Feasibility of Concrete Septic Privies for Sewage Disposal in Anguilla, B.W.I.

STANLEY SEBASTIAN, M.Sc., and IVAN C. BUCHANAN

THE INHABITANTS of the small island of Anguilla share health conditions common to rural communities in the tropics. Many of the problems can be traced to poor sanitation practices. As one means of improving this situation, the Medical and Health Department conducted the experimental sewage disposal program reported here. The following background information may help give perspective to readers who are unfamiliar with this Caribbean island.

Anguilla is an island of 34 square miles, located in the northeast corner of the Caribbean. It forms part of a territory with two other islands, St. Kitts (St. Christopher) and Nevis, administered as one government with sovereign allegiance to the British Crown.

Anguilla was overlooked by Columbus and only found and colonized by the English in 1650 (1). The name "Anguilla" is supposed to denote the snakelike form of the island.

Anguilla has an absence of tropical vegetation, with no mountain ranges, no rivers, and consequently a low average rainfall of 40 inches per annum. Katherine J. Burdon in her handbook (2) stated: "The greater part of the island is uncultivated and except for a few coppices, is covered with a low lying shrub." Salt ponds are a feature of the island scenery, and these mostly attracted and accounted for the early settlers. Its panorama is one of low land with

Mr. Sebastian is the public health engineer and Mr. Buchanan is the chief public health inspector of the Medical and Health Department, St. Kitts Nevis Anguilla, British West Indies. scrub growth and ponds; with dotted cultivation and vegetables; with scattered but wellmade houses, more concentrated at the Valley, the main community, and its natural attraction is enhanced by the lovely beaches.

Health and Vital Statistics

The health of the population is administered by a Medical and Health Department, headquartered in St. Kitts. Anguilla has a hospital with 16 beds, a health center, and 3 health outposts.

At the census of 1960 the population was 5,568 with a crude death rate of 13.2 per 1,000 and an infant death rate of 72.1 per 1,000 (3).

It is now history that in 1928 the infant mortality rate of the territory of St. Kitts Nevis Anguilla was so high that it was questioned in the British Parliament. The figure for that year was 259 per 1,000 live births (4). In keeping with the axiomatic statement that the infant mortality rate of a territory is the yardstick of the environmental health, it is fitting to mention subsequent rates to indicate the state of the health of the island. In 1936 the infant death rate in Anguilla was 124 per 1,000 (5). In 1950 it was recorded as 96.6 per 1,000 (6) and in 1954 it was 66.6 per 1,000 (4). Though sanitation services were introduced in Anguilla in 1944 with the posting of the first public health inspector, all these rates are high and enable one to see a clearer picture of bad sanitation in many ways. The main cause of the infant deaths was gastroenteritis.

Marked progress in the health activities of the territory was realized in 1950. A new health law was enacted dealing with food, infectious diseases, insect control, offensive trades (such as industries producing offensive odors), and housing with special emphasis on latrine accommodations. A Central Board of Health was established to administer the law. A health plan to erect and establish health centers was initiated and for the first time the department studied, isolated, and defined the major health problems. A sanitation program was considered, with the aims of reducing the incidence of diseases due to bad sanitation and obtaining a marked reduction in the infant mortality rate.

In 1949 it was estimated that 90 percent of the dwelling houses in the territory had no satisfactory sanitary latrines. To meet this grave hazard the provision of sanitary latrines was

Figure 1. Design for septic privy made from 3-foot-diameter precast concrete cylinders for use in Anguilla, B.W.I.



Capacity is 220 imperial gallons for 1 to 5 persons. All joints in the concrete must be watertight to maintain an efficient 3inch waterseal with the hopper. The water level must be maintained and the privy flushed with 1—5 buckets of water daily. Sludge accumulation should be removed at periods of approximately 7 years, or earlier if it approaches a depth of 18 inches. placed under a plan controlled by Colonial Development and Welfare Agency and operated by the public health engineering unit, established under that agency. Later two United Nations agencies—WHO and UNICEF—began assisting the territory in its sanitation program.

By 1954 the achievements were significant enough for the chief medical officer to record in his annual report (4), "Good indications of the improvements in public health in recent years are the fruits that (a) in 1954 the general death rate and the infant death rate were the lowest mortality figures to be found in the hundred year old records. . . ." The crude death rate was 11.3 per 1,000. The infant death rate is aforementioned.

Geologic Factors

At the initial stage of the sanitation program the situation of Anguilla was the most difficult because of geologic features which hampered the work of well drilling for adequate and more palatable water and the installation of sanitary toilet facilities. The island is made up mainly of Miocene limestone resting on volcanic rock, according to Martin-Kaye's reports (6). He also explains that small deposits of clay are noticeable in the limestone, and fossiliferous rocks are evident at certain parts of the island. It is interesting to note in passing that phosphate deposits are to be found in caves and cavities in the limestone, and that phosphates were exported in the 1870's to the United States.

It follows from these comments on Anguilla's geology that the soil is most difficult to penetrate manually. This contributed to the poor sanitation and the resulting prevalence of intestinal diseases. The populace was resigned to this calamitous condition. The "clump of bushes" offered the necessary privacy for excreta disposal, and even in the preparation of a dwelling site the "clump of bushes" was left intact for use as a latrine.

The Sewage Disposal Program

A latrine census in 1956 showed that of a house population of 1,700 only 263 had a latrine of any type, including buckets or pails. It was at this time that an experiment was made at the central workshop at the headquarters of the Medical and Health Department in St. Kitts. The experiment involved the construction of a small septic privy with two concrete cylinders placed outside the house as are the gas cylinders used to supply the kitchen stoves. One unit was designed and installed at a selected household on St. Kitts for observation for a year. The septic privy was the best answer to many angles of the sanitation problem in Anguilla. The complete unit exclusive of the superstructure can be constructed for about U.S. \$42. It functions on a limited or inadequate water supply, it can be installed partly on the surface, and it can be so sealed as to be incorporated in or placed beside the home.

Adaptation. All piped supplies of water in the island are derived from wells, and the aquifers that yield these supplies are limestone. The widespread and unqualified installation of pits and bored-holes might lead to contamination of the supplies. An alternative answer had to be sought to prevent contamination. Coupled with this basic public health principle there was need for an easily erected structure which would be relatively inexpensive, and generally acceptable to the populace.

A 3-foot-diameter metal mould for precast concrete culverts sparked the idea for the design of a septic privy. The fluid capacity of two precast units at the invert level of the proposed effluent pipe amounted to 220 Imperial gallons, which compared reasonably with the capacity formula:

$$V = PQt + SP$$

where V = volume in gallons

P =contributory population

- Q =quantity of water per day in gallons per capita
- t = detention time
- S=volume of sludge to be stored per capita

The units are small, so that disturbance is a maximum and settling efficiency a minimum, t in days is made a function of PQ, using the modified formula (7):

$$V = (1.3 - 0.3 \log PQ) PQ + SP$$

P was taken as an average of 5 persons, Q as a maximum of 10 gallons per day and S as 30 gallons (minimum design), giving a volume of 189.52 or 190 gallons. The actual capacity of 30 gallons in excess of this figure was ignored with the impression that this would increase the storage capacity S to 36 gallons, a figure well within the design range.

Construction. At first all units were precast except the floor. Eventually it was found more convenient to cast the cylinders in place. This saved the expense and rigors of transporting the bulky units, and avoided the possibility of breakage over the rough terrain. The precast units include a concrete box seat riser, which fits into a box seat slab. A concrete hopper is bolted on the under side of the slab, providing the water seal for the system. There also are two short lengths of 4-inch-diameter pipe and a plain concrete slab.

Final disposal of the effluent is partly by absorption and partly by evaporation, arranged by a shallow trench, 12-inches wide, 12- to 20feet long, and not more than 18-inches deep. The trench is filled with rubble (crushed stone) and covered to form some sort of French drain. The gradient on this drain is limited to about 1 in 30. With an ambient temperature of 80° F. and a relatively low humidity coupled with a sparse rainfall, the processes of absorption and evaporation have proved successful in the disposal of the effluent. At the time of this evaluation, there was no evidence of particle clogging.

Evaluation

To evaluate the adaptability of this type of latrine to the particular island conditions, 10 percent of a total of 311 were chosen for study in February 1964, taking dates of installation ranging from 1957 to 1963. The most effective means of attaining the results was impractical or impossible as there are no laboratory facilities for the examination of sewage in any of the three



Figure 2. Precast units for septic privy. *Left.* Hopper which is bolted to under side of slab. *Right.* Assembled hopper, seat, and slab.



Figure 3. Completed septic privy. Left. Installation partly above ground. Right. Completely above ground, effluent pipe bent down to enter French drain.

islands of the territory or any of the larger islands not too far distant. It was subsequently decided to base judgment on the sludge accumulation in the digestion chamber by the method described in a publication of the Arkansas State Board of Health (θ). The method consists of lowering a long stick wrapped with rough white cloth to the bottom of the tank. This gives an indication of the liquid depth. After several minutes, the stick is carefully removed, and the sludge line can be easily distinguished by sludge particles clinging to the cloth.

Measurements recorded February 12, 1964, are as follows:

Year of construction	Depth	of	sludge
and number of users	(inches)		
1957:			
4	-	5	
5	-	2	
2	-	8	
18	-	16	
1958:			
4	-	10	
4	-	7	
6	-	7	
1959 :			
9	-	6	
5	-	12	
1	-	6	
1960 :			
6	-	6	
8		5	
1961 :			
3		4	
1962 :			
1	. 7	Crac	e
3	-	1	
1963 :			
3	. ว	Crac	e
3		Do.	

It was noted, too, that there was little or no nuisance from odors. In several cases these latrine units have been incorporated into a building with no complaints from the inhabitants.

The table shows that the accumulation of sludge in the digestion chambers has been negligible. Though there is no direct statistical correlation between date of installation, number of users, and sludge accumulation, the design can be accepted as satisfactory, taking into account the impact on the community and the effect on public health. Variations in results given in the table could be related to the care and attention given the units by the users. In each case a printed sheet of instructions was distributed to the users, and the advice of the public health inspector was always readily available. The text of the instructions issued by the Medical and Health Department is as follows:

INSTRUCTIONS TO HOUSEHOLDERS

ON

MAINTENANCE OF SEPTIC PRIVIES

You are expected to care for the Septic Privy which is now installed on your premises.

Note carefully the following:

1. Use ONLY SOFT ABSORBENT PAPER. Do not throw any stones, cloth, cigarette ends, and matchsticks, in your Privy.

2. Every day pour at least one bucket of water into the Privy whether you have used it for that day or not. This maintains the water level above the bottom of the hopper.

3. Do not throw Dettol, Creolin, or any other disinfectant into the Privy. Disinfectants will cause it to be offensive.

The septic privy is now the generally accepted type of installation for household use in Anguilla. The skepticism and misuse noticed at the initial stage have been overcome. Initially some householders used the concrete cylinders to store potable water and continued to defecate in the "clump of bushes."

The problem of latrine sanitation in Anguilla is typical of rural places and small communities which subsist on generally low incomes. While it is necessary to face up to the explanation that some people are not financially able to afford the construction of a latrine, the public health maxim that every dwelling must have a sanitary latrine, should not be overlooked. Public health programs must embrace financial indigents, so that the maximum benefits can accrue. It is our aim in Anguilla to have the householder as an active participant in the provision of this basic hygienic amenity. As Wagner and Lanoix (10) have said: "One measure of the success of a rural sanitation program is its power to sustain itself and grow." Toward this end the program geared as a government operation must change to a big community effort.

Already there are 375 septic privies installed.

This is no more an experiment. It is an accepted household accommodation though there is still much to be done to establish this sanitary amenity in all households. Pride of possession must be fostered to assure the care and maintenance of these fittings. A sort of collective labor must be triggered through demonstrations and involvement of organized groups. In short, the tenets of health education must be employed to assure the lasting benefits from adaptation of this method of sewage disposal in Anguilla.

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Insurance Coverage for Psychiatric Care

A preliminary study to measure the effects of a new prepayment plan on the provision of community mental health services will be conducted jointly by the American Psychiatric Association and the United Auto Workers. A grant of \$95,144 for the first year, and additional support for a second year will be financed by the National Institute of Mental Health, Public Health Service.

The study is being undertaken following a contract negotiated in 1964 between the UAW and the automobile and agricultural implement industries under which more than 2,450,000 workers and their families will receive broader insurance coverage for psychiatric care.

Investigators will observe and attempt to propose solutions to problems in supplying and insuring care through various community mental health services. They will also collect and organize data that can be used as a basis for further research in extended psychiatric coverage and wider mental health services.

The new UAW-industry plan, to become effective September 1966, includes coverage for inpatient care, partial hospitalization, clinic care, and private office visits.