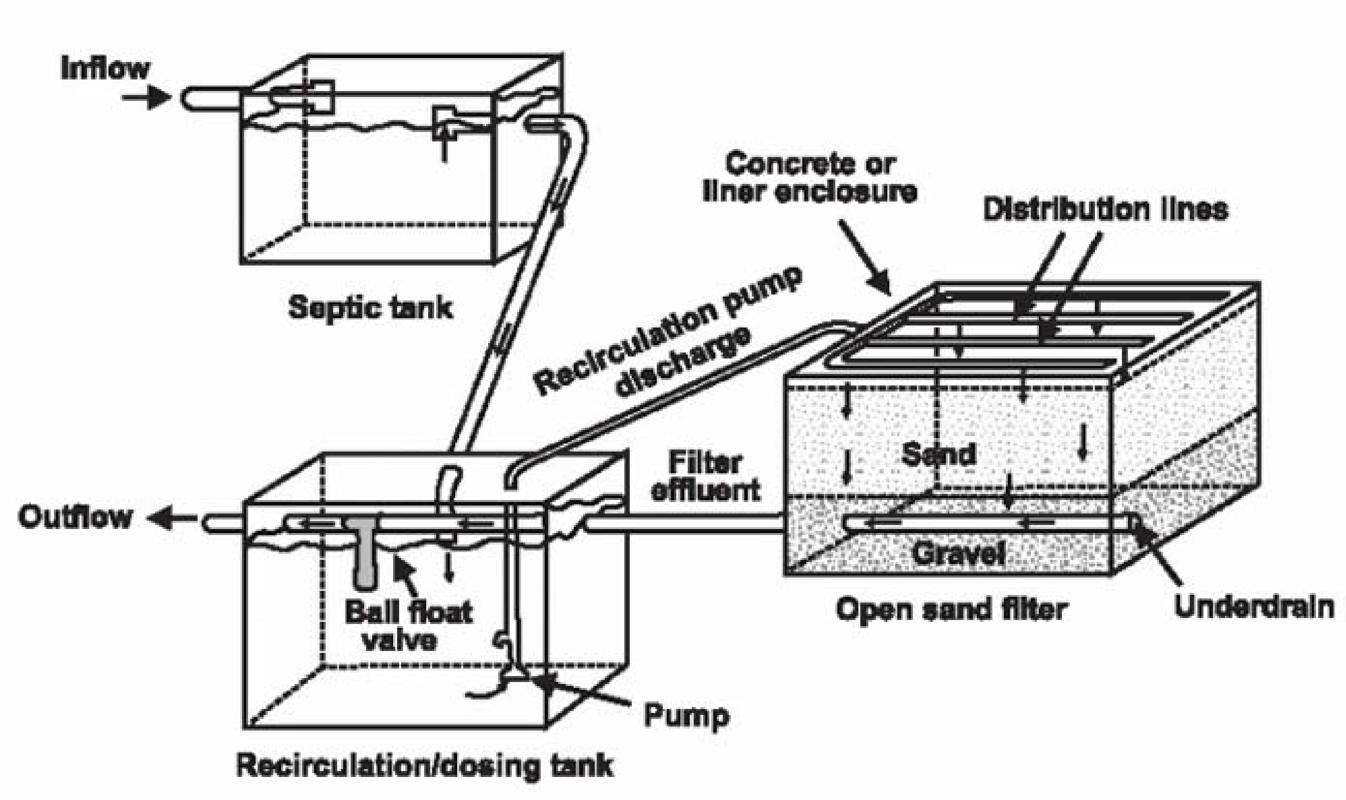
Missouri Department of Natural Resources

Recirculating Media Filter Operation and Maintenance

Water Protection Program fact sheet 10/2018
Division of Environmental Quality Director: Ed Galbraith PUB2738

Sorrento Square, Camden County, Missouri - photographed by Troy Potteiger, SWRO Environmental Specialist



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Introduction

This guidance is intended to provide facility owners and operators with guidance on operation and maintenance of Recirculation Media Filter (RMFs) in Missouri. It is in no way intended as a substitute for professional engineering consulting advice. While the scenarios described in this document may appear to provide solutions for some situations, users of this guide are urged to seek the advice of their own consultants and wastewater treatment professionals who can assess the unique circumstances and address specific facility conditions.

RMFs using sand, gravel, or other media provide advanced secondary treatment of primarily treated wastewater or septic tank effluent. They consist of a lined excavation or structure filled with media, typically uniform washed sand or pea gravel, which is placed over an underdrain system. The wastewater is dosed onto the surface of the sand through a distribution network and allowed to percolate through the media to the underdrain system. The underdrain system collects and recycles the filter effluent to the recirculation tank for further processing or discharge.

In Missouri, the majority of existing RMFs were designed to remove biochemical oxygen demand (BOD) and total suspended solids (TSS) and typically were planned for a hydraulic loading rate of less than five gallons per day per square foot (5 gpd/ft^2) and a recirculation ratio of 4:1. While the systems were designed for BOD and TSS removal, nitrification and some denitrification can occur. Nitrification converts the ammonia or ammonium present in wastewater through biological oxidation to nitrite followed by the oxidation of nitrite to nitrate. While nitrification is what the majority of facilities are attempting to achieve currently, it may be in a facility's best interest to achieve nitrification and denitrification. Denitrification is the removal of the nitrogen from the wastewater, including the ammonia, total kjeldahl nitrogen (TKN), nitrate, and nitrite.

Properly designed, operated, and maintained RMFs can produce effluent that is protective of water quality where instream assimilative capacity exists. On the other hand, aging and/or neglected systems can pose a threat to water quality. RMF facilities are encouraged to properly maintain facilities and actively work toward optimization of operations to achieve the highest attainable effluent quality.

How a Recirculating Media Filter Operates

Raw wastewater flows into primary treatment, usually a septic tank. The purpose of the septic tank is to provide an area where heavy solids settle and where oil, grease and lighter solids float to the top for collection. The remaining liquid then flows on to secondary treatment or a second chamber/tank to collect any floating and settling solids that passed through the septic tank (first chamber) or to act as an equalization tank. The wastewater then goes into the pumping/recirculation chamber/tank where it is pumped through the distribution lateral line, onto the surface of the filter media bed.

As wastewater percolates slowly through the filter media bed, physical, biological and chemical processes remove contaminants. On the surface of the grains of sand, gravel, or other media grows a naturally occurring, microscopically thin zoogleal film composed of large populations of bacteria and other microorganisms. Commonly called slime.

As wastewater flows over the surface of this film, organic material is absorbed onto the film where it becomes food for the bacteria. For maximum treatment, it is essential that wastewater be in frequent contact with the film attached to the media. Because the aerobic organisms in the film need oxygen to live, it is also essential to maintain unsaturated flow conditions through the filter media.

The organism population within a RMF multiplies to balance the organic loading rate. When food is not coming in organisms begin to consume each other, a sort of survival of the fittest phenomenon. This process is called endogenous respiration. This process keeps the filter from building up a large organic content of biological cells. If the system is too heavily loaded, biological cells and biodegradation byproducts accumulate, and the pores of the media bed may become filled with organic matter. If gray or tan gelatinous growth is observed on the media at the squirt holes, this is a sign of over saturation. Oversaturation can lead to the media bed becoming plugged which results in ponding on the surface. Therefore, it is necessary to balance the application rate with the rate at which the bugs can decompose the applied material and keep the development of a large bacterial cell mass from accumulating.

From the time a zone has been dosed, it is recommended there be a 25 to 30 minutes wait until the dosing returns to that zone to allow for the process of endogenous respiration.

Unsaturated flow and sustained contact are achieved by distributing the wastewater evenly over the surface of the media bed and by keeping doses small and frequent over the course of the day. Even distribution also ensures that the entire media is used, thus preventing clogging that can result when parts of the media go unused and others are hydraulically and organically overloaded.

The question everyone wants to know is: How long will recirculating media filter beds last? The life of a filter bed is dependent on many variables such as: organic loading, hydraulic loading, hydraulic retention time (septic tanks), STEP system, solids removal (septic tank pumping), weed removal, flow configuration, dosing rate, oil and grease entering the system, and the type or size of media. With the varying nature of these systems it is difficult to determine the life expectancy of any individual bed.

Department staff experience indicates the need for media to be replaced varies widely. Media in some RMF facilities needed to be replaced in as few as seven years due to ponding, while other facilities exceeded 20 years of use and are still in operation with the original media.

If you have questions about or would like more information on recirculating media beds, you may contact the wastewater specialist at the appropriate Department of Natural Resources Regional Office. See https://dnr.mo.gov/regions/index.html

Operational Concerns

Site Control and Maintenance

The site must be made secure from passersby and particularly from vehicular traffic, including all-terrain vehicles, which may be attracted to the large, level surface of loose gravel. Woven wire or three-strand wire fence should be sufficient for this purpose. Locked gates must be used to assure restricted access. Grass on the berms surrounding the media bed should be mowed regularly, and clipping should be collected or blown away from the media bed surface.

Mainenance Issues

Staffing

An RMF facility is typically operated and maintained by a single person. Depending on the frequency of visits and sampling requirements, the average amount of time spent monitoring an RMF facility ranges from two to seven hours per week. For larger facilities, daily visits might be needed, or required according to the permit. On non-sampling days, operators report that the daily checkup should take about 15 minutes. On sampling days, one hour is typically needed to collect samples and prepare them for delivery to the lab. Weeks during which periodic maintenance of equipment or the media bed itself is performed will require additional hours.

For small facilities equipped with an alarm dialer, daily visits may not be necessary, but the operator is reminded to consistently maintain compliance with the applicable permit requirements.

Sampling

Surface discharging facilities regulated under the NPDES permit program will have influent and effluent sampling requirements spelled out in the permit. These may range from once per quarter to once per week for parameters such as

- BOD
- TSS
- ammonia-nitrogen

- E. coli
- pH
- dissolved oxygen
- phosphorus

Periodic sampling for operational control is recommended. These samples are collected separate from the permit required samples that are to be reported to the Department. Such sampling can provide a benchmark level of performance for a system, allowing the operator to observe trends in performance and address a potential issue before it is allowed to progress to failure of the system. A minimum recommended sampling protocol, identified in Table A below, for RMF systems will help provide the operator with additional information on the performance of their system.

Table A
Minimum Recommended Sampling Location and Frequency

Parameter	**Septic Tank Influent**	**Septic Tank Effluent**	**Effluent**
BOD	Monthly	Monthly	Monthly
TSS	Monthly	Monthly	Monthly
Ammonia	Monthly	N/A	Monthly
Temperature	Monthly	N/A	Monthly
D.O.	N/A	N/A	Monthly
pH	N/A	N/A	Monthly
Phosphorus	N/A	N/A	Weekly*
Phosphorus	N/A	N/A	Monthly**

* if permitted for monthly reporting
** if permitted for quarterly reporting

If the facilities are conducting chemical addition for the removal of phosphorus it is recommended that the operators perform operational sampling on a shorter frequency than what is required per permit reporting to allow for chemical feed rate adjustments.

If it appears that the chemical additive, such as alum, used to remove phosphorus is not working the operator should check the alkalinity of the water. The removal efficiency of the additive depends on the alkalinity of the water being at a certain level. However the over use of the additive can also cause the alkalinity and pH of the water to drop. Certain waters may already be low in alkalinity, therefore, testing of the influent may also show that the water is low in alkalinity and not directly related to the use of the additive. It has been experienced that an alkalinity of 100mg/L in the effluent is recommended.

Record Keeping

The operator should keep a bench sheet for recording observations made on each visit. Items that should be recorded include but are not limited to:

- Weather observation (temperature, precipitation)
- Influent/effluent flow (if metered)
- Total pump run time, each pump
- Daily pump run time, each pump (calculated)
- Total pump starts, each pump
- Daily starts, each pump (calculated)
- Cells and zones in service
- Dissolved oxygen
    - Recirculation tank

    - Effluent
- Effluent pH
- Effluent temperature
- Alkalinity
    - Influent
    - Effluent
- Other observations and comments

If the facility is a manufactured textile system, such as an Advantex system, at a minimum the operations and maintenance requirements from the manufacturer must be followed and documented.

Media Saturation and Ponding

As water starts to collect in ponds on the surface, it also spreads out over the surface of the media. While initially only a small area underneath the orifice of a distribution lateral will receive water, ponding will increase the amount of media utilized in the treatment process. So while ponding is a preliminary indication of clogging, isolated ponding need not cause alarm, as it also allows for better media use.

However, a properly operating RMF should never pond completely. Ponding that persists or covers large areas could be an indication that the media has become plugged. For RMF facilities that are using sand as the media the bed will initially look to be ponding. This may result in the build up of a layer of bacterial growth in the form of a biomat. There should always be sufficient area that is not covered by biomat so that the water recedes within a few minutes. If this is not the case, the RMF is not operating correctly and the nature and reason for excessive biomat needs to be investigated before anaerobic conditions set in. An anaerobic RMF may also foster the growth of worms or other macrophytes. A RMF cell should be taken off line and rested before it is completely ponded. Once the surface has dried, it can be raked or tilled and placed back into service.

Freezing

Water that is kept moving is less likely to freeze. In a coarse media filter (1.5 mm), water will percolate through the media fast enough to prevent freezing, even in northern Missouri. Some ice "shields" will form above the surface of an open filter and distribution lines, but water should continue to flow underneath the ice all winter. This ice provides insulation from the cold ambient air. Vegetative and algae growth is inhibited by the cold temperature, making winter operation relatively low maintenance.

Freezing is a concern with fine or clogged media. In subfreezing ambient temperatures, ponded wastewater may cool to the point where freezing occurs. Once a filter surface freezes, it effectively prevents its use for treatment until it thaws. Allowing an entire bed to freeze would leave a community without any secondary treatment at all. If the filter built up a heavy layer of biomat during the warmer season and is continually saturated, it could lead to the entire filter bed freezing up in winter. One of the keys to preventing a frozen filter is to transfer flow onto a rested and raked filter cell in the fall months while the temperature is still warm enough to establish a biomat for nitrification. Once established the rested bed will have a smaller layer of biomat and therefore allow for more efficient drainage, reducing the likelihood of freezing. Further, frequent smaller doses to minimize ponding will also help to avoid freezing.

Pumps and Electrical

Pumping systems should be provided with a redundant pump for each zone to provide good reliability. The dosing pumps must be able to meet the worst-case instantaneous flow rate requirement with one unit out of service. Pumps are generally controlled by timers, floats, or some type of electronic level sensor.

Odors

Pretreatment Units

Odors can originate in the septic tank, which is vented to the atmosphere. While generally not a nuisance to neighbors, carbon canisters can be installed on the vent piping to further reduce odors.

Media Bed

Odors in the sand or gravel filter media are uncommon, and, if present, are an indicator that something is wrong. As an aerobic system, the products of metabolism are chiefly carbon dioxide and water, which are odorless. Odors are produced under anaerobic conditions. Odors are an indicator that the dissolved oxygen in the filter is being depleted and that BOD and ammonia removal are likely being impacted.

Septic Tank Effluent Screen Cleaning Intervals

The cleaning of the effluent screens should be done more frequently than recommended by the manufacturer until the operator has a sense of how quickly they are prone to clogging. An initial cleaning interval of every two weeks is suggested. If clogging does not appear to be a problem after two weeks, the operator can gradually begin to extend the interval between cleaning. The operator should look for signs of surcharging such as a high waterline on the wall of the tanks and debris on top of the screen and overflow pipes.

Screens should be sprayed off with high-pressure water over the head end of the septic tank. Water may be from a well, or from a sump pump drawing effluent from the splitter structure. If water is not available on site, the operator may place a spare screen into service, and haul the dirty screen off site for cleaning. Note that the screen will likely retain some water and the operator will need to transport the screen in a manner that minimizes any spillage. Examples include wrapping it up in a plastic tarp or placing the screen in a bucket.

Solids Removal

Solids will accumulate in the settling tank, particularly the first cell of a multi-chambered tank. A properly sized tank will allow for solids to accumulate for 1-5 years. During this period, the solids will compact and anaerobically break down. An operator should monitor the level of solids accumulation annually with a Sludge Judge® or similar sampling device. A rule of thumb would be to arrange for sludge removal when sludge occupies half of the volume of the settling tank. The quality of the sludge is equivalent to a Class B sludge under 40 CFR Part 503, the federal sludge quality regulations, and can generally be land applied. Sludge should be handled by a licensed hauler. Sludge may be land applied by the facility if authorized in the permit or by another properly permitted facility.

The scum layer that may form at the surface in the settling tank should also be monitored. The scum thickness should not exceed a few inches. In some cases, the thickness of the scum layer may be a factor that would trigger tank cleanout.

Solids or sludge pumping contractors usually charge by the gallon, so reducing the volume of wastewater above the sludge can save the facility money. Decanting the liquid portion from one cell into another can be accomplished by lowering a submersible pump into the tank cell and suspending it above the surface of the sludge blanket. Another advantage of using multiple small tanks instead of one large tank is that the pump-out operation will be much more effective if the pumper truck(s) can completely remove the contents of a given tank in a few minutes so that new flow does not add to the total volume of material to be pumped. Pumping a large tank can take days. During the pumping period, continuous influent will add to the tank contents and increases the total volume to be pumped.

Pumps and Recirculation Tank

Water in the recirculation tank should be relatively clear and free of solids. If large amounts of solids or debris are noticed, it could be an indicator that the filter screens have failed or overflowed.

Most of the recirculation tanks have a depth of around 4 to 5 feet. The recirculation tank should be pumped out by a contract hauler when solids accumulation has reached 15 inches anyplace in the recirculation tank. Another indication of the need to have this tank pumped is the appearance of solids deposits on the media at the distribution lines.

The operation of the pumps should be observed to be functioning according to how the system was designed and configured at the control panel. The pumps may be operated by floats, timers or a combination of the two. Operators can also check the function of the pumps by setting the pumps to run on manual mode and bypassing the automated system.

The pump runtimes should be checked and recorded to verify that all pumps are receiving approximately the same amount of run time. Disparities in run times will indicate a failure to alternate or failure of a pump to run when called. Such failures should be investigated and corrected.

The manufacturer's recommendation for pump service such as oil changes, seal replacements and bearing replacements should be followed. At least one spare pump should be maintained in reserve in the event a pump needs to be removed for service for more than one day.

Pump control floats in the recirculation tank should be suspended freely in the tank.

The floats should be free of debris or grease build-up, and should be cleaned off as needed.

Distribution Piping

The automatic distribution valve(s) should be observed to be indexing the dosing of each filter cell and zone. Using a shovel, the operator should expose laterals at various locations on the filter surface to verify that the area under the laterals is wet.

If the media under some laterals is dry, it indicates that clogging of the distribution lateral is likely to be occurring. As the orifices become plugged the squirt height of the unplugged orifices will increase. Noting the changes in squirt height can be a good method to determine extent of clogging. Clogging is usually first evident at the most distant ends of the laterals, and indicates that the laterals need to be cleaned or flushed.

Lateral flushing can be accomplished simply using the pumped flow to scour out the lines. With the pump running to a zone, remove the end cap or open the valve on each lateral sequentially, one at a time, to flush each line clean. This takes only a few seconds for each line. Surge the flow in each line by rapidly closing and reopening the valve or hold and remove the end cap over the end to stop and start the flow. This can help dislodge solids in the line or in slightly clogged orifices. Wear rubber gloves and take care to be sure any wastewater does not come toward you.

If flushing is not sufficient to dislodge the clogging, a more vigorous method of cleaning is required. High pressure jetting can be done while the lateral is off-line by running the nozzle of a pressure washer up and down the length of each lateral 2-3 times. Alternatively, a bottle brush attached to the end of a sewer snake can be used to ream solids out of the lateral.

Filter Media

Look for any obvious signs of ponding. For laterals bedded under the media, look for any wetness on the surface, which indicates localized fouling of the media. Where monitoring tubes have been installed, they should be observed for ponded water. Tubes penetrating to the surface of the treatment media should not show ponded water, except perhaps for a brief period after a dose. Where ponding remains for minutes after a dose, the dose volume is either too large or fouling of the media is starting to occur. If either of these conditions are occurring, it is an early indication of media clogging, and the operator should consider taking the filter cell off line and allowing it to rest.

The operator should also observe the biological activity in the filter. Look for any tan to light gray gelatinous deposits around the orifices, orifice caps and media immediately around these zones. If present, this is an aerobic floc that is starting to build and is an indication that the applied effluent dosing is occurring too often. The operator should either reduce pump run time or increase the pump off time to allow for the proper recirculation ratio. It is experienced that a time delay of 25 to 30 minutes between dosing on a single zone is optimal.

Also look for black deposits. If present, this is an indication of anaerobic overload conditions. It may mean that the organic loading rate is too high or that the recirculation ratio is too low. Sometimes black deposits may build during cold weather and dissipate when it warms up, even if the organic loading and the recirculation ratio are both within the proper range. As long as the black deposits go away seasonally, it is not a major problem.

Vegitation Control

All vegetative growth should be kept off the surface of the media bed. Where wastewater is surface applied, this will require regular, frequent weed removal in the summer. If done frequently, the maintenance provider will deal only with small weeds having little root depth. Removal can be accomplished by raking the surface around to dislodge the developing roots. If weeds are allowed to get well established with significant roots into the media, removal will require hand pulling, probably with follow-up work to prevent plants from getting reestablished from roots that do not come out with the initial attempt.

Where wastewater is applied below a few inches of the media, take care to keep the media arranged over the distribution lines to prevent any surface wetness. This will prevent most weeds from getting a start.

Chemical weed killer or other herbicides is not recommended and should be avoided. Do not use a roto-tiller or other garden equipment to mix up the media filter beds. Any removed vegetation, sticks, leaves or other debris should not be burned on the surface of the RMF.

How to Conduct a Routine Mainenance Visit

The following checklist is intended to provide a ready reference to follow for the different components of the RMF treatment system during a maintenance visit. Again, the minimum requirements recommended by the manufacturer should also be followed. Routine maintenance includes checking septic tanks, but details of septic tank inspection are not given here.

Recirculating Media Filter Check Sheet

Controls and Pumps

1. Start at the panel.

2. The panel should be equipped with a pump run event counter and a total pump run time meter. Identify each. The run time meter will usually show hours, tenths, and hundredths of hours. The pump run event counter is just a counter for each time the pump ran. You may want to label each for future reference if they are not labeled.

3. Record meter readings and determine total run time and the number of pump cycles counted since the meters were last read.

4. Are the pumps operated by a float activated timer system?

If yes, determine the average run time per cycle and compare with timer setting. If the actual run time per cycle is much longer than the timer setting implies, the system may be running on a float (demand) basis. It may be necessary to adjust the timer on and off setting to compensate for the fact that the timer setting is not providing enough total run time per day to keep up with the flow.

Determine pump run time for each cycle. To check actual run time.

- Stand at panel and listen for pump to kick on.
- With stop watch, determine actual run time.
- Compare with timer setting as read from timer dial.
- Repeat the above for 3 cycles to check repeatability and accuracy of time measurement.

Determine pump off time for each cycle. To check actual off time.

- Stand at panel and listen for pump to kick off.
- With stop watch, determine actual off time.
- Compare with timer setting as read from timer dial.
- Repeat the above for 3 cycles to check repeatability and accuracy of time measurement.

RECIRCULATION TANK

Recirculation tank water level should be maintained at or just above the splitter valve closed level and the splitter valve open level. If the water level is significantly above or below this zone, the reasons could be as follows.

Low level

1. Splitter valve not allowing desired flow to return to the tank
2. Blockage in return line or filter drain
3. Filter drain partially blocked off
4. Pumps have just run and are set to run for too long a time
5. Tank leaks
6. Filter is partially frozen not allowing return flow

High level

1. Recent heavy rain
2. Groundwater infiltration
3. Float valve not closing or other flow splitter not working correctly
4. Short term, high raw wastewater inflow rate
5. Pumps not set to run enough for the incoming flow
6. Flow to the filter is severely restricted
7. Recirculation splitter valve – float type without pipe overflow returns, float ball issues.

    a. Float ball is in place but not freely moving, stuck between vertical rails, etc.
    b. Float ball not properly inflated

        i. Check by using an L-shaped paddle to raise and feel ball
        ii. It should not be possible to push ball out between vertical rail guides

8. Recirculation splitter valve – float type with overflow returns

    a. Float ball issues. Check ball condition as above
    b. Run pumps on manual for a longer than normal dose

        i. Allow return flow to build up (3-5 minutes after pumps turned on)
        ii. Check to be sure all return lines are flowing after return flow has built up
        iii. Float valve should close
        iv. Check flow rate into final dose tank to be sure float by-pass is working correctly

CHECK SCUM AND SLUDGE IN RECIRCULATION TANK

Normal conditions may vary by type of wastewater input, time of inspection including seasonal effects, and location along the tank.

Scum on the top of the tank may be only floating clumps or may be continuous mat, which is unusual. Scum thickness should not exceed a few inches. If scum is consistently observed in this condition it may be time to have the contents of the recirculation tank removed and hauled or applied at an approved septage disposal site

Sludge is usually light and fluffy. As such, be very slow, deliberate and careful in making a measurement to avoid stirring up the sludge. Sludge thickness should not exceed about 15 inches in depth anywhere in the tank. If so, it is time to have the contents of the recirculation tank removed to an approved septage disposal site.

RECIRCULATION TANK CONTENTS

1. pH throughout the tank should be near neutral (pH of 7)
2. Dissolved oxygen content of the tank will vary. It should be higher, 4-5mg/L or more, near where water is returning from the media bed. The incoming sewage should be less than 1 mg/L. The blended mix in the tank that is pumped to the media bed should be less than 2 mg/L.
3. Temperature of the tank near the pumps feeding the RMF should be greater than 40°F.
4. Odor of the tank should be faint septic near the incoming end to musty near where water is returning from the media bed.

SURFACE OBSERVATIONS OF THE RMF BED

Weed growth

1. All growth should be kept off the surface of the filter. Where effluent is surface applied, this will require regular, frequent weed removal in the summer. If done frequently, the maintenance provider will deal only with small weeds having little root depth. Removal can be accomplished by raking the surface media around to dislodge the developing weed roots. If weeds are allowed to get well started with significant roots into the stone, removal will require hand pulling, and probably will require follow-up work to prevent plants from getting reestablished from roots that do not come out with the initial attempt.
2. Where effluent is applied within a few inches of media surface, take care to keep the media at a sufficient depth over the distribution lines to prevent any surface wetness. This will prevent most weeds from getting a start.

CHECK MONITORING TUBES (if present)

A few inches of ponding is normal at the bottom of the filter. Where the drain system consists of chambers, each with an outlet, the ponding should not exceed 2-3 inches, and that will be due to irregularities in the surface under the liner. Where the drain system is slotted drain pipe embedded in stone, up to 4-8 inches of ponding may be present, especially right after a dose application. The ponding depth should be consistent, varying only due to dose timing and possibly precipitation.

MONITORING TUBES

In the case of both single-pass and recirculating sand filters, it is recommended that monitoring tubes be placed to the bottom of the media around the distribution pipe, terminating at the surface of the treatment media.These should be placed in strategic locations so that if ponding begins to occur on the surface, it will be observed. Monitoring tubes shall also be installed to the bottom of the filter, terminating at the surface of the liner, for determining if the level of ponding in the base of the filter is normal. Monitoring tubes located at the maximum distance from underlying drains are recommended for this purpose. The monitoring tube is a 3 in. or 4 in. pipe, which is perforated in the bottom few inches and placed during construction. Support options for monitoring tubes are shown in the figure below. Monitoring tubes should be capped with an easily removable cover. The use of valve boxes over the tops of monitoring tubes is recommended. If other forms of cover are used, such as slip caps, the bottom of the monitoring tube must be anchored when it is installed with a flange, tee, or rods through the pipe to render it secure so that it does not pull out when the cover is removed. Valve box covers are not directly connected to the monitoring pipe and do not present this problem.

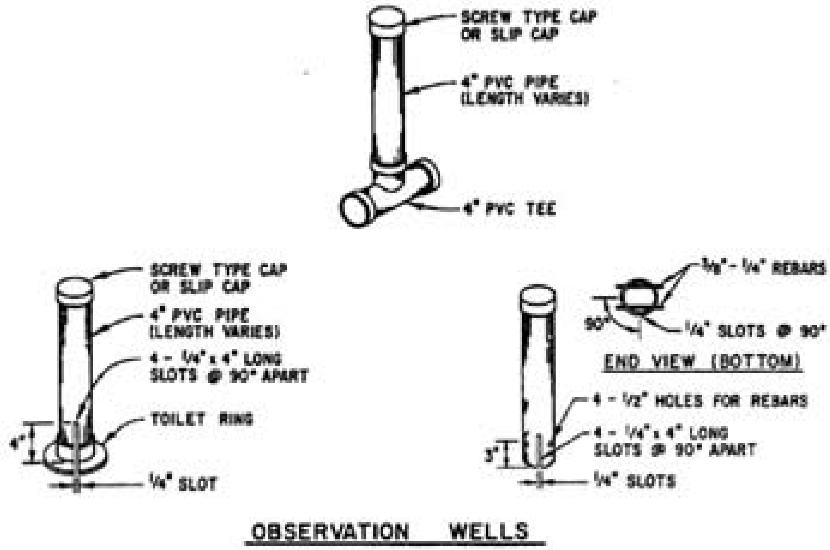

Figure 3.16 Support options for monitoring tubes.

Remote monitoring

Equipment and technology are available for providing remote monitoring of water levels, pressures, flows, and pump-run events. Data can be sensed and stored on a local data logger for periodic downloading to a monitoring computer or can be automatically downloaded and accessed over the world wide web via a server or dial-up modem. These types of systems can be programmed to recognize parameters that are out of range and alert maintenance personnel. Maintenance personnel can troubleshoot the system from a remote computer and often determine and fix a problem without visiting the site. If the problem is occurring because a timer is not correctly adjusted to accommodate the flows occurring, it can be reset from the remote location. The sophistication and cost of remote monitoring and graphical user interfaces make them attractive alternatives for many systems. Designs for commercial systems, community or cluster systems, and remote or sparse systems — where access for maintenance is time consuming and expensive — should incorporate remote monitoring. Designers are recommended to continue tracking the development of remote monitoring technologies and incorporate them where feasible.

Monitoring routine

For a proprietary product, the manufacturer should provide a maintenance routine along with an operations and maintenance manual. In the case of sand filters without remote monitoring, a complete monitoring visit should

Advanced on-site wastewater systems technologies, Anish R. Jantrania, Mark A. Gross

DISTRIBUTION LATERAL PIPING

1. Check appearance of several orifices under the orifice shields.
    a. Removal of some media around distribution pipes may be necessary.
    b. Remove orifice caps

c. Look for any clogging in the orifices. If orifices are pointed down, it may be necessary to use a mirror to view them.
d. Look for any tan to light gray gelatinous deposits around the orifices, orifice caps and media immediately around these zones. If present, this is an aerobic floc starting to build and is an indication that the applied effluent is being does too often. Reduce pump run time to reduce recirculation ratio.
e. Look for solids deposits as this can be an indication that the recirculation tanks needs to be pumped out.
f. Replace orifice shields and media over distribution pipes.

2. Flush the distribution laterals

a. With the pump running to a zone, remove the end cap or open the valve on each lateral sequentially, one at a time, to flush each line clean. This takes only a few seconds for each line. Wear rubber gloves and take care not to get effluent on you. If end caps are used instead of a valve on each line, loosen all caps before starting the procedure.
b. Surge the flow in each line by rapidly closing and reopening the valve or hold and remove the end cap over the end to stop and start the flow. This can help dislodge solids in the line or in slightly clogged orifices. Take care to be sure the squirt does not come toward you.

3. Check pressure in each zone after flushing

a. For each pumping zone, remove the media and splash pad from the orifice that is the farthest from the pump (last orifice at the end of the lateral line). Turn the pump on and measure the squirt height. Repeat until all pumps and zones have been measured and recorded.
b. Compare head measured with what is supposed to be in the system and with the last measurement.
c. If the head increases more than a few inches, it is an indication that orifices are becoming plugged. If the head is approaching 20% more than it should be, the lines should be cleaned to clear the orifices.
d. If the head has decreased since the last check, it is an indication of a leak in the system, a partial blockage in the line feeding the system or a problem with a pump.
e. Fluctuating pressure would be an indication that the flow to the suction side of the pump is limited. If the pump is in a pump vault, the screen ahead of the pump is in need of cleaning or, if equipped, the screen around the pump intake is clogged.

4. Orifice cleaning procedures operators may use:

a. Bottle brush on a snake

i. Obtain a stiff bristle bottle brush that is just larger in outside diameter than the inside diameter of the distribution laterals
ii. Securely fasten the brush to a plumbing snake longer than the length of the laterals
iii. With the pump turned off, push the bottle brush through each lateral, moving it back and forth in small sections.
iv. Clogged orifices are most likely to be at the dead-end of the pipe where flow is lowest and where any solids in the pipe get pushed each time the pump turns on, so be most vigorous when the brush is near that end.

b. High pressure jetting

i. Obtain a high pressure jetter with a small hose and jetting nozzle that will fit inside the laterals.
ii. With the pump off, run the jetter down each lateral 2-3 times.

c. Apply suction to the laterals

i. Make an attachment so that you can fasten a vacuum pump to one or more laterals at a time. A septic tank pumper truck works well for this as it has a powerful vacuum pump.
ii. Close the valve at the pump leading to a distribution zone pipe network.

iii. Build up a vacuum and suddenly open the vacuum to the line(s). This will remove anything that has entered an orifice. It may be necessary to cycle the vacuum on and off several times for each set of pipe(s) to which it is attached.

7. Recheck pressures as described above to be sure that orifices have been successfully cleaned. System pressure should be restored to proper level.

Nothing in this document may be used to implement any enforcement action or levy any penalty unless promulgated by rule under chapter 536 or authorized by statute.

For more information
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