

Training Course for operators of Effluent Treatment plants in textile factories

Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

Program on Promoting Sustainability in the Textile and Garment Industry in Asia (FABRIC)

Guideline for Trainers and Facilitators



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<p>Purpose This document has been prepared to guide trainers of ETP operators in using the GIZ training package of Training Course for capacity development of operators of Effluent Treatment plants in textile factories</p>	

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List of abbreviations used

BOD	Biochemical Oxygen demand
COD	Chemical oxygen demand
DO	Dissolved Oxygen
DoE	Department of Environment, Government of Bangladesh
ETP	Effluent Treatment Plant
F/M	Food to Micro-organism Ratio
FABRIC	GIZ Project on Promoting Sustainability in the Textile and Garment Industry in Asia
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH
h	Hour(s)
HP	Horse Power
kg	Kilogram(s)
kW	Kilowatt
kWh	Kilowatt hour
Kg	Kilogram
MLSS	Mixed Liquor Suspended Solids
MLVSS	Mixed Liquor Volatile Suspended Solids
m ³	Cubic meter
MoC	Material of construction
MS	Mild steel
MLD	Million litres per day
mg/l	Milligram(s) per litre
O&M	Operation and maintenance
pH	Negative logarithm of hydrogen ion concentration
ppm	Parts per million
RCC	Reinforced cement concrete
s	Second(s)
SS	Stainless Steel
SVI	Sludge Volume Index
Tk	Bangladesh Taka
Tonnes, tons	1000 kilograms
TSS	Total suspended solids
cm	Centimeter(s)
oC	Degree Celsius
d	Day(s)
km	Kilometers
L	Litre (s)
M	Meter(s)
Mm	Millimeter
m3	Cubic meter(s), 1000 litres.
m2	Square meter

1 About this guideline

The objective of this document is to provide guidance to trainers, learning facilitators, or service providers who conduct training of Training Course for operators of Effluent Treatment plants in textile factories. The GIZ ETP training course was prepared under the project *Promoting Sustainability in the Textile and Garment Industry in Asia* (FABRIC).

The materials are primarily intended to help the trainer to guide operating staff of effluent treatment plants of textile and garment factories to increase their knowledge on principle of effluent treatment, improving efficiency of treatment, management of sludge, ensure safety and health of ETP staff, monitoring of effluent treatment plant and troubleshooting & maintenance of ETPs. While the materials may help to train operator of obtain the required qualifications of ZDHC, training itself is not meant to obtain any qualifications under the ZDHC criteria.

The materials under the ETP operator training course are based on training needs of service providers and textile and garment factories in Bangladesh, Pakistan, and Vietnam. The materials have already been translated into Bangla and other regions may attempt translation into their vernacular.

The master materials are managed by the GIZ, which also looks after the review and updating of learning materials.

Overview of Training Materials

The ETP training course consists of Ten topic-specific modules and two on-site ETP visits/practical sessions.

Section 3 of this trainer guideline provides an overview of the available modules and learning units. Each module consists of 4 components, including (1) 3 - 5 power presentations with illustrations (2) group discussion formats (3) quiz/work exercise sessions and (4) hand-outs/reading materials. It also contain formats of site visit questionnaires and evaluation criteria.

Interactive sessions would be the key for the training program to be involving and interesting.

Practical exercises are intended to guide learners towards the next step in practically translating the newly acquired knowledge from the module/learning unit into the context of the ETP and workplace environment. To achieve this, the trainers may use short quiz questions after one set of slides are over, on an average some 3-4 quiz sessions within the presentations.

Target groups of this training course

The primary target group of the training program are ETP operators who are already carrying out operation maintenance and monitoring (OM&M) of effluent treatment systems. Second target groups are students who are studying environmental science/engineering and plans to make a career in pollution control. Third category of targets are the service providers. The materials enable the service providers to conduct training programs for the operators besides serving as a primary source of knowledge for the service providers themselves.

The fourth target group will be faculty working with institutions dealing with the subject of pollution control in textile industries. The fifth category which can use the course materials would be the ETP managers who could use the course materials to improve their knowledge and train the ETP staff. However, this

training program also aims at those who want to familiarize themselves with the concept, description and requirements of ETP units.

Learning objectives

After attending this training, the ETP operators participating in it shall be able to

- Understand the legal and non-legal requirements of the effluent treatment
- Learn the different objectives of effluent treatment and how it is done.
- Learn the water usage and effluent generation in textile production process.
- Understand the characteristics of effluent generated from textile factories, understand the pollution load and the detrimental effects of uncontrolled discharge of the same.
- Understand the status of effluent treatment in Bangladesh and the technologies used by them
- Learn the principle involved in preliminary treatment, units used, operation control, maintenance and monitoring of preliminary treatment systems such as screens, grit chamber & equalisation.
- Understand the function and application of chemical treatment in textile ETP management. Learn how to determine correct dosages through jar tests and how to calculate the quantity to be dosed. Familiarise with units used in primary treatment and its control.
- Learn the principle involved in biological treatment, types of biological treatment, units used, operation control, maintenance and monitoring of Secondary treatment systems such as screens, grit chamber & equalisation.
- Learn how sludge is generated in ETP, its nature how it is dewatered, reduced in volume and disposed.
- Understand how ETP monitoring is done, sampling techniques and analysis procedures, record keeping.
- Learn how to control routine operation after entering the ETP and tasks to be done by the Operator.
- Familiarize with common issues in ETP and how trouble shooting is done in all sections of the ETP including primary, secondary treatment and sludge management.
- Learn about the advanced treatment techniques and role of membranes in textile effluent treatment.

How to use this guideline

Section 2 of this guideline explains various options regarding how you as a trainer, learning facilitator, or service provider can employ or integrate the ETP operator training materials into your own training or advisory services.

Section 3 of this guideline provides a more detailed description of all the available Training modules. Apart from stating the purpose of the respective module, you will also find (i) an overview of the content of the modules and learning units, (ii) available materials (e.g. presentations, handouts, quizzes, assignments), (iii) references to additional training and reference material (iv) the average estimated time required for completing the module or each of its learning units, and (v) notes for trainers to understand the session plan.

In addition, most module descriptions also contain suggestions how to plan the site visits and organize live demonstration. This will allow you to decide which modules/learning units you want to include into your course and how to plan your training program in one stretch or as multiple modules. Furthermore, the information in this section will also help you to plan the possible time required for your course and to schedule the same accordingly.

2 How to use the Training materials to plan a training program

The learning materials are mainly structured for class lectures. However, for integrating this course with other academic activities such as seminars on specific topics or include it in curriculum in a training course by a University etc. several variants/options are possible and a few of them are discussed here.

Option 1- Using materials in a standalone short term training

The service providers trained for this dissemination and provide with the course material may organise commercial training programs for the ETP operating staff in batches. The material provided under this course can be freely used by them with proper acknowledgement. The service providers may add, modify and cut off some of the material and create their own package.

Still, it can be stated here that the course material provided is all inclusive for a 12 day training package without any modification or addition in itself, if so desired by the service provider.

The training material are primarily structured to directly integrate the presentations into virtual or face-to-face class room lectures with the learners. In this setting, your role would be to directly reflect on the content of the entire module or learning unit presentations (or parts of them) together with the participants of your workshop. For this option, however, please keep in mind that all participants are required to follow the same learning pace, i.e., not allowing them to tailor the learning settings to their own individual preferences (e.g., when, and how to complete which learning unit).

However, it must be noted that all the modules do not need to be delivered on consecutive days, and the training can be divided into multiple phases. It may be possible that if the ultimate group of trainees are already employed in the ETP, it may be difficult for them to stay away from their work place for a long time. In such a case the 12 days can be spread into 12 weeks with one day in a week (ideally the weekly holiday) as the training day. This, however, may need greater commitment and interest from the participants.

The material is organized in modules, each one focussing on specific, exclusive but connected topics and the trainers may define number of phases according to the availability of trainees and their convenience.

Option 2 - Organising the training as a sponsored program by the factory

It may be possible that the program can be organised for one or few ETPs as a sponsored program for them.

In such a case, the order of the training program can be re-organised according to the duties of the ETP operating staff. For instance, if there is a chemist in the ETP, his training sessions can be organised for the module dealing with ETP monitoring (sampling, analysis and record keeping). Similar is the case with stores-in-charge or maintenance engineers.

It may be useful to encourage the ETP manager to participate in some modules relevant also for him. For instance, modules on biological process control, safety measures & first aid, record keeping etc. are as much interesting to the ETP manager too as to the ETP operator.

Option 3 - Supplementing academic learning programs

It is noteworthy that some of the Universities in the country did try to organise certificate courses for ETP operation and management. But they were not much successful till now. One of the reason for such a scenario was the lack of availability of adequate number of training materials of required quality.

This training package is expected to fill this gap and now the institutions may find it much easier to design the curricula and conduct such short term program.

It is also possible that the training material provided herein would be used by the faculty to supplement their teachings in the regular environmental engineering/science courses too.

At the moment, professors in Universities tend to make their own presentations since most of the presentations and videos available online are either promotional material of a particular ETP or supplier and the few good educational material available are too theoretical/technical for an ETP operating staff.

Considering the fact that even the many 1-4 year courses does not have enough structured course presentations, this package will be an invaluable asset to them.

3 Content and structure of the ETP operators training materials

Module 1: Introduction to training program & legal aspects.

<p>Expected outcome</p>	<p>Participants to know the importance of ETPs, definition of operator and what is to be expected from the training program, Participants are made aware of the prevailing legal requirements in environmental rules with respect to textile industry.</p>
<p>1. This module has essentially two main parts. The first one deals with introduction and the importance of water. These are general and supposed to initiate the trainees into the training program. The second part is dealing with legal aspects. The module contains one group discussion too. The salient points which may be noted in this module are:</p> <ul style="list-style-type: none"> • For conducting the session on Legal aspects, it would be helpful if you could invite a trainer from DoE or other regulatory agencies who is well versed with the rules, regulations and stipulations of the relevant acts/rules of Government. • Depending on the time availability, a general video related to global water scenario which can either be sourced from YouTube or short films aired by TV channels (e.g. film on water for industries by DW TV, 2001) may be shown to participants to keep their interest alive. • For group formation, it is better to keep the number of groups not more than four. Each of the group may be advised to select a leader and at the end of the discussion he may present the answers of the group in a white board/flip chart. Sufficient encouragement should be there from the participants and the trainer on the answers. The trainer may then present additional points, if any, needed and correct any mistakes in a gentle manner. • Hand-outs should be prepared in required number of prints (one for each participant) and may be handed over to them during/on completion of the training module. • Important and large documents forming part of hand-outs (e.g. ECA 1995) may be given as soft copy too and/or reference to web-sites publishing such information may be given to participants. • The trainees may be encouraged to find out videos/articles related to water and issues with wastewater from internet, YouTube, Wikipedia etc. and to discuss about them in the next days re-cap session. <p>2. The hand-outs to be given include (In case of Bangladesh. Other countries will have similar rules, which may replace the list below)</p> <ul style="list-style-type: none"> • Environmental policies Bangladesh • Environmental Protection rules DoE • Shilpodushon (in Bangla) • Water conservation rules (Bangla) • Textile Policy • National Water policy 1999 • Environmental Conservation Act 1995 <p>The trainers are encouraged to source other relevant rules as well as the updates of the above rules.</p>	

Session	Content of the module	Training material provided	Type of input needed
<p>Presentation 1: Need for training for ETP operator & expected outcomes</p>	<ul style="list-style-type: none"> Who & what is an ETP Operator, what are the operator requirements under ZDHC Guidelines. Why does the operator need training. What do I achieve by participating in the training program. What is the expected outcome as per ZDHC guidelines. What are the roles & responsibilities of an ETP operator, Detailed course outline and how it is beneficial to day to day work of the ETP operator. Rules of participating in the program. 	Power point presentation, hand-outs	Laptop, Projector, screen, flip charts/meta plan cards, markers, pin board, pin and white board.
<p>Presentation 2: Importance of Water resource & situation</p>	<ul style="list-style-type: none"> Why water is an Important resource, why we need water for industry & its importance in employment and economy. How much water is consumed by public & industries in Bangladesh. What will be the scenario by 2030, why we need water conservation. How the water is used in textile industries. What happens to the water Why we need proper effluent treatment, direct & indirect impacts. Role of operator in ETP. Why should I be proud of being an ETP operator? 	Power point presentation.	Laptop, Projector, screen, pin board, pin and white board
<p>Question & answers</p>	<ul style="list-style-type: none"> Quiz by Trainer to the trainees Trainees seeking clarification of sessions covered 		Feedback form, white board, marker, stickers.
<p>Presentation 3: Legal requirements in BD</p>	<ul style="list-style-type: none"> Need for legal control of effluent discharge. Major environmental rules, water policy by Government. Standards stipulated by DoE for wastewater management. Other ETP related requirements (e.g. sludge management) Environmental compliance preferred by international agencies, buyer requirements 	Power point presentation.	Laptop, Projector, screen, flip charts/meta plan cards, markers, pin board, pin and white board.
<p>Question & answers</p>	<ul style="list-style-type: none"> Quiz by Trainer to the trainees Trainees seeking clarification of sessions covered 		Feedback form, white board, marker, stickers.
<p>Group formation & First group discussion (GD-1):</p>	<ul style="list-style-type: none"> What are sections using water in textile industry How much water is consumed per kg of product? How can the factory reduce water consumption. What are requirements to get ECC from DOE. What are the standards related to discharge of effluent from textile factories. 	Group discussion format with questions.	Sufficient number of print outs, projector for showing questions.

Module 2: Effluent Treatment Schemes & Roles of Operator

<p>Expected outcome</p>	<p>Participants to know the basics of effluent treatment, present status of ETPs in Bangladesh, the typical tasks of an ETP operator, qualifications needed as per ZDHC guidelines and the standard operating procedures for ETP.</p>		
<p>1. This module has essentially two main parts. The first one deals with the need, importance and the basics of effluent treatment and narrate the present situation of effluent treatment in Bangladesh including the type of ETPs presently installed. The second part deals with the tasks to be carried out by the Operator in an ETP and the necessity of creating a specific standard operating, maintenance & monitoring procedures for the ETP and how to follow the same. It also give an opportunity for the operator to self-evaluate himself vis-à-vis the ZDHC guidelines. It also provide information on the components needed for optimisation of the ETPs in textile effluent treatment.</p> <p>The following aspects may be considered while handling this module:</p> <ul style="list-style-type: none"> • The program should start with a re-cap of topics covered in module-1. • Any standard operation & maintenance procedures (SOMP) already adopted & used by a well operational ETP can be taken as a model and copies of this SOMP may be provided to the trainees as an example. • If it is possible to invite the plant manager of a well operational ETP to give a presentation to the trainees it will be an interesting case-study for the participants. • Depending on the time availability, a general video related to effluent treatment in textile industry which can be sourced from YouTube may be shown to participants to keep their interest alive. • The individual work exercise on calculating the complexity of the ETP where the trainees are working may be done by giving the participants work sheets & a copy of the relevant pages of ZDHC guideline. This should be done as a part of the program. • The entire copy of ZDHC guidelines on ETP operator qualifications may be given as a hand-outs should be prepared in required number of prints (one for each participant) and may be handed over to them during/on completion of the training module. • A copy of this hand-out may be given as soft copy too for easy search & find options by the operators. • The trainees may be encouraged to find out videos/articles related to textile effluent treatment in Bangladesh from the internet and may be allowed to list out their search results as an information to the other participants. <p>2. Handout to be given</p> <ul style="list-style-type: none"> • ETP Operators Qualification Guidelines by ZDHC 			
<p>Session</p>	<p>Content of the module</p>	<p>Training material provided</p>	<p>Type of input needed</p>
<p>Presentation 1: What, Why and How of the ETP</p>	<ul style="list-style-type: none"> • What is an ETP and its components? • Why we do need to have ETPs? • Common unit operations in the ETP • Removal of organic contaminants. • Common anaerobic treatment systems • Common aerobic treatment systems. • Sludge dewatering & disposal • Rules of participating in the program. 	<p>Power point presentation, hand-outs</p>	<p>Laptop, Projector, screen, flip charts/meta plan cards, markers, pin board, pin and white board.</p>

<p>Presentation 2: Effluent Treatment schemes in Bangladesh</p>	<ul style="list-style-type: none"> • General wastewater treatment scheme. • Quantity & quality of effluent generation from Bangladesh textile industry. • Primary ETPs & Combined ETPs in textile industry of Bangladesh. • All biological treatment - a new trend. • Performance of each type of ETPs. • Compliance with DoE standards. 	<p>Power point presentation.</p>	<p>Laptop, Projector, screen, markers and white board.</p>
<p>Work Exercise (WE-1)</p>	<ul style="list-style-type: none"> • Refer to the given tables of ZDHC • Calculate the Wastewater Treatment System Complexity Scoring of your ETP 	<p>Individual exercise</p>	<p>Printed copies of Appendix A of ZDHC guideline, projected in screen.</p>
<p>Presentation 3: Optimisation of ETPs</p>	<ul style="list-style-type: none"> • What is optimisation, why is it needed? • Optimisation of energy in ETPs • Optimization of dosing chemicals • Optimization of the oxygen supply in aeration systems • Optimization of maintenance procedures • Optimization of waste and sludge treatment 	<p>Power point presentation.</p>	<p>Laptop, Projector, screen, markers and white board.</p>
<p>Question & answers</p>	<ul style="list-style-type: none"> • Quiz by Trainer to the trainees • Trainees seeking clarification of sessions covered 		<p>Feedback form, white board, marker, stickers.</p>
<p>Presentation 4: General ETP requirements, standard operating procedures</p>	<ul style="list-style-type: none"> • What makes a good ETP? • Requirement of personnel in ETP & their roles, required qualifications. • Career improvement program for ETP personnel. • Special roles of operator. • Need for an operator manual. • Standard Operating & Maintenance Procedures. 	<p>Power point presentation, quiz slides</p>	<p>Laptop, Projector, screen, flip charts/meta plan cards, markers, pin board, pin and white board.</p>
<p>Group discussion (GD-2):</p>	<ul style="list-style-type: none"> • Why should the effluent be treated? • How important is an ETP, why it is important to the industry, public and the country? • What are the present duties of the operator, what are the scope for improvement? • How does preparing a Standard Operating Procedures in your ETP will help? 	<p>Group discussion format with questions.</p>	<p>Sufficient number of print outs, projector for showing questions.</p>
<p>Presentation 5: Roles & responsibilities of operator.</p>	<ul style="list-style-type: none"> • What makes a good ET operator? • What are the tasks & responsibilities of ETP operator? • What are the usual challenges faced by an operator? • Steps to be taken before & during start-up of ETP operation. • How to prepare for a visitor to the ETP? 	<p>Power point presentation.</p>	<p>Laptop, Projector, screen, markers, flip chart and white board.</p>
<p>Question & answers</p>	<ul style="list-style-type: none"> • Quiz by Trainer to the trainees • Trainees seeking clarification of sessions covered 		<p>Feedback form, white board, marker, stickers.</p>

Module 3: Primary Treatment of textile effluent

<p>Expected outcome</p>	<p>Participants to know the details of primary treatment, objective and operation of physical treatment, need for equalisation, chemicals used in effluent treatment and control of chemical treatment</p>		
<p>1. This module has essentially two main parts. The first one deals with physical treatment units including screening, grit remover and equalisation. The second part deals with principle of coagulation & flocculation, chemicals used in primary ETP in textile sector . It also give an opportunity for the operator to witness a live demonstration of jar test. The salient points to be noted here include the following:</p> <ul style="list-style-type: none"> • The program should start with a re-cap of topics covered in module-2. The result of the Work Exercise on Day-2 shall be discussed and any mistake corrected. • For the demonstration of Jar tests, it is better to get the help of a chemist. If possible, the same can be conducted in a laboratory and use a standard jar test apparatus. If the training is done in an ETP as an exclusive package, it can be done in the ETP laboratory. Required type of chemicals with varying strength may be prepared in advance to conduct the jar tests. • If possible, a model of equalisation tank can be made to explain the maintenance of required water levels in the tank. • Depending on the time availability, a general video related to chemical coagulation/flocculation/ sedimentation in textile industry which can either be sourced from YouTube may be shown to participants to keep their interest alive. • The individual work exercise on Calculation of the chemical requirement per day (ferrous sulphate, lime and polyelectrolyte) for a 1 MLD ETP including the required concentration of chemical slurry etc. may be done for each participant. • The trainees may be encouraged to find out videos/articles related to primary effluent treatment of textile wastewater from the internet and may be allowed to list out their search results as an information to the other participants. <p>2. Handout to be given</p> <ul style="list-style-type: none"> • Operation Control record keeping and troubleshooting of primary treatment 			
<p>Session</p>	<p>Content of the module</p>	<p>Training material provided</p>	<p>Type of input needed</p>
<p>Presentation 1: Objective, function and details of primary treatment</p>	<ul style="list-style-type: none"> • What is primary treatment in textile effluent? • What are objectives of primary treatment? • Expected results from primary treatment? • Description, objective and details of screens. • Description, objective and details of grit removers. • Description, objective and details of equalisation tanks. • Details and objectives of chemical mixers, clarification. • Meaning of flocs and process of flocculation 	<p>Power point presentation, hand-outs</p>	<p>Laptop, Projector, screen, flip charts, markers, pin board, pin and white board.</p>

<p>Presentation 2: Details and operation of physical treatment</p>	<ul style="list-style-type: none"> • Function of primary treatment units. • Details of various type of screens, objective and operation. • Manually cleaned & mechanically cleaned screens. • Different types of grit remover and their details. • Details of equalisation, units for aeration/mixing. • pH control : need, details and systems 	<p>Power point presentation.</p>	<p>Laptop, Projector, screen, markers and white board.</p>
<p>Work Exercise (WE-2)</p>	<ul style="list-style-type: none"> • Calculate the ferrous sulphate, lime and polyelectrolyte requirement/day for a 1 MLD ETP for dosages given. • Calculate the chemical slurry concentrations for the above chemicals 	<p>Individual exercise</p>	<p>Work sheets are given with baseline information. Also, projected in screen.</p>
<p>Presentation 3: Details and operation of chemical treatment</p>	<ul style="list-style-type: none"> • Chemical treatment units • Mixing, coagulation and flocculation. • Units in chemical preparation and mixing. • Floatation and dissolved air floatation. • Different kind of settling process. • Different kind of settling units : clarifier, hopper bottom units, tube settlers/lamella clarifiers. 	<p>Power point presentation.</p>	<p>Laptop, Projector, screen, markers and white board.</p>
<p>Question & answers</p>	<ul style="list-style-type: none"> • Quiz by Trainer to the trainees • Trainees seeking clarification of sessions covered 		<p>Feedback form, white board, marker, stickers.</p>
<p>Presentation 4: Control of primary treatment</p>	<ul style="list-style-type: none"> • Control of manually cleaned & mechanically cleaned screens. • Do's & Don'ts of screening. • Control of equalization, maintaining levels & aeration. • Do's & Don'ts of equalisation • Control of chemical dosing/solids separation. • Do's & Don'ts of chemical treatment. • Details, operation and control of filters 	<p>Power point presentation, quiz slides</p>	<p>Laptop, Projector, screen, flip charts/meta plan cards, markers, pin board, pin and white board.</p>
<p>Presentation 5: Jar tests</p>	<ul style="list-style-type: none"> • Jar tests- need and objectives. • How to conduct jar tests? • How to modify the treatment based on jar tests. • Frequency of jar tests. 	<p>Power point presentation.</p>	<p>Laptop, Projector, screen, markers, flip chart and white board.</p>
<p>Demonstration of jar test (DM-1)</p>	<ul style="list-style-type: none"> • The instructor will conduct jar tests using actual effluent and coagulant chemicals, demonstrate settling operations. • Model tabulation of jar test results and selection of chemicals. • Model selection of chemical dosages. 	<p>Live demonstration</p>	<p>Jar test apparatus, chemical solutions, stirrer, stop watch and assistants for demo.</p>

Module 4: Visit to a Primary ETP for textile effluent

Expected outcome	Participants to get first-hand information on how a primary ETP is operating. They are expected to collect the information given in feedback form and submit the same on conclusion of visit.
General Information	<ul style="list-style-type: none"> • Name of the Factory • Address/Location • Type of process • Effluent discharged to • Capacity of the ETP • Land area used for ETP • Consultant for the ETP • Supplier of the ETP • Resource person & ETP contact person

B. OBSERVATIONS IN ETP

Section of ETP	Parameter
Effluent collection lines,	Type: underground pipe/covered channel/uncovered channel
	Manholes: numbers, covering material (RCC slab/Steel cover)
	Cleaning : Manual/mechanical
Screens	N. of manual screens, bar size (mm)
	Frequency of cleaning
	No. of mechanical screen, pore size (mm), type of screen (drum/ brush/mechanical bar)
	quantity of screenings collected.
Raw effluent collection	Collection tank : present/absent
	type (circular/rectangular)
	Volume (m ³) and retention time (hrs)
Raw effluent pumps	Type of pumps (centrifugal/submersible)
	Numbers (working/standby)
	Capacity: m ³ /h, motor power, kilowatt
Equalisation tank	type (circular/rectangular)
	Volume (m ³) and retention time (hrs)
	type of aeration system (surface/submerged)
	Diffuser: type (disc/tubular), Nos.
	Diffuser sheet material:
	any dead spots? If yes how much surface area is dead (%)
	Any coarse bubbles/torn diffusers
	Water levels maintained,
Aerator/Blower: type, nos., capacity (kilowatt)	
Equalised effluent transfer pumps	Type of pumps (centrifugal/submersible)
	Numbers (working/standby)
	Capacity: m ³ /h, motor power: HP
	Pumping control : manual / level switch/ automatic
Chemical treatment	coagulant type & dosages (ppm)
	flocculant type & dosages (ppm)
	Polyelectrolyte : used/not used, dosage (ppm)
	slurry concentration of each chemical (%)
	How many tanks for each chemical dosing (one or two)

	Retention time of flash mixer & flocculator (mins)
	MoC of mixer (MS / SS), grade of steel:
	Dosing control system. : manual/automatic
	pH maintained at inlet of primary settling:
Primary settling	System type: circular clarifier/hopper bottom settling/tube settler (lamella)
	rotational speed (if it is clarifier),
	Retention time (minutes)
	surface loading rate (m ³ /m ² /day)
	Material of construction of walkway and handrails : (MS/ SS/Concrete)
	sludge evacuation frequency (one inhrs)
	Sludge concentration (%)
Polishing treatment	Present/absent
	Type
	No. of units and details.
Sludge Thickener	Present/absent:
	System type : with mechanism/without mechanism
	Retention time of sludge : hrs
	Percentage of inlet sludge and thickened sludge (%)
Sludge dewatering	Mechanical system/ sludge drying beds/Not present
	No. of units and details (capacity of unit or total area of sludge drying beds)
	Solids content : inlet slurry, dewatered cake (%)
	Usage of any conditioning chemical : Name & dosage
	Feed pumps : nos., capacity and pressure.
	Quantity of dewatered sludge per day (kg)
Sludge maturation	Present /absent
	Period of sludge storage (months)
	Moisture content in sludge after maturation (%)
	Final disposal method
Laboratory	In house lab - Present/absent:
	Tests conducted: pH, TSS, TDS, BOD, COD, colour,
	Other parameters tested:
	Bacteriological tests, if any:
	Heavy metal tests, if any
Online monitoring	Present/absent:
	If yes, what are the parameters tested online
ETP control	Manual /automatic/semi-automatic
	If not manual, details of control system
Record keeping	How many records are maintained: Just give the type of records maintained (e.g Flow, Operational timings of equipment, chemical records, sludge details, effluent quality parameters etc.) and not details.

Module 5: Secondary Treatment of textile effluent

Expected outcome	Participants to know the principle of biological treatment, details of anaerobic & aerobic treatment, objective and operation of biological treatment, microbiological variants used in biological treatment, common anaerobic & aerobic treatment, need for aeration in aerobic treatment, importance of environmentally favourable conditions for bacterial growth.
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1. This module has essentially three main parts. The first one deals with general biological treatment where the principles of biological treatment is explained, type of biological treatment discussed and anaerobic treatment systems. The second part deals with types of aeration systems with their advantages and disadvantages. The third part deals with the most common biological treatment, i.e., activated sludge as well as control of activated sludge treatment systems.

The salient points to be noted here include the following:

- The program should start with a re-cap of topics covered in module-3. The result of the Work Exercise on Day-3 too shall be discussed and any mistake corrected. Thereafter, the feed- back form submitted by the trainees based on the ETP visit shall be collected for evaluation.
- If possible, it will be interesting to organise a microscopic examination of activated sludge. Normally an operator would not have any experience in observing bacteriological activity through microscope.
- Depending on the time availability, a general video related to biological treatment n textile industry which can either be sourced from YouTube or any other educational platform may be shown to participants to keep their interest alive.
- The individual work exercise on calculation of the biological control status including F/M in aeration tank and SVI of activated sludge.
- The trainees may be encouraged to find out articles related to secondary effluent treatment of textile wastewater from the internet and may be allowed to list out their search results as an information to the other participants.
- A live demonstration of checking of sludge volume in 30 minutes may be conducted by the trainer to give hands-on experience on the biological treatment.

2. Handout to be given

- Operation Control Biological Treatment
- Problems and Solutions in biological treatment

Session	Content of the module	Training material provided	Type of input needed
Presentation 1: Introduction to biological treatment	<ul style="list-style-type: none"> • What are the different kind of biological treatment processes? • How does biological process works, what happens to the organics? • What are the common anaerobic systems? • Principle of different anaerobic units including lagoons, high rate digestors, filters, UASB • Anaerobic treatment systems tried in textile effluents and their effectiveness. • What are the common aerobic systems? • Principle of different aerobic units trickling filter, MBBR, RBC, ASPs, Aerated lagoons, SBR. 	Power point presentation, hand-outs	Laptop, Projector, screen, flip charts, markers, pin board, pin and white board.

<p>Presentation 2: Aeration devices and systems</p>	<ul style="list-style-type: none"> • Aeration, why & how? • What are the common aeration devices, type of aerators: surface & submerged. • Floating aerators: construction, operation, pros & cons. • Fixed surface aerators: unit design, operation, pros & cons. • Cage rotors: unit design, operation, pros & cons. • Jet aerators: unit design, operation, pros & cons. • Principles of submerged aerators, blower design. • Ejectors/aspirators: unit design, operation, pros & cons. • Turbine aerators: unit design, operation, pros & cons. • Deflected air bubbler: unit details, operation, pros & cons. • Diffused aeration systems: unit design, operation, different bubble types, pros & cons • Summary, selection of right type of aeration. 	<p>Power point presentation.</p>	<p>Laptop, Projector, screen, markers and white board.</p>
<p>Group discussion (GD-3):</p>	<p>(a) Why is anaerobic treatment not so popular in textile effluent treatment? (b) What is the difference between suspended growth and attached growth treatment units? (c) List five aerobic treatment systems. (d) What are the common submerged aeration systems?.</p>	<p>Group discussion format with questions.</p>	<p>Sufficient number of print outs, projector for showing questions.</p>
<p>Question & answers</p>	<ul style="list-style-type: none"> • Quiz by Trainer to the trainees • Trainees seeking clarification of sessions covered 		<p>Feedback form, white board, marker, stickers.</p>
<p>Presentation 3: Activated sludge treatment</p>	<ul style="list-style-type: none"> • What is activated sludge treatment, why is it so called? • What is the content of activated sludge? • What are essential stages of activated sludge plant? • What is MLSS and MLVSS? • What is Food to Microorganism (F/M) ratio, how to calculate the same ? • How to calculate the MLSS needed in the ETP? • Return activated sludge & Waste activated sludge • Explanation of good, too fast and too slow settling of bio-sludge. • What is sludge volume index (SVI)? How much is the desirable SVI? • How to calculate the I? Importance of nutrients, DO and what are desirable values of pH and temperature. 	<p>Power point presentation.</p>	<p>Laptop, Projector, screen, markers and white board.</p>
<p>Work Exercise (WE-3)</p>	<ul style="list-style-type: none"> • Calculate the Food to Microorganism ratio for a 1 MLD ETP. • Calculate Sludge volume index for the ETP 	<p>Individual exercise</p>	<p>Work sheets with baseline information, Screen</p>

Module 6: Sludge management in textile effluent treatment

Expected outcome	Participants to know the principle of biological treatment, details of anaerobic & aerobic treatment, objective and operation of biological treatment, microbiological variants used in biological treatment, common anaerobic & aerobic treatment, need for aeration in aerobic treatment, importance of environmentally favourable conditions for bacterial growth.
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1. This module has essentially two main parts. The first one deals with sludge generation and sludge dewatering and O & M of sludge dewatering systems. The second part deals with need for reduction of sludge and technologies available for the same. The third part deals with disposal options for dewatered sludge and the legal requirements of sludge disposal..

The salient points to be noted here include the following:

- The program should start with a re-cap of topics covered in module-5. The result of the Work Exercise on Day-5 too shall be discussed and any mistake corrected.
- A demo of sludge at different stages including liquid sludge, dewatered sludge and dried sludge ready for disposal may be useful.
- Depending on the time availability, a general video related to sludge dewatering and/or sludge disposal in textile industry which can either be sourced from YouTube or any other educational platform & may be shown to participants to keep their interest alive.
- The individual work exercise on calculation of the sludge from primary and secondary ETPs may be done based on a typical ETP and participants may be allowed to discuss each other for calculation.
- The trainees may be encouraged to find out articles related to sludge disposal from the internet and may be allowed to list out their search results as an information to the other participants.
- Reference to web-sites giving information on the standards etc. may be provided to the trainees for their further study.

2. Handout to be given (legal papers are specific for Bangladesh, for other countries, applicable legal standards may be sourced and copies given to trainees)

- Bangladesh Standards and Guideline for sludge management
- Classification of sludge
- Manual for Sludge Management in Bangladesh Textile Sector
- Technical Report Textile Sludge Management in Bangladesh

Session	Content of the module	Training material provided	Type of input needed
Presentation 1: Introduction to sludge management	<ul style="list-style-type: none"> • What is sludge? • Presence & sources of heavy metals in sludge • Primary sludge: generation and nature. • Bio-sludge: sources, composition and nature. • Steps of sludge handling in an ETP - concentration/dewatering/disposal • Why the sludge is considered hazardous? • How to calculate sludge generation - Primary, secondary and dewatered sludge quantification.. 	Power point presentation, hand-outs	Laptop, Projector, screen, flip charts, markers, pin board, pin and white board.

<p>Presentation 2: Sludge dewatering</p>	<ul style="list-style-type: none"> • Need for sludge dewatering. • What are the units in sludge dewatering? • Sludge pumps: requirement, type and specifications. • Submersible/Progressive cavity/diaphragm pumps: specs and operational requirements. • Sludge thickening: gravity & mechanical thickening. • Sludge dewatering: chamber filter press • Sludge dewatering: belt filter press • Sludge dewatering: centrifuge • Sludge dewatering: sludge drying beds • Conclusion & selection of sludge dewatering units 	<p>Power point presentation.</p>	<p>Laptop, Projector, screen, markers and white board.</p>
<p>Work Exercise (WE-4)</p>	<p>Based on the chart provided, calculate sludge quantity of a 1 MLD ETP from</p> <p>(a) Primary treatment (b) Conventional activated sludge process</p> <p>Find out the dewatered sludge quantity @30% solids content</p>	<p>Individual exercise</p>	<p>Work sheets with baseline information, Screen</p>
<p>Presentation 3: O & M of sludge dewatering units</p>	<ul style="list-style-type: none"> • Operation of liquid sludge pumps (centrifugal & submersible) • Dos & Don't's in sludge pump. • Operation of thickened sludge pumps • Dos & Don't's in thickened sludge pump. • Operation of gravity thickener • Dos & Don't's in gravity thickener. • Operation of dissolved air floatation thickener • Dos & Don't's in floatation thickener • Operation of chamber filter press, press opening mechanism • Dos & Don't's in chamber filter press • Operation of centrifuge • Dos & Don't's in sludge centrifuges • Operation of belt press filter • Dos & Don't's in belt filter press operation. • Operation and control of sludge drying beds • Dos & Don't's in sludge drying beds 	<p>Power point presentation.</p>	<p>Laptop, Projector, screen, markers and white board.</p>
<p>Question & answers</p>	<ul style="list-style-type: none"> • Quiz by Trainer to the trainees • Trainees seeking clarification of sessions covered 		<p>Feedback form, white board, marker, stickers.</p>
<p>Presentation 4: Reduction of sludge quantity</p>	<ul style="list-style-type: none"> • Why to reduce quantity & volume of sludge? • Sludge reduction in primary treatment: replacement of chemicals, optimise dosages. • Advantages & disadvantages of conversion to all-biological treatment. • Anaerobic sludge digestors: process, unit details and management. • Aerobic sludge digestors: process, unit details and management, operation steps of digester. • Reduction of sludge through sludge maturation, control • Sludge reduction through thermal drying, paddle dryer. • Pros & cons of thermal drying • Reduction of sludge : incineration 	<p>Power point presentation.</p>	<p>Laptop, Projector, screen, markers, flip chart and white board.</p>

	<ul style="list-style-type: none"> Conclusion & selection of sludge management options. 		
Presentation 5: Sludge disposal	<ul style="list-style-type: none"> Why is proper disposal of sludge important ? Damage potential of different kind of sludge What are the guidelines pertaining to sludge disposal in Bangladesh. Explain category A, B and C of sludge as per DoE stipulation. Management of hazardousness in sludge. Challenges in process modifications with less hazardous sludge. Sludge disposal options currently not permitted: manure, composting, soil conditioner. Thermal incineration of sludge. Manufacturing of bricks from sludge Co-processing in cement factories, options offered by Holicim. Secure landfill, construction, advantages and disadvantages of TSDF. Conclusion and selection of sludge management options 	Power point presentation.	Laptop, Projector, screen, markers, flip chart and white board.
Group discussion (GD-4):	<ul style="list-style-type: none"> (a) What are the sources of sludge & their characteristics? (b) What are the options to dewater the sludge, which one is most suitable for textile effluent, give reasons? (c) Do we need reduction of sludge? If yes, what is the optimum method in your opinion? (d) What are the options of sludge disposal in your country 	Group discussion format with questions.	Sufficient number of print outs, projector for showing questions.
Question & answers	<ul style="list-style-type: none"> Quiz by Trainer to the trainees Trainees seeking clarification of sessions covered 		Feedback form, white board, marker, stickers.

Module 7: Visit to a Biological /Combined ETP for treatment of textile effluent

Expected outcome	<p>Participants to observe in person the operation, maintenance & monitoring of a biological ETP, including sludge management and also interacting with ETP management.</p> <p>They are expected to collect the information given in feedback form and submit the same on conclusion of visit</p>
General Information	<ul style="list-style-type: none"> Name of the Factory Address/Location Type of process Effluent discharged to Capacity of the ETP Land area used for ETP Consultant for the ETP Supplier of the ETP Resource person & ETP contact person

<p>Observations (First part)</p>	<ul style="list-style-type: none"> • Screening: Manual and, or mechanical, type, MoC, quantity of screenings removed, condition. • Raw effluent Pumps: type, numbers, quality, capacity, redundancy, MoC, condition • Equalization: Retention time, type of aeration system, Blower nos., type, capacity. • Equalized pumping: numbers, type, quality, capacity, redundancy, MoC, condition, flow control system • Neutralisation: Dosing control system, pH maintained, acid dilution, mixing uniformity • Cooling tower: System design, inlet & outlet temperature, blower speed, power • Aeration tank: HRT, Organic loading rate, Specific power, type of aeration system, diffuser material, any dead spots, coarse bubbles, foam-type, quantity, colour & spread, SV-30, SPC, floc formation, MLSS-colour, formation and compactness, nutrient dosing-dosage, methodology & frequency, de-foaming system, signs of filaments. • Blowers: Blower nos, type, Enclosure, capacity, condition, VFD, DO control, Heating tendency, pressure, noise, redundancy • Secondary clarifier: colour removal agent-dosage, concentration and effect, System type, HRT, SRT, rotational speed , RAS-% rate, control, solids loading rate, surface loading rate, underflow concentration, overflow uniformity, clarity of overflow, sludge bulking, ashing, pinpoint, bubbling • Sludge return pumps: numbers, type, quality, capacity, redundancy, MoC, condition, flow control system • Thickener: Type, mechanism, surface loading rate Inlet solids concentration, Underflow SC, Overflow clarity, settling rate. • Sludge drying beds: Surface area, surface loading rate, application depth, drying cycle, dryness of sludge, underflow clarity • Tertiary treatment: Type, units and details.
<p>Observations (Second part)</p>	<ul style="list-style-type: none"> • Thickener: System type, HRT, SRT, rotational speed (if circular) percentage of inlet sludge and thickened sludge • Sludge dewatering mechanism: Type of mechanism, inlet solids content, dewatered DSC, PE-dosage, slurry concentration & consumption, cycle time, Feed pump-pressure, VFD and rate, Filtrate or centrate clarity, solids content, qty of dewatered • Sludge maturation: Days stored, input DS, Output DS, method of disposal, qty • MCC room & controls: Control system, Isolators, SCADA, PBS, Indicators, Cooling system, meters, spare. • Laboratory : Tests conducted, background of chemists, glassware, reagents, instruments, lab standards. If possible, some Jar test demonstration in the lab.

Module 8: ETP monitoring

<p>Expected outcome</p>	<p>Participants to know different level of monitoring of ETP and learn the basics of testing and learn how to keep records.</p>		
<p>1. This module has essentially three main parts. The first one deals with sampling of wastewater including preservation and transport/storage. Legal sampling is also discussed and explained. The second part deals with analysis procedures of important parameters such as TSS, TDS, DO, COD and BOD. The third part deals with record keeping as the important part of the monitoring.</p> <p>The salient points to be noted here include the following:</p> <ul style="list-style-type: none"> • The program should start with a re-cap of topics covered in module-7. The result of the Work Exercise on Day-7 too shall be discussed and any mistake corrected. • Thereafter, the feed- back form submitted by the trainees based on the ETP visit shall be collected for evaluation. • If the training program is done in an ETP, on site sampling can be demonstrated to the trainees. • If possible, a visit to an environmental laboratories may be organised and live demo of checking of important parameters (DO, COD, TDS, TSS, pH etc.) may be done. • Depending on the time availability, a general video related to effluent analysis which can either be sourced from YouTube or any other educational platform may be shown to participants. • The work exercise include checking pf pH by the trainees. At least 4 sets of two different pH solutions (4 x 2=8) are prepared. Each of the operators may come forward and check pH of two solutions. Using the bottle no. instructor check if it is correct. • The trainees may be encouraged to find out articles related to sampling and/or analysis of textile wastewater from the internet and may be allowed to list out their search results as an information to the other participants. <p>2. Handout to be given</p> <ul style="list-style-type: none"> • Chart for Wastewater sampling • Analysis procedure as per APHA for important parameters. • Sample log sheet for ETP monitoring 			
<p>Session</p>	<p>Content of the module</p>	<p>Training material provided</p>	<p>Type of input needed</p>
<p>Presentation 1: Introduction to ETP monitoring</p>	<ul style="list-style-type: none"> • Importance of ETP monitoring • What is to be monitored? • Monitoring ETP operational parameters: equipment operation time. • On site wastewater monitoring • How to use & calibrate pH meter, usage of pH paper? • How to use & calibrate DO meter? • How to do settling studies in biological treatment? • Off-site wastewater monitoring. • Monitoring of operational problems, Inventory monitoring • Expenditure monitoring • Conclusion and the need to ensure correct monitoring. 	<p>Power point presentation, hand-outs</p>	<p>Laptop, Projector, screen, flip charts, markers, pin board, pin and white board.</p>

<p>Presentation 2: Sampling of wastewater</p>	<ul style="list-style-type: none"> • What role an operator has in analytical monitoring? • What are the basic objectives in collection of samples? • What are the six criteria for quality sampling? • Flow measurement techniques. • What are the sample collection devices & methods? • What is a grab sampling and when is it useful? • How to conduct a sampling for volatile organic compounds? • How is a discrete sampling done, how to sample for heavy metals? • How do you conduct sampling for organics and microbiological analysis? • What are the different type of automatic sampler? Pros & cons of each type. • Procedure for manual sampling. • How to handle samples after the sampling? • How to manage composite sample manually? • Sample labelling/identification needs. • Chain of custody, transport & storage of samples. • Legal samples-why, how and when? • Conclusion and selection of best sampling method. 	<p>Power point presentation.</p>	<p>Laptop, Projector, screen, markers and white board.</p>
<p>Group discussion (GD-5):</p>	<p>(a) Why is monitoring important, what is the role of operator in monitoring? (b) What are the different kind of sampling, how these are different from one another? (c) What are legal samples? (d) What are the stages from sampling to delivery of the same at the laboratory? What precautions are to be taken by operator?</p>	<p>Group discussion format with questions.</p>	<p>Sufficient number of print outs, projector for showing questions.</p>
<p>Question & answers</p>	<ul style="list-style-type: none"> • Quiz by Trainer to the trainees • Trainees seeking clarification of sessions covered 		<p>Feedback form, white board, marker, stickers.</p>
<p>Presentation 3: Laboratory analysis</p>	<ul style="list-style-type: none"> • Why should the operator know about laboratory analysis? • Lab safety measures in brief? • Testing of pH, using meter and pH paper. • Testing of TSS and the procedure used. • Stages of testing the TDS. • Determination of DO using meter • Determination of DO using Winkler's method • Principle of COD testing • Testing for alkalinity (for anaerobic ETPs) • Principle of BOD, with or without incubators. • Conclusion and need for basic analysis knowledge 	<p>Power point presentation.</p>	<p>Laptop, Projector, screen, markers and white board.</p>
<p>Work Exercise (WE-4)</p>	<p>The trainees are required to check the pH of a given solution using a pH meter (if possible) or a pH paper for two given solutions provided to them.</p> <p>Report the pH to the instructor</p>	<p>Individual exercise</p>	

<p>Presentation 4: Record keeping</p>	<ul style="list-style-type: none"> • Why to keep the records? • What are the six types of records to be maintained at the ETP? • How to maintain and use log sheets? • Recording operational aspects: working time of pumps & equipment, incidence of power failures/DG times, flow rates • Model log sheet for operational data recording. • Performance parameters: chemical dosages, pH, temperature, MLSS, RAS/WAS, nutrient and sludge generation. • Laboratory records: inlet & at different stages of ETP and outlet quality parameters • Model log sheets for lab analysis monitoring • Inventory records, stock, spares and procurement, model log sheet. • Maintenance records: preventive maintenance, breakdowns, repair • Model log sheets for maintenance records • Expenditure records: Cost of treatment • Model log sheet for recording cost of treatment • Record review and monitoring plan: daily, weekly and monthly and at different levels. 	<p>Power point presentation.</p>	<p>Laptop, Projector, screen, markers, flip chart and white board.</p>
<p>Question & answers</p>	<ul style="list-style-type: none"> • Quiz by Trainer to the trainees • Trainees seeking clarification of sessions covered 		<p>Feedback form, white board, marker, stickers.</p>

Module 9: Safety & Health in ETP

<p>Expected outcome</p>	<p>Participants to know various safety risks in the ETP, how to prevent them, protective measures to be taken and basic first aid.</p>		
<p>1. This module has essentially four main parts. The first one deals with safety risks in an ETP including chemical, mechanical or electrical hazards within an ETP as well as how to prevent them. The second part specifically deals with the subject of management of hydrogen sulphide including the sources, risks and preventive measures. The third part deals with personal protective measures & equipment to be used within ETP and the fourth part deals with basic aspects of fire-fighting & control.</p> <p>The salient points to be noted here include the following:</p> <ul style="list-style-type: none"> • The program should start with a re-cap of topics covered in module-8. The topic could be Why is monitoring of ETP important and what is the role of operator in it. The result of the Work Exercise on Day-8 too shall be discussed and any mistake corrected. • A live demonstration of basic first aid by a qualified first aid trainer would be of immense value. • Depending on the time availability, a general video related to safety aspects in an ETP which can either be sourced from YouTube or any organisations dealing with safety practices may be shown to participants. • The trainer may demonstrate detection of hydrogen sulphide gas using lead acetate paper using a sample of sulphide solution & controlled acid addition to generate hydrogen sulphide in small quantities. • The trainees may be encouraged to find out articles related to textile ETP safety from the internet and may be allowed to list out their search results as an information to the other participants. • Selected trainees may be encouraged to share their emergency management plan to benefit other trainees. <p>2. Handout to be given</p> <ul style="list-style-type: none"> • ETP OHS Matrix • Prevalent Hazards in ETP (Bangla) • Document on Occupational Health and Safety • UNIDO manual - how to deal with hydrogen sulphide gas 			
<p>Session</p>	<p>Content of the module</p>	<p>Training material provided</p>	<p>Type of input needed</p>
<p>Presentation 1: Safety management in ETP</p>	<ul style="list-style-type: none"> • What is OSH and OSH Aspects? • Physical hazards in ETP, Mechanical hazards in ETP • Is there any workplace hazards specifically for textile ETPs? • Mechanical & electrical hazards. • What is meant by biological hazards? Is it present in ETP? • Are there any chemical hazards in ETP? • Mechanical & electrical safety provisions needed. • Danger signs, what to keep where? • Ergonomics, how to keep it good? • Toxic gas risks in ETP • PPE & emergency preparedness • Contents of first aid box • OSH management steps in an ETP 	<p>Power point presentation, hand-outs</p>	<p>Laptop, Projector, screen, flip charts, markers, pin board, pin and white board.</p>

<p>Presentation 2: Management of Hydrogen sulphide</p>	<ul style="list-style-type: none"> • What are the safety issues with hydrogen sulphide? • What are the locations prone to H₂S risks? • Precautions to be taken in confined spaces • What are the safety precautions needed in manhole cleaning? • Detection of Hydrogen sulphide with meter. • How to detect H₂S without a meter? • Procedure for work at places prone to H₂S • Impact of H₂S on humans. • Manual & mechanical cleaning of manholes • First aid to personnel affected by H₂S poisoning. • Conclusion & further reading 	<p>Power point presentation.</p>	<p>Laptop, Projector, screen, markers and white board.</p>
<p>Group discussion (GD-6):</p>	<p>(a) What are the safety risks in ETPs? (b) How the operator will protect himself in various hazards? (c) What is H₂S and where can you face its risk? (d) What is basic first aid for a person affected with H₂S?</p>	<p>Group discussion format with questions.</p>	<p>Sufficient number of print outs, projector</p>
<p>Question & answers</p>	<ul style="list-style-type: none"> • Quiz by Trainer to the trainees • Trainees seeking clarification of sessions covered 		
<p>Presentation 3: Personal protective equipment</p>	<ul style="list-style-type: none"> • What is PPE? • Purposes of personal protective equipment. • Common PPEs to be used by ETP operator • Eye and ear protection • Respiratory protection and footwear. • Sanitation and housekeeping. • Protection from chlorine gas leaks. • Fall protection equipment • Confined space protective equipment 	<p>Power point presentation.</p>	<p>Laptop, Projector, screen, markers and white board.</p>
<p>Presentation 4: First aid in the ETP</p>	<ul style="list-style-type: none"> • What the first aid measures in general? • What are the first aid actions permissible by an un-qualified person? • CPR and emergency measures possible. • How to attend a person with body injury from a fall? • How to attend to a person with cuts and stop bleeding? • How to take care of person who suffered burns? • What are the first steps to attend a broken limb? • How to maintain emergency contacts, ambulance etc. 	<p>Power point presentation.</p>	<p>Laptop, Projector, screen, markers and white board.</p>
<p>Live demonstration (DM-02)</p>	<p>In-class Demonstration The trainer, with the help of qualified first aid trainer, may demonstrate the emergency help measures to be taken in common hazards in the ETP</p>		<p>A qualified first aid instructor with support staff.</p>
<p>Short Presentation 5: Firefighting</p>	<ul style="list-style-type: none"> • Areas in ETP with the risk of fires. • How to manage a fire caused by electric short circuits. • General fire-fighting techniques. • How to maintain emergency contacts, local fire station and display of information. . 	<p>Power point presentation.</p>	<p>Laptop, Projector, screen, markers</p>
<p>Question & answers</p>	<ul style="list-style-type: none"> • Quiz by Trainer to the trainees • Trainees seeking clarification of sessions covered 		<p>Feedback form, white board, marker,</p>

Module 10: ETP maintenance & trouble shooting

<p>Expected outcome</p>	<p>Participants to know the operation and maintenance steps to be taken by an ETP operator once he enter the plant. They will also learn the trouble-shooting techniques in ETP in various sections such as primary, secondary and tertiary treatment. The process of obtaining & maintaining necessary spares, handling replenishments and how to order for new spares and general store management may be explained in a practical session.</p>
<p>1. This module has essentially two main parts. The first part deals with maintenance of ETP with, mechanical or electrical preventive maintenance and break down maintenance. The second part deals with trouble shooting in various sections such as primary, secondary treatment and how to identify and resolve common issues.</p> <p>The salient points to be noted here include the following:</p> <ul style="list-style-type: none"> • During the factory/ETP visit, the maintenance arrangements installed in the primary & secondary ETP should be highlighted and explained to the participants. • Organise a discussion with stores in charge of the ETP and let him explain the process related to sourcing, stock maintenance and record keeping of spares. • The program should start with a re-cap of topics covered in module-9. The topic could be Why is monitoring of ETP important and what is the role of operator in it. The result of the Work Exercise on Day-9 too shall be discussed and any mistake corrected. • A preventive maintenance chart being followed by a good working ETP may be shown as a model and the oiling & greasing schedule may be explained to the trainees. • Depending on the time availability, a general video related to maintenance in an ETP which can be sourced from YouTube may be shown to participants. • Regarding the issues in aeration system, difference between various kind of foams (black, grey, white, bubbly etc.) may be explained to the participants showing video clips of the same. • The trainees may be encouraged to find out articles related to biological ETP trouble shooting from the internet and may be allowed to list out their search results as an information to the other participants. • Selected trainees may be encouraged to share their experience in managing process related problems in their ETP to benefit other trainees. • A visit to the in-house work shop of any ETP, explaining the basic repairs and winding of motors etc. may help the operator to understand the process involved. <p>2. Handout to be given</p> <ul style="list-style-type: none"> • Guide to trouble shooting in physicochemical ETPs • Trouble shooting in biological treatment • Model preventive maintenance chart with specifications of oil & grease. 	

Session	Content of the module	Training material provided	Type of input needed
Presentation 1: Maintenance of ETP	<ul style="list-style-type: none"> • What are the general maintenance components of the ETP? • Preventive maintenance : oiling : grade, frequency and application technique. • Preventive maintenance : greasing: where, type, frequency and application technique. • Painting as preventive maintenance: colour selection, specs needed, frequency. • Break-down maintenance: repair facilities (on-site and off site) • Major mechanical maintenance requirements in ETP • Major electrical maintenance requirements in ETP • Importance of maintenance for functionality and life of ETP. 	Power point presentation, hand-outs	Laptop, Projector, screen, flip charts, markers and white board.
Work Exercise (WE-5)	Prepare a preventive maintenance chart for your combined ETP with frequency of oiling, greasing and painting at different components of the ETP.	Individual exercise	Work sheets with baseline information
Presentation 2: Trouble shooting in Primary treatment	<ul style="list-style-type: none"> • Common problems in physical treatments • Management of issues in physical treatment • Guide of trouble shooting chart for screening, grit remover and pumps for reference. • Common issues in equalisation tanks • Management of issues in equalisation • Trouble shooting guide/chart for equalisation, blower, pumping. • Common issues in chemical preparation and its management. • Common issues in flash mixer, flocculator and primary clarifier. • Management of problems in chemical treatment • Ready-reference trouble shooting chart for chemical dosing. Flash mixer, flocculator and primary clarifier. 	Power point presentation.	Laptop, Projector, screen, markers and white board.
Experience sharing by participants:	<ul style="list-style-type: none"> • Two participants may be allowed to narrate any major constructional or process problem occurred in their ETP, how it affected the operations and how they eventually solved the issues. • Highlight the lessons learnt. 		White board, marker, flip charts.
Question & answers	<ul style="list-style-type: none"> • Quiz by Trainer to the trainees • Trainees seeking clarification of sessions covered 		Feedback form, white board, marker, stickers.
Presentation 3: Trouble shooting in Aeration tank of Activated Sludge Treatment	<ul style="list-style-type: none"> • Common problems in biological treatment systems • Issues specifically in activated sludge treatment. • Mechanical problems in ASP: aerators, blowers, pumps and solutions for mechanical problems. • Problems/repair/replacement of diffusers. Procedure for cleaning of diffusers. • Different kind of foams in aeration tank, their causes and mitigation measures. 	Power point presentation.	Laptop, Projector, screen, markers and white board.

	<ul style="list-style-type: none"> • Reasons for imbalance in MLSS growth and mitigation measures. • Trouble shooting guide/chart for aeration tank. 		
<p>Group discussion (GD-6):</p>	<p>(a) Name any four likely issues in primary treatment. List out their mitigation measures.</p> <p>(b) Name any four likely issues in activated sludge treatment. List out the mitigation measures.</p>	<p>Group discussion format with questions.</p>	<p>Sufficient number of print outs, projector & flipcharts</p>
<p>Presentation 4: Trouble shooting secondary settlers in</p>	<ul style="list-style-type: none"> • Common mechanical issues with clarifiers. • Factors influencing settling in secondary settling units • Causes of rising sludge: difference between sludge bulking, ashing of sludge, clumping of sludge and pinpoint floc. • Issues with filamentous micro-organisms and control • Issues due to insufficient RAS/WAS. • Trouble shooting guide/chart for secondary settling. 	<p>Power point presentation.</p>	<p>Laptop, Projector, screen, markers</p>
<p>Question & answers</p>	<ul style="list-style-type: none"> • Quiz by Trainer to the trainees • Trainees seeking clarification of sessions covered 		<p>Feedback form, white board, marker,</p>

Module 11: Tertiary treatment & ETP operation control

<p>Expected outcome</p>	<p>Participants to know the type and details of tertiary treatment systems generally used within an ETP. They will also be taught the step-by-step actions they should carry out once they enter the ETP for daily operation.</p>		
<p>1. This module has essentially two main parts. The first part deals with various types of tertiary treatment systems including disinfection, filtration, adsorption and oxidation. It also provides advantages & disadvantages of different systems. The second part deals with actual operational duties to be performed by an operator once he enters the ETP. It gives the task to be done during different rounds through the ETP.</p> <p>The salient points to be noted here include the following:</p> <ul style="list-style-type: none"> • The program should start with a re-cap of topics covered in module-11. The topic could be Why is monitoring of ETP important and what is the role of operator in it. • One or two of the trainees may be encouraged to talk about their routine operation work in an ETP, animating how he manage the visit through the ETP till his shift is over and the duty is handed over to the next shift in-charge. • Depending on the time availability, a general video related to tertiary treatment systems employed in textile ETP which can be sourced from YouTube may be shown to participants • The trainees may be encouraged to find out articles related to tertiary treatment and may be allowed to list out their search results as an information to the other participants. <p>2. Handout to be given</p> <ul style="list-style-type: none"> • Objective & control of tertiary treatment in textile effluent. 			
<p>Session</p>	<p>Content of the module</p>	<p>Training material provided</p>	<p>Type of input needed</p>
<p>Presentation 1: Tertiary Treatment-1</p>	<ul style="list-style-type: none"> • What are the general maintenance components of the ETP? • Preventive maintenance : oiling : grade, frequency and application technique. • Preventive maintenance : greasing: where, type, frequency and application technique. • Painting as preventive maintenance: colour selection, specs needed, frequency. • Break-down maintenance: repair facilities (on-site and off site) • Major mechanical maintenance requirements in ETP • Major electrical maintenance requirements in ETP • Importance of maintenance for functionality and life of ETP. 	<p>Power point presentation, hand-outs</p>	<p>Laptop, Projector, screen, flip charts, markers and white board.</p>
<p>Work Exercise (WE-6)</p>	<p>Draw a diagram showing the construction of a pressure filter, showing inlet, backwash, rinse lines etc.</p>	<p>Individual exercise</p>	<p>Rough Work sheets (A 4 sheets)</p>

<p>Presentation 2: Tertiary treatment -2</p>	<ul style="list-style-type: none"> Options for management of residual organics. Adsorption of organics: efficiency, process and control Specifications of activated carbon suitable for textile effluent. Operation and monitoring of ACF Maintenance of ACF. Pros & cons of activated carbon filters. Oxidation techniques, principle involved, units Ozone systems: concept, application & units Pros & Cons of ozone Photo-chemical oxidation: process, application & units Pros & cons of photochemical oxidation. Fenton treatment: process, applications & popularity Pros & cons of photochemical oxidation. 	<p>Power point presentation.</p>	<p>Laptop, Projector, screen, markers and white board.</p>
<p>Question & answers</p>	<ul style="list-style-type: none"> Quiz by Trainer to the trainees Trainees seeking clarification of sessions covered 		<p>Feedback form, white board, marker, stickers.</p>
<p>Presentation 3: Operation control of ETP- Part 1</p>	<ul style="list-style-type: none"> Tasks for operator upon entering the ETP Communication exchange with operator of previous shift. First round through the ETP. Points to be noted/activities Checking of records after first round. Second round through the ETP: Checking & control of equalisation Arranging for chemical feeding & dosing. Checking primary clarifier operation and sludge evacuation. Operation control of acid dosing & cooling tower. Checking the biological treatment and observations to be made in Aeration tank. Activities to be carried out in aeration tank: settling studies, nutrient addition etc. 	<p>Power point presentation.</p>	<p>Laptop, Projector, screen, markers and white board.</p>
<p>Group discussion (GD-7):</p>	<p>(a) What is the need for disinfection? What are the techniques used for disinfection? (b) What are the objectives of filtration? List the different kind of filters. (c) Details of the principle of adsorption of organics? (d) What are the techniques for oxidation of organics?</p>	<p>Group discussion format with questions.</p>	<p>Sufficient number of print outs, projector & flipcharts</p>
<p>Presentation 4: Operation control of ETP - Part 2</p>	<ul style="list-style-type: none"> Second round through the plant - secondary clarifier Observations & checks to be made in the secondary clarifier. Operation control of RAW/WAS and ensure sludge settling. Visit to sludge handling area & observations to be made. Observations & operation control of sludge thickener Sludge drying beds: operation control, observations of different stages of drying. Sludge filter press: operation, control, filtrate control and removal of dried cakes. Visit to sludge maturation area and operation control. 	<p>Power point presentation.</p>	<p>Laptop, Projector, screen, markers</p>

	<ul style="list-style-type: none"> • Visit to MCC & control room. • Checks to be made in control panel and control. • Return to operators room and entering values. • Final round through ETP and activities to be done. • Information to be shared with relieving operator.. 		
Question & answers	<ul style="list-style-type: none"> • Quiz by Trainer to the trainees • Trainees seeking clarification of sessions covered 		Feedback form, white board, marker,

Module 12: Tertiary treatment & ETP operation control

Expected outcome	Participants to know the type and details of tertiary treatment systems generally used within an ETP. They will also be taught the step-by-step actions they should carry out once they enter the ETP for daily operation.		
<p>1. This module has essentially three main parts. The first part deals with membrane based treatment of effluent from textile effluents, essentially membrane bio-reactor (MBR), nano filtration and RO based effluent recovery. It also provides a guidelines for safe re-start of an ETP, portions of which may also be applicable to commissioning of a new ETP. The third part of the module is a the written examination to test the knowledge gained by the trainees from the program.</p> <p>The salient points to be noted here include the following:</p> <ul style="list-style-type: none"> • The program should start with a re-cap of topics covered in module-11. The topic could be Why is monitoring of ETP important and what is the role of operator in it. • After the re-cap an assessment test may be conducted for all the trainees to check their knowledge gained from the program. • The assessment test may be formatted by the trainer based on the group he trains. The questions can be of objective type or multiple choice questions. • While presenting the membrane based treatment, It will be useful to show a membrane (spiral wound module or disc shaped one) to the participants for them to get an idea about the membrane treatment. • It may be useful to encourage one or two selected participants to narrate the experience and difficulties faced during re-starting of their ETP. <p>2. Handout to be given</p> <ul style="list-style-type: none"> • SOP for restarting of Textile ETPs final • Safe Re-start of ETP - FAQ Part 1 • Safe Re-start of ETP - FAQ Part 2 			
Session	Content of the module	Training material provided	Type of input needed
Assessment test	<ul style="list-style-type: none"> • All students are provided with question paper and answer sheets to record their answers. • Objective of the test is to help the trainee to recollect the lessons learnt and show-case 		Exam sheets

<p>Presentation 1: Membrane based Effluent treatment</p>	<ul style="list-style-type: none"> • Introduction to membrane systems • Different type of membranes: Micro, Ultra, Nano and RO. • Important terms such as membrane flux, fouling, silt density Index, Langelier Saturation Index etc. • Principle of membrane bio-reactor (MBR), difference between conventional biological treatment and MBR. • Operational parameters of MBR and output performance • Pros & cons of MBR. • Cost-effectiveness of MBR. • MBR as a pre-treatment to wastewater recovery & re-use. • Suitability of MBR in textile effluent.. 	<p>Power point presentation.</p>	<p>Laptop, Projector, screen, markers and white board.</p>
<p>Presentation 2: Safe restart of ETP</p>	<ul style="list-style-type: none"> • Issues in restarting of an ETP • Various risks associated with re-starting • Management of hazards during restarting. • Mechanical & electrical checks needed. • Process control for re-starting. • Recommissioning of the ETP • How to shutdown ETP safely. 	<p>Power point presentation.</p>	<p>Laptop, Projector, screen, markers and white board.</p>
<p>Concluding session</p>	<ul style="list-style-type: none"> • Overview of the training program : feedback opinion from two trainees • Summarisation of the training program by the Trainer. 		<p>Laptop, Projector, screen, markers and white board</p>
<p>Distribution of certificates</p>	<ul style="list-style-type: none"> • Announcement of results • Distribution of certificate 		<p>A senior person to distribute certificates.</p>

4 Conclusion

The training package provided by GIZ is a unique source of knowledge and only one of its kind. It is difficult to find a practical training course on ETP operation elsewhere. The magnitude of the package will be evident when one consider over 1400 pages of slides in about 40 power point presentations. **8** quiz program contents and **7** group discussion formats as well as 3 homework formats have been included in the package.

The package has been already translated into Bangoli and is available in English for any translations to other regional languages.

While videos are avoided due to size limitations and copyright issues, the trainers are encouraged to show the maximum number of video clips to sustain the interest of trainees. Suggested type of videos have been indicated in this document.

Handout materials are generally simple, short and specific and some of them are already available in Bangoli. Some of the booklets published by DoE (e.g. simplified manual on sludge disposal and standards stipulated by DoE) are included in the course material as extra item.

If site visit to the ETP is not feasible, one day of the training program may be deleted and during the remaining day for site visits, a video clip (e.g. overview of textile ETP prepared by GIZ) may be used.