

Elimination of Frost-Proof Toilets and Hydrants

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AN OTHERWISE safe water supply (potentially, an entire municipal system) can become polluted by back-siphonage from a frost-proof toilet or a frost-proof hydrant. These inexpensive fixtures, introduced in many cities in the 1920's and the 1930's, were often installed in unheated structures on residential, business, and public properties because they did not freeze. Generally, they received little or no maintenance. Many cities have prohibited their installation in recent years, but few have carried out aggressive programs to find and remove those already installed.

Back-siphonage results if the stop-and-waste valve is defective or if it is opened while the pressure in the water main is under a negative pressure or vacuum. Reductions in pressure can be expected whenever a main is broken, when an unusually large volume of water is used for a demanding purpose, such as firefighting, or when an excessive amount is drawn off by some other user (1). Therefore, if the trap in the waste line from a frost-proof toilet or the drain from a frost-proof hydrant becomes obstructed while the water-control valve is malfunctioning and the water pressure is reduced, back-siphonage and consequent contamination of the water supply will result.

The American Standard National Plumbing Code describes the frost-proof toilet as ". . . a hopper that has no water in the bowl and has

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the trap and the control valve for its water supply below the frost line" (2a). In the literature this fixture has been referred to as the "hopper," the "closet," and by various brand names.

A typical frost-proof toilet is shown in figure 1. When the seat is depressed, a plunger rod activates the stop-and-waste valve, allowing the overhead tank to fill. When the seat is released, the valve is closed, allowing the water in the overhead tank to flush through the hopper. In some installations the overhead tank is bypassed or omitted, so that the hopper is flushed continuously while the seat is depressed. Water above the valve drains through a waste line into the sewer when the valve is closed, leaving the water supply pipe dry and frost-proof; hence the name. In one type, the waste line drains into a gravel pit, such as that shown for the frost-proof hydrant in figure 2, but the potential remains for back-siphonage of surface and ground water.

A typical frost-proof hydrant and one type of this fixture are shown in figures 2 and 3. The stop-and-waste valve of the hydrant (fig. 2) is similar to that of the frost-proof toilet. According to Kalinske, in a report for the Wisconsin State Board of Health, in most cases the vertical supply riser is drained by a small tube leading to some gravel or crushed stone, but it is entirely possible for ground water, worms, and filth to get into the supply riser through the open drain tube when the pressure is shut off, past a leaky or opened valve, or with the water when the hydrant is opened (3). Such an installation would be especially dangerous if the water from it were used for drinking purposes.

The following selections from the literature

are examples of the public health hazards associated with the use of frost-proof fixtures:

In Marion County, Ind., an outbreak of 30 cases of typhoid fever was attributed to an interconnection between a frost-proof "water closet" and the well-water distribution system, which permitted backflow of sewage into the water system (4).

An explosive outbreak of bacillary dysentery in Newton, Kans., in September 1942, resulted in 2,500 cases and 2 deaths. The cases were uniformly distributed throughout the entire city. Investigation revealed that a water main was out of service periodically for 3 days. Sewage from a clogged frost-proof toilet flowed into a frost-proof hydrant, and back-siphonage then introduced the sewage into the water main. Each time the main was restored to service, only a small amount of water was flushed through it and no attempt was made to sterilize the main (5a).

In another epidemiologic study, circumstantial evidence suggested that contamination of the water supply through outdoor plumbing (frost-proof hydrants and closets) was responsible for the spread of infectious hepatitis, diarrhea, and typhoid fever in a small area of Washington, D.C., in late 1954 and early 1955. Investigation showed that although one outbreak of diarrhea was probably waterborne, contact was the major factor in most cases of the three diseases (6).

Water Waste

Frost-proof toilets may waste a great deal of water, simultaneously increasing the volume of sewage for disposal, especially in communities where water meters are not used. Hunt, in an investigation in Pueblo, Colo., from August 1953 through October 1955, found that of approximately 900 "hopper" toilets in use, a large proportion were not in proper operating condition (7). An estimated 500 of these toilets were each wasting water at a rate of more than 10,000 gallons during a 24-hour period, or a daily loss of over 5 million gallons. To support this estimate, each of two water boards responsible was requested to install meters on a number of the fixtures that were wasting water. As a result of the measurements, the average esti-

mated 24-hour loss reported by one board was 10,500 gallons per fixture, and by the other board it was 7,200 gallons per fixture. This evidence was presented to the city council, which adopted an ordinance prohibiting frost-proof toilets. Within 60 days, one of the water districts was pumping 3 million gallons less water per day than the seasonal average, while the other was pumping the regular average despite a large increase in the number of consumers. At the same time the city sewage disposal plant reported a daily reduction of 750,000 gallons below the seasonal average.

Finding Frost-Proof Fixtures

Frost-proof toilets may be found by a survey such as the community "block" survey developed and used by the communicable disease control demonstrations (8). These installations may be inside dwellings, in outbuildings, in back-porch enclosures, or in rooms attached to the rear of dwellings. In such a survey, the

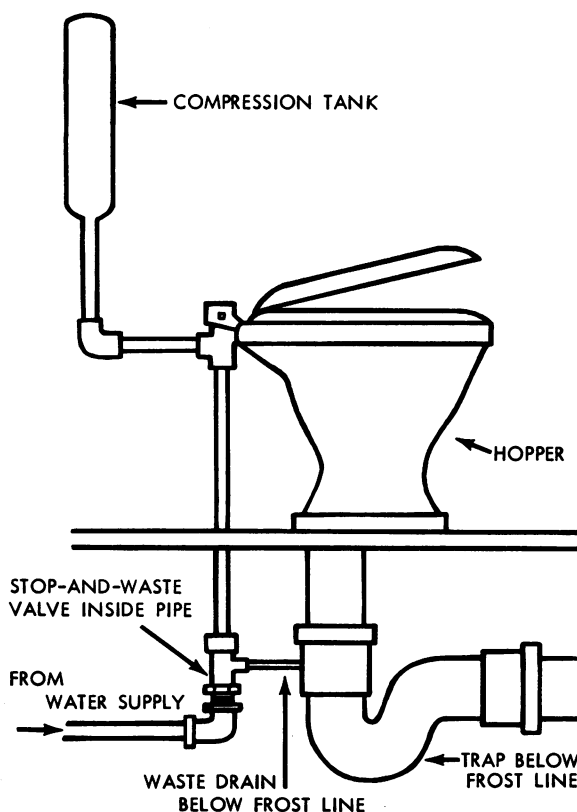


Figure 1. Typical frost-proof toilet

Definitions and Descriptions

Back-Siphonage

The Public Health Service has defined back-siphonage as, "... siphon action in an undesirable or reverse direction . . . caused by the force of atmospheric pressure exerted against a pollutant liquid forcing it towards a potable water supply system which is under a negative pressure, or vacuum" (5b).

Cross-Connection

According to the American Standard National Plumbing Code (2c), "a cross-connection is any physical connection or arrangement between two otherwise separate piping systems—one of which contains potable water and the other water of unknown or questionable safety—whereby water may flow from one system to the other, the direction of flow depending on the pressure differential between the two systems." A cross-connection is illustrated in figure 1 by the waste drain which connects a potable water supply pipe with the sewer.

Stop-and-Waste Valve

The stop-and-waste valve in a water supply line, as described by Babbitt (9), "... so operates that when the water supply is shut off the water remaining in the pipe on the nonpressure side of the valve will drain out through the waste line, which is opened when the pressure side of the valve is shut off. A stop-and-waste valve should be installed on the house end of all service pipes where the service pipe comes through the basement wall of the building, or if a meter is installed, the valve should be placed close to the meter and on the street side of it. The valve must be accessible and neither underground nor where it can be submerged. This kind of valve is essential to the protection of water pipes from freezing when heat and water are turned off of a building in cold weather."

surveyor looks for a cast-iron "vent stack" extending above outbuildings or small rooms built onto older dwellings. In blocks where the presence of frost-proof toilets is suspected, all premises are inspected. This close search may disclose installations not detectable from the streets, especially those inside or at the rear of dwelling units.

Frost-proof hydrants are more difficult to recognize. However, if a hydrant is equipped with a lever-actuated valve and there is a brief delay before the water begins to flow when the valve is opened, this provides the quickest clue that it is frost-proof. Often it is impossible to determine whether a yard hydrant is of frost-

proof construction without excavating down to the supply line. The sanitarian or other person making the survey discusses this problem with local plumbers before beginning his search. Usually only one or two brands or designs were installed in any given community, and once the surveyor knows what fixtures are typical of the area, he can make his survey with greater ease and profit. Usually, frost-proof hydrants are found on the same premises as frost-proof toilets—predominantly in railroad servicing areas, at service stations, and at other business establishments.

When the surveyor finds a frost-proof fixture,

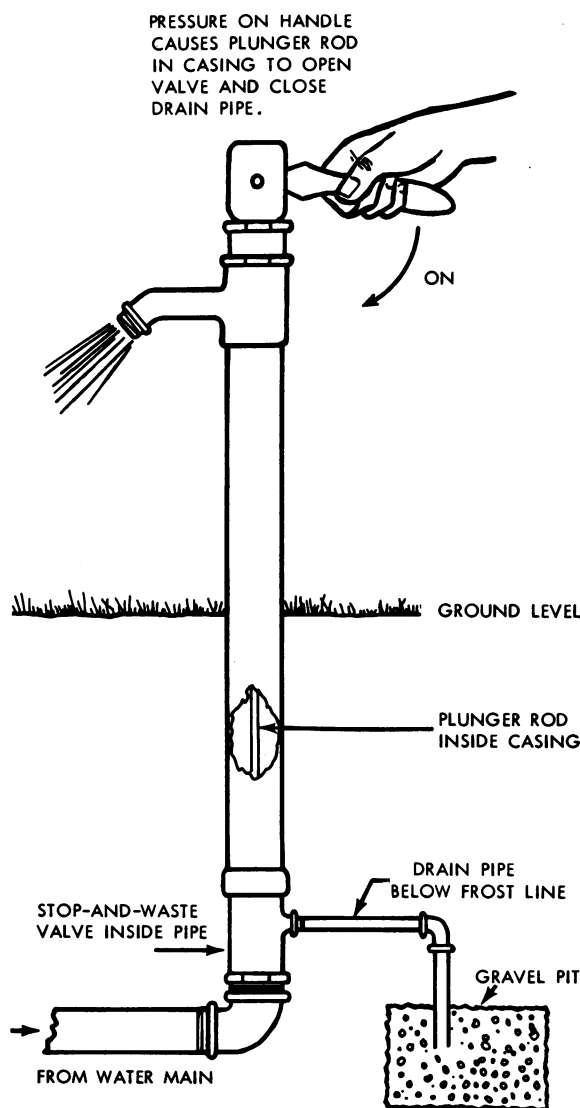


Figure 2. Typical frost-proof hydrant

he indicates its location on a sketch map of the block with the premises serially numbered, and records the total for the block. If legal action is to be taken at a later date, he also records the street address of the premises. It is recommended that individual citation not be made at the time of the survey unless a severe hazard exists, but rather that correction be encouraged as part of a community-wide program.

When the survey has been completed, all frost-proof toilets and frost-proof hydrants are plotted on a good base map of the city, with the city blocks color-coded according to the number of unapproved fixtures found. Photographs are then taken of typical installations and of the completed map, and 2-inch by 2-inch color slides are made for use in an educational program.

Public Education

The survey findings and recommendations are first presented to the community's administrative and legislative officials. The color slides are used to show the nature of existing sanitation deficiencies, and the colored maps to show the location and extent of the problem of frost-proof fixtures. Hydrants and toilets may be shown on the same map or separately.

A plan to remedy the deficiencies is presented to guide the health department and the community in correcting the problem. After the plan has been endorsed by the governing officials, an intensive education program is initiated. Meetings are held with civic groups, women's clubs, and community agencies. Newspaper articles and personal contacts with property owners generally result in voluntary compliance with program objectives, thereby minimizing the amount of enforcement required.

Legislation and Enforcement

A study of local codes and ordinances is a necessary step toward eliminating frost-proof toilets and hydrants from a community. The American Standard National Plumbing Code (2b) prohibits frost-proof fixtures: "10.6.3 Stop-and-Waste Valve Combination. Combi-

nation stop-and-waste valves and cocks shall not be installed in an underground service pipe." Since frost-proof toilets and hydrants require stop-and-waste valves, they are illegal under this code.

In November 1961, the Richmond (Va.) Department of Public Health brought a test case into Hustings Court concerning the removal of a frost-proof toilet. The housing and plumbing codes both prohibited frost-proof toilets, and the judge ordered removal of the

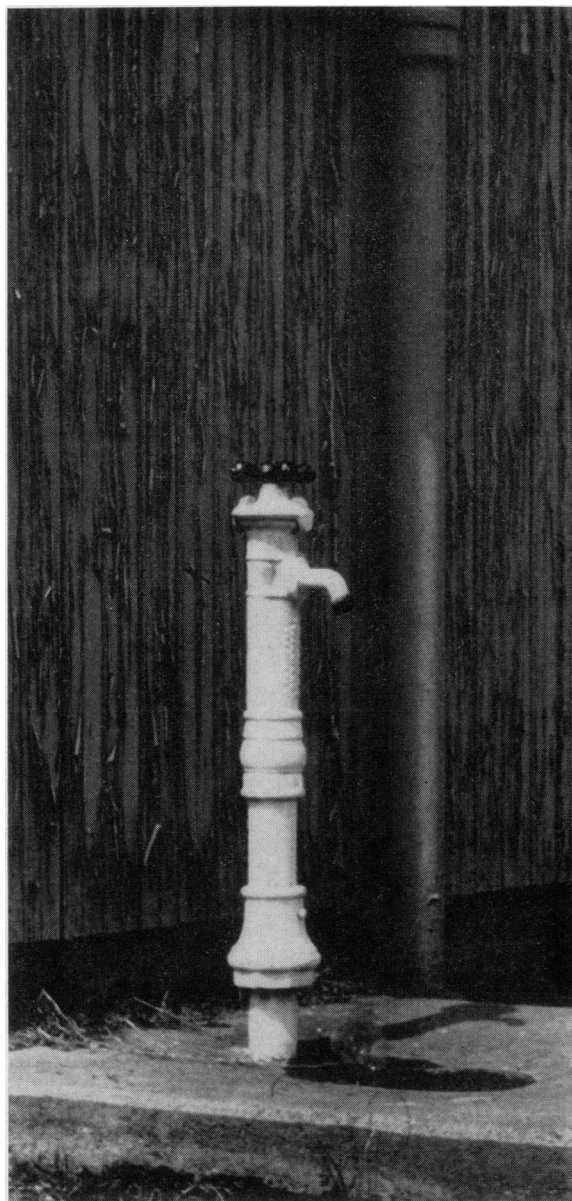


Figure 3. One type of frost-proof hydrant

toilet, concluding that there was a relationship between public health and toilets of this type; that the ordinance was preventive; and that the degree of use of the facility was not a factor that determined the applicability of the ordinance.

In communities where prohibiting legislation does not exist and must be enacted, it may be necessary to allow a 30- to 60-day period after enactment to permit voluntary compliance before enforcement begins.

Fredericksburg Survey

At Fredericksburg, Va., during the community block survey carried out in the demonstration project initiated there in August 1961, frost-proof toilets were found on 210 premises in 53 blocks. These premises were clustered around the three public elementary schools and one public high school. This information, made vital through the use of color slides and a map showing the locations and the density of these outmoded and dangerous fixtures, was presented to the city council in April 1962. Adoption of the necessary ordinances and establishment of a schedule for eliminating all frost-proof toilets within a reasonable but definite time were recommended. However, by the time specific legislation had been developed and proposed, a number of corrections had been made.

After the survey findings had been presented to the city council, they were released to the local daily newspaper, which carried a series of news releases about dilapidated housing and frost-proof toilets.

Sanitarians from the Fredericksburg District Health Department met with civic organizations and obtained additional support for an ordinance to prohibit frost-proof toilets in the community. In August 1962, two proposed ordinances were submitted to the Health and Welfare Committee of the city council for study. One ordinance defined and prohibited frost-proof toilets, and the second required each dwelling unit to have a kitchen sink and to have an inside flush toilet in a room affording privacy.

Some 5 months after the results of the survey had been presented to the city council and be-

fore legislation had been passed, another survey was made for two purposes: to learn the results of the newspaper publicity and the orientation of civic groups, and to ascertain and document the state of disrepair (fig. 4) of the remaining frost-proof toilets. Of the original 210 premises with frost-proof toilets, 64 now had flush toilets and 61 had kitchen sinks. However, at 11 dwellings with both a flush toilet and a kitchen sink the frost-proof toilet was still in place. Therefore, 53 of the 210 frost-proof

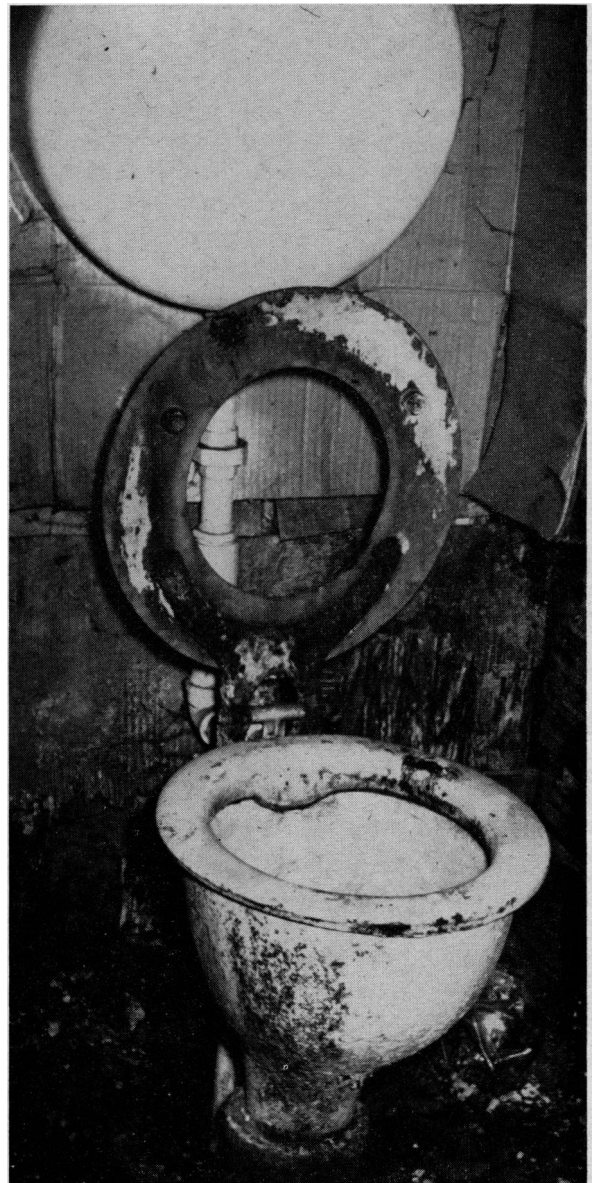


Figure 4. Typically dilapidated frost-proof toilet found by survey

toilets had been removed and 157 remained. An additional 6 had been found since the original survey, raising the total number found in Fredericksburg to 216. At the time of the re-survey, therefore, 163 frost-proof toilets remained installed.

Of the remaining 163 frost-proof toilets (see table), 14 (9 percent) had an obstructed trap, and 27 (17 percent) would not flush because of corrosion or faulty valves or because the water supply to them had been shut off. Some tenants attempted periodically to clear these non-flushing fixtures by pouring buckets of water through the hoppers. Some of the toilets had broken seats or the seats were missing, and sometimes excreta had been deposited on the floor. Quite often no toilet tissue was provided, and the newspaper or other material that was substituted, together with other refuse thrown into the hoppers, caused clogging and increased the danger of back-siphonage.

Repair parts for frost-free toilets are generally unavailable, which may be one reason why many of these facilities are left unrepaired or are improperly modified.

On September 11, 1962, the city council passed the two proposed ordinances. A 6-month grace period to permit voluntary compliance was established, making March 11, 1963, the date for enforcement to begin.

A list of the properties having frost-proof toilets, by location, was prepared and copies were given to the city manager and the building inspector. With this information, supplemented by the owners' names and addresses drawn from the tax records, the city manager sent a letter to each property owner or his agent calling attention to the provisions of the new ordinances, indicating the violations found on the premises in question, and encouraging voluntary compliance by the owner or agent in correcting these violations before the deadline date by allowing him to use the services of a licensed plumber of his own choice.

During March, when another inspection was made to determine what progress had resulted, the frost-proof toilets had been removed from 133 (62 percent) of the 216 premises, and flush toilets and kitchen sinks had been installed. Eighty-three frost-proof toilets remained, and six bathroom facilities were under construction.

Condition of 163 frost-proof toilets in Fredericksburg, Va., August-September 1962

Condition	Number	Percent
No flush water.....	27	17
Stopped up.....	14	9
Stopped up in past year.....	26	16
Broken or lost seat.....	66	40
Floor rotted or in poor repair.....	99	61
Fixture or floor not clean.....	87	53
No toilet tissue.....	18	11
Rat infested.....	18	11
Not flytight.....	118	72
No electric light.....	153	94
Location:		
Outbuilding.....	39	24
Backporch.....	26	16
Attached to rear of dwelling.....	58	36
Inside house.....	31	19
Not stated.....	9	5
Rental property.....	117	72
Shared by two families.....	5	3
Additional plumbing facilities:		
Water in yard only.....	34	21
Inside water only.....	7	4
Kitchen sink only.....	107	66
Bathtub only.....	1	1
Lavatory only.....	1	1
Complete facilities and frost-proof toilet.....	11	7
Not determined.....	2	1

At one dwelling unit with inside plumbing facilities, the frost-proof toilet had not yet been removed. There were still 41 dwelling units without kitchen sinks and 3 units without either toilets or kitchen sinks.

Forty-six owners of property found in violation of the new ordinances were mailed 30-day notices. After the 30 days had elapsed, another inspection was made. Ten property owners still had not complied with the new laws, and warrants were issued against them. By the time of their hearings, all but one had begun work on the necessary plumbing and some had completed it. The judge ordered the remaining violator to complete the necessary work in a reasonable time or face new court action.

As of July 1, 1963, the frost-proof toilets had been eliminated from 185 (86 percent) of the 216 premises. The addition of new bathrooms was in progress at 10 dwellings, and 3 dwellings with frost-proof fixtures were vacant. Three estates representing 14 dwelling units with the illegal fixtures were tied up in litigation.

On September 13, 1963, 1 year after the city council ruled frost-proof toilets a health hazard and 6 months after the law went into effect pro-

viding for their removal, the city council passed the following amendment to the ordinance:

Section 7-43.1 Same—Elimination of "Frost-proof" type.

(c) Any person who shall occupy or as owner cause or allow to be occupied as a dwelling any structure with sanitary facilities including a frost-proof toilet or toilets as herein defined shall be guilty of a misdemeanor.

(d) The City Manager shall, upon being notified of the existence of any frost-proof toilet, as herein defined, cause the same to be removed and the sewer connection closed in a workman-like manner and the cost of such removal and closing together with a twenty percent administrative charge shall be added to the City of Fredericksburg real estate tax bill next following and shall be collected as a part of such bill in the same manner as taxes are collected by law.

As of November 13, 1963, 12 of the original 216 frost-proof toilets remained. Seven of these were being replaced by bathrooms; at three premises (two of which were vacant), the city was to remove the fixtures; and the owners of two premises were still under notice.

By March 16, 1964, according to the records of the Fredericksburg Health Department, all frost-proof toilets in the city had been removed. No further legal action had been taken in any case.

Summary

Frost-proof toilets and hydrants are a public health hazard because of the danger of back-siphonage into the water supply serving them. In the United States these fixtures were widely installed in unheated structures in past years, and many are still in use.

As part of a communicable disease control demonstration in Fredericksburg, Va., a program to abolish frost-proof toilets and hydrants was started in August 1961. A survey located these fixtures on 216 premises. As of March 16, 1964, after a public education campaign, a

study of existing legislation and adoption of necessary new ordinances, and establishment of a reasonable time limit for voluntary removal by property owners, all frost-proof toilets in Fredericksburg had been eliminated. Three of these fixtures had been removed by the city and the remainder voluntarily removed by the property owners or their agents.

The experience at Fredericksburg demonstrated that frost-proof toilets and hydrants can be abolished in a relatively short time if: (a) health departments make appropriate surveys, after inspection personnel have learned to recognize these fixtures; (b) the information is presented to the public; and (c) appropriate legislation is adopted and enforced.

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