Recreation Management
Tech Tips

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SST Installation Guide

Brenda Land, Sanitary Engineer

Introduction

A vault toilet building designed for passive ventilation can be very effective at maintaining an odor-free facility. However, the best-designed building will not function properly if incorrectly sited and maintained. The SST (odor-free vault toilet) concept covers all facets of a toilet building's design, construction materials, maintenance, and location. This Tech Tip is intended to reacquaint architects, engineers, landscape architects, and others involved in the design, construction, or placement of toilet buildings with the basic principles of SST technology. Only passive ventilation principles and key siting considerations are discussed.

Figure 1—*In-Depth Design and Maintenance Manual For ...*

Background

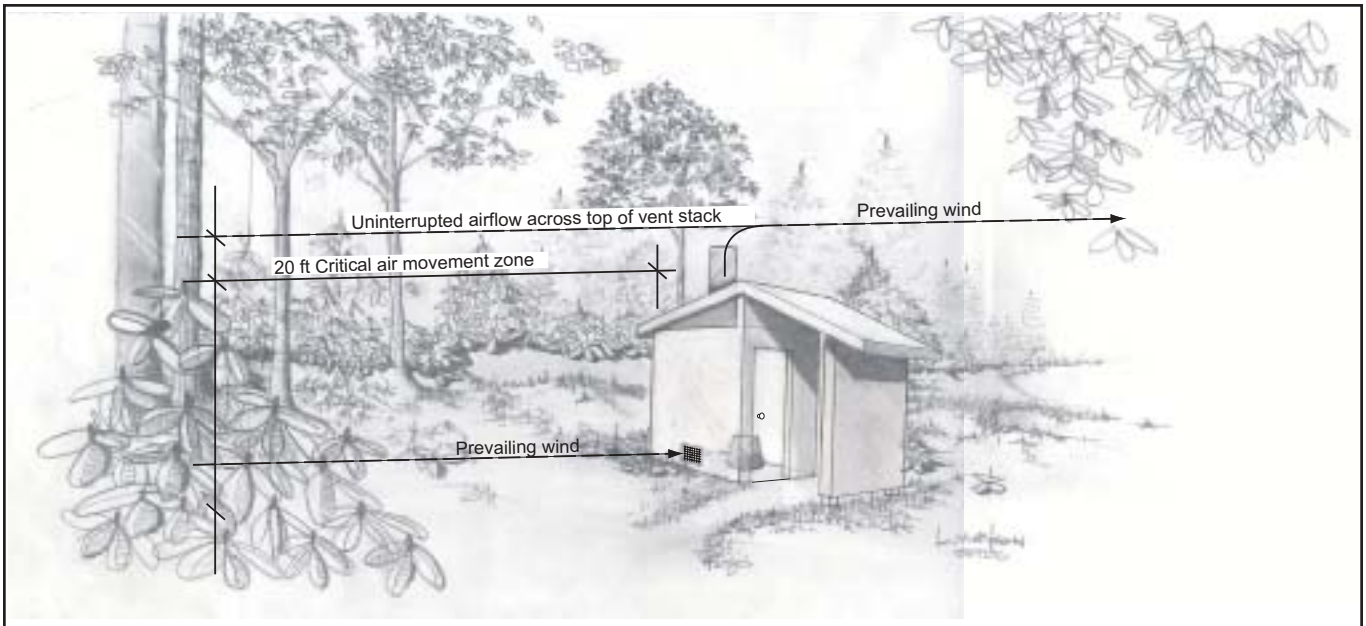
Briar Cook, San Dimas Technology and Development Center (SDTDC) (retired), developed the passive ventilation principles—nicknamed SST. He spent most of 1990 teaching the SST ventilation concept throughout the U.S. Department of Agriculture (USDA) Forest Service regions. His report *In-Depth Design and Maintenance of Vault Toilets*, 9123 1601–SDTDC, July 1991, covers the complete SST design. Today, many employees who attended his training remember only that the vent stack should be located on the south side of the building, and new USDA Forest Service employees—since this document was published—may be unfamiliar with the SST concept.

SST Passive Ventilation

SST passive ventilation encompass building design, materials, location, and maintenance. Prefabricated vault toilets, such as Romtec and CXT, have incorporated the design and materials to allow for an odor-free toilet. However, if the toilets are not located and maintained properly, they will not achieve this goal. Some basic concepts of passive ventilation are:

- Have an unobstructed airflow over the top of the vent stack. A 2-mile-per-hour laminar airflow will evacuate 58 cubic feet per minute from the vault. This airflow is enough to keep the building odor free. If the air movement is turbulent, a venturi draft will not be created. The top of the vent stack should be 3 feet above the top of the roof to avoid the air turbulence created by the building and 20 feet away from trees.

For additional information, contact: Recreation Management Program Leader, San Dimas Technology & Development Center, 444 East Bonita Avenue, San Dimas, CA 91773–3198; Phone: 909–599–1267; TDD: 909–599–2357; FAX: (909)592-2309
LotusNotes: MailroomWOSDTDC@FSNOTES • Intranet(web site):http://fsweb.sdtdc.wo.fs.fed.us • Internet e-mail:mailroom_wo_sdtdc@fs.fed.us



Notes:

—Locate wall vent on the side of the building facing the prevailing wind.

—Door should remain closed at all times.

—Low-growing trees and shrubs located within the critical airflow zone (20 ft in any direction from the building) are a welcome attraction so long as their growth does not exceed the height of the building eaves.

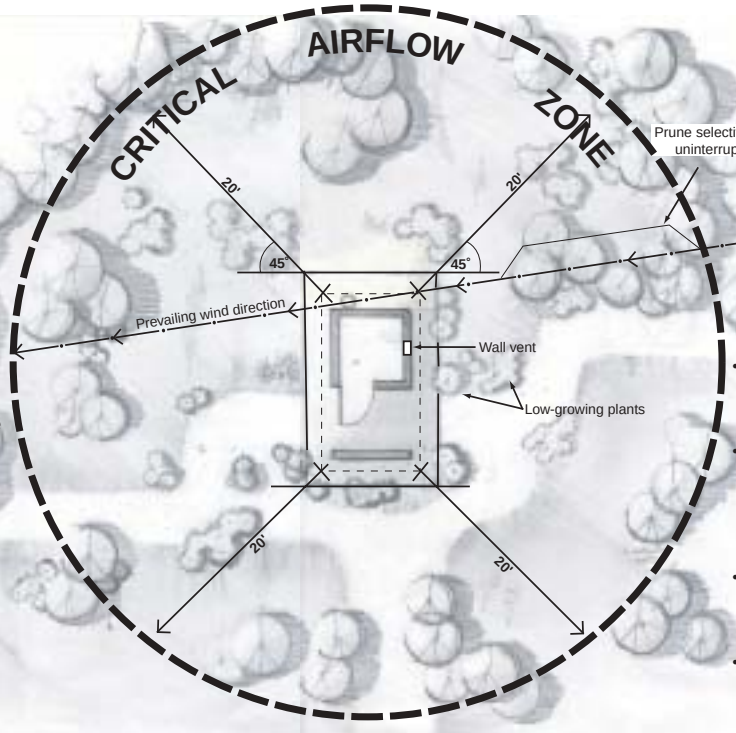
Figure 2—The most important aspect of passive ventilation is an unobstructed airflow over the top of the vent stack.

Locating the Building

–Locate toilet buildings where they are visible and easy to access.

–All vault toilet buildings' need a critical airflow zone (CAZ) to function properly. This zone is defined as 20 ft in any direction away from the building. Trees, shrubs, and other plants may occupy this zone if the following are observed:

- Plants should never exceed the height of the building.
- Plants of any height should never block the flow of air to the wall vent.
- Trees that fall within the CAZ shall be selectively pruned to assure an uninterrupted flow of air across the top of the vent stack (see illustration).



- Look for sites that have no more than a 1:1 ratio of tree crown cover to open space.
- In heavily tree covered areas, locate toilet building to assure a continuous flow of air to the wall vent and the top of the vent pipe.
- If it is difficult to satisfy these two criteria, try a different location.
- If that is not possible, mechanical means may be the best alternative to vent odors from the building.

Figure 3—Desired airflow through toilet building.

- Know the desired air path through the building. Air enters through the wall vent, flows down the toilet riser, and out the vent stack. The wall vent allows air to enter the building. The vent should not obstruct the free movement of air into the building.

  (a) In locations with a prevailing wind, locate the vent to pressurize the building. Place the wall vent high on the prevailing windside of the building to pressurize the building and help push air down the riser.

  (b) When the wind is variable, locate the vent so that a negative draft is prevented. Place the wall vent as low to the ground as possible, where the windspeed is the least. This pre vents air from being pulled out of the building through the wall vent.

- Have the proper vent size—120 square inches (10 inches by 12 inches) if unscreened, or 144 square inches (12 inches by 12 inches) if ¼-inch mesh screen is used. Use only one wall vent, one riser, one vault, and one vent stack.

- Extend the vent stack 3 feet above the building to allow solar heating to occur regardless of orientation. The concept of heating the vent pipe with solar energy by orienting it on the south side of the building only helps when the sun is shining on the pipe. Campground toilet use is highest in the morning and evening—when the sun angle is too low to provide much help.

Siting

Determine the toilet location during the planning stages of the project. Some key things to keep in mind are normal pedestrian traffic flow, prevailing wind (if any), downwind attractions, and vegetation or other obstructions (canyon walls).

- Face the toilet door toward normal incoming pedestrian traffic flow. Do not route visitors around the building to enter.

- Identify airflow characteristics at the site and the prevailing wind to determine the appropriate wall vent location, and downwind impact area. Tying ribbon to a 10-foot pole installed at the site during the initial planning process will allow a quick visual indication of wind direction. Many areas have a shifting wind.

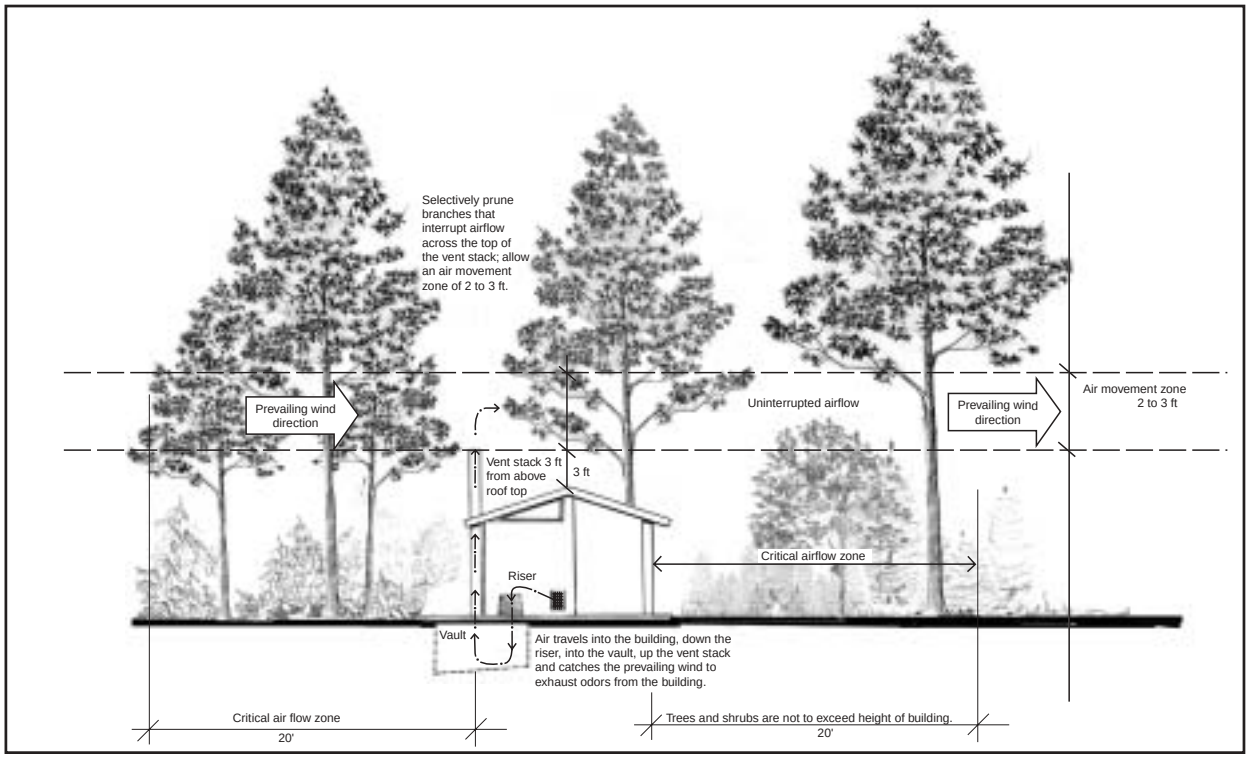


Figure 4—Determine the toilet building location during the planning stages.

Figure 5—A good location.

Figure 6—If dense forest vegetation will interfere with airflow, install a fan in the vent stack.

- Check the site plan to see what features are downwind of the proposed toilet location. A functioning SST does not destroy the vault odor; it just moves the odor out of the building. Avoid locating the toilet upwind of facilities or attractions. During the planning stages of a project, evaluate the location of the toilet in relation to other site attractions to minimize the impact of odor.

- Locate the toilet 20 feet from trees or prune the trees to eliminate lower limbs. Pay attention to how dense the vegetation is at 12 to 15 feet above the ground. Prune trees judiciously to allow an unobstructed airflow in the proposed location. Lower vegetation and shrubs around the building do not cause ventilation problems so long as they do not obstruct the wall vent.

Mitigation Measures

If the toilet must be located in an area where dense forest vegetation will interfere with the airflow across the top of the pipe or upwind of an attraction, mitigation measures are required to ensure an odor-free toilet.

Steps can be taken when a toilet building cannot be located where passive ventilation will work, or when downwind odor is a problem. The Tech-Tip *Vault Toilet Vent Gas Odor Control,* 0023 1304–SDTDC, September 2000, describes the steps in more detail.

- Install a fan in the vent stack. The fan should be capable of moving 75 cubic feet of air per minute. Solar-powered fan kits are available. Battery storage and a timer allow for operation during normal hours of use.

- Install a bio-filter, carbon filter, or pilot flame in the vent stack to minimize downwind nuisance odor.

- Install a buried pipe and a fan to move the odor away from the use area.

All of these options require some form of power, increased cost, and increased maintenance. Solar panels are subject to theft; fans must be replaced every few years.

Summary

The USDA Forest Service spends millions of dollars every year on vault toilets. Many of these toilets are being installed improperly. Passive ventilation of SST toilets is very effective at eliminating toilet odors, but the best-designed building will not work properly if the siting aspects are ignored. An understanding of the principles of passive ventilation is required to ensure proper location. Although the most important consideration for locating an SST vault toilet is an unobstructed airflow over the top of the vent stack, the size and location of the wall vent and building orientation cannot be ignored.

SST toilets will not function at all locations. If wind and solar power are unavailable to ventilate the toilet, another power source must be used.

For further information or to request the referenced documents, contact SDTDC by phone at 909–599–1267 or by e-mail at bland@fs.fed.us.