APPENDIX I

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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.