SEWAGE EFFLUENT – LIABILITY OR ASSET?

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Summary:
Subsurface drip dispersal (SSDD) and reuse of domestic effluent under conditions where conventional drainfields do not work is both economic and environmentally friendly. The technology was introduced about ten years ago. Because of the formidable regulatory barriers to entry, it has been difficult to penetrate the market.

Keywords:
Irrigation, drip, subsurface, reuse, effluent, disposal, drainfield.

INTRODUCTION

During the last five years, 40% to 50% of all new residences were built with on-site septic systems. As housing density increases, and land with soils that are not suitable for a conventional drainfield are developed, disposal of the effluent is an increasing problem. The growing metropolitan population is putting pressure on water supplies. Subsurface drip dispersal combined with reuse is advantageous, as is the low risk of human contact with the effluent.

Barriers to entry are both technical and bureaucratic:

- Federal, state, and county health and environmental regulations are inconsistent, and discourage new technology
- The "no-growth" lobby uses the regulatory process to advance it's agenda
- Civil engineers are conservative and risk averse
- The poor reputation of this technology is caused by inept application by innovators who had to go through their learning curve
- Year-round operation is required, regardless of climatic conditions
- Designers, operators, installers and regulators are inadequately trained
- Biological slime can build up in the drip system and plug the emitters
- A biological mat can plug the soil, resulting in surfacing of the effluent
- Root intrusion into the drippers

THE TECHNOLOGY

The following illustration demonstrates the movement of water applied in small pulses. The subsurface application results in a 40% increase of wetted volume over the surface application. We can, therefore, imply that there is more air in the subsurface wetted area. Most of the sewage effluent pathogens are anaerobic bacteria and virus. These are absorbed under aerobic conditions. Thus, SSDD can be an efficient technology for the treatment of the sewage effluent.

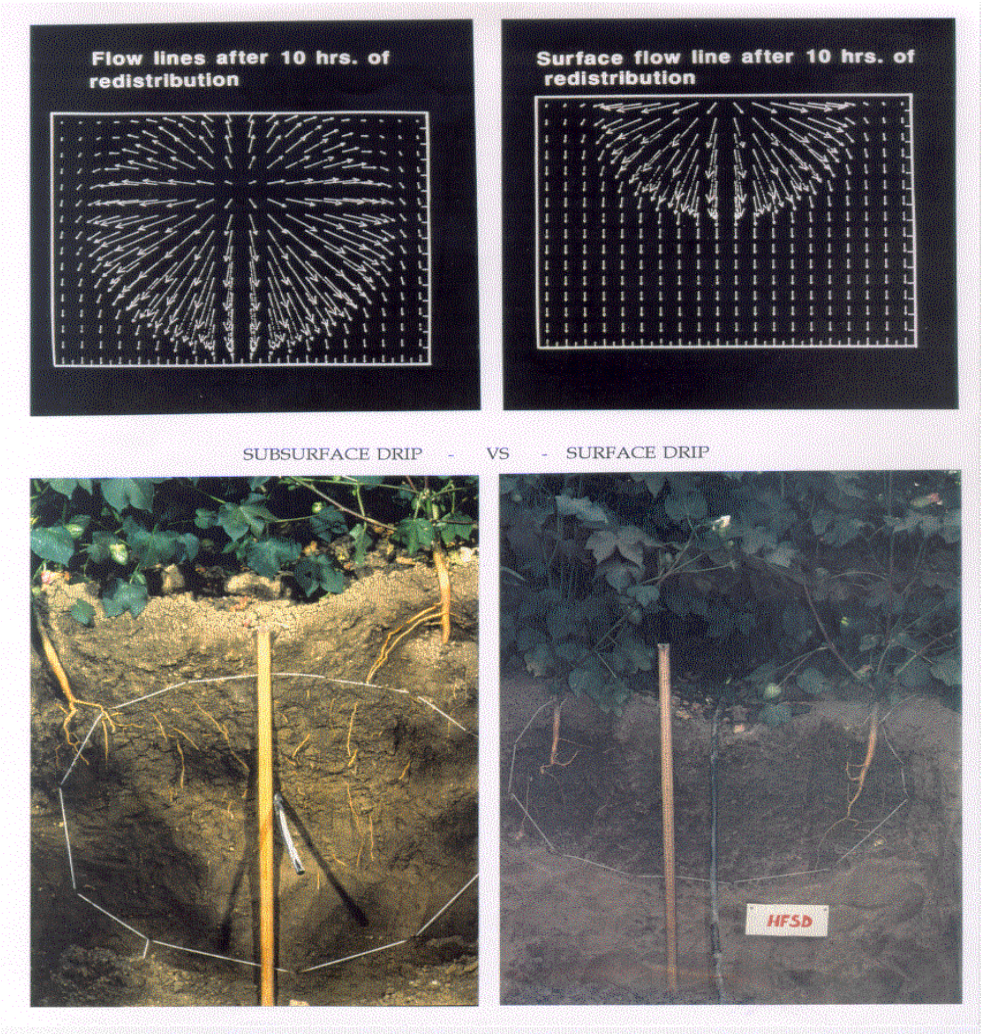

Fig. 1: Movement of water with pulsed subsurface application **Photo: Dr. C. Phene of the USDA**

Hydraulic engineering skills are required in order to design a conventional subsurface drip irrigation system. In the case of SSDD, one is effectively operating an independent sewage treatment plant at each and every emitter. In the event that the bacteria are not absorbed, a biological mat can form in the soil. This mat will plug the soil and prevent the movement of the effluent away from the dripper (1), thereby causing the effluent to surface and the system to irrevocably fail. The designer must know the capacity of the soil, both to absorb the pathogens, and to dispose of the volume of water being applied. Soils science is an essential part of the technology.

MATERIALS

BIOLOGICAL SLIME: The risks of slime build-up in the dripperline and root intrusion can both be solved.

Biological slime easily builds up inside the dripperline. This slime will slough off the tube wall and plug the emitters. The risk of slime build-up is a function of the effluent quality, the temperature of the effluent, and the length of time the effluent stays in the system. One solution is to use a tube with a bactericide lining. This will prevent slime formation on the walls of the tube, even with extremely poor quality effluent. Another solution is to frequently flush the system at very high velocity. However, as Dr. Sievers of the University of Missouri has reported (2), despite frequent high velocity flushing, aerobic slime built up in the drip system. In order to clear this slime, it was necessary to apply repeated treatments of industrial strength Drano.

ROOT INTRUSION: Nitrogen, which is a component of almost all sewage effluent, will attract dense growth of roots around the emitters. While this root growth is beneficial in improving the soil permeability, it also increases the risk of root intrusion. Root intrusion is a severe risk, particularly if the system is used under grass or other vegetation. There are three techniques registered with the US EPA, which are used to prevent root intrusion. They all depend upon the application of the herbicide trifluralin. One technique incorporates Treflan®[1] into the polymer of the dripper. This technique is known as ROOTGUARD®[2] (3). A second technique adds Gowan Trifluralin 5 directly into the irrigation water. The third technique adds Triflurex®[3] into the irrigation water by means of a dosing system incorporated as a feature of a disk filter.

YEAR-ROUND OPERATION: Systems can freeze under extreme winter conditions. Freezing can be controlled by draining the system at every cycle, and insulating the other operating parts of the system (4). Systems must continue to operate by means of percolation, even during heavy rain events when the soil is at field capacity. Good soils science, combined with correct design, can achieve this balance.

DISCUSSION

In the Introduction I stated: Barriers to entry are both technical and bureaucratic:

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The last four items of the above list have been shown to be manageable by product selection and competent hydraulic engineering and soils science. Consequently, we must address the first three bureaucratic barriers, and the perceived barrier that "SSDD does not work".

These barriers have been formidable. For example, California has fifty-one counties with independent health departments. There are nine Regional Water Quality Control Boards with twelve offices. There are also state health and environmental regulatory bodies. There are no state regulations covering on-site sewage. The county regulations are based upon the use of septic tanks and drainfields, and the Uniform Plumbing Code. Consequently, 19th century seepage pits are permitted, while 21st century SSDD is not! The regulators are generally open-minded and approachable; however, they are restricted by the rules and precedents that do not include new technologies, especially the introduction of a technology as innovative as SSDD. This chaotic situation discourages civil engineers from specifying SSDD, because they do not know whether or not the health and environmental authorities will approve their designs. The market has finally begun to open for new innovations when nothing else will work. If our industry maintains high standards, it will slowly gain credibility and acceptance.

CONCLUSIONS

As is almost inevitable with new ideas, the pioneers in the field had failures, due to both inappropriate equipment and lack of soils science knowledge. Despite several well-recorded local successes, on a national level the regulatory barriers change at glacial speed and remain formidable.

NOTES

(1) Treflan is a registered trademark of Dow Agrosciences
(2) ROOTGUARD is a registered trademark licensed to Geoflow, Inc.
(3) Triflurex is a registered trademark of Makhteshim-Agan

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