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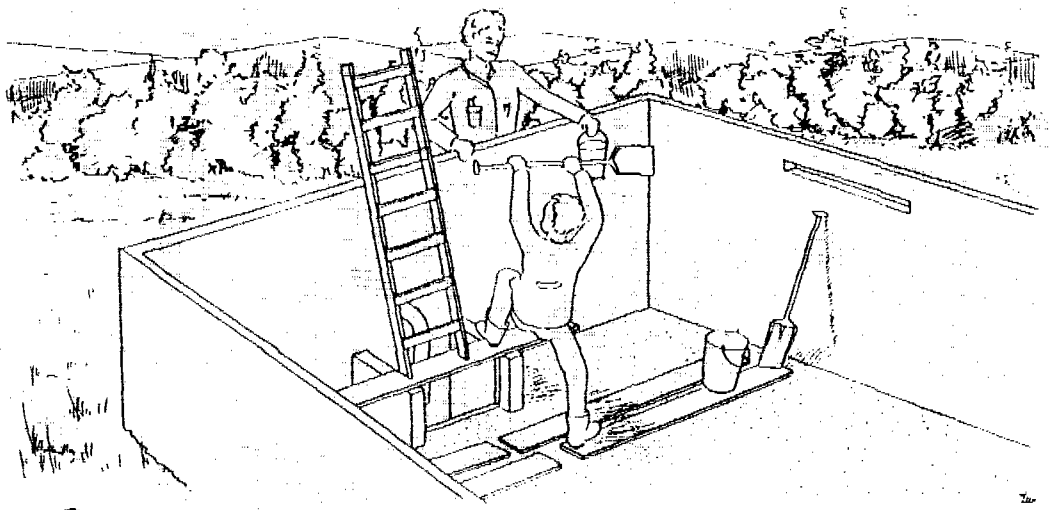
IRC
International Water and
Sanitation Centre

WHO Collaborating Centre

The Hague, The Netherlands

Slow Sand Filtration

Guide for training
of caretakers



6

Training Series

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IRC INTERNATIONAL WATER AND SANITATION CENTRE

IRC is concerned with knowledge generation and transfer and technical information exchange for water supply and sanitation improvement in developing countries. The emphasis is on innovative approaches to prevailing problems. The target groups are management and technical staff concerned with planning implementation and use of water supply and sanitation facilities in rural and urban fringe areas.

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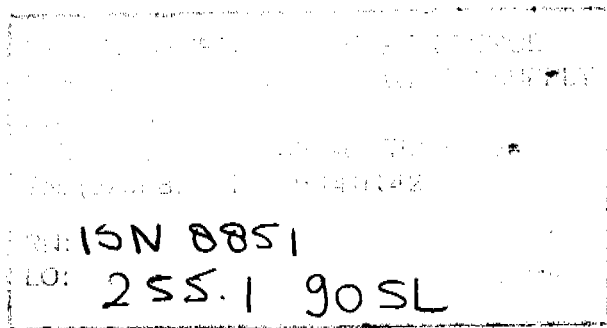
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SLOW SAND FILTRATION

Guide for Training of Caretakers

Prepared by IRC
International Water and Sanitation Centre



TRAINING SERIES NO. 6

IRC International Water and Sanitation Centre
The Hague, The Netherlands

1990

INTERNATIONAL REFERENCE CENTER
FOR CLEAN WATER SUPPLY AND
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Preface

This training guide has been prepared in the context of the International Research and Demonstration Project on Slow Sand Filtration sponsored by the Department of Research and Development of the Netherlands Ministry of Foreign Affairs. The project was initiated by institutions in Colombia, India, Jamaica, Kenya, Sudan and Thailand in collaboration with the IRC International Water and Sanitation Centre.

The document is meant to serve as a basis and a guide for a training course on operation and maintenance of slow sand filters for present and future caretakers in developing countries.

The guide draws heavily on an earlier IRC document prepared by the SSF project team, "Trainers' Guidelines - Operation and Maintenance of Slow Sand Filtration Plants in Rural Areas of Developing Countries". It has been prepared by Mr. Jan Teun Visscher and Mr. Hielke Wolters. Grateful mention is made of Mr. Teun Bastemeijer and Mr. Jo Smet from IRC for reviewing the draft versions.

The present document will be field tested by the institutions participating in the SSF Research and Demonstration Project, after which we intend to revise it.

Comments and suggestions for changes, corrections or additions are most welcome and can be directed to IRC.

1. Introduction

When a slow sand filtration plant (further referred to as SSF plant) is installed it is important that it is operated and maintained efficiently. For this, the caretaker of the scheme should have the knowledge, skills and attitudes needed for the proper performance of his job. Training is the means to achieve this objective in the shortest possible time.

A new caretaker should not be left to pick up the necessary skills and knowledge merely by exposure to the job. Instead, he should understand the right way of doing the job from the beginning and why this is important. Training may also be necessary when the caretaker of an existing SSF plant lacks the skills and knowledge to operate the plant efficiently. In this case training aims at the improvement of the existing knowledge, skills and attitudes of the caretaker.

The primary objective of this training manual is to provide country level organizations responsible for the implementation of SSF plants in rural communities with a comprehensive set of guidelines which they can use to plan, implement and evaluate local training programmes for caretakers (operators) of SSF plants. These programmes aim to improve knowledge, skills and attitudes of (future) caretakers.

The manual is intended to serve as a guide for instructors (or supervisors) while they conduct the training. It is to be used jointly with the "Manual for Caretakers of Slow Sand Filtration" (IRC Training Series, No.1), which has been prepared to provide the instructor with the information relevant for the training. Emphasis is placed on the practical skills required for proper operation and maintenance of SSF plants.

The information contained in each section has been restricted to that which is absolutely essential for successful training of (future) caretakers of an SSF plant.

Because of the wide variety of circumstances under which it will be used, it will be necessary for those concerned with its application to modify the details to suit local conditions and individual instruction styles.

2. *The Training Programme*

2.1 Introduction

It is important for those responsible for the planning and implementation of the training programme to take into account the following points.

Task analysis

Before any training can be planned it is essential to establish exactly what the caretaker must be able to do and what he must know. This can be established by analysing the performance of an experienced operator and by reviewing the plant design. The analysis should precisely identify the knowledge, skills and attitudes needed to perform the job efficiently.

Task analysis should also pinpoint those parts of the job that a trainee may find particularly difficult to master, so that they can be given special attention in the training programme.

Programme planning

Effective programme planning requires a definition of what, when, where and how the various items will be taught. The information obtained during the task analysis enables one to prepare:

- **Instruction items**
A list of the required knowledge, skills and attitudes to be taught to the trainee. The list resembles the findings obtained during the task analysis.
- **Instruction plans**
A plan for each instruction session indicating where and how the trainees are to be taught and should practice each part of the job.
- **Timetable**
A plan showing when and in what sequence each part of the job should be taught and how much time should be allocated to each part.

When dealing with a complex job, it is necessary to first provide the trainee with an outline of the whole job so that he can concentrate on one part of the job and in the meantime relate individual instruction sessions to other parts of the job.

Progress recording

In order to monitor the training programme and to assess the trainee's performance there should be a clear method for recording the instructions given and the practical exercises carried out. This provides a means for keeping the trainee informed about his progress. It also provides an overview of what has been taught and still needs to be taught.

Evaluation and revision

Once a training programme has commenced, programme details should be reviewed frequently and modified where necessary. In this way specific local conditions and needs will be incorporated automatically in the programme.

2.2 Training Approach

During an intensive, eight-day course at the training institute, the trainees get acquainted with the knowledge, skills and attitudes required for proper operation and maintenance of an SSF plant. The number of trainees participating in the course should be limited to about ten.

Background theory sessions are conducted in a group learning setting, normally in an instruction room at the training institute. Practical training sessions take place in a special training area where materials and equipment are available. The trainees practice the skills demonstrated during the sessions.

During the guided experience or practice sessions the trainee gradually develops his skills at his own workplace under close supervision. It should be realized that on-the-job supervision of the caretaker's abilities needs careful planning, especially for SSF schemes in remote villages (because of transport and organizational problems).

2.3 Training Sessions

For the training of caretakers of an SSF plant a combination of the following training methods is required:

- **Theory lesson**

During the theory lesson, the knowledge specifically related to a job is taught. It normally includes telling, illustrations, questions and answers and discussions. It can be taught in any convenient place and can be used in those cases when equipment and materials are not essential or accessible for use.

When providing background information a lecture may be the most convenient means. Most of the time (not more than 30 minutes in each session) is spent in telling, leaving some time at the end for questions. Illustrations should be included as much as possible.

- **Practical training**

During the practical training the instructor teaches a practical skill or part of a skill. The lesson includes telling, illustrations, demonstrations by the instructor, questions and answers, demonstrations by the trainee and some practice.

It normally takes place in the workplace or in a special training area where the necessary materials and equipment are available.

- **Guided experience**

Guided experience (on-the-job practice) is the means by which the trainee gradually develops his confidence in doing the job. Most of the practice can be imparted only at a functioning SSF plant or a demonstration plant. It is necessary to continue the series of practice sessions until the trainee can demonstrate his ability to perform the job or parts of the job in accordance with the standards required.

Instruction plan

A very useful method for the preparation of a training session is the writing of an instruction plan for the session. An instruction plan defines what is to be taught, where the instruction will take place, which instruction method will be used, what training aids are needed and the level to be reached. The outline of the plan and information which it should contain is given in Table 1.

2.4 Timetable for Training

A timetable is basically a chart showing the sequence in which the knowledge and practical skills should be taught and when practice sessions should take place. An example of a timetable is given in Table 2. This table is based on the syllabus for the training programme presented in Chapter 3 and does not include on-the-job practice sessions.

Care should be taken to ensure that the timetable is used as a guide that is variable according to the progress and abilities of the trainees; it should never be used as a rigid plan. It is not possible to lay down a very precise timetable for the on-the-job practice sessions, as it will be necessary to fine-tune them to occasional events such as cleaning of a filter.

Table 1: Outline of an instruction plan for a training session

TITLE of session	
OBJECTIVE of session	A precise statement of what the trainee should learn.
EQUIPMENT	A list of tools, equipment, protective clothing, visual aids, reference sources, etc.
METHOD OF INSTRUCTION	Lecture, theory lesson, practical lesson, practice.
DURATION	An estimate of how long the session will take.
INTRODUCTION	An explanation of the importance of the session, its objective, the method of instruction and its relationship to previous sessions.
DEVELOPMENT	A breakdown of the main points that the session will cover
SUMMARY	A statement of the main points that have been covered.
TEST	A check that the trainees have acquired the knowledge or skills taught during the session.
REVIEW	Comparison of the test results with the objective in order to establish progress of the trainees.
GUIDED EXPERIENCE	A series of practice sessions carried out under close supervision until the trainee can demonstrate his ability to perform the job to the standards required.

DAYS

Table 2: Timetable for the training programme

Training Item	Instruction site	Duration	1	2	3	4	5	6	7
Surface water and its need for purification	Instruction room	2 hours	■						
Operation and maintenance by the caretaker	Instruction room	2 hours				■			
Community support for the caretaker	Instruction room	2 hours						■	
The slow sand filter	Instruction room	3 hours	■	■					
The purification process in a slow sand filter	Instruction room	1 hour		■					
Operation and maintenance of the raw water intake	Training site	2 hours				■			
Preparation of a new filter	Training site	5 hours		■	■				
Starting up a filter	Training site	5 hours			■	■			
Daily operation of a filter	Training site	5 hours	■					■	
Water quality control	Training site	3 hours				■			
Shutting down procedure	Training site	4 hours				■	■		
Cleaning a filter bed	Training site	5 hours					■	■	
Sand washing by hose	Training site	3 hours						■	
Resanding a filter	Training site	5 hours							■
Record keeping	Instruction room	3 hours		■				■	

2.5 Training Records and Reports

A good system for records and reports is essential for the success of any training programme. Those which are compiled during the first few courses are of particular value because it is from the information recorded during these courses, that ideas for improvement to subsequent courses are derived.

Records and reports should be kept for the following reasons:

- To provide a means to keep trainees informed about their progress in terms of instructions received and practice successfully carried out;
- To provide a means to co-ordinate all the information about the training given and the ability of the trainee(s). This can be used to evaluate and revise each part of the training programme.

A training report is essentially an assessment of a trainee's performance written by an instructor and/or supervisor. The main difficulty with assessments is the maintenance of consistent, objective reporting standards. For this reason it is essential that instructors and supervisors make reports adhere to common definitions. Table 3 is provided as an example to be used when compiling the training records.

Records and reports should be kept simple and practical, requiring a minimum amount of administration. For these reasons the records and reports shown in Appendix 1 and 2 are recommended. They can easily be adapted to suit local requirements providing the essential information is not neglected.

Table 3: Assessment of the trainee's performance

	KNOWLEDGE	PRACTICE
GOOD	Easily grasps new information and is quick to learn	Works competently and accurately and is able to deal with most problems which arise
FAIR	Receptive but does not always grasp new information quickly	Works competently and usually produces work of good quality
POOR	Unreceptive - slow to grasp and understand new information	Works slowly and is liable to make mistakes

2.6 Evaluation and Revision

At the end of the practice a final evaluation session will be arranged. During this session the supervisor will complete an evaluation report to assess whether the trainee's ability to carry out the practical skills required for the job meet the standards set. The evaluation reports shown in Appendix 3 are recommended. They can easily be adapted to local conditions provided the essential information is not neglected.

The records and reports kept during the training as well as the evaluation reports completed during the final evaluation session should form a basis to determine the supervision the trainee is likely to need once the training programme has been completed. Table 4 can be used as a guide when assessing the supervision needed by the trainee after evaluation of their performance. The set of records and reports should be used as a basis for regular progress discussions with the trainee in order to build confidence and identify needs for additional training.

Table 4: Assessment of supervision needed by the trainees

PRACTICE \ KNOWLEDGE	KNOWLEDGE		
	GOOD	FAIR	POOR
GOOD	Able to operate and maintain SSF plant without supervision	Able to operate and maintain SSF plant with limited supervision	Able to operate and maintain SSF plant under close supervision
FAIR	Able to operate and maintain SSF plant with limited supervision	Able to operate and maintain SSF plant under close supervision	Able to operate and maintain SSF plant under close and continuous supervision
POOR	Only able to operate and maintain SSF plant under close and continuous supervision	Not very likely able to operate and maintain SSF plant	Not able to operate and maintain SSF plant

Additional training should be identified for those caretakers needing close supervision once the programme has been completed. Close supervision will often be problematic, especially for SSF plants in remote rural areas. Trainees with poor knowledge and practical abilities are unsuitable for the job and should be replaced by someone else selected from the community.

The set of records and reports provides a basis for regular discussions among instructors and supervisors involved in conducting the training programme. The effectiveness of the training programme can be assessed and improvements or revisions of parts of the training programme can be identified during these discussions. Thus the continuity and consistence of the training programme can be assured.

2.7 Selection Criteria for Trainers

It is important that the persons who are selected for training are suited for the job. If not, everyone's confidence will be undermined in the long run. Some guidelines for the selection criteria and the selection procedure are given below.

The trainee should:

- have a basic knowledge of official and local language(s);
- be a person respected by the community (in some cases a youth might not be accepted by the community as being reliable and/or respectable);
- preferably previously have been employed or engaged in a technical job (e.g. mechanic) or in a function in which the participant showed responsibility (e.g. member of the board of a (women's) co-operative committee, farmer's association or parish council);
- preferably be a local inhabitant with a reasonable guarantee of prolonged residence.

The procedure to select a trainee may include:

- oral or written baseline test
- interview by committee consisting, for instance, of a representative of a planning agency, an instructor of the training programme and a community representative

At the end of the training programme it is useful to compare the data from the selection procedure with the results of the final evaluation by the instructor.

3. Syllabus of the Training Programme

Once a thorough task analysis has been made of the process that is to be taught, the syllabus for the training programme can be established. It should indicate what skills and knowledge a local caretaker of an SSF plant should possess.

The content of the syllabus indicated below is based on the information which is given in "Manual for Caretakers of Slow Sand Filtration". As the specific job requirements might vary in the different countries, it is advisable to adapt the contents of this syllabus to the local circumstances before starting the training programme.

BACKGROUND THEORY

General background

1. Surface water and its need for purification
2. Operation and maintenance by the caretaker
3. Community support for the caretaker

Technical background

4. The slow sand filter
5. The purification process in a slow sand filter

PRACTICAL SKILLS

6. Operation and maintenance of raw water intake
7. Preparation of a new filter
8. Starting up a filter
9. Daily operation of a filter
10. Water quality control
11. Shutting down procedure
12. Cleaning a filter bed
13. Sand washing by hose
14. Resanding a filter
15. Record keeping

For every subject instruction plans can be developed, relevant to the background knowledge and skills which the trainee should obtain. Chapter 4 gives a set of instruction plans for background knowledge sessions and for practical training. Instruction plans for guided experience are not included.

4. *INSTRUCTION PLANS*

This section contains the instruction plans pertaining to the theoretical background and practical skills which the trainee should obtain.

Each instruction plan contains a detailed procedure for the conducting of the sessions including the method of assessment to be used to establish whether the trainee has absorbed what has been taught. In every plan reference is made to the related section(s) in the "Manual for Caretakers of Slow Sand Filtration".

The procedure suggested in each plan is designed to use the principles of systematic training referred to in this guide. It should not be regarded rigidly, but should be used as a guide for the instructor when adapting it to suit his own style of presentation.

Background theory lesson

Before starting the instruction, the purpose of the training and an outline of the course should be explained to the trainee(s). A timetable can be given to them and the training procedures should be explained. At this stage it is important that tests will be incorporated into almost every training session as a means of helping the trainee(s) to learn.

Practical training

In the first session of the practical training it should be explained that because the demonstration of most of the jobs will take considerable time, the instruction content usually will be fragmented and that each piece of instruction will show the following pattern:

1. Demonstration by the instructor.
2. Questions from trainee(s) to clear up doubts or misconceptions.
3. Demonstration by trainee(s).

Explain that whenever a trainee makes a mistake it will be corrected immediately to prevent the trainee from learning wrong methods.

1. Surface Water and its Need for Purification

OBJECTIVE	Trainee(s) will be able to describe in their own words: <ul style="list-style-type: none">- how the surface water becomes dirty and contaminated;- the need for purification of surface water;- the (dis)advantages of prevalent treatment methods within the community.
EQUIPMENT	Paper, blackboard
METHOD OF INSTRUCTION	Lecture and discussion with questions and answers.
DURATION	2 hours
INTRODUCTION	State title and objective of session. Explain the method of instruction.
DEVELOPMENT	<ol style="list-style-type: none">1. Ask the trainee(s) to name various water sources and discuss:<ul style="list-style-type: none">- quantity/quality aspects of water sources;- reliability of water sources.2. Discuss:<ul style="list-style-type: none">- the ways of contamination;- health effects of pollution/contamination;- the need for purification of surface water.3. Ask the trainee(s) to name various treatment methods prevalent within the community and discuss the technical/ financial/social (dis)advantages.
SUMMARY AND TEST	Ask the trainee(s) the following questions and record their answers: <ul style="list-style-type: none">- how does surface water become contaminated;- why should surface water be purified.
REVIEW	Revise any parts not clear to the trainee(s).
GUIDED EXPERIENCE	Not applicable for this training session.

2. Operation and Maintenance by the Caretaker

OBJECTIVE	Trainee(s) will be able to describe in their own words: <ul style="list-style-type: none">- the need for proper functioning of the entire water supply system;- the general tasks of the caretaker.
EQUIPMENT	Paper, blackboard
METHOD OF INSTRUCTION	Lecture and discussion with questions and answers.
DURATION	2 hours
INTRODUCTION	State the title and objective of the session. Explain the method of instruction.
DEVELOPMENT	<ol style="list-style-type: none">1. Discuss the importance of proper functioning of the entire water supply system.2. Discuss the general tasks of the caretaker, which are to:<ul style="list-style-type: none">- ensure a proper functioning of the treatment plant;- ensure that the tasks related to the operation and maintenance of a slow sand filter are performed at regular frequency;- safeguard adequate functioning of the entire system;- ensure proper use of taps;- discuss safe collection and storage of the treated water with the community members;- provide information on breakdowns to the users.
SUMMARY AND TEST	Build up a discussion by questioning the trainee(s) about: <ul style="list-style-type: none">- the importance of a proper functioning of the entire water supply system;- the tasks of the caretaker in the operation and maintenance of the entire water supply system;- the tasks of the caretaker and frequency of the operation and maintenance of a slow sand filter.
REVIEW	Revise any parts not clear to the trainee(s).
GUIDED EXPERIENCE	Not applicable for this training session.

3. Community Support for the Caretaker

OBJECTIVE	Trainee(s) will be able to describe in their own words: <ul style="list-style-type: none">- why support from the community is important for the caretaker;- how the community can support the caretaker in the operation and maintenance of the water supply system.
EQUIPMENT	Paper, blackboard
METHOD OF INSTRUCTION	Lecture and discussion with questions and answers.
DURATION	2 hours
INTRODUCTION	State the title and objective of the session. Explain the method of instruction.
DEVELOPMENT	1. Discuss the importance and the means of community involvement in: <ul style="list-style-type: none">- preventing pollution of river water;- reporting leakages to the caretaker;- reducing the risks of re-pollution of treated water;- using facilities properly;- assisting in operation and maintenance activities (e.g. resanding).
SUMMARY AND TEST	Build up a discussion by questioning the trainee(s) about: <ul style="list-style-type: none">- the role of the caretaker and the community in the operation and maintenance of the entire water supply system.
REVIEW	Revise any parts not clear to the trainee(s).
GUIDED EXPERIENCE	Role playing may provide useful experience to the caretaker for interaction with the community.

4. The Slow Sand Filter

OBJECTIVE	Trainee(s) will be able to describe the essential elements of a slow sand filter in their own words.
EQUIPMENT	Blackboard
METHOD OF INSTRUCTION	Lecture and discussion with questions and answers.
DURATION	2 hours of lectures and 1 hour of discussion
INTRODUCTION	State title of session. Explain that the trainee(s) need to know the essential elements of the filter so that they can understand why and how they must take care of the filter.
DEVELOPMENT	<ol style="list-style-type: none">1. Build up a figure of a slow sand filter stage by stage and explain the function of each part of the filter.2. Before proceeding to the next stage check by means of questions and answers that the trainee(s) have understood what they have been told.3. Ask for general questions from trainee(s).4. Inform the trainee(s) that the session will be completed once they have gained some practical experience in the operation and maintenance of a slow sand filter.
SUMMARY AND TEST	Build up a new figure of a slow sand filter by asking the trainee(s) questions and recording their answers.
REVIEW	Revise any parts not clear to the trainee(s).
GUIDED EXPERIENCE	Not applicable for this training session.

5. The Purification Process in a Slow Sand Filter

OBJECTIVE	Trainee(s) will be able to describe in their own words what happens as the water flows through the sand bed.
EQUIPMENT	Blackboard
METHOD OF INSTRUCTION	Lecture and discussion with questions and answers.
DURATION	1 hour
INTRODUCTION	State the title of the session and explain that it is necessary to know what happens as the water passes through the filter to understand the operation needed to ensure a proper functioning of the plant.
DEVELOPMENT	<ol style="list-style-type: none">1. Discuss the mechanism of biological filtration and point out the need for flow control.2. Explain the importance of the biological skin.3. Point out that operation at a constant rate is advisable and that intermittent operation should be avoided.4. Ask for general questions from the trainee(s).
SUMMARY AND TEST	Ask the trainee(s) the following questions and record their answers: <ul style="list-style-type: none">- why is it important that the filter is operated at a constant rate- why should intermittent operation be avoided.
REVIEW	Revise any parts not clear to the trainee(s).
GUIDED EXPERIENCE	Not applicable for this training session.

6. Operation and Maintenance of Raw Water Intake

OBJECTIVE	Trainee(s) will be able to maintain the raw water inlet and the raw water pump.
EQUIPMENT	Raw water inlet structure Raw water pump A rake, measuring stick and cleaning material
METHOD OF INSTRUCTION	Demonstration on site.
DURATION	2 hours
INTRODUCTION	<p>Explain the need for a free water inflow and regular maintenance of the pump.</p> <p>State the objectives of the session, explain the method of instruction, and emphasize that the trainee(s) should be able to maintain the raw water inlet and the raw water pump under close supervision next time.</p>
DEVELOPMENT	<p>Use the steps for the operation and maintenance of raw water intake (Caretakers Manual, (chapters 4 and 8), emphasizing the following key actions:</p> <ol style="list-style-type: none">1. Explain the need for regular cleaning of the screen and demonstrate how it should be done.2. Demonstrate the way in which the depth of deposits in the sump and the water level in the sump-pump should be measured, and explain the reason for it.3. Show the raw water inlet valve and explain that intermittent intake of water may be needed.4. Point out that pump failure is reported to be the most frequent reason for breakdowns in water supply systems in developing countries. Explain that regular maintenance is essential to prevent pump failures.5. Show how the pumps should be checked and kept clean. <p>Ask the trainees if they have any questions.</p>

**SUMMARY
AND TEST**

Ask the trainee(s) to actually operate and maintain the raw water intake by first explaining what they are going to do and then doing it.

Correct any mistakes immediately.

When the trainee(s) have completed the operation and maintenance of the raw water intake ask them to explain what they have done and why.

**GUIDED
EXPERIENCE**

Inform the trainee(s) that they will be asked to maintain the raw water inlet and the raw water pump twice under close supervision. This will be followed by a third time, when they will be asked to do it on their own while the supervisor completes an evaluation record to make sure that they are competent to work on their own. These sessions will be arranged as and when the opportunity arises at the caretaker's work site.

7. Preparation of a New Filter

OBJECTIVE	Trainee(s) will be able to prepare a new filter.
EQUIPMENT	Slow sand filter Wooden planks, boots, rakes, spades, buckets, long handled brushes, levelling tools, washed gravel and sand
METHOD OF INSTRUCTION	Demonstration on site.
DURATION	5 hours
INTRODUCTION	<p>Explain that correct and careful preparation of a new filter is very important to ensure that the filter is working effectively and that it is producing a safe supply of water.</p> <p>State the objective of the session, explain the method of instruction, and emphasize that the trainee(s) should be able to prepare a filter under close supervision next time.</p>
DEVELOPMENT	<p>Use the steps for preparation of a new filter (Caretakers Manual, Chapter 5) emphasizing the following key actions:</p> <ol style="list-style-type: none">1. Discuss the way in which the check for water tightness can be made.2. Demonstrate each of the following key actions, explaining what is being done and why it is being done:<ul style="list-style-type: none">- cleaning the filter box;- cleaning the filtered water outlet box.3. Explain the washing of the gravel bed and the sand on the washing platform and why they should be as clean as possible (demonstration of sand washing will be carried out during another session):<ul style="list-style-type: none">- placing the gravel on top of the underdrains and levelling of the gravel layer;- placing clean sand in the filter. <p>Ask the trainees if they have any questions.</p>

**SUMMARY
AND TEST**

Ask the trainee(s) to actually prepare a new filter by first explaining what they are going to do and then doing it.

Correct any mistakes immediately as they arise.

When the trainee(s) have completed the preparation of a new filter ask them to explain what they have done and why.

**GUIDED
EXPERIENCE**

Inform the trainee(s) that they will be asked to prepare a new filter once under close supervision while the supervisor completes an evaluation record to make sure that they are competent to work on their own. This will be arranged as and when the opportunity arises at the caretaker's work site.

8. Starting up a Filter

OBJECTIVE	Trainee(s) will be able to start up a filter.
EQUIPMENT	Slow sand filter with clean sand Levelling tools, boots
METHOD OF INSTRUCTION	Demonstration on site.
DURATION	5 hours
INTRODUCTION	<p>Explain that the correct and careful starting up of a filter is very important to ensure that the filter is working effectively and that it is producing safe water.</p> <p>State the objective of the session, explain the method of instruction, and emphasize that the trainee(s) should be able to start up the filter under close supervision next time.</p>
DEVELOPMENT	<p>Use the steps for starting up a filter (Caretakers Manual, Chapter 6.1) emphasizing the following key actions:</p> <ol style="list-style-type: none">1. Demonstrate each of the following key actions by actually operating valves and equipment, and explain what is being done and why it is being done:<ul style="list-style-type: none">- levelling of the sand surface;- undercharging the filter with water;- carefully charging the filter with water.2. Explain the reason and steps involved in setting the low initial filtration rate:<ul style="list-style-type: none">- starting the filtration process;- gradual increase of filtration rate;- daily adjustment of the flow rate;- passing the water into supply.3. Explain the need for daily checking of filtered water quality (demonstrated later on). <p>Ask the trainees if they have any questions.</p>

**SUMMARY
AND TEST**

Ask the trainee(s) to actually start up a filter by first explaining what they are going to do and then doing it.

Correct any mistakes immediately.

When the trainee(s) have completed the starting up of the filter ask them to explain what they have done and why.

**GUIDED
EXPERIENCE**

Inform the trainee(s) that they will be asked to start up a filter twice under close supervision. This will be followed by a third time, when they will be asked to do it on their own while the supervisor completes an evaluation record to make sure that they are competent to work on their own. These sessions will be arranged as and when the opportunity arises at the caretaker's work site.

9. Daily Operation of a Filter

OBJECTIVE	Trainee(s) will be able to operate a slow sand filter in the normal situation.
EQUIPMENT	Slow sand filter under normal operation Levelling tools, long handled brushes
METHOD OF INSTRUCTION	Demonstration on site.
DURATION	3 hours of instruction and 2 hours of practise
INTRODUCTION	<p>Explain the importance of the filter skin to the process and the need to avoid sudden changes in the equilibrium of the bed, for which a constant rate of filtration should be kept.</p> <p>State the objective of the session, explain the method of instruction, and emphasize that the trainee(s) should be able to operate a filter under close supervision next time.</p>
DEVELOPMENT	<p>Use the steps for daily operation of a filter (Caretakers Manual, Chapter 6.2) emphasizing the following key actions:</p> <ol style="list-style-type: none">1. Demonstrate each of the following key actions, explaining what is being done and why it is being done:<ul style="list-style-type: none">- checking of the water level in the filter box and keeping the required level;- removing of scum and floating dirt;- daily checking of the filtration rate;- adjusting of the filtration rate;- deciding when to clean the filter. <p>Ask the trainees if they have any questions.</p>

**SUMMARY
AND TEST**

Ask the trainee(s) to actually operate a filter by first explaining what they are going to do and then doing it.

Correct any mistakes immediately.

When the trainee(s) have completed the daily operation tasks ask them to explain what they have done and why.

Inform the trainee(s) that they will be asked to perform the various stages of the daily operation of an SSF once again at a later stage during the training programme.

**GUIDED
EXPERIENCE**

Inform the trainee(s) that they will be asked to operate a filter twice under close supervision. This will be followed by a third time, when they will be asked to do it on their own while the supervisor completes an evaluation record to make sure that they are competent to work on their own. These sessions will be arranged as and when the opportunity arises at the caretaker's work site.

10. Water Quality Control

OBJECTIVE	Trainee(s) will be able to collect samples and measure and/or compare the samples.
EQUIPMENT	Sample bottles Turbidity standards Buckets, long handled brushes
METHOD OF INSTRUCTION	Demonstration on site.
DURATION	3 hours
INTRODUCTION	<p>Explain the importance of the correct collection of the samples and measurements and stress the need for strict adherence to the method that will be demonstrated during the session.</p> <p>State the objective of the session, explain the method of instruction, and emphasize that the trainee(s) will be able to take and measure and/or compare samples under supervision next time.</p>
DEVELOPMENT	<p>Use the steps for water quality control (Caretakers Manual, Chapter 6.3), emphasizing the following key points:</p> <ol style="list-style-type: none">1. Demonstrate the following key actions, explaining what is being done and why it is being done:<ul style="list-style-type: none">- cleaning the sampling devices;- collecting the samples;- comparing with prepared standards and/or other samples;- interpreting the comparison;- recording the findings and taking action. <p>Ask the trainees if they have any questions.</p>

**SUMMARY
AND TEST**

Ask the trainee(s) to collect the samples and make and interpret the comparison by first explaining what they are going to do and then doing it.

Correct any mistakes immediately.

When the trainee(s) have completed the sample collection ask them to explain what they have done and why.

**GUIDED
EXPERIENCE**

Inform the trainee(s) that they will be asked to take samples twice under close supervision. This will be followed by a third time, when they will be asked to do it on their own while the supervisor completes an evaluation record to make sure that they are competent to work on their own. These sessions will be arranged as and when the opportunity arises at the caretaker's work site.

11. Shutting Down Procedure

OBJECTIVE	Trainee(s) will be able to shut down a filter.
EQUIPMENT	Slow sand filter ready to clean Long handled brushes, levelling tools
METHOD OF INSTRUCTION	Demonstration on site.
DURATION	4 hours
INTRODUCTION	<p>Explain the conditions which indicate that a filter is ready for cleaning. Explain that shutting down a filter correctly is very important to facilitate subsequent cleaning of the filter bed.</p> <p>State the objective of the session, explain the method of instruction, and emphasize that the trainee(s) should be able to shut down a filter under supervision next time.</p>
DEVELOPMENT	<p>Use the steps for the shutting down procedure (Caretakers Manual, Chapter 7.1), emphasizing the following key actions:</p> <ol style="list-style-type: none">1. Demonstrate each of the following key actions, explaining what is being done and why it is being done:<ul style="list-style-type: none">- closing the inlet valve;- removing floating material;- brushing the walls;- draining the supernatant water from the filter;- draining the upper part of the sand bed;- maintaining the water output of the plant. <p>Ask the trainees if they have any questions.</p>

**SUMMARY
AND TEST**

Ask the trainee(s) to actually shut down a filter by first explaining what they are going to do, why they are going to do it and then doing it.

Correct any mistakes immediately.

When the trainee(s) have shut down the filter ask them to explain what they have done and why.

**GUIDED
EXPERIENCE**

Inform the trainee(s) that they will be asked to shut down a filter twice under close supervision. This will be followed by a third time, when they will be asked to do it on their own while the supervisor completes an evaluation record to make sure that they are competent to work on their own. These sessions will be arranged as and when the opportunity arises at the caretaker's work site.

12. Cleaning a Filter Bed

OBJECTIVE	Trainee(s) will be able to prepare a bed for cleaning, clean the bed, and prepare the bed for re-charging under supervision.
EQUIPMENT	Slow sand filter ready for cleaning Wooden planks, ladders, boots, rakes, spades, buckets, levelling tools
METHOD OF INSTRUCTION	Demonstration on site.
DURATION	5 hours
INTRODUCTION	<p>Explain that it is important to do a thorough job of cleaning, to do it as quickly as possible and to avoid or prevent contamination during the cleaning process.</p> <p>State the objective of the session, explain the method of instruction, and emphasize that the trainee(s) should be able to clean a filter under supervision next time.</p>
DEVELOPMENT	<p>Use the steps for cleaning a filter bed (Caretakers Manual, Chapter 7,2), emphasizing the following key actions:</p> <ol style="list-style-type: none">1. Demonstrate each of the following key actions by actually using equipment, and explaining what is being done and why it is being done:<ul style="list-style-type: none">- cleaning of equipment and boots before entering the filter box;- placing boards on a small, scraped area;- placing equipment on the boards;- marking out the bed;- scraping of the upper 2-3 cm of each area and removing the scrapings from the filter;- checking inlet valve and outlet valve;- removing all equipment and then levelling the surface of the sand;- checking and recording the depth of the sand;- adjusting the inlet box to the new sand level;- starting up the filter again;- allowing the filter skin to develop;- passing the filtered water into supply and adjusting the filtration rate in the other unit(s).

Ask the trainees if they have any questions.

**SUMMARY
AND TEST**

Ask the trainee(s) to actually clean a filterbed by first explaining what they are going to do, why they are going to do it and then doing it.

Correct any mistakes immediately.

When the trainee(s) have completed the cleaning ask them to explain what they have done and why.

**GUIDED
EXPERIENCE**

Inform the trainee(s) that they will be asked to clean a filter twice under close supervision. This will be followed by a third time, when they will be asked to do it on their own while the supervisor completes an evaluation record to make sure that they are competent to work on their own. These sessions will be arranged as and when the opportunity arises at the caretaker's work site.

13. Sand Washing by Hose

OBJECTIVE	Trainee(s) will be able to remove impurities from sand, check the quality of washed sand, and dry and store washed sand.
EQUIPMENT	Sand scrapings removed from the filter Washing platform Storage for clean sand Supply of wash water Hose, stick and a sieve
METHOD OF INSTRUCTION	Demonstration on site.
DURATION	3 hours
INTRODUCTION	<p>Explain why sand washing is carried out and when it should be done.</p> <p>State the objective of the session, explain the method of instruction, and emphasize that the trainee(s) should be able to wash sand under supervision next time.</p>
DEVELOPMENT	<p>Use the steps for washing by hose (Caretakers Manual, Chapter 7.3), emphasizing the following key actions:</p> <ol style="list-style-type: none">1. Demonstrate each of the following key actions, explaining what is being done and why it is being done:<ul style="list-style-type: none">- placing sand scrapings on the washing platform;- spraying water on the scrapings while stirring them with a stick;- checking whether sand is clean;- draining the water from the platform;- drying the sand;- removing coarse material from sand;- storing washed and dried sand;- cleaning washing equipment and platform. <p>Ask the trainees if they have any questions.</p>

**SUMMARY
AND TEST**

Ask the trainee(s) to actually wash the sand by hose by first explaining what they are going to do and then doing it.

Correct any mistakes immediately.

When the trainee(s) have completed the sandwashing ask them to explain what they have done and why.

**GUIDED
EXPERIENCE**

Inform the trainee(s) that they will be asked to carry out the sand washing procedure twice under close supervision. This will be followed by a third time, when they will be asked to do it on their own while the supervisor completes an evaluation record to make sure that they are competent to work on their own. These sessions will be arranged as and when the opportunity arises at the caretaker's work site.

14. Resanding a Filter

OBJECTIVE	Trainee(s) will be able to decide when resanding is necessary and to resand the filter bed under supervision.
EQUIPMENT	Slow sand filter ready for cleaning Wooden planks, ladders, rakes, spades, buckets, wheelbarrows, long handled brushes, levelling tools
METHOD OF INSTRUCTION	Demonstration on site.
DURATION	5 hours
INTRODUCTION	<p>Explain the conditions under which resanding becomes necessary, and why and how to decide when it is necessary.</p> <p>Explain the activities for resanding.</p> <p>State the objectives of the session, explain the method of instruction, and emphasize that the trainee(s) should be able to resand a filter bed under supervision next time.</p> <p>Explain that the trainee(s) have already been instructed in the jobs preceding the resanding of a filter. Briefly state the key actions for lowering the water level and scraping the filter bed.</p>
DEVELOPMENT	<p>Use the steps for resanding a filter (Caretakers Manual, Chapter 7.4), emphasizing the following key actions:</p> <ol style="list-style-type: none">1. Demonstrate each of the following key actions, explaining what is being done and why it is being done:<ul style="list-style-type: none">- shutting down and cleaning the filter;- draining the water from the sand bed;- removing the sand and placing it beside the filter;- placing a layer of clean sand on top of the gravel pack;- levelling the surface of the new sand layer;- replacing the sand on top of the clean sand;- levelling the surface of the sand;- adjusting the inlet box;- re-starting the filter process. <p>Ask the trainees if they have any questions.</p>

**SUMMARY
AND TEST**

Ask the trainee(s) to actually resand a filter by first explaining what they are going to do and then doing it.

Correct any mistakes immediately.

When the trainee(s) have completed the resanding of a filter ask them to explain what they have done and why.

**GUIDED
EXPERIENCE**

Inform the trainee(s) that they will be asked to resand a filter twice under close supervision. This will be followed by a third time, when they will be asked to do it on their own while the supervisor completes an evaluation record to make sure that they are competent to work on their own. These sessions will be arranged as and when the opportunity arises.

15. Record Keeping

OBJECTIVE	Trainee(s) will be able to complete and maintain a logbook.
EQUIPMENT	Paper, blackboard and flip-over Examples of information to enter into a logbook Example of a completed record sheet and logbook
METHOD OF INSTRUCTION	Lecture and discussions with questions and answers. Demonstration.
DURATION	1 hour of lecture and 2 hours of practise
INTRODUCTION	State the title and objective of the session. Explain the method of instruction.
DEVELOPMENT	<ol style="list-style-type: none">1. Explain the need for daily record keeping.2. Demonstrate how to fill in a record sheet of a logbook.<ul style="list-style-type: none">- Provide each trainee with a blank record sheet and demonstrate on the blackboard or the flip-over how to fill in the record sheet, explaining how the information is obtained, why it is important, and exactly what information should be entered.- Ask the trainee(s) to fill in their blank record sheets with the information.3. Explain to the trainee(s) that they will be asked to fill in a blank record sheet during the practical sessions.4. Discuss how to interpret the information gathered in a logbook.<ul style="list-style-type: none">- Provide each trainee with an example of a completed record sheet for a representative period, and discuss how to interpret the information in terms of what it tells about the functioning of the filter.- Emphasize the usefulness of record keeping.

**SUMMARY
AND TEST**

1. Give the trainee(s) an empty record sheet and information, and ask them to enter it on their record sheet.
2. Give the trainee(s) a completed record sheet and ask them to examine the information on it and deduce what it tells them in terms of how well the filter is functioning and is being operated.

REVIEW

Revise any parts not clear to the trainee(s).

**GUIDED
EXPERIENCE**

Inform the trainee(s) that they will be asked to keep a logbook and that they will be asked to fill in a record sheet of that logbook three times under close supervision. This will be followed by a fourth time, when they will be asked to do it on their own while the supervisor completes an evaluation record to make sure that they are competent to work on their own. These sessions will be arranged as and when the opportunity arises.

Discuss the results of the record with the trainee(s).

APPENDIX I: RECORD OF TRAINING SESSIONS AND PERFORMANCE

Name of Trainee:

Date training commenced:

Name of Scheme:

Date training completed:

TRAINING SESSION	DATE	INSTRUCTOR	ASSESSMENT *		
			GOOD	FAIR	POOR
Background knowledge					
Surface water and its need for purification					
Operation and maintenance by caretaker					
Community support for the caretaker					
The slow sand filter					
The purification process in a filter					
Practical skills					
Operation and maintenance of water intake					
Preparation of a new filter					
Starting up a filter					
Daily operation of a filter					
Water quality control					
Shutting down procedure					
Cleaning a filter bed					
Sand washing by hose					
Resanding a filter					
Record keeping					

*** ASSESSMENT:**

Knowledge **Good:** Easily grasps new information and is quick to learn
 Fair: Receptive but does not always grasp new information quickly
 Poor: Unreceptive-slow to grasp and understand new information

Practice **Good:** Works competently and accurately and is liable to deal with most problems that arise
 Fair: Works competently, usually produces work of good quality
 Poor: Works slowly and is liable to make mistakes

REMARKS:

Name of Trainee:

Name of Scheme:

ACTIVITY	PLANNED EXPERIENCE SESSIONS						EVALUATION SESSION			
	DATE	INSTRUCTOR	ASSESSMENT*	DATE	INSTRUCTOR	ASSESSMENT*	DATE	INSTRUCTOR	ASSESSMENT*	REMARKS
Operation and maintenance by the caretaker										
Community support for the caretaker										
Organizing the caretaker's job										
Operation and maintenance of raw water intake										
Preparation of a new filter										
Starting up a filter										
Daily operation of a filter										
Water quality control										
Shutting down procedure										
Cleaning a filter bed										
Sand washing by hose										
Resanding a filter										

* ASSESSMENT Poor: Works slowly and is liable to make mistake
 Fair: Works competently, usually produces work of good quality
 Good: Works competently and accurately and is liable to deal with most problems that arise

ANNEX III
PERFORMANCE EVALUATION RECORDS

III.1 OPERATION AND MAINTENANCE OF THE RAW WATER INTAKE AND THE RAW WATER PUMP

Name of the caretaker:

Name of the supervisor:

Date:

Activities	Assessment	
	yes	no
Did the caretaker
1. Clean the screen of the intake
2. Check the inlet valve
3. Check the depth of the sump
4. Remove the deposit from the sump when it was more than 50 cm. deep
5. Check the water level in the sump
6. Look after the raw water pump

Remarks:

When completed discuss results with trainee and file form.

Supervisor's signature:

III.2 PREPARATION OF A NEW FILTER

Name of the caretaker:

Name of the supervisor:

Date:

Activities	Assessment	
	yes	no
Did the caretaker		
1. Check for watertightness of the filter box
2. Clean the filter box
3. Clean the filtered water outlet
4. Wash the filter gravel
5. Place the washed gravel on the drainage system
6. Wash and sieve the filter sand
7. Spread the sand evenly on top of the gravel to the required height

Remarks:

When completed discuss results with trainee and file form.

Supervisor's signature:

III.3 STARTING UP A FILTER

Name of the caretaker:

Name of the supervisor:

Date:

Activities	Assessment	
	yes	no
Did the caretaker	yes	no
1. Level the sand surface
2. Undercharge the filter with water
3. Add sand and level the sand surface again, if required
4. Carefully recharge the filter with water until the water level is 20 cm. above the sand surface
5. Start the filtration process
6. Increase the filtration rate every half hour by 0.02 m/h until design flow is reached
7. Adjust the flow rate daily
8. Check daily whether the water is safe to drink
9. Pass the water into supply

Remarks:

When completed discuss results with trainee and file form.

Supervisor's signature:

III.4 DAILY OPERATION OF A FILTER

Name of the caretaker:

Name of the supervisor:

Date:

Activities	Assessment	
	yes	no
Did the caretaker		
1. Check the water level in the filter box and keep it at the required level
2. Remove scum and floating dirt
3. Check the rate of filtration
4. Adjust the rate of filtration
5. Check whether the filter needs to be cleaned

Remarks:

When completed discuss results with trainee and file form.

Supervisor's signature:

III.5 WATER QUALITY CONTROL

Name of the caretaker:

Name of the supervisor:

Date:

Activities	Assessment	
	yes	no
Did the caretaker		
1. Clean the sampling device
2. Find out the correct sampling points
3. Collect the samples correctly
4. Measure and compare the samples correctly
5. Record the findings and take action if required

Remarks:

When completed discuss results with trainee and file form.

Supervisor's signature:

III.6 SHUTTING DOWN PROCEDURE

Name of the caretaker:

Name of the supervisor:

Date:

Activities	Assessment	
	yes	no
Did the caretaker		
1. Close the inlet valve
2. Remove floating material
3. Drain the water from the filter
4. Stop draining the water when the level has fallen 20 cm below the sand surface
5. Brush the filter walls
6. Maintain the water output of the plant

Remarks:

When completed discuss results with trainee and file form.

Supervisor's signature:

III.7 CLEANING A FILTER BED

Name of the caretaker:

Name of the supervisor:

Date:

Activities	Assessment	
	yes	no
Did the caretaker		
1. Wash equipment and boots before entering the filter box
2. Clean an area at the foot of the steps to place the equipment on
3. Place boards on scraped area
4. Place equipment on the boards
5. Mark out areas of about 3x3m by scraping narrow strips, and place boards on these strips
6. Scrape the upper 2-3 cm of each area
7. Remove all scrapings from the filter
8. Examine condition of exposed valves and filter equipment		

Remarks:

[continued]

		Assessment	
		yes	no
9.	Remove all equipment from the bed	...	...
10.	Level the surface of the sand	...	...
11.	Check and record the depth of the sand bed	...	...
12.	Adjust the inlet box to the new sand level	...	...
13.	Start up the filter again	...	...
14.	Pass the filtered water into supply when it is safe	...	...
15.	Adjust the rate of filtration of other filter unit(s)	...	...
16.	Preserve hygienic conditions during the whole operation	...	...

Remarks:

When completed discuss results with trainee and file form.

Supervisor's signature:

III.8 SAND WASHING BY HOSE

Name of the caretaker:

Name of the supervisor:

Date:

Activities	Assessment	
	yes	no
Did the caretaker		
1. Wash sand immediately after scraping
2. Place a correct volume of sand on the washing platform
3. Wash scrapings correctly
4. Take care to avoid removal of fine particles
5. Wash sand correctly
6. Check whether the sand is clean

Remarks:

[continued]

		Assessment	
		yes	no
7.	Drain the water from the platform	...	...
8.	Dry the sand properly	...	...
9.	Remove coarse material from the sand	...	...
10.	Store washed and dried sand in a place free from contamination	...	...
11.	Clean washing equipment, platform and sedimentation pit	...	...

When completed discuss results with trainee and file form.

Supervisor's signature:

III.9 RESANDING A FILTER

Name of the caretaker:

Name of the supervisor:

Date:

Activities	Assessment	
	yes	no
Did the caretaker		
1. Make a correct decision to resand the filter
2. Shut down and clean the filter
3. Drain the water from the sand bed to the level of the gravel
4. Divide the bed into strips
5. Store sand of the first strip beside the filter
6. Place a layer of clean sand on top of the gravel pack of the strip

Remarks:

[continued]

		Assessment	
		yes	no
7.	Level the surface of the new sand layer	...	...
8.	Place the sand of an adjacent strip on top of the clean sand layer	...	...
9.	Repeat 6, 7 and 8 until the bed is completely resanded	...	...
10.	Level the surface of the sand	...	...
11.	Adjust the inlet box to the new sand level	...	...
12.	Examine condition of exposed valves and filter equipment	...	...
13.	Re-start the filtration process	...	...
14.	Preserve hygienic conditions during the whole operation	...	...

Remarks:

When completed discuss results with trainee and file form.

Supervisor's signature:

III.10 RECORD KEEPING

Name of the caretaker:

Name of the supervisor:

Date:

Activities	Assessment	
	yes	no
Did the caretaker		
1. Keep a record of:		
- interruptions in the raw water intake
- cleaning of the inlet and sump
- raw water quality
2. Keep a record of:		
- removal of floating algae
- filtration rate
- filtered water quality
- interruptions in filter operation
- head-loss development
- actions undertaken
3. Keep a record of cleaning, indicating:
- date and time of cleaning
- sand level after cleaning
- date and time of return to operation

Remarks:

When completed discuss results with trainee and file form.

Supervisor's signature: