This course requires Flash Player version 8 or higher to run effectively. **Download the most up-to-date version of Flash Player.**

WHAT YOU WILL LEARN IN THIS LESSON

In this lesson, you will learn that the CO-OP RFS III...

- is an alternate filter system that provides ADVANCED TREATMENT of effluent.
- is a proprietary component manufactured by Ashco-A Corp.
- may be used on sites with limiting zones (LZ) of less than 20 inches.
- is comprised of a free access recirculating filter and a manufacturer-required ultraviolet disinfection unit.
- recirculates the effluent multiple times through a filter system, comprised of aggregate, crushed boiler slag (called Black Beauty), and a “bottom zone."
- may be used with a variety of final treatment options.

WHAT IS THE CO-OP RFS III?

CO-OP RFS III is an alternate filter that is described in the Alternate Systems Guidance (guidance) and is available to homeowners. It is a PROPRIETARY system created and manufactured by Ashco-A Corp. of Morgantown, W.V.

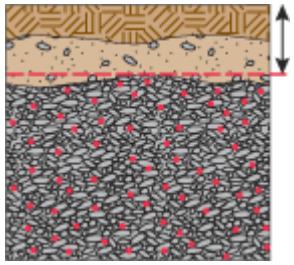
CO-OP = cooperative – the unit was designed to use the electric cooperatives as managers. Two co-ops in Pennsylvania are currently distributing the system: Northwestern Rural Electric Cooperative and Somerset Rural Electric Cooperative.

RFS = rock filter storage – a patented filtering process designed by Ashco-A Corp.

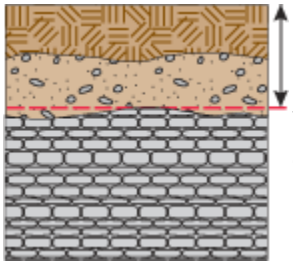
III = the manufacturer's model number – designates that the system is for residential units. (Ashco-A Corp. also has a II model designated for commercial systems.)

Approved for Sites With LZ <20 Inches

DEP approved this system for use on limiting zones of greater than or equal to 10 inches to a seasonal high water table and greater than or equal to 16 inches to rock.



≥10 inches of suitable soil depth to a seasonal high water table



≥16 inches of suitable soil depth to rock formation

The effluent quality produced by the CO-OP RFS III meets the definition of ADVANCED TREATMENT. This means that statistically it will produce, to the 95th percentile, an effluent quality equal to or less than 10 mg/L BOD_5/$CBOD_5$ and 10 mg/L TSS. UV disinfection helps to reduce FECAL COLIFORM concentrations to less than 200/100 ml.

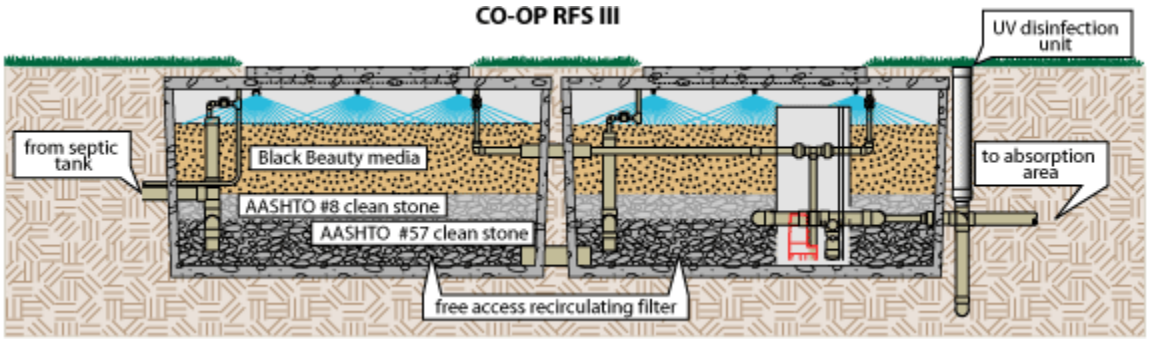
The CO-OP RFS III is described in Section 5 of the guidance.

Advanced Treatment

CO-OP RFS III is another option for providing ADVANCED TREATMENT of raw sewage effluent with characteristics typical of UNTREATED DOMESTIC WASTEWATER. The unit consists of two parts:

1) a free access recirculating filter, and

2) a manufacturer-required ultraviolet disinfection unit.



REVIEW

 **The CO-OP RFS III provides _____ treatment of the effluent in an onlot system.**

Select the choice that best completes this statement.

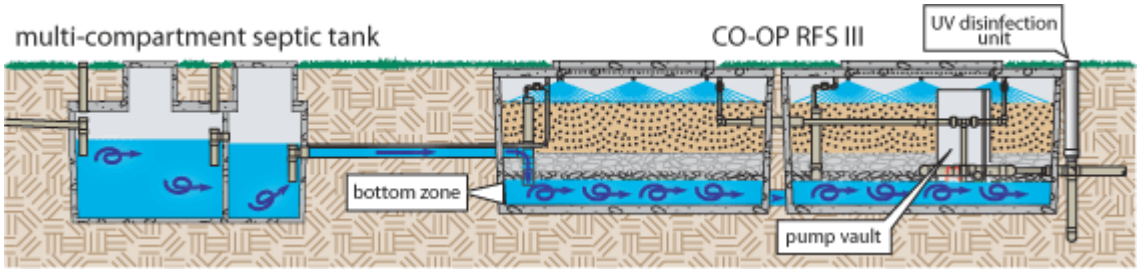
- A) primary
- B) advanced
- C) final

Submit

BASIC CONCEPT OF FILTER

Wastewater flows by gravity from the septic tank, which provides primary treatment of the effluent, through an effluent filter and into the recirculating filter. The filter is comprised of two tanks.

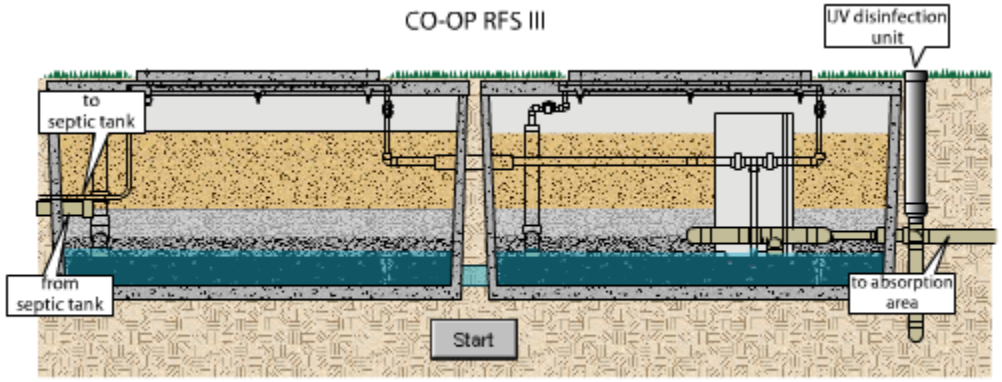
Once inside the recirculating filter, the effluent goes into what is called the “bottom zone” in both tanks where it mixes with effluent already in the system before moving into the pump vault in the second tank. From the pump vault, the pump cycles the effluent through the filter.



Movement Of Effluent in the Filter

Every 20 minutes, the filter pump in the pump vault switches on for approximately 2 minutes, and the effluent is distributed to the following three locations:

1) Up to a spray grid in the lid of each filter tank. Approximately 4 gallons of effluent per minute is sprayed through each sprinkler head onto the top of the aggregate, where it filters down through to the bottom zone in the bottom of the filter tanks.

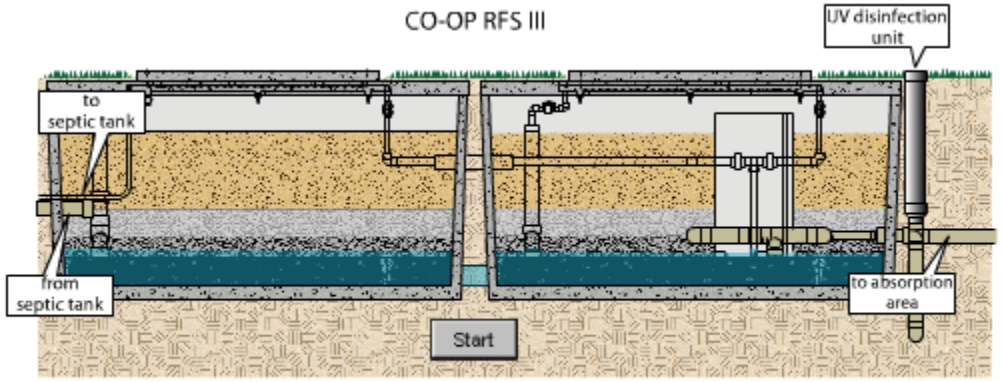


Press "Start" to see how effluent moves through the CO-OP RFS III.

2) Back to the septic tank. Approximately 2 gallons per minute is returned to the septic tank.

3) Back to the bottom zone. Approximately 4 gallons per minute per return is pumped directly back in to the bottom zone to stir the effluent and move any new effluent from the septic tank forward.

During the time that the pump is turned off, the filter media is given an opportunity to dry out. This helps to prevent a BIOMAT from forming on the media.



Press "Start" to see how effluent moves through the CO-OP RFS III.

HOW THE FILTER CLEANS THE EFFLUENT

The CO-OP RFS III recirculating filter progressively treats the effluent by blending, mixing, and diluting the effluent as it cycles through the filter.

Section 5.D.6
A.S.G.

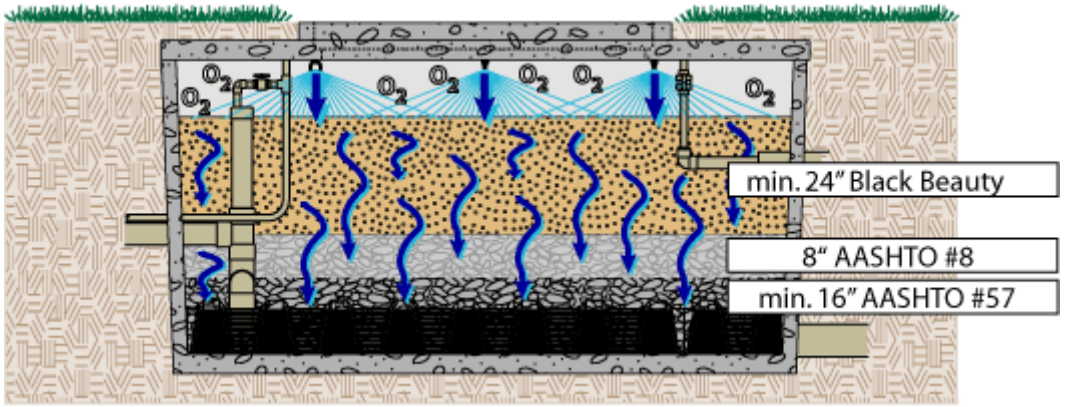
The guidance states that the recirculation rate, as specified by the manufacturer, must be 12 to 1. This means a gallon of effluent should cycle through the filter approximately 12 times before it moves through the UV unit to an absorption area.

Aerobic and Anaerobic Renovation

The manufacturer claims that the CO-OP RFS III uses both AEROBIC and ANAEROBIC processes to renovate the effluent.

Aerobic Renovation

As the effluent falls from the sprinkler heads through the open space in the filter tank toward the filter media, it picks up oxygen. This oxygen-rich effluent flows through the media where naturally occurring beneficial microorganisms help to remove bacteria in the effluent.



The bacteria in the wastewater attach themselves to the media, and nutrients are extracted. Through a combination of biochemical and physical filtration and chemical ADSORPTION, suspended solids are filtered out and the bacteria convert organic matter to carbon dioxide and water. Organic nitrogen and ammonia are converted to nitrite, then nitrate.

Aerobic Renovation *(continued)*

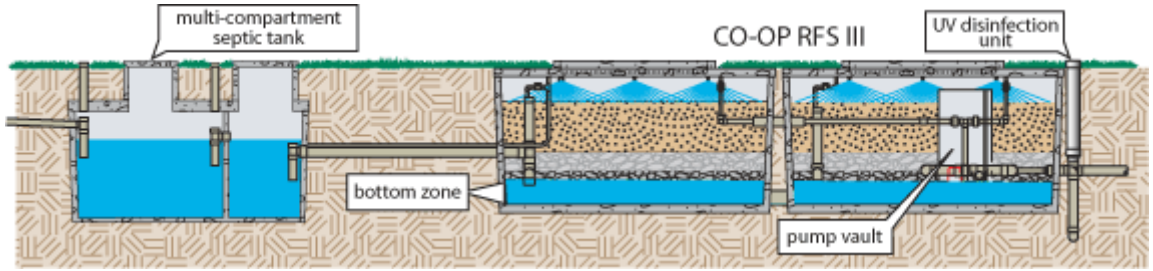
What occurs in an aerobic environment:

1) Viruses and anaerobic bacteria found in septic tank effluent cannot easily survive; and

2) Nitrate-nitrogen is produced.

Anaerobic Renovation

Because the nitrogen created within the aerobic environment of the filter could cause problems if left untreated in the effluent, the reduction of nitrate-nitrogen levels is important. According to the manufacturer, the CO-OP RFS III system provides oxygen-deprived anaerobic conditions necessary to reduce nitrate-nitrogen by turning it into nitrogen gas.



According to the manufacturer of the CO-OP RFS III, the oxygen-deprived environment of the septic tank and the bottom zone of the filter helps to convert nitrate-nitrogen into nitrogen gas.

REVIEW

The CO-OP RFS III recirculates the effluent in the filter by blending, mixing, and diluting the effluent as it moves through a cycle.

What is the movement of the effluent when it first enters into the filter tank?

- A) Goes into the pump vault and then moves to the bottom zone.
- B) Is pumped into the spray grid and filtered down through the media to the bottom zone.
- C) Moves directly into the bottom zone and then works its way into the pump vault.
- D) Is pushed on top of the Black Beauty to begin the filtering process.

Submit

REVIEW

After the effluent moves into the pump vault, it is pumped directly to which of the following locations for distribution?

Select all that apply.

- [ ] A) Bottom zone
- [ ] B) Spray grid
- [ ] C) Black Beauty media filter
- [ ] D) Septic tank

Submit

REVIEW

The CO-OP RFS III is designed so that a gallon of effluent should cycle through the filter unit ____ times before it moves through the UV unit to the absorption area.

Select the choice that best completes this statement.

- A) 8
- B) 10
- C) 12
- D) 24

Submit

REVIEW

According to the manufacturer, the effluent in the CO-OP RFS III is treated through the following processes:

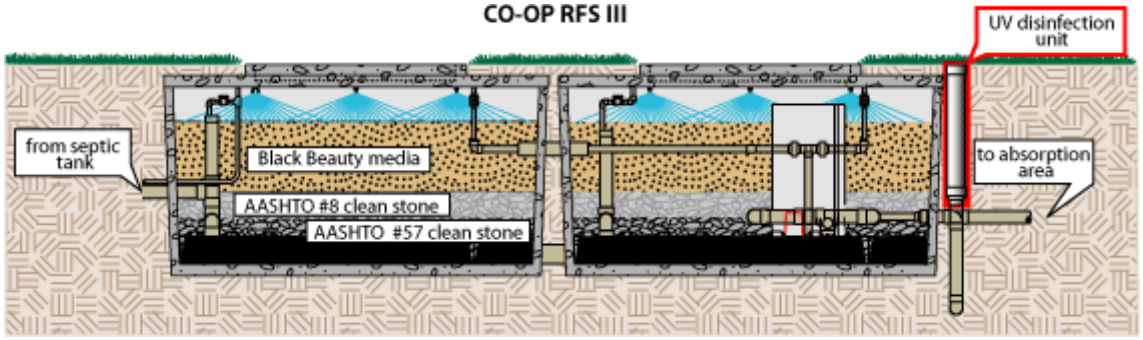
- A) Aerobic and anaerobic renovation
- B) Biochemical and physical filtration
- C) Chemical adsorption
- D) All of the above

Submit

UV DISINFECTION

The manufacturer requires that a UV disinfection unit be installed after the recirculating filter and before the absorption area.

After the partially treated effluent leaves the CO-OP filter through the pump vault, the UV disinfection unit provides further treatment of the effluent by deactivating disease-causing organisms.



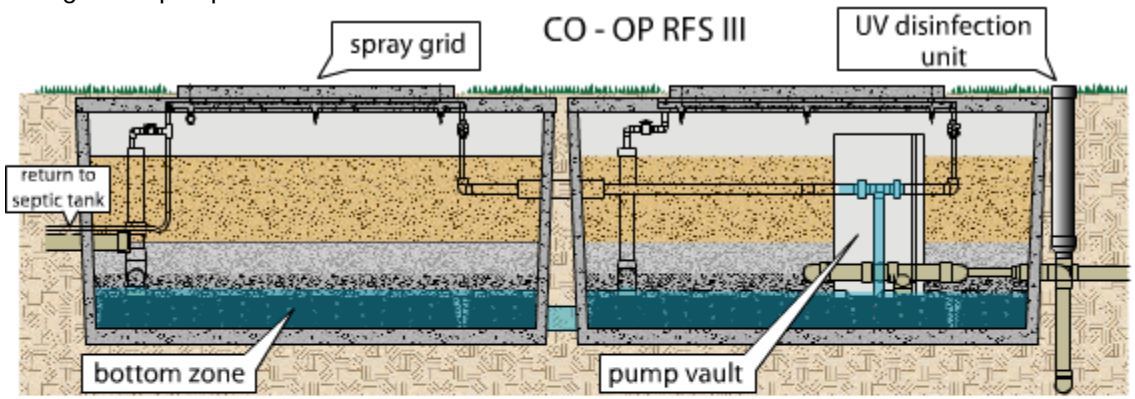
ABSORPTION AREA OPTIONS

The CO-OP RFS III may be used as an advanced treatment with any of the following absorption areas:

- An onlot system as described in Chapter 73, including Individual Residential Spray Irrigation System (IRSIS)
- An at-grade absorption area (≥20 inches of suitable soil)
- A shallow limiting zone at-grade absorption area (<20 inches of suitable soil)
- A drip irrigation area

REVIEW

Review the graphic below to see how the effluent is distributed through the CO-OP RFS III filter, starting at the pump vault.



How often is the effluent cycled through the filter?

- A) Continuously
- B) Every two minutes
- C) Every 12 minutes
- D) Every 20 minutes

REVIEW

Under the guidance, the CO-OP RFS III may be used with any of the following absorption areas at this time:

Select all that apply.

- [ ] A) IRSIS
- [ ] B) At-grade absorption area
- [ ] C) Drip irrigation
- [ ] D) Shallow limiting zone at-grade absorption area
- [ ] E) Subsurface media filter bed where 12 inches of media is eliminated

Submit

THE SYSTEM MANUFACTURER

The guidance lists Ashco-A Corp. as the approved manufacturer of the proprietary system. Ashco-A Corp. is the inventor of the CO-OP RFS III and holds a patent on the system.

If you have further questions concerning the CO-OP RFS III system, contact:

Ashco-A Corp.
1946 Grafton Road
Morgantown, WV 26508
(304) 291-0808
www.ashco-a.com

INSTALLERS OF THE SYSTEM

Currently, two electric cooperatives install and provide maintenance of the system in Pennsylvania:

1) Northwestern Rural Electric Cooperative – serving Crawford, Erie, Mercer, Venango, and Warren counties
P.O. Box 207
22534 State Highway 86
Cambridge Springs, PA 16403
800-472-7910
www.northwesternrec.coop

2) Somerset Rural Electric Cooperative – serving Bedford, Cambria, Fayette, Indiana, Somerset, and Westmoreland counties
223 Industrial Park Road
P.O. Box 270
Somerset, PA 15501-0270
814-445-4106
www.somersetrec.com

LESSON SUMMARY

In this lesson, you learned that the CO-OP RFS III...

- is a proprietary system approved by DEP to provide advanced treatment of effluent.
- may be used on sites with a least 10 inches of suitable soil before a seasonal high water table and at least 16 inches of suitable soil before a limiting zone of rock.
- is composed of a free access recirculating filter and a manufacturer-required ultraviolet disinfection unit.
- recirculates the effluent multiple times through a filter system, which is comprised of aggregate, crushed boiler slag (called Black Beauty), and a “bottom zone.”
- may be used with a variety of final discharge options.

WHAT YOU WILL LEARN IN THIS LESSON

In this lesson, you will learn . . .

- the CO-OP RFS III may only be used to serve dwellings or structures that produce sewage having chemical characteristics typical of untreated domestic wastewater.

- the following site criteria are used to determine the absorption area(s) that may be proposed for use with the CO-OP RFS III:

    - ✓ The required isolation distances
    - ✓ The maximum slope requirements
    - ✓ The minimum suitable soil depths
    - ✓ The percolation rate requirements

- percolation tests are not performed and a soil morphological evaluation is required when either a shallow limiting zone at-grade absorption area or drip irrigation is proposed.

RESIDENTIAL WASTEWATER

As with any alternate component, the CO-OP RFS III may only be used to serve residential dwellings or structures that produce untreated domestic wastewater. Take a moment to review criteria for this type of flow in the "Residential Flow Characteristics" job aid from the link below. This document can also be found in the job aids under "Residential Flow Characteristics" and in the glossary.

Click here to open and print the "Residential Flow Characteristics" job aid in Adobe Acrobat Reader.

Note: If the proposed structure is not residential, but the sewage flow from the structure has characteristics typical of untreated domestic wastewater, a CO-OP RFS III may be used on the site. The only exception would be if the proposal calls for final treatment to occur with an IRSIS. IRSIS may only be used with a single-family residential dwelling.

SITING CRITERIA

As with any system, site evaluations must be performed to determine the conditions of each of the criteria below:

1. Isolation distances
2. Slope
3. Suitable soil depth
4. Percolation test on sites with a limiting zone of greater than or equal to 20 inches
5. Soil morphological evaluation by a qualified soil scientist when proposing drip irrigation or a shallow limiting zone at-grade absorption area.

ISOLATION DISTANCES

Section 73.13(b)

The CO-OP RFS III must comply with the following minimum horizontal isolation distances:

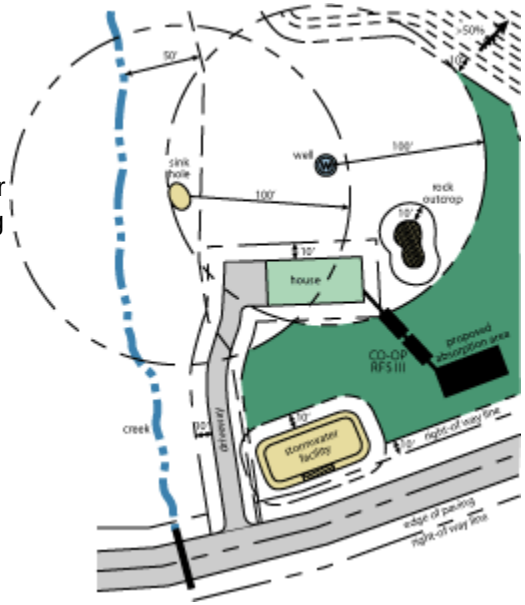
- 10 feet to a property line, easement, or right-of-way
- 10 feet to an occupied building, swimming pool, or driveway
- 50 feet to an individual water supply or water supply system suction line
- 10 feet to a water supply line under pressure
- 25 feet to streams, lakes, or other surface waters
- 25 feet to a cistern used as a water supply

Isolation Distances

Isolation distance requirements also vary with the final treatment option proposed.

Section 73.13(c)

Conventional absorption areas – Review the minimum horizontal isolation distance requirements for systems that use a conventional bed or trenches using the graphic to the right. Isolation distance requirements vary with the final treatment option proposed.



Click on the isolation distance topographic map above for a larger version.

Isolation Distances *(continued)*

Section 73.13(d)

IRSIS - Click to see a review of minimum horizontal isolation distance requirements for a system that employs an IRSIS. Minimum isolation distances to the recirculating filter would be the same as for a conventional system, while minimum isolation distances from the spray field differ.

At-grade absorption area and ***shallow limiting zone at-grade absorption area*** - The isolation distance requirements for a system employing either type of at-grade absorption area are the same as for a conventional system as specified in Chapter 73. See link under "Conventional absorption areas" on previous page.

Section 12.A.4
A.S.G.

Drip irrigation - Isolation distances are the same as for a conventional system as specified in Chapter 73. However, isolation distances from drip irrigation tubing must be measured from a perimeter extending 2 feet beyond the outermost drip tubing in a drip irrigation zone.

Slope

Maximum slope requirements are a factor in the choice of the final treatment option.

Drag and Drop the correct percentage onto each of the red boxes.

Seepage bed	
Standard trenches	
Sand mound bed or trenches	
Subsurface media filter bed	
Subsurface media filter trenches	
IRSIS (nonfood-producing agricultural areas)	
IRSIS (open, grassed areas)	
IRSIS (forested areas)	
At-grade absorption area	
Shallow limiting zone at-grade absorption area	
Drip irrigation	

12%

25%

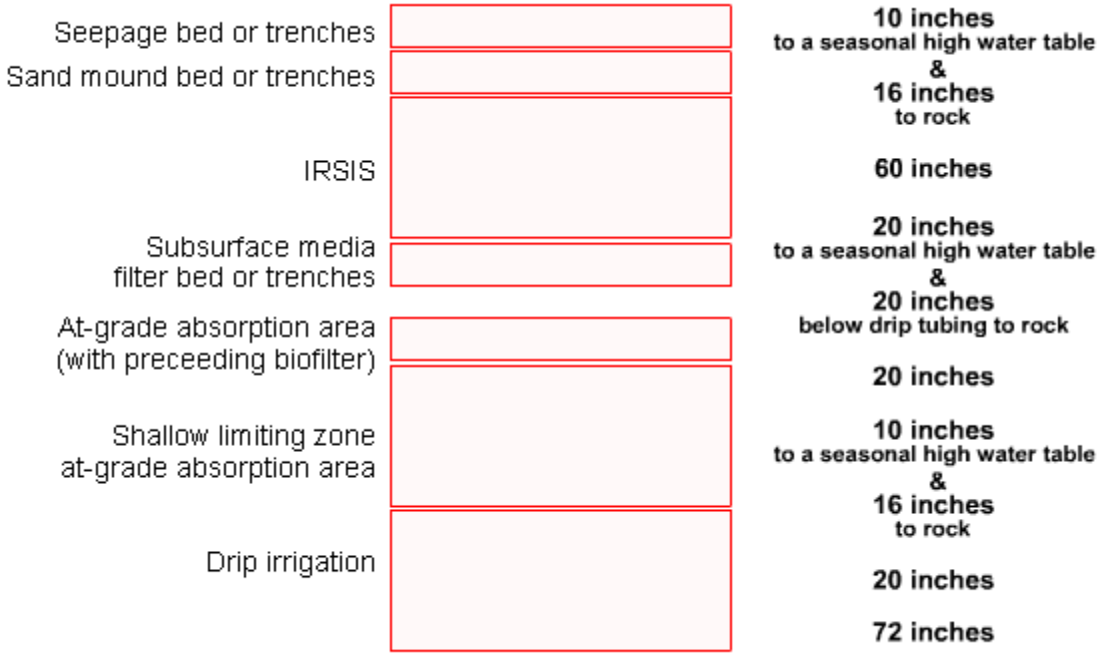
4%

8%

Suitable Soil Depth

The minimum suitable soil depth is a factor in the choice of the final treatment option.

Drag and Drop the correct criteria onto each of the red boxes.



Percolation Rate

Percolation rate requirements are a factor in the selection of the final treatment option.

Drag and Drop the correct criteria onto each of the red boxes.

Seepage bed or trenches	
Sand mound bed or trenches	
Subsurface media filter bed or trenches	
IRSIS	
At-grade absorption area	
Shallow limiting zone at-grade absorption area	
Drip irrigation	

A qualified soil scientist must do a soil morphological evaluation.

3-180 minutes per inch

A qualified soil scientist must do a soil morphological evaluation.

6-90 minutes per inch

3-180 minutes per inch

No percolation test required

> 90 minutes per inch
at 12-36 inches
&
3-90 minutes per inch
at a depth between 36 and 60 inches

Soil Morphological Evaluation

A soil morphological evaluation is required when the following absorption areas are proposed:

1) Shallow limiting zone at-grade absorption area
2) Drip irrigation

The evaluation must be conducted by a "qualified soil scientist" as defined in Chapter 73.

Qualified soil scientist: A person certified as a sewage enforcement officer and who has documented two years' experience in the characterization, classification, mapping and interpretation of soils as they relate to the function of onlot sewage disposal systems and either a Bachelor or Science Degree in soils science from an accredited college or university or certification by the American Registry of Certified Professionals in Agronomy, Crops and Soils.

Soil Morphological Evaluation Requirements for Shallow Limiting Zone At-Grade Absorption Area

On a site with less than 20 inches of suitable soil from the mineral soil surface, the siting and absorption area design is based upon the Hydraulic Linear Loading Rate (HLLR) Table in Appendix 5 of the guidance. The at-grade absorption area will be constructed on contour in a long and narrow configuration, and the distribution network will consist of a central manifold and a single pair of laterals.

When final treatment occurs in a shallow limiting zone at-grade absorption area, the soil scientist must sign a report that shows the soil drainage classification and assigns a loading rate and horizontal linear load from the HLLR table.

Soil Morphological Evaluation Requirements for Shallow Limiting Zone At-Grade Absorption Area *(continued)*

The loading rate (required to calculate the square footage of the aggregate area) and hydraulic loading rate (required to calculate the length of the aggregate area) for a shallow limiting zone at-grade absorption area are determined by applying the most restrictive results of the soil profile evaluations to the HLLR table. The shape and grade of the soil structure as well as the textural classification of the soil must be known.

To learn more about the shallow limiting zone at-grade absorption area, take the Web-based course on this absorption area (#342). The course is currently being developed.

Soil Morphological Evaluation Requirements for Drip Irrigation

A qualified soil scientist must sign a soils report verifying the following:

- Soils are classified morphologically as either well drained or moderately well drained.
- Soil linear loading rate (min. linear feet of drip tubing required) as listed in the table in Appendix 5 of the guidance is met.
- Horizontal linear load (min. zone length) as listed in the table in Appendix 5 of the guidance is met.

The report must be attached to the permit application.

The soil scientist determines the number and placement of the soil profile descriptions required to conduct the morphological evaluation of the soils in the proposed drip zones. The requirements for a minimum number of soil profiles as specified for other onlot absorption areas do not apply to drip irrigation.

A hand auger may be used to confirm soil conditions between profiles. However, care must be taken to avoid excessive disturbance of the soils.

REVIEW

Absorption Area	Limiting Zone: Minimum suitable soil depth to seasonal high water table	Limiting Zone: Minimum suitable soil depth to rock	Slope	Percolation Rate
Seepage bed or trenches	60 inches	60 inches	0-8% for beds; 0-25% for trenches	6-90 minutes/inch
Sand mound bed or trenches	20 inches	20 inches	0-12%	3-180 minutes/inch
Subsurface media filter bed or trenches	72 inches	72 inches	0-8% for bed; 0-25% for trenches	>90 minutes/inch at 12-36 inches; 3-90 minutes/inch at 36-60 inches
IRSIS	10 inches	16 inches	0-4% nonfood-producing agricultural area 0-12% open, grassed area 0-25% forested area	Test not required.
At-grade absorption area	20 inches	20 inches	0-12%	3-180 minutes/inch
Shallow limiting zone at-grade absorption area	10 inches	16 inches	0-12%	Soil morphological evaluation by soil scientist.
Drip irrigation	20 inches	Min. 20 inches below drip tubing	0-25%	Soil morphological evaluation by soil scientist.

REVIEW

A system with a CO-OP RFS III and drip irrigation zones has been proposed on a site with the following information and testing results:

- Single-family home
- Limiting zone to seasonal high water table – 22 inches
- Limiting zone to rock – 26 inches
- Slope – 25 percent
- Percolation rate – 16 minutes per inch

Based on information provided, may an alternate permit be issued for this proposed system?

- A) Yes
- B) No

Submit

REVIEW

A system with a CO-OP RFS III and a shallow limiting zone at-grade absorption area has been proposed on a site with the following information and testing results:

- Single-family home
- Limiting zone to seasonal high water table – 12 inches
- Limiting zone to rock – 16 inches
- Slope – 11 percent
- Complete soil morphological evaluation conducted by soil scientist.

Based on this information and testing results, may an alternate permit be issued for this proposed system?

- A) Yes
- B) No

Submit

REVIEW

A system with a CO-OP RFS III and a shallow limiting zone at-grade absorption area has been proposed on a site with the following information and testing results:

- Single-family home
- Limiting zone to seasonal high water table – 12 inches
- Limiting zone to rock – 16 inches
- Slope – 16 percent
- Complete soil morphological evaluation conducted by soil scientist.

Based on this information and testing results, may an alternate permit be issued for this proposed system?

- A) Yes
- B) No

Submit

REVIEW

A system with a CO-OP RFS III and a shallow limiting zone at-grade absorption area has been proposed on a farm field with the following information and testing results:

- Office with one bathroom and four employees
- Limiting zone to seasonal high water table – 16 inches
- Limiting zone to rock – 10 inches
- Slope – 10 percent
- Complete soil morphological evaluation conducted by soil scientist.

Based on this information and testing results, may an alternate permit be issued for this proposed system?

- A) Yes
- B) No

Submit

REVIEW

A system with a CO-OP RFS III and a shallow limiting zone at-grade absorption area has been proposed on a farm field with the following information and testing results:

- Restaurant
- Limiting zone to seasonal high water table – 20 inches
- Limiting zone to rock – 16 inches
- Slope – 9 percent
- Complete soil morphological evaluation conducted by soil scientist.

Based on this information and testing results, may an alternate permit be issued for this proposed system?

- A) Yes
- B) No

Submit

REVIEW

An open, grassy site that was tested for an onlot system provided the following information and testing results:

- Single-family home
- 16 inches to rock
- Complete soil morphological evaluation by soil scientist
- 12 inches to a seasonal high water table
- 12 percent slope

Based on this information and results, which of the following systems would be permitted on this site?

Select all that apply.

- [ ] A) IRSIS
- [ ] B) At-grade absorption area
- [ ] C) Drip irrigation
- [ ] D) CO-OP RFS III with IRSIS
- [ ] E) CO-OP RFS III with shallow limiting zone at-grade absorption area

Submit

LESSON SUMMARY

In this lesson, you learned . . .

- the CO-OP RFS III may only be used to serve dwellings or structures that produce effluent with characteristics typical of untreated domestic wastewater.

- the absorption area proposed for use with the CO-OP RFS III will be determined by the following site criteria:

  ✓ The required isolation distances

  ✓ The maximum slope requirements

  ✓ The minimum suitable soil depths

  ✓ The percolation rate requirements

  ✓ A soil morphological evaluation conducted by a qualified soil scientist. This evaluation must occur when a proposal calls for either a shallow limiting zone at-grade absorption area on a site with a limiting zone of less than 20 inches ($\geq$10 inches to seasonal high water table or $\geq$16 inches to rock) or a drip irrigation system.

WHAT YOU WILL LEARN IN THIS LESSON

In this lesson, you will . . .

- review the design criteria for septic tanks, which provide primary treatment of effluent in a system employing a CO-OP RFS III, as specified in the DEP regulations and Alternate Systems Guidance (guidance).

- learn that the septic tank is also used during the advanced treatment of the effluent, when some of the effluent in the CO-OP RFS III is recirculated back into the septic tank for mixing with raw effluent.

SEPTIC TANK CONSTRUCTION STANDARDS

The septic tank(s) must meet the requirements of the regulations regarding construction of septic treatment tanks.

Section 73.31

To review the construction standards for septic treatment tanks, see Section 73.31 of the regulations.

Rectangular Tanks

Section 5.D.1

A.S.G.

The guidance requires the septic tank to be either a multi-compartmented rectangular tank or two rectangular tanks in a series.

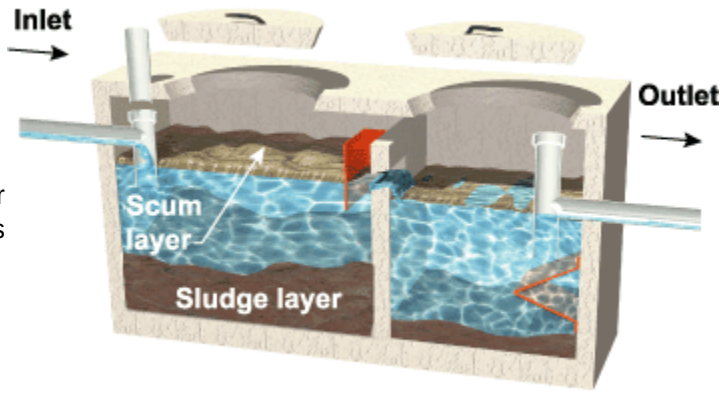
Aerobic Tank Option

Section 73.32

DEP would allow an aerobic tank to be used in place of a septic tank with a CO-OP RFS III as long as the treatment performance standard for the effluent was met. See Section 73.32 of the regulations to review standards for aerobic treatment tanks.

PRIMARY TREATMENT

The CO-OP RFS III, as stated in the guidance, is designed to treat septic tank effluent. Wastewater flows from the structure to the septic tank for primary treatment. Once in the septic tank, solids settle to the bottom and scum floats to the top, and the clearer effluent in the middle of the tank flows by gravity through an effluent filter and into the recirculation filter.



Required Effluent Filter

Section 5.D.1

A.S.G.

The guidance ***requires*** that ***each*** septic tank used with a CO-OP RFS III be equipped with a 4-inch Biotube effluent filter or its equivalent. The filter is used in the primary treatment of the effluent and helps prevent solid particles from leaving the septic tank.

The Flowlink and Zabel A300 filters are examples of effluent filters that must be part of each septic tank used with a CO-OP RFS III.

Required Solids Retainer

Section 73.31.c.5

The regulations ***require*** a solids retainer to be placed at the outlet baffle or vented tee at the last septic tank or final compartment of the septic tank. A solids retainer is defined as a deflection device designed to deflect buoyed solids from escaping the tank.

The Biotube effluent filter, as specified in the guidance, meets this requirement of the regulations.

ROLE OF SEPTIC TANK IN ADVANCED TREATMENT

The septic tank also plays a role during the advanced treatment of the effluent, when some of the effluent in the CO-OP RFS III is recirculated back into the septic tank.

In addition to the inlet and outlet connections specified in the regulations (Section 73.31(c)), another inlet connection must be installed in the second tank or compartment of the septic tank. This connection leads from the CO-OP RFS III and is used when the pump in the CO-OP RFS III turns on to recirculate effluent through the filter. Every 20 minutes when the pump is turned on for 2 minutes, approximately 4 gallons of effluent are pumped from the CO-OP RFS III back into the septic tank through this line.

The return line enters the second septic tank or compartment a few inches above the outlet connection.

This view from inside the CO-OP RFS III tank shows where the return line to the septic tank is installed, just a few inches above the connection from the second compartment or septic tank to the CO-OP RFS III.

Review

The following tanks may be used to provide primary treatment in a system employing a CO-OP RFS III for advanced treatment:

Select all that apply.

- [ ] A) A multi-compartmented rectangular tank
- [ ] B) Two round tanks in a series
- [ ] C) Two rectangular tanks in a series
- [ ] D) Aerobic tank
- [ ] E) All of the above

Submit Reset

REVIEW

According to the specifications for the CO-OP RFS III option in the guidance, the following statement about the septic tank is true:

- A) A 4-inch Biotube effluent filter or its equivalent must be installed in each septic tank.
- B) A 4-inch Biotube effluent filter or its equivalent must be installed in the last septic tank only.
- C) An effluent filter is recommended for each septic tank but not required.
- D) No effluent filter is necessary.

Submit

REVIEW

Which of the following statements about the septic tank used in conjunction with a CO-OP RFS III is false?

- A) The septic tank provides primary treatment of the effluent.
- B) The septic tank provides advanced treatment of the effluent.
- C) Raw sewage enters the septic tank through the building sewer from the dwelling.
- D) Wastewater enters the septic tank through a return line from the CO-OP RFS III.
- E) Effluent exiting the septic tank travels to the CO-OP RFS III.

Submit

Lesson Summary

In this lesson, you learned the design criteria for septic tanks, which provide primary treatment of effluent in a system employing a CO-OP RFS III, as specified in the DEP regulations and the guidance. This criteria includes specifications for the following:

- primary treatment
- rectangular tanks
- aerobic tank option
- a required effluent filter

In addition, you learned that the septic tank also plays a role during the advanced treatment of the effluent, when some of the effluent in the CO-OP RFS III is recirculated back into the septic tank through a return line.

WHAT YOU WILL LEARN IN THIS LESSON

In this lesson, you will learn ...

- the tank specifications for the recirculating filter.
- that the recirculating filter created within the tanks is composed of four components:
    1. The bottom zone
    2. The filter zone
    3. The spray grid
    4. The pump vault and recirculating system

FILTER TANKS

The recirculating filter used in the CO-OP RFS III to serve a single-family home is created within two precast concrete tanks supplied by the manufacturer.

Size of Tanks

Section 5.D.3

A.S.G.

The effective surface area of the free access recirculating filter must be sized to maintain a hydraulic loading rate no greater than 5 gpd / square foot (design influent flow). The surface area may not be less than 120 square feet with a minimum sewage flow of 200 gallons per day.

Example: 400 gpd ÷ 120 square feet = 3.3 gpd / sq. foot

The guidance states that the CO-OP RFS III's recirculation tank be 1,120 gallons. Typically, Ashco-A, the filter manufacturer, uses two 2,200-gallon tanks for the recirculating filter.

Tank Construction

Section 73.31(b)

Drag and Drop the correct answer to each of the red boxes.

The tank must be constructed to comply with Section 73.31(b) of the regulations. Accordingly, the tank...

- Must be [ ] and constructed of sound, durable material not subject to excessive corrosion or decay.
- If constructed of precast slab, must have a minimum wall thickness of [ ] and be adequately reinforced.
- Should have precast cover slabs that are adequately reinforced and have a thickness of at least [ ].
- May not be constructed of [ ], bricks, or similar masonry.
- May not have an inside horizontal dimension of less than [ ].

3 inches

36 inches

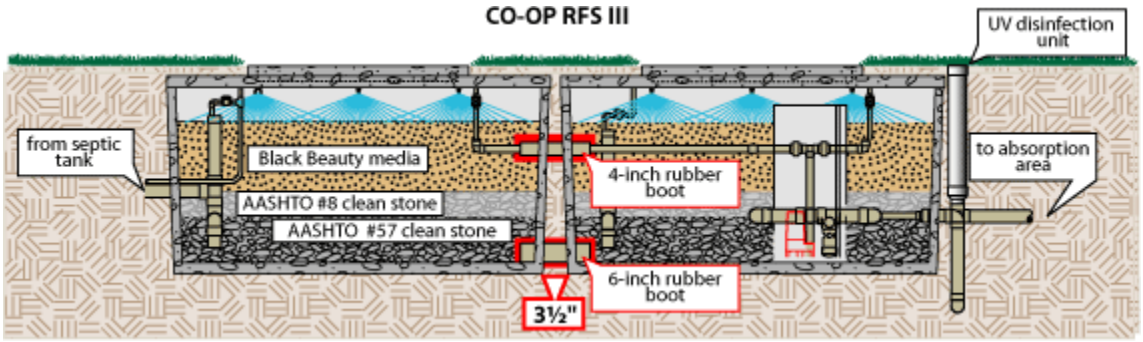
blocks

2½ inches

watertight

Placement of Tanks

The manufacturer recommends placing the filter tanks at least **3½ inches apart**. 6-inch rubber boots are cast into the concrete tanks so that piping can connect the two filter tanks. A 4-inch rubber boot is also cast into each tank to allow for the recirculating system piping to run between the tanks.



Access to Tanks

A.S.G. **Section 5.D.2**

Access to the tanks is provided by a minimum of two access openings (one opening per tank). The openings should be sized at least 24 inches by 36 inches and must provide access to the entire surface of the filter.

Ashco-A Corp. recommends placing pine bark in the access lids to the filter to help absorb any odor that might escape from the filter tank. The lids provide access to the atmosphere so that oxygen may freely flow into the filter.

REVIEW

Of the following filter tank specifications for a CO-OP RFS III, which of the following, if any, *do not meet* the guidance requirements:

- A) The tank is sized so that a maximum hydraulic loading rate of 5 gpd / square foot is maintained.
- B) Access to the tanks is provided by two openings, 24 inches by 24 inches.
- C) The openings provide access to the entire filter surface.
- D) All of the above specifications meet the Alternate Systems Guidance requirements.

Submit

Review

True or False

The CO-OP RFS III is created within a single precast concrete tank.

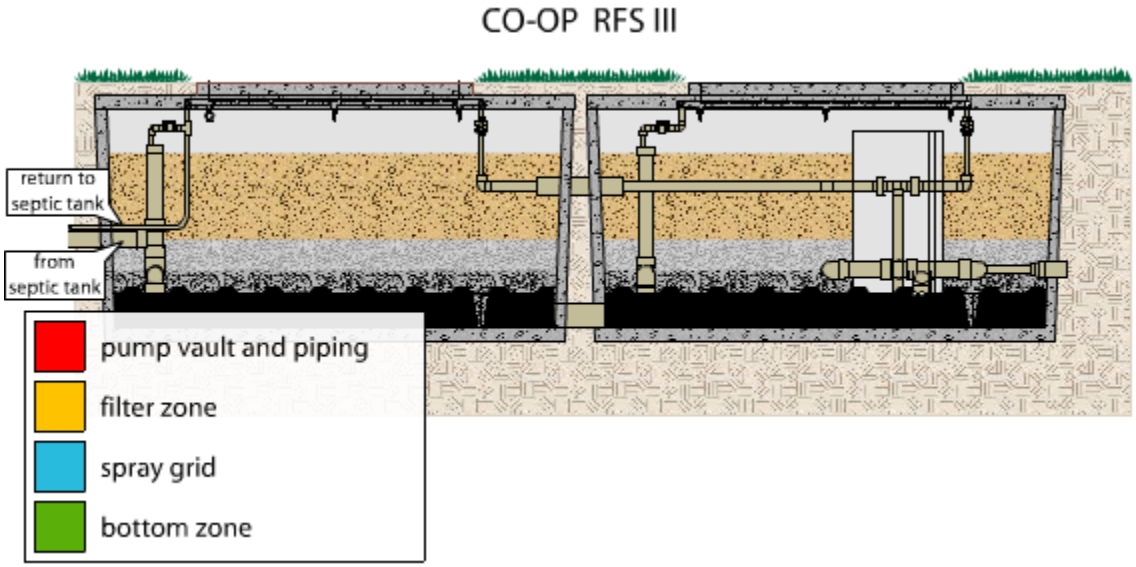
- A) True
- B) False

Submit

CREATING THE FILTER INSIDE THE TANKS

Within the two tanks, the recirculating filter system is created. The filter is composed of four components, as illustrated below.

Click on each of the color-coded keys below to view that component of the CO-OP RFS III.



Bottom Zone

The bottom zone of the filter is an underdrain system where mixing and recirculating of the effluent occurs. This zone was created and patented by the system manufacturer, Ashco-A Corp.

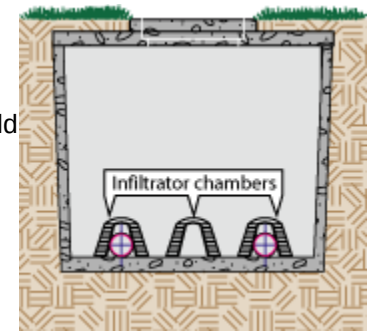
To build the bottom zone, Infiltrator Systems, Inc.'s Equalizer 36 chambers, or their equivalent, are placed on the floors of the two filter tanks.

Bottom Zone *(continued)*

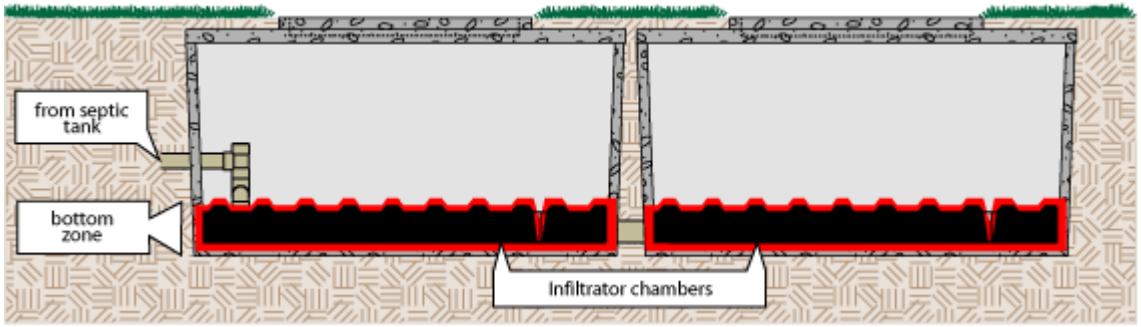
The Infiltrator chambers are placed side by side on the floor of the tanks to create three rows.

According to the Alternate Systems Guidance, the underdrain should

be positioned on either side of the spray grid.

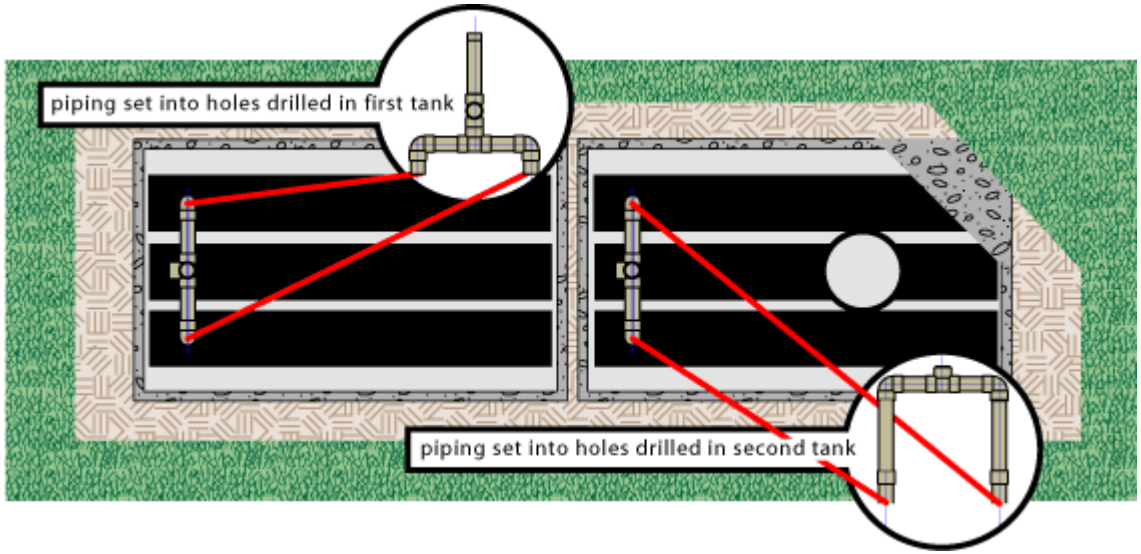


Cross-section of the Infiltrator chambers in the filter.



Bottom Zone *(continued)*

Holes are placed at the end of the first and third rows of the Infiltrators in both tanks. The holes are drilled in the center of the hump 5 inches from the end closest to the septic tank. The piping carrying the effluent from the septic tank to the first filter tank and from the first filter tank to the second filter tank will be connected to the holes.



Infiltrators are set on the floors of the tank. The distribution piping assembly should stand up in the tank.

Bottom Zone *(continued)*

When the effluent exits the septic tank, it is piped by gravity flow into the first and third Infiltrators in the bottom zone of the first filter tank. After mixing with existing effluent here, it will move by gravity into the first and third Infiltrators in the bottom zone of the second tank to be mixed again. Then it will move into the pump vault.

From the septic tank, the effluent is piped by gravity flow into the first and third Infiltrators to the bottom zone in the first filter tank.

REVIEW

After the effluent exits the septic tank, it enters the CO-OP RFS III at the following location:

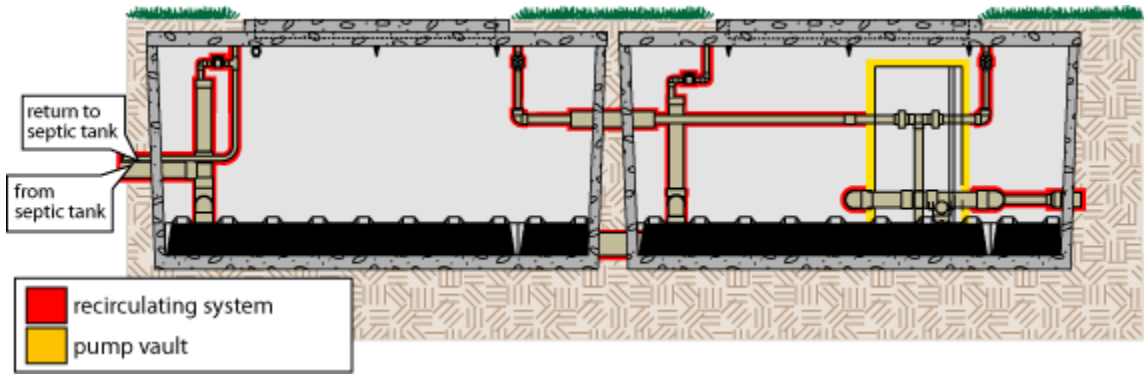
- A) The pump vault
- B) The Infiltrator chambers located in the spray grid
- C) The bottom zone
- D) The filter zone

Submit

PUMP VAULT AND RECIRCULATING SYSTEM

The pump vault is located in the second filter tank, where it is placed between the Infiltrators and attached to them with a return loop of piping.

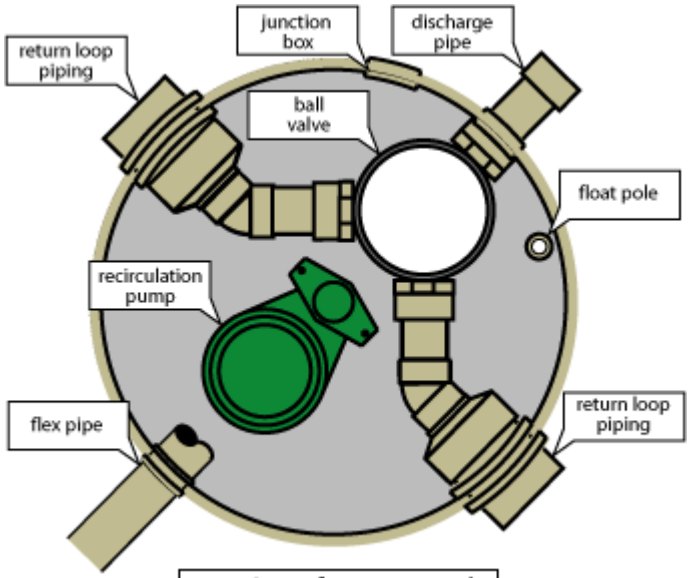
The recirculating system piping is installed throughout the two tanks.



PUMP VAULT

The following items are installed inside the pump vault:

- A recirculating pump
- Feed line assembly, which includes the return loop piping and the discharge pipe to the absorption area
- A ball valve assembly
- A float pole containing a high-water alarm
- Junction box



top view of a pump vault

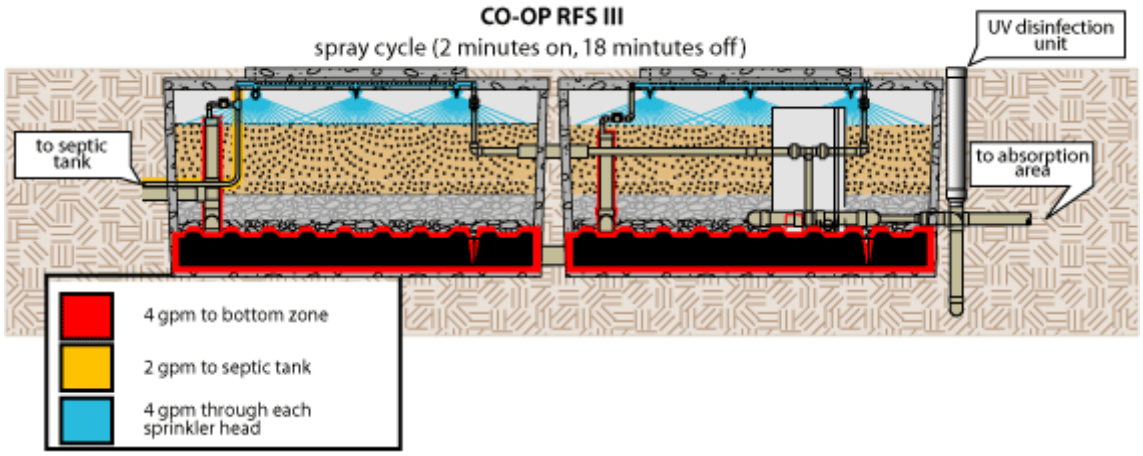
Pump Vault *(continued)*

The recirculating pump is set to provide 72 cycles per day. It works on a 12:1 recirculation ratio to provide 20-minute duration cycles during which the pump turns on for approximately 2 minutes and then off for approximately 18 minutes. According to the guidance, the submersible pump must be sized to maintain a flow of at least 33 gallons per minute at required TOTAL DESIGN HEAD.

RECIRCULATING SYSTEM

When the pump turns on for 2 minutes, approximately 68 gallons of effluent are pumped through piping to the following locations:

1. Bottom zone through bottom zone feed valve in each filter – 4 gallons per minute
2. The septic tank through piping in tank #1 – 2 gallons per minute
3. Spray nozzles located at top of filter tanks – 4 gallons per minute per sprinkler head



Review

The pump in the pump vault runs on the following approximate cycle:

- A) On for 18 minutes, off for 2 minutes
- B) On for 2 minutes, off for 18 minutes
- C) On for 10 minutes, off for 10 minutes
- D) Turns on only when enough effluent has entered the system

Submit

REVIEW

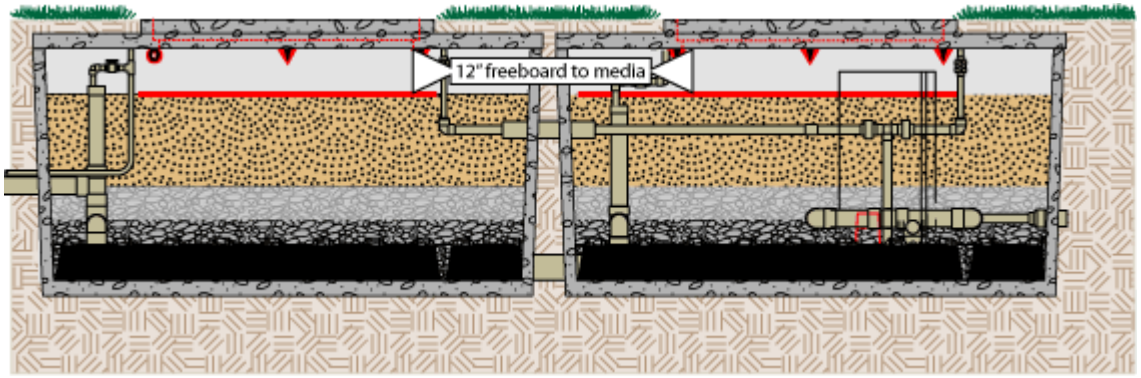
The following statements are true about the pump vault and recirculating system: ***Select all that apply.***

- [ ] A) The pump vault is placed in the filter tank closest to the septic tank.
- [ ] B) The recirculating pump must work on a 12:1 recirculation ratio to provide 36 cycles per day.
- [ ] C) The submersible pump must be sized to maintain a flow of 33 gallons per minute at required total design head.
- [ ] D) Approximately 68 gallons of effluent are pumped to the bottom zone, the spray grids, and the septic tank during each pump cycle.

Submit Reset

SPRAY GRID

A spray grid is installed in each tank of the filter. In the Ashco-manufactured filter, the spray grid assembly is cast into the ceiling of each filter tank. There must be **12 inches of freeboard** between the surface of the Black Beauty and the ceiling of the filter.



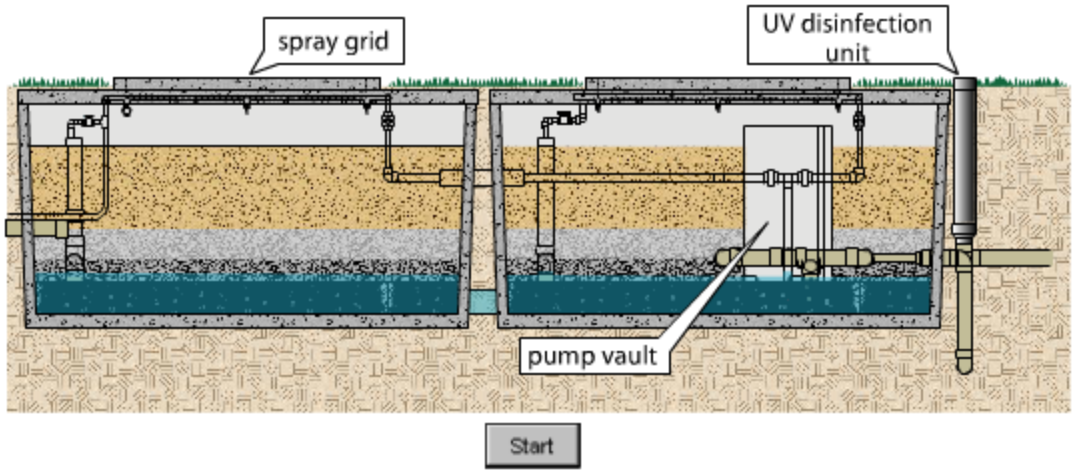
Spray Grid *(continued)*

The spray grid is made up of two laterals, 10 feet in length, which run above the tank, and four orifices, .25-inch in diameter. Three of the orifices are spaced 52 inches on center and contain nozzles that spray the effluent on to the surface of the media, and one orifice distributes effluent through a pipe to the bottom zone.

The spray grid assembly is cast into the lid of each filter tank in the Ashco A-manufactured filter. The holes in the tank lid in this photo are the spray nozzles.

Spray Grid *(continued)*

When the recirculating pump is on, the effluent moves from the pump vault through the various piping and approximately 4 gallons per minute per nozzle is sent to the spray grid for distribution on to the filter zone.



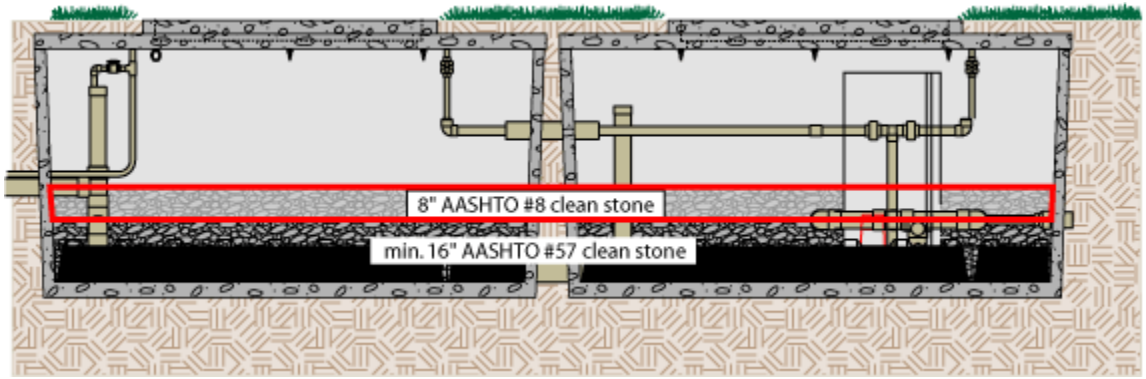
Press "Start" to see how effluent moves through the CO-OP RFS III.

FILTER ZONE

The media that makes up the filter zone is placed on top of the Infiltrator chambers. This is made up of three layers.

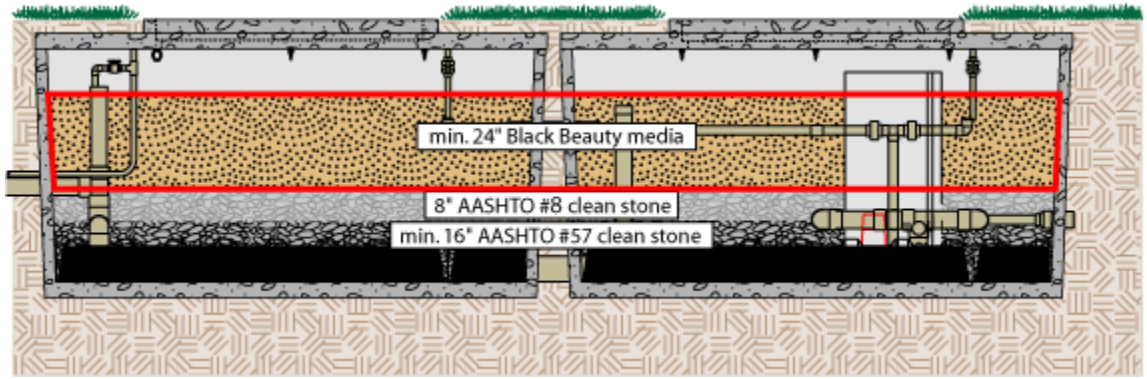
The bottom layer of aggregate is a minimum of 16 inches of AASHTO no. 57 aggregate, washed and crushed.

Then, a layer of 8 inches of AASHTO no. 8 aggregate, washed and crushed, is placed on top of that layer.



Filter Zone *(continued)*

The final layer of media, placed on top, is a minimum of 24 inches of crushed boiler slag, called “Black Beauty.”



Black Beauty Specifications

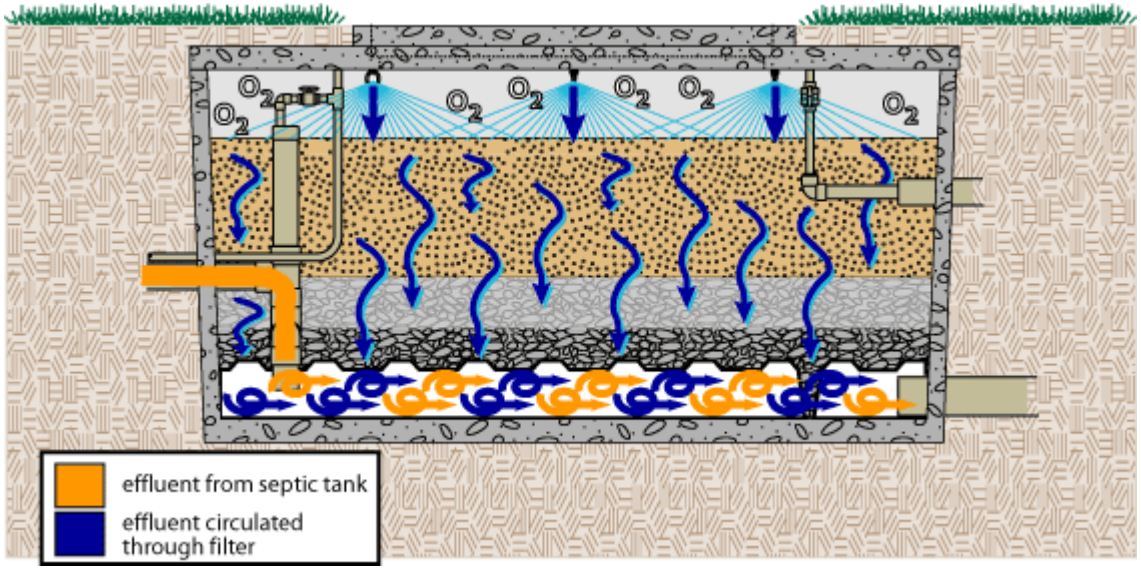
According to the guidance, this media must conform to wastewater treatment media requirements to be hard, durable, and free of organic matter. The guidance specifically calls for crushed boiler slag (a product called Black Beauty grade #1040) or a manufacturer-approved equal with the following physical properties:

Black Beauty is a byproduct of coal combustion. It is the hard slag that doesn't decompose in a boiler.

Effective size	1.00 to 1.7 mm
Uniformity coefficent	less than 1.9
Particle shape	angular
Hardness	6 to 7 on Moh's scale
Bulk density	75 to 100 pounds per cubic foot
Specific gravity	2.73
Moisture content	less than 0.5 percent
Free silica	less than 1 percent

Filter Zone *(continued)*

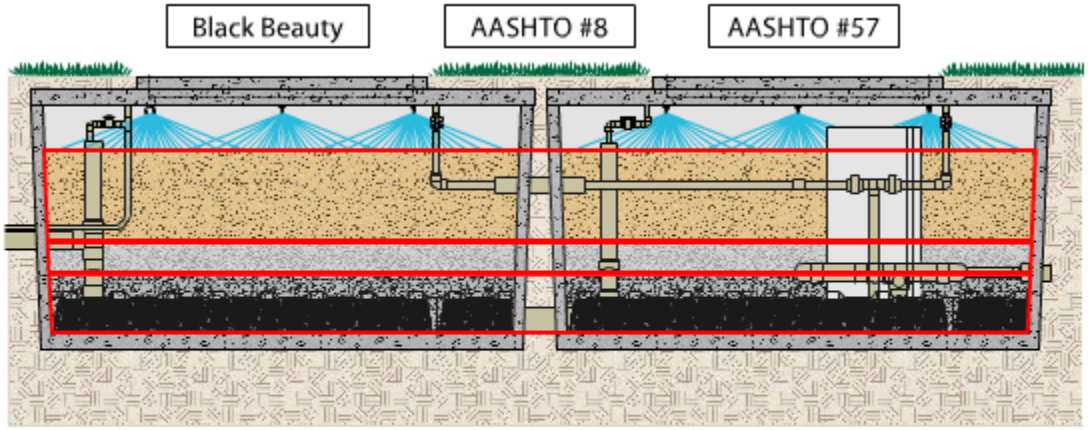
After the effluent is sprayed on top of the Black Beauty or its equivalent, it flows down through the filter, where it is treated by naturally occurring microorganisms in the filter, and returns to the bottom zone, where it mixes with previously filtered and incoming septic tank effluent.



REVIEW

What are the various layers of the media filter composed of?

Drag and Drop the correct label in the boxes to each layer of the filter, then answer the corresponding question.



REVIEW

Effluent *directly* enters the bottom zone in the CO-OP RFS III from the following sources:

Select all that apply.

- [ ] A) The filter zone
- [ ] B) From the pump vault, via the fourth orifice in the spray grid
- [ ] C) Sprayed from orifices in the spray grid
- [ ] D) The septic tank

Submit Reset

Review

The spray grid assembly is cast into the lid of each filter tank, and the lid of the tank must be positioned to allow _____ inches of freeboard above the surface of the Black Beauty.

Select the choice that best completes this statement.

- A) 8
- B) 10
- C) 12
- D) 24

Submit

REVIEW

The Black Beauty used in the CO-OP RFS III is best described as ...

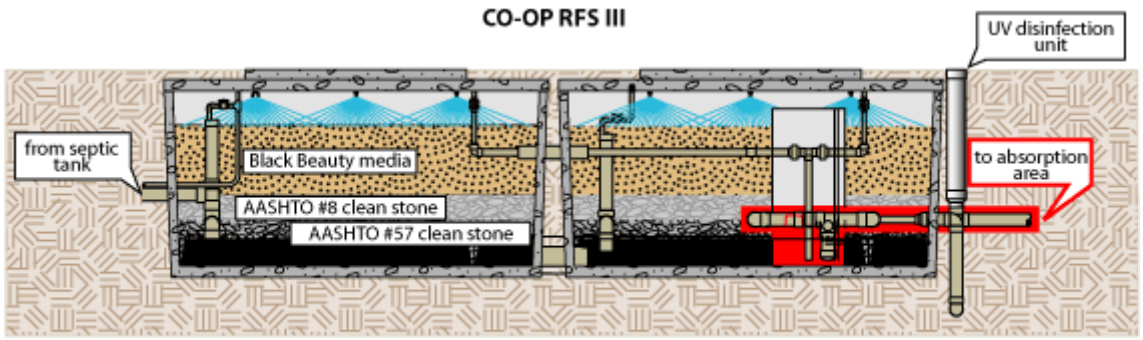
- A) Bituminous coal
- B) Crushed boiler slag
- C) Crushed coal 1.8 to 2.0 mm in diameter
- D) Volcanic sand

Submit

RELEASE OF EFFLUENT FROM THE FILTER

Let’s go back to the pump vault to see how the effluent moves from the filter to the next stop in the system, the UV disinfection unit.

According to the manufacturer, the CO-OP RFS III is designed so that each gallon of effluent will be recirculated through the filter system approximately 12 times before it is released for disinfection and final dispersion.

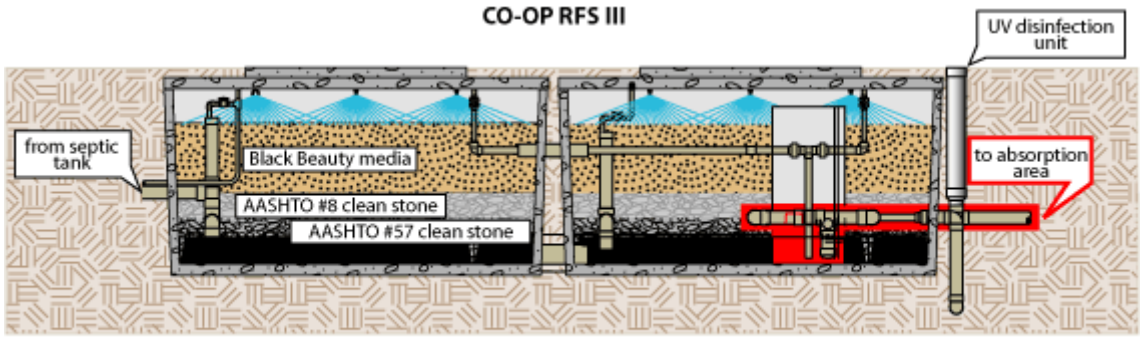


Movement of effuent from the pump vault through the discharge pipe to the UV disinfection unit and then to the absorption area.

RELEASE OF EFFLUENT FROM THE FILTER *(continued)*

Treated effluent is not discharged to the UV system during the spray cycle because the water level in the pump vault is too low. When the pump is at rest, the ball valve enables effluent in the vault to be discharged to the UV unit. The UV disinfection system will be explained in the next lesson.

The valve also ensures that raw effluent does not reach the outlet pipe before it can be treated. As effluent flows into the filter from the septic tank, the water level in the filter rises, and the check valve closes off.

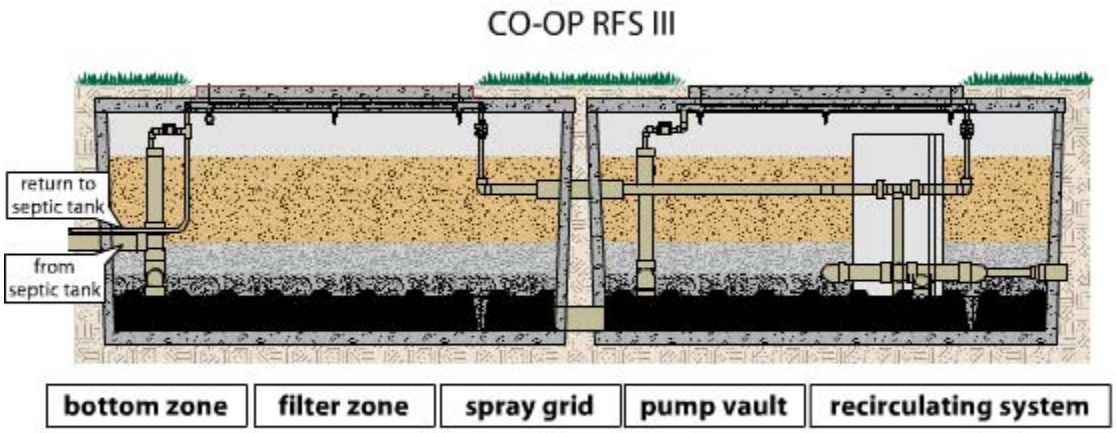


Movement of effuent from the pump vault through the discharge pipe to the UV disinfection unit and then to the absorption area.

Review

Various components make up the CO-OP RFS III filter.

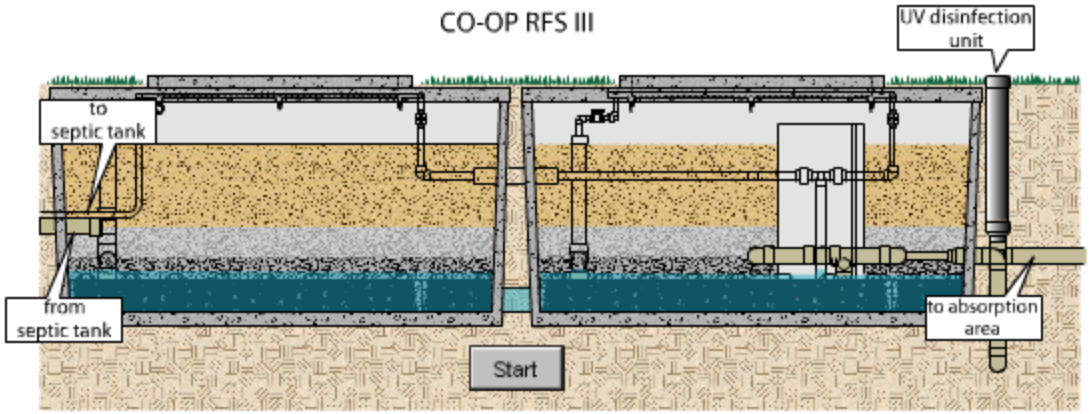
Drag and Drop each label for the following components of the recirculating filter on the illustration: Bottom Zone, Filter Zone, Spray Grid, Pump Vault, Recirculating System



LESSON SUMMARY

In this lesson, you learned about the various components that make up the CO-OP RFS III.

You also learned how the effluent is circulated through the CO-OP RFS III.



Press "Start" to see how effluent moves through the CO-OP RFS III.

WHAT YOU WILL LEARN IN THIS LESSON

In addition to requiring that all spray field effluent be disinfected, reguardless of limiting zone, DEP also requires the disinfection of effluent if a site has less than 20 inches of suitable soil. However, a UV disinfection unit is standard with the manufacturer's CO-OP RFS III and is typically installed regardless of the depth of suitable soil available on a site.

In this lesson, you will learn about using a UV light with the CO-OP RFS III to provide disinfection of the effluent.

Specifically in this lesson, you will learn . . .

- how a UV light provides disinfection (to further reduce disease-causing organisms) before effluent is discharged to the absorption area
- the design of the UV disinfection unit
- the maintenance of the disinfection unit
- the role of the SEO in permitting a system with a UV disinfection unit

DISINFECTING THE EFFLUENT

HOW THE DISINFECTION UNIT WORKS

In the disinfection unit, the effluent passes by the UV light, which deactivates disease-causing organisms. UV disinfection helps to further reduce fecal coliform concentrations to less than 200 per 100 mL of effluent.

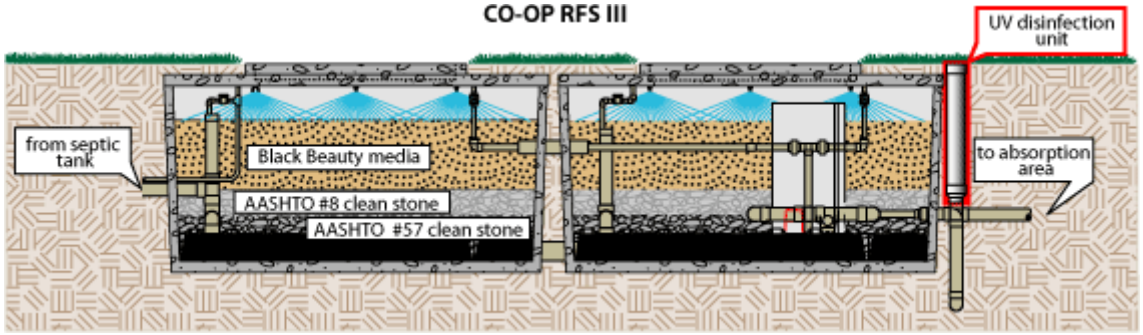
Note: When using UV disinfection, no other means of disinfection, such as chlorination, may be used. High levels of disinfectants, such as chlorine, may have negative effects on the necessary soil bacteria in the absorption area and may also result in the production of undesirable disinfection by-products.

Therefore, if the CO-OP RFS III is used with IRSIS, the UV disinfection would substitute for the chlorination required in a standard Chapter 73 IRSIS. **No chlorination system would be used.**

DESIGN OF UV DISINFECTION SYSTEM

WHERE IS THE UV DISINFECTION UNIT PLACED?

The UV disinfection unit is placed after the CO-OP RFS III filter. Typically the unit is buried in the ground at the exit from the filter. The unit must have easy access for cleaning.



DESIGN OF UV DISINFECTION SYSTEM

WHAT DESIGN CRITERIA MUST BE MET?

Section 5.D.7.a
A.S.G.

The UV disinfection unit must meet the design criteria described on this and the following three pages:

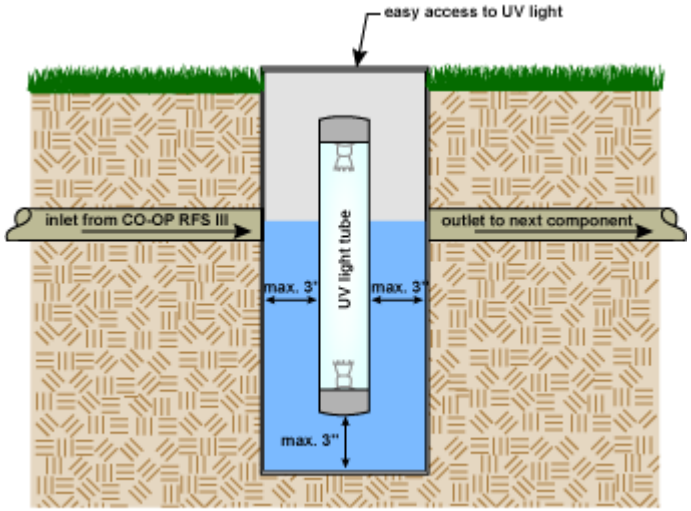
- The UV light must provide ultraviolet radiation at a level of 254 nanometers that is applied at a minimum dosage of 25,000 microwatt-seconds per square centimeter at all points throughout the water disinfection chamber. The guidance recommends providing a dosage of 30,000 to 35,000 microwatt-seconds per square centimeter.

DESIGN OF UV DISINFECTION SYSTEM

WHAT DESIGN CRITERIA MUST BE MET? (continued)

- The ultraviolet tube must be jacketed in quartz or high-silica glass so that an operating temperature of 104 degrees Fahrenheit is maintained in the tube.

- The maximum water depth in the chamber, measured from the tube surface to the chamber wall, is 3 inches.

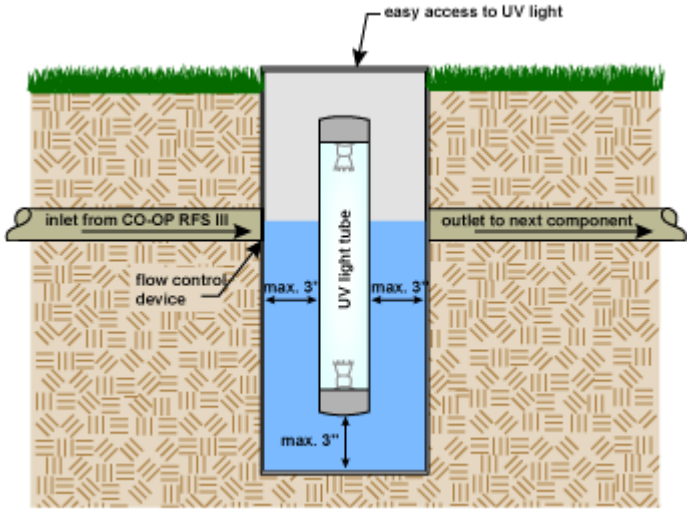


DESIGN OF UV DISINFECTION SYSTEM

WHAT DESIGN CRITERIA MUST BE MET? (continued)

- The unit must be designed to allow the water contact surface of the UV tube jacket to be mechanically cleaned frequently without disassembly of the unit.

- A device must be installed to limit the flow rate of the effluent to the maximum design flow of the treatment unit.

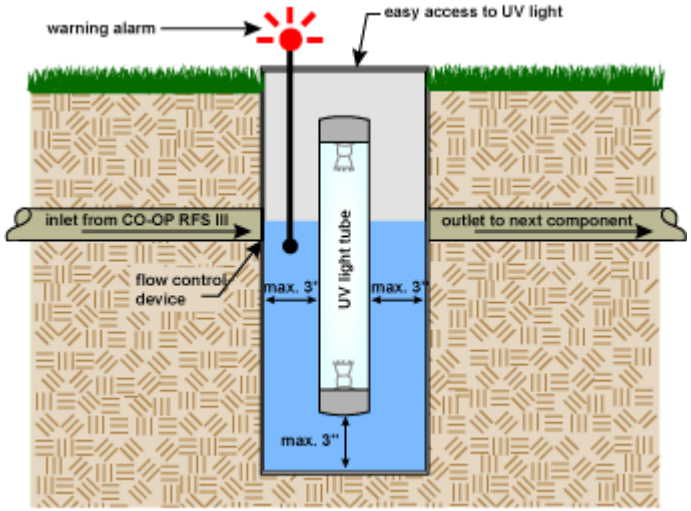


DESIGN OF UV DISINFECTION SYSTEM

WHAT DESIGN CRITERIA MUST BE MET? (continued)

- A warning alarm must be installed to signal when a UV tube burns out and thus alert the property owner to replace a burned-out tube.

- A UV intensity meter, accurately calibrated and filtered to restrict its sensitivity to the point of the disinfection spectrum, may be installed in the wall of the disinfection chamber at the point of greatest water depth from the tube.



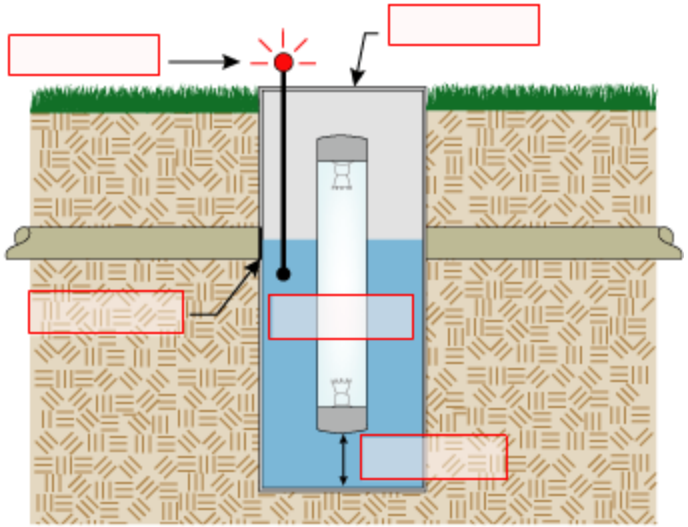
DESIGN OF UV DISINFECTION SYSTEM

REVIEW

Drag each of the design criteria below to its correct location on the diagram of the UV disinfection unit.

1. **UV light** provides ultraviolet radiation at a level of 254 nanometers applied at a minimum dosage of 25,000 microwatt-seconds per square centimeter. The UV tube is jacketed in quartz or high silica glass to maintain operating temperature of 104 degrees F.
2. **Max. 3-in.** water depth, measured from tube surface to chamber wall
3. **Flow-control device** to limit flow of effluent to maximum design flow of treatment unit
4. **Access** to allow frequent cleaning of UV light tube without disassembly of unit
5. **Alarm light** to warn of burned-out UV bulb

Note: Although the above design criteria must be met, the actual appearance of the UV unit will vary depending on the manufactuer and the flow path (gravity or pressurized) of the effluent to the unit.



MAINTENANCE ISSUES

Section 5.F

A.S.G.

INSPECTIONS

- Every month, the property owner must inspect the disinfection unit to make sure the unit is clean and functioning within the specifications of the manufacturer.

MAINTENANCE ISSUES

INSPECTIONS

- Every six months, the maintenance entity must inspect the unit and a qualified technician must determine if the unit meets the minimum standards of the alternate guidance. Under Section 72.25(h) of the regulations, the maintenance entity is an individual, firm, or corporation experienced in the operation and maintenance of the sewage treatment system. Although it is often a private third party, the maintenance entity could also be the municipality or its designated local agency.

- During the six-month inspection, the manufacturer recommends that the UV tube be pulled out of the unit and wiped clean. The bottom of the unit should also be checked for any solids that may have settled there. If necessary, the settlement should be flushed away with water from a hose.

MAINTENANCE ISSUES

MAINTENANCE

- At least once a year, a laboratory must test the effluent discharged to the system. The sample must be taken following the disinfection unit and should be tested for fecal coliforms, carbonaceous biological oxygen demand (CBOD), and suspended solids. A copy of the lab results and the inspection documents must be sent to the local agency.

- At least once a year, the UV tube should be replaced. The replacement should be made earlier if an inspection reveals the need for a new light.

- To ensure that appropriate UV dose levels are maintained, a warning alarm must be functioning properly to alert the homeowner that a UV bulb is burned out and needs replaced.

- A spare UV tube and other necessary equipment must be available to allow for prompt repair of the UV unit.

ROLE OF THE SEO

FINAL INSPECTION

When conducting the final inspection of a system that calls for a UV disinfection system, the SEO must make sure the UV unit is installed properly and is working correctly. This inspection would include making sure the UV light is on, checking it with the calibrated UV intensity meter, if one is available, and ensuring that the signal alarm operates properly.

MAINTENANCE

The UV disinfection unit requires maintenance that the homeowner must be made aware of. Before a permit is issued, the SEO should make sure the maintenance entity is named and a maintenance schedule is set up. The SEO could perform the scheduled maintenance if the local agency has a sewage management program in place.

REVIEW

True or False

If the CO-OP RFS III is used with an IRSIS, UV disinfection is not necessary since the IRSIS requires chlorination instead.

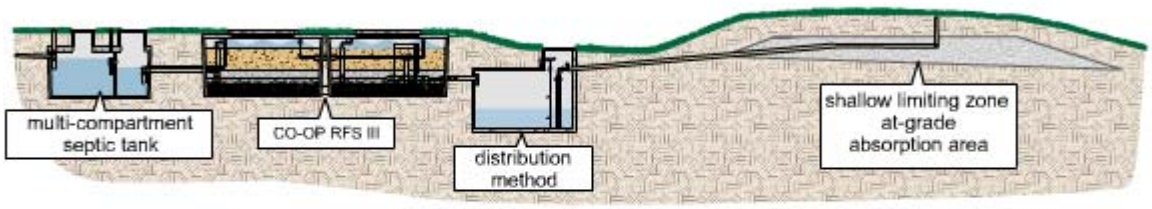
- A) True
- B) False

Submit

Review

This system design calls for a CO-OP RFS III with a shallow limiting zone at-grade absorption area. Where should the UV disinfection unit be located?

Click on the graphic below to indicate where the UV disinfection unit should be placed.



Review

True or False

The property owner must inspect the disinfection unit every six months.

- A) True
- B) False

Submit

Review

True or False

The maintenance entity (an individual, firm, or corporation experienced in operation and maintenanace of sewage treatment systems or the municipality or its designated local agency) must inspect the disinfection unit every six months.

- A) True
- B) False

Submit

REVIEW

The guidance requires a copy of the lab results testing the discharge to the absorption area to be sent to the _____ at least once a year.

Select the choice that best completes this statement.

- A) regional DEP office
- B) homeowner
- C) maintenance entity
- D) local agency

Submit

Review

True or False

The homeowner must check the unit a minimum of every week to make sure the UV bulb in the disinfection unit is not burned out.

- A) True
- B) False

Submit

Lesson Summary

In this lesson, you learned that a UV disinfection unit, which is standard with the CO-OP RFS III, provides disinfection (to reduce disease-causing organisms) before effluent is discharged to the absorption area.

You also learned specifics about the design and maintenance of the UV unit and what role the SEO plays in permitting a system with such a unit.

What You Will Learn in this Lesson

In this lesson, you will learn . . .

The CO-OP RFS III is an advanced treatment option that may be used with any of the following options for final treatment:

1. An onlot system as described in Chapter 73
2. An at-grade absorption area
3. A shallow limiting zone at-grade absorption area
4. Drip irrigation

ABSORPTION AREA OPTIONS WITH THE CO-OP RFS III

Section 5.A
A.S.G.

The Alternate Systems Guidance (guidance) lists the following options as possible absorption areas that may be used with the CO-OP RFS III:

1. An onlot system as described in Chapter 73

2. An at-grade absorption area, if the limiting zone is ≥20 inches

3. A shallow limiting zone at-grade absorption area (based on the HLLR table in Appendix 5 of the guidance), if the limiting zone is <20 inches

4. Drip irrigation

With any of these absorption areas, the use of the CO-OP RFS III would classify the system as alternate for permit issuance.

1) An Onlot System as Described in Chapter 73

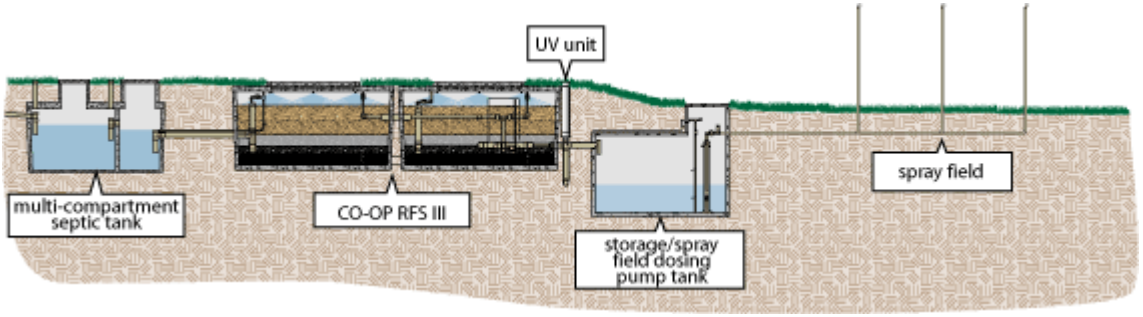
This implies that the CO-OP RFS III may be used as additional treatment before a standard seepage bed, trenches, elevated sand mound bed, or subsurface media filter bed or trenches. Homeowners can use the CO-OP RFS III with these options if, for some reason, the homeowner would want cleaner effluent than provided with these conventional components alone.

Remember: If a designer would elect to use the CO-OP RFS III as advanced treatment with any onlot system described in Chapter 73 of the regulations, then the system would be classified as alternate for permit issuance.

IRSIS

The guidance specifically states that the CO-OP RFS III “may be used as a 1:1 replacement for the free access intermittent sand filter described in Chapter 73, Section 73.162, for individual residential spray irrigation systems permitted by the local agency.”

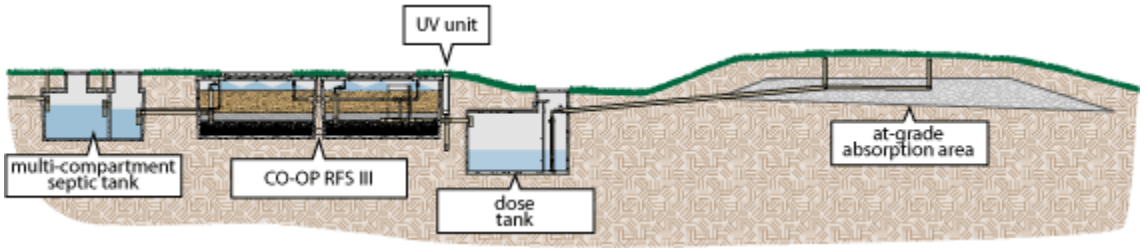
When a CO-OP RFS III is used with an IRSIS, the system would be classified as an alternate instead of a conventional system, and disinfection would occur through a UV unit instead of by chlorination.



2) An At-Grade Absorption Area

The CO-OP RFS III may be used as an advanced treatment option when an at-grade absorption area provides final treatment.

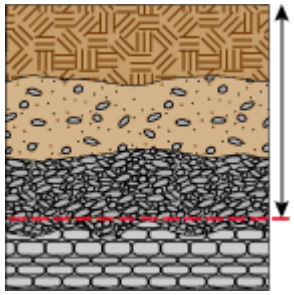
To permit this type of system, an SEO must have successfully completed both this course on the CO-OP RFS III (#335) and the Web-based course on at-grade absorption areas (#341 or 329).



2) An At-Grade Absorption Area *(continued)*

Keep in mind that this absorption area option may only be used on sites where the minimum vertical isolation distance is 20 inches or more.

The guidance states that on sites with limiting zones greater than or equal to 20 inches from the mineral soil surface, the at-grade absorption area must be designed to meet the at-grade absorption area standards specified in Part 9 of the guidance.

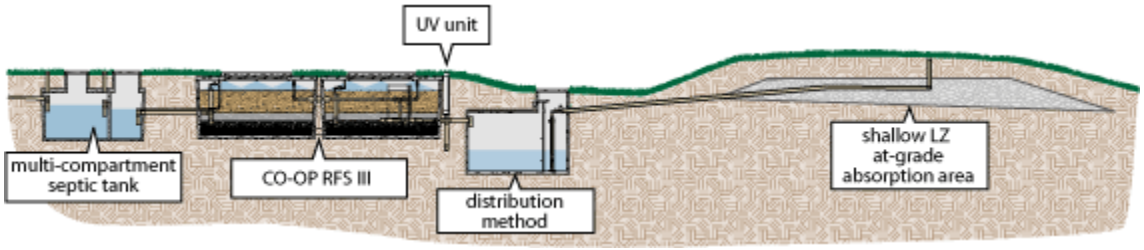


≥20 inches of suitable soil from mineral soil surface

3) A Shallow Limiting Zone At-Grade Absorption Area

The CO-OP RFS III may be used as an advanced treatment option when a shallow limiting zone at-grade absorption area provides final treatment.

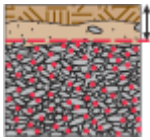
To permit this type of system, an SEO must have successfully completed both this course on the CO-OP RFS III (#335) and the Web-based course on shallow limiting zone at-grade absorption areas (#342).



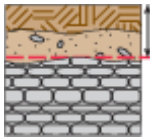
3) A Shallow Limiting Zone At-Grade Absorption Area *(continued)*

The shallow limiting zone at-grade absorption area may be used on sites where the minimum vertical isolation distance is 10 inches or more to a seasonal high water table or 16 inches or more to rock.

The guidance states that since the CO-OP RFS III has been documented to provide sufficient consistent and reliable treatment of wastewater, a shallow limiting zone at-grade absorption area may be used on sites with limiting zones of less than 20 inches. However, a soil morphological analysis must be conducted by a qualified soil scientist, and the treatment and absorption area configuration must be based on the horizontal linear loading rate derived from this soil morphological analysis and the HLLR chart in Appendix 5 of the guidance. This was reviewed in Lesson 1-2.



≥10 inches of suitable soil depth to a seasonal high water table



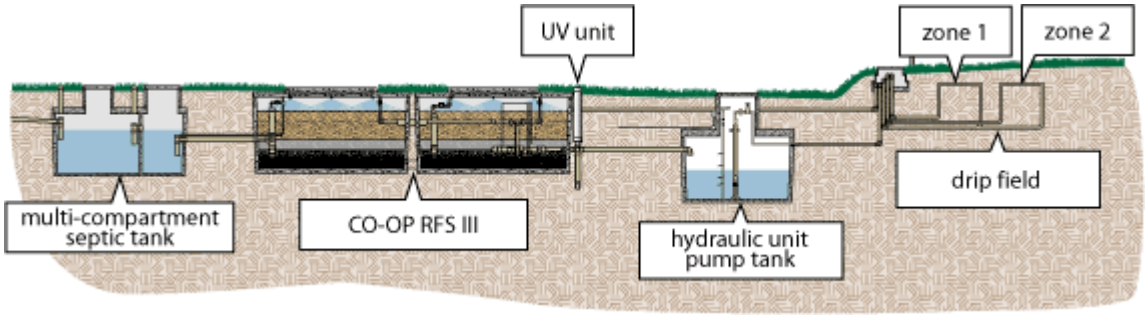
≥16 inches of suitable soil depth to rock formation

Note: DEP requires that an at-grade absorption area placed on soils with suitable depth of ≥10 inches to seasonal high water table or ≥16 inches to rock be designed to comply with Section 5.E.2 of the guidance. DEP refers to this absorption area as a “shallow limiting zone at-grade absorption area.”

4) Drip Irrigation

The CO-OP RFS III may be used as an advanced treatment option when drip irrigation provides final treatment.

To permit this type of system, an SEO must have taken both this course on the CO-OP RFS III (#335) and the Web-based course on drip irrigation (#321) or the now-defunct classroom course (#312).



REVIEW

Complete the table by indicating which absorption area works with a CO-OP RSF III under the site conditions listed below.

Click on the blank spaces in the table below and select an absorption area fitting the site conditions.

Absorption Area	Advanced Treatment	Slope	Minimum Suitable Soil Depth	Percolation Rate
	CO-OP RFS III	0-12%	10 inches to seasonal high water table; 16 inches to rock	Soil morphological evaluation by qualified soil scientist
	CO-OP RFS III	0-12%	20 inches	3-180 min./in.
	CO-OP RFS III	0-25%	20 inches to seasonal high water table; min. 20 inches to rock below drip tubing	Soil morphological evaluation
	CO-OP RFS III	0-4% agric. 0-12% grass 0-25% forest	10 inches to seasonal high water table; 16 inches to rock	No test required
	CO-OP RFS III	0-8%	60 inches	6-90 min./in.
	CO-OP RFS III	0-25%	60 inches	6-90 min./in.
	CO-OP RFS III	0-12%	20 inches	3-180 min./in.

REVIEW

Although the guidance allows the CO-OP RFS III to be used with a variety of final treatment options, this alternate filter is typically installed with the shallow limiting zone at-grade absorption area. What site conditions make the CO-OP RFS III with the shallow limiting zone at-grade absorption area a feasible option?

- A) A steep slope up to 25 percent
- B) Shallower suitable soil depths, up to 10 inches to a seasonal high water table and up to 16 inches to rock
- C) Slow percolation rate, up to 180 minutes per inch
- D) All of the above

Submit

Lesson Summary

In this lesson, you learned that the CO-OP RFS III is an advanced treatment option that may be used with any of the following options for final treatment.

- An onlot system as described in Chapter 73
- An at-grade absorption area
- An alternate drip irrigation
- A shallow limiting zone at-grade absorption area

What You Will Learn In This Lesson

In this lesson, you will be taken through a typical installation of a CO-OP RFS III. The installation, as recommended by the manufacturer, has been simplified for this course.

Although the SEO is not responsible for any part of the installation, he or she should be familiar with the steps involved in installing a CO-OP RFS III.

Placement of Filter Tanks

Six inches of crushed stone is provided as a base, and the recirculating filter tanks are placed on top of the stone and leveled.

Tanks should be 3½ inches apart. Crossover piping is installed to connect the two filter tanks.

Creating the Bottom Zone

The Infiltrator chambers are installed in the bottom zones of the two filter tanks.

Installing the Pump Vault

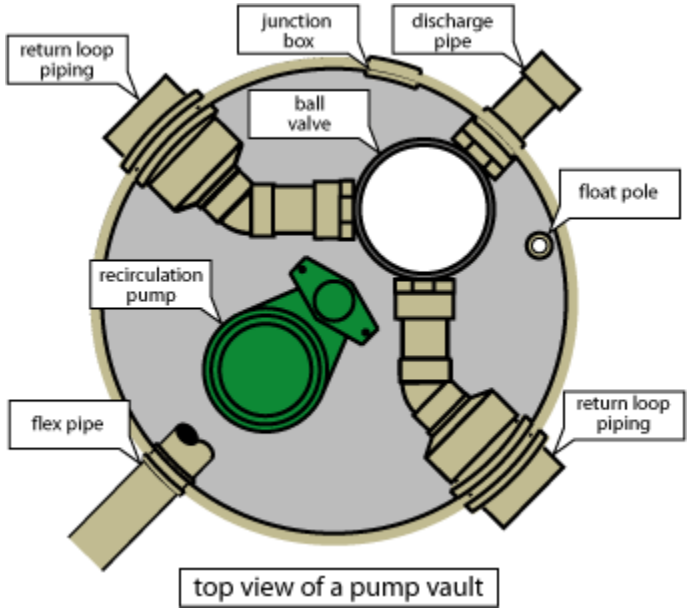
The pump vault is installed in the second filter tank.

Installing the Pump Vault (*continued*)

The pump vault is placed into the opening in the second filter tank between the Infiltrators in the middle row, and the recirculation pump and the discharge pump, if applicable, are set in place inside the vault.

Installing the Pump Vault (*continued*)

The preassembled feed line and discharge assemblies are installed in the pump vault.



top view of a pump vault

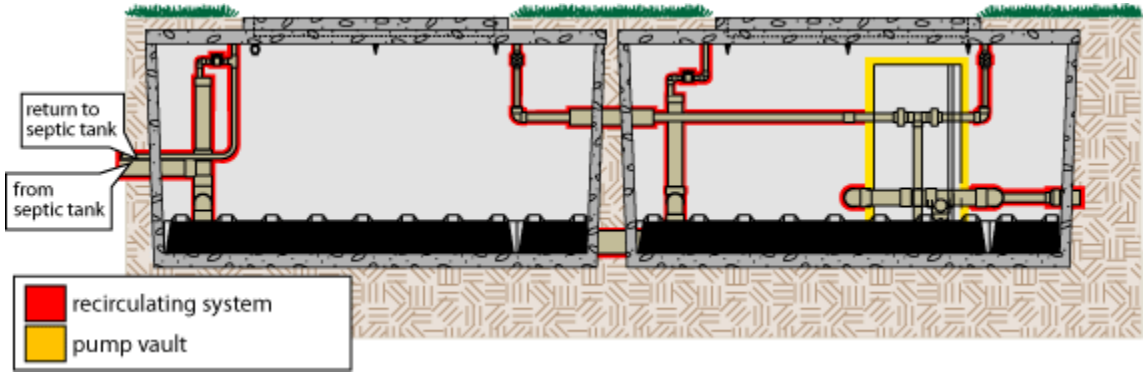
Recirculating System Installed

This shows the yoke coming from the septic tank into the first filter tank.

The piping and lines are installed in the filter tanks. Piping yokes are placed into the holes of the Infiltrators in both tanks. This allows the effluent to pass from the septic tank into the first filter tank and cross over from the first filter tank to the second filter tank.

RECIRCULATING SYSTEM INSTALLED (*continued*)

Inlet and discharge lines are attached, feed lines are connected, and the feed line crossover is installed. The return valve assemblies, through which effluent will feed to the bottom zone during spraying, are installed.



The return loop is installed in the second filter tank.

The return valve assembly to the septic tank is also installed in the first filter tank.

RECIRCULATING SYSTEM INSTALLED (*continued*)

The UV disinfection unit is placed outside the CO-OP RFS III and is connected to the second filter tank.

A 1½-inch hole is drilled at the discharge end of the second tank. A conduit is attached to the pipe stub of the junction box at the pump vault and run out of the tank to the UV unit.

REVIEW

Place the typical installation steps you've learned so far in the correct order, from first step to last.

Drag and Drop each step into the correct order.

Step 1.

Step 2.

Step 3.

Step 4.

Piping and lines are installed and connected.

Pump vault is installed in second tank.

Crushed stone provides base for recirculating filter tanks. Tanks are set.

Infiltrators are installed on bottom of both filter tanks.

CREATING THE FILTER

The filter media is installed in the tanks of the filters.

First stone: min. 16 inches of AASHTO #57, followed by 8 inches of AASHTO #8

Then Black Beauty: min. 24 inches of media

HOOKING UP THE SPRAY NOZZLES

The spray nozzles are installed in the spray grids, which are encased in the filter tank ceilings.

A spray nozzle encased in the ceiling of the filter tank.

HOOKING UP ELECTRIC

The electric hookups are attached to the main power, the pumps, the floats, and the control power. All float wires and pump wires are run to the control box.

Inside the pump vault.

At the control box.

INSTALLING THE ULTRAVIOLET DISINFECTION UNIT

The UV disinfection unit is installed outside the second filter tank.

The UV disinfection unit is installed.

INSTALLING LINES

Septic lines are installed from the septic tank to the CO-OP RFS III and from the CO-OP RFS III to the absorption area. Then the tanks and septic lines are backfilled.

Here, septic lines installed from the CO-OP RFS III to the absorption area are ready to be backfilled.

TESTING THE UNIT

To test the unit, the installer will...

- Set run times
- Check UV
- Check pumps
- Check floats
- Check spray grids
- Adjust flow at spray orifices (¼ turn)
- Adjust septic tank orifices (¼ turn)
- Adjust bottom zone feed orifices (¼ turn)

REVIEW

Put the following typical installation steps for a CO-OP RFS III in the correct order, from first step to last.

Drag and Drop each of the options into the red box in the correct order next to its corresponding step number.

Step 1.	Infiltrators are installed on the bottom of both filter tanks.
Step 2.	Piping and lines are installed and connected.
Step 3.	Min. 24 in. of Black Beauty laid down.
Step 4.	UV unit is installed.
Step 5.	Unit is tested.
Step 6.	Crushed stone provides base for recirculating filter tanks. Tanks are set.
Step 7.	8 in. of AASHTO #8 laid down.
Step 8.	Pump vault is installed in second tank.
Step 9.	Min. 16 in. of AASHTO #57 laid down.
Step 10.	Electrical hookups are made.

LESSON SUMMARY

In this lesson, you learned about the typical installation of a CO-OP RFS III. Although the SEO is not responsible for any part of the installation, he or she should be familiar with the steps involved in installing a CO-OP RFS III, which include the following:

- Filter tank placement
- Creating the bottom zone
- Installing the pump vault
- Installing the recirculating system
- Creating the filter
- Hooking up the spray nozzles
- Hooking up the electricity
- Installing the ultraviolet disinfection unit

WHAT YOU WILL LEARN IN THIS LESSON

In this lesson, you will learn . . .

- recirculating filters require periodic maintenance to operate properly. Although the Alternate Systems Guidance (guidance) addresses the operation and maintenance of the UV unit, it is silent on specific maintenance requirements for the CO-OP RFS III.

- the manufacturer of the CO-OP RFS III requires homeowners to enter into a maintenance agreement with a service provider. A monthly monitoring fee is typically charged.

- the service provider conducts routine maintenance on the CO-OP RFS III four times a year.

MAINTENANCE UNDER THE ALTERNATE SYSTEMS GUIDANCE

 **Section 5.F**

A.S.G.

The guidance is silent on any specific maintenance required on the CO-OP RFS III itself. It does advise homeowners that recirculating filters require periodic maintenance to operate properly. The following information on maintenance is presented in the guidance:

- Septic tanks, dosing tanks, and lift pump tanks must be inspected every six months for structural integrity of the tank, inlet and outlet baffles, solids retainers, pumps, siphons, and electrical connections.

- Operation and maintenance of systems employing spray irrigation or at-grade absorption areas for final treatment must meet the manufacturer’s specifications.

- Disinfection units must be inspected monthly by the property owner and every six months by a maintenance entity. Operation and maintenance of the UV disinfection unit was reviewed in Lesson 2-3.

Routine Maintenance of CO-OP RFS III

Although the guidance is silent on specific maintenance requirements for the CO-OP RFS III, the manufacturer requires a homeowner who installs a CO-OP RFS III to enter a maintenance agreement with a service provider to monitor the filter and make sure it is working properly. A monthly monitoring fee is typically charged.

The service provider will perform the following tasks on the CO-OP RFS III during his or her routine visit four times per year.

Click on the question marks to fill in the blanks.

- Inspect the area and check for strong ? . Such an odor may indicate organic overloading or a mechanical malfunction.
- Inspect the filter area for ? on the surface. This would indicate that the Black Beauty in the filter is plugged.
- Rake the Black Beauty to break up any crust that may have formed on the surface.
- Check the spray grid during operation to look for a ? spray pattern. Any spray nozzles that appear to be clogged are cleaned.

Routine Maintenance of CO-OP RFS III *(continued)*

Service Provider's Routine Maintenance Tasks *(continued)*

The white pipe next to the control box is the inspection port for the UV unit.

Click on the question marks to fill in the blanks.

- Obtain a sample of the effluent after it leaves the UV disinfection unit and inspect it for clarity and odor.
- At least ? a year, send a sample to a laboratory to have it tested for fecal coliforms, carbonaceous biochemical oxygen demand (CBOD), and suspended solids, as mandated in the guidance. A copy of the lab results and the inspection documents for the UV disinfection unit must be sent to the ?.
- Inspect the ultraviolet disinfection unit. Pull up the UV tube, clean it when necessary and replace it at least ? a year, as mandated in the guidance.

Routine Maintenance of CO-OP RFS III *(continued)*

Service Provider's Routine Maintenance Tasks *(continued)*

Click on the question marks to fill in the blanks.

- Check the amp draw on the recirculation pump and record the results.
- Check float switches for proper operation. Test the ? .
- Make sure the ? is running at the manufacturer's preset times.
- Inspect the ball valve in the recirculating filter and make sure it is opening and closing properly

During the four-times-a-year maintenance inspection, the service provider will check the control panel to make sure the recirculation pump is operating properly.

Routine Maintenance of CO-OP RFS III *(continued)*

Service Provider's Routine Maintenance Tasks *(continued)*

Click on the question marks to fill in the blanks.

- Check and, if necessary, clean the **effluent filter** in the septic tank.

- Annually measure sludge and scum accumulations in the septic tank, and if necessary, recommend pumping the tank.

- Periodically perform a dissolved oxygen test to make sure the system is operating in the range of 6 to 8 mg/l of dissolved oxygen. If it isn't, run times for the CO-OP RFS III may need to be adjusted. However, the pump's maximum run time should never exceed more than 50 percent of the 20-minute cycle.

REVIEW

 **Routine maintenance on the CO-OP RFS III is...**

Select all that apply.

- [ ] A) Addressed in the Alternate Systems Guidance
- [ ] B) Required by the system manufacturer and installer
- [ ] C) The responsibility of the SEO
- [ ] D) The responsibility of the homeowner
- [ ] E) Performed four times a year by the service provider

Submit Reset

LESSON SUMMARY

In this lesson, you learned . . .

- recirculating filters require periodic maintenance to operate properly.
- athough the Alternate Systems Guidance addresses the operation and maintenance of the UV unit, it is silent on specific maintenance requirements for the CO-OP RFS III.
- the manufacturer of the CO-OP RFS III requires homeowners to enter into a maintenance agreement with a service provider. A monthly monitoring fee is typically charged.
- the service provider conducts routine maintenance on the CO-OP RFS III four times a year.

WHAT YOU WILL LEARN IN THIS LESSON

In this lesson, you will learn . . .

- the role of the SEO in the various stages of permitting a CO-OP RFS III.
- the SEO who successfully completes DEP-approved training on the CO-OP RFS III may permit a system containing this type of filtering system.
- things to look for during a final inspection of a CO-OP RFS III.

THE SEO'S ROLE

An SEO must have successfully completed DEP-approved training on the CO-OP RFS III to be able to independently issue or deny a permit for a system containing a CO-OP RFS III without DEP review. In addition, the SEO must have successfully completed DEP-approved training on any alternate absorption area that will be used in conjunction with the CO-OP RFS III.

The SEO plays a role during the following stages in the process of permitting a system in which a CO-OP RFS III is proposed for advanced treatment:

1. **Site evaluation** – The SEO verifies that the following criteria are met: isolation distances, slope requirements, soil probe including suitable soil depth for type of absorption area, and complete soil morphological evaluation conducted by a soil scientist, if required.

2. **System design** – The SEO reviews the system design to make sure it complies with DEP's regulations and the guidance.

3. **System installation** – The SEO should conduct, at minimum, a final inspection of the system, although DEP recommends that SEOs conduct periodic inspections throughout the installation.

THINGS TO LOOK FOR DURING THE FINAL INSPECTION

To help you with your final inspection of a CO-OP RFS III, a final inspection checklist has been prepared. You can access this checklist by clicking on the following link:

Open & print the CO-OP RFS III Final Inspection Checklist in Adobe Acrobat Reader.

Printing out a copy of the checklist now may help to provide better comprehension as we move through these steps in the next few pages of this course.

✓ Access to Two Filter Tanks

The SEO may verify that each filter tank has at least one access opening measuring a minimum of 24 inches by 36 inches. The openings should provide access to the entire surface of the filter.

✓ **Depth of Black Beauty and Freeboard**

The SEO may measure the depth of the Black Beauty in the filter tanks with a poke rod to make sure it is a minimum of 24 inches deep.

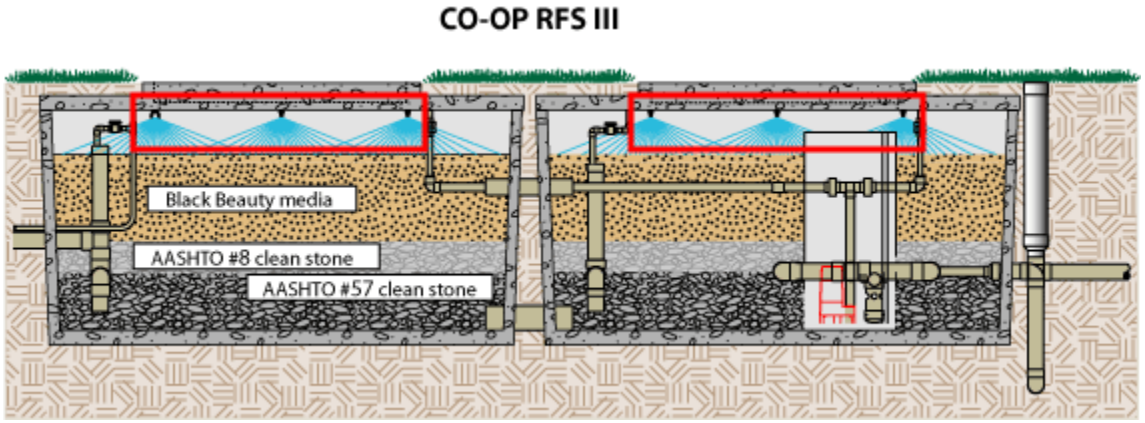
The SEO also may confirm that the freeboard from the top of the tank interior to the surface of the Black Beauty is 12 inches.

Measuring the freeboard space in one of the CO-OP RFS III's filter tanks.

✓ Grids and Laterals

The SEO may verify that each filter contains two spray grids, one in each filter tank, and that the effluent flow to any grid can be shut off, if necessary.

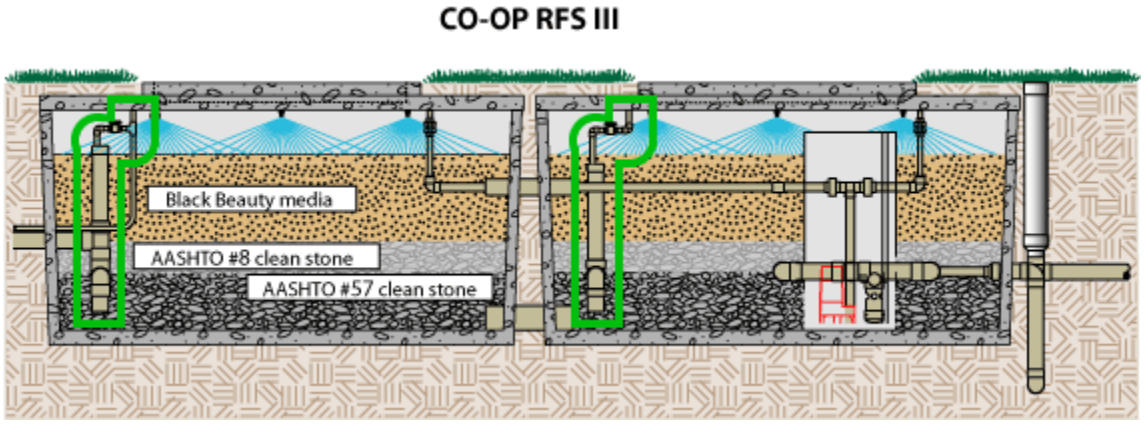
The SEO also may verify that each spray grid includes two laterals, each 10 feet long.



Areas highlighted in red indicate location of spray grid and laterals in each filter tank.

✓ Orifices

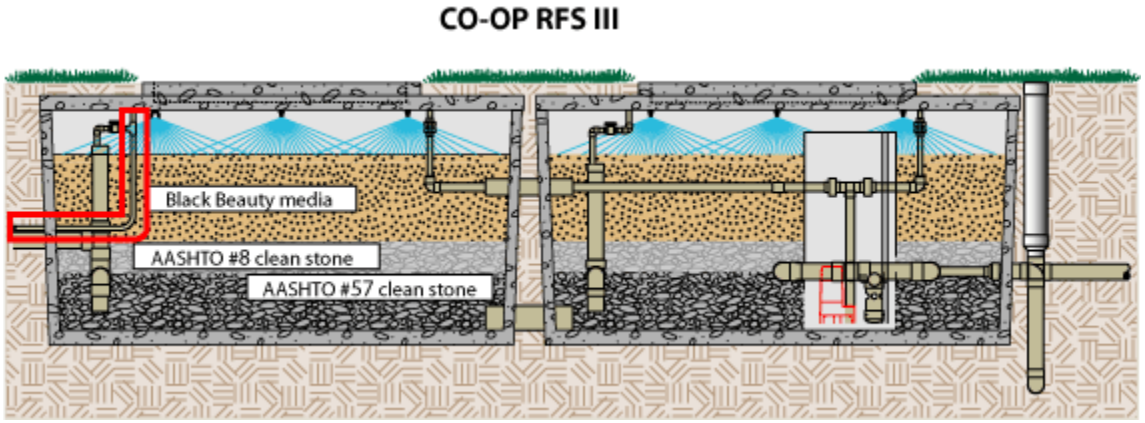
The SEO may verify that the spray grid in each filter tank contains four orifices (three for sprinkler heads, one for the return to the bottom zone). The orifices should be sized .25-inch diameter and spaced approximately on 54-inch centers. Each grid should contain one flushing orifice to the underdrain (bottom zone) with a valve.



The areas highlighted in green show the locations of the flushing orifices to the bottom zone.

✓ **Return to Septic Tank**

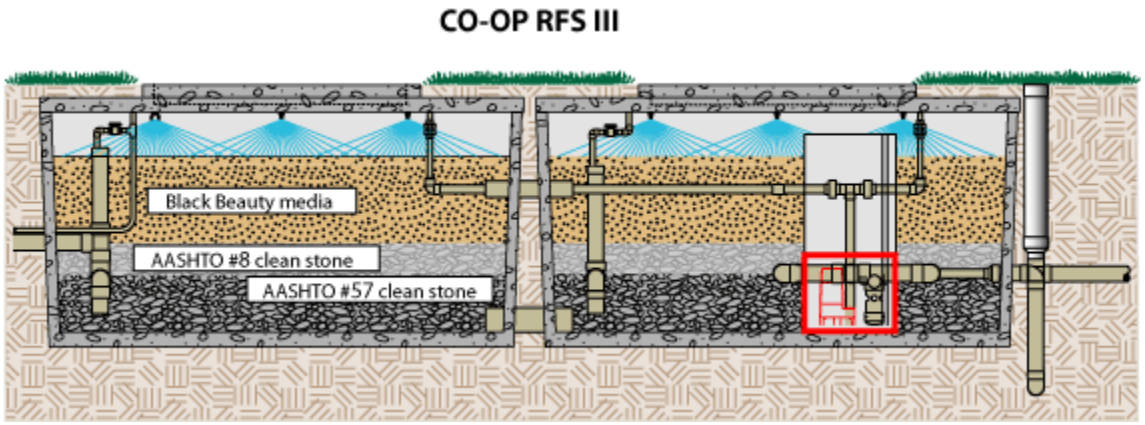
The SEO may verify that the filter contains one return to head of septic tank with a recirculation valve. This should be located in the first filter tank, on the wall closest to the septic tank.



The area highlighted in red shows the location of the return to head of septic tank.

✓ Pump Cycle

The SEO may verify that the pump is operating approximately 2 minutes on and 18 minutes off during each cycle. This will confirm that the system cycles 72 times per day, as stated in the guidance. (Three 20-minute cycles in an hour, 24 hours in a day: 3 x 24 = 72)



The area highlighted in red indicates the location of the pump. The SEO can verify the pump cycle by timing the duration of the spraying (2 minutes) and the rest period (18 minutes) until the next spraying occurs.

✓ **Flow of Effluent**

The SEO may verify the flow of the effluent from the spray orifices and the flow of the effluent returned to the septic tank from the filter.

To do this, the SEO should use a bucket to catch the escaping effluent from each of these locations for a certain period of time to make sure 4 gallons/minute is released at a single spray nozzle and 2 gallons/minute is released at the return line from the filter to the septic tank.

EXAMPLE:
One way to do this is to catch the effluent in a bucket for 15 seconds, measure the captured effluent, and then multiply this measurement by 4 **(15 seconds x 4 = 60 seconds)** to get the actual flow of gallons per minute.

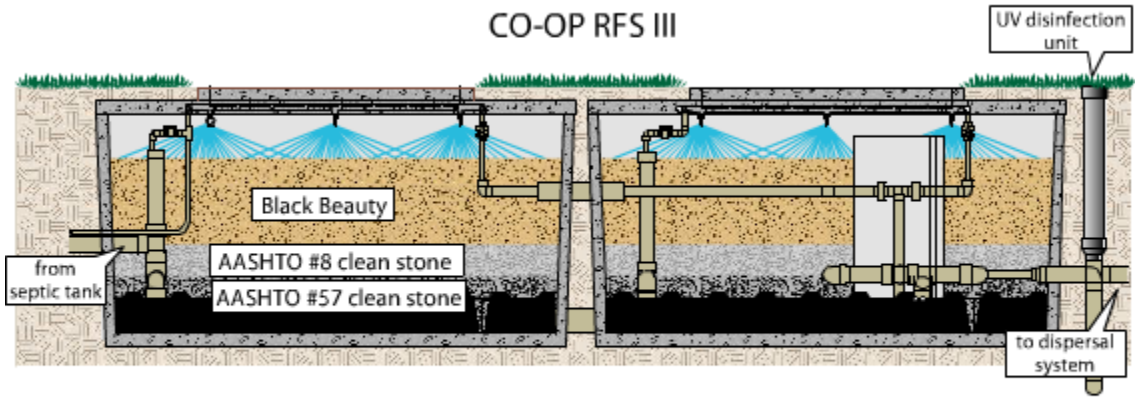
For example, at a **spray nozzle**, you should capture 1 gallon of effluent every 15 seconds. **(1 gallon x 4 = 4 gallons per minute)**

Inside the septic tank at the return pipe from the filter, you should capture ½ gallon of effluent every 15 seconds. **(½ x 4 = 2 gallons/minute)**

REVIEW

An SEO may verify the following requirements during a final inspection of a CO-OP RFS III filter.

Drag and Drop each of the requirements in the boxes below to the applicable location in the CO-OP RFS III filter.



12 inches of space	**min. depth of 24 inches**	**4 gpm**	**2 gpm**	**on 2 min., off 18 min.**

LESSON SUMMARY

In this lesson, you learned the following.

- The role of the SEO in the various stages of permitting a CO-OP RFS III, including:

    1. **Site evaluation** – SEO verifies that the proper site criteria are met.
    2. **System design** – SEO reviews the system design to make sure it complies.
    3. **System installation** – SEO conducts a final inspection of the system.

- The SEO who successfully completes DEP-approved training on the CO-OP RFS III may permit a system containing this type of advanced treatment filter.

- The final inspection checklist (available on this web page or in the job aids) will help you to look for the following items during a final inspection of a CO-OP RFS III.

    1. Access to filter tank – correct number and size measurement
    2. Depth of Black Beauty and freeboard – correct measurement
    3. Grids and laterals – correct number and size
    4. Flow of effluent – correct measurement
    5. Orifices – correct number and size
    6. Flow of effluent – correct measurement
    7. Pump cycle – correct duration