PROCEEDINGS
WORKSHOP ON
HOME SEWAGE DISPOSAL
IN COLORADO

edited by
Robert C. Ward

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PROCEEDINGS

WORKSHOP ON HOME SEWAGE DISPOSAL IN COLORADO

Edited by

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Held at the
Student Center
Colorado State University
June 14, 1972

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Colorado State University
and the
Water Pollution Control Division of the
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INTRODUCTION

The Environmental Resource Center at Colorado State University (CSU) in conjunction with the Water Pollution Control Division of the Colorado Department of Health sponsored a one-day workshop at CSU on home sewage disposal systems. The purpose of the workshop was to identify and quantify problems associated with regulation and operation of home sewage disposal units.

Workshop attendance included representations of county, state, and federal governments; industrial and commercial firms; and universities. The varied backgrounds of the participants stimulated the type of discussion necessary to accomplish the purpose of the workshop. Hopefully, these proceedings have been able to capture the success of the workshop experienced by those in attendance.

Robert C. Ward
Workshop Chairman

PROGRAM

7:30-9 a.m. Registration and Coffee
Student Center East Ballroom

MORNING SESSION
203-205 Student Center

9:00 a.m. Welcome and Introductions
Robert C. Ward, Workshop Chairman

9:05 a.m. Background
Norman Evans, Director
Environmental Resources Center

Regulation: Trends, Recent Developments, Problems

Presiding: Edwin Bennett
Civil Engineering
University of Colorado

9:15 a.m. "County Regulation"
Donald Marmande, Director
Division of Environmental Health
Boulder City, County Health Department

9:35 a.m. "State Regulation"
Fred Matter, Supervisor
Division of Water Pollution Control
Colorado Department of Health

9:55 a.m. "Federal Position"
Paul Ferraro, Chief
State and Local Planning, Air and Water Division
Environmental Protection Agency

10:15 a.m. Coffee Break, East Ballroom

Technology: Treatment, Effluent Disposal, Research

Presiding: William Ross
Chemical Engineering
University of Denver

10:30 a.m. "Microbiological Aspects of Home Sewage Disposal"
S. M. Morrison
Microbiology
Colorado State University

10:50 a.m. "Geological Factors of Home Sewage Disposal"
James Waltz
Geology
Colorado State University

PROGRAM - (Continued)

11:10 a.m.	"The Role of Tile Drainage in the Design of Septic Tank Drain Fields" W. L. Mallmann Microbiology and Public Health Michigan State University
11:30 a.m.	"The National Sanitation Foundation Program" Heinz B. Russelmann, Director Wastewater Technology National Sanitation Foundation
12:00 noon	Lunch Student Center West Ballroom Lucheon Speaker: Harry A. Cornell, Secretary Colorado Land Use Commission

AFTERNOON SESSION
Group Discussions

1:30 p.m.	Group I - Regulation, 202 Student Center
	Group 2 - Regulation, 204 Student Center
	Group 3 - Regulation, 206 Student Center
	Group 4 - Technology, 207 Student Center
	Group 5 - Technology, 208 Student Center
	Group 6 - Technology, 209 student Center
3:00 p.m.	Coffee Break, East Ballroom
3:15 p.m.	Summarries of Group Discussions by Chairman 203-205 Student Center
4:15 p.m.	The Workshop in Retrospect Robert C. Ward
4:30 p.m.	Adjourn

WELCOME

by

Robert C. Ward
Workshop Chairman

First of all, I would like to welcome you to Colorado State University. I'm glad you could come, and I hope that you will find the workshop beneficial and useful. There has been one change in the program. Presiding at the regulation session will be Ed Bennett of the University of Colorado rather than Ernest Flack.

Why does the university involve itself in programs of this kind? Many people look at the university as a place to educate the youth of the state and nation. However, the university does not just accept the student so they can spend four years here and send him out, never to see him again. While we teach a student we are in the process of making his knowledge obsolete. This is done through research at the university. Consequently, the university not only has to have an education program while the students are here, but also has to have what we call an extension program or a continuing education program. The university, therefore, has three major functions or duties. They are teaching, research and extension or service.

Getting back to the research side of the university, a research program is essential to maintaining the graduate program at a university. University research has made great contributions to the present way of life. As the research results are produced, they are distributed to the benefit of the American public. The American public and the researchers themselves hope to keep the university research as relevant as possible. The purpose of keeping this research relevant is to satisfy many of the needs of society. However, to keep the university research relevant the university must have an understanding of the problems and their relationships to the needs of society. Therefore, the university must not only disseminate the information it is generating, but it must also receive information from people as to what the problems are and how they relate to society. So, hopefully, today this workshop will accomplish several purposes. One of them would be to disseminate research information to you while at the same time getting information from you as to what are the problems and how can we identify them. We are specifically looking today at home sewage disposal.

Today in Colorado we hear alot about the quality of our environment and what mountain recreational development, the '76 Olympics, oil shell development, etc., is going to do to it. Environmentalists and politicians bemoan the fact that the front range is slowly turning into another southern California. At the same time they are also bemoaning the fact that some of our rural areas are losing population. Why? There are many reasons which are much greater than home sewage disposal. But in a small way if we don't provide home sewage disposal we are in effect increasing that migration. By forcing everyone to be on a central system we are in fact creating more urban problems. The

question then with respect to home sewage disposal is: "How do we provide adequate home sewage disposal so that people can live away from a central sewer system? How do we provide and how do we regulate?"

Another side-light of this is do we want to use home sewage disposal as a means of shaping the growth and development of our state. This has been proposed. If technology for home sewage disposal were not available, of course the growth and development that would take place would be alot different than the growth that would take place if it were available. Thoughts like this soon take home sewage disposal out of the realm of a specific problem and throw it into the whole environmental problem. I do not think we are going to answer a question that big here today. But I believe that we are taking the first step towards obtaining a solution to a total environmental solution.

I don't think that you will ever be able to answer a big question without solving some of the little ones first. I believe that we have an excellent group of speakers here today and I hope they will be able to shed much light on the problems of regulation and technology of home sewage disposal units. The discussions this afternoon will provide a forum where meaningful dialog will take place between the researchers, the people in regulation and the manufactures of home sewage disposal units. Hopefully we will be able to develop a meaningful dialog that will help identify and quantify the problems we are facing today.

With the Water Pollution Control Commission symposium on Monday and the discussion they had yesterday afternoon at their commission meeting and with the workshop today, I think that Colorado is finally taking some real steps towards getting a hold on the home sewage disposal problem. With those comments I will turn the podium over to Dr. Norm Evans who is the director of the Environmental Resources Center here at Colorado State University and a Water Pollution Control Commissioner.

BACKGROUND

by

Dr. Norman A. Evans
Director: Environmental Resources Center
Colorado State University

Thank you Robert. I have the privilege of welcoming you for the sponsors because I am both a member of the university faculty and a member of the Water Pollution Control Commission. The Environmental Resources Center of the university is the co-sponsor with the Colorado Water Pollution Control Commission.

The Environmental Resources Center is a unit which has been created to help the university respond to the scientific needs of the people of Colorado as well as the needs of the faculty to identify the problems of the communities and to get research oriented toward solutions for those problems. This orients us toward practical, applied research on these questions facing you and me and all citizens in respect to environmental conditions. The Environmental Center serves as a coordinating instrument to help bring faculty research teams together within the campus and to get communications across disciplinary lines. We help to get the social scientists talking with the biological scientists and the physical scientists. The word interdisciplinary is appropriate to describe the coordinating and communicating role of this unit. And, of course, the interface for the faculty of the campus with the users of new technology and new research information is another important role for that unit. Within the unit we have now a substantial amount of activity which can be described in this way: we help faculty teams, primarily interdisciplinary teams, to get together and to organize to attack a particular research problem. We help identify the problem and help get the research teams organized. The teams do their work within the framework of the university department and college structure, but the Center serves as a facilitator and a coordinator. We have now something like fourteen such teams working on studies that you would describe as environmental problems.

We are working with such problems as impact analyses and projections of long range impact of oil shale development, of nuclear power plants, and similar projects.

The other major functions of the Environmental Resources Center is a home for the Colorado Water Research Institute which is provided under The Water Resources Research Act of 1964. The Congress set up an institute in each state for water resource research and provides funding. This water research program set up by the Congress was intended to accelerate and stimulate water research in the state, particularly on problems of the state. We try to bring together the best scientific resources available within the state on the problems that are identified for the state. In other words, we interface between the user of research and the research capabilities of the state.

It is in that role that our Center has co-sponsored with the Water Pollution Control Commission this conference today and similar ones which are designed to help us communicate with one another. We hope you will help us identify where knowledge gaps exist and what research is needed. Most of you, as users of research, came to learn of newer developments, and of advances in the arts and science of water pollution control and waste disposal.

So, it is pleasing to me to be able to welcome such a very large group to this workshop, both on behalf of Colorado State University and the Colorado Water Pollution Control Commission.

I need not say any more by way of backgrounding the problem of septic tank systems. I'm sure you will agree it is urgent that those who are responsible on behalf of the public for monitoring and regulating waste disposal and looking out for the public interest in this matter have the benefit of the latest developments and experiences from both the public and private domain. I hope that we will get on the record your viewpoints and opinions that will help guide both the regulatory agencies and the universities engaged in research in this field.

COUNTY REGULATION

by

Donald Marmande
Director: Division of Environmental Health
Boulder City-County Health Department

I think I should start by explaining the legal structure in this state of how county health departments fit into the overall state program. It is different in every state and in order to understand the regulations we have now and how they come about, we will briefly go into this part of the governmental structure.

In 1947, Dr. Florence Sabin, who was a pioneer in public health, introduced and had passed what is known as the Sabin Health Plan. This type of legislation created the authority for the formation of local health departments by state statue. Nothing can be done without state statue authority.

There are three sections on the formation of Health Departments: 1) Chapter 66-1, which deals with the authority and duties of the State Health Department, 2) Chapter 66-2, which deals with county health departments and district health departments, 3) Chapter 66-3, which deals with local health departments. In small counties, county commissioners serve as the Board of Health. The duties of these gentlemen, or ladies are spelled out specifically. Eighty-seven percent of the population in Colorado is covered by county health departments. County and district health departments must carry out all state laws, rules and regulations of the State Board of Health. This is not selective enforcement. The county commissioners under Chapter 2 can appoint a Board of Health to form a county or district health department. The Board of Health is not like the county zoning or county planning board. The Board has the power of decision; they have the power to subpoena; they can conduct hearings; they can adopt rules and regulations; and they have decision making authority. Boulder County is organized under this particular section in the law.

For the past twenty years I have been involved in legislation. I have been responsible for writing and assisting in passage of six or seven basic laws which have been passed by the state legislature. The first one was on rabies control in 1954; the last one in 1970, had to do with recreation and land use, House Bill 14-15 Lt. Governor Vanderhouf used that particular bill in connection with the festival or group gathering activities at Grandby. This bill covers recreational use and group outings for over 10 hour durations. Last month the State Board of Health adopted regulations pertaining to group gatherings. The group conducting the festival at Grandby, met with the Lt. Governor and asked him to suspend those regulations which were adopted by the state pertaining to sewage disposal and other sanitation requirements at this meeting.

To return to what we are discussing today: In 1965, along with several of the legislators, including John Mackey of Longmont, Mr.

Monford from Greeley, and Senator Bermingham, we wrote actual law Senate Bill 65, that pertains to septic tanks. At that time, there were no guidelines to use on septic tank installation and you cannot put into a bill a group of statements that cannot be referred back to some technical document. I have heard castigations of this law last Monday at the Water Pollution Control Commission Symposium in Denver, but we had to use U.S. Public Health Service Publication 526, as it was the only guideline available - the state had no other technical document to refer to. When writing legislation, you will have approximately 50% of the legislatures who state guidelines must be in law; others state, let boards of health write in rules and regulations. You must put something in the way of guidelines into a basic law. You will notice this law says the standards and charts, and what have you, published in 526, are the guidelines which must be used in writing septic tank regulations. This particular law was permissive legislation. It permits local counties, to adopt regulations by their board of health. We have had regulations in Boulder County since 1953, but frankly, we did not feel they really became legal until 1965, when the basic state law was passed covering septic tanks and their installations. People have criticized this particular bill in the fact that its description of septic tanks was too inclusive and it needs expansion, granting that it does. This year we set up four different guidelines in changing this law, including the fee, alternate systems, etc. This proposal was presented to some of the key legislators and because this was a fiscal session and a short session, it could not be introduced in this session. At the present time we are trying to upgrade this particular piece of legislation, beginning with the county regulations particularly pertaining to installation of individual disposal systems.

The problems which come into existence here are administative and technical. In technical areas we try to refer to and leave it as it is in 526. You will notice that 526 has alot to do with recommendattions. You get interpretations from people saying it is only recommendations, that some of the alternate systems are only recommendations. It was the intent of the legislature to use 526 as a guideline and a parameter and that is what we tried to do.

The administrative area has to do with the issuance of permits, how to schedule percolation tests, the licensing of installers, etc. The regulations that we have is written into two parts: one is the administration part (the collection of fees, the requirements for final inspection, etc.) and the technical part (dealing with the interpretation and we follow those charts which are in 526).

Since 1965, the Water Pollution Commission has come into existence and we now have two laws which must be considered: 1) the issuance on the site approval by the Water Pollution Control Commission, and 2) issuance of permits for septic tanks by local health departments under Senate Bill #65. The final authority rests with Water Pollution Control Commission on site approvals. However, there has been no conflict with these two state laws. In Boulder County, we issue a septic tank permit after an applicant gets Water Pollution Control Commission "site approval."

Senate Bill 69, passed during the last session of legislature, stated that the section of the 1965 bill, taken from 526, which pertains to no more nor no less stringent, must be deleted. That county regulations could be more stringent or less stringent than 526 was so confusing to people, that the legislators deleted that section. It now reads that in your county regulations you have to follow 526. It is the opinion of some people that this piece of legislation is unconstitutional. In talking to the legislators they wanted uniformity; some people were having difficulty getting HUD money because the interpretation by some authorities was that the 1965 bill did not answer the question that was put forth. The legislators thought that they were doing the proper thing by deleting the stringency section of the 1965 law. In the opinion of some legal authorities this has created a real problem. The interpreation now is the existing regulation which we have in Boulder County (adopted in 1968) stay into effect. If we amend it or rewrite it, which we are in the process of doing, it has to stay within 526. It cannot be more stringent or less stringent; it has to follow 526 exactly. That is the legal interpreation at the present time on this.

We have been working for six months with a citizen's committee, attempting to rewrite our regulation and bring it up to date; to bring in alternate systems and include all of the new technical developments. It appears we cannot do this at the present time as we must follow 526. As stated earlier, we are now faced with the problem of what to do in the next session of the legislature on this matter. One of the county legislators was in my office to get a septic tank permit for a home he is building and I had a captive audience. We discussed this matter and it comes down to a problem which I have had in the last twenty years in writing legislation, and that is how much do you put in the basic statutory law and how much do you put in regulations? If you put too much in the law you have to go back and amend it each year and you cannot put a penalty in the regulations. You have to file upon the statutory law and not the regulations in court action because the legislature has never delegated the authority to local boards to put a penalty clause in. Example: if a person installs 360 feet of absorption system and your permit calls for 500, you cannot file on your regulation. You have to file back on the statutory law which give local boards the authority. You can quote the regulations in the legal complaint you sign.

In rewriting the law at the present time we will have to undoubtedly spend alot of time discussing this with the Water Pollution Control Commission. It has been my experience that you come up with a rough draft of a new law and then you take it down to legislative drafting bureau for their review. On the last bill I worked on, Mr. Wilson did not have the time to discuss it with me and he assigned a couple of people from his office who were inexperienced and so made this process all the more difficult. There are some 900 to 1500 pieces of legislation for possible introduction during one session and his department has to go over these. It is most important that everyone dealing with individual sewage disposal systems send to the Water Pollution Control Commission, state and local health departments some of their thinking

on this matter because legislation will be coming up on septic tank matters. We would like to talk to Mr. Wilson and find out just what is acceptable in the form of statutory law changes which is then passed on down to the local health department and others for comment.

On air pollution regulations and others you will notice in the last couple of years the state has gone to what is called concurrent jurisdiction between local departments and state on enforcement. I believe this is the way this type of thing will be written and put into effect. It is physically impossible for the state government in Colorado to enforce all of the environmental health regulations. We have some 30 different activities in our county including air, water, food, drug, etc., and all these activities we implement and enforce state law. New laws will undoubtedly be written and appear to be headed in this particular direction. That is where we are at the present time on laws, rules and regulations. Whether or not we should specifically put into basic law, to revise the 1965 law, all the parameters, charts, distances or leave in 526 is debatable. If you don't something has to be there as in the building code law; it is an accepted part that the U.P.C. is on file in the libraries. It is impossible to put that uniform building code into state law. It is referred to as the U.P.C. or whatever is used in state law such as the A.P.H.A. housing code; this code then becomes law and new buildings must be constructed accordingly, and that is the same principle that we use in Senate Bill 65, in referring to 526 which may be out of date and need revision on federal level.

QUESTIONS AND ANSWERS

Q. Would you repeat again where this 526 came from?

A. This is a U.S. Public Health Service Publication 526.

Q. Did they do a study resulting in the bulletin?

A. This came out in the Cincinnati center and it is now EPA.

Q. When was 526 instituted?

A. It was in 1957 and it was revised in 1963. I wrote to EPA two or three weeks ago and they have no revision of that at the present time.

COMMENT: There was a revision in 1967.

That is another problem we have. The law stated one thing and every time the revision comes up you have to go back and change the basic statutory law. Fortunately, the Attorney General said this is not so. Every time the federal government changes 526 that automatically changes the state statutes. That is his opinion.

STATE REGULATIONS

by

Fred Matter
Supervisor: Water Pollution Control Division
Colorado Department of Health

Prior to 1965, one of the easiest ways to solve a septic tank problem was to approach it on a nuisance basis.

In 1965, Chapter 66, Article 2, CRS 1963, gave specific authority to organized local and district health departments concerning the location, construction of, and use of septic tanks and other non-municipal systems.

Chapter 66, Article 3, gave the same authority to local boards of health.

The state made recommendations only on septic tanks and installations thereof. PHS 526 was used as a guide. It was recommended that there be a minimum of one acre for individual sewage disposal facilities and private wells on some plots under ideal conditions.

In 1966, the Colorado Water Pollution Control Act was passed, and part of that Act, Article 28-13, states that no person shall commence the construction of any domestic sewage treatment works unless the location thereof has been approved by the Commission.

Rules for Site Location Approval of Septic Tank Systems were developed in 1968, then in 1970 and presently have been revised again. Some of the important points are:

> "If a proposed site is in a county having a local, county, or district health department, which department has adopted and is enforcing septic tank regulations conforming to Sections 66-2-16 or 66-3-14, CRS 1963 (1965 Perm Cum. Supp.) and the rules on site location of the Commission, the application shall be made to the local, county, or district health department."
>
> "Such departments may require the applicant to retain the services of a registered professional engineer or other professional discipline."
>
> "All applications approved by the local, county, or district health departments shall be reported monthly, on a form to be furnished by the Commission, by such departments to the Commission for confirming final approval by the Commission."
>
> "If a proposed site is in a county which has not adopted and is not enforcing septic tank regulations, the application shall be made directly to the Commission."

In 1970 an amendment to the WPC Act defines septic tank as any non-municipal disposal system intended or used primarily for the disposal of human wastes and shall include, without limitation, aeration facilities, privies, sumps and cesspools.

In 1970 another amendment to the Water Pollution Control Act states that:

> "The Commission shall have the power to require and issue or deny licenses, permits, or other written authorizations for the construction and use of septic tanks in any lot, tract, subdivision, area, political subdivision, or any other portion of this state, which may be identified by the Commission at any time or from time to time, in which the soil, geological conditions, or other factors indicate that unregulated outflow from one or more septic tanks would or might pollute the waters of the state."

The Commission cannot delegate the authority of site approvals. It can and has delegated to local health departments to investigate and make recommendations to the Commission for final action on site applications. This delegation is for a one or two family dwelling or equivalent. Anything larger, up to 20,000 gpd, is referred to the district engineer for his action. Anything over 20,000 gpd is taken to the Executive Committee by the district engineer for Commission action.

If any controversy arises regarding site applications, it is referred to the Executive Committee who generally makes a recommendation then at the following full Commission meeting. It is here that an applicant has a chance to be heard by the Commission if he so desires.

In 1968-69 there were problems in the Cherry Hills area where high ground water table and/or clay soils made the installation of a regular septic tank system impractical. These situations, along with other areas in the state having the same problems, instigated the Commission to have criteria developed for waste disposal in identified areas and also to hold hearings on location of identified areas. Hearings were held and criteria developed. The Commission acted favorably on the location of the identified areas, but did not determine the terms and conditions for septic tank construction, use, design, maintenance, spacing and location that would be applicable in identified areas. The Commission chose instead to take each application under consideration on its own merits.

Home aeration systems started showing up on the market in mid 1960's and the trend was indicated that we had a better quality of effluent more easily disposed of. It was interpreted that these units provided secondary treatment and with the addition of disinfection to the effluent, could discharge into waters of the state. There were problems of enforcing, testing, etc. Some local health departments do not concur with this application. The Division had a policy to neither approve or disapprove a system, but allow them to stand on their own

merit. The Division did ask that test results be provided by the manufacturer from an independent laboratory, university, or other reputable source, that would substantiate claims of the manufacturer. The Commission has not backed the Division on this action.

There have been recent developments toward completely contained systems using total evaporation for effluent disposal. The Armon system is probably the most familiar example. Other developments include the use of trenches and trees -- all aimed at transevaporation for disposal of the effluent.

There is recent criteria indicating that the effluent from aeration systems percolates faster than effluent from septic tank or anaerobic systems and that based on that, seepage beds can be made smaller, say by one-third.

We have the problem of many proposed subdivisions and the varied conditions existing that need to be evaluated to determine the feasibility of septic tanks in the area. The trend is now to ask for soil profiles down to depths of 8 to 10 feet. Much of the area in subdivisions is not suitable for septic tanks. It is pretty well agreed, I think, that with adverse soil or geological conditions, a system should be designed by a registered professional engineer or other professional discipline. Let us also recognize the fact that there are tracts of ground where no economical type system will work successfully.

There is a problem with aeration systems in mountainous areas where weekend living is practiced or some type of part time occupancy. If the electrical power is turned off between visits, the tank turns septic and even when the power is restored upon arrival, the system will not put out a good quality of effluent before the weekend is over and its time to turn the power off and leave again. There is a question, and we do not have the answer, as to how a system performs if the power is left on between weekend visits.

We speak of criteria that allows reduction by 1/3 of the size of septic tank disposal field by using aeration facilities. A question arises then of what size reduction of disposal field is warranted, if any, in weekend or other part time occupancy where the effluent is probably not the same quality as that used in the criteria for reduction. The only apparent safe solution at present is to require regulat sized disposal fields.

There is a possible problem with aeration systems with regular use where a malfunction occurs and no maintenance contract exists. Unless repairs are made right away, a septic condition results and unless a subsurface effluent disposal method is used a nuisance or public health problem will exist. We see a possible problem here also if a smaller disposal area is used and due to anaerobic effluent being applied, clogging results and surfacing of anaerobic effluent occurs. There is a specific need to make the homeowner more responsive to the responsibility of maintaining their own equipment.

One other problem area we see is that of power failure such as occurred earlier in the Brighton and Adams County area. Power was off for eleven days. The idea that if power if off, that the water is off also, may not be true if public water supply is used.

There is certainly merit to consider requiring a tank or trash trap as it is sometimes called, ahead of the aeration system that will catch most of the solids, grit, etc. At least, with this set-up, there would be a good quality anaerobic effluent if power failure occurs and with subsurface disposal, there should be no problem.

There appears to be a trend toward total evaporation or trans-evaporation systems in problem areas. One developer is proposing the use of septic tanks in a mountain area with transevaporation where part time occupancy is proposed at first. When full time occupancy occurs, the system would be converted to an aeration system.

We are not against aeration systems. On the contrary, we see the use of aeration systems in areas or under conditions where septic tank installations are not feasible. We encourage the new ideas and concepts, but we do not want our department to be the testing laboratory for private enterprise. We do not want these concepts forced upon us until they have been tested by other than theory. There is a definite need for all aeration systems to be tested by the National Sanitation Foundation, a university, or other reputable institutions to avoid the general public being used a guinea pigs to bear the expense of perfecting a system for private enterprise. There are those who expect the State Health Department to do the testing program for them and have asked that it be done. Yet the same persons reject all corrective ideas and criticisms that staff members make to improve their facility. I compliment most all the manufacturers in that they come in seeking advice and ideas on how to overcome a problem or condition. We encourage these manufacturers to continue to come in, and rest assured that we will assist in all ways possible with a cooperative viewpoint.

A committee will be set up shortly to develop rules, guidelines, or what have you for the use of aeration systems. It is something that has been needed for some time. We know already that some will not be pleased with the new controls, but I am sure we can safely assume that the controls will correct and prevent many problems we have today with some aeration systems.

QUESTIONS AND ANSWERS

Q. Would NSF approval of package plants have any bearing on your accepting them?

A. Let's look at it this way. We heard NSF yesterday state that they will not approve or disapprove them. They could only run a criteria type effort on a system. I think that in our department we would certainly encourage all to use something of this nature to come up with an answer to the question, "Is your system doing what you

say it is?" You say it will provide 85% BOD reduction and this is fine except we would like to hear it from some impartial party other than the manufacturer.

Q. If it did, would you accept it?

A. I think that the Commission and the Division would certainly be receptive as we have in the past to something other than the manufacturers own information or own criteria or own data and have again it can be as honest as the day is long, but you know the problem...

Q. I don't want to belabor the point but if you did have this acceptance and verification, could you use it, or didn't we decide yesterday that if it isn't in the law today it won't make any difference if all plants were moved 100% and all the tests in the world verified it, you still couldn't use it?

A. Use what?

Q. Use the plant if it wasn't in 526. You still have to bury the effluent.

A. This may be true today. I think this is also true...

Q. Is it worth our going through NSF to give you this data until the law is changed?

A. Well, I think by the time you get it through NSF the law will be changed. I think we are coming in with guidelines and rules for these anaerobic systems. This is going to be in the next few months - the next few weeks. Of course, I don't know how long it takes; several weeks or months to go through NSF. Now if we have NSF, I won't approve, but if we have a system that has been through NSF and has the criteria showing this, then here is a system that we can say "Okay, it has been proved in the laboratory under ideal conditions." If we can apply this to the field, and here again this doesn't prevent 10 or 12 people from getting on the same system. We are talking about the same loading conditions which NSF would use, or a similar institution. I think that it is pretty well accepted that the universities are getting into this. I heard Wisconsin is and I think this is great. But what we need is something, some criteria, that will tell us that this system has been put through the paces and should under normal conditions operate this way.

Q. Are the maps that designate the areas in Colorado which are unacceptable for septic tank developments, have these been prepared?

A. Yes, these have. There has not been a map published but there is a list of identified areas that is available from our office. Those are listed by a legal description by sections.

Q. Is this for the whole state of Colorado?

A. That is correct. Now, all of the identified areas that we have listed are on this list - recognize the fact that this was a first attempt. The commission has designated that there will be others following as soon as we see how this first one is going to do. We recognize that this is probably one of the best things that we have as far as putting a hold on the indiscriminate use.

Q. Is the data that provides this report collected on failing systems or is it based on geological analysis or soil types?

A. There are several sources, one of those being observations by state health departments or local health department people, by this U.S. geological survey, all types of information was used, and at the hearings all this information was presented and evaluated accordingly to get results of this type.

FEDERAL POSITION

by

Paul Ferraro
Chief: State and Local Planning
Air and Water Division
Environmental Protection Agency
Denver, Colorado

INTRODUCTION

My comments today will reflect EPA's views and not those of other Federal agencies. I would like to give a brief background on the use of home disposal systems in the United States and a status of research and demonstration programs.

EPA does consider the individual home system as an alternate to the central collection system. We are not opposed to this type of a system providing that it is properly designed, installed and maintained. There are advantages in certain areas of having such a system in terms of economics and from a water quality point of view.

STATUS OF INDIVIDUAL SYSTEMS

With the demand for housing right after World War II, the central collection systems just couldn't keep up with the housing demand and consequently new housing developments relied on individual systems. The result was that between 1946 and 1950, between 4 and 5 million individual systems were installed. Between 1950 and 1960 there were efforts to replace many of these individual systems, and ten million of them were replaced by connections to central systems. However, with the housing boom continuing, we still ended up with a considerable number of individual systems still in operation.

In 1967, for example, the U.S. Public Health Service estimated that approximately 25 percent of the new homes that were being constructed were using individual home systems. The status today is that approximately 70 percent of the population of the United States is served by a sewer collection system, and of these, 92 percent are served by waste treatment facilities. Of the 30 percent that have individual systems the breakdown is that between 15 and 17 million systems are septic tanks and cesspools, and between 5 and 10 million homes have privies or direct discharge into streams. The estimated number of individual aerobic systems in the United States is less than 50,000.

Today, we can say that of the new homes being constructed, there are between 10 to 25 percent of these being constructed using septic tanks for their wastewater treatment. I wish I had some information on the breakdown of individual systems in Colorado, but I don't.

In the past, septic tanks and individual home systems have been considered as temporary measures until it was economically or politically feasible to construct a central collection system. Hopefully, there

will be some change. As far as the EPA is concerned, there are areas where individual systems should be used providing they are properly installed and maintained. Then, we won't have to consider them as a temporary measure.

PROBLEMS

In terms of some of the problems arising from the use of individual systems, I don't want to belabor this point because I believe all of you know what the problems have been. However, I just want to mention a few of them. Some of these are:

The units were installed on small lots in urbanized areas where they shouldn't have been installed; they were installed too close to a neighbor's home; the design in some cases was inadequate and the systems were improperly installed.

Another major problem was the homeowner's lack of adequately maintaining his system. Due to inadequately or improperly constructed systems, many individual systems failed. In many communities, up to one-third of the homes in subdivisions that had septic tanks failed within three or four years. You can see the same problems today. You can see it here in Colorado and throughout the United States. There is an effort to eliminate the septic tank and go to central systems, without regard as to whether the septic tank systems are operating correctly. We had an interesting case recently, not in Colorado, but in another state in our Region -- a small rural community wanted to construct a central system. The question we raised was, "Why do you want a central system?" The response was, "Well, we were told it was the thing to do because of the public health hazard associated with septic tanks." Our planning staff raised the question as to whether or not the community really needed to construct a central system when the individual systems appeared to be working satisfactorily. We believe that the decision to construct a central collection system to replace septic tanks should not be an automatic one just because funds are available. There are other alternatives that should be considered.

EPA RESEARCH AND DEMONSTRATION PROGRAMS

In the past, we have related to this whole problem and studied certain aspects of it, and I just want to mention a few of these. As was mentioned by previous speakers, in recent years, most of the Federal research efforts have been on municipal and industrial facilities. EPA's authority lies for grants assistance to communities and this is where the major emphasis has been.

There has been reference made to Manual 526 ("Manual of Septic-Tank Practice") which was developed when the water program was within the Public Health Service and after much research was performed for several years. The latest revision to this Manual was in 1967. At the present time, the EPA is trying to deal with the entire problem of home disposal. Our agency, which in 1969 was the Federal Water

Quality Administration, did a study on flow reduction possibilities of wastewater from households[1].

Presently, we have two demonstration projects considering low cost pressure sewer collection systems with one underway in Grand View, Indiana and the other one in Phoenixville, Pennsylvania. Here we are looking at using a small diameter sewer with a grinder and pump at the home to deliver the wastewater to a central treatment plant. In areas where it is difficult or very expensive to install gravity sewers, we might be able to use this type of collection system as well as being able to reduce the flows from households.

EPA has been funding a study at the University of Connecticut to evaluate how best to handle the pumpings from septic tanks and methods of treating it, including ejection into the soil. The study should be done fairly soon, but I don't have an exact date.

Most recently, EPA has funded a study done by Mitre Corporation[2] to study selection economic and environmental aspects of individual home wastewater treatment systems. The report is now available. This study goes into some of the problems we have discussed today and what directions EPA should be taking in the next twenty years.

To the best of my knowledge, that is what the EPA has been doing. At the moment, EPA is not conducting any research on septic tanks or aerobic systems. In addition, there are no plans to do so in the near future. However, I think that we may get more involved due to the pending Federal legislation. That is just a guess on my part. I think, we may get more involved in individual systems, maybe as a result of workshops such as this one. A recommendation from this group could be that the EPA renew its research activities in studying individual systems. If such a recommendation is indicated today, I will bring it to the attention of our people in headquarters.

ADMINISTRATIVE CONSIDERATIONS

I think, we could say that one of the problems of septic tanks is the information, or misinformation that has been given to the homeowner on how best to maintain his individual unit which he has the sole responsibility of maintaining.

We now see in some areas that service contracts are available to the homeowner for maintaining individual systems. For example, in two Europian countries (Switerland and Sweden) the managing of septic tanks is done by the local Public Health or Public Works Department. The

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1 "A Study of Flow Reduction and Treatment of Wastewater from Households," December 1969, 11050FKE.

2 "A Study of Selected Economic and Environmental Aspects of Individual Home Wastewater Treatment Systems," March 1972.

local agency is responsible for inspecting and maintaining the systems, as well as regular pumping and disposal of the sludge. This sort of control appears to be working quite well.

I would like to suggest that maybe we should consider this type of a management arrangement here in the United States. We do have septic tanks and we need some agency, whether it be public or private, to properly manage them. I don't even want to rule out private industry, but we should look at some type of management control over septic tanks. Presently, there is no way to penalize the homeowner if he doesn't keep his home disposal system operating properly. Consequently, we end up with failures and public health hazards.

Presently, there are two subdivisions, one in South Dakota and the other in California, that are considering some type of management system. I don't have any of the details, but it is now being considered here in the United States.

PENDING FEDERAL LEGISLATION

The House Committee has stated that it is their intention to have a bill which will provide funding for septic tanks under certain conditions. However, we still don't have the legislation and we don't know what the final version will be. The House Committee Report states that the Committee's intent is to provide Federal funding for a septic tank or a collecting system and septic tank serving a cluster of homes in rural areas. Under this type of system, a unit of government, such as a sanitary district, must own the collecting facility and septic tanks and would be responsible for the design, installation, maintenance and replacement of the system. The eligible cost for a grant would be for engineering, construction, all improvements, and all necessary equipment for proper installation and maintenance of the system including the disposal of residual sludge. As you can see, Congress is thinking about continuing the use of individual home systems in certain areas.

EPA'S POSITION

In terms of EPA's position on individual systems, we don't really have a set policy or statement, other than to say that we are very concerned about the use of individual systems. We believe septic tanks have a place providing they are properly designed, installed and maintained.

Those of us in the planning feel that we need to take a broader look at the entire problem. Today, this workshop is primarily involved in just the technical aspects of individual systems. From a planning point of view, there is a need, here in Colorado and throughout the United States, for good planning to consider land use, water quality and the impact on the environment of new developments. In certain areas, I think, the State and counties should consider not permitting any type of treatment systems to be constructed. I think we need to consider where developments should take place, and what areas should not be developed. For example, the State of Vermont passed a law that

doesn't permit any type of development above 2500 feet elevation. When you consider the mountains in Vermont which are only four or five thousand feet high, versus the mountains in Colorado, I would say that the environment in our mountain areas is more fragile than it is in the State of Vermont. Yet, the State of Vermont has decided to protect their mountains by not permitting development. I just mention this in passing as to what has been done in another state.

I think we need to evaluate what type of system is best for an area and where it should be located. There may be areas where we should not use an individual system as a temporary measure, especially if a central collection system is recommended. We should consider some other type of treatment such as a package plant until a central treatment facility is constructed. It is only through good areawide planning that includes land use, land capability, water quality, impact on the environment, soil suitability and cost effectiveness that we can answer these questions.

I just have two last points to make. One is that EPA is considering having a national workshop or conference on the individual home wastewater treatment system to get the problems and possible solutions aired. The EPA is looking into this further and I think that we will be more involved in individual home systems with the passage of the pending legislation.

The other point I wish to make is that EPA has a technology transfer program. The purpose of the program is to be sure that advances in waste treatment research are transferred to those involved in the design and use of this kind of technology. Thus far, most of the effort has been in municipal, industrial and agricultural treatment. However, I don't see why the technology transfer program could not be used as a way of transferring new thoughts and knowledge on individual systems from the researchers to the general public in the future.

QUESTIONS AND ANSWERS

Q. You have emphasized planning very nicely. What is the agency doing towards helping State efforts in planning?

A. We do have planning requirements. The regulations require that before EPA can fund a project an approved basin water quality management plan is required. We also require an approved metro/regional plan where applicable before funding. Although this became a requirement in 1970, in 1972, we still have very limited funds available for planning. We are funding a Water Quality Management Study being developed by the Denver Regional Council of Governments for the Denver Metro area. The study cost is over $400,000 and EPA is funding 50 percent of the cost. We are also funding a similar study in Salt Lake City. Pending legislation will give us more money for planning. According to the Senate Bill, EPA will provide 100 percent grants for the 1st two planning years, and 75 percent grants in the 3rd year. Plans will have to be completed in two years, the third year will be for the implementation of those plans. Also, our planning staff provides technical assistance to State, regional and local agencies involved in water quality planning.

NOTES AND COMMENTS ON MICROBIOLOGICAL ASPECTS OF HOME SEWAGE DISPOSAL

by

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Pleased to have this opportunity to participate in this program on home sewage systems.

I am no expert on the subject because research workers never seem to be satisfied that their work is complete, and research usually leads to more questions than answers. There are few experts in terms of the geography of Colorado.

There is pretty good evidence that many, many home sewage treatment systems in our state just do not work. For a variety of reasons the wrong systems have been installed in the wrong places and used in the wrong ways. Somehow the burden of continued safe and efficient operation of any installation must rest with the home owner and his suppliers and not with the health departments or pollution control agencies. By the time odors, bacterial counts, seepages, gas bubbles, cave-ins and the other defects are observed, damage to soil and water environment -- often of dangerous as well as obnoxious qualities -- has already taken place.

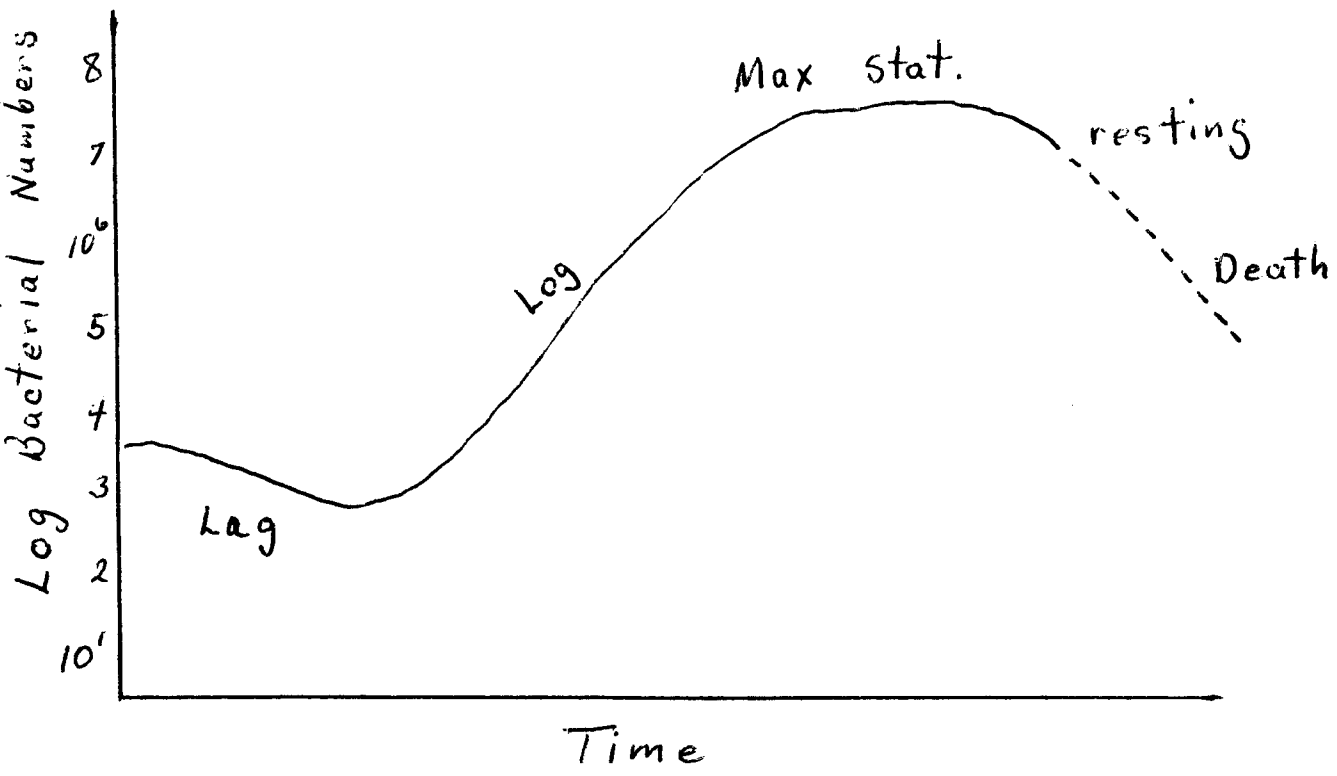
In principle, as demonstrated in the laboratory or in small pilot scale, the aeration system of waste stabilization from a household is a very simple and effective scheme. The bacteria present in the usual mixed waste from a household find the nutrient fluid system a fine one to grow, rapidly using up fantastic quantities of organic molecules to provide the materials for their life processes and extremely rapid multiplication. The process proceeds with low levels of oxygen or with no oxygen, but a far more rapid and aesthetically suitable process is the system with added oxygen usually added by way of mixing air into the system. Much more is needed to be known on how to diffuse air.

While the bacteria, the mixed population that take part in the process, have a great degree of flexibility in keeping their metabolism going in the face of all sorts in insults, there are distinct limits to these variations. All too often it is assumed that the microorganisms can adapt to all the changes -- usually by persons who haven't had the experience of working with organisms in a laboratory where growth stops in the middle of an experiment, dies at a critical point of your work or starts to behave strangely biochemically.

I would like to briefly touch on the many kinds of factors that can cause a treatment system to operate improperly. Not all can be covered and certainly not in detail. We are dealing with a dynamic system in which each input change creates an internal change.

A. Power Failures--An Obvious Problem. Mixing and keeping the bacteria, nutrient-bearing wastes in small particle suspended form and proper gas mixture all in balance continuously is necessary. Brief shutdowns upset the entire system.

B. The digestion depends upon steady input of organisms of mixed type to maintain the capability of providing the proper enzymes to meet all the things man puts into the waste system. All too often, slugs of materials are introduced for which enzymes do not exist, and time is needed to build up a population of needed bacteria.



C. This leads to my third point on the need for knowledge of growth patterns and cycles of bacteria. They all have a lag growth phase -- this may be brief or quite long. It is a period during which the organisms must elaborate the proper enzymes or series of enzymes for action on substrate. Also changes take place in the cell membranes altering the size and permeability of the outer layers of the cell. When provided a steady diet of utilizable food at fairly constant concentration, temperature, salts, pH, oxygen level, etc., the organisms will show a short-lag phase and can handle fresh nutrient quickly. The organism is said to be in logarithmic growth phase where metabolism and reproduction are very rapid. If, however, as often happens, the loading of a digestor is uneven with periods of no fresh input and the other factors fluctuate, the organism goes beyond its log phase into

stationary or later the resting and death phases. Reproduction stops, metabolism is reduced and when provided fresh nutrient, there is a long period of lag before action is initiated. I believe this suggests the obvious problem of uneven loading of the single home digestor. Municipal plants do not have this fluctuation.

D. Also another very important characteristic of microorganism growth cycles is their varying sensitivity to toxic materials or conditions among the growth phases. When actively metabolizing and reproducing, cells are most sensitive to detergents, antibiotics, disinfectants, some metallic agents, and changes in O_2 tension, pH, agitation, temperature change, etc. No matter how careful a system design is or how much warning the householder gets, there are times that detergents, spilled disinfectants, cleaning materials, drugs, oils, antibiotics, etc., get into the system. Likewise, physical shocks such as temperature, pH, salts, and air mixture will upset the biological action. Oddly enough, organisms in resting stage or old age are more resistant; but when they receive these mistreatments, they are slower to respond to fresh food supplies.

E. There are real difficulties in a small system to maintain a level quantity of oxygen, dispersed evenly throughout the system. The usual methods of measuring oxygen give us gross answers about the system but do not indicate what is happening in the environment of the cell. The microbial population is sensitive to oxygen shifts. A related problem is the often neglected adjustment of gaseous input into the system required by altitude. May I point out that there can be too much of a good thing. Too much air or oxygen can cause foaming and similar physical problems and can limit growth of several varities of bacteria.

F. Microorganisms are sensitive to temperature shifts. Each can grow and metabolize best within some limits, sometimes as narrow as 20°C. Every time the temperature in a treatment system shifts, changes in the mixed population occur with different cells and enzymes becoming predominant. Raising the temperature speeds up reactions to a point. Dropping the temperature for a particular organism lowers activity 1/2 for 10°C or so, but in mixed culture this is overcome somewhat. Psychrophilic bacteria do contribute to the 'BOD' lowering action.

G. I would like to come back to a point quickly referred to earlier -- to a bacterium, a particle of waste the size of a kernel of corn that looks like Mt. Evans on top of Pike's Peak to us -- waste materials must be broken down to size for bacterial action (and oxygen contact); and this is often difficult to do with the wastes that come from a garbage strainer and even a grinder and the non-digestibles that pass through the human digestive tract. Enzyme activity is a surface phenomenon.

H. Because of uneven loadings and variations of materials that are loaded because of family habits, modifying retention time becomes a big factor in proper waste stabilization. This is pretty hard to control in a family unit. From empirical observations of people, it

must be a pretty tough job to design a system for a family and to keep their habits stabilized. The family of two adults and two school children suddenly becomes two, two and a pair of twin infants with the increased laundry problem. The school kids grow up and acquire friends who drink vast quantities of soda pop and beer. The family has a large number of relatives from Kansas or New York who love to visit using trailers and campers and the weekday load of four people becomes 40 on the weekend. I am sure you can imagine an endless array of similar design destroying situations.

I. More seriously I should reemphasize the very sensitive nature of the microbial flora of a waste system to temperature fluctuations and pH changes. In a municipal system the mixed input, dilution factors and buffering action absorbs the shock of alkaline cleaning compounds, hot laundry water and detergents and a slug of acid drain cleaner. The single unit is more sensitive and can slow up biological action and prolong the needed retention time.

J. Not all inputs to a waste system are equally digestible by microorganisms. Small molecule sugars and semi-digested proteins and fats may not strain the bacterial enzyme systems. However, gobs of raw or cooked fats, mineral oils, cellulosic materials such as corn husks and materials such as peelings or skins of plant food material pose a severe problem to the bacteria. These substances are broken down slowly or even not at all; and if they do not settle into a bottom sludge, they can sure raise problems of disposal of the materials coming through the system by the soil or leach field.

K. May I point out an often forgotten item. The bacteria that we measure as an indication of public health safety of waste treatment effluent are not the bacteria which are the prime digesters or oxidizers of the waste material. No one really knows the whole array of bacteria that are working in an efficient aeration system.

L. One substance which cannot be used by the organisms is salt. Common salts in many areas can build up to become detrimental to soil or to waterway outfall. While we have mostly ignored the salt problem in sewage treatment, you will be hearing more of it in the future.

M. While much attention has been paid to digester design and workings, much less attention is usually paid to leach fields -- these are often too small. They clog up too fast when non-digested material gets through the treatment system. Contaminated water either runs to the nearest waterway, to someone's well or runs overground.

N. I personally have some fears of spray type irrigation with effluents that come from home treatment systems and even from larger systems. The dangers of pathogen transfer are great. Chlorine treatment may alleviate the pathogen problem but kill the organisms that may be needed for continued metabolic activity on the waste materials in soil. Our long winters cause some problems for irrigation disposal. Other types of irrigation and evaporation procedures need considerable work. It does rain and snow and we do have cold cloudy weather; Irrigating in winter is questionable and using the soil for waste disposal still is not well understood.

O. Mountain dwelling sites pose an even greater problem. Leach fields in solid rock just don't work. As shown in our research, fractured rock can create a direct flow of waste to sub-surface water. Uneven loadings on a recreation dwelling could have severe effects on efficiency. Irrigation is not feasible in many mountain terrains, temperature variation is great, etc.

SUMMARY

I know that much of my presentation has been negative in approach. It really is a prelude to my plea that all of us related to the business of water pollution control need to strive for a great deal of investigative work, research, testing and surveillance. Systems designed on a big city drawing board by people who have little or no knowledge of the life processes of the bacteria are just not going to work in rural Colorado. We need cold, hard data collected under working conditions. It is going to be expensive and the consumer is going to pay for it in some manner, but with adequate research information he will pay for it once and not two, four, or six times.

Thank you for your patience with a college professor who, without the financial pressures of the business man or the legal pressures of the enforcement people, has some hope of participating in a neutral, objective manner.

QUESTIONS AND ANSWERS

Q. How, or does, the same type of cycle apply to an anaerobic microbiological system?

A. Yes! Well, different factors are involved. Oxygen input would disrupt the cycle. The anaerobic system behaves in a similar manner if not disturbed by slugs of oxygen or rapid shifts in pH or nutrients.

Q. No, I was thinking of when you mentioned all the antibiotics, etc.

A. The anaerobics are sensitive in exactly the same manner to shifts in pH , oxygen levels, toxic metallic elements, antibiotics, yes in the same. Each organism has its own array of sensitivity, but the anaerobics are sensitive.

Q. Does the last part of your graph last for ten, fifteen, or twenty years or does it have a tendency to unbalance itself?

A. No, not for long periods. The prolonged life of organisms that we normally talk about is right in here, the decline line on graph. It would be the resting stage, rather than going all the way to the death. It would be somewhere in here in the resting area that you would find the organism lasting.

Q. What effect would the backwash of a water softner have on either an anaerobic or aerobic system?

A. I don't think I would dare give you a yes or no answer on it. It has an effect, but I think we would have to isolate the details of what we are putting in as to salts and possible toxic materials.

GEOLOGICAL FACTORS OF HOME SEWAGE DISPOSAL

by

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I've given a number of talks to various groups about my research on pollution in the mountains, and I'm sure many of you have heard me talk on this subject before. I'm going to try and not belabor details of the technical results which our research has produced, but I would rather make a few general and hopefully stimulating remarks that will cause you to come up with comments or questions of your own. I think the best kind of symposium is the kind where the audience participates. I do intend to leave time for your questions.

I'm to speak on the geological factors of home sewage disposal. I think it is necessary for me to confine that topic to the problem of home sewage disposal in the mountainous terrain where I have had most of my experience. There are geological factors which affect home sewage disposal units other than in the mountains, but those factors constitute another topic in itself, and unless you have specific questions on that I will not deal with it.

I tried to organize my comments with regard to three types of systems and the geological problems as I see them that affect each of these types. The first type would be those systems that incorporate a leaching field. Our public health service manual, which has been referred to repeatedly today, calls for six feet of soil in the area of the leaching field. And just between you and me, I wish we didn't have the word soil. Of course, without it we would probably have another term which is just as difficult to work with. We have so many different definitions of the term soil that as we read about it in the health service manual we really don't know what soil is. As a geologist I look at soil as a product of weathering of the rock, one which can support life. I think that people in agronomy also use the biological aspects of this surface material as a criterion in defining soil. But for a leaching field it's got to be something more than that--it has to include the ability of the soil to not only transmit the effluent (the percolation test), but it also has to include some measure of the ability of that material to filter out and cleanse that effluent. Getting rid of the fluid is only part of the problem, and cleansing it is the other part. At the present time we do not do a very good job of establishing whether or not effluent will be filtered. I have more to say on this subject later, but first lets return to the concept of soil as presented in the U.S. Public Health Service Manual No. 526.

The manual calls for six feet of soil. In the mountainous areas, where the rocks are generally what we call crystalline, igneous and metamorphic types, soil development is very poor. Soil in many places is absent or thin. Now I am not talking about material that you can go in with a trencher and excavate. Just because you can dig it does not

mean that it is soil. Weathered bedrock may be soft enough to dig, but it may not be a suitable medium for handling sewage wastes. If leach fields are installed where thin soils overlie weathered rock, the top two feet of surface material are scraped away, and as far as I'm concerned you have scraped away all of the best soil when you have done this. With the soil removed, the leaching field gravels and the drain tile are placed in direct contact with the fractured and weathered bedrock. You have permitted, then, the effluent to enter more directly into the natural rock fractures which are so common in the mountainous terrain. The result of this practice is contamination of the ground water. Sometimes this contamination is obvious because someone has a polluted well. But I submit to you that most of the time the contamination of the ground water is not recognized simply because no one picks it up in a nearby well. But, as mountain subdivision continues to develop, and many of these subdivisions are, say, operating with 20% occupancy, or 10% occupancy right now, we are going to see an even greater increase in the incidence of contamination if our present practices are continued.

The problem, as I see it, comes from two wrong assumptions. The first one is that the percolation test is a suitable criterion for approving a leach field site. It perhaps answers the question: Will this fluid disappear? Perhaps. It certainly does not answer the question: Will the fluid be filtered (purified)? We dig a hole on top of weathered, fractured rock; we let fluids go in. The fluids can follow the fractures and they do follow the fractures even though the material might be weathered enough so that you can break it apart with your fingers. There is still a preferential transmission of the fluid through the cracks that have existed in this rock even before it was weathered. Because the fluid passes through these cracks there is a limited amount of surface area that the fluid comes in contact with, unlike going through a porous medium, such as sand or true soil. The bacteria are not appreciably filtered when they pass through the fractures. I'm saying that the percolation test is probably necessary but not sufficient, and it is wrong for us to assume that it is sufficient.

The second wrong assumption has to do with the rule of thumb that is often used to determine where to locate a water well relative to a leach field. In short, it is generally assumed that a well is safe if placed upslope from a leach field system. I recently wrote a short article, and I can give any of you copies who would like one, that is entitled, "How Safe is Mountain Well Water?" It points out the problems of this second assumption. Here are some examples.

We consider a home with a well upslope and the leach field downslope. We consider that the effluent from this leach field will move downslope. And there is some justification for that assumption because weathering in this fractured rock tends to be zoned. Weathering is most intensive near the ground surface and decreases with depth. Percolating fluids tend to move downslope through this weathered surface zone. But there are also fractures in the rock, and until that percolating leach field fluid reaches the saturated zone, which might be 100 feet deep, it is

going to follow the fractures. So any fractures which are oriented back towards the well can certainly transmit relatively raw effluent back into the well. This contamination can occur even if the well is several tens of feet higher in elevation than the leach field.

Another example of how "upslope" contamination can occur can be seen where the water table is rather shallow. In this case, barring heavy drawdown near the well, there is no way for sewage effluent to travel through fractures back into the well. Once the effluent enters the water table it will generally move downslope. Because many mountain rocks are crystalline in texture, their porosity is derived only from the fractures. They can store about 1% of their total volume of water. When you pump water from a well in this type of rock, you get extensive dewatering around the well and a "cone of depression" forms. The cone results in a water table slope toward the well which may extend for hundreds of feet in all directions from the well. So the effluent reaching the water table perhaps a scant 100 feet away from this well can be drawn back towards the well because of the radius of influence of the cone of depression.

These are examples of problems that you run into in the mountains. These would not be problems if there were sufficient soil to cleanse that effluent before it got into the fractures of the rock. These are problems only because the thin mountain soils are generally not satisfactory as a leach field medium. You must recognize that I am generalizing. I know there are places in the mountains where you can use a conventional septic tank-leaching field system and the proper purification occurs. But I am willing to say that I think those places are so few in the mountainous areas underlain by crystalline rocks, that we should take the approach of designating all of the mountain areas as unsuited for septic tanks and requiring that before a person apply to have a conventional septic tank system installed that the burden of proof should be on him to demonstrate that the ground conditions are acceptable. No county or state agency can afford to document that it is unsuitable. I think that the developers can afford to document the suitability of good land, and for unsuitable land they should be using alternative approaches to their sewage disposal plan.

I want to pass very quickly to comments on the two other types of systems; the evapo-transpiration system has one major geological problem as I see it. If you pump water out of the ground from a well and dispose of it in an evapo-transpiration system, your consumptive use of this water resource is about 100%. There is seldom enough water in these mountain rocks to sustain that kind of a use. If you have subdivisions consisting of 2 to 5 acre lots, and you pump the water out and dispose of it into the atmosphere, the ground water resource may not last long. The same comment would hold for a community sewage system in the mountains. You conduct the fluids away from the area rather than recharge them, and you are going to run out of the groundwater resource. Finally, the shallow bedrock in the mountains and the often rugged topography make it very difficult, or at least very expensive, to implement community sewage systems.

It seems to me that the best solution to many of these mountain sewage disposal problems is a modification of the conventional septic tank-leach field system, a modification that entails design and testing of approved techniques for purifying effluent before it enters the bedrock fractures.

I have with me a report that deals with the early research that we have completed on this mountain contamination problem, called "Methods of Geologic Evaluation of Pollution Potential at Mountain Homesites," and if you want to contact me I'll be happy to give you a copy of this. It gives some of the details of the research that we have done and some suggestions in terms of applying it to practical situations.

Are there any questions you would like to ask?

QUESTIONS AND ANSWERS

Q. Where do we get a hold of you?

A. Just leave me a business card or your name, or write to me in care of the Geology Department, Colorado State University, and I'll be happy to have reprints of my articles sent to you.

Q. On soil depth, that seems to be the main thing we are interested in, how about using artificial fill for the leach field area?

A. I think that this is a great idea. But I know there are problems that will arise from use of fill--especially surfacing of effluent. I don't know about all of the Colorado counties, but I do know that Boulder County has a mechanism for approving engineered fills in leach fields. I am currently working with a client in Boulder County to construct one of these. In this case we are not actually placing it on the surface--this site is in weathered granite, and we want to dig a seven foot hole and put the weathered granite back in as engineered fill. You could crumble this weathered rock with your fingers; it is probably a good percolating medium. We feel that by the time the effluent gets through that engineered fill, it will be clean enough that subsequent travel through fractures will not contaminate the ground water. This design would still preserve and recycle the water.

Q. Do you have a method for determining whether or not the soil is suitable for filtration before you put it back in?

A. I think that there is a modification of the percolation test which can be used to at least get a handle on the filtering capabilities of the soil in addition to its percolation.

Q. Do you suggest that each home sewage disposal system be individually "engineered" for each situation?

A. My experience has been that it is economically feasible for individual home owners to obtain technical assistance on these matters. There are geological tools, some of which can be applied by evaluation of an air photo or even a topographic map that will reveal something on the capability, of potential problems of the site. I don't think that it requires bringing in a drill rig and spending thousands of dollars. I do believe, however, that these studies should be done on the scale of a subdivision and should be done by the developer and not by the individual lot owner. But, if needed, I think a lot owner can afford to get geological assistance for the problem.

Q. Do you feel that certain types of fill material make better drain fields than other types of material?

A. One criterion for suitability of the fill material relates to the effective diameter of the particles. We have done some studies that have indicated that there are chemical effects due to rock type which determine somewhat the viability of organisms in the ground over a period of time. This viability will effect, ultimately, the safe distance between a leach field and a well.

THE ROLE OF TILE DRAINAGE IN THE DESIGN OF SEPTIC TANK DRAIN FIELDS

by

Dr. W. L. Mallmann
Professor Emeritus
Department Microbiology and Public Health
Michigan State University

The effluent from a septic tank is characterized by its putrifactive odor. It is a very unstable fluid loaded with soluble organic matter consisting of carbon, nitrogen and sulphur compounds. These reduction compounds are devoid of molecular oxygen available to anaerobic microorganisms. It also contains particulate matter in small particles which are slowly settleable. These particles are largely undigested carbohydrates and proteins. The effluent carries a very high population of microorganisms. This population consists of the anaerobic bacteria growing in the septic tank and some of the bacteria and viruses carried over from the sewage. The latter organisms are mainly facultative anaerobes coming from the intestinal tract of man consisting of nonpathogenic bacteria such as Escherichia coli, Aerobacter aerogenes, Streptococcus fecalis that multiply in the intestinal tract. Also there may be some pathogenic bacteria, viruses and worm eggs and cysts of Entamoeba. The presence of the pathogenic microorganisms make the sewage effluent a definite health hazard.

Because of the possible presence of disease producing organisms, the septic tank effluent must be disposed of in a manner such that it doesn't come in contact with man or animal or contaminate drinkable water supplies and food.

Disposal is generally by drainage tile laid below the surface into preferably agricultural soil. Because of the possible presence of pathogenic microorganisms in the effluent, the location should be, at least, 50 feet from a well site, lake or stream.

If the effluent were discharged upon the ground surface where it could form ponds or puddles, the liquid would continue to be low in dissolved oxygen and objectionable odors would result. In addition, the pathogenic microorganisms would be readily accessable to man and animal.

The effluent can be discharged into a lagoon for aerobic disgestion provided the lagoon is located in a place inaccessable to man and animal. Lagoons are commonly used in place of septic tanks and drainage fields for installations larger than one household. For small villages, a series of lagoons are used successfully.

The biochemical oxygen demand (BOD) of a septic tank effluent is determined by the length of time of digestion in the tank, which is dependent upon the volume of sewage, the volume of sludge within the septic tank, pH , and the temperature of the contents of the septic tank. In general the BOD will vary from 150-300 ppm.

The effluent from a septic tank should be discharged beneath the surface of the soil, because of the health hazard from pathogenic bacteria and viruses. Before public health regulations were adopted, septic tank effluent was discharged into lakes, rivers, ditches and even upon the ground in low areas adjacent to the septic tank. In Michigan, for example, we still are finding effluents being illegally discharged into lakes and rivers or finding drainage fields too close to lake shores.

Originally, septic tanks consisted of two chambers, one for anaerobic digestion of the sewage and the second served as a dosage chamber. The chamber was equipped with an automatic siphon that functioned only when the chamber was filled with effluent. The tile field was sized so that the effluent from the dosage chamber reached all the tile in the system. In the interim between doses of effluent, the aerobic bacteria in the tile field had an opportunity to oxidize the organic matter in the effluent discharge before another dose of effluent arrived.

The discontinuous dosing of the tile system avoided the saturation of the field with effluent and the resulting exhaustion of oxygen from the soil in the field.

Later I want to talk about discontinuous discharging of effluent in relation to disinfection.

Presently effluent is discharged more or less continuously and the tiles adjacent to the discharge point are overworked whereas the tiles at the end of the lines receive little if any effluent.

The rate of discharge from the tile to the soil is dependent upon the physical condition of the space between each tile. If the soil is an open type, the effluent passes readily from the tile to the soil whereas if the soil is heavy, the acceptance rate of the liquid to the soil is poor.

When the suspendable solids in the effluent pass into the soil, they are trapped. These solids with the accompanying microorganisms form filter barriers that slow down the acceptance of the liquid into the soil.

These filter barriers develop faster in a heavy soil than in an open sandy soil. Unfortunately, the filter barriers continue to increase in thickness in a heavy soil. In a light soil, oxygen is more accessible, and the aerobic bacteria tend to dissolve the solids.

When a drainage field is filled with solids, the effluent accumulates in the tiles and eventually the effluent is pushed to the surface of the bed.

A filter barrier tends to hold back bacteria and viruses. Ordinarily the distance of 50 feet between the well and drainage field is sufficient to prevent the passage of pathogenic microorganisms and

such indicator organisms as coliforms and fecal streptococci. High water tables are conducive to travel of bacteria and viruses in the soil. The microorganisms tend to travel on the surface of the water table and the distance of travel through the soil below the tile is generally not enough to filter out the microorganisms so they tend to accumulate at the water table surface.

In Alabama in 1937, Cadwell and Parr (1) investigated the migration of bacteria in sandy soil as measured by coliform organisms from a bored-hole latrine that penetrated below the water table. Initially coliform organisms traveled 15 feet in three days. After three months of continued use of the latrine 90 percent recovery was made at 15 feet, 40 percent at 25 feet and only an occasional positive sample at 35 feet. Chemical pollution traveled farther than the bacteria. The travel of pollution was only in the stream flow. The width of the flow of bacterial pollution was three feet at a distance of 15 feet, whereas the chemical pollution was five feet at 25 feet.

When only 10 gallons of water were drawn daily, after two months of use in the latrine, coliforms were occasionally detected at only 10 feet from the latrine. When large volumes (750) gallons were drawn, coliform organisms were consistently detected at 10 feet. Thus in the normal stream flow, the coliforms were held back by the filter barrier. When large volumes of water were drawn, the flow pressure increased at the filter barrier and organisms passed through the barrier.

The significant findings in this study was the demonstration of a barrier to the spread of microbial contamination. This barrier formed by the deposition of particulate material at the periphery of the latrine functioned as a filtering mechanism.

To prevent excessive build-up of filter barriers in the soil surrounding the drainage field, a settling basin can be placed between the septic tank and the drainage field. The use of a two chamber septic tank has some value, but in order to have sufficient surface area in the settling chamber to allow good settling, the cost becomes prohibitive.

Sheldon, of the Michigan State Agricultural Engineering Department, some years ago designed an improved drainage field. This system consisted of four inch tubes or sealed tile placed in two or more parallel lines headed by a manifold to discharge effluent to all tile lines. At the head and foot of each tile line a sump was placed to hold sludge which may settle in the tile lines.

When in operation the entire system is filled with effluent up to a line of orifices placed at regular intervals along the tile on each side so that the depth of effluent in the tile system is about three inches. When additional effluent is added, liquid trickles out of the orifices into the surrounding soil.

Thus, the tile system acts as a settling basin as well as a drainage field. The effluent in the tiles is largely in a static

condition, thus allowing time for good settling of the suspended particles and a resulting clear effluent discharge through the openings in the tile. There is still enough particles in the effluent entering the soil to form filter barriers.

In a drainage bed consisting of 4 lines of tile 75 feet in length, the surface area of the settling basin would be roughly 25 square feet.

If the tile system is vented so fresh air can pass over the surface of the effluent in the tile, the liquid may absorb emough oxygen from the air so that aerobic digestion can occur.

This system has been thoroughly tested in use. It offers a marked improvement in the disposal of septic tank effluent.

The septic tank system is a very satisfactory method of handling domestic waste water where soil conditions make drainage fields acceptable.

There are many ground areas in the United States that are not suitable for the use of a tile drainage field. Lands with high water tables with heavy clay soils that prevent the passage of water and with outcropping of bed rock with little or no soil covering.

We need new methods of sewage disposal so that these lands can be used for housing. In many cases, a collective sewage system isn't practical. If a septic tank was equipped with a holding tank for effluent, the contents could be disinfected before discharge into a drainage field in soils with high water tables.

If the effluent in a holding tank were treated with ozone to kill microorganisms and to reduce the BOD to low levels then the resulting effluent could be discharged above ground without health hazard or nuisance from odor or appearance.

If instead of using anaerobic digestion aeration was substituted the BOD of sewage could be reduced to low levels and the effluent could be discharged above ground, provided the effluent was disinfected.

Such methods are now available and are being tested by field experience.

REFERENCE

(1) Caldwell, E. L. and Parr, L. W. Ground water pollution and the borehole latrine. Jour. Inf. Dis. 61:48. 1937.

THE NATIONAL SANITATION FOUNDATION PROGRAM

by

Heinz B. Russelmann
Director: Wastewater Technology
National Sanitation Foundation

I'm at a loss as to how to approach this subject within this time constraint. Also, in discussions with Prof. Ward and others, I find that NSF has been both maligned and praised. I feel that much of this results from lack of understanding of what NSF is all about. We have no profit margin and therefore commit limited resources for publicity. As a result, regulatory people have a certain concept of NSF, manufacturers have their concept and, in many cases, these concepts are distorted.

NSF - The National Sanitation Foundation is often confused with the National Science Foundation, but, in fact, it predates the National Science Foundation and therefore has an edge on the acronym. It is a non-governmental, not-for-profit group, devoted to research, education and service in matters of environmental health.

NSF had its beginnings over 25 years ago in the University of Michigan School of Public Health, ultimately occupied its own building in Ann Arbor and in May 1972 moved to new quarters in Ann Arbor. The staff of 65 persons pursue programs of criteria and standards development, research and testing. The foundation lists 10's of thousands of products made by thousands of industries in the U.S., Canada, Europe and Asia.

THE NSF TEST SITE

Activities involving wastewater treatment are located adjacent to the Ann Arbor Municipal Wastewater Treatment Plant.

The test site receives raw wastes from the city collection system at the rate of 1 1/4 million gallons each day and distributes the waste to numerous small sewage treatment plants through eight control stations.

The wastes enter the plant through a comminuter and pass through the distribution main of the control gallery. After treatment, wastes are returned to the Ann Arbor plant for treatment.

A control plant is operated continuously for performance data and clues to irregularities in the waste.

Plants under test provide a variety of processes and treatment concepts, including plants for shipboard.

The work relates primarily to biological treatment processes -- extended aeration, contact stabilization -- but it need not be so limited. Physical-chemical treatment and disinfecttion processes under consideration.

Flow control for various hydraulic simulations and composite sampling serve the test functions.

The mainstay of the operation is the laboratory. It is well equipped to permit adherence to Standard Methods in carrying out chemical, physical, and bacteriological analyses. It also affords the opportunity to carry out bench-scale research.

HOMESITE TREATMENT PLANTS

After various efforts to mount a program concerned with the performance of aerobic plants for individual homesites, the Foundation adopted NSF Standard No. 40 in late 1970. By mid-summer of 1971, the plants of Cromaglass, Nayadic Sciences and Flygt Corporation were received. They were installed below ground surface to simulate the on-lot condition. Raw sewage was distributed to the plants and composited samples of treated effluent were collected. The test does not reproduce the precise household condition biologically or hydraulically, but it does attempt to apply a reasonable flow regimen (Figure 1). There are three periods of the day, each of three hours duration, at the peak use hours, when flow is applied ... 35 percent of the daily flow in the morning, 25 percent at noon and 40 percent at dinnertime. The plants under test have been loaded at 400 GPS which, with the prescribed flow pattern will provide as much as 53 gallons per hour during the peak, evening, period.

In this activity, NSF is not scrutinizing design. The intent of the program is to demonstrate, or measure, what the plant can do under these operating conditions. This does not ignore materials and construction but considers them from a general aspect of safety and use. Also, there is no deliberate effort to make a plant perform satisfactorily. The intent is to observe the plant as if it had been installed by the manufacturer or his distributor and left to the operation and maintenance instructions provided to the user.

The analyses performed on the process are recorded on a standard laboratory report form (Figure 2). Although plants are operated continuously through the 6-month duration, laboratory work is limited to weekday samples.

The Standard calls for an effluent quality having maximum limits for 5-day BOD and for SUSPENDED SOLIDS (Figure 3). Two classifications are used, merely to show the level of performance which may be expected. A CLASS I plant is one which can produce an effluent BOD_5 of 20 mg per liter and suspended matter of 40 mg per liter at least 90 percent of the time. The intent was, initially, to suggest that such an effluent may be suitable for discharge to surface waters.

A CLASS II plant is one which can produce an effluent within 60 mg per liter BOD_5 and 100 mg per liter suspended solids.

In addition the CLASS I plant effluent must be relatively free of color, odor, oily film and foam (Figure 4).

Figure 1

FLOW PATTERN

NSF STANDARD NO. 40

Individual Aerobic Wastewater Treatment Plants

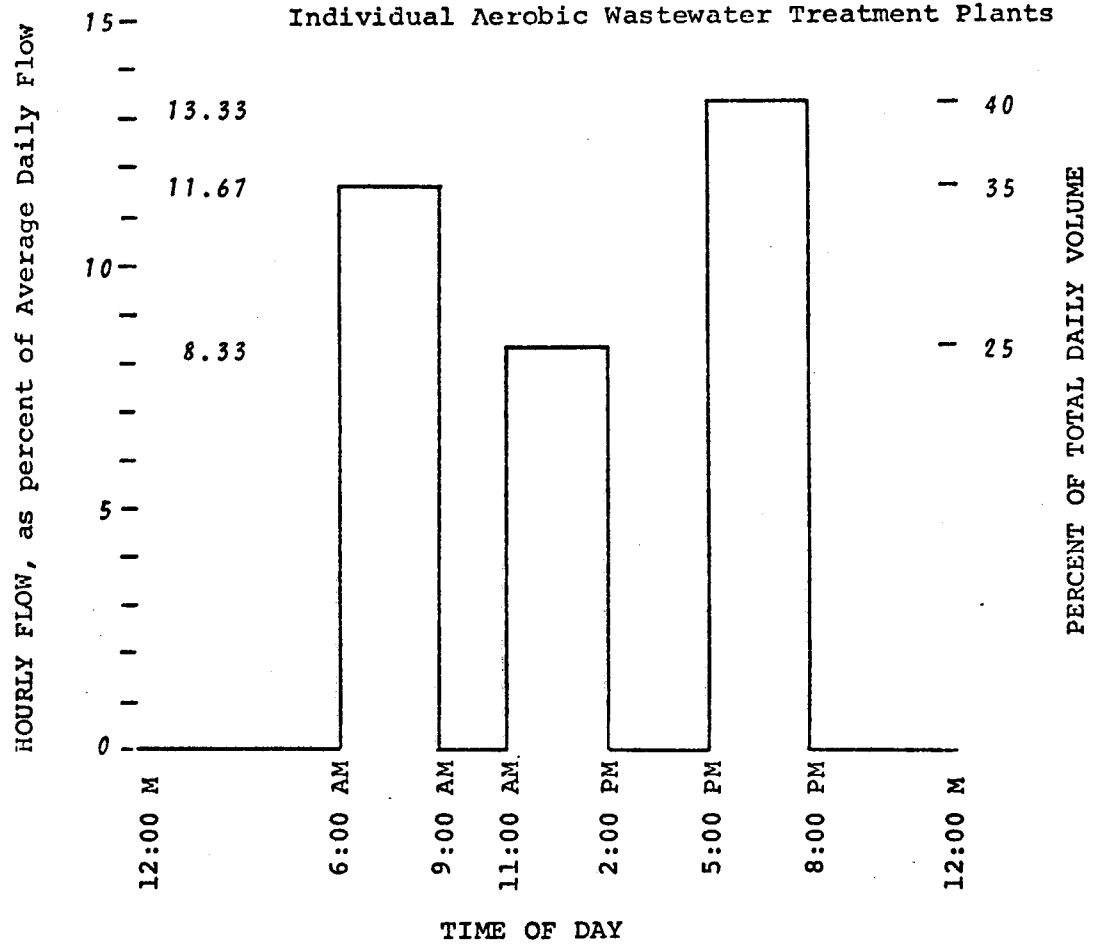

FIGURE 2

NATIONAL SANITATION FOUNDATION TESTING LABORATORY
STANDARD NO. 40 - INDIVIDUAL AEROBIC WASTEWATER TREATMENT PLANTS

Week Beginning _____ Plant Code _____

Flow	gpd					
Dissolved Oxygen mg/l 12:00 noon	mixed liquor					
	effluent					
Temperature °C 12:00 noon	influent					
	mixed liquor					
	effluent					
pH	influent					
	mixed liquor					
	effluent					
Biochemical Oxygen Demand mg/l	influent					
	effluent					
Suspended Solids mg/l	influent					
	effluent					
	mixed liquor					
Volatile Suspended Solids percent	influent					
	effluent					
	mixed liquor					
Settleable Solids ml/30 min.	mixed liquor					
Color	effluent					
Threshold Odor	effluent					
Oily Film	effluent					
Foam	effluent					

FIGURE 3

	Biochemical Oxygen Demand (5-day) mg/l	Suspended Solids mg/l
CLASS I	20	40
CLASS II	60	100

EFFLUENT REQUIREMENT

VALUES NOT TO BE EXCEEDED MORE THAN 10 PC OF THE TIME.

FIGURE 4

EFFLUENT REQUIREMENT

CLASS I

(Dilution 1:1000)

COLOR	15 UNITS, MAXIMUM
THRESHOLD ODOR	3 UNITS, MAXIMUM
OILY FILM	NONE VISIBLE
FOAM	NONE

Among other requirements in Standard No. 40 is the requirement that the plant be equipped with an alert mechanism to call attention to equipment failure -- generally the blower, or high water levels.

A unique feature of the Standard is its focus on support information and service. The design and construction of a unit are not equal to the treatment task if proper installation, operation, maintenance and service are not assured. Consequently, the manufacturer's responsibility becomes an essential aspect of the evaluation. He must supply an OWNER'S MANUAL which details the process operation, shows the plant design and flow. It must include the necessary warranty and service policies. Instructions for OPERATION and MAINTENANCE must be clear and concise.

A visible label must be applied to the plant control system providing instructions for obtaining service.

A recurrent issue is DEPENDABILITY. Our test program can demonstrate dependability of the process and its parts but not the homeowner's ability to keep the plant in operation. The Standard makes additional requirements of the manufacturer that are intended to help keep the plant in service. There is the required one-year warranty on materials and parts. He must provide a policy covering replacement of parts; include a two-year service program upon installation; make available a continuing service program; maintain an inventory of standby parts; and maintain a service competance that will fill a request within two days.

The user's responsibility is also stated. This cannot be a condition of the evaluation, but most of the elements of the Standard can be promulgated as a control agency regulation by adoption or by reference.

The testing program does not answer all questions but it is an orderly approach to the solution of a problem rampant with conjecture and confusion. It is only a beginning effort and there are many other efforts being brought forth. What is needed is a focal point; coordination must marshal all effort toward some well-defined goals because there is a desperate need to solve the problem of homesite waste treatment.

THE NSF PHILOSOPHY

1. The Foundation exists to bring regulatory agents and manufacturers to a common base of understanding and agreement. NSF Standard No. 40 is a product of this.

2. The test program does not guarantee performance under field use conditions but it does provide a known, standard, uniform condition against which all plants and processes can be evaluated. It provides a reliable body of data, unbiased and true, which indicates that this is how the plant performed under these conditions.

3. The Standard encourages an awareness on the part of the user as to what he should expect of the plant he purchases.

4. The Standard has encouraged the manufacturer to accept the fact that his role is far greater than merely affering a product for sale and discharging his responsibility with that sale.

QUESTIONS AND ANSWERS

Q. Does your organization publish comparative tables of data indicating the performance of various types of systems?

A. We publish data on individual projects; it is not comparative, but there is no reason why comparisons cannot be developed without identifying specific manufacturers. If you are interested in a product which has been tested at NSF, that data is available. But to compare one with another is something we would not do unless it is in a very general way, as in a professional paper, which does not reveal the manufacturer.

Q. Do you think the staff of 65 which is divided up among the many different areas can avoid bias? What kind of outside review or expertise do you utilize?

A. I don't know how bias would be introduced. The 65 people are employees of the Foundation; they are fundamentally scientists and are professional people held in high regard. The standards and criteria are developed by a large group of people brough together from the university, from the manufacturer's area, from the regulatory agencies. We have a Council of Public Health Consultants who are among the most distinguished environmentalists, medical and public health administrators in the country. Proposed standards and criteria pass through their hands. To uphold the integrity of the Foundation is a matter of concern because if that integrity is maligned in any way, then the value of our work is very limited.

Q. Why don't you make an effort to test these plants under more average conditions of a home plant? Basically the problem is more in the type of effluent going into a home plant and not that which is coming from a sewer line.

A. I agree with you. We are doing what we are able to do. If we could mount a research project with funded support, it would permit us to do this. We are trying to approach this issue ourselves and I have my staff working on ways in which we can enhance the waste to more closely resemble household waste. At the same time, the University of Wisconsin is doing a study. They are actually trying to characterize what happens in the household and through computer systems stress the plant and apply the waste in the same manner that it would happen in the household. It is important to maintain a controlled situation. The National Bureau of Standards is trying to set up a standard for a test material, for example. There are many groups pursuing studies. We do not initiate very much; we are

not really able to. What we do is to be responsive to the needs and ideas of others and carry them out.

Q. Hasn't the history of home plants been a problem when they get in the field, not in laboratory tests? I have seen all kinds of laboratory tests that are perfect.

A. I don't know. I see alot of laboratory tests, but they are not really qualified. I don't know what they really mean. I think that this is one of the difficulties that every manufacturer has in presenting test data. I am not saying that the NSF program meets every issue, but it does demonstrate how the plant performed under specific conditions. Hopefully, we will arrive at a point in time when we can get closer to reality.

Q. How do you control the end product of your research program so that it wouldn't compete with any of your clients?

A. First of all, we do not have any research programs.

Q. Your initial effort was research and education. Is it published for public information or do you license the use of it?

A. No, the research that we would undertake is for developmental purposes. For example, the test site was provided by a federal grant that was close to a third of a million dollars. It exists on federal property today, EPA land.

Q. It must be very tempting to say now this unit is almost right if they would just do this. You see that and document it. And this man goes somewhere else a year later with that information. You must find improvements on all these test units. How do you control that?

A. We work with a plant and when we find that there are deficiencies and problems we make recommendations to the manufacturer to correct them.

Q. Is that what you do -- merely make the recommendations? What is confidential?

A. Nothing is confidential.

LAND USE IN COLORADO

by

Harry A. Cornell
Secretary: Colorado Land Use Commission

INTRODUCTION BY NORMAN A. EVANS

In 1970, the Colorado general assembly made provisions for a land use commission to be established. In doing so, it placed the state out in front nationally in formalizing an effort to establish statewide land use regulations. This was done in response largely to the explosion of mountain subdivisions; building in rural and inaccessible areas, the drive for people to get out from the urbanizing areas into the more remote rural areas. I don't know how correct the figure is, but I have heard around five million acres in this state are under subdivision plans. But in any case, in response to that tremendous pressure, the Colorado Land Use Commission was appointed by Governor Love in 1970.

You and I are here today because the common problem we face in one way or another -- in our professional work or our daily work, or other interests -- is in home waste disposal. Part of this reason why it is important enough for us to come together here today also relates to mountain subdivision; the pressure for vacation homes; homes not serviced by public sewer and waste disposal facilities. So we have come together to talk about the problems of home waste disposal, particularly septic tanks and others. It seemed to us that it would be appropriate, because of the commonality of our interest, to invite the secretary of the Colorado Land Use Commission to join us at lunch and give us a review of progress and status of the program that agency is developing.

Our speaker is a consulting engineer of long time residence in Colorado, but a native of Wyoming; he is a graduate of Colorado State University, of which we are indeed particularly proud -- a civil engineering graduate of about 1951. He has been a representative of the Portland Cement Association in this area for a number of years before going into the consulting engineering business. He is, of course, a member of the professional organizations which most all of you would recognize: ASCE, APWA, WPCA, and NSPE. It is a real pleasure to welcome to the podium Mr. Harry Cornell, Secretary of the Colorado Land Use Commission.

(Mr. Cornell provided the notes he used as luncheon speaker for enclusion in the proceedings. It is a chronological description of the land use activities in the state since the passage of the 1970 Act. - Editor).

1970

THE COLORADO LAND USE ACT OF 1970

- CREATED THE COLORADO LAND USE COMMISSION WITHIN THE OFFICE OF THE GOVERNOR

- DIRECTED THE LAND USE COMMISSION TO STUDY THE LAND USE SITUATION IN COLORADO AND MAKE RECOMMENDATIONS BY DECEMBER 1970

DECEMBER 1970 "RECOMMENDATIONS" REPORT

- RETAIN LOCAL CONTROL OF LAND USE WHERE POSSIBLE
- EVERY COUNTY SHOULD BE REQUIRED TO HAVE A PLANNING COMMISSION
- EVERY COUNTY SHOULD BE REQUIRED TO ADOPT SUBDIVISION REGULATIONS
- FUNDS SHOULD BE PROVIDED FOR THOSE COUNTIES LACKING PERSONNEL OR MONEY TO SET UP A PLANNING COMMISSION
- COLORADO'S LAND USE SYSTEM AND PLAN SHOULD BE A FOUR-PART STUDY PROGRAM:
    - MANAGEMENT MATRIX -- A DOCUMENTATION OF EXISTING LAND USE POLICIES AND CONTROLS AT ALL LEVELS OF GOVERNMENT
    - ENVIRONMENT MATRIX -- A COMPILATION AND ORGANIZATION OF ALL EXISTING INFORMATION AND KNOWLEDGE ABOUT MAN'S LAND USE ACTIVITIES AND THEIR IMPACTS ON THE ENVIRONMENT
    - LAND USE IMPACT MODEL SYSTEM -- A SYSTEM FOR PREDICTING LAND USE IMPACTS ON NATURAL AND MAN-MADE ENVIRONMENTS, USING INFORMATION GATHERED FROM:
    - THE GROWTH MONITORING (SURVEILLANCE) SYSTEM -- WHICH WOULD BE A CONTINUING COLLECTION OF RECORDS OF CHANGES IN LAND USE ACTIVITIES. THIS INFORMATION WOULD COME FROM AGENCIES WHICH CURRENTLY DO ROUTINELY COLLECT AND RECORD SUCH CHANGES -- TAX ASSESSORS, AGENCIES WHICH GRANT BUILDING PERMITS, ZONING CHANGES, AND SUBDIVISION APPLICATIONS, ETC.

1971

LEGISLATION RESULTING FROM "RECOMMENDATIONS" REPORT

- SENATE BILL 91: THE REVISED COLORADO LAND USE ACT OF 1971
- SENATE BILL 92: REGARDING SUBDIVISION REGULATIONS
- SENATE BILL 93: THE COLORADO PLANNING AID FUND ACT OF 1971

THE REVISED COLORADO LAND USE ACT OF 1971

- LAND USE CONTROL TO REMAIN AT LOCAL LEVEL
- LAND USE COMMISSION TO DEVELOP MODEL SUBDIVISION REGULATIONS
- LAND USE COMMISSION TO COMMENCE TO STUDY STATE LAND USE ACCORDING TO PLAN PROPOSED IN "RECOMMENDATIONS"
- LAND USE COMMISSION TO WORK WITH DENVER ORGANIZING COMMITTEE ON COMMUNITY IMPACTS RELATING TO 1976 OLYMPICS
- LAND USE COMMISSION TO DESIGNATE FLOOD PLAINS AND DEVELOP CONSTRUCTION CONTROLS ON FLOOD PLAINS
- LAND USE COMMISSION TO CREATE AN "ADVISORY COMMITTEE" TO PROVIDE PUBLIC INPUT
- LAND USE COMMISSION GRANTED "TEMPORARY EMERGENCY POWERS" REGARDING LAND USE ACTIVITIES WHICH CONSTITUTE DANGER TO PUBLIC SAFETY OR THE ENVIRONMENT
- LAND USE COMMISSION TO SUBMIT A PROGRESS REPORT IN FEBRUARY 1972

SENATE BILL 92 REGARDING SUBDIVISION REGULATIONS

- EVERY COUNTY REQUIRED TO ESTABLISH A PLANNING COMMISSION
- EVERY COUNTY REQUIRED TO ADOPT AND ENFORCE SUBDIVISION REGULATIONS, INCLUDING PROVISIONS ON:
  - OPEN SPACE, SCHOOLS, UTILITIES
  - STORM DRAINAGE PLAN STANDARDS
  - SEWAGE STANDARDS
  - SOIL PERCOLATION RATES
  - WATER SYSTEMS STANDARDS
- EVERY SUBDIVIDER REQUIRED TO SUBMIT DATA, SURVEYS, ANALYSES, ETC., ON:
  - PROPERTY OWNERSHIP
  - SITE CHARACTERISTICS -- GEOLOGY, VEGETATION, STREAMS, SOILS, ETC.
  - SUBDIVISION LAYOUT AND KEY FIGURES
  - ESTIMATES ON WATER AND SEWAGE CONSUMPTION RATES AND REQUIREMENTS
  - ESTIMATES ON WATER AND SEWAGE AND UTILITY CONSTRUCTION COSTS, AND PROPOSED METHODS

SENATE BILL 93: THE COLORADO PLANNING AID FUND ACT OF 1971

- ESTABLISHED FINANCIAL ASSISTANCE FUND FOR PLANNING AREAS IN "CRITICAL" NEED. APPROPRIATION: $200,000.

SUMMER OF 1971

TASK FORCE WORKSHOPS

TASK FORCE IDEA CREATED BY LUC; COMPRISED OF DIVERSE INTEREST GROUPS:

- Colo. Assn. of Commerce and Industry
- Colo. Cattlemen's Assn.
- Colo. State Assn. of County Commissioners
- Colo. Farm Bureau
- Colo. Municipal League
- Colo. Open Space Council
- Colo. State Grange
- C.S.U. Extension Service
- League of Women Voters
- Rocky Mountain Center on Environment
- Rocky Mountain Land Developers Assn.
- Rocky Mountain Farmers Union
- Soil Conservation Districts
- Soil Conservation Service

30 SUMMER WORKSHOPS THROUGHOUT COLORADO; MORE THAN 3000 ATTENDED

PURPOSE: TO IDENTIFY LOCAL ISSUES AND AREAS OF URGENT CONCERN

AREAS OF URGENT CONCERN:

- SUBDIVISION ACTIVITIES

ALSO:

- CHANGING LAND USE PATTERNS
- PRESSURES ON NATURAL RESOURCES
- AIR, WATER POLLUTION; SOLID WASTE
- ECONOMIC IMPACTS
- TRAFFIC CONGESTION
- FLOOD PROBLEMS AND OTHER NATURAL HAZARDS
- UNSTABLE SOILS AND GEOLOGY
- INADEQUATE UTILITIES

FEBRUARY 1, 1972, PROGRESS REPORT

- RETAIN LOCAL CONTROL OF LAND USE WHERE POSSIBLE

- STRONGER SUBDIVISION REGULATIONS NEEDED, TO BOLSTER LOCAL ENTITIES' ABILITY TO CONTROL LAND USE

- MANAGEMENT MATRIX PRINTED; STATUS OF ENVIRONMENT MATRIX, IMPACT SYSTEM, AND SURVEILLANCE SYSTEM DESCRIBED

- FLOOD PLAINS IDENTIFIED AND MAPPED AND CONTROLS ON CONSTRUCTION RECOMMENDED

- MODEL SUBDIVISION REGULATIONS, AS REQUIRED BY SENATE BILL 91, WERE PRINTED IN DECEMBER 1971

- MODEL SUBDIVISION REGULATIONS HAVE BEEN REVISED IN SPRING 1972, TO CONFORM TO NEW REQUIREMENTS AS STATED IN SENATE BILL 35, THE 1972 SUBDIVISION REGULATIONS ACT

1972 LEGISLATION RESULTING FROM PROGRESS REPORT

- SENATE BILL 35, REGARDING SUBDIVISION REGULATIONS:
  - ALL COUNTIES MUST ADOPT SUBDIVISION REGULATIONS IN CONFORMANCE WITH S.B. 35 BY SEPT. 1, 1972
  - "SUBDIVISION" HAS BEEN REDEFINED
  - NO ONE MAY SELL LAND UNTIL THE FINAL PLAT HAS BEEN APPROVED AND RECORDED BY THE COUNTY COMMISSIONERS
  - NO PLAT MAY BE APPROVED WITHOUT PROOF OF ADEQUATE WATER, ADEQUATE SEWAGE, AND SUITABLE SOILS
  - SUBDIVIDERS MUST PROVIDE "PERFORMANCE GUARANTEES" FOR PUBLIC IMPROVEMENTS
  - SUBDIVIDERS MUST PROVIDE FOR OPEN SPACE AND SCHOOL SITE DEDICATION OR CASH IN LIEU
  - COUNTY COMMISSIONERS MUST SEND COPIES OF ALL PLANS AND PLATS TO APPROPRIATE AGENCIES AND TO THE LAND USE COMMISSION
  - COUNTY AND MUNICIPAL OFFICIALS MUST SEND APPROPRIATE RECORDS OF ALL LAND USE CHANGES TO LAND USE COMMISSION -- FOR GROWTH MONITORING SYSTEM
  - OTHER REQUIREMENTS FOR COUNTIES' SUBDIVISION REGULATIONS:
    - GEOLOGIC IMPACT STUDIES
    - IDENTIFY AREAS OF RADIATION HAZARD
    - SOILS ANALYSES
    - EVIDENCE OF WATER RIGHTS, QUANTITY, QUALITY, AVAILABILITY, AND AMENABILITY TO PROPOSED USE
  - IN SUM: "EVIDENCE OF SOUND PLANNING AND ENGINEERING"

- SENATE BILL 36, THE LAND SALES ACT OF 1972: DID NOT PASS

WHAT NEXT?

SUMMER OF 1972

MORE SUMMER TASK FORCE WORKSHOPS

- REMEMBER THE LAND USE COMMISSION'S LEGISLATIVE CHARGE:
  - TO DEVELOP A LAND USE PLAN AND MANAGEMENT SYSTEM FOR THE STATE OF COLORADO
  - "INTERIM PLAN" IS DUE BEFORE THE GOVERNOR AND THE GENERAL ASSEMBLY IN JANUARY 1973
  - FINAL PLAN IS DUE IN DECEMBER 1973
- THIS YEAR'S SUMMER TASK FORCE WORKSHOPS:
  - LAND USE COMMISSION BRINGS MAPS AND MANAGEMENT POLICY DOCUMENTS TO COUNTY AND MUNICIPAL OFFICIALS
  - SIT AROUND TABLE AND BRAINSTORM: "WHAT DO THESE MAPS AND DOCUMENTS TELL YOU ABOUT YOUR COUNTY OR YOUR MUNICIPALITY? IS THIS THE WAY YOU WANT TO GROW (OR NOT GROW)?"
  - OFFICIALS AND CITIZENRY DECIDE WHAT DIRECTION THEY WANT THEIR COUNTY OR TOWN TO TAKE, BASED ON FEASIBILITIES IN ALL DATA ASSEMBLED

AUTUMN OF 1972

LAND USE COMMISSION ASSEMBLES MATERIALS FROM WORKSHOPS INTO DRAFT "INTERIM PLAN"

JANUARY 1973

LAND USE COMMISSION SUBMITS "INTERIM PLAN" TO GOVERNOR AND LEGISLATURE, ALONG WITH POSSIBLE LEGISLATIVE PACKAGE

DECEMBER 1973

SUBMIT FINAL PLAN

1974

BEGINNING OF IMPLEMENTATION AND CONTINUAL UP-DATING OF PLAN AND MANAGEMENT FOR ORDERLY GROWTH IN COLORADO

SUMMARY

1970: FIRST LAND USE ACT, ESTABLISHING LAND USE COMMISSION

"RECOMMENDATIONS" REPORT OF DECEMBER 1970

1971: THREE PIECES OF LEGISLATION RESULTING FROM "RECOMMENDATIONS":

REVISED LAND USE ACT, EXPANDING LUC LEGISLATIVE CHARGES

SUBDIVISION REGULATIONS ACT -- A FIRST STEP

PLANNING AID FUND ACT TO HELP AREAS OF "CRITICAL PLANNING NEED"

SUMMER TASK FORCE WORKSHOPS

1972: FEBRUARY PROGRESS REPORT, URGING STRONGER SUBDIVISION REGULATIONS

SENATE BILL 35, ESTABLISHING STRONGER SUBDIVISION REGULATIONS

SUMMER WORKSHOPS SCHEDULED FOR INPUT INTO "INTERIM PLAN"

1973: "INTERIM PLAN" TO BE PRESENTED TO GOVERNOR AND LEGISLATURE

FINAL PLAN DUE IN DECEMBER

1974: IMPLEMENTATION OF COLORADO'S LAND USE PLAN AND MANAGEMENT SYSTEM

DISCUSSION GROUP SUMMARIES

HOME SEWAGE DISPOSAL IN COLORADO

DISCUSSION QUESTIONS

The group discussions are organized to provide three discussions which center on regulations and three which center on technology. The questions stated below are to serve to generate the initial discussion. Although the groups are titled either regulation or technology, the topics are not mutually exclusive; therefore, it is expected that the discussions will cross general topic areas.

Regulations

1. Would the licensing of installers help regulate home sewage disposal and would the licensing be acceptable to the industry?

2. What should county and state home sewage disposal regulations contain?

3. How will the current push toward land use regulation affect home sewage disposal?

4. Installation inspection and control are time consuming processes. What are the alternatives? (More regulation of existing laws, new laws, etc.)

5. Is the existing coordination between federal, state and county regulation efforts sufficient? If not, how can this coordination be increased?

6. What is seen as the most pressing problem with respect to regulation of home sewage disposal systems?

Technology

1. Do aerated package units in their present form provide acceptable treatment? If not, how could their design be modified to provide better home sewage disposal?

2. Are septic-aerated units in series feasible?

3. Is surface disposal feasible?

4. What is the future of evapotranspiration systems?

5. How can drainfield design be improved for mountain installations?

6. What is seen as the most pressing need with respect to technological developments in the area of home sewage disposal?

DISCUSSION SUMMARY - GROUP I

by

Heinz B. Russelmann

This workshop group had a tremendous diversity of interests. We were primarily concerned with the quality of the work of installation and performance. We directed ourselves to the question of licenses and inspection and control. The following comments are a sense of the discussion.

First of all, control of installation and performance is essential. It is probably most practical at the county level.

Apparently there are problems with regard to the quality of installation. These problems involve the integrity of the installer and his competence to do the job -- his understanding of the technology and problems involved. Whether one refers to "licensing" or "registration" may be an issue but the discussion group preferred the term "registration" and identified these advantages: First of all, registration to work in an area identifies the person or the company that is doing the work. This establishes him as a reputable business man in that community. Also, registration provides an avenue for communication whereby orientation to local regulation and problems becomes possible and even training to some degree would be possible. This would also fix responsibility because more responsibility must be assumed by the installer, not only for the structural aspect, but for the performance itself. There must be some practical limit as to how long he assumes this responsibility. Stronger mechanisms for fixing this responsibility are desirable. Registration could provide a means to enforce responsibility through exclusion if his performance or assumption of responsibility is not adequate.

Registration or licensing requires a standard or guide by which to measure conformance. Generally any standard that is set becomes a minimum to which people adhere. Therefore automatically there is adopted a fairly low level of performance expectancy. Furthermore, there has to be uniformity, certainly, among communities in their requirements. There is also the possibility that reliance upon registration would take the place of actual inspection, or design approval.

The discussion group concluded that inspection of the actual facility is necessary, and while it is time consuming it affects the cost of doing the job. This can be self-supporting through a fee schedule; therefore the administrative procedure that involves inspection can be taken care of at a local level.

In turning to the pressing problems and issues that need to be addressed, the group came up with some of these thoughts: Criteria have to be developed for achievement in homesite waste disposal technology without encumbrance by regulations or hardware. These criteria need to be responsive to planning in the general area. It is essential to know what needs to be done rather than blindly scrutinize

the hardware that is going to be used to do the job when that job has not been defined. Criteria for homesite waste disposal must be identified before hardware can be responsive to the task.

Performance criteria need to be tailored to regional problems and, therefore, will have to emerge from environmental planning. The problem of sewage disposal cannot stand by itself anymore, but is ultimately related to other land use considerations.

In the matter of cost, it appears that some manufacturers are trying to compete with septic tank installations by offering solutions to problems at the lowest possible cost, and yet this does cause problems in the quality of installation and design. It is necessary to get away from the idea of meeting sewage disposal problems at lowest cost. We should set out requirements to meet environmental needs first. Then installations have to be accomplished at more realistic cost levels if they are to utilize the kind of equipment that will do the job that is intended. The cost has to be consistent with the value of the environmental protection that results from the installation that is made.

The institutional setting within which control takes place is very important and needs to be looked at. The study at the University of Wisconsin, which is sponsored by the Upper Great Lakes Regional Commission and the state of Wisconsin, does address itself to the question of the institutional setting. This concerns itself with the kind of organization of people or local officials that can provide for the control of the installation, operation, servicing and repair in a way that the user's responsibility, and the user's participation and interest's can be assured.

DISCUSSION SUMMARY - GROUP II

by

Jack B. Jenkins

I will apologize to start with because I don't think I am as good a speaker as Mr. Russelmann, but we did manage to cover all six points set forth in discussion and I will go down the list.

Number one was whether installers should be licensed or not? It was the general opinion of the group that they should be either licensed or have some kind of a permit system set up for installers, and if this was done (it is being done in two counties that were represented in my group) and if this is done, possibly, as Mr. Russelmann said, a list of requirements should be met, formal procedures set up for possibly training these installers, and most of the points that Mr. Russelmann covered, we had actually covered also.

The second category was what should county and state home sewage disposal regulations contain? This is a very difficult subject to talk about. It was the general consensus that regulations should contain definitions, mechanics of the regulations, and implementation of the regulations. Now, how this is going to be done, we are not experts in this field and we really could not come up with any further suggestions along these lines. They did feel that the state should not be any less stringent than 526 and the counties should at least meet these minimums or exceed them in some cases.

Number three, how will the current push towards land use regulations affect home sewage disposal? Again, this would depend on what type of regulations were set up, whether these regulations actually encourage, and here we are talking about, as far as I'm concerned, home operation plants. We would also be talking about septic tanks, of course, but I am in the home aeration business so I would rather talk about home aeration plants, but if the regulations set up would encourage home aeration plants or septic tanks, of course, you are going to have more use of all these lines. The group felt that there should be more uniformity throughout the counties on this particular regulation, if indeed these regulations are passed. If this would be an acceptable type of treatment as far as home aeration was concerned, these things would have to be done.

One county that was mentioned, I think the other day, someplace in the east, I forget who brought it up, but it was suggested that counties could provide, for instance on septic tanks and home aeration plants if it was deemed that they should be pumped at say a certain number of years. Counties could provide pumping service for these home disposal systems and the people assessed a certain amount of money on an annual basis or a bi-annual basis, or whenever the tanks were pumped. This is actually being done, according to one person, someplace in the east, and I don't know where this is.

Number four, installation inspection and control are time consuming processes. I think that this was brought out by Mr. Russelmann and we feel about the same way, or our group though about the same way. Some of us agree that the state should set minimums and authorize counties to regulate their own particular situations. I feel strongly about this, and a couple of the others felt more or less the same way - that the state should set up a regulation or a guideline and then delegate authority to the counties to set up their own ordinances because each county has their own problems. If a state sets up a very stringent regulation and says that this is how you have to do this, this, and this, it is certainly going to hurt a local situation. A local county cannot cope with this kind of a regulation. As far as existing laws, we have got to have existing laws that have teeth in them and in areas where they have no existing local laws, these laws are going to have to be passed and there are no alternatives to inspection and controls. In some cases we are going to have to have more. I doubt very seriously whether we have too many areas where there are too few inspections and too few actual controls.

Number five, is there existing coordination between federal, state and county regulations and is their effort sufficient? And, I think that everybody agrees that they are not. There should be more of an attempt to coordinate. I don't know about federal. I think possibly that state and county are more important and were discussed more than federal, but certainly there should be more coordination and this would have to do with lines of communications, just like we are having today, like the symposium Monday with the Water Pollution Control Commission. Education of the general public would be another way of doing it. These things have to be done on a continuing basis to get better coordination between the governing bodies.

Number six, what is seen as the most pressing problem with respect to regulation of home sewage disposal systems? I think it was in general agreement as far as home aeration is concerned, the state is going to have to implement design criteria, specifications, and require performance data from the manufacturer. It was felt that the state should not have to supply testing data and so forth, on thes home aeration plants, but it should be done by the manufacturer, as the burden of proof lies with the manufacturer. All plants should be scruntinized and inspected for sound engineering practices. This should be done on the state level by the state engineering department.

I think that covers all six of the items.

DISCUSSION SUMMARY - GROUP III

by

Raymond O. Nordstrom

1. Would the licensing of installers help regulate home sewage disposal and would the licensing be a-ceptable to the industry?

   First of all on question number one would licensing installers help regulations? We came to the consensus that it would. All installers should be licensed. The basic statutory laws state that this would be more or less approved on a voluntary basis. Now, it was also added that there would be different types of installers. Also that there would be more responsibility to the installer.

2. What should county and state home sewage disposal regulations contain?

   We definitely hit on Senate Bill 35 and the criteria used by public health publication series, number 526, for county and state home sewage regulation. We are sure there are not any county regulations in the state of Colorado that do not contain publication number 526 in their regulations.

3. How will the current push toward land use regulation affect home sewage disposal?

   We came to the conclusion that one needs to be sure that the lot is buildable and that the regulations, as they are coming up now, implies that we are to scatter out, that this is the way to go. But by using these regulations this is what we came up with if the lot is buildable.

4. Installation inspection and control are time consuming processes. What are the alternatives? (More regulation of existing laws, etc.).

   1. The installer must sign and affidavit, a permit issued and installed according to regulations.

   2. All installers should be bonded.

   3. The law should be updated so that the program itself is self-sustaining.

5. Is the existing coordination between federal, state and county regulation efforts sufficient? If not, how can this coordination be increased?

   Well, to come right out, if not, how can this coordination be increased? Well, one gentleman in our group pointed out that all three are not coordinating. In other words, neither federal, state or county. Now he pointed out that one party ought to have the final approval. In other words, this should be either up to

the state or to the county to make that final approval. One other person commented that the federal ought to step in and update Septic Tank Manual 526, and that this would help.

6. What is seen as the most pressing problem with respect to regulation of home sewage disposal systems?

Don Marmande brought this up that number one was denial of the permit. This was the most pressing problem that was confronting him. We had others in our group who also agreed with him that what to do next is the problem. The alternate, and should I say the final one, was that he cannot build. And then we had one other gentlemen who brought up licensing, and the need for work on this. The installer should be licensed and get bonding, and also all of this should be on the state level.

TECHNOLOGY DISCUSSION SUMMARY - GROUP IV

by

Ron Schuyler

The technology discussed in our group was very limited due to time, therefore not all topic areas were discussed.

Just to stay with the program, we first talked about question number 1, "Do aerated package units in their present form provide acceptable treatment?" It was the consensus of opinion that the answer is NO, even though we had no strict definition of "acceptable treatment." "Acceptable treatment" will have to be defined before enforcement and designer-manufacturers can agree on whether or not a certain unit can be used in any specific situation.

In general it was felt that the following would improve individual waste treatment systems:

a. design systems for a minimum of operation and maintenance.

b. the seller should always provide adequate operation and maintenance instructions.

c. a maintenance contract should be required since the normal householder does not usually want to operate a sewage treatment system.

It appeared as though system sizing and shock loads were the biggest design concerns of the group. The question of how to size a system for an average home was discussed, but no answers were found since no home is really an average home. How to handle shock loads was also unanswered, but the general feeling was that shock loads would show less effect on a large system. Some members felt that physical-chemical treatment methods would have advantages when considering shock loads, but economics and sludge disposal limit their effective use.

While moving into question number 5 we got side-tracked into a discussion of the use of USPHS publication No. 526. It seemed as though no one was over-joyed by having to use 526 as a guideline. This was especially true with mountain subdivisions where it was pointed out by many that new concepts and ideas are needed to assure proper treatment of waste. Ideas for improved mountain leach fields included using trenches, exclusively, rather than beds; replacing in place subsurface materials with other materials better suited for the job; and changing the characteristics of in-place materials by removing, replacing and compacting.

Little time was left to discuss the most pressing technological needs, but the discussion centered around the fact that the proper

technology cannot be developed until there is a definition of adequate waste treatment.

I would like to thank the guys in this group for a very interesting and lively discussion.

DISCUSSION SUMMARY - GROUP V

by

Edwin R. Bennett

The panal represented a good cross-section of the people interested in this field, including two manufacturers' representatives, several health department people on all levels, and a couple of college professors.

The first question that was discussed was, "How is day by day control accomplished with individual aerobic units?" This question we left primarily to the manufacturers' representatives. Their conclusion was that it is very difficult to maintain close control and the units must inherently be such that they do not need very much day by day control and they must be essentially fool-proof. It was brought out that the pollutional characteristics of the influents may be quite different from application and that this should be very carefully considered. The pollutional characteristics of the influents may be very different than the test conditions in, say, an NSF test. This is particularly true if commercial waste flows are present, such as restuarants. The influent characteristics are extremely important.

We then considered the question of discharges, and how the discharges from aerobic units should be handled. The panel discussed discharging from the aerobic unit directly into the stream, and at least in this group, no one was in favor of this. Leaching fields similar to those used with septic tanks to follow the aerobic unit were discussed and this method was a generally acceptable technique. It was brought out that unit for unit, the aerobic unit costs approximately three times what an anaerobic septic tank unit costs. And therefore, if leaching field size standards are to be the same for aerobic units as with septic tanks, the application of aerobic units is going to be quite small. It was concluded that if the leaching field size requirement were approximately one-half of that for septic tanks, the cost of the two units would begin to become comparable.

We then discussed the feasibility of evaporation-transpiration systems for effluent discharge. It was brought out that there are a number of different ways of utilizing ET systems. One of these is the use of a lined trench with plantings such as blue spruce trees over the trench. This was described as an effective means of disposal. The question of water souce depletion in an aquifer was brought up and it was felt to be a very localized problem, one which should be considered with each basin or application. Also the question of salt build up in the ET systems was mentioned. It was presumed that this was slow.

The spraying into the air technique of effluent disposal for lawn irrigation was not favored by this particular group primarily because of the winter freezing problem and the potential aerosol transport of viruses. If the method is used, it should be applied in warm climates and the effluent should be disinfected prior to spraying.

We then looked at the question of pre-treatment. It was the general consensus that the pre-treatment unit should include a trash trap, grease trap, and a grinder. There was mixed opinion on the need for a pre-settling unit.

The idea was proposed, that the aerobic units should be designed in such a way that should the air source stop operating, the unit would function essentially as a septic tank for the off period, and this would be an acceptable short term means of operation.

It was also agreed that long design detention times are advisable. A figure of 48 hours detention time based on average flow was found to be favored by the panel. We came up with no good answers to the question of how to handle the week-end use situation except that the unit should not be turned off between uses.

Another idea that came up during the discussion was the possible treatment of the effluent through a technique that has been known for a long time but isn't very much used any more. That is the intermittant sand filter followed by surface discharge. This could be a box filter designed specifically for filtration of the effluent, with fairly high filtration rates. The unit could be similar to the type used in water treatment employing a filtration rate in the three gallons per minute per foot range. This was generally found to be something that the people in the study group felt was acceptable. Again, with disinfection of the effluent.

One last suggestion was that many of the people in the discussion were not completely familar with the units. It was suggested that a copy of the brochures of each of the manufacturers be included in the proceedings.

DISCUSSION SUMMARY - GROUP VI

by

Glen Paul

We had a very lively discussion, and I am glad to see that we did have a couple or three manufacturers, with three or four from the health departments, and we had one gentleman from the health department who has had quite a bit of experience, more so than my county, Weld county. So we will go down the line beginning with number one, but I want to thank the committee for the discussion.

First, we noted that we don't have any criteria. We should have criteria (standards) before we can say it is acceptable treatment. Who is going to accept it, maybe one county will and maybe one county won't, and the State Health Department says that you are both wrong. So we would like to see some criteria and standards set up before we do accept some treatment plants. We felt that under some good criteria that it could be acceptable, under controlled conditions, but we have to set up some standards before we would accept that.

Getting down to two, you have to consider whether it is feasible. It was thought that septic area units are feasible in series. Yes, in series they are feasible, in some parts of the state maybe yes while in others no. But I think that in general we could say that septic tanks in series are feasible.

This was a pretty lively group, and we had some pretty, not heated discussion, but this was lively. Getting to number three here, is surface disposal feasible? Well, if you know Weld county, the county where I come from, we have some country out there where it is five and six miles between houses, so what is wrong with a surface disposal when you are three or maybe four miles from your neighbor? And we have some people in the county where they are pretty closely populated, pretty dense, and we don't think that it is feasible there. Unless, we went through the sand treatment or chlorination or disinfectant, if you want to call it that. So, yes, we could say that number three is feasible in some places and maybe not in some others, and that we need some criteria and standards on it.

What is the future of evapotranspiration systems? I don't know. The future looks like there might be some criteria on that. We might have to accept it, we don't know how fast, and it looks like we in the area here where we are growing pretty doggone fast, that we might have to accept some standards that we don't want at the beginning, but we see that one of the health departments say that they have set up standards and are making some evaluation on it and they don't even meet their own. I think that we should have some standards set up there.

How can drain field designs be improved for mountain installations? We talked there on evapotranspiration and if designed properly and if you can control bacteria or your BOD, we considered what Dr. Waltz

mentioned about the water, I think that in certain areas we should consider it. We have been having rains here in June this year over in our county, we would like for it to let up for awhile.

Number six, what is seen as the most pressing need with respect to technological developments in the area of home sewage disposal criteria? I think that if we get the county, state and federal people together and get some criteria written that we can live with, then that is most important.

THE WORKSHOP IN RETROSPECT

by

Robert C. Ward

What have we accomplished today? After hearing the discussion summaries, I feel that there are just as many different opinions as to what the problems and solutions are as when we began this morning. Maybe our only achievement has been that we did get together and begin a dialogue.

I do believe that we are initiating the discussion that will eventually lead to some type of agreement among ourselves. I do not think that time has permitted us to reach an agreement today; however, we have made the first (and most difficult) step and are now going in the right direction. The symposium that the Water Pollution Control Commission held on Monday, the discussions at the Water Pollution Control Commission yesterday, and the workshop here today are all contributing to the beginnings of further work in the area of home sewage disposal. Already the Commission has directed that a committee be established to look at the possibility of setting up some type of standards or criteria for the regulation of aeration systems. This is one action that has resulted from these three days of activity. Hopefully this will stimulate other activities. The proceedings of this workshop today will serve as good reference material for anyone who is actively working on home sewage disposal in Colorado.

Looking beyond the fact that we should have agreement among ourselves on home sewage disposal, we have also got to have the understanding of everyone in the state. This refers to the fact that home sewage disposal affects many people who in turn have considerable influence on it. You have lawyers writing laws (Senate Bill 35) that say you have to have adequate home sewage disposal on a subdivision lot. What does the word adequate mean with respect to home sewage disposal? What did the lawyer have in mind when he wrote the law? We need to have some input to the lawyer so that as he writes laws he has an understanding of the limitations that we face. Likewise, we need to understand some of the legal problems so that we can have an appreciation of the lawyer's problems in writing laws. When we ask for a new law or new regulation, we must be sure that we communicate with the people doing the rewriting.

This same type of discussion could be extended to sociologists, economists, land use planners, etc. We must communicate with these different disciplines. For example, what is the social cause of a person knocking a hole in his home sewage disposal vault? Is it economic? Does this person have no respect for the environment? We need answers to these questions if we are to control home sewage disposal.

As we begin to communicate with people of other disciplines, we can begin to create the laws and criteria that reflect an awareness of the real world and the current technological state of the art. What are the real world problems? - a person dumping his sewage in a roadside ditch to avoid paying for its disposal? What is the state of the act

of our current home sewage disposal technology? Maybe society is asking for more than we can currently furnish at the price they are willing to pay. Our social development has out stripped our technological ability and this is creating problems. Many people can afford a mountain cabin, but not the home sewage disposal system.

Looking at the problem in this manner illustrates the crying need for more communication. Hopefully this communication will lead to more specific, more rational regulation, which can also be related very closely to the current technological state of the art of home sewage disposal.

So as we begin to identify and quantify the problems we have been talking about today, let's also explain our findings to people in other areas. There should be other workshops on home sewage disposal in which lawyers, legislators, sociologists, economists, etc., in addition to ourselves, also participate. This would help create the basis of communication among various disciplines. Maybe the next workshop in Colorado should be expanded beyond the limited role which this one has had. Let me caution, however, that before we do that, let's make sure that we know what we are talking about. Too many different opinions confuse the issue for people outside the technical range of home sewage disposal. So, we need to be very explicit in how er preceive the current technological state of the art and the existing problems of regulation. Only then will we be able to tell other people what we need and be very specific and clear in our explanations.

Also along this same line of thought, I didn't realize this morning when I mentioned land use planning as a side light, that I would feel at the end of the day that maybe that is one of the more crucial problems we face. Although we may have disagreements among ourselves as to what is home sewage disposal and how it should be regulated, it may be worthwhile to have some preliminary discussions with these other disciplines. This may help us get to the root of our problem alot quicker and will in turn help us get agreement among ourselves much faster.

I would now like to briefly go over the comments that have been made today. I feel that the speakers on regulation this morning outlined their position very well. I think that they presented the situation and their problems, and I think that this helped us all to get a better feel for regulation. Don Marmande discussed the county position, and I think he went over very clearly the relation of that to the state. I think that this relationship is crucial. I can appreciate the action, or the involvement that Don has in the evaluation of current regulations. I think that it is very important to all of us to get involved in developing regulations -- let's don't sit back and let someone else do it.

Fred Matter talked about the limitations which are placed on the regulatory people. They have certain laws in certain areas, but they don't have laws in other areas. Here again, I feel that maybe if we had a little more communication between the legislative and

administration branches of government, and the technological implementation of these laws, we might be able to simplify alot of our problems just by implementing the proper laws. So this is a very valid observation.

Paul Ferrero expressed a very candid description of EPA's position. It was a very, very good explanation of where they fit into this. I am glad to hear the EPA is looking at their relationship of home sewage disposal and that hopefully there will be more activity on their part.

I thought that the technological session was quite good. Dr. Morrison presented a very good discussion on simple microbiological limitations that we tend to forget about. He talked about weekend units and it seems that we tend to throw micobiology right out of the window. We are going to have to be very careful in using biological treatment. We must be aware of the biological limitations and their impact on individual home sewage disposal systems.

Jim Waltz presented a very thought provoking discussion on geological factors in mountain installations. There are many ramifications of having your home sewage disposal pollute your fresh water supply and from that standpoint I think that there is a good tie-in with what our luncheon speaker presented. There is apparently an effort under way to get at some of these problems. The developer has to have water and sewage disposal available. He has to define that before development ever occurs and I think that this is going to help eliminate some of these problems.

Dr. Mallmann presented an excellent review on some of the practical aspects of home sewage disposal drain field designs. There were some very interesting concepts presented in flushing out a drain field.

Heinz Russelmann, I thought presented a very comprehensive review of the NSF. I learned quite abit about their program that I didn't realize existed. I think that there is a need for much more of this type of testing in this field. I think that once we begin to get a data base (I'm not talking about a data base that would have each person doing a different study, but rather would have everyone tested under the same conditions) at least we will have some basis of comparison. Data, a good base, has to be developed before you can have good decision making. I see that as one of the major problems that comes out of the discussions today. There is alot of data, but is this good data and can it be used for decision making? I think not. I think there needs to be more data developed and it needs to be good data.

I thought that Harry Cornell presented some very stimulating thoughts; it was his thoughts that got me to thinking about bringing other disciplines in to a workshop in which we concentrated on home sewage disposal. I think that this is going to be required if we are ever going to get to the total environmental problem, but as I say, I still think that we have got some discussion to do among ourselves to get at our specific problems.

I think that the discussion groups went very well. I was quite pleased at the way everyone was distributed without any help whatsoever. It just seemed like everybody gravitated in such a way that each discussion had very good representation. You had what I would consider some very good discussions. I thought that the discussion chairmans did a very good job in presenting the results.

I want to personally thank all of you for making the effort to attend the workshop. I think that the only way it could have been a success is by having all of you here. I especially want to thank Dr. Mallmann and Heinz Russelmann for their extra effort because they had some a long way to attend out workshop in Colorado. I also want to acknowledge the discussion chairmen, most of whom I button holed in the hall today. We need to give them a great vote of thanks.

My only hope is that I will be able to capture in the proceedings the excellent dialog that has taken place today. I hope that all of you have learned as much as I did, and I hope that I can put it into the proceedings so that others can benefit from what we have done today. With that, I think I will adjourn the workshop and I want to thank you again for coming.

HOME SEWAGE DISPOSAL WORKSHOP
June 14, 1972

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