October 13, 2010

Robert W. Scully, P.E., Supervising Sanitary Engineer
Connecticut Department of Public Health
410 Capitol Ave. MS# 51SEW
P.O. Box 340308
Hartford, CT 06134-0308

RE: Proposed Revisions to Leaching System Rating Formula

Dear Mr. Scully,

We offer the following comments to the above referenced.

Review of CT DPH rating system for subsurface sewage apparatus

The Connecticut rating system for septic system***s*** is being reviewed. As our product ***"Living Filter"*** is greatly affected I wish to submit the following response.

The Living Filter product

Formcell introduced its Living Filter product more than 20 years ago. Its first commercial installation took place 1991 almost 20 years ago. Living Filter employed a pioneering design in septic systems. It was born out of experience from clogged septic systems and observations in nature. In containers of water with vertical sides, be it a lake, river or man made construct, deposits will take place on the bottom and practically nothing on the vertical sides. Adding for the hydraulic pressure and permeable surrounding material, deposits will also occur on the vertical sides but would still be far less than at the bottom. The same principle would most certainly be applicable in a septic system.

Formcell has verified both in tests and in actual installations of Living Filter using vertical areas to build up a bio-mat, that the speed of build-up is NOT equal on vertical and horizontal interfaces. The LTAR critical level will be reached much earlier at the bottom interface and rather uniformly over the surface. On the sidewalls the critical level will be reached gradually from low to high. As a matter of fact, a system with a sealed bottom area would still be

functional with permeable sidewalls. It would still benefit from material being deposited on the bottom and thus the bio-mat on the sidewalls being thinner with greater permeability. The gravity component is most likely the most important factor causing systems to be less efficient and eventually fail. The gravity factor has practically no effect on the sidewalls. The current rating system does not consider this at all.

The difference between bio-mat build-up on horizontal versus vertical surfaces should in itself be grounds for an overhaul of the rating system from the ground up.

Competing interfaces / *Biomats*

Claims about competing interfaces, or bio-mat surfaces being to close, have emerged in discussions about changes to the rating system. A result from this claim would be that surfaces at an angle towards each other would be discounted considerably. The claim, of unknown origin, seems to be born out of theory and has no basis in actual results from installed systems. If applied, this rule would in effect render all installed Living Filter systems severely undersized. Since these Living Filter systems have an excellent record with no failures of properly installed systems, a rule that seems to single out a certain design without grounds should not be implemented.

Living Filter obviously is the product that more than other products will be hurt by a rule about competing biomats. The most sensible action would be to investigate whether there are any Living Filter installation failures due to proximity of biomats. Our own investigations have shown no evidence of biomat formation beyond the space of the fabric

Paper not dissolving / disintegrating.

To benefit from the above mentioned effect of gravity on sidewalls vs bottom area, Living Filter uses walls of biodegradable paper fiber as a temporary structure to hold material in place. In the constantly wet conditions, this structure will after only a few weeks of use be almost totally degraded and offers no restriction compared to the bio-mat. Several tests and results from numerous installed systems show that this paper structure breaks down very quickly. A test performed in 1991 shows that the cardboard used by Living Filter submerged in waste water after 2 weeks was almost entirely consumed by microorganisms (App 1). What scientific evidence is there that contradicts this and facts from numerous installations, that warrants a reduced rating for utilizing a temporary biodegradable form in the interface?

The claim that paper fiber does not degrade is simply totally confounding and must be explained.

Fabric in the interface

In addition to using a biodegradable form in the interface, Living Filter uses fabric to promote build-up of the bio-mat in the fabric and to separate materials so that a continuous membrane can exist with controlled placement. The sheet of fabric will still let water through at a rate much higher (approximately 10,000 times – See Appendix 1) than that of the bio-mat. If the bio-mat fills its interstices, flow rate would certainly be no less than that of the bio-mat itself.

Lack of oxygen

Its been argued that lack of oxygen in the ground should reduce the allowed area for so called "accordion fold systems". Lack of oxygen has successfully been taken care in Living Filter installations since the early nineties using Formcell's Bioren system.

Conclusion

Living Filter is a pioneering design based on innovations that has proven workable in numerous installations in CT. Further underlining its good design, is that some of its features have been copied by competitors. There are good reasons for the Connecticut Department of Public Health (CT DPH) to be conservative in granting permissions, but it must at the same time make judgements that are based on scientific evidence and facts and in particular they should be based on actual results from installed systems.

I urge the CT DPH to consider the following:

- Gravity causes bio-mats to be much thicker on the bottom area as opposed to the sidewalls. This factor should be taken into account in rating different systems with factors set accordingly.
- The competing biomats effect is a theory that has no ground in real life experience in particular in light of differences in the build-up of bio-mats on vertical and horizontal surfaces respectively.
- The paper fiber temporary form is securing the integrity of the shape of the sidewalls. It will decompose just as any paper product does and will after a few weeks be practically gone. The effect on the flow is negligible and should not be a factor in rating systems.

- Tests and experience from Living Filter installations shows that fabric in the interface is no restriction to the flow of water through the bio-mat and should not affect the rating.
- All in all the benefits of leaching through a vertical surface has been proven since long ago and should be reflected in the way ELU-credits are calculated.

Hampden Oct 13, 2010

Best regards

Kjell E Berg

Living Filter
16 Andrew Circle
Hampden, MA, 01036

Encl.:

Appendix 1

APPENDIX I

FRANK A. MEUNIER, JR., P.E. & L.S.
Environmental Engineering Services
P.O. Box 225
Stafford, Connecticut 06075

Mr. Kjell Berg
Form-Cell
P.O. Box 352586
Palm Coast, Florida 32135

RE: Form-Cell™ Living Filter™, Testing #LF10 and #LF11

Dear Mr. Berg:

I have enclosed the test reports generated from work done on the above referenced. A portion of the data has been converted into chart form to show the time required to reach the long term acceptance rate.

The testing was performed using a small controlled section of the Living Filter (10 cells covered with 4 oz. filter fabric) and two individual cells; one using cardboard only and the second using a 6 oz. filter fabric over the cardboard form. Native soil k value = 3m/day(10 ft/day).

Testing was commenced on the fifth of June 1990 and is continuing at present. The test modules designated LF10 and LF11 are loaded from a black water dumping station. LF10 has a displacement capacity of approximately 50 gallons and LF11 has a capacity of 5 gallons for each cell.

The cardboard form showed increased permeability after approximately two to three weeks, coinciding with the stabilization of the drawdown curve. A piece of cardboard was submerged completely in septic waste for approximately two weeks and was almost entirely consumed by the microorganisms. The cardboard forms were degraded to approximately 75% of their mass, six inches below the ground surface, after three weeks.

The tests were run from June through October in 1990 and from July 16, 1991. Both test periods have shown that the long term acceptance rate is achieved within approximately two weeks of start-up. The rate of permeation and liquid drop remains very steady from that point.

Test #LF11 showed that the filter fabric covered cell was more predictable in the rate of drop. The soil/stone interface without the filter fabric showed faster permeation at high heads indicating intermittent breakthroughs.

For the ten - cell filter, the long term acceptance rate was found to be approximately .38 gallons per sguare foot of actual sidewall interface (filter fabric in contact with filter

sand) at an average of 9 inches of head pressure (h), .6 gallons per s.f. at 15 in. h and 1.5 gallons per s.f. at 21 in. h.

Assuming the system was operated with an average head of 15 inches the capacity would be .83 gallons per square foot. The 24 in. F-C filter has a sidewall area of 13.35 s.f. and a bottom area of 1.67 square feet. The bottom area should not be counted in the capacity calculation. It becomes much less permeable than the sidewall of the system and thus the capacity would be 13.35 (incl. reserve above 18 in.) x .83 = 11 gallons per l.f. of system. If the system was operated at 21 inches, the capacity would be 13.35 x 1.5 = 20 gallons per l.f.

When the system is operating at 15 inches of h the capacity is approximately 6 gallons per l.f. per day leaving a reserve storage capacity of 5 gallons per l.f. Assuming a typical installation comprises one trench 75 feet in length, the capacity would then be 450 g.p.d. with a reserve of 375 gallons (above the 12 inch mark). An additional reserve would also exist in the extra capacity at higher head pressure (20 g.p.d./l.f. at 21 inch head) which translates into (20g.-6g)75l.f. - 375g = 675 gallon reserve.

I recommend taking a conservative approach using a .45 gal. per s.f. infiltration rate (excluding the bottom) based on 13.35 square feet per l.f. of system for the 24 in. model. This will give you a very generous safety factor of 3 and rate the system at 6 gallons per l.f. regardless of soil permeability. It can not, however, be installed in areas where the permeability is less than 2 ft./day without expanding the cells. The cell spacing should be no less than one per l.f. under those conditions which would double the length of the system. In the cases of very low soil permeabilities extreme care must be taken to keep high groundwater sufficiently below the system.

The long term acceptance rate of filter fabric has been tested at the University of Connecticut as presented in a paper by Professor Rein Laak at the American Society of Agricultural Engineers 1989 International Summer Meeting, jointly sponsored by ASAE and CSAE. Testing was done using a polyester fabric with a k/value of 0.1 cm/s. The fabric after long term leachate loading had a permeability of 1.8 - cm/D which equals a permittivity of .4 gal/s.f./day.

The living filter designer has indicated the use of a filter fabric (Amoco 4551) with a permeability of 0.2 cm/s (clean fluid type - water). The higher permeability rating assures that the long term acceptance rate will not be adversely affected by the cloth. This translates into a permeability of 17,280 cm/D for clean water. The permeability is thus reduced >10,000 times by the combination of biological growth, filter sand and aggregate.

In summary, I feel very confident that the Form-Cell Living Filter will provide excellent performance and longevity, based on my studies. I would advise, however, that you be very explicit in declaring the need to inspect, pump and maintain the septic tanks, piping and other appurtenances. The tanks should be pumped at intervals dictated by the septic tank design (usually no more than three years). You should also recommend that each installation be carefully graded to eliminate surface waters entering the filters.

I would also recommend that you emphasize to the installers the need for extra care as they are building filters which, if installed correctly, should make a serious contribution to reducing the pollutant load entering our waters.

In summary, my rating of the capacity of these systems is perhaps a bit conservative, but likely prudent at this time. After a performance period, with a broadened experience base, we can again analyze and review collected data to possibly redraw the specifications and possibly recommend a higher loading rate

August 20, 1991

Respectfully,

Frank A. Meunier, Jr., P.E & L.S.