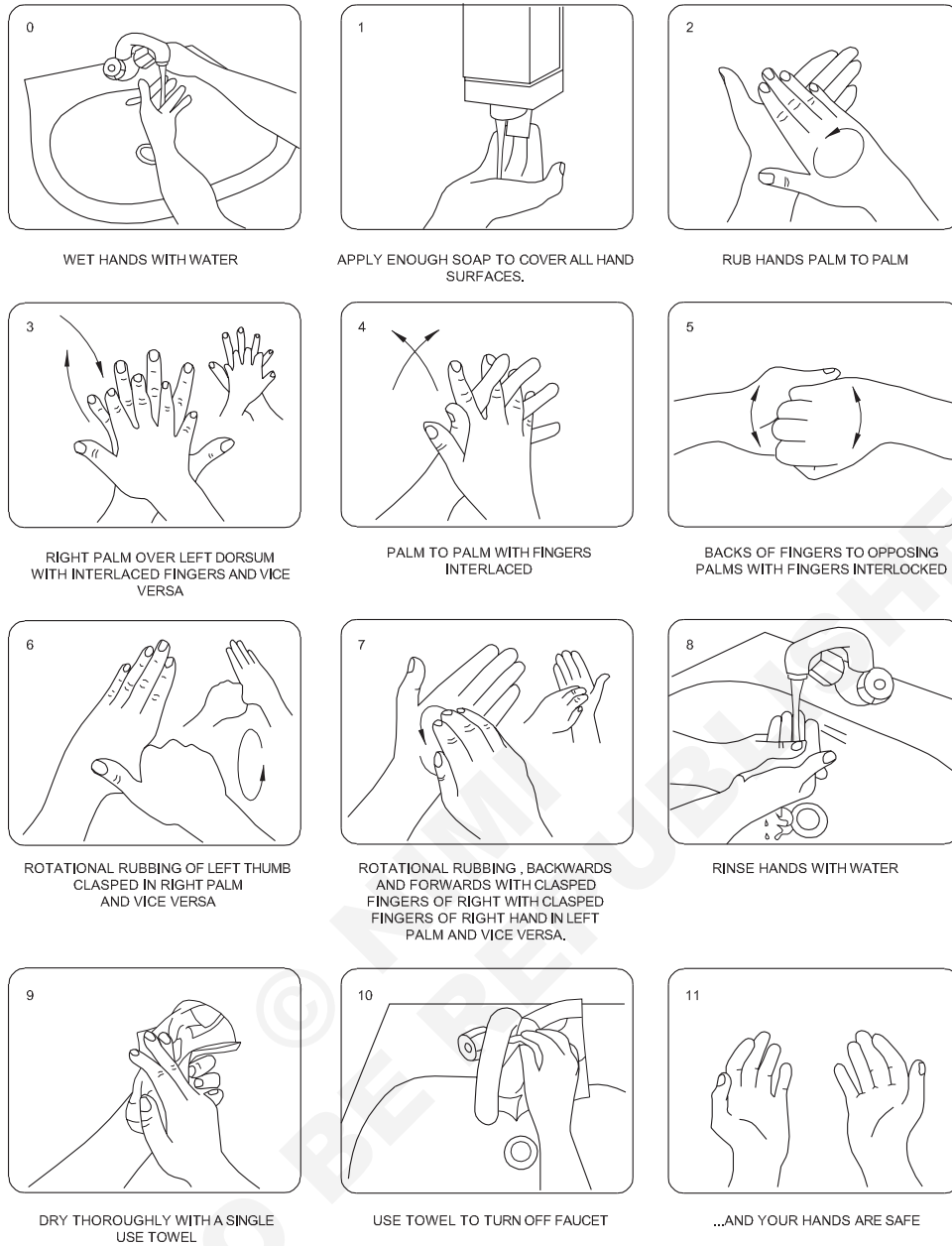
- Wet your hands with clean, running water — either warm or cold.
- Apply soap and lather well.
- Rub your hands vigorously for at least 20 seconds. Remember to scrub all surfaces, including the backs of your hands, wrists, between your fingers and under your fingernails.
- Rinse well.
- Dry your hands with a clean towel or air-dry them.

### How to use an alcohol-based hand sanitizer

Alcohol-based hand sanitizers, which don't require water, are an acceptable alternative when soap and water aren't available. If you use a hand sanitizer, make sure the product contains at least 60% alcohol. Follow these steps:

- Apply the gel product to the palm of one hand. Check the label to find out the appropriate amount.
  - Rub your hands together.
  - Rub the gel over all the surfaces of your hands and fingers until your hands are dry.
1. Hand-washing offers great rewards in terms of preventing illness. Adopting this habit can play a major role in protecting your health

Fig 1



H20N181111

## PERSONAL PROTECTIVE EQUIPMENT

### GLOVES:

There are various types of facilities, each of which having numerous applications that require disposable gloves. Within these facilities, numerous tasks – some core to the business and other supporting – are undertaken, and each of these instances requires a certain level of protection.

Here are some examples of activities at large facilities and how gloves are be beneficial to each:

- **Cleaning and janitorial staff:** These workers need gloves for protection from the harsh chemicals in the cleaning supplies they use. Additionally, they must protect themselves from pathogens while sanitizing restrooms. Nitrile or vinyl gloves are used for these

workers, as nitrile holds up to harsh chemicals, and vinyl is perfect for many glove changes between tasks.

- **Childcare:** Some facilities have childcare services for employees on site. Daycare employees wear gloves as a protective barrier for themselves and the children. Gloves are donned for diaper changes, cleaning up messes, cleaning toys and feeding children.
- **First aid:** This is another area where gloves serve as a protective barrier between wearers and the individuals. Nitrile exam gloves, for example, safeguard employees administering first aid against bloodborne pathogens and other diseases and are latex free.



A face mask is a product that covers the wearer's nose and mouth. Here are the basics of how to wear a mask:



- **Cafeteria:** Three glove types are used in this area. Vinyl gloves appear in food production, poly gloves are used in food service and nitrile gloves are donned for heavier-duty, longer-period use. Many facilities prefer the use of antimicrobial vinyl gloves as an added layer of protection.
  - **Line workers, assembler and fabricators:** Workers on a factory floor handle harmful materials and substances. In battery manufacturing and processing plants, for example, lead is present during the manufacturing process. Employees who are exposed to these risks need protection for their hands while they work. Nitrile gloves, which are made of a highly chemically resistant synthetic rubber, are a suitable choice. Plus, they conform more closely to the hand as they are warmed by body heat, which allows for additional dexterity.
  - **Maintenance:** This area includes repairs to machinery used for manufacturing processes and to a facility's fleet of transport vehicles. Maintenance workers come into contact with grease, gasoline and other solvents and need protection for their hands as they make repairs.
  - **Packaging:** Workers in this part of the manufacturing process are also subject to food safety regulations if foodstuffs and other consumables are being packaged. Furthermore, glove usage preserves the integrity of the packaging by preventing fingerprints.
  - **Printing workers:** Industrial printers use chemicals to produce printed labels and other items for their products. These chemicals include emulsions, inks, oxidizers and solvents. Disposable gloves protect workers' hands from health risks, such as nervous system damage, that occur through skin absorption. Due to these chemical hazards, nitrile gloves are the solution in this case.
  - **Security guards:** These employees conduct inspections of other workers and need to wear gloves when doing so. Gloves protect security guards against contracting illnesses from persons they come in physical contact with.
  - Clean your hands before you put your mask on, as well as before and after you take it off, and after you touch it at any time.
  - Make sure it covers both your nose, mouth and chin.
- A face mask is a product that covers the wearer's nose and mouth. Here are the basics of how to wear a mask:
- Clean your hands before you put your mask on, as well as before and after you take it off, and after you touch it at any time.
  - Make sure it covers both your nose, mouth and chin.
  - When you take off a mask, store it in a clean plastic bag, and every day either wash it if it's a fabric mask, or dispose of a medical mask in a trash bin.
  - Don't use masks with valves.

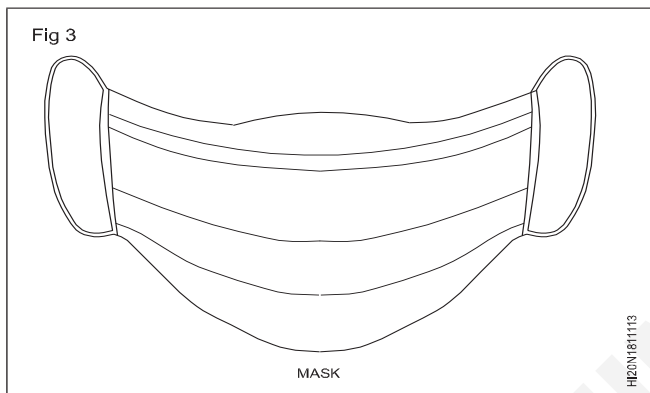
#### Benefits of wearing mask:

1. If someone is infected from communicable diseases, the mask works as a barrier and prevents them from being infected to others.
2. Even conditions happen when we sneeze and our sneeze droplets spread in the air and if we are infected then it may infect others.
3. Wearing a mask gives a confidence to ourselves and others also that we are maintaining the hygiene. And it may also inspire others to maintain it.
4. Masks are very useful to breathe even in polluted air. It filters the small dust particles and invisible

or minute harmful particles and gives clean air to breath.

- 5 Masks not only stop infection but even purify the air. It acts as the front line air purifier. Gowns are common personal protective equipment (PPE) used in the health care industry.

Different gowns vary in their levels of protection, with each type designated for a specific environment, usually based on the risk of exposure to bodily fluids. While each type of gown is manufactured using different materials, they all serve a similar purpose. They protect the wearer from the penetration of microorganisms and infectious fluids, minimizing the spread of disease. Gowns act as a barrier between the health care personnel who wear them and pathogens or viruses.



### Types of Medical Gowns

Hospitals and other health care facilities are responsible for providing quality PPE for their workers to ensure they are kept safe and at minimal risk as they work. There are several different types of medical gowns and protective clothing for doctors and medical personnel. Here are some of the most common types of PPE gowns.

#### Surgical Gowns

They are designed to be worn by any health care worker involved in a surgical procedure to protect themselves and the patient from the transfer of harmful microorganisms, bodily fluids, and other potentially hazardous materials.

#### Non-surgical Gowns

Non-surgical gowns are unsuitable for use during invasive procedures such as surgery or settings with a medium to high risk of contamination. Their primary use is to protect the wearer from the transfer of fluids or microorganisms in minimal to low-risk medical environments, such as a routine physical examination.

#### Isolation Gowns

Surgical isolation gowns can be worn during invasive medical procedures but are specifically designed for medium to high-risk situations. There is a need for a larger critical zone of protection under circumstances where the chances of contamination are higher



### Safe Injection Practices

Safe injection practices are intended to prevent transmission of infectious diseases between one patient and another, or between a patient and dental health care personnel (DHCP) during preparation and injection of medications

- Prepare injections using aseptic technique in a clean area.
- Disinfect the rubber septum on a medication vial with alcohol before piercing.
- Do not use needles or syringes for more than one patient (this includes manufactured prefilled syringes and other devices such as insulin pens).
- Medication containers (single and multidose vials, ampules, and bags) are entered with a new needle and new syringe, even when withdrawing additional doses for the same patient.
- Use single-dose vials for parenteral medications when possible.
- Do not use single-dose (single-use) medication vials, ampules, and bags or bottles of intravenous solution for more than one patient.
- Do not combine the leftover contents of single-use vials for later use.
- The following apply if multidose vials are used:
  - a. Dedicate multidose vials to a single patient whenever possible.
  - b. If multidose vials will be used for more than one patient, they should be restricted to a centralized medication area and should not enter the immediate patient treatment area (e.g., dental operatory) to prevent inadvertent contamination.
  - c. If a multidose vial enters the immediate patient treatment area, it should be dedicated for single-patient use and discarded immediately after use.
  - d. Date multidose vials when first opened and discard within 28 days, unless the manufacturer specifies a different date.
  - e. Do not use fluid infusion or administration sets (e.g., IV bags, tubings, connections) for more than one patient.

## Safe handling of potentially contaminated equipment

Clinical waste is produced from health and social care. Clinical waste can be either hazardous (waste that poses or may pose a risk of infection for example, pads and dressings) or non-hazardous (which is not infectious waste). Waste containers should be handled carefully to avoid contamination. Where appropriate you should use PPE to protect you from contamination and infection. It is placed in either yellow or orange plastic sacks. It should be kept separate from other waste and disposed of using specialist facilities

## Disposal of Clinical Waste

- Black plastic bags – normal household waste, paper towels and double-wrapped sanitary and incontinence products (where there is no known infection)
- Yellow plastic bags – waste that may contain body fluids e.g. used gloves, aprons and wound dressings (can be ordered from the Council, who will also be able to inform you of the weekly collection day. This is detailed in the Support Plan)
- Brown cardboard box – aerosols and glassware
- Yellow plastic sharps box – used needles (must not be discarded with normal household rubbish)

Don't forget to wash hands after disposing of any waste

## Guidelines for the Safe Disposal of Sharps

The following guidelines in relation to sharps should be followed:

- They must be disposed of at the point of use into an approved container
- All sharps bins should have the name of the person who assembled it and the date of assembly on the label. The same applies for the person closing the bin
- Do not fill bins past the 'full' line marked on the bin. Sharps can fall out and cause injury
- Use the temporary closure mechanism on the top of the bin when it is not being used, to prevent spillages if the bin is toppled over
- Always keep bins above floor level to prevent children from reaching them
- Store bins securely out of sight and reach of other people who may be present. If workers are transporting sharps by car, these should be kept in the car boot
- Do not pass sharps from one hand to the other
- Do not handle sharps more than is essential
- Do not put protective covering back on needles
- Do not bend or break needles
- Do not separate needles or syringes before disposal.

## Soiled Linen

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Linen that comes into contact with workers or individuals can become contaminated with harmful micro-organisms and body fluids. Linen refers to anything that is made of cloth including bedding, towels and clothing. Personal protective equipment (PPE) must be worn when handling infected linen as it can transfer pathogens to skin and clothing. All infected linen (that is linen that is contaminated with body fluids) must be washed separately to other items.

- Clothing can be decontaminated in a 40°C- 50°C wash followed by tumble-drying or hot ironing
- Bedding and towels should be washed in a hot wash to ensure that bacteria are killed
- Laundry should be moved to the washing area in sealed, colour coded bags

## Safe handling of contaminated surfaces in the patient environment

To keep patients safe, hospitals must maintain a clean environment and minimize the presence of pathogens. No single "blueprint" exists for the best cleaning and disinfection method, but there are several foundational elements, or Core Components, that help establish and sustain a clean, safe environment that supports the safety of patients, healthcare personnel (HCP), and visitors.

## Educate and Train All HCP Responsible for Cleaning and Disinfecting Patient Care Areas

All personnel who clean and disinfect patient care areas must understand their roles and responsibilities. This is critical for the ongoing success of the cleaning and disinfection program and for protecting the health of HCP, patients, and visitors. Because many HCP are responsible for cleaning and disinfecting reusable patient care equipment and environmental surfaces in patient care areas, appropriate education and training is required for a broad range of HCP.

- Focus education and training for HCP responsible for cleaning and disinfection on:
- Learning hospital cleaning and disinfection policies and following them (i.e., correct practices are observed by a trainer)
- Understanding the basic concepts of pathogen transmission
- Recognizing the impact of their work on infection control and patient safety
- Protecting themselves while working:
- Proper use of personal protective equipment (PPE)
- Safe use of chemicals and cleaning technologies
- Infection control risks, including sharps safety
- Other aspects of worker safety as appropriate to the setting or situation

## Select Appropriate Cleaning and Disinfection Technologies and Products

- Make sure that cleaning and disinfection technologies and products are tailored to the setting and standardized as much as possible.
- Use a systematic process to select technologies and products, including advanced technologies (e.g., no-touch disinfection devices), for patient care areas.
- Standardize Setting-Specific Cleaning and Disinfection Protocols
- Identify standardized, setting-specific protocols for cleaning and disinfection, including use of technologies and products.
- Emphasize that surfaces, including high-touch surfaces, must be cleaned effectively, accounting for differences in room layout, equipment, and patient risk.
- Clearly define responsibilities for the cleaning and disinfection of noncritical equipment, shared medical equipment, and other electronics (e.g., ICU monitors, ventilator surfaces, bar code scanners, point-of-care devices, mobile workstations, code carts, airway boxes).
- Make sure that staff involved in cleaning and disinfection are aware of their responsibilities and are appropriately trained to fulfill them.
- Make sure that cleaning and disinfection supplies are easily accessible (e.g., cleaning cart and patient care areas are adequately stocked)

#### **Monitor Effectiveness and Adherence to Cleaning and Disinfection Protocols**

An environmental cleaning and disinfection monitoring strategy allows EVS personnel, other relevant HCP, and the facility cleaning and disinfection program to understand the current state of facility cleanliness and to identify areas for improvement.

- Develop and implement a monitoring strategy for adherence to, and effectiveness of, cleaning and disinfection procedures.

#### **Respiratory hygiene/Cough etiquette:**

Covering coughs and sneezes and keeping hands clean can help prevent the spread of serious respiratory illnesses like influenza, respiratory syncytial virus (RSV), whooping cough, and COVID-19. Germs can be easily spread by:

- Coughing, sneezing, or talking
- Touching your face with unwashed hands after touching contaminated surfaces or objects
- Touching surfaces or objects that may be frequently touched by other people

#### **To help stop the spread of germs:**

- Cover your mouth and nose with a tissue when you cough or sneeze
- Throw used tissues in the trash
- If you don't have a tissue, cough or sneeze into your elbow, not your hands

#### **Remember to immediately wash your hands after blowing your nose, coughing or sneezing.**

Washing your hands is one of the most effective ways to prevent yourself and your loved ones from getting sick, especially at key times when you are likely to get and spread germs.

- Wash your hands with soap and water for at least 20 seconds
- If soap and water are not readily available, use an alcohol-based hand sanitizer that contains at least 60% alcohol to clean hands

To help prevent the spread of respiratory disease, you can also avoid close contact with people who are sick. If you are ill, you should try to distance yourself from others so you do not spread your germs. Distancing includes staying home from work or school when possible.

## Non-communicable Diseases

**Objectives:** At the end of this lesson you shall be able to

- state the types of non communicable diseases and symptoms
- state the causes and prevention
- state about hypertension -causes-symptoms-prevention
- state about diabetes types-prevention
- state immunity and immunisation

### NON COMMUNICABLE DISEASES:

A non-communicable disease is a non-infectious health condition that **cannot be spread from person to person**. It also lasts for a long period of time. This is also known as a **chronic disease**. A combination of genetic, physiological, lifestyle, and environmental factors can cause these diseases.

Main types of non-communicable diseases

- Cardiovascular diseases
- Diabetes
- Preventable cancers
- Chronic respiratory diseases, including asthma
- Mental health conditions
- Injuries

Main risk factors

- Tobacco use
- Unhealthy diet
- Harmful use of alcohol
- Air pollution
- Physical inactivity

### CANCER

Cancer is the uncontrolled growth of abnormal cells anywhere in a body.

There are over 200 types of cancer.

- Anything that may cause a normal body cell to develop abnormally potentially can cause cancer; general categories of cancer-related or causative agents are as follows: chemical or toxic compound exposures, ionizing radiation, some pathogens, and human genetics.

### Symptoms

Signs and symptoms caused by cancer will vary depending on what part of the body is affected.

Some general signs and symptoms associated with, but not specific to, cancer, include:

- Fatigue
- Lump or area of thickening that can be felt under the skin
- Weight changes, including unintended loss or gain
- Skin changes, such as yellowing, darkening or redness of the skin, sores that won't heal, or changes to existing moles
- Changes in bowel or bladder habits
- Persistent cough or trouble breathing
- Difficulty swallowing
- Hoarseness
- Persistent indigestion or discomfort after eating
- Persistent, unexplained muscle or joint pain
- Persistent, unexplained fevers or night sweats
- Unexplained bleeding or bruising

### Causes

Cancer is caused by changes (mutations) to the DNA within cells. The DNA inside a cell is packaged into a large number of individual genes, each of which contains a set of instructions telling the cell what functions to perform, as well as how to grow and divide. Errors in the instructions can cause the cell to stop its normal function and may allow a cell to become cancer

### PREVENTION:

Doctors have identified several ways to reduce your risk of cancer, such as:

- **Stop smoking.** If you smoke, quit. If you don't smoke, don't start. Smoking is linked to several types of cancer — not just lung cancer. Stopping now will reduce your risk of cancer in the future.
- **Avoid excessive sun exposure.** Harmful ultraviolet

(UV) rays from the sun can increase your risk of skin cancer. Limit your sun exposure by staying in the shade, wearing protective clothing or applying sunscreen.

- **Eat a healthy diet.** Choose a diet rich in fruits and vegetables. Select whole grains and lean proteins. Limit your intake of processed meats.
- **Exercise most days of the week.** Regular exercise is linked to a lower risk of cancer. Aim for at least 30 minutes of exercise most days of the week. If you haven't been exercising regularly, start out slowly and work your way up to 30 minutes or longer.
- **Maintain a healthy weight.** Being overweight or obese may increase your risk of cancer. Work to achieve and maintain a healthy weight through a combination of a healthy diet and regular exercise.
- **Drink alcohol in moderation, if you choose to drink.** If you choose to drink alcohol, do so in moderation. For healthy adults, that means up to one drink a day for women and up to two drinks a day for men.
- **Schedule cancer screening exams.** Talk to your doctor about what types of cancer screening exams are best for you based on your risk factors.
- **Ask your doctor about immunizations.** Certain viruses increase your risk of cancer. Immunizations may help prevent those viruses, including hepatitis B, which increases the risk of liver cancer, and human papillomavirus (HPV), which increases the risk of cervical cancer and other cancers.

## **HYPERTENSION:**

Abnormally high blood pressure and a combination of high psychological stress are known as Hypertension. These patients suffering from this disorder will have their blood pressure reading greater than 140 over 90 mm.

Hypertension is diagnosed by measuring blood pressure. The Systolic pressure would be the first readings viz. a pressure by which the heart pumps blood through the body, and second readings would be the Diastolic pressure, meaning a pressure at which the heart relaxes and refills the blood.

### **Causes of Hypertension**

Acute stress and unfavourable environmental factors are the main factors for increasing blood pressure in normal and healthy individuals. The increasing rate of the prevailing condition is mostly blamed on the lifestyle and dietary factors such as inactive habits, high diet sodium content from processed fatty foods, tobacco and alcohol use.

## **Symptoms of Hypertension**

High blood pressure is itself asymptomatic, which means there is no indication or any clear symptoms. This is the reason why high blood pressure is also referred to as 'the silent killer' since it could cause damage to the Cardiovascular system.

High blood pressure could also create problems in certain organs. A prolonged illness may lead to complications such as arteriosclerosis, where the production of plaques narrows the blood vessels.

A systolic blood pressure readings of 180 mmHg or above and a diastolic blood pressure readings of 110 mmHg or above could indicate the signs of hypertensive crisis that requires immediate medical attention.

## **Treatment and Precautions**

- Weight loss treatment programs like diet and exercise are recommended as high blood pressure and obesity are related to each other.
- Having a well-balanced diet including whole grains, fruits, vegetables and low-fat dairy products.
- Avoid foods that have high amounts of LDL cholesterol (low-density lipoprotein).
- Reduce intake of sodium in the diet.
- Increase the intake of calcium and vitamin D.

## **Cardiovascular diseases:**

Cardiovascular diseases (CVDs) are a group of disorders of the heart and blood vessels. They include:

- 1 coronary heart disease – a disease of the blood vessels supplying the heart muscle;
- 2 cerebrovascular disease – a disease of the blood vessels supplying the brain;
- 3 peripheral arterial disease – a disease of blood vessels supplying the arms and legs;
4. rheumatic heart disease – damage to the heart muscle and heart valves from rheumatic fever, caused by streptococcal bacteria;
- 5 congenital heart disease – birth defects that affect the normal development and functioning of the heart caused by malformations of the heart structure from birth; and
- 6 deep vein thrombosis and pulmonary embolism – blood clots in the leg veins, which can dislodge and move to the heart and lungs.

Heart attacks are usually acute events and are mainly caused by a blockage that prevents blood from flowing to the heart .The most common reason for this is a build-up of fatty deposits on the inner walls of the blood

vessels that supply the heart.

The most important behavioural risk factors of heart disease and stroke are unhealthy diet, physical inactivity, tobacco use and harmful use of alcohol. The effects of behavioural risk factors may show up in individuals as raised blood pressure, raised blood glucose, raised blood lipids, and overweight and obesity.

### Symptoms of heart attacks

Often, there are no symptoms of the underlying disease of the blood vessels. A heart attack or stroke may be the first sign of underlying disease. Symptoms of a heart attack include:

- Pain or discomfort in the centre of the chest; and/or
- Pain or discomfort in the arms, the left shoulder, elbows, jaw, or back.

In addition the person may experience difficulty in breathing or shortness of breath; nausea or vomiting; light-headedness or faintness; a cold sweat; and turning pale. Women are more likely than men to have shortness of breath, nausea, vomiting, and back or jaw pain.

### Cardiovascular Disease Treatments

Treatments for cardiovascular diseases can differ by the type of condition. It may include:

- Changing parts of your lifestyle like your diet, exercise, and alcohol and tobacco use
- Medications, including ones that treat risk factors like blood pressure or cholesterol or to break up clots
- Medical procedures like having a balloon or stent placed in your blood vessel, heart valve surgery, or coronary artery bypass graft surgery.

### DIABETES:

Diabetes is a chronic disease that occurs either when the pancreas does not produce enough insulin or when the body cannot effectively use the insulin it produces. Insulin is a hormone that regulates blood sugar. Hyperglycaemia, or raised blood sugar, is a common effect of uncontrolled diabetes and over time leads to serious damage to many of the body's systems, especially the nerves and blood vessels.

Some of the signs and symptoms of type 1 diabetes and type 2 diabetes are:

- Increased thirst
- Frequent urination
- Extreme hunger
- Unexplained weight loss

- Presence of ketones in the urine (ketones are a by-product of the breakdown of muscle and fat that happens when there's not enough available insulin)
- Fatigue
- Irritability
- Blurred vision
- Slow-healing sores
- Frequent infections, such as gums or skin infections and vaginal infections

Type 1 diabetes can develop at any age, though it often appears during childhood or adolescence. Type 2 diabetes, the more common type, can develop at any age, though it's more common in people older than 40.

### Causes of type 1 diabetes

The exact cause of type 1 diabetes is unknown. What is known is that your immune system — which normally fights harmful bacteria or viruses — attacks and destroys your insulin-producing cells in the pancreas. This leaves you with little or no insulin. Instead of being transported into your cells, sugar builds up in your bloodstream.

### Causes of pre-diabetes and type 2 diabetes

In pre-diabetes — which can lead to type 2 diabetes — and in type 2 diabetes, your cells become resistant to the action of insulin, and your pancreas is unable to make enough insulin to overcome this resistance. Instead of moving into your cells where it's needed for energy, sugar builds up in your bloodstream.

### Prevention

Type 1 diabetes can't be prevented. However, the same healthy lifestyle choices that help treat pre-diabetes, type 2 diabetes and gestational diabetes can also help prevent them:

- **Eat healthy foods.** Choose foods lower in fat and calories and higher in fiber. Focus on fruits, vegetables and whole grains. Strive for variety to prevent boredom.
- **Get more physical activity.** Aim for about 30 minutes of moderate aerobic activity on most days of the week, or at least 150 minutes of moderate aerobic activity a week.
- **Lose excess pounds.** If you're overweight, losing even 7% of your body weight — for example, 14 pounds (6.4 kilograms) if you weigh 200 pounds (90.7 kilograms) — can reduce the risk of diabetes.

## Immunity and Immunisation

Getting immunized is important for at least two reasons: to protect yourself and to protect those around you. Vaccines are the best way we have to prevent infectious disease.

- Vaccinations prevent you or your child from getting diseases for which there are often no medical treatments. These illnesses can result in serious complications and even death.
- A small number of people may be susceptible to diseases, such as those with impaired immune

National Immunization Schedule				
Vaccine	When to give	Dose	Route	Site
For Infants				
BCG	At birth or as early as possible till one year of age	0.1ml (0.05ml until 1 month of age)	Intra -dermal	Left Upper Arm
Hepatitis B Birth dose	At birth or as early as possible within 24 hours	0.5 ml	Intramuscular	Anterolateral side of mid-thigh-LEFT
OPV Birth dose	At birth or as early as possible within the first 15 days	2 drops	Oral	-
OPV 1,2 & 3	At 6 weeks, 10 weeks & 14 weeks	2 drops	Oral	-
IPV (inactivated Polio Vaccine)	14 weeks	0.5 ml	Intramuscular	Anterolateral side of mid-thigh-RIGHT
Pentavelant 1,2 & 3	At 6 weeks, 10 weeks & 14 weeks	0.5 ml	Intramuscular	Anterolateral side of mid-thigh-LEFT
Rota Virus Vaccine	At 6 weeks, 10 weeks & 14 weeks	5 drops	Oral	-
Measles 1 <sup>st</sup> Dose	9 completed months-12 months. (give up to 5 years if not received at 9-12 months age)	0.5 ml	Subcutaneous	Right Upper Arm
Vitamin A, 1 <sup>st</sup> Dose	At 9 months with measles	1 ml (1 lakh IU)	Oral	-
For children				
DPT 1 <sup>st</sup> booster	16-24 months	0.5 ml	Intramuscular	Anterolateral side of mid-thigh-LEFT
OPV Booster	16-24 months	2 drops	Oral	
Measles 2 <sup>nd</sup> dose	16-24 Months	0.5 ml	Subcutaneous	Right Upper Arm
Vitamin A (2 <sup>nd</sup> to 9 <sup>th</sup> dose)	16 months with DPT/OPV booster, then, one dose every 6 month up to the age of 5 years)	2 ml (2 lakh IU)	Oral	-
DPT 2 <sup>nd</sup> Booster	5-6 years	0.5 ml.	Intramuscular	Left Upper Arm
TT	10 years & 16 years	0.5 ml	Intramuscular	Upper Arm



systems. These people may not be able to get vaccinations or may not develop immunity even after having been vaccinated. Their only protection against certain diseases is for others to get vaccinated so the illnesses are less common.

- Getting immunized costs less than getting treated for the diseases that the shots protect you from.
- If exposure to a disease occurs in a community, there is little to no risk of an epidemic if people have been immunized.

### The Importance of Strong Immunity

Having a strong, healthy immune system is imperative in helping to fight off potentially harmful viruses and bacteria, such as the coronavirus. When your immune system is low, you are much more susceptible to picking up infections and diseases with the effects being much more serious, so it's important to support it in order for it to function at its very best.

### Types, purpose and effect of immunisation

#### The different types of vaccines are as follows:

- 1 **Inactivated Vaccine:** Vaccines of this type are created by inactivating a pathogen, typically using heat or chemicals such as formaldehyde or formalin. This destroys the pathogen's ability to replicate, but keeps it "intact" so that the immune system can still recognize it.
- 2 **Attenuated Vaccine:** Attenuated vaccines can be made in several different ways. Some of the most common methods involve passing the disease-causing virus through a series of cell cultures or animal embryos (typically chick embryos). When the resulting vaccine virus is given to a human, it will be unable to replicate enough to cause illness, but will still provoke an immune response that can protect against future infection.
- 3 **Toxoid Vaccine:** Some bacterial diseases are not directly caused by a bacterium itself, but by a toxin produced by the bacterium. Immunizations for this type of pathogen can be made by inactivating the toxin that causes disease symptoms. As with organisms or viruses used in killed or inactivated vaccines, this can be done via treatment with a chemical such as formalin, or by using heat or other methods.
- 4 **Subunit Vaccine:** Subunit vaccines use only part of a target pathogen to provoke a response from the immune system. This may be done by isolating a specific protein from a pathogen and presenting it as an antigen on its own.
- 5 **Conjugate Vaccine:** Conjugate vaccines are somewhat similar to recombinant vaccines: they're made using a combination of two different components. Conjugate vaccines, however, are made using pieces from the coats of bacteria. These coats are chemically linked to a carrier protein, and the combination is used as a vaccine

- 6 **Valence Vaccine:** Vaccines may be monovalent. A monovalent vaccine is designed to immunize against a single antigen or single microorganism. A multivalent or polyvalent vaccine is designed to immunize against two or more strains of the same microorganism, or against two or more microorganisms.
- 7 **Heterotypic Vaccine:** Heterologous vaccines also known as "Jennerian vaccines", are vaccines that are pathogens of other animals that either do not cause disease or cause mild disease in the organism being treated.
- 8 **mRNA Vaccine:** An mRNA vaccine (or RNA vaccine) is a novel type of vaccine which is composed of the nucleic acid RNA, packaged within a vector such as lipid nanoparticles.

### Measles Vaccination

Measles is a very contagious disease caused by a virus. It spreads through the air when an infected person coughs or sneezes. Measles starts with a cough, runny nose, red eyes, and fever. Then a rash of tiny, red spots breaks out. It starts at the head and spreads to the rest of the body.

Measles can be prevented with MMR vaccine. The vaccine protects against three diseases: measles, mumps, and rubella. CDC recommends children get two doses of MMR vaccine, starting with the first dose at 12 through 15 months of age, and the second dose at 4 through 6 years of age. Teens and adults should also be up to date on their MMR vaccination.

The MMR vaccine is very safe and effective. Two doses of MMR vaccine are about 97% effective at preventing measles; one dose is about 93% effective. Children may also get MMRV vaccine, which protects against measles, mumps, rubella, and varicella (chickenpox). This vaccine is only licensed for use in children who are 12 months through 12 years of age.

Schedule for MMR vaccine		
	First Dose	Second Dose
Children	Age 12-15 months	Age 4-6 years

### TYPHOID VACCINE

Typhoid vaccine can prevent typhoid. There are two vaccines to prevent typhoid. One is an inactivated (killed) vaccine given as a shot. The other is a live, attenuated (weakened) vaccine which is taken orally (by mouth)

Vaccination can help prevent typhoid fever. CDC recommends vaccination for people traveling to places where typhoid fever is common, such as South Asia, especially India, Pakistan, or Bangladesh.

#### Two typhoid fever vaccines are available

- **Oral vaccine:** Can be given to people at least 6 years old. It consists of four pills taken every other day and should be finished at least 1 week before travel.
- **Injectable vaccine:** Can be given to people at least

2 years old and should be given at least 2 weeks before travel.

Typhoid vaccines are not 100% effective. Always practice safe eating and drinking habits to help prevent infection. Typhoid vaccines lose effectiveness over time. The injectable vaccine requires a booster every 2 years, and the oral vaccine requires a booster every 5 years. If you were vaccinated in the past, ask your doctor if it is time for a booster vaccination. Taking antibiotics will not prevent typhoid fever; they only help treat it.

### PENTAVALENT VACCINE

Pentavalent vaccine is a type of children's vaccine that protects against five types of diseases. These diseases include diphtheria, pertussis (whooping cough), hepatitis B, tetanus, pneumonia, meningitis, etc. This vaccine is usually given to infants between one to three and a half months of age and not given to children beyond one year of age. The pentavalent vaccine has reduced the risk of certain diseases such as diphtheria, pertussis (whooping cough), hepatitis B, tetanus, pneumonia, meningitis in infants.

Pentavalent vaccine is said to be a vaccine that protects against five diseases. Doctors have prepared this vaccine to protect children from five diseases. Let us explain further.

- 1 **Diphtheria** – This disease can cause difficulty breathing, paralysis, and uncontrolled heart rate.
- 2 **Pertussis (whooping cough)** – Pertussis is also called whooping cough. This disease is characterized by severe coughing because of which the child is unable to eat properly and may have difficulty breathing. Whooping cough may affect the infant's brain and cause epilepsy. In some cases, the baby may die due to the complications.
- 3 **Hepatitis B** – Hepatitis B is a type of infectious disease that can occur at any time to the baby. As you know, this infectious disease directly causes liver damage. Due to this, the baby has a fever, fatigue, and joint pain.
- 4 **Tetanus** – Tetanus is a serious bacterial infection that affects the nervous system of the body. In this, the infant experiences painful muscle contractions, especially in the jaw muscles resulting in swallowing difficulties.
- 5 **Pneumonia** – Pneumonia is an infection that directly affects the lungs. This infection can occur in the baby due to viral or bacterial attacks.

### Disinfection and Sterilisation

Disinfection is the inactivation or destruction of microorganisms that cause disease. Disease-causing pathogenic micro-organisms include viruses, bacteria, and protozoans. Although many common wastewater treatment processes reduce the concentration of microbial pathogens, it is necessary to provide a final disinfection process that ensures safe levels of

pathogens

Disinfection may be needed for two distinctly different situations: (1) disinfection of nets, holding facilities, and piping prior to use; and (2) disinfection of process water prior to use or before reuse. Sterilization destroys all microorganisms on the surface of an article or in a fluid to prevent disease transmission associated with the use of that item. Most medical and surgical devices used in healthcare facilities are made of materials that are heat stable and therefore undergo heat, primarily steam, sterilization. Sterilization destroys all microorganisms on the surface of an article or in a fluid to prevent disease transmission associated with the use of that item.

Medical devices that have contact with sterile body tissues or fluids are considered critical items. These items should be sterile when used because any microbial contamination could result in disease transmission. Such items include surgical instruments, biopsy forceps, and implanted medical devices. If these items are heat resistant, the recommended sterilization process is steam sterilization, because it has the largest margin of safety due to its reliability, consistency, and lethality. However, reprocessing heat- and moisture-sensitive items requires use of a low-temperature sterilization technology (e.g., ethylene oxide, hydrogen peroxide gas plasma, peracetic acid)

Disinfection and sterilization are essential for ensuring that medical and surgical instruments do not transmit infectious diseases to patients. The sterilization process can also be done by using dry heat, steam under pressure, hydrogen peroxide gas, plasma, and liquid chemicals.

### THE IMPORTANCE OF MEDICAL DISINFECTANTS

Disinfectants have an important role in the medical field. Because clean and hygienic medical equipment is an unavoidable part of medical care and health service. Importance of sterilization & disinfection. Improper use of medical equipment always lead to dangerous health issues and in turn affect the life of patients. Hence, the proper use of medical disinfectants is important and it helps to prevent the spread of harmful viruses and bacteria. Routine disinfection and sterilization services help to trap many infectious diseases.

**Halogens:** The halogens, especially chlorine and iodine, are frequently used as disinfectants as they possess antimicrobial activity. They exist in a free state and form a salt with sodium and most other metals.

- **Chlorine:** It is the most commonly available disinfectant. Chlorine is most often used in the form of **sodium hypochlorite (NaOCl)**, the compound known as **household bleach**. CDC recommends that tabletops be cleaned following blood spills with a 1:10 dilution of bleach. It is also used for municipal water supplies, swimming pools, dairy and food industries, etc.

- **Iodine:** Iodine compounds are widely employed antiseptics. Iodine is prepared either as tincture with alcohol or as an iodophor coupled with a neutral polymer, for example, **povidone-iodine**.

#### KMNO4 SOLUTION

Potassium Permanganate is a very versatile chemical. It can be used for disinfection, removing hardness,

removing iron and manganese. It has another health related use, it can be mixed into a paste and used as a topical salve for athlete's foot Formaldehyde

#### Formaldehyde

Formaldehyde is used as a disinfectant and sterilant in both its liquid and gaseous states. Formaldehyde

## IMPORTANCE OF STERILIZATION

### ❖ Medical Sterilization

#### ❖ Prevents the Growth of Diseases

In any medical tool/device used, bacteria comes onto it. If left unchecked or not disinfected properly, it is highly likely that bacteria will grow.

#### ❖ Prevents the Spread of Diseases

If surgical equipment is not properly sterilized, patients treated are exposed to a disease the previous patient had.

#### ❖ Prevents Double Surgeries

If unsterilized equipment is used, it can cause an infection leading to another surgery later on in order to remove it.

This is costly and can cause many life-threatening complications.

is sold and used principally as a water-based solution called formalin. The ingestion of formaldehyde can be fatal, and long-term exposure to low levels in the air or on the skin can cause asthma-like respiratory problems and skin irritation, such as dermatitis and itching. For these reasons, employees should have limited direct contact with formaldehyde, and these considerations limit its role in sterilization and disinfection processes. a bactericide, tuberculocide, fungicide, virucide and sporicide. Formaldehyde inactivates microorganisms by alkylating the amino and sulfhydryl groups of proteins and ring nitrogen atoms of purine bases.

Formaldehyde is used in the health-care setting to prepare viral vaccines (e.g., poliovirus and influenza); as an embalming agent; and to preserve anatomic specimens; and historically has been used to sterilize surgical instruments, especially when mixed with ethanol. Aqueous formaldehyde solutions (1%–2%) also have been used to disinfect the internal fluid pathways of dialysis machines 583. To minimize a potential health hazard to dialysis patients, the dialysis equipment must be thoroughly rinsed and tested for residual formaldehyde before use.

### Uses of the Halogens

Fluorine	Chlorine	Bromine	Iodine
Toothpaste	Water disinfection	Photographic film	Disinfectant
Water treatment	Hydrochloric acid	Tear gas	Halogen lamps
Extraction of Aluminium	Plastics	Flame retardants	X ray diagnosis
Non stick coatings	Bleaches	Pharmaceuticals	Salt additive
Enrichment of Uranium			Thyroid treatment
			Cancer treatment

### Halogens

- Intermediate-level antimicrobial chemicals
- Believed that they damage enzymes via oxidation or by denaturing them
- Iodine tablets, iodophores (Betadine®), chlorine treatment of drinking water, bleach, chloramines in wound dressings, and bromine disinfection of hot tubs



## Chlorine gases

Hypochlorites, the most widely used of the chlorine disinfectants, are available as liquid (e.g., sodium hypochlorite) or solid (e.g., calcium hypochlorite). They have a broad spectrum of antimicrobial activity, do not leave toxic residues, are unaffected by water hardness, are inexpensive and fast acting remove dried or fixed

LIQUID DISINFECTANTS	
Disinfectant Agent	Use Concentration
Ethyl or isopropyl alcohol	70% - 90%
Chlorine (bleach)	100 ppm
Phenolic	UD
Iodophor	UD
Quaternary ammonium compound (QUAT)	UD
Improved/Accelerated hydrogen peroxide	0.5%, 1.4%

organisms and biofilms from surfaces and have a low incidence of serious toxicity. Sodium hypochlorite at the concentration used in household bleach (5.25-6.15%) can produce ocular irritation or oropharyngeal, esophageal, and gastric burns

### Uses

Hypochlorites are widely used in healthcare facilities in a variety of settings. Inorganic chlorine solution is used for disinfecting tonometer heads and for spot-disinfection of countertops and floors.

Chlorine long has been used as the disinfectant in water treatment. Hyperchlorination of a Legionella-contaminated hospital water system resulted in a dramatic decrease (from 30% to 1.5%) in the isolation of *L. pneumophila* from water outlets and a cessation of healthcare-associated Legionnaires' disease in an affected unit.

Water disinfection with monochloramine by municipal water-treatment plants substantially reduced the risk for healthcare-associated Legionnaires disease. Chlorine dioxide also has been used to control Legionella in a hospital water supply. Chloramine T and hypochlorite have been used to disinfect hydrotherapy equipment.

Sulphur dioxide is a chemical compound of sulphur with the molecular formula  $SO_2$ . It is a highly toxic and soluble gas in water. Liquid sulphur dioxide is a useful solvent that is used widely as a bleaching agent and refrigerant for food preservation

### Uses of sulphur dioxide

- It is a toxic gas that causes various health problems but we use sulphur dioxide for the production of various industrial compounds such as sulphuric acid, sulphur trioxide, and sulphites. Sulphuric acid obtained from sulphur dioxide uses for the production of steel, fertilizers, medicines, fuels, batteries, paper, plastics, etc.

- It is used as a disinfectant or bleaching agent for removing excess chlorine.
- Liquid sulphur dioxide uses as a refrigerant for food preservation.
- It is used as a reducing agent or solvent for different types of chemical transformations in the laboratory.
- Due to its toxic nature, it is widely used for the production of pest control products.

### Use of UV radiation

Following are five ways that a spectrum of facilities can utilize UV disinfection effectively.

#### Air Disinfection

Any facility that needs to disinfect air spaces can use a UV light to do so, to some extent. There needs to be sufficient contact of the air with the UV light, making this type of disinfection more effective on still or stagnant air than on moving air.

#### Water Disinfection & Wastewater Treatment

Facilities can also use UV light to disinfect water and even for wastewater treatment. Because UV disinfection is a physical process and does not require adding any chemicals to the water to clean it, this can be a very safe and effective option. UV light can reduce the incidence of parasites such as cryptosporidium or giardia, which can be resistant even to chemical disinfection.

#### Surface Disinfection

It should come as no surprise that UV light can be useful for disinfecting surfaces in healthcare facilities and other spaces. In fact, UV light can destroy active viruses and other pathogens on a surface in just a matter of seconds. In this case, UV in healthcare facilities, can be much more efficient and effective than other cleaning and disinfecting options.

#### Equipment Disinfection

In addition to stationary surfaces like countertops, tables, and floors, UV light is a popular disinfection solution for equipment. For example, laboratories that risk contamination may use UV to disinfect goggles, glassware, or other laboratory instruments. As with other applications, the UV light has the benefit of being effective but also dry and simple, unlike washing or bleaching, which can leave residue and moisture behind.

#### Food & Beverage Disinfection

The use of UV light in food and beverage disinfection combines the effectiveness of UV light on surfaces as well as liquids. UV disinfection has been shown to be effective in food manufacturing facilities when used to disinfect things like conveyor belts that are otherwise difficult to clean thoroughly

## OZONE

The use of ozone as a sanitization and disinfecting agent has many economic and environmental benefits. It is low cost and safe to produce and apply. Ozone is also environmentally friendly and eliminates the risk of residual chemicals. Ozone can replace chlorine, hot water, and steam. In turn, this reduces the consumption of chemicals and water and eliminates the energy required to produce hot water and steam.

Ozone has been used successfully in various applications:

- Food and beverage manufacturing
- Pharmaceutical manufacturing
- Medical device manufacturing

- Cosmetics manufacturing
- Circuit board manufacturing/coating
- Healthcare facilities
- University laboratories
- Biotechnology
- Clean rooms

Ozone is a powerful oxidizing and disinfection agent, naturally destroying harmful microorganisms and compounds through oxidation.

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## Personal Hygiene

**Objectives:** At the end of this lesson you shall be able to

- identify the personal hygiene habits
- state the proper care of their own nails and hands cleaning
- identify the Dental care procedures and regular food habits
- state the menstrual hygiene and waste management

### Need and Importance of personal hygiene in daily life:

This means more than just keeping ourselves clean. This means shunning all practices that lead to bad health. Throwing garbage on the road, defecating in the open, and many more. By adopting such a practice, we not only make ourselves healthier but also improve the quality of our lives.

Personal hygiene means keeping the body clean, consumption of clean drinking water, washing fruits and vegetables before eating, washing one's hand, etc. Public hygiene refers to discarding waste and excreta properly, that means, waste segregation and recycling, regular disinfection and maintenance of the city's water reservoir. Quality of hygiene in the kitchens is extremely important to prevent diseases.

Diseases spread through vectors. Say the vector is contaminated water as in the case of typhoid, cholera, and amoebiasis (food poisoning). By drinking clean water, we can completely eliminate the chances of getting diseases. Some diseases are caused by pathogens carried by insects and animals. For e.g., plague is carried by rats, malaria, filarial, roundworms by flies and mosquitoes, etc.

Mosquitoes thrive in stagnant water and rats in garbage dumps and the food that is dumped out in the open. By spraying stagnant water bodies with kerosene or other chemicals, we can completely eliminate mosquitoes from our neighbourhood. If that is unfeasible, we can all use mosquito nets prevents us from mosquitoes while we're asleep. This poses a physical barrier for the mosquito.

Rats thrive on unsystematic waste disposal. By segregating the waste we can ensure that we don't leave food lying around for rats to eat. Close contact with sick people is also another way of contracting diseases.

A country has to strive to educate more doctors so that medical need of every citizen is taken care of. The importance of cleanliness should be inculcated in every citizen and this will in turn show in the cleanliness of the places we live in.

### Factors influencing health and hygiene habits

Good hygiene, or personal cleanliness, not only helps maintain a healthy self-image, but is important

in preventing the spread of infections and disease. Physical, psychological and social factors can affect a person's ability or willingness to perform the self-care tasks necessary for good hygiene.

### Physical Factors

In many cases, people understand the importance of good hygiene and wish to practice it, but are prevented from doing so by physical factors that make them unable to accomplish the mechanics of bathing. Paraplegics and amputees usually require some assistance with hygiene tasks from family members or caregivers. People with conditions that limit mobility -- such as back problems, obesity or arthritis -- may have difficulty getting in or out of a bathtub or shower;

Post-operative patients may find that their physical abilities are restricted, either temporarily or permanently. Plaster casts, surgical incisions etc. can all provide some degree of limitation. Adjustments should be pre-empted and help offered from family and friends even for mundane chores such as laundry and ironing.

Anyone suffering from back problems and arthritis or other mobility affecting conditions may find getting in and out of the bath very difficult. If these problems are expected to be long-term, amendments of domestic appliances may be required. A shower may need fitting, possibly with a chair to help with hygiene needs, the use of a home hair dresser and nail technician may prove very beneficial.

### Psychological Conditions

Any mental health problem can affect a person's ability and motivation for caring for their hygiene needs. Depression, anxiety, schizophrenia, Alzheimer's and others are all known to have the potential to affect a person's ability to care for oneself.

Loss of memory, motivation, social isolation and a lack of self-worth are all contributory factors. Carers of these sufferers can help by ensuring there are adequate provisions to be able to carry out these tasks. Making sure the soap, towels and such like are readily available and in view may help the person to remember to bathe or wash.

Oral hygiene and fluid intake are frequently overlooked in mental illness. A simple action such as a thorough cleaning of the teeth can significantly raise a person's moral and help them to feel better about themselves.

## Social Factors

Unfortunately even in today's modern society, there are still individuals whom find hot water, soap and towels difficult to gain access to. This lack of resources can result in individuals becoming unkempt and socially isolated.

Poor education and a lack of knowledge are other reasons why people have different ideas on hygiene needs. It is important for young children to understand and be taught how to maintain their own hygiene at as early an age as possible.

## Hospitalisation

Many patients in hospital, especially those whom are unconscious, become dependent on staff and visitors to care for their hygiene needs. If necessary their own products should be brought in from home as the familiarity may help them to recover. Patients often need extra help with bathing and washing, hair care, nail care, pressure area care, toileting needs and oral care.

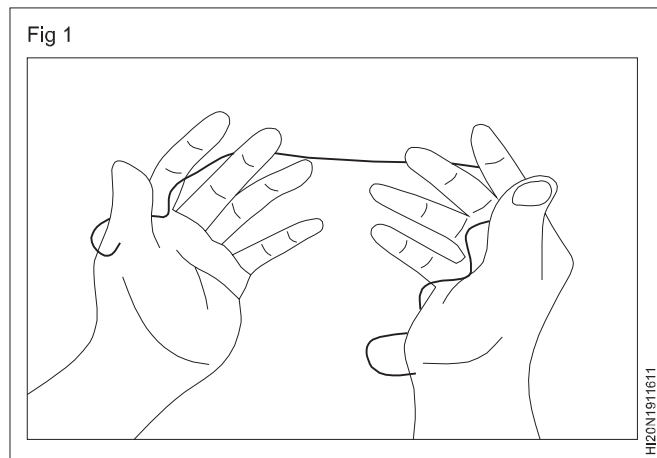
## Skin Hygiene

Your skin is a natural barrier against abrasion, chemicals, and pathogens. Proper skin hygiene is the best way to keep your skin healthy. Removing dead cells, dirt and microbes from the surface of the skin is key to good hygiene. At the same time, it is important to maintain the natural fats and oils (extracellular lipids) in the outer skin layer (stratum corneum).

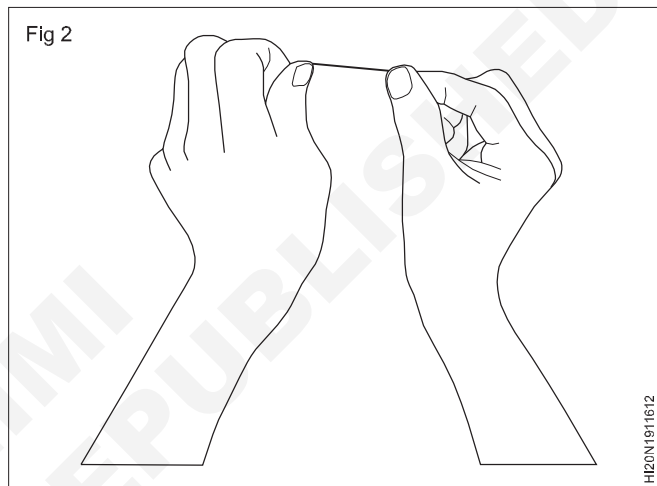
- 1 Remove daily dirt and grime by washing with mild soaps and cleansers. For effective hand washing, be sure to wash at least 10-15 seconds. Avoid harsh scrubbing actions.
- 2 Choose skin cleansers that contain moisturizers and emollients with mild-surface active agents and that are not overly acidic or alkaline, such as Lubrex® Cleanser. Avoid harsh soaps and detergents because they can remove skin oils and fats, and strip protective layers.
- 3 Use lukewarm water to wash your hands. Using hot water can overdry and damage skin.
- 4 Be sure to rinse your skin well after washing.
- 5 Dry your hands and skin thoroughly. Pat skin dry: Do not rub.
- 6 Select skin care products carefully. Many over-the-counter lotions and creams have fragrances or preservatives that can irritate your skin or worsen your allergy symptoms.

## HAIR HYGIENE:

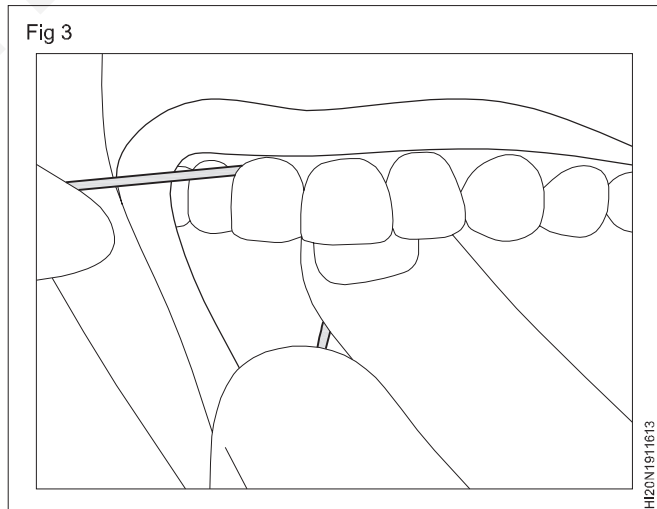
- 1 Wash oily hair more frequently. How often you wash your hair should be based on how much oil your scalp produces.
- If your scalp is oily, you may need to wash it as often as once a day.
  - If you have chemically treated hair, your hair may be



drier, so you may want to wash it less frequently.



- As you get older, your scalp makes less oil, so you may not need to shampoo as often. But if you see



flakes in your hair, you may not be shampooing enough. This can lead to dandruff and other scalp diseases

- 2 Concentrate shampoo on the scalp. When washing your hair, concentrate on cleaning primarily the scalp, rather than washing the entire length of hair. Washing only your hair can create flyaway hair that is dull and coarse.
- 3 Use conditioner after every shampoo unless you use

a “2-in-1” shampoo, which cleans and conditions hair. Using a conditioner can significantly improve the look of damaged or weathered hair by increasing shine, decreasing static electricity, improving strength and offering some protection from harmful UV rays.

- 4 Protect hair when swimming. Protect your hair from the damaging effects of chlorine by wetting and conditioning your hair before swimming. Wear a tight-fitting swim cap and use a specially formulated swimmers shampoo and deep conditioner after swimming to replace lost moisture.

## Oral Hygiene

Good oral health helps you enjoy life. It lets you: speak clearly; taste, chew, and swallow delicious and nutritious foods; and show your feelings through facial expressions such as smiling. If you protect your oral health with good oral hygiene practices (brushing and flossing), the odds are in your favour you can keep your teeth for a lifetime.

### Brush Your Teeth

To keep your teeth healthy, it is important to remove dental plaque, a sticky, colourless film of bacteria. Plaque build-up can cause tooth decay and gum disease.

#### Brushing tips:

- Use fluoride toothpaste. Fluoride is what protects teeth from tooth decay (cavities). It prevents decay by strengthening the tooth’s hard outer surface, called enamel.
- Angle the bristles toward the gumline, so they clean between the gums and teeth.
- Brush gently using small, circular motions. Do not scrub hard back and forth.
- Brush all sides of each tooth.
- Brush your tongue.

And, remember to replace your toothbrush when the bristles become frayed.

### Clean Between Your Teeth

Cleaning between teeth to remove plaque is also part of a good oral hygiene routine. If plaque is not removed, some of it can harden below the gum line and irritate the gums. The gums become red, swollen, and may bleed easily. These are signs of gingivitis. Gingivitis is a mild form of gum disease, and you can usually reverse it with daily brushing and flossing.

Use a string of floss about two feet long. Wrap it around the middle finger of each hand. Grip the floss between the thumb and index finger of each hand.

Ease the floss gently between the teeth until it reaches the gumline (don’t force the floss into place - this could harm the gums). Curve the floss like the letter “C”

around the side of each tooth. Slide the floss up and down under the gum.

Follow these tips to keep your teeth and gums healthy:

- Brush your teeth twice a day with a fluoride toothpaste.
- Clean between teeth regularly to remove plaque. Use dental floss or a special brush or wooden or plastic pick recommended by a dental professional. Or try a floss holder, floss threader, or water flosser.
- Visit the dentist for routine check-ups and professional cleaning.
- If you are at a higher risk for tooth decay (for example, if you have a dry mouth because of medicines you take), your dentist or dental hygienist may give you a fluoride treatment, such as a varnish or foam during the office visit. Or, the dentist may recommend a fluoride gel or mouth rinse for home use.
- If you are at higher risk for gum disease because of a medical condition (for example, diabetes), your dentist may want to see you more frequently.
- Drink fluoridated water. Drinking water with the right amount of fluoride protects your teeth throughout the day. Learn the fluoride content of your community’s water here or check with your water utility company.
- Eat a well-balanced diet. Limit sweets and sugary drinks, such as soda.

### Nail Hygiene

Appropriate hand hygiene includes diligently cleaning and trimming fingernails, which may harbor dirt and germs and can contribute to the spread of some infections, such as pinworms. Fingernails should be kept short, and the undersides should be cleaned frequently with soap and water. Because of their length, longer fingernails can harbor more dirt and bacteria than short nails, thus potentially contributing to the spread of infection.

Before clipping or grooming nails, all equipment (for example, nail clippers and files) should be properly cleaned. Sterilizing equipment before use is especially important when nail tools are shared among a number of people, as is common in commercial nail salons.

To help prevent the spread of germs and nail infections:

- Keep nails short and trim them often.
- Scrub the underside of nails with soap and water (or a nail brush) every time you wash your hands.
- Clean any nail grooming tools before use.
- In commercial settings such as nail salons external icon, sterilize nail grooming tools before use.
- Avoid biting or chewing nails.
- Avoid cutting cuticles, as they act as barriers to prevent infection.
- Never rip or bite a hangnail. Instead, clip it with a



clean, sanitized nail trimmer.

## DENTAL CARE

With proper care, your teeth and gums can stay healthy throughout your life. The healthier your teeth and gums are, the less risk you have for tooth decay and gum disease.

There are four basic steps to caring for teeth and gums:

- Brushing
- Flossing
- Rinsing
- Eating right
- Visiting the dentist

### Tips for Brushing Your Teeth and Gums

- Brush teeth and gums at least twice a day. If you can, brush 30 minutes to 1 hour after every meal. Brushing removes plaque, a film of bacteria that clings to teeth. When bacteria in plaque come into contact with food, they produce acids. These acids lead to cavities. To brush:
  - Place a pea-sized dab of fluoride toothpaste on the head of the toothbrush. (Use a soft toothbrush.)
  - Place the toothbrush against the teeth at a 45-degree angle to the gum line.
  - Move the brush across the teeth using a small circular motion (if using an electric toothbrush, hold it at the same angle against the teeth and gum line and let it do the work). Continue with this motion cleaning one tooth at a time. Keep the tips of the bristles against the gum line. Avoid pressing so hard that the bristles lie flat against the teeth. (Only the tips of the toothbrush clean the teeth.) Let the bristles reach into spaces between teeth.
  - Brush across the top of the chewing surfaces of the back teeth. Make sure the bristles get into the grooves and crevices.
  - Use the same small circular motion to clean the backside of the upper and lower teeth -- the side that faces the tongue.
  - To clean the inside of the bottom front teeth, angle the head in an up-and-down position toward the bottom inside of the mouth and move the toothbrush in a small circle.
  - For the inside of the top front teeth, angle the brush in an up-and-down position with the tip of the head pointing towards the roof of the mouth. Move the toothbrush in a small circle.
  - Give your tongue a few gentle brush strokes, brushing from the back of your tongue forward. Do not scrub. This helps remove bacteria and freshens your breath.
- After brushing your teeth for two to three minutes, rinse your mouth with a mouthwash.

- Replace your toothbrush with a new one every three to four months.

### Tips for Flossing Your Teeth

Floss your teeth once a day. Flossing gets rid of food and plaque between the teeth, where your toothbrush cannot reach. If plaque stays between teeth, it can harden into tartar, which must be removed by a dentist or hygienist. To floss:

- Remove about an 18-inch strip of floss from the dispenser.
- Wind the floss around the middle fingers of each hand, leaving a 1-inch section open for flossing. Floss the top teeth first, then the bottom.
- Place the floss in your mouth and use your index fingers to push the floss between the teeth. Be careful not to push too hard and injure the gums.
- Move the floss up and down against the tooth and up and around the gum line. The floss should form a C-shape around the tooth as you floss.
- Floss between each tooth as well as behind the back teeth.
- Use a clean section of floss as needed and take up used floss by winding it around the fingers.

Also, antibacterial mouth rinses (there are fluoride mouth rinses as well) can reduce bacteria that cause plaque and gum disease, according to the American Dental Association.

### Tips for Rinsing Your Teeth & Gums

The third part of your daily oral care routine should be mouthwash -- but not just any mouthwash.

- Rinse daily with an antiseptic (also known as antibacterial) mouthwash to help kill bacteria that cause plaque, early gum disease, and bad breath.
- Fluoride-containing mouthwash helps prevent tooth decay. Some mouthwashes have both antibacterial ingredients and fluoride.
- Swish the rinse around in your mouth for 30 to 60 seconds.
- You can use a mouthwash before or after you brush and floss.

### Eating Right and Dental Health

For good dental health, eat a variety of foods, avoiding those that contain sugars and starches. These foods produce the most acids in the mouth, and the longer they stay in the mouth, the more they can damage the teeth. Hard "sucking candies" are especially harmful because they stay in the mouth a long time.

Snacking on sugary foods can lead to tooth decay, because most people don't brush after snacks. Starchy snack foods, like potato chips, stick to the teeth. Avoid snacking on:

- Candies, cookies, cakes, and pie

- Sugary gum
- Crackers, breadsticks, and chips
- Dried fruits and raisins

### Dental Check-Ups

- Visit your dentist at least once every six months. To maintain healthy teeth and gums, it's important to have regular check-ups and professional cleanings. You should also see your dentist if you have pain in your teeth or mouth or bleeding, swollen gums.
- You can also ask your dentist about dental sealants. Sealant is a material used to coat the top, chewing surfaces of the back teeth. This coating protects the tooth from decay and usually lasts a long time.

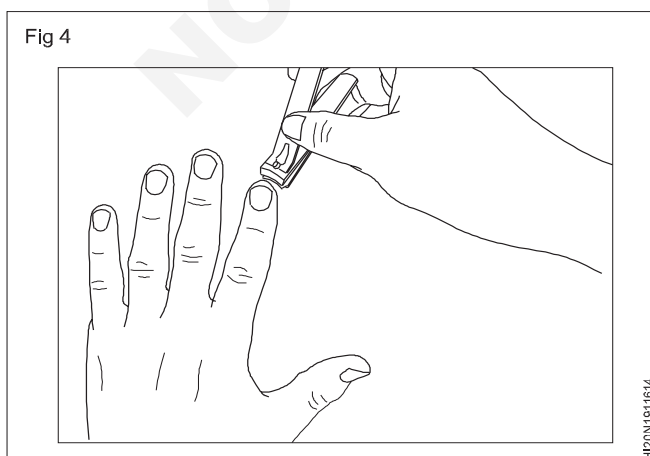
### Care of hands

Wash with a moisturizing hand soap. It's important to keep your hands clean, but using an antibacterial hand soap can dry out your skin. Instead, wash your hands with a moisturizing soap that contains hydrating ingredients, such as shea butter, olive oil, or Aloe Vera, to avoid stripping the natural oils from your skin.

- When you wash your hands, avoid using hot water, which can also dry out your skin. Wash with lukewarm water instead.
- Fragrance-free soaps are gentler on your skin.
- It's important to wash your hands regularly to prevent the spread of contagious disease. You should at least wash your hands before you eat and after you use the bathroom. However, too much hand washing can irritate your skin

**Clean under your nails with a nail brush.** Even if you wash your hands regularly, there may be dirt and grime under your fingernails that doesn't rinse away. While you're washing your hands, use a good quality nail brush to gently scrub beneath your nails and remove any dirt that may be stuck there.

- When you use the brush, hold it in a downward direction so it's perpendicular to your nails. Move it along the entire nail, scrubbing back and forth to remove the dirt and debris.
- After scrubbing your nails, rinse away the soap,



water, and dirt as you normally would.

**Keep your nails trim and well-shaped.** You'll have an easier time keeping your nails clean if you groom them properly. Use nail clippers to keep them at a length that you like, and file them with a crystal nail file or gentle emery board into a neat shape, such as a square or oval. It's also a good idea to use a cuticle remover and cuticle pusher to keep your cuticles neat. The cuticle is the thin hand of skin around your nail. The remover softens the skin, so you can easily push it back with a metal cuticle pusher or a wooden orange stick. Never cut your cuticles -- the skin may get infected.

**Exfoliate your hands weekly.** Use a hand scrub once a week to buff away the dry, rough skin and keep your hands soft and healthy. Wet your hands with lukewarm water, and massage a small amount of the scrub over both of your hands, working in circular motions. Rinse it off with warm water, and apply a hand cream.

- Wash your hands with the moisturizing soap before exfoliating.
- You can purchase hand scrubs at the drugstore, beauty supply store, and other stores that sell bath products.
- If you prefer, you can mix up your own all-natural hand scrub with ingredients from your kitchen. Combine equal parts of sugar and olive oil, and use it to scrub the dead skin from your hands.

Apply hand cream regularly. To ensure that your hands stay soft, you should use a hand cream several times a day. Look for a formula that contains emollient ingredients, such as glycerine, shea butter, and natural oils. Massage the cream in after you wash your hands in the morning and before you go to bed at night. If your hands start to feel dry at any point during the day, reapply then as well.

- If you're worried about your hands being greasy, look for a hand cream that's designed to be fast-absorbing. It will sink into your skin quickly without leaving any residue behind that might make your hands feel slippery.
- Thick emollient creams can help you avoid dryness or roughness on your hands.
- The skin on men's hands tends to be thicker, oilier, and hairier, so you may want to purchase a cream designed specifically for male skin. It usually has a richer texture, and doesn't contain any fragrance.

**Use vitamin E oil to moisturize your nails.** While you should rub your hand cream over your nails to keep them moisturized, it's also important to target them directly with more intensive treatments. To keep your cuticles healthy, apply a vitamin E oil to the skin around your nails each night before you go to bed. That will help prevent the skin from becoming cracked and painful.

- You can also purchase a cream specifically for the cuticles that can help moisturize and protect the area.

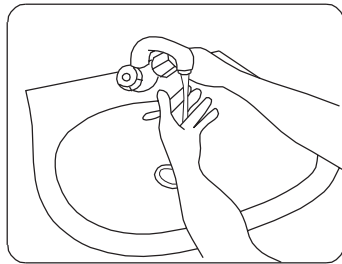
- Both men and women should take the time to moisturize their nails and cuticles. Whether or not you get regular manicures, neglecting your cuticles can lead to painful hangnails.

cream can provide. Reach for a rich ointment instead -- it will deliver moisture and create a barrier over your skin that helps protect and heal. If you don't have a specific ointment for your hands, petroleum jelly works just as well.

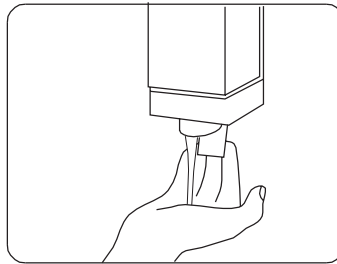
**Treat cracks on your hands with an ointment.** When your hands become extremely dry, the skin may actually crack and split. To treat this painful type of dry skin, you need more intensive moisture than a regular hand

**Treat your hands with a mask weekly.** Even if you moisturize your hands daily, they may not get all the moisture that they need. Use a hand mask once a week

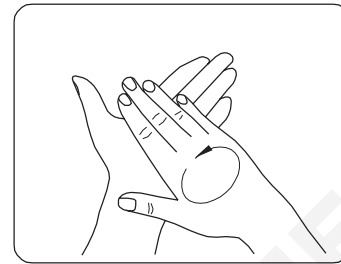
Fig 5



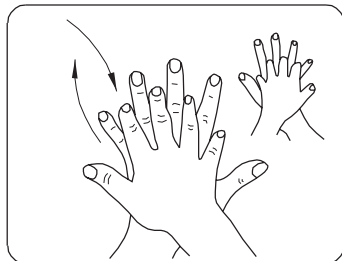
WET HANDS WITH WATER



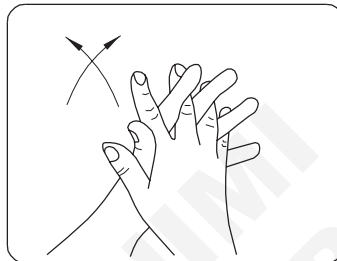
APPLY SOAP



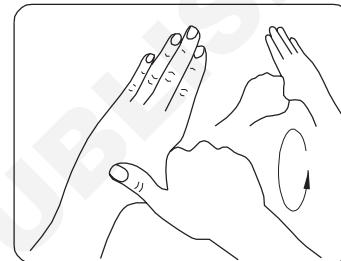
RUB PALM TO PALM



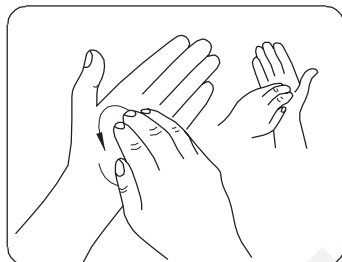
RUB PALM TO PALM WITH FINGERS INTERLACED



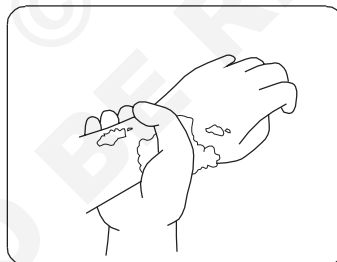
RUB BACK OF EACH HAND WITH THE PALM OF THE OTHER



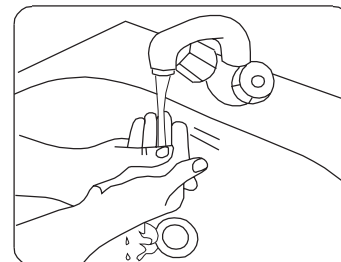
RUB EACH THUMB USING A ROTATIONAL MOVEMENT



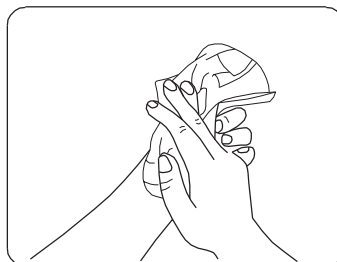
CIRCULARLY RUB THE TIPS OF YOUR FINGERS IN EACH PALM



RUB EACH WRIST WITH YOUR OTHER HAND



RINSE HANDS WITH WATER



DRY THOROUGHLY WITH A SINGLE USE TOWEL

HAND WASHING TECHNIQUE WITH SOAP AND WATER

HE20NT1911615

to deliver a super dose of hydration that keeps the skin on your hands soft and healthy. Apply it to clean, dry hands, and allow it to sit for the specified time on the packaging. Wash it off with warm water, and follow up with a hand cream to lock in the moisture.[10]

- You can purchase hand masks at drugstores, beauty supply stores, and other stores that specialize in skincare products.
- You can also make a moisturizing hand mask at home with leftover avocado. Mix ½ an avocado with 1 egg white, and apply it to your hands. Allow it to sit on your skin for 20 minutes before rinsing it off.

**Wear gloves when doing chores.** Plenty of the tasks that you have to do around the house can do damage to your hands. Whether you're washing dishes, doing yard work, or working with tools, always put on a pair of protective gloves first. That will keep your hands from getting dry, cracked, and callused.

- For chores that require submerging your hands in water, plastic or rubber gloves are the best option.
- For light yard work and gardening, cloth gloves are usually effective in protecting your hands from dirty and grime.
- For difficult manual labor, such as working with heavy tools, suede or leather work gloves usually offer the most protection for your hands.
- You should also wear gloves to protect your hands from cold weather, which can dry out your hands too. Knit and leather gloves can both work well, but look

for a pair with an insulated lining in material such as fleece to provide the most warmth.

### Hand Washing Steps:

- 1 Wet your hands and apply liquid hand wash
- 2 Rub it on your hands and between your fingers
- 3 Make sure to rub it on the back of your hands too
- 4 Don't forget the back of your fingers and thumbs
- 5 Remember to clean your finger nails as well
- 6 Finish off by soaping your wrists before rinsing the liquid hand wash off
- 7 Rinse with clean running water
- 8 Dry with a clean towel or paper towel

### Importance of regular exercise and nutritious food

If you pair regular exercise with a well-balanced diet, you'll notice immediate changes in mood and

energy levels. More importantly, consistently eating well and exercising will improve your health and extend your lifespan.

### Energy

If you eat healthy, small snacks and meals throughout the day, you'll keep your blood sugar from crashing and feel more energetic. If you hit the gym for 30 minutes each day, you'll have the added benefit of a neurotransmitter called serotonin, which is a natural mood booster.

### Weight Control

Losing weight and keeping it off takes a combination of eating fewer calories and burning more energy. Eat nutrient-dense, low-calorie foods such as fruits, vegetables and lean meats and other proteins that will fill you up. Integrate physical activity into your everyday routine in addition to scheduled exercise. For instance, take the stairs at work or park at the far end of the lot.

### Health

Regular exercise and good nutrition may ameliorate or prevent a myriad of conditions including heart disease, hypertension, stroke, Type 2 diabetes, arthritis, osteoporosis and depression.

### Self-Esteem

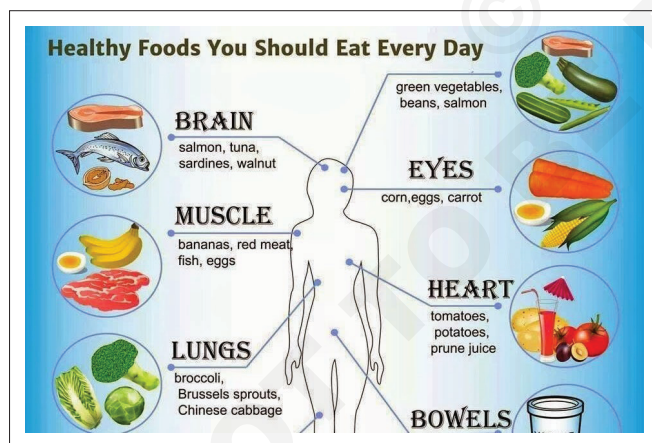
There is nothing like running farther or improving your physique to boost your self-esteem. Take time to enjoy your new healthy lifestyle. Update your wardrobe and enroll in a cooking class.

### Sleep

If you exercise vigorously for 30 minutes a day, you may find you sleep much more soundly at night. A good night's rest will improve your mental acuity and energy levels the next day

### Menstrual Hygiene

Menstrual Hygiene is vital to the empowerment and well-



being of women and girls worldwide. It is about more than just access to sanitary pads and appropriate toilets – though those are important. It is also about ensuring women and girls live in an environment that values and supports their ability to manage their menstruation with dignity.

### Reproductive tract infections and complications

Reproductive tract infections (RTI) refers to three different types of infections affecting the reproductive tract:

- 1 Endogenous infections are probably the most common RTI worldwide. They result from an overgrowth of organisms normally present in the vagina. Endogenous infections include candidiasis and bacterial vaginosis. These infections can be easily treated and cured.
- 2 Iatrogenic infections occur when the cause of infection (bacteria or other microorganism) is introduced into the reproductive tract via a medical procedure, such as menstrual regulation, abortion, insertion of an IUD or during childbirth. This can happen if the surgical instruments used during the procedure has not been properly sterilized, or an infection, which was already present in the lower reproductive tract is pushed through the cervix into the upper reproductive tract.
- 3 Sexually transmitted diseases (STDs) are caused by viruses, bacteria or parasites microorganisms that are transmitted through sexual activity with an infected partner. About 30 different sexually transmitted infections have been identified, some of which are easily treatable, many of which are not. HIV, the virus that causes AIDS, is perhaps the most serious sexually transmitted infection, since it eventually leads to death. STDs affect men and women, and can also be transmitted from mother to child during pregnancy and childbirth.

Female RTI usually originate in the lower genital tract, such as vaginitis or cervicitis and can produce symptoms such as:

- Abnormal vaginal discharge ,
- Genital pain and itching
- Burning feeling with urination
- Abdominal pain
- Irregular mensural cycle
- Blood stained discharge

### Menstrual hygiene management

Menstrual hygiene management (MHM) practices vary worldwide and depend on the individual's socioeconomic status, personal preferences, local traditions and beliefs, and access to water and sanitation resources. MHM practices can be particularly unhygienic and inconvenient for girls and women in poorer settings. Little is known about whether unhygienic MHM practices increase a woman's exposure to urogenital

infections, such as bacterial vaginosis (BV) and urinary tract infection (UTI).

Menstrual hygiene is an important issue that affects healthy adolescent girls and pre-menopausal adult women monthly. Around the world women have developed their own personal strategies to cope with menstruation, which vary from country to country and depend on economic status, the individual's personal preferences, local traditions and cultural beliefs and education status. Often methods of management can be unhygienic and inconvenient, particularly in poorer settings. In India, between 43% and 88% of girls wash and reuse cotton cloths rather than use disposable pads. However reusable material may not be well sanitized because cleaning is often done without soap and with unclean water, and social taboos and restrictions force drying indoors, away from sunlight and open air. Unhygienic washing practices are particularly common in rural areas and amongst women and girls in lower socio-economic groups. Menstrual hygiene

#### DISPOSING A SANITARY PAD

- Wrap the soiled napkin in its plastic cover or a leak-proof bag
- If unavailable, wrap it in few layers of toilet paper or paper bag
- Discard in a trash that is out of reach of pets and animals
- Use trash cans located inside cabinets, like under the bathroom sink, or ones with lids
- Do not flush, burn or mix it with wet, household garbage

management (MHM) is also likely to be affected by contextual factors, such as access to places where women can manage menstruation-related washing in privacy and comfort. These factors are influenced by having access to water, hygiene and sanitation facilities at the household, and their link with MHM and with urogenital infections.

In urban areas, people follow either solid waste management or flush the sanitary pads in toilets, while in rural India, there are many options like burning and burying. In rural areas, women mostly use clothes or reusable pads. In many slum areas, women dispose of their menstrual waste into pit latrines, as burning and burial are difficult due to limited space. There are no proper disposal bins in some schools and colleges, which is why many girls choose to remain absent during menstruation.

Some schools do have incinerators for disposal of menstrual waste. However, disposing habits also vary on the basis of places, regions, cultures and houses. In case of no bins, menstrual waste is either thrown in the corners of public toilet facilities, oftentimes unwrapped. In many cities, a major complaint heard regarding the cleaning of public toilets is blockage of sewage systems due to flushing of menstrual waste in toilets.

In our country, sanitation systems have been constructed

only for urine and faeces. These systems are inefficient as far as menstrual materials are concerned; sewage pipelines cannot absorb them and result in clogging. Furthermore, menstrual waste is easily decomposable in landfills, except for the plastic cover of commercial sanitary pads, which takes years to decompose, leaving the plastic line. Usually, in rural areas, huge pits are dug collectively due to space constraints. Menstrual waste is thrown in these pits and later, burnt or buried.

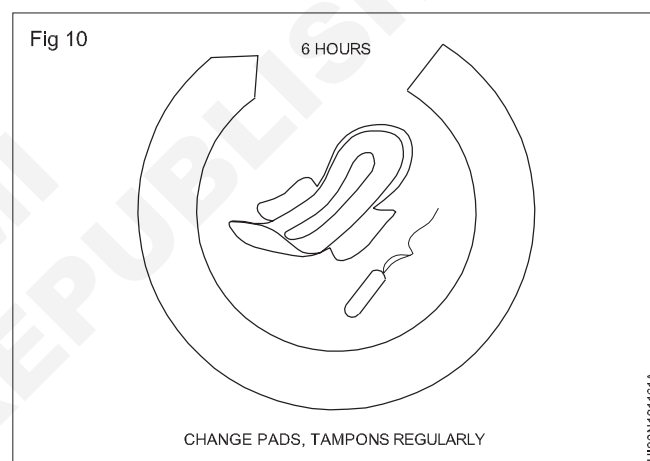
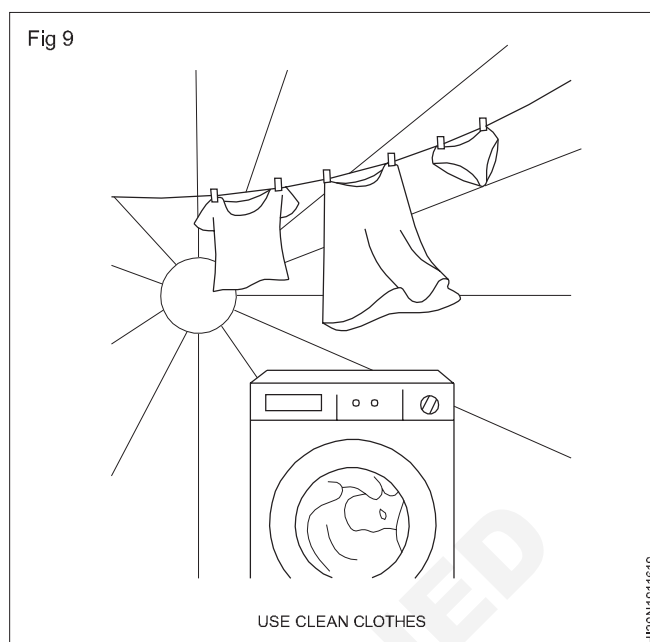
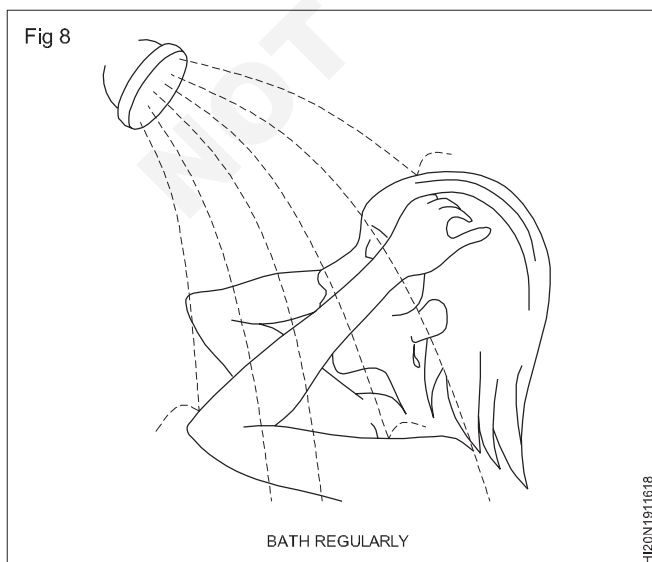
However, as commercial disposable sanitary pads make their way to rural areas, the pit system of disposal is becoming more and more redundant. To improve the design of sanitary pads, manufacturers design adhesive wings, which make biodegradation tougher. These pads, when flushed into the toilets, clog them.

Sewage system blockage due to poor disposal systems for menstrual waste management has become a global issue. Women who live on riversides dispose of these pads into the rivers, which infests germs and breeds many pathogenic microorganisms. A blood-soaked sanitary product may contain hepatitis and HIV viruses, which may retain their microbe activity in the soil and live up to six months in the soil. When sewage workers try to clean the clogs, they may get exposed to several pathogens and chemicals, and fall sick.

Incineration of menstrual waste causes pollution as the harmful chemical gases produced are toxic and carcinogenic. The current solid waste management in India faces an unintended result of providing plastic wrappers for waste disposal, which increases waste and pollution.

Two solutions currently exist. Incinerators have emerged as a favoured disposal and treatment option, particularly in schools. On the other hand, cities including Bangalore and Pune are implementing a solid waste intervention to segregate and identify menstrual waste during routine garbage collection effectively. These two solutions meet a growing need to manage menstrual waste appropriately.

### Practical field exposure on menstrual hygiene



You can take the following hygiene measures during menstruation:

- Take a bath or shower at least once a day.
- Use clean undergarments and change them regularly.
- Change pads or tampons regularly.
- Wash the genital area with plain water (no soap) after each use of toilet and even after urination.
- Keep the area between the legs dry, otherwise you may experience chafing.
- It is very important to remember that vagina has its own self-cleaning mechanism and an external cleaning agent like deodorant or soap should not be used inside it.

Practice	Health risk
Unclean sanitary pads/materials	Bacteria may cause local infections or travel up the vagina and enter the uterine cavity.
Changing pads infrequently	Wet pads can cause skin irritation which can then become infected if the skin becomes broken.
Insertion of unclean material into vagina	Bacteria potentially have easier access to the cervix and the uterine cavity.
Using highly absorbent tampons during a time of light blood loss	Toxic Shock Syndrome (see right).
Use of tampons when not menstruating (eg to absorb vaginal secretions)	Can lead to vaginal irritation and delay the seeking of medical advice for the cause of unusual vaginal discharge <sup>30</sup> .
Wiping from back to front following urination or defecation	Makes the introduction of bacteria from the bowel into the vagina (or urethra) more likely.
Unprotected sex	Possible increased risk of sexually transmitted infections (see below) or the transmission of HIV or Hepatitis B during menstruation.
Unsafe disposal of used sanitary materials or blood	Risk of infecting others, especially with Hepatitis B (HIV and other Hepatitis viruses do not survive for long outside the body and pose a minimal risk except where there is direct contact with blood just leaving the body).
Frequent douching (forcing liquid into the vagina)	Can facilitate the introduction of bacteria into the uterine cavity <sup>31</sup> .
Lack of hand-washing after changing a sanitary towel	Can facilitate the spread of infections such as Hepatitis B or Thrush <sup>32</sup> .

## **Demography and health survey**

**Objectives:** At the end of this lesson you shall be able to

- **state demography**
- **state the death rate, birth rate, MMR, IMR, etc...**
- **identify the various acts and its importance**
- **state air and water pollution control acts**

### **Definition**

The Demographic and Health Surveys (DHS) Program is responsible for collecting and disseminating accurate, nationally representative data on health and population in developing countries. The project is implemented by ICF International and is funded by the United States Agency for International Development (USAID) with contributions from other donors such as UNICEF, UNFPA, WHO, and UNAIDS. The DHS is highly comparable to the Multiple Indicator Cluster Surveys and the technical teams developing and supporting the surveys are in close collaboration.

### **Introduction**

Since September 2013, ICF International has been partnering with seven internationally experienced organizations to expand access to and use of the DHS data: Johns Hopkins Bloomberg School of Public Health Center for Communication Programs; Program for Appropriate Technology in Health (PATH); Avenir Health; Vysnova; Blue Raster; Kimetrica; and EnCompass.

Since 1984, The Demographic and Health Surveys (DHS) Program has provided technical assistance to more than 300 demographic and health surveys in over 90 countries. DHS surveys collect information on fertility and total fertility rate (TFR), reproductive health, maternal health, child health, immunization and survival, HIV/AIDS; maternal mortality, child mortality, malaria, and nutrition among women and children stunted. The strategic objective of The DHS Program is to improve and institutionalize the collection and use of data by host countries for program monitoring and evaluation and for policy development decisions.

### **The DHS Program supports the following data collection options:**

- Demographic and Health Surveys (DHS): provide data for monitoring and impact evaluation indicators in the areas of population, health, and nutrition.
- AIDS Indicator Surveys (AIS): provide countries with a standardized tool to obtain indicators for the effective monitoring of national HIV/AIDS programs.
- Service Provision Assessment (SPA) Surveys: provide information about the characteristics of health and family planning services available in a country.
- Malaria Indicators Surveys (MIS): Provide data on

bednet ownership and use, prevention of malaria during pregnancy, and prompt and effective treatment of fever in young children. In some cases, biomarker testing for malaria and anemia are also included.

- Key Indicators Survey (KIS): provide monitoring and evaluation data for population and health activities in small areas—regions, districts, catchment areas—that may be targeted by an individual project, although they can be used in nationally representative surveys as well.
- Other Quantitative Data: include Geographic Data Collection, and Benchmarking Surveys.
- Biomarker Collection: in conjunction with surveys, more than 2 million tests have been conducted for HIV, anemia, malaria, and more than 25 other biomarkers.
- Qualitative Research: provides information outside the purview of standard quantitative approaches.

### **Factors of Demography**

Demographic factors are essential to the study of child development. Children grow up in countries with very different health and socioeconomic contexts that vary on both the macro- and micro-level. Macro-level contexts are defined by demographic factors at the country, state, county, and city level, and they affect everyone in a given location. Education and healthcare systems and the economy are examples of macro-level contexts. Micro-level contexts are defined by the demographic characteristics of individuals. Examples of micro-level contexts are family income and educational attainment. Child well-being indicators are measures used to track macro and micro health and socioeconomic demographic contexts over time and across populations.

The health and socioeconomic demographic contexts of children throughout the world vary vastly and portray a picture of 'haves' in the MDCs and 'have nots' in the LDCs. Children in MDCs grow up in the context of developed social and economic infrastructures that provide good healthcare, schooling, and an abundance of food. By contrast, children in LDCs often do not even have access to healthcare, schools, or food. Thus, children in LDCs face significant challenges to normal



development. Children in the sub-Saharan region of Africa and those in South Asia grow up in the least hospitable health and socioeconomic demographic contexts. One cannot help but think of the remarkable resiliency of the Asian and African children who do survive childhood, given the overwhelming demographic factors they overcome. Demographic factors, including gender, age, race, and ethnicity, provide a general indication of those groups in the general population that are at the highest risk of suicide. As indicated in almost all countries, the risk of suicide is greater among males than females, and globally for both genders the suicide risk increases with age.

### Various Stages of Demography

Studying the world population since 1650 suggests that demographic transition of a nation involves of 5 stages. These stages constitute the “demographic cycle”.

#### 1 FIRST STAGE (High stationary)

It is characterized by both

- A high birth rate and
- A high death rate

Therefore the population remains stationary

It is seen when the country is economically most weak India was in this stage till 1920

#### 2 SECOND STAGE (Early expanding)

It begins with the

- Declining of death rate while
- Birth rate still remains high.

As a result a huge increase of population occurs.

The DR decline is mainly due to improvements in food supply, health care and sanitation)

At present many developing countries of Asia and Africa are in this stage

The BRs have actually increased in some of these countries probably because of:

- improved health care provisions, and
- shortening periods of breast-feeding

#### 3 THIRD STAGE (Late expanding)

- Death rate declines further and
- Birth rate now begins to fall.

However, as the BR still exceeds the DR, there is an increase of population

The fall in BR results mostly from access to contraceptives, women empowerment etc.

India appears to be this stage.

In some developing countries (e.g. China, Singapore) birth rates too have declined fast.

#### 4 FOURTH STAGE (Low stationary)

This stage is characterized with

- Low birth rate and
- Low death rate

Consequently, the population remains stationary.

An aging population is a feature of this stage.

Japan, Sweden, Belgium, Denmark and Switzerland are in this stage

Most industrialized countries have undergone a demographic transition

- From a high BR and high DR
- To low BR and low DR
- Zero population growth has already been recorded in Austria during 1980- 85.
- Growth rate as low as 0.1 was recorded in UK, Denmark, Sweden and Belgium during 1980-85.

#### 5 FIFTH STAGE: (Declining)

Birth rate is now lower than death rate

Hence the population begins to decline

Some East European countries (e.g. Germany and Hungary) and some north European countries (e.g.

Sweden, Norway) are now in this stage

#### Health Survey

The first phase of the fifth round of the National Family Health Survey (NFHS-5) was conducted in 2019-20 and its findings were released in December 2020. The NFHS provides estimates on key indicators related to population, family planning, child and maternal health, nutrition, adult health, and domestic violence, among others. The fourth round of NFHS was conducted five years ago in 2015-16. In the first phase of the fifth round, the findings for 22 states and union territories (17 states and 5 union territories) have been presented. A total of 2,81,429 households, 3,07,422 women, and 43,945 men were surveyed across the 17 states. In this note, we look at the findings for the 17 states on indicators related to: (i) population, (ii) health and nutrition, (iii) access to infrastructure, and (iv) gender.

#### Population

In this section, we look at certain indicators related to population: (i) use of family planning methods (includes female or male sterilization, and use of contraceptives), (ii) Total Fertility Rate (TFR), and (iii) sex ratio at birth. TFR is the average number of children born to a woman in her life time. Governments set targets for TFR for the purpose of population control. TFR of 2.1 is considered as the replacement level fertility rate at which population stability is achieved (i.e., population replaces itself). The National Population Policy, 2000 had sought to achieve replacement level fertility by the year 2010.

Use of family planning methods increased; most states reduce their fertility rate, below the target level

- All states (except Mizoram) have seen an increase in the use of family planning methods. Goa (42%-point) and Bihar (32%-point) have seen the highest increase in the use of family planning methods.

Figure 1: Use of Family Planning methods (in %)

Note: AP = Andhra Pradesh, AS = Assam, BR = Bihar, GA = Goa, GJ = Gujarat, HP = Himachal Pradesh, KA = Karnataka, KL = Kerala, MH = Maharashtra, MG = Meghalaya, MZ = Mizoram, NL = Nagaland, SK = Sikkim, TS = Telangana, TR = Tripura, WB = West Bengal

- Consequently, most states have seen a decrease in the total fertility rate (TFR). Bihar's TFR has declined from 3.4 (in NFHS-4) to 3. All other medium and large states in the survey (i.e., population above 1 crore) have a TFR below the replacement level rate of 2.1.

### Sex ratio at birth has declined in a few states

- Sex ratio at birth for children born in the last five years is below 950 for seven (of the 17) states. Sex ratio at birth is the number of female children born per 1,000 male children born. In three states, the

ratio is below 900 (Goa: 838, Himachal Pradesh: 875, and Telangana: 894).

- The ratio has declined in seven states. The most notable decline was in Goa (from 966 to 838), and Kerala (from 1,047 to 951). Only Tripura has a sex ratio at birth above 1,000 (i.e., more females born than males).

### Health and Nutrition

In this section, we look at certain health related indicators: (i) proportion of institutional births across states, (ii) the average out of pocket expenditure for deliveries at public health facilities, (iii) infant mortality rate (IMR), and (iv) nutrition levels for children and adults. IMR is the number of infants who die before reaching the age of one year, per 1,000 live births. Institutional deliveries are helpful in reducing infant mortality rates.

### Population Control Measures

Population of India is quite large and rapidly increasing. One per cent growth rate means an addition of 1 crore people every year. Effective population control measures are the need of the hour. We know that birth rate is mainly responsible for rapid population growth. Hence measures which can reduce the birth rate should be adopted. These measures can be classified into 3 heads.

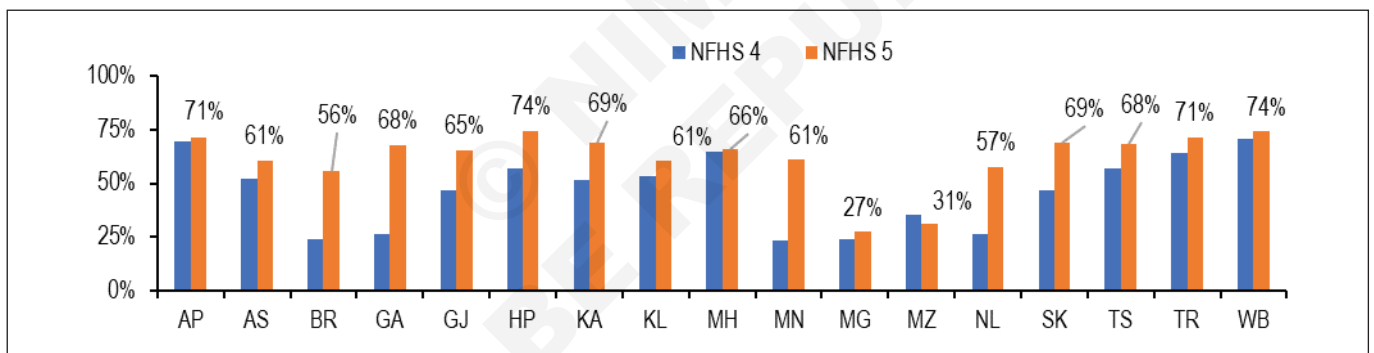


Figure 2: Total Fertility Rate across states

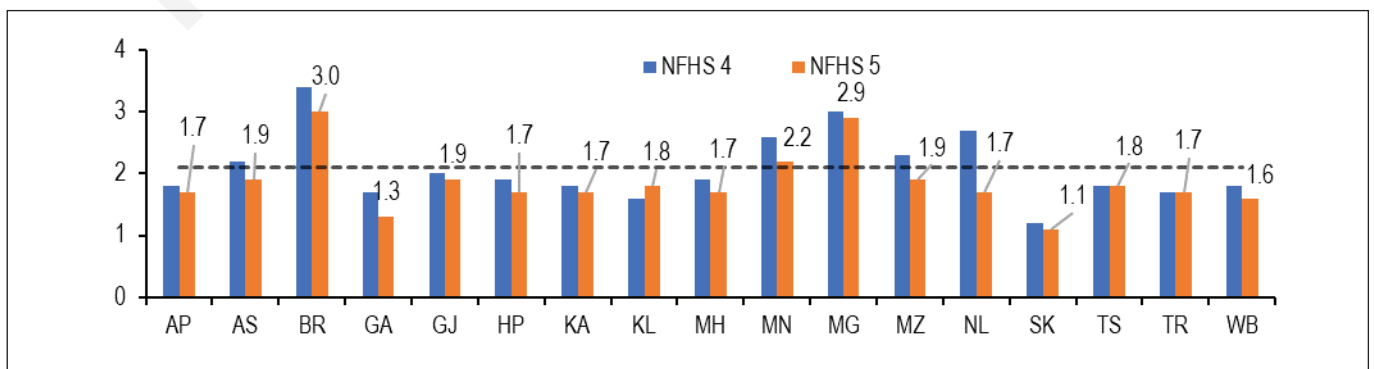
### 1 Social Measures

Population explosion is a social problem and it is deeply rooted in the society. So efforts must be done to remove the social pressures in the country.

- Minimum age of Marriage: Fertility depends on the age of marriage. The minimum age of marriage

should be strictly enforced. In India minimum age for marriage is 21 years for men and 18 years for women have been fixed by law. This law should be firmly implemented and people should also be made aware of this through publicity.

- Raising the Status of Women: There is still discrimination to the women. They are often confined to the house. They are still confined to rearing and



bearing of children. So women should be given opportunities to develop socially and economically. Free education should be given to them.

3 Spread of Education: The spread of education changes the outlook of people. Educated men prefer to delay marriage and adopt small family norms. Educated women are health conscious and avoid frequent pregnancies and thus help in lowering birth rate.

4 Social Security: More people should be covered under-social security schemes. So that they do not depend upon others in the event of old age, sickness, unemployment etc. with these facilities they will have lesser desire for more children.

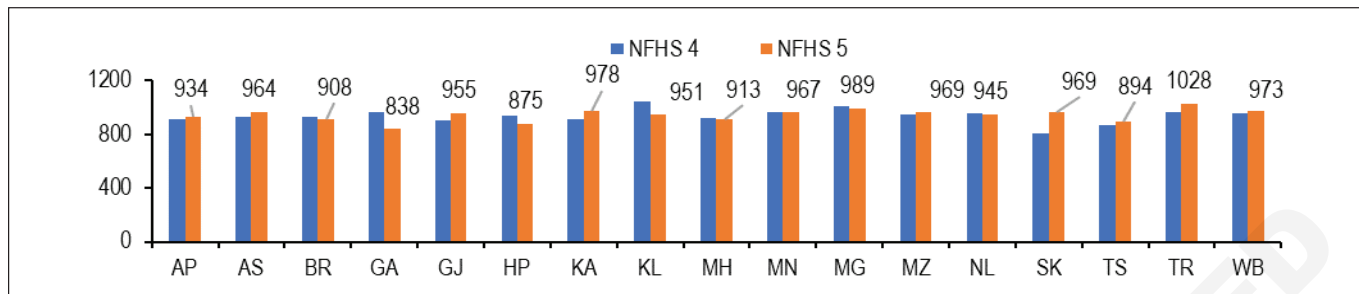


Figure: 3: Sex ratio at birth for children born in the last five years

## 2 Economic Measures –

1 Development of Agriculture and Industry: If agriculture and industry are properly developed, large number of people will get employment. When their income is increased they would improve their standard of living and adopt small family norms.

2 Standard of Living: Improved standard of living acts as a deterrent to large family norm. In order to maintain their higher standard of living people prefer to have a small family. According to A.K. Das Gupta those who earn less than Rs. 100 per month have on the average a reproduction rate of 3.4 children and those who earn more than Rs. 300 per month have a reproduction rate of 2.8 children.

3 Urbanisation: It is on record that people in urban areas have low birth rate than those living in rural areas. Urbanisation should therefore be encouraged.

## 3. Other Measures –

1 Late Marriage: As far as possible, marriage should be solemnized at the age of 30 years. This will reduce the period of reproduction among the females bringing down the birth rate.

2 Family Planning: This method implies family by choice and not by chance. By applying preventive measures, people can regulate birth rate. This method is being used extensively; success of this method depends on the availability of cheap contraceptive devices for birth control.

3 Publicity: The communication media like T.V., radio and newspaper are good means to propagate the benefits of the planned family to the uneducated and illiterate people, especially in the rural and backward areas of country.

4 Incentives: The govt. can give various types of incentives to the people to adopt birth control measures. Monetary incentives and other facilities like leave and promotion can be extended to the

working class which adopts small family norms.

5 Employment of Women: Another method to check the population is to provide employment to women. As a result their number in teaching, medical and banking etc. will increase rapidly. Due to job pressure and promotion they will delay having children.

## Public Health Act Definition

Public health policy that integrates concepts from law, medicine, health care, and public health. Public health law typically includes certain public health interventions of a legal nature. Thus, implementation of public health law is an essential element in ensuring population-level health, especially through governmental entities. It provides public health professionals with the legal basis for their practice and defines the scope of their practice. In recent decades, public health law has developed as a specialization – both for general lawyers and public health practitioners. International legislation such as international health regulations and public health treaties call for legal expertise in public health, at both national and international levels.

## Introduction

Reformers had from the 1830s wanted to resolve sanitary problems in urban areas, because sewage was flowing down the street daily, including the presence of sewage in living quarters. In 1848 their efforts led to the establishment of a three-man Board of Health – if one with very limited powers. Many factors delayed effective implementation of reform, however, such as the fact that to perform a clean-up would cost money, and neither government, factory owners, nor local authorities were keen to pay. Gradually, however, reformers helped to counteract the laissez-faire attitude of the government and public. In 1871, the Board of Health was subsumed into the Local Government Board by the Liberal Party; and when the Conservatives came to power in 1874, they were committed by Disraeli to extending social

reform. A public health Act was introduced in 1875. Home Secretary Richard Cross was responsible for drafting the legislation, and received much good will from trades union groups in the consequent years for “humanising the toil of the working man”. Disraeli ensured the passing of the 1875 Act; and when mocked by his opponents for neglecting more important political reforms, retorted on them with the resounding phrase “sanitas sanitatum, omnia sanitas”.

### Importance of Acts

The Act made it compulsory for local powers to:

- Purchase, repair or create sewers
- Control water-supplies
- Regulate cellars and lodging houses
- Establish by-laws for controlling new streets and buildings

With the rapid urbanization that accompanied the Industrial Revolution, huge swathes of terraced houses had been built to accommodate the factory workers. The contrast between the housing stock built before the passage of the Act and that built after it was stark. The Act required all new residential construction to include running water and an internal drainage system, and also led to the government prohibiting the construction of shoddy housing by building contractors.

The Act also meant that every public health authority had to have a medical officer and a sanitary inspector, to ensure the laws on food, housing, water and hygiene were carried out; and that towns had to have pavements and street lighting.

It is, however, important to realize that the new powers provided were permissive, not compulsory: they provided a model of best practice for municipalities, but actual implementation remained for the most part up to the individual local authority.

### Indian Epidemic Disease Act

The Epidemic Diseases Act, 1897 is a law which was first enacted to tackle bubonic plague in Mumbai (formerly Bombay) in former British India.[3] The law is meant for containment of epidemics by providing special powers that are required for the implementation of containment measures to control the spread of the disease

#### Section 2 of the Act

When at any time the [State Government] is satisfied that [the State] or any part thereof is visited by, or threatened with, an outbreak of any dangerous epidemic disease, the [State Government], if it thinks that the ordinary provisions of the law for the time being in force are insufficient for the purpose, may take, or require or empower any person to take, such measures and, by public notice, prescribe such temporary regulations to be observed by the public or by any person or class of persons as it shall deem necessary to prevent the outbreak of such disease or the spread thereof, and may determine in what manner and by whom any

expenses incurred (including compensation if any) shall be defrayed.

### Powers of Central Government

When the Central Government is satisfied that India or any part thereof is visited by, or threatened with, an outbreak of any dangerous epidemic disease and that the ordinary provisions of the law for the time being in force are insufficient to prevent the outbreak of such disease or the spread thereof, the Central Government may take measures and prescribe regulations for the inspection of any ship or vessel leaving or arriving at any port and for such detention thereof, or of any person intending to sail therein, or arriving thereby, as may be necessary.

### Penalty

Any person disobeying any regulation or order made under this Act shall be deemed to have committed an offence punishable under section 188 of the Indian Penal Code (45 of 1860).

### Protection to persons acting under Act

No suit or other legal proceeding shall lie against any person for anything done or in good faith intended to be done under this Act. The Act has been routinely used to contain various diseases in India such as swine flu, cholera, malaria and dengue. In 2018, the Act was enforced as cholera began to spread in a region of Gujarat. In 2015, it was used to deal with dengue and malaria in Chandigarh and in 2009 it was invoked in Pune to combat swine flu. Following the COVID-19 pandemic the Cabinet Secretary of India on 11 March 2020 announced that all states and Union territories should invoke provisions of Section 2 of the Epidemic Diseases Act, 1897. Since March 2020, the act is being enforced across India in order to limit the spread of COVID-19.

### Epidemic, Endemic and Pandemic Diseases

Infectious diseases are spread by either bacterial or viral agents and are ever-present in society. Usually infected cases are present in numbers below an expected threshold but every once in a while there may be an outbreak, a new strain or a new disease that has a significant impact at either a local or global level. The spread and rate of new cases can be classified as:

- Endemic - describes a disease that is present permanently in a region or population
- Epidemic - is an outbreak that affects many people at one time and can spread through one or several communities
- Pandemic - is the term used to describe an epidemic when the spread is global.

### Endemic

Endemic is derived from Greek en meaning in and demos meaning people. It is used to describe a disease that is present at an approximately constant level within a society or country. Each country may have a disease

that is unique, for example

Caribbean Dengue is still present due to a failure to eradicate the *Aedes aegypti* mosquito (see image R). Dengue first appeared in the Americas and the Caribbean and with the assistance of the Pan American Health Organisation (PAHO) in the 1950s and 1960s the Americas were largely able to eradicate the presence of the *Aedes Aegypti* virtually eliminating the occurrence of Dengue. However, failure to eradicate its presence in the Caribbean resulted in the continued transmission throughout the region and more recently it has found its way back into the Americas causing several epidemics.

Varicella, more commonly known as chickenpox in the UK. It is more common in children under the age of 10, who often only experience mild symptoms and after exposure develop a natural immunity to the virus. Although there is a vaccine available it is only offered to those who are seen as vulnerable.

### **Epidemic**

An epidemic is derived from Greek *epi* meaning upon or above and *demos* meaning people and is the term used to describe a situation where a disease spreads rapidly to a large number of people in a given population over a short time period. The term epidemic is not just used with infectious diseases. It is also used with any scenario that leads to a detrimental rise of health risks within a society. e.g.,

The rise in obesity globally (often described as an "obesity epidemic"). Over the last 3 decades, the United States has seen an increase in the number of people who have a BMI higher than the recommended average. When the term epidemic is used in connection with infectious diseases it is due to the sudden rise of cases usually resulting from a new infectious agent or a change in an existing agent, for example:

- An agent moving between host populations, for example moving from animals to humans (zoonotic diseases).
- A genetic change (mutation) in the infectious agent, eg bacteria, virus, fungi or parasite.
- Introduction of new pathogens to a host population.

Epidemics can follow predictable patterns and these trends are often used to monitor, predict and control the spread of the infection. A typical example of this is seasonal flu.

### **Pandemic**

A pandemic is derived from Greek *pan* meaning all and *demos* meaning people and is the term used to describe the rapid spread of a transmissible infectious/communicable disease over several continents or worldwide. Once an epidemic becomes global and affects a large percent of the population it becomes known as a pandemic. The terms pandemic and epidemic are used to describe the rate and distance of the spread of the disease and not the severity of the disease.

### **Significant features of a pandemic are listed below:**

- Affects a wider geographical area, often global
- Infects a very large number of people
- Often caused by a new virus or a new strain of a virus that has been dormant for many years
- Spreads quickly in humans as there is little to no existing immunity
- Can cause a high number of deaths
- Because of the need to control the spread of the disease, there is often social disruption, unrest and economic loss

### **Six Phases of Pandemic**

The WHO has identified six phases that it follows before declaring a pandemic. Phase 1 represents a low risk and phase 6 is a full-blown pandemic, you can see the phases below:

- Phase 1 - a virus is seen in animals but has not been shown to infections in humans
- Phase 2 - a known animal virus has caused an infection in humans
- Phase 3 - scattered or isolated incidence of cases or small clusters of the disease occurring in humans; possible cases of human-to-human transmission but not at a level to cause community-level outbreaks
- Phase 4 - human to human transmission at a rate that causes an outbreak in communities
- Phase 5 - the spread of the disease between humans is now evident in more than one country
- Phase 6 - community-level outbreaks are in at least one additional country other than that seen in phase 5.

### **Epidemiology**

Epidemiology is the method used to find the causes of health outcomes and diseases in populations. In epidemiology, the patient is the community and individuals are viewed collectively. By definition, epidemiology is the study (scientific, systematic, and data-driven) of the distribution (frequency, pattern) and determinants (causes, risk factors) of health-related states and events (not just diseases) in specified populations (neighborhood, school, city, state, country, global). It is also the application of this study to the control of health problems.

### **Air and Water Pollution Control Act**

The Central Pollution Control Board (CPCB), statutory organization, was constituted in September, 1974 under the Water (Prevention and Control of Pollution) Act, 1974. Further, CPCB was entrusted with the powers and functions under the Air (Prevention and Control of Pollution) Act, 1981.

It serves as a field formation and also provides technical services to the Ministry of Environment and Forests of the provisions of the Environment (Protection) Act, 1986.

Principal Functions of the CPCB, as spelt out in the Water (Prevention and Control of Pollution) Act, 1974, and the Air (Prevention and Control of Pollution) Act, 1981, (i) to promote cleanliness of streams and wells in different areas of the States by prevention, control and abatement of water pollution, and (ii) to improve the quality of air and to prevent, control or abate air pollution in the country.

Air Quality Monitoring is an important part of the air quality management. The National Air Monitoring Programme (NAMP) has been established with objectives to determine the present air quality status and trends and to control and regulate pollution from industries and other source to meet the air quality standards. It also provides background air quality data needed for industrial siting and towns planning. Besides this, CPCB has an automatic monitoring station at ITO Intersection in New Delhi. At this station Resirable Suspended Particulate Matter (RSPM), Carbon Monoxide (CO), Ozone (O<sub>3</sub>), Sulphur Dioxide (SO<sub>2</sub>), Nitrogen Dioxide (NO<sub>2</sub>) and Suspended Particulate Matter (SPM) are being monitored regularly. This information on Air Quality at ITO is updated every week.

Water Quality Monitoring is an important part of the Water quality management. Fresh water is a finite resource essential for use in agriculture, industry, propagation of wildlife & fisheries and for human existence. India is a riverine country. It has 14 major rivers, 44 medium rivers and 55 minor rivers besides numerous lakes, ponds and wells which are used as primary source of drinking water even without treatment. Most of the rivers being fed by monsoon a rain, which is limited to only three months of the year, run dry throughout the rest of the year often carrying wastewater discharges from industries or cities/towns endangering the quality of our scarce water resources. The parliament of India in its wisdom enacted the Water (Prevention and Control of Pollution) Act, 1974 with a view to maintaining and restoring wholesomeness of our water bodies. One of the mandates of CPCB is to collect, collate and disseminate technical and statistical data relating to water pollution. Hence, Water Quality Monitoring (WQM) and Surveillance are of utmost importance.

#### **Functions of the Water and Air Pollution Control Act**

- 1 Advise the Central Government on any matter concerning prevention and control of water and air pollution and improvement of the quality of air.
- 2 Plan and cause to be executed a nation-wide programme for the prevention, control or abatement of water and air pollution;
- 3 Co-ordinate the activities of the State Board and resolve disputes among them;
- 4 Provide technical assistance and guidance to the State Boards, carry out and sponsor investigation and research relating to problems of water and air pollution, and for their prevention, control or abatement;

- 5 Plan and organize training of persons engaged in programme on the prevention, control or abatement of water and air pollution;
- 6 Organize through mass media, a comprehensive mass awareness programme on the prevention, control or abatement of water and air pollution;
- 7 Collect, compile and publish technical and statistical data relating to water and air pollution and the measures devised for their effective prevention, control or abatement;
- 8 Prepare manuals, codes and guidelines relating to treatment and disposal of sewage and trade effluents as well as for stack gas cleaning devices, stacks and ducts;
- 9 Disseminate information in respect of matters relating to water and air pollution and their prevention and control;
- 10 Lay down, modify or annul, in consultation with the State Governments concerned, the standards for stream or well, and lay down standards for the quality of air; and
- 11 Perform such other function as may be prescribed by the Government of India.

#### **Food Adulteration Act**

- The Act provides the protection from adulteration / contamination of food that may lead to the health risk of consumers. The Act deals with the frauds also that can be perpetrated by the dealers by supplying cheaper or adulterated foods. The Act regulates the use of chemicals, pesticides, flavours and other additives in food preparation. Through this Act there is a control over dumping of sub-standards foods. Enrichment of flour, bread, or other cereals with vitamins or minerals, iodization of salt, vitaminisation of vanaspati oil, addition of vitamin "C" in certain foods can be done under the provision made in this Act.
- Different definitions of food, adulteration, misbranding, etc. are described in the Act (Sec 2). Centre is empowered to appoint an Advisory committee called the Central Committee for Food Standard (Sec 3). In any dispute an adulterated sample need to be examined by the court. The Central Food Laboratories give its final opinion on the subject. These 4 laboratories are located in Calcutta, Ghaziabad, Mysore and Pune. There are approximately 82 food laboratories in the country at district/ regional/state level working for the purpose of the PFA Act. Powers are given to the State Governments to appoint Public Analyst and Food Inspectors who control the food supply, storage, and marketing of foods. It is the duty of inspector to draw and dispatch samples to a laboratory. The Central Government is empowered to define the standards of quality, control over production, distribution and sale of food, packing, labelling, licensing, and controlling the food additives.
- There is a provision of penalty if anybody break

the law for a maximum imprisonment of 1 year or a minimum fine or Rs. 2000 in the first instance and for imprisonment of 6 months which may extend to 6 years and cancellation of license on the second or subsequent offense. There is a penalty for violation of rules with regard to seized article subsequently found adulterated and contaminated with injurious substances. When consumed adulterated food is likely to cause death or injury to the body or amount to grievous hurt can be punished according to Section 320 of the Indian Penal Code. There is an imprisonment of 3 years but which may extend to the life term and with the fine which shall not be less than Rs. 5000.

**Table 1 –List of Adulteration/Contamination of food items**

Food items	Adulteration	Contamination
1	Non-Alcoholic Beverages	Non-permitted colours, Saccharin, ducin, lead, arsenic and copper, and Dirt and filth.
2	Baking powder	Citric acid.
3	Starchy foods	Foreign starches in arrowroot, sand, dirt, etc.
4	Spices	Sand, grit, coal tar dyes, saw dust, lead or lead chromate in haldi, In shah zeera excessive stalky and woody matter.
5	Coffee and Tea	Coat tar dyes, excessive stuff, husk, tamarik husk, sand and grit, used tea dust.
6	Milk	Water, Starch ad abstraction of fat.
7	Vansapati	Animal fat, excessive hydrogenation Rancid stuff. Sesame oil deficiency, foreign flavour.
8	Mustard seed	Argemone seeds which can cause epidemic dropsy.
9	Oils	Mineral oil potential carcinogenic, argimone oil.
10	Dals	Kesari dal which can cause lathyrism coal tar dyes.

### Birth & Death Registration Act

(1) In this Act, unless the context otherwise requires,

- (a) Birth means live-birth or still-birth;
- (b) Death means the permanent disappearance of all evidence of life at any time after live-birth has taken place;
- (c) Foetal death means absence of all evidence of life prior to the complete expulsion or extraction from its mother of a product of conception irrespective of the duration of pregnancy ;
- (d) Live-birth means the complete expulsion of extraction from its mother of a product of conception, irrespective of the duration of pregnancy, which, after such expulsion

or extraction, breathes or shows any other evidence of life, and each product of such birth is considered live-born ;

- (e) Prescribed means prescribed by rules made under this Act;
  - (f) State Government, in relation to a Union territory, means the Administrator thereof;
  - (g) Still-birth means foetal death where a product of conception has attained at least the prescribed period of gestation.
- (2) Any reference in this Act to any law which is not in force in any area shall, in relation to that area, be construed as a reference to the corresponding law, if any, in force in that area.

### Registration of Birth and Death

Persons required registering births and deaths should follow the guidelines:

- (1) It shall be the duty of the persons specified below to give or cause to be given, either orally or in writing, according to the best of their knowledge and belief, within such time as may be prescribed, information to the Registrar of the several particulars required to be entered in the forms prescribed by the State Government under sub-section (1) of section 16,--
  - (a) in respect of births and deaths in a house, whether residential or nonresidential, not being any place referred to in clauses (b) to (e), the head of the house or, in case more than one household live in the house, the head of the household, the head being the person, who is so recognized by the house or the household, and if he is not present in the house at any time during the period within which the birth or death has to be reported, the nearest relative of the head present in the house, and in the absence of any such person, the oldest adult male person present therein during the said period;
  - (b) in respect of births and deaths in a hospital, health center, maternity or nursing home or other like institution, the medical officer in charge or any person authorized by him in this behalf;
  - (c) in respect of births and deaths in a jail, the jailor in charge ;
  - (d) in respect of births and deaths in a choultry, chattram, hostel, dharmasala, boarding house, lodging house, tavern, barrack, toddy shop or place of public resort, the person in charge thereof ;
  - (e) in respect of any new-born child or dead body found deserted in a public place, the headman or other corresponding officer of the village in the case of a village and officer in charge of the local police station elsewhere: Provided that any person who finds such child or dead body, or in whose charge such child or dead body may be placed, shall notify such fact to the headman or officer aforesaid;

- (f) In any other place, such person as may be prescribed.

### M.T.P Act

The Medical Termination of Pregnancy Act, 1971 ("MTP Act") was passed due to the progress made in the field of medical science with respect to safer abortions. In a historic move to provide universal access reproductive health services, India amended the MTP Act 1971 to further empower women by providing comprehensive abortion care to all. The new Medical Termination of Pregnancy (Amendment) Act 2021 expands the access to safe and legal abortion services on therapeutic, eugenic, humanitarian and social grounds to ensure universal access to comprehensive care.

The MTP Act 1971 and The MTP Act Amendments 2021		
	MTP Act 1971	The MTP Amendment Act 2021
Indications (Contraceptive failure)	Only applies to married women	Unmarried women are also covered
Gestational Age Limit	20 weeks for all indications	24 weeks for rape survivors Beyond 24 weeks for substantial fetal abnormalities
Medical practitioner opinions required before termination	One RMP till 12 weeks Two RMPs till 20 weeks	One RMP till 20 weeks Two RMPs 20-24 weeks Medical Board approval after 24 weeks
Breach of the woman's confidentiality	Fine up to Rs 1000	Fine and/or Imprisonment of 1 year

Fig: Key Provisions of the MTP Amendment Act, 2021

Under the Act, a pregnancy may be terminated up to 20 weeks by a married woman in the case of failure of contraceptive method or device. It allows unmarried women to also terminate a pregnancy for this reason.

### Opinion Needed for Termination of Pregnancy:

- Opinion of one Registered Medical Practitioner (RMP) for termination of pregnancy up to 20 weeks of gestation.
- Opinion of two RMPs for termination of pregnancy of 20-24 weeks of gestation.
- Opinion of the State-level medical board is essential for a pregnancy to be terminated after 24 weeks in case of substantial foetal abnormalities.

#### i. Upper Gestation Limit for Special Categories:

Increases the upper gestation limit from 20 to 24 weeks for special categories of women, including survivors of rape, victims of incest and other vulnerable women (differently abled women, minors, among others).

#### ii. Confidentiality:

The "name and other particulars of a woman whose pregnancy has been terminated shall not be revealed", except to a person authorized in any law that is currently in force.

#### b. Significance:

The new law will contribute towards ending preventable maternal mortality to help meet the Sustainable Development Goals (SDGs) 3.1, 3.7 and 5.6. SDG 3.1 pertains to reducing maternal mortality ratio whereas SDGs 3.7 and 5.6 pertain to universal access to sexual and reproductive health and rights.

The amendments will increase the ambit and access of women to safe abortion services and will ensure dignity, autonomy, confidentiality and justice for women who need to terminate pregnancy.

- Issues: Different opinions on Termination: One opinion is that terminating a pregnancy is the choice of the pregnant woman and a part of her reproductive rights while the other is that the state has an obligation to protect life, and hence should provide for the protection of the foetus.
- Across the world, countries set varying conditions and time limits for allowing abortions, based on foetal health, and risk to the pregnant woman.
- Not allowed beyond 24-weeks: The Act allows abortion after 24 weeks only in cases where a Medical Board diagnoses substantial foetal abnormalities.
- This implies that for a case requiring abortion due to rape, that exceeds 24-weeks, the only recourse remains through a Writ Petition.
- Abortion to be performed by doctors: The Act requires abortion to be performed only by doctors with specialization in gynaecology or obstetrics. As there is a 75% shortage of such doctors in community health centers in rural areas, pregnant women may continue to find it difficult to access facilities for safe abortions.

### Suppression of Immoral Traffic Act (SITA)

An Act to provide in pursuance of the International Convention signed at New York on the 9th day of May, 1950, for the suppression of immoral traffic in women and girls.

Be it enacted by Parliament in the Seventh Year of the Republic of India as follows:-

- This Act may be called the Suppression of Immoral Traffic in Women and Girls Act, 1956.
- It extends to the whole of India.
- This section shall come into force at once; and the remaining provisions of this Act shall come into force on such date as the Central Government may, by notification in the Official Gazette, appoint.

#### In this Act, unless the context otherwise requires,-

- "brothel" includes any house, room, or place or any portion of any house, room or place, which is used for purposes of prostitution for the gain of another person or for the mutual gain of two or more prostitutes;



- 2 “girl” means a female who has not completed the age of twenty-one years;
- 3 “magistrate” means a District Magistrate, a Sub-Divisional Magistrate, a Presidency Magistrate, or a Magistrate of the first class specially empowered by the State Government, by notification in the Official Gazette, to exercise jurisdiction under this Act;
- 4 “prescribed” means prescribed by rules made under this Act;
- 5 “prostitute” means a female who offers her body for promiscuous sexual intercourse for hire, whether in money or in kind;
- 6 “prostitution” means the act of a female offering her body for promiscuous sexual intercourse for hire, whether in money or in kind;
- 7 “protective home” means an institution, by whatever name called, in which women and girls may be kept in pursuance of this Act

**It includes:**

- i a shelter where female undertrials may be kept in pursuance of this Act; and
- ii a corrective institution in which women and girls rescued and detained under this Act may be imparted such training and instruction and subjected to such disciplinary and moral influences as are likely to conduce to their reformation and the prevention of offences under this Act;
- iii “public place” means any place intended for use by, or accessible to, the public and includes any public conveyance;
- iv “special police officer” means a police officer appointed by or on behalf of the State Government to be in charge of police duties within a specified area for the purpose of this Act;
- v “woman” means a female who has completed the age of twenty-one years.

**Rules of the Act**

- 1 The State Government may, by notification in the Official Gazette, make rules for carrying out the purposes of this Act.
- 2 In particular, and without prejudice to the generality of the foregoing powers, such rules may provide for-
  - a the notification of any place as a public place;
  - b the placing in custody of women and girls released under sub-section (1) of section 10 or for whose safe custody orders have been passed under sub-section (1) of section 17 and their maintenance;
  - c the detention and keeping in protective homes of women and girls under sub-section (2) of section 10, sub-section (2) of section 17 and section 19 and their maintenance;
  - d the carrying out of the provisions of section 11 regarding notification of residence or change of or

- e absence from residence by released convicts;
- e the delegation of authority to appoint the special police officer under sub-section (1) of section 13;
- f the carrying into effect of the provisions of section 18;
- g (i) the establishment, maintenance, management and superintendence of protective homes and the appointment, powers and duties of persons employed in such homes;
- ii the form in which an application for a license may be made and the particulars to be contained in such application;
- iii the procedure for the issue or renewal of a license, the time within which such license shall be issued or renewed and the procedure to be followed in making a full and complete investigation in respect of an application for a license;
- iv the form of a license and the conditions to be specified therein;
- v the manner in which the accounts of a protective home shall be maintained and audited;
- vi the maintenance of registers and statements by a licensee and the form of such registers and statements;
- vii the care, treatment, maintenance, training, instruction, control and discipline of the inmates of protective homes;
- viii the visits to and communication with such inmates;
- ix the temporary detention of women and girls sentenced to detention in protective homes until arrangements are made for sending them to such homes;
- x the transfer of a woman or girl from one protective home to another;
- xi the transfer in pursuance of an order of the court from a protective home to a prison of a woman or girl found to be incorrigible or exercising bad influence upon other inmates of the protective home and the period of her detention in such prison;
- xii the transfer to a protective home of women or girls sentenced under section 7 or section 8 and the period of their detention in such home;
- xiii the discharge of inmates from a protective home either absolutely or subject to conditions, and their arrest in the event of breach of such conditions;
- xiv the grant of permission to inmates to absent themselves for short periods;
- xv the inspection of protective homes and other institutions in which women and girls may be kept, detained and maintained;
- h any other matter which has to be, or may be, prescribed.

## **Municipal and Local Body Acts related to Housing Sanitation Act**

The Ministry of Urban Development, Government of India, is nodal Ministry in charge of various aspects of Urban Development including Urban Water Supply and Sanitation in the Country. The Ministry formulates the policies and strategies pertaining to various aspects of Urban Development including Water Supply, Sanitation and Municipal Solid Waste Management in the Country and also provides technical and financial assistance to the States.

The Central Public Health and Environmental Engineering Organization (CPHEEO) is Technical Wing of the Ministry of Urban Development, Government of India, and deals with the matters related to Urban Water Supply and Sanitation Including Solid Waste Management in the Country.

The CPHEEO was constituted under the erstwhile Ministry of Health & Family Welfare, Directorate General of Health Services (DGHS) in 1953 as per the recommendations of the Environmental Hygiene Committee to deal with Water Supply and Sanitation in the Country. In 1973-74, the CPHEEO was affiliated to the Ministry of Urban Development (erstwhile Ministry of Works & Housing). Since then, it is functioning as the technical wing of the Ministry.

As per the Constitution of India, "Water, that is to say, water supplies" falls within the legislative jurisdiction of the State Governments vide item 17 of the List II-State List under Seventh Schedule referred to in the Article 246(3) of the Constitution and States are vested with the constitutional right to plan, implement, operate and maintain water supply projects

Though water supply and sanitation is a State subject, the policies, strategies and guidelines are being provided by CPHEEO to the States & UTs Governments including Municipal Corporations / Committees. The CPHEEO plays a vital role in processing the schemes posed for external funding agencies including World Bank / JBIC/ ADB/ and Bilateral and Multilateral funding agencies and institutional financing such as LIC. It acts as an Advisory body at Central level to advise the concerned State agencies and Urban Local Bodies (ULBs) in implementation, operation & maintenance of urban water supply, sanitation and Solid Waste Management projects and helps to adopt latest technologies in these sub sectors.

Besides, the CPHEEO also implements centrally sponsored Accelerated Urban Water Supply Programme (AUWSP) for small towns (scrutinizing / approving the schemes received from State Departments from techno-economic angle), Solid Waste Management in 10 airfield towns, sponsors research studies, organizes training courses for the in-service engineers working in the water supply and sanitation sector.

PHE training was launched in 1956 as a Plan Programme to provide training to in-service Public Health Engineers

so as to keep them abreast with the latest know-how in the field of Public Health / Environmental Engineering. At present, it sponsors Post Graduate Courses in Public Health Engineering / Environmental Engineering through 12 recognized academic institutions and over 60 Short Term & Refresher Courses through 21 academic institutions and training institutes under field departments.

## **Factory Act (1948)**

The Factories Act, 1948 (Act No. 63 of 1948), as amended by the Factories (Amendment) Act, 1987 (Act 20 of 1987), served to assist in formulating national policies in India with respect to occupational safety and health in factories and docks in India. It dealt with various problems concerning safety, health, efficiency and well-being of the persons at work places. It was replaced by the Occupational Safety, Health and Working Conditions Code, 2020. The Act is administered by the Ministry of Labour and Employment in India through its Directorate General Factory Advice Service & Labour Institutes (DGFASLI) and by the State Governments through their factory inspectorates. DGFASLI advises the Central and State Governments on administration of the Factories Act and coordinating the factory inspection services in the States.

The Factory Acts were a series of acts passed by the Parliament of the United Kingdom to regulate the conditions of industrial employment. The early Acts concentrated on regulating the hours of work and moral welfare of young children employed in cotton mills but was effectively unenforced until the Act of 1833 established a professional Factory Inspectorate. The regulation of working hours was then extended to women by an Act of 1844.

The Factories Act 1847 (known as the Ten Hour Act), together with Acts in 1850 and 1853 remedying defects in the 1847 Act, met a long-standing (and by 1847 well-organized) demand by the millworkers for a ten-hour day. The Factory Acts also sought to ameliorate the conditions under which mill-children worked with requirements on ventilation, sanitation, and guarding of machinery.

Introduction of the ten-hour day proved to have none of the dire consequences predicted by its opponents, and its apparent success effectively ended theoretical objections to the principle of factory legislation; from the 1860s onwards more industries were brought within the Factory Act.

The Act is applicable to any factory using power & employing 10 or more workers and if not using power, employing 20 or more workers 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; but this does not include a mine, or a mobile unit

belonging to the armed forces of the union, a railway running shed or a hotel, restaurant or eating place.

#### **Various provisions included in the Act are:**

- Preliminary
- The Inspecting Staff
- Health
- Safety's
- Provisions relating to Hazardous processes
- Welfare & Grievance
- Working hours of adults
- Employment of young persons
- Annual leave with wages
- Special provisions
- Penalties and procedure
- Supplemental

#### **ESI Act:**

Employees' State Insurance Corporation (abbreviated as ESIC) is a statutory body under the ownership of Ministry of Labour and Employment, Government of India. The fund is managed by the Employees' State Insurance Corporation (ESIC) according to rules and regulations stipulated in the ESI Act 1948. Employees' State Insurance Corporation (ESIC), established by ESI Act, is an autonomous corporation under Ministry of Labor and Employment, Government of India. As it is a legal entity, the corporation can raise loans and take measures for discharging such loans with the prior sanction of the central government and it can acquire both movable and immovable property and all incomes from the property shall vest with the corporation. The corporation can set up hospitals either independently or in collaboration with state government or other private entities, but most of the dispensaries and hospitals is run by concerned state governments.

As per the section 46 of the ESI Act, 1948, there are six benefits are envisaged to its subscribers.

- 1- Medical benefit
- 2- Sickness benefit
- 3- Maternity benefit
- 4- Disablement benefit
- 5- Dependants benefit
- 6- Other benefits

For all employees earning 21,000 (US\$280) or less per month as wages, the employer contributes 3.25% and the employee contributes 0.75%, total share 4%. This fund is managed by the ESI Corporation (ESIC) according to rules and regulations stipulated there in the ESI Act 1948, which oversees the provision of medical and cash benefits to the employees and their family. ESI scheme is a type of social security scheme for employees in the organized sector.

The employees registered under the scheme are entitled to medical treatment for themselves and their dependents, unemployment cash benefit in certain contingencies and maternity benefit in case of women employees. In case of employment-related disablement or death, there is provision for a disablement benefit and a family pension respectively. Outpatient medical facilities are available in 1418 ESI dispensaries and through 1,678 registered medical practitioners. Inpatient care is available in 145 ESI hospitals and 42 hospital annexes with a total of 19,387 beds. In addition, several state government hospitals also have beds for the exclusive use of ESI Beneficiaries. Cash benefits can be availed in any of 830 ESI centres throughout India.

Recent years have seen an increasing role of information technology in ESI, with the introduction of Pehchan smart cards as a part of Project Panchdeep. In addition to insured workers, poor families eligible under the Rashtriya Swasthya Bima Yojana can also avail facilities in ESI hospitals and dispensaries. ESI Corporation also runs medical, nursing and paramedical schools in some ESI hospitals across India.

#### **National Programme Acts and Legislation**

##### **(a) Food Safety**

Food Safety and Standards Authority of India (FSSAI) is a statutory body established under the Ministry of Health & Family Welfare, Government of India. The FSSAI has been established under the Food Safety and Standards Act, 2006, which is a consolidating statute related to food safety and regulation in India. FSSAI is responsible for protecting and promoting public health through the regulation and supervision of food safety.

The FSSAI is headed by a non-executive Chairperson, appointed by the Central Government, either holding or has held the position of not below the rank of Secretary to the Government of India. Rita Teatoria is the current Chairperson for FSSAI and Shri Arun Singhal is the current Chief Executive Officer for FSSAI. The FSSAI has its headquarters at New Delhi. The authority also has 6 regional offices located in Delhi, Guwahati, Mumbai, Kolkata, Cochin, and Chennai. 14 referral laboratories notified by FSSAI, 72 State/UT laboratories located throughout India and 112 laboratories are NABL accredited private laboratories notified by FSSAI. In 2021, with the aim of benefitting industries involved in manufacturing, handling, packaging and selling of food items, FSSAI decided to grant perpetual licenses to restaurants and food manufacturers on the condition that they file their returns every year.

##### **History**

FSSAI was established by Former Union Minister Dr Anbumani Ramadoss, Government of India on 5 August 2011 under Food Safety and Standards Act, 2006 which was operationalized in year 2006. The FSSAI consists of a chairperson & 22 members. The FSSAI is responsible for setting standards for food so that there is one body to deal with and no confusion in the minds of consumers, traders, manufacturers, and investors.

Ministry of Health & Family Welfare, Government of India is the Administrative Ministry of Food Safety and Standards Authority of India. The following are the statutory powers that the FSS Act, 2006 gives to the Food Safety and Standards Authority of India (FSSAI).

1. Framing of regulations to lay down food safety standards
2. Laying down guidelines for accreditation of laboratories for food testing
3. Providing scientific advice and technical support to the Central Government
4. Contributing to the development of international technical standards in food
5. Collecting and collating data regarding food consumption, contamination, emerging risks, etc.
6. Disseminating information and promoting awareness about food safety and nutrition in India

### Regulatory Framework

The Food Safety and Standards Authority of India is a statutory body under Food Safety and Standards Act, 2006. The Food Safety and Standards Act (FSS), 2006 is the primary law for the regulation of food products. This act also sets up the formulation and enforcement of food safety standards in India. The FSSAI appoints food safety authorities on the state level. The FSSAI functions under the administrative control of the Ministry of Health and Family Welfare. The main aim of FSSAI is to

- Lay down science-based standards for articles on food
- To regulate the manufacture, storage, distribution, import, and sale of food
- To facilitate the safety of food

The FSS Act is a bucket for all the older laws, rules and regulations for food safety. The FSS Act took 7 older acts into one umbrella.

- Prevention of Food Adulteration Act, 1954
- Fruit Products Order, 1955
- Meat Food Products Order, 1973
- Vegetable Oil Products (Control) Order, 1947
- Edible Oils Packaging (Regulation) Order 1988
- Solvent Extracted Oil, De- Oiled Meal and Edible Flour (Control) Order, 1967
- Milk and Milk Products Order, 1992

### National Health Programme Acts

The National Health Planning and Resources Development Act is a piece of 1974 American Congressional legislation. Many Certificate of Need programs trace their origin to the act which offered incentives for states to implement these programs.

In this Act, three distinct existing programs were

consolidated:

- Hill-Burton
- Regional Medical Program
- Comprehensive Health Planning Act

Congress realized that the provision of federal funds for the construction of new health care facilities was contributing to increasing health care costs by generating duplication of facilities.

The intent of Congress in passing this Act was to create throughout the United States, a strengthened and improved federal-, state- and area-wide system of health planning and resources development that would help provide solutions to several identified problems.

### The perceived problems the Act was intended to address were as follows:

- lack of equal access to quality health care at reasonable cost
- infusion of federal funds into the health care system was contributing to inflationary health care costs while failing to produce an adequate supply or distribution of health resources
- the lack of a comprehensive, rational approach by the public and private sectors to creation of uniformly effective methods of delivering health care
- misdistribution of health care facilities and manpower
- increasing and uncontrolled inflation of health care costs, particularly the costs associated with hospital stays
- inadequate incentives for the use of alternative levels of health care and the substitution of ambulatory and intermediate care for inpatient hospital care
- the lack of basic knowledge regarding proper personal health care and methods for effective use of available health services in large segments of the population
- This legislation was also intended to encourage health care providers to play an active role in developing health policy.

### Waste Management Rules

The principle of reducing waste, reusing and recycling resources and products is often called the "3Rs." aspects. Recycling means the use of waste itself as resources. The new rules have mandated the source segregation of waste in order to channelize the waste to wealth by recovery, reuse and recycle. Waste generators would now have to now segregate waste into three streams- Biodegradables, Dry (Plastic, Paper, metal, Wood, etc

Every Waste Generators shall segregate waste and store separately and hand over to Municipal workers or authorized waste pickers. (ii) Ministry of Environment, Forest & Climate Change shall constitute 'Central Monitoring Committee' to monitor and review every year.