HYDROGEN PEROXIDE TREATMENT UPDATE[2/]

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8.8

Introduction

In the thirty-five years since the end of World War II there has been a continuous increase in the number of homes built in the country beyond the reaches of collector sewers, homes which therefore rely upon septic systems for the treatment and disposal of their sanitary waste streams. There have been several technical, economical, and social reasons for this trend. First, the rural electrification scheme brought to the countryside a convenient source of energy which could be used to provide the comforts of heating, lighting, and running water hitherto normally available only to city dwellers. The availability of running water drawn from private wells with electrical pumps made possible the use of flush toilets and automatic washing machines in modern country homes and created the need for a cheap, safe technology for disposal of waterborne wastes. Septic systems seemed an obvious choice to fulfill this need.

The number of rural homes incorporating such new facilities was greatly increased in the years immediately following the war by the veterans benefits program which provided federal government guarantees for mortgages on homes built by former members of the military forces. Many veterans of the world war had come from farms or small rural communities and availed themselves of this opportunity to build a house in rural America and settle near their families. This trend toward preference for homes in the country continued as increasing

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environmental awareness in the early sixties created a movement towards areas where the air and water were fresh and clean, nature and wildlife were unspoiled and spacious building lots were available for relatively low prices. Migration from the cities to suburban, exurban or rural communities accelerated as the economy began to lag during the Vietnam era of the late sixties and early seventies, as the prices of developable lots and property taxes in the cities escalated, and as the inner cities began to deteriorate. Symptomatic of this situation is the fact that within recent years, two-thirds of the new houses built in Wisconsin are served by on-site wastewater disposal systems, not sanitary collector sewers. Because of this diffusion of a large fraction of the population into low-density housing developments on large lots in suburbia/exurbia or in rural settings, it is now no longer economically feasible to provide communal water supplies and sewer service to all such people.(1) It is therefore essential in terms of public health to ensure that the drinking water resource -- usually groundwater -- available to such disperse populations is of good quality and therefore that the systems used to treat and dispose of their sanitary wastes prevent any contamination of the water resource or the environment.

Unfortunately, the rate at which urban flight occurred did not provide this assurance: the state-of-the-art relative to the siting, sizing, installation, use and maintenance of septic systems did not keep pace with the demands placed upon them by many families who wished to maintain a modern city lifestyle while living in a country home. Frequent showering/bathing (not only for daily cleanliness, but often for refreshment following jogging, tennis or other recreation), frequent laundering in automatic washing machines, dishwashing in automatic machines, use of garbage grinders, large parties and other social gatherings, etc., represent water-consuming activities that are considered normal in suburban life nowadays, but were not normal when initial designs for septic systems for country homes were evolved. Overloading and abuse of septic systems therefore became common, especially when city emigrants purchased existing homes in the country and improved or enlarged the dwellings, while neglecting to improve or enlarge the septic system.

The public health, environmental pollution, and public nuisance problems created by failure of septic systems to accept and purify the wastewater generated in many country homes were responsible for stimulating scientific research into practices for on-site wastewater pollution. At the level of the Federal Government, interest in failing septic systems began when large numbers of veterans abandoned their country homes, because the buildings had deteriorated and the septic systems had failed, and Uncle Sam became responsible for the unpaid balance on the mortgage of worthless properties. Extensive research conducted with federal funding at the University of California Sanitary Engineering Research Laboratory identified the formation of a slimy black "biological clogging layer" in the soil underneath the gravel in septic system seepage trenches as a major cause of failure of septic systems.[2,3] This material is more resistant to water infiltration than the initial soil, i.e., it decreases the soil percolation rate upon the basis of which the system was initially sized, so that in time the system ponds and overfills, causing sluggish performance of the system and eventually surface discharge of septic tank effluent, the partially treated wastewater which flows from the septic tank to the drainfield, or backups of sewage in the household.[3,4,5] The strategy suggested by the Califórnia researchers to alleviate or avoid this problem involved prolonged resting of a failed system or alternating use of two separate seepage areas, because in laboratory experiments they observed partial destruction of the clogging layer when application of septic tank effluent was interrupted and the soil was "rested."[2,3] However, the soils used in their experiments clogged and failed again rapidly when effluent applications were renewed.[3]

Because of public health concerns associated with failing septic systems and because a large percentage (22%) of septic systems around recreational lakes (i.e., in environmentally sensitive areas) were found to be failing by surface discharge, a state-funded research program was started in Wisconsin in 1971 to examine causes of septic system failure and determine methods of preventing or remedying such failures (University of Wisconsin-Madison/University of Wisconsin-Extension Small Scale Waste Management Project = SSWMP). As part of this program, the causes of system failure by biological soil clogging were examined, and a method was evolved for a chemical treatment of clogged soil to restore its initial permeability.[4,5] The development of this process and some experience gained from its experimental and commercial application to failed septic systems are described in the following.

Development of the Hydrogen Peroxide Process

Clogging of soil by black "biological crusts" following applications of septic tank effluent has been studied repeatedly in the laboratory using columns of sand or "lysimeters."[2-7] When such columns are dosed daily with septic tank effluent, the sand gradually loses its initial permeability because the soil pores become clogged with a black, slimy deposit composed of organic wastes, bacteria, inorganic precipitates and other debris which are removed from septic tank effluent as it percolates through the soil. Partial transient restoration of soil permeability has been observed when effluent applications were discontinued for several days or weeks and the soil was "rested."[2,3] Clogged columns treated with small amounts of hydrogen peroxide, on the other hand, were restored within minutes to hours to essentially their initial permeability.[4,5] Rehabilitation is accomplished by removing any stagnant water from the system and treating the soil with strong solutions of hydrogen peroxide. This treatment removes the bulk of the organic and some of the inorganic materials and restores the soil essentially to its initial permeability.[4,5]

Following the first successful unclogging of crusted sand columns in the laboratory in the winter of 1973, the silt loam soil under two trenches of a failed household septic system at the University of Wisconsin Experimental Dairy Farm near Arlington, Wisconsin was unclogged by peroxide treatment in May 1974. A soil tensiometer, a simple device used to measure the moisture content of soils by observing the height to which a column of mercury rises against gravity because of the pull exerted by surface tension in the soil capillaries[8], indicated that the soil below the crusted trenches was much drier before the crusting material was destroyed by peroxide. The higher soil moisture indicated by lower soil moisture tension after peroxide treatment revealed that water started to percolate easily into the soil again because the clogging layer had been destroyed (Fig. 1). This septic

Figure 1. Changes in subcrust soil moisture tension following a POROX treatment in a field system. The initial steep drop indicates wetting of the soil as the crust is dissolved away. The rise in tension during the first few days probably reflects resorting of soil agitated by decomposing peroxide. The slow rise over several months suggests gradual reformation of a biologically clogging layer.

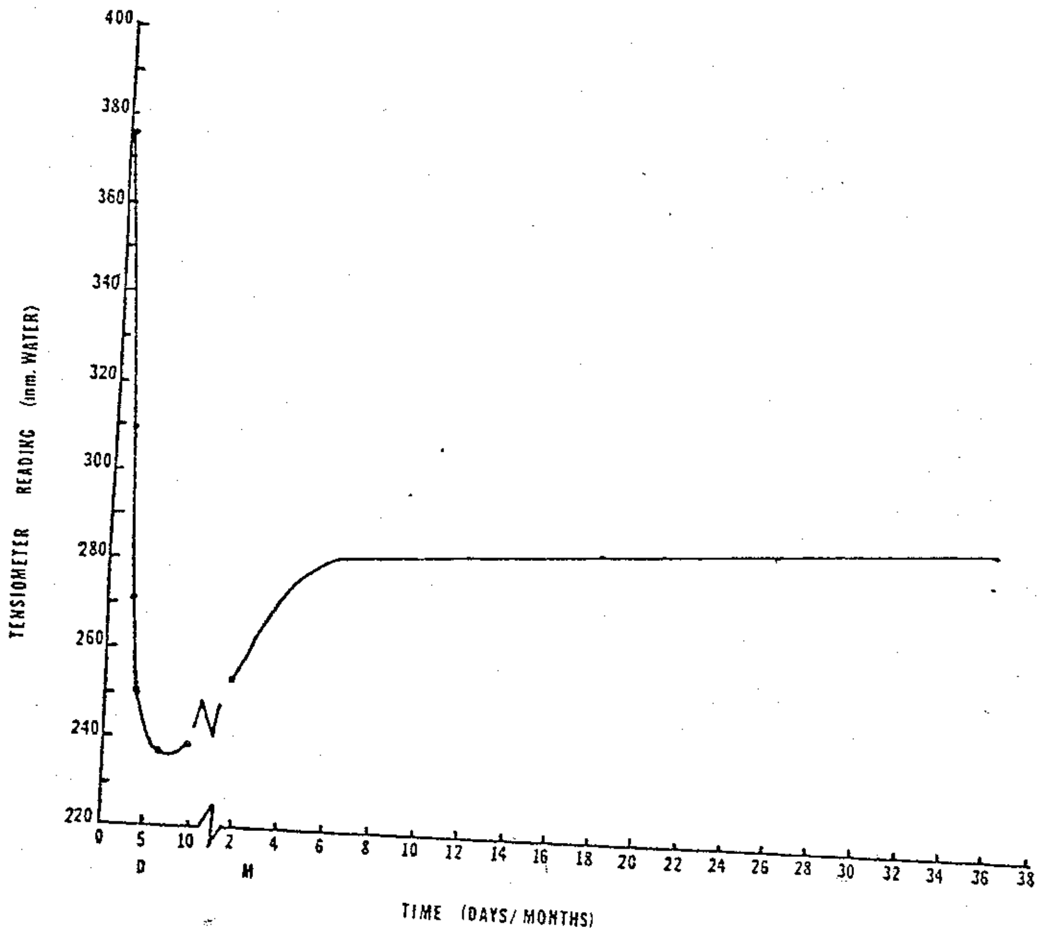

Fig. 1

system is still working satisfactorily; tensiometer readings taken for 3 years following treatment showed that water continued to percolate readily from the gravel leach field into the soil below but a small gradual increase in the soil moisture tension indicates that the soil below the bed is becoming drier, i.e., the system is slowly beginning to clog again.

Three more systems in sandy soils in a mobile home park at Rhinelander, Wis., a second system in glacial till at the University Dairy Farm, and a fifth system in a clayey soil just north of Madison's Lake Mendota were also treated in the summer and fall of 1974. Again tensiometer data indicated that the soil below these ponded, clogged systems became wetter after treatment, indicating that the clogging layer which once inhibited percolation of septic tank effluent into the soil had been destroyed by peroxide. Tensiometry revealed that one of the systems in the sand soil failed again soon after treatment. However, this system was properly rehabilitated by a second peroxide treatment. Insufficient chemical had been added during the first treatment to penetrate the crust. Similar effects were observed with clogged soil columns in the laboratory; unless enough peroxide was added, the crust was not completely dissolved and permeability was not adequately restored, but a second treatment invariably destroyed the residual crust and restored the column to its initial permeability.

The advantage of the peroxide treatment of failed systems is that it restores the soil permeability without creating major disturbances at the site and without inaccomodating the users of the system by restricting water use.[4,5]

Following the success of the laboratory and field experiments, a patent covering the process of chemically rehabilitating septic systems, sand filters, and the like which had become clogged by biological crusts following applications of wastewater was obtained in May, 1977 and was assigned to the Wisconsin Alumni Research Foundation (WARF), the organization which handles patent matters for the University of Wisconsin.[9] WARF also received a registered service mark for the name POROX to designate the process. Anyone practicing chemical treatments of failed septic systems and the like using hydrogen peroxide must be licensed by WARF. In addition, in Wisconsin, anyone performing chemical treatments of failed septic systems must be licensed by the State Division of Health.[10]

Since 1974, several hundred failed septic systems have been treated using the POROX process either by licensees of WARF or by the author and his associates. Experimentation has continued, seeking the limitations of the process and ways to simplify and to ensure uniform treatment of the clogged soil. A variety of systems of different sizes, types, and configurations has been treated: adsorption trenches, beds and seepage pits (drywells) in a variety of soil types serving single family dwellings, multiple housing units (mobile homes, small apartment buildings, etc.), retirement homes, restaurants, and even industrial plants. Modifications of the initial treatment solution have been developed to improve the treatment; for example, appropriate stabilizers may be added to inhibit enzymatic breakdown of the peroxide by catalases in the soil bacteria, and equipment has been developed to facilitate the peroxide additions and assure its thorough dispersal throughout the system. Details of procedures for performing POROX treatments cannot be revealed, since this is privileged information or "know-how" supplied only to licensees of WARF.

Most, but not all of the treatments carried out to date have been successful. Paradoxically, many systems in sandy soils were expected to work well after treatment but did not respond to treatment, while other systems, where treatment seemed unlikely to help because they were in heavy clay soils, undersized, poorly constructed, etc., performed amazingly well. Detailed examination of systems where POROX treatments were ineffective generally revealed peculiarities with the system which explained the lack of success. Recognition of these problems revealed patterns of shortcomings in system design or installation that are worth describing, so that they can be avoided in future. A few illustrative case histories follow.

Inappropriate Use of an Aerobic Unit

While a system at an industrial plant in upstate New York was being treated, it was discovered that the system was not clogged in the customary fashion; in addition to the soil clogging, the distribution lines were half-filled with a black greasy material, so that water could not drain out through most holes in the distribution lines. A small distribution box at the head of the system was also half-filled with black greasy material. The system was being served by an aerobic unit, installed in place of a 5000 gallon septic tank initially used, following an increase in the number of plant employees. It was presumed that the aerobic unit would treat the wastewater more efficiently and forestall any problems with the system. Instead, the aerobic unit caused problems with the system.

Workers in the plant used large amounts of barrier creams or hand cleaners with a lanolin base; the lanolin was not degraded in the aerobic unit. The bulk of the lanolin remained suspended as a fine dispersion in the wastewater owing to agitation caused by the aeration device, and passed out of the unit with the effluent. As the effluent emerged from the aeration unit, it became anaerobic and lanolin settled out as a sludge in the pipes and in the soil of the absorption area, being colored black by precipitates of metal sulfides formed under the anaerobic conditions. This system was rehabilitated by cleaning out the lines, regenerating the field permeability with a POROX treatment, and re-installing the septic tank in series in front of the aerobic unit. The quiescent conditions in the septic tank allowed the lanolin to separate before the septic tank effluent entered the aerobic unit, where further biological treatment was continued before the water passed into the absorption field, which now functions properly.

Improper Septic Tank Baffles

In several systems which were examined to determine whether they should be given a POROX treatment, problems with the outlet baffles were observed which had led or contributed to failure of the system. In some tanks, the outlet baffles or sanitary tees were too long so that the septic tank effluent flowing into the field was coming from a layer in the tank just above the sludge layer. These tanks were more like grease traps than septic tanks. Incompletely settled solids were being flushed out into the absorption area, increasing the clogging in the soil and sometimes blocking the pipes in the distribution system. The load of suspended solids in septic tank effluent is a major contributor to clogging and failure of soils.(11) Shorter baffles or sanitary tees were installed and the pipes were cleaned in addition to POROX treatment of the field to rehabilitate such systems.

In several systems inspected, the outlet baffles were so badly damaged or corroded that they were ineffective in retaining the scum layer in the tank; often the baffles were missing altogether. Here the load of solids from the scum layer was contributing to clogging of the soils, and sometimes completely blocking the outlet pipe from the septic tank. Cleaning of the pipes and unusually large amounts of peroxide were required to rehabilitate some of these systems. No peroxide was needed in some other cases, because the drainfield was functioning properly. The clogged septic tank outlet pipe was the only problem.

Deterioration of both metal and concrete baffles was observed. Some metal baffles were so pitted and corroded that they were totally ineffective at retaining scum. No scum layer was observed in these tanks. Hydrogen sulfide and organic acids produced in septic tanks by bacterial action on the sulfates and putrescible organics in the wastewater can corrode steel baffles. In several concrete tanks, metal baffles had fallen to the bottom of the tank because they had been inadequately anchored into the walls; sometimes bolts securing the baffles or metal anchors embedded in the concrete to hold the fasteners had corroded away. Some anchors had been set far too shallow to remain secure. Presumably galvanic cells are set up between baffles and bolts and metal anchors of different materials in the agressive atmosphere in a septic tank and accelerate corrosion of the metals. Lightweight fiberglass baffles secured with plastic anchors or PVC sanitary tees were used to replace metal baffles in these systems.

Many concrete baffles, usually half-round baffles in monolithic concrete tanks, were found to be damaged or missing. Missing baffles had not been reinforced with wire mesh. In some reinforced baffles, the concrete was eroded away and the flimsy residues adhering to the wire were of powdery, sandy consistency. Apparently a thinner concrete mix had been used to facilitate the formation of the thin baffle walls because the tank walls were strong and undamaged. In the alkaline environment of septage, the poorer quality concrete had evidently deteriorated rapidly, leading to failure of the baffle and subsequent failure of the system by accelerated clogging.

Systems Installed in Sloping Sites

A large variety of problems was encountered with systems installed in sloping sites. In at least four different systems examined which had been installed parallel to the slope, the normal elevation of water in the septic tank was at a higher level than the soil surface at the end of the seepage beds or trenches. Here soil clogging created an "artesian well" that regurgitated untreated effluent ot the surface almost as rapidly as wastewater entered the systems. POROX treatments provided temporary relief for these systems, but they soon clogged and failed again at the bottom end because the bulk of the water entering the system was running down to the end of the system, and overloading and clogging the soil in a localized area. Holes augered into the upper part of one such system revealed that the upper section of the bed was dry and unclogged although water was surfacing at the low end.

Most sanitary codes and installation guidelines recommend that beds or trenches should be laid across slope at sloping sites. However, here too problems were encountered. In at least four systems that had been unclogged by POROX treatments, water was observed in the seepage trenches or beds soon after treatment. Samples of water taken from the distal end of one such system contained very few fecal indicator organisms (total coliforms, fecal coliforms, and fecal streptococci). Water levels in the trenches of two systems that were monitored varied according to the patterns of precipitation. Measurement of water levels in several groundwater wells installed upslope from the systems revealed that the water table often came close to or rose above the level of the trench bottoms following rainstorms. The trenches were in effect acting as interceptor drains and occasionally collecting high groundwater moving down the slope through the soil following heavy rains. Such systems could have been easily protected by drainage lines (curtain drains) installed upslope from the seepage trenches.

Similar problems were observed with some deep systems at the downslope end of long slopes; the homeowners had installed deep systems to accomodate toilets and showers in the basement level of their houses to avoid the need for a grinder pump to elevate the waste to a higher level in a shallow system. These deep systems also intercepted groundwater moving downslope through the soil; homeowners with shallow systems upslope from these sites experienced no such problems. Cross-slope systems are apparently particularly vulnerable to unusual groundwater flows, therefore careful soil inspection for signs of mottling or preferably monitoring of the site seems advisable before any system is installed at sloping sites. In any case, shielding of the system by a curtain drain before the site is landscaped is recommended.

Groundwater Recharge Areas

The deep systems flooded by groundwater seeping down through soils at sloping sites just described represent examples of inappropriate placement of systems in areas of localized groundwater "recharge." Although the groundwater does not in fact recharge to the surface, it returns to a high enough elevation in the subsoil at the downslope end of some hills to flood some absorption fields or at least intermittently prevent the percolation of septic tank effluent out of them. While observation of soil mottles during a soil inspection prior to system installation could have provided warning of seasonally high groundwater in such areas, some other systems were encountered where this was not the case.

In some areas of Wisconsin, recreational lakes have been created by damming of minor rivers. Some of the houses now on the shores of these lakes were in existence even before the lake was planned, some were built after the development was planned but before the river was dammed and the lake was created. As a result of the formation of the lake, the groundwater level in the soil close to the lake has also been raised, and some septic systems that were once built in good, well-drained soil are now failing because of artificially created high groundwater. Instances were found where the seepage beds of such systems are now permanently located in groundwater. If test holes are augered or monitoring wells are installed near such systems, the groundwater level can be easily determined. It is inappropriate to try to revive such systems with a chemical treatment. Such systems should be replaced by Wisconsin mound systems.(12)

Intrusion of Soil Into Gravel Beds

The most frequently observed reason for lack of success of POROX treatments, especially in sandy soils, which are very easily unclogged in the laboratory, was intrusion of soil into the gravel within the absorption field.

As a soil absorption field is being installed, after gravel has been placed in the seepage trenches or bed, and after the septic tank effluent distribution system (perforated pipes or drainage tile) has been installed and embedded in or covered over with a further thin layer of gravel, some barrier material is normally placed above the gravel before the system is backfilled with the soil removed during excavation. Materials typically prescribed in state sanitary codes to cover the gravel are untreated building paper, straw or marsh hay, or pea gravel.

These materials are supposed to prevent soil from falling down into the gravel during backfilling. Untreated building paper is often recommended for two reasons: first, it is cheap and easy to apply, second, it is meant to be only a temporary barrier, remaining in place only until the soil has become compacted above the gravel, and then rotting away so that no barrier is left between the gravel and the soil. This is supposed to facilitate movement of water vapor up through the soil and of air down into the soil, enhancing loss of moisture from the system by evapotranspiration, and biological treatment of the wastewater by admission of oxygen to the soil bacteria. On the basis of such reasoning, use of impermeable barriers (plastic sheet, treated paper, or roofing felt) is prohibited in many states.

The benfits of this theory are not realized in practice. At fault is the clogging of the system by biological crusts. When a system

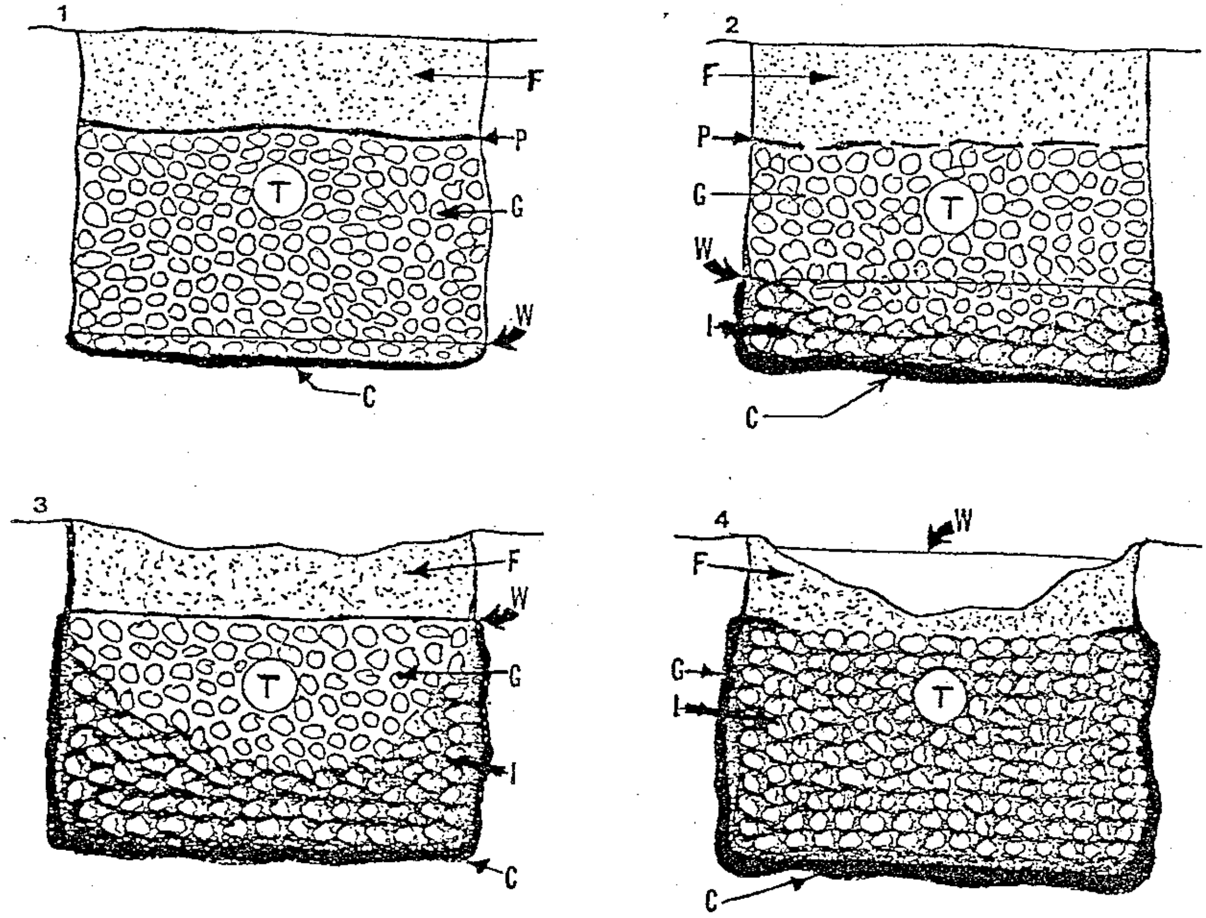

Figure 2. Schematic representation of progressive stages in failure of a field system installed in sandy soil with untreated building paper as barrier material (C = biological clogging material, W = level of ponded water, P = paper in barrier layer, G = gravel, F = backfilled soil, T = drain tile or distribution pipe, I = infiltrated soil in gravel): 1. a thin biological clogging mat is forming under the gravel, causing water to begin to pond; paper is still undecomposed and retains backfilled soil; 2. sidewalls are beginning to clog, ponded water is becoming deeper, paper is beginning to rot, some soil (probably mainly from sidewalls) is invading lower gravel; 3. paper is totally decomposed, water level is now at top of gravel, sidewalls and bottom are more heavily clogged, soil from the fill is beginning to wash into the gravel; 4. the gravel is almost totally filled with soil, the backfill is slumping, and ponded water is surfacing.

clogs, water begins to pond deeper and deeper within the gravel bed. Some ponded water seeps laterally into the soil, clogging the side walls of the trenches or bed as well (Fig. 2). In time, the ponded water fills the whole absoprtion area, thus impinging upon the unprotected soil overlying the gravel. Although this soil may have been compacted and remained in place up until that time, it is easily dislodged when wetted and can trickle down into the gravel.

The major forces normally holding soil particles together in a consolidated mass above the gravel are cohesive forces (mainly hydrogen bonding) due to films of moisture surrounding the individual particles of soil.(13) These moisture films are extremely thin and the cohesive forces are therefore strong when the soil is relatively dry. Dry clay is very hard and brittle; wet clay is plastic and easily worked. Similarly when the soil in backfill becomes waterlogged ("saturated") as effluent rises in a clogged and ponded system, the moisture between the soil particles is abundant and the cohesive forces become weak or are totally overcome. The soil particles no longer adhere together and can trickle down into the gravel, filling up spaces between the stones. Soil from the sidewalls of trenches or beds may invade the gravel in the same way while the water depth is increasing in the system. Soil that intrudes into the system and fills up the pore space between the gravel rapidly reduces the seepage area available for septic tank effluent infiltration (Fig. 2).

This phenomenon was demonstrated using a laboratory model of a clogged septic drainfield (Fig. 3). A plexiglass cylinder 12 inches in diameter and 4 feet high was sealed with a plexiglass base and filled with gravel (1 - 1-1/2 inch diameter) to a depth of 12 inches. A section

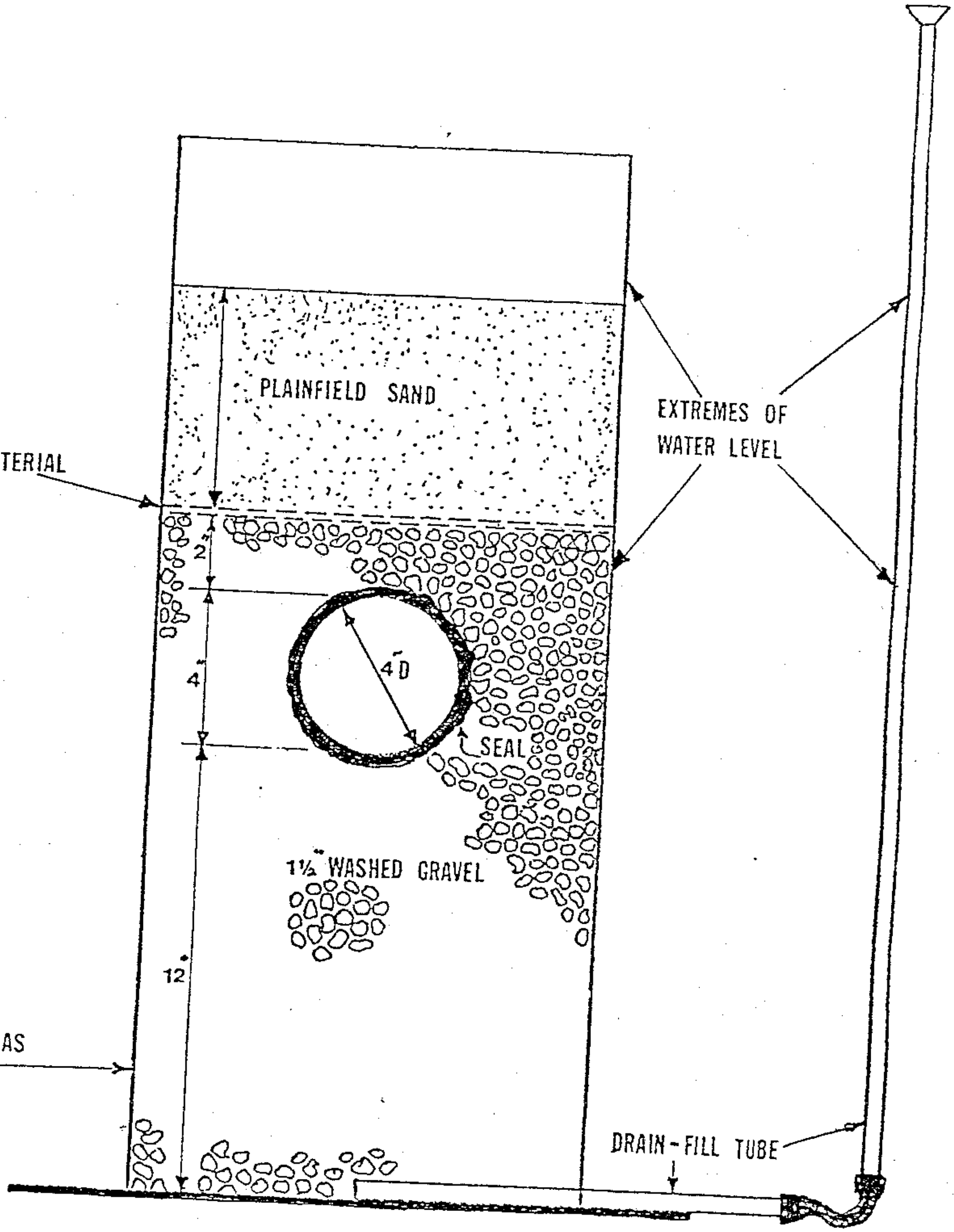

Figure 3. Laboratory model for testing barrier materials. Water levels were raised from the gravel-sand interface into the sand or to the surface of the sand ("ponding") and vice versa by adding or draining water from the tube.

of 4 inch perforated pipe was puttied onto the sides. The pipe was surrounded with gravel and covered with 2 inches of gravel. One of a selection of barrier materials was placed above the gravel, being taped to the plexiglass sidewalls if needed to provide an adequate seal, and 1-2 feet of Plainfield sand (C horizon) was placed above the barrier material and compacted by tamping. Plainfield sand was the soil chosen for four reasons: it is a common soil in the central sand plains of Wisconsin, it has a fast percolation rate and is therefore considered ideal for installation of conventional septic systems , it has the texture recommended for fill material for Wisconsin mound systems[12], and it is the soil which had invaded the gravel in several septic systems which did not respond to POROX treatments.

Using the model system, the efficacy of different barrier materials in preventing invasion of soil into the gravel in the unponded and ponded conditions was easily measured. To simulate ponding, water was filled into the gravel using a tube sealed into the bottom of the plexiglass cylinder. When the water level was just above or below the barrier material, the water level was raised and lowered at different rates to simulate two different conditions: first, the slow minor fluctuations that would result in a ponded system from normal patterns of water use in a household (increase in water level during the day corresponding to peaks of water use in the house, drop in water level overnight)[14]; second, a sudden drop in water level that would occur if the septic tank were pumped in a system which was ponded and surfacing.

The barrier materials tested were: untreated ("Red Rosin") building paper; a 2-inch uncompressed layer of marsh hay; an 8- to 10-inch layer of marsh hay compressed to a thickness of 1-2 inches; a 2-inch layer of pea gravel; 2-inch unbacked fiberglass (building insulation); and synthetic fiber filter fabrics.

Fresh undamaged building paper prevented both dry and wet sand from falling into the gravel and allowed both air and water to pass through. However, torn paper did not retain the dry sand, and even pinholes in the paper allowed wet sand to trickle into the system, especially when the water level was fluctuating slightly near the barrier. Dry sand fell easily through holes in torn paper during "backfilling" and tamping. Wet sand cascaded through holes or tears in the paper when the system was flooded regardless of whether the water level was rising or falling and whether the rate of change of water level was fast or slow.

To examine how paper used as a barrier material in a real system might behave after it was weakened or rotted by biological action in the soil, undamaged paper was taped onto the sidewalls of the cylinder above the gravel and covered with tamped sand in the usual manner. The paper was then degraded by treatment with strong acid or alkali. Chemically weakened paper did not prevent wet Plainfield sand from invading the gravel when the water level fluctuated near the paper.

A loose layer of marsh hay was also not an effective support for either dry or wet sand; some sand fell into the gravel immediately during "backfilling" and tamping of the sand layer, more sand trickled in when "ponded" water reached and fluctuated around the gravel/hay/sand interfaces. The 2-inch layer of compressed hay was somewhat better: Dry sand did not flow easily through the compressed hay layer and very little wet sand passed through this barrier. The disadvantages of using such a barrier in practice are the expense of a sufficient amount of hay and the labor of spreading and compressing it uniformly. Hay does not rot as easily in the soil as paper because hay contains some lignin[15], while most of the lignin has been removed from building paper by kraft pulping.[16] Consequently hay persists and prevents soil from entering the gravel for a longer time than paper. It may however eventually rot, especially in well drained, aerobic sandy soils, and no longer afford protection.

Pea gravel, does not rot in soil but is not a good barrier material. Some dry sand and more wet sand pass through a 2-inch layer of pea gravel. Experiments with soil drainage, graded sand filters and the like have shown that particles pass easily through the interstices between particles which are more than 5 - 7 times larger in diameter.[17]

Unbacked fiberglass does not rot in the soil and forms an excellent barrier to movement of both dry and wet soil. Disadvantages of fiberglass are its relatively high cost, occasional scarcity due to the competing market for building insulation, and difficulty in application. A large volume of material is needed to cover a field absorption area, and normally only batts or rolls of the relatively narrow standard breadths used for building insulation are available. Fibers penetrate the skin and cause itching or are inhaled and cause throat irritation.

These problems are not shared by a large number of synthetic filter fabrics available on the market (Table 1). These are excellent barrier materials in the model system. They are marketed in

TABLE 1: Synthetic filter fabrics suitable for use as barrier materials in septic system drainfields.

Name	Fiber	Weave	Producer	U.S. Distributor	Efficiency*	Type	Approx. Cost $/yd^2	Weight oz/yd^2
Typar	Polypropylene	Spunbonded	DuPont	DuPont	120	3201	0.38	2
						3301	0.55	3
						3401	0.75	4
						3601	1.00	6
Bidim	Polyester	Nonwoven	Rhone-Poulenc (France)	Monsanto	60	C-22	0.75	4.5
						C-28	0.95	6
						C-34	1.25	8
						C-38	1.55	10
						C-42	2.40	17
Mirafi	Nylon-polypropylene	Nonwoven	I.C.I. (U.K.)	Celanese	140	140	0.90	5
Supac	Polypropylene	Nonwoven	Phillips-Petroleum	Phillips Fibers	120	4P	0.75	4.1
Stabilenka	Polyester	Nonwoven	Dutch ENKA (Hlland)	American ENKA	40		0.68	2.5
							0.73	3.2
							1.05	4.4
Cerex	Nylon	Spunbonded	Monsanto	Monsanto	50	-	-	2
Polyfilter X	Polypropylene	Woven	Carthage Mills	Carthage Mills	210	PFX	1.75	7.2
						FX	2.55	6.6
						PFGB	2.80	12

*100% retention of particles greater than given diameter (microns) long rolls of varying widths and are easy to cut, either with a chainsaw in the roll, or with scissors when unrolled. A big advantage of these materials over all others is that they can be used to prevent soil intrusion from trench or bed sidewalls. A layer of filter fabric can be placed around or tacked into excavation sidewalls before spreading the gravel during installation of field systems.

The choice of material used should be determined by availability, cost, performance, strength and ease of application. Production costs are largely determined by the nature of the synthetic fiber used and the nature of the fabric: polyolefins are cheaper to manufacture than polyesters or nylon, nonwoven felts are cheaper to make than spunbonded materials (compressed felts whose individual strands are bonded by melting) or woven fabrics. The strength and performance of the materials are determined by their weight (thickness), weave and pore size: thick, soft felts are relatively impermeable to soils but are costlier and of lower tensile and tear strength, woven materials are expensive and relatively porous, spunbonded materials are strong, easy to manipulate and relatively impermeable. Considering all factors, spunbonded polyolefins seem best suited. Unlike building paper, when spread over gravel in field systems they do not tear or rupture when walked on or when backfill soil is dumped on them. Although heavier grades are more expensive than building paper, they supply lasting protection to soil intrusion while allowing unhampered passage of liquids or gases through the soil. Field systems installed on sloping sites using these materials are currently being monitored and are performing well, even though one trench was intentionally allowed to pond completely.

Outlook

The POROX process is an effective method for rehabilitating septic systems that have failed because of soil clogging. The process is much cheaper and far less disturbing to the users of the system and their property than replacement of the failed system. However, complicating factors such as those described above can thwart the effectiveness of the chemical treatment or expedite recurrence of failure. The process should be applied only by properly trained and licensed practitioners who have been taught safe handling of the chemicals involved, appropriate techniques for their application, safe and accurate methods of diagnosing causes of septic systems failure, and who know how to decide whether a treatment should be performed and how much chemical should be used. Inappropriate application of the procedure can only result in failures and disappointments and bring the process into disrepute. In time, as the design and quality of septic system installations improve, the natural process of biological clogging caused by aging of systems should become the only reason for system failure, so that the applicability of the POROX process should increase. Research is continuing to determine whether there are factors other than those described above which complicate or frustrate application of the POROX process and to improve methods of diagnosis of system problems and the quality of POROX treatments.

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