Re Nimbin Sewerage Investigation Report

Eddie (853426) is familiar with this Report.

Council have approved recycling of grey water at Jabiru. It appears Mark Norris was involved with this - or will know about it.

They are using composit toilets, the grey water from houses is recycled onto the gardens.

The designs appear to have been designed by the individual owners. One using a standard system absorption trench.

Where septic systems have been used it is not the septic tank which is a cause of contamination but the absorption trench systems which have not been able to handle the effluent.

(Tank size of course needs to be large enough to accommodate increased load.).

I suggest in developing a check list of questions to ask Mark N about these options.

The Nimbin Report seems will indicate that there are a range of options available and that it is reasonable that this matter can be adequately dealt with as a "condition of consent".

PH 7/6

[redacted]
The Channon 2480
10 May 1985

These notes and exerpts are intended to help anyone who wants to build a [redacted] Minimus composting toilet. The basic design of this toilet appears in "Goodbye to the Flush Toilet" (by Carol Hupping Stoner; Rodale, 1977) on page 158. Figure 1 in these notes is acopy of this page.

At time of writing we have had one unit (the narrow chambered design illustrated in figure 1) operating for about 9 months. A wide chambered unit is currently nearing completion. On the basis of the first unit's successful operation Lismore City Council has approved the design for use on Multiple Occupancy developments in its area.

I would be happy to answer any questions that prospective [redacted] builders may have by phone (066 886307) or show anyone over the existing two units. A third wide chambered unit is planned and several more narrow ones will be going in on our community over the next few years.

Yours biodegradably,

Leigh Davison

Location

Due to its odour-free operation the [redacted] can be located under the house. For an outhouse, the best location is on a well drained slope with the back of the chamber dug into the hill.

Cost

The total cost of the chamber is roughly $200. Naturally there will be an extra cost involved in providing four walls and a roof.

Steps in the construction of Clivus

Footings: We make ours 25 cm wide by 15 cm deep reinforced with 3 bar trench mesh. On a flat site or when digging into a hillside with a backhoe the footings will be flat. If digging into a hillside by hand it will be easier to dig astepped footing as illustrated in figure 2. To ensure that water does not enter the chamber from below it is recommended to line the footing with plastic. In very wet situations it is a good idea to run a length of ag. drain under the floor of the humus chamber to ensure proper drainage of the soil below the sloping floor of the compost chamber.

Laying the blocks: Details of a block arrangement that works are shown in figures 2 to 6 (narrow chamber) and figures 2 and 7 (wide chamber).

Evening up the sloping face: After the fourth course the front block on each sidewal is bevelled as shown in figure 2. Where this bevel takes out more than half the block length on the side (eg on course 7) it is easiest to fill in with cement after all the blocks have been layed. A layer of concrete up to 2 cm deep by 10 cm wide (the full block width) is put down on the sloping edge of the sidewalls to provide a flat face for the lid of the chamber. Acouple of wide floorboards G-clamped to the top of the wall makes a suitable form to por the concrete into. Three 6 or 8 mm anchor bolts should be [redacted] into the concrete as it starts to set.

Pouring the Squatplate: Our squatplate holes are formed by a tapered plastic bucket about 26 cm in diameter. In our wide chambered unit we have included 2 holes, located centally over the gaps between the three layers of air ducts. By having two holes on this unit we are able to provide a standard seat, thunderbox or throne; as well as a squatting hole for those who prefer this more effective posture for evacuation.

When pouring the squatplate don't forget to insert a short length of plastic pipe (90 mm drain) in the back corner as a starter for the vent pipe.

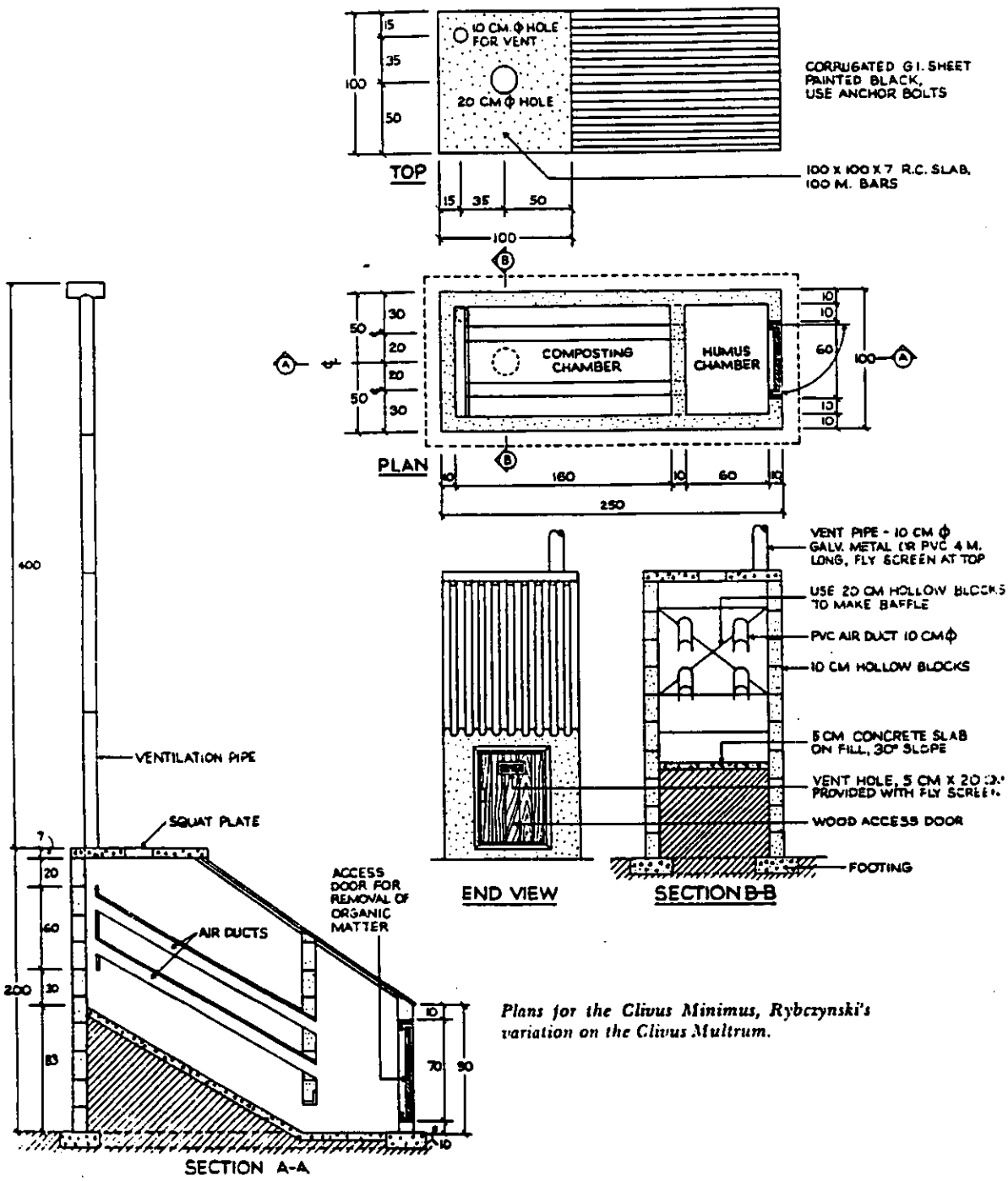
Air ducts: We use 90 mm diameter PVC drain pipe for the air ducts and ventillation pipe. It is necessary to knock holes in the baffle at the rear of the composting chamber and in the wall between the humus and composting chambers. This is easily done with a heavy hammer and pointed chisel. It is important that you don't try to put the holes through the web of a concrete block. This will not happen if you use the block arrangementoutlined in these notes.The ducts, which are made by cutting the pvc pipe in half with a hand-saw or circular saw, can be held in place with brickie's mortar.

Priming the compost process: It is easiest to "prime" the compost ing chamber before the corrugated iron "lid" is put in place.I found that one bale of peat moss (cost about $25)is sufficient. This is laid evenly on the sloping floor of the chamber. Three inches of topsoil and a little compost are then added onto the top of the peat moss.

The lid itself can be screwed or nailed onto timber battens which are themselves secured to the blockwork by the anchor bolts. It may be possible to bolt the iron directly ontothe cement (we will be trying this on our number 2 unit). Gaps and chinks around the lid can be filled in with mortar.

Drainage: When the chamber is partly below ground it is essential that the outer walls be water-proofed. For this purpose we paint the external walls of the chamber with a black goop (available from the Boral depot in Lismore - a couple of 4 litre paint cans-full is plenty and costs about five dollars). Plastic sheeting then goes over the gooped wall.We overlap the wall plastic with the plastic under the footings and backfill with gravel. A length of 50 mm flexible ag. drain is a good idea where the ground is particularly wet.

This is the case with our number 2 unit. Here we found it necessary to lay a length of ag. drain under the floor slab of the humus chamberto drain the soil under the sloping floor of the composting chamber. As one if the main enemies of aerobic conditions is moisture, all care should be taken to ensure that the below-ground part of the chamber is sealed and that drainage is adequate.



Plans for the Clivus Minimus, Rybczynski's variation on the Clivus Multrum.

Fig. 1 Plan of Clivus Minimus
Excerpted from "Goodbye to the Flush Toilet"
Page 158

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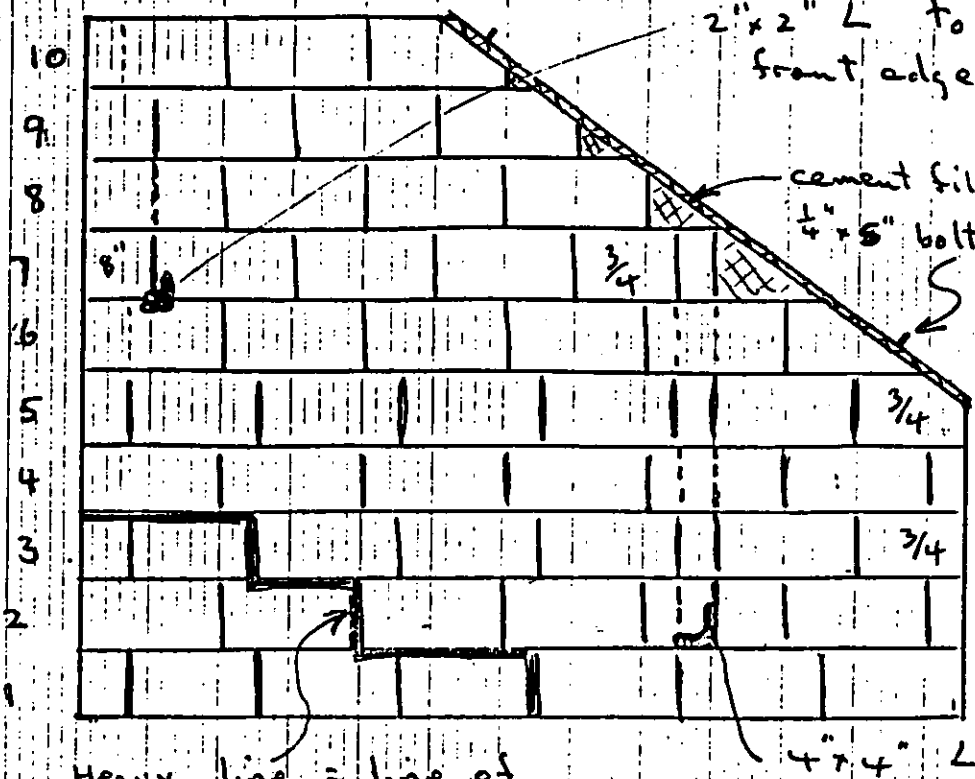
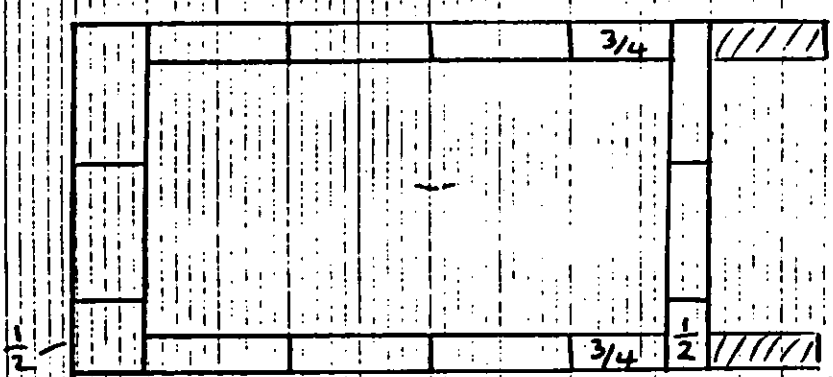
Fig. 2 Block arrangement for side walls



Courses 7, 8, 9 have 8" wide blocks as back wall to form baffle.



eg Course 7 backwall is 2½ 8" blocks (narrow chamber)

fig 3 Block arrangement for Course 7 of Narrow Chamber

Narrow Chamber (2½ blocks wide)

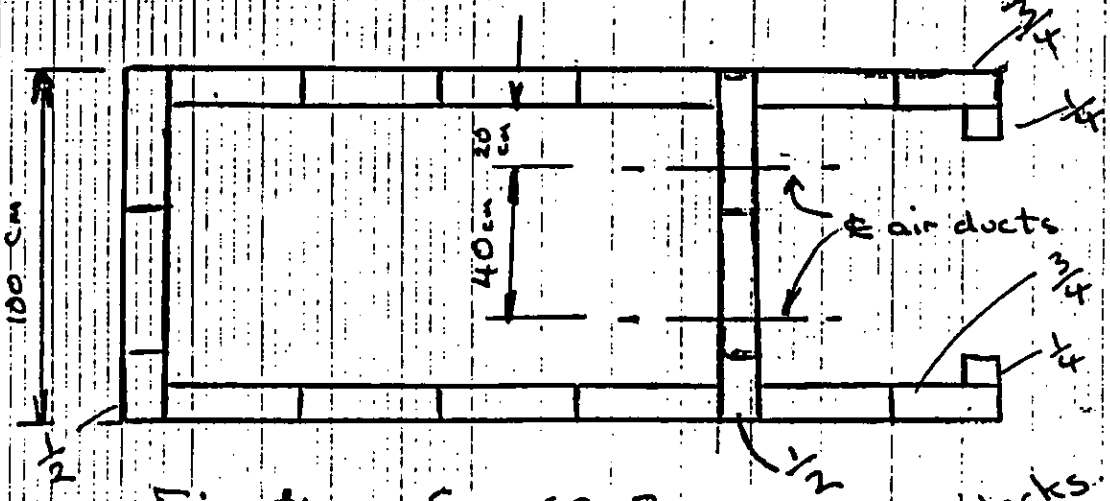


Fig 4 Course 3 (narrow chamber)

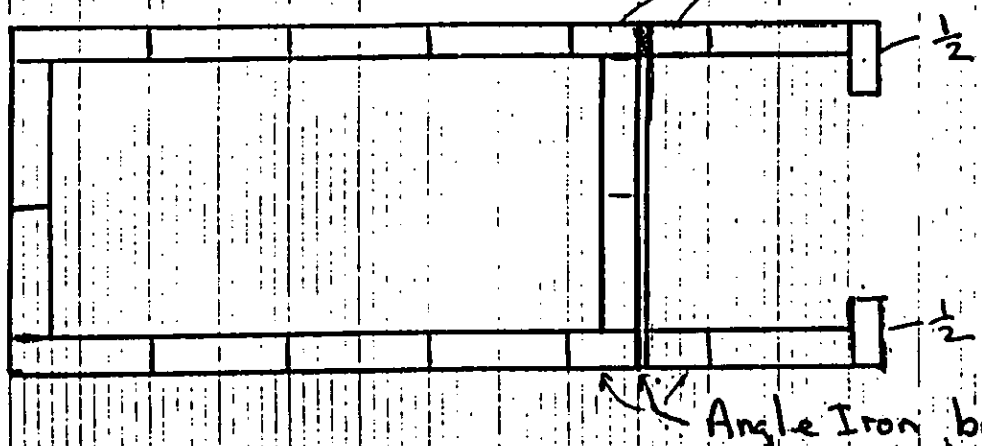


Fig 5 Course 2 (narrow chamber)

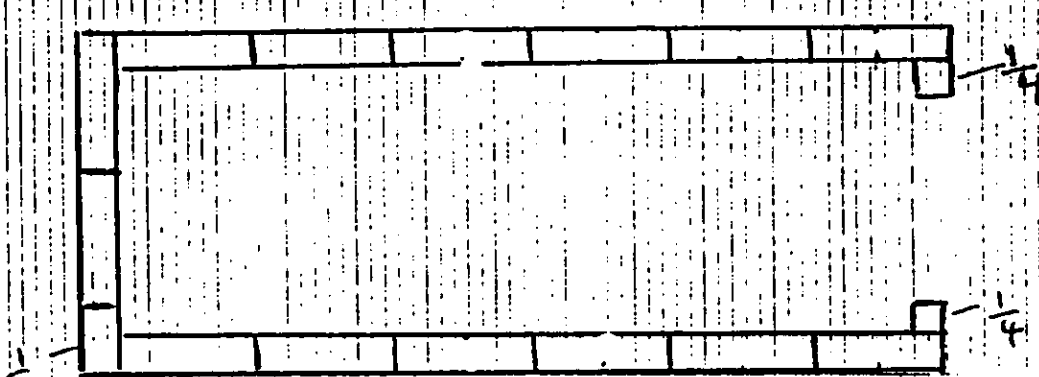


Fig 6 Course 1 (narrow chamber)

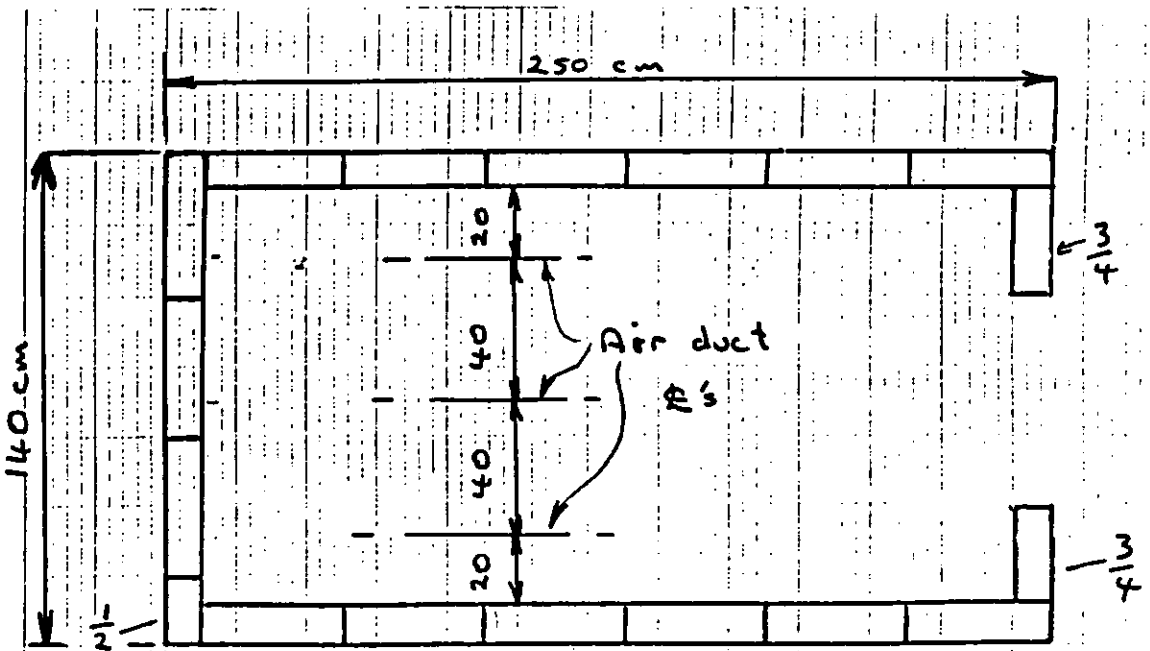
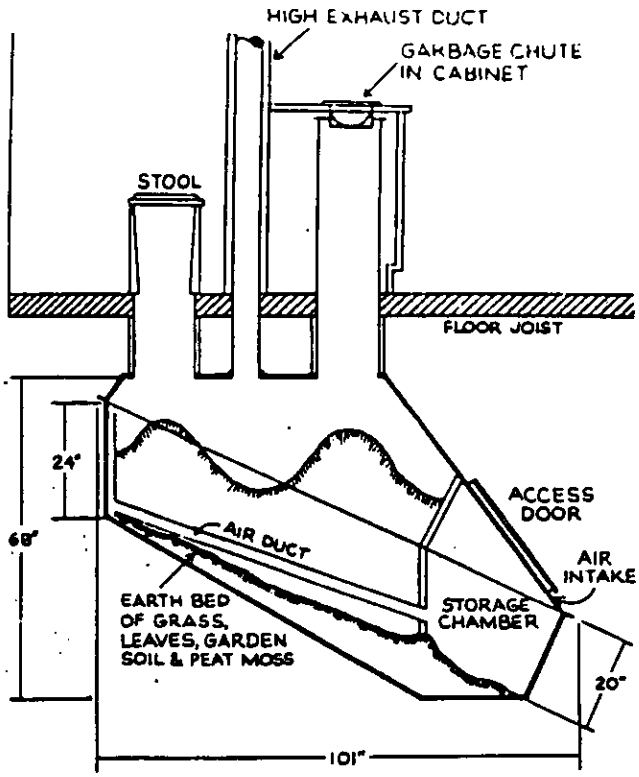


Fig. 7 Course 1 for wide chamber

Cross section of the Clivus Multrum, showing its characteristic sloping bottom and second chute for garbage. From "Goodbye to the Flush Toilet" edited by Carol Hupping Stoner (Rodale 1977).



CLIVUS MULTRUM ORGANIC WASTE TREATMENT SYSTEM

Abby A. Rockefeller

The Clivus Multrum composting toilet is a system which has been in use in Sweden since 1964 and in the United States since 1973. After comprehensive testing, the system was approved in October 1980 by the Victorian Health Commission for use in Victoria.

The following article by Abby Rockefeller explains the system in detail. Further information is available from the Australian agents, Clivius Multrum Australia, P.O. Box 105, Oakleigh, Vic, 3166. Phone (03) 569 0851.

What?

Clivus Multrum is a self-contained system for the treatment of organic household wastes. It combines toilet and kitchen wastes in an environment where they decompose slowly by composting, producing a humus which can be returned directly to the soil. Multrum uses no water, no energy and no chemicals of any kind. It is not connected to sewers as it has no liquid effluent. It has no moving parts, so requires virtually no maintenance. Capacity ranges from 2-3 people for small unit, to 10-12 for the large unit with mid-sections.

Clivus Multrum means literally "inclined compost room", (Figure 1).

How?

It is simple. The Multrum consists of a large impervious container with tubes connected to toilet and kitchen garbage inlets, and a vent pipe which carries away all odors as well as water vapor and CO^2 produced by the decomposition process. The tank is partitioned into three chambers. The upper one receives toilet wastes, the middle one kitchen garbage. The combined wastes decompose at the same time as they settle and slide slowly down the inclined bottom. By the time the material reaches the storage chamber it has been converted to humus. It takes 2-3 years for the first humus to reach the storage chamber. After this time 3-10 gallons of soil may be removed per person per year. The process is continuous from this time on.

Why?

Multrum is designed to meet the need for a convenient, hygienic and natural means of converting organic household wastes into a useful product. Unlike any standard waste treatment system, Multrum solves the major problems in this area without creating new ones (e.g., pollution, waste of energy, loss of nutrients) in the process. It uses no water, thus saving 40-50% of the water used in an average household, or 10,000 gallons per person per year. It uses no energy except what is supplied by the micro-organisms which do the work. The wastes are converted to a usable product on the site so need no transportation to remote treatment plants. In short, the Multrum eliminates the very notion of "waste" and, as such, it is truly a device for the post-industrial age.

Where?

The Multrum is suited for new and existing buildings, vacation homes, campgrounds and small industrial and commercial facilities.

It may be installed indoors (first or second floor), beneath a house in a full or partial basement, or outside as a comfort station for campgrounds or forest stations.

It may be used either seasonally

Exerpt from "The Owner Builder"
No 5 September 1982

or year round.
It can be placed on or below grade.
Households with a Multrum need to provide for the separate disposal of dish, laundry and bath water.

When?

The Multrum is now available for sale in the U.S. and Canada. It was produced in limited numbers during 1974 in a factory in northeastern U.S.A. Approval should be sought from local health officials prior to purchase.

Clivus Multrum Inc. holds the exclusive U.S. license to the system which was invented over 30 years ago in Sweden. It is widely known in Scandinavia where it has been sold commercially for the past 10 years.

QUESTIONS/ANSWERS

Why doesn't it smell?

A natural draft, like that in a chimney, causes a suction effect at the vent opening above the roof which in turn causes all air to be drawn down through either the garbage or the toilet opening when the lid is open. As a consequence, the toilet room and kitchen are ventilated by the Multrum and kept free of odors at all times.

Don't the chutes and toilet stool get soiled and produce odors?

There are currently two toilet designs commonly used in connection with the Multrum. The simplest is a stool which, being wider at the base, connects to a 16" tube leading to the container. In this case, soiling is infrequent simply due to the large diameter of the stool and chute. The alternative is a more conventional looking stool with a small hole (5") in the bowl which may be connected either to the large 16" chute or to a smaller (6") one. This one can be provided with a small spray to clean the bowl when necessary. In either case, however, soiling of either bowl or chutes is not a problem from the point of view of odor due to the continuous downward draft.

Could not odors occur in the house when there are downdrafts?

Yes, but it would be a rare occurrence with a properly installed vent. For those who want insurance against the infrequent possibility of an odor coming in the house when either toilet or garbage lids are open caused by a downdraft, an exhaust fan can be installed.

What happens if it fills up?

If used with reasonable consideration to the recommended number of people per Multrum as well as to the effect of certain conditions (ambient temperatures, humidity, etc.) it will not fill up. The process is continuous with regard to both the decomposition and the slow, glacier-like movement of the mass towards the removal chamber. The container is designed so that the rate of input regulates the rate of motion towards the storage chamber (i.e., the heavier the mass is, the faster it moves). The process does, in fact, work best when the container is nearly full during continuous use.

Would any odor coming from the vent above the roof be offensive or constitute air pollution?

Aerobic decomposition does not produce noxious gases (carbon dioxide and water vapor are the main waste products of the micro-organisms in this process). There is, consequently, less odor from the Multrum vent than from the plumbing vents on most houses.

What if something valuable falls down either chute? Can it be recovered?

Access ports have been provided in the sides of the container for this purpose. It should be emphasized that nothing is ever really lost in the Multrum; everything is retrievable sooner or later, and if inorganic (e.g., spoons and forks) it will hardly show any effects of the process.

Could insects and rodents create a problem?

Since the air inlet and outlet above the roof are both screened, and since the toilet and garbage lids are always closed except when being used, they should not be a problem. Moreover, the only place from which any odor escapes and which might therefore attract such creatures is the vent outlet above the roof. The only precaution that must be taken is to avoid leaving exposed food wastes around before depositing them in the garbage chute, lest flies have a chance to lay their eggs and in this way be introduced into the tank. If the garbage inlet can be installed in the kitchen counter, it is less likely that this will happen.

Can the Multrum ever go out of commission?

The Multrum is an environment which supports a great variety of living creatures essential to the process. These have specific environmental requirements which must be considered. If substantial quantities of disinfectants, drain cleaner or fumigants (i.e., poisons) are introduced, the number of organisms that carry on decomposition can be reduced to the point where the process will cease. Flooding or limiting the entry of air into the Multrum will shift the aerobic action to the undesirable anaerobic state for as long as these conditions persist.

Does it use any water at all?

Conventional toilets use water to transport the wastes to a central treatment plant (if not a river, lake or ocean). As the Multrum is the "treatment plant" and is located in the house directly under or close to the toilet, there is no need for water to perform this function. Wastes enter the Multrum from the toilet or kitchen refuse opening either directly by gravity through vertical chutes, or by a recently-developed mechanical horizontal transportation system. Any water used in connection with the Multrum is for cleaning purposes only, and for this very small amounts are needed.

How much water is saved when a Multrum is used instead of a flush toilet?

An average family of four uses 40,00 to 50,000 gallons of fresh water to flush toilets alone, per year. Use of the Multrum permits a saving of all this water, which generally accounts for 40 to 50% of the total water used in the home.

What can be put into the Multrum?

Besides urine and excrement, toilet paper, kleenex, tampax, kotex, disposable diapers (not the plastic part) and similar bathroom wastes can go into the toilet. Practically all organic kitchen and household wastes which could be a potential odor problem can go in the garbage chute. These include cooking liquids, paper towels, grease and fat, dust pan and vacuum cleaner refuse, vegetable and meat scraps and peelings, and even bones and eggshells (although these are mineralized calcium and are acted on chemically rather than bacteriologically). Some large bones will emerge incompletely deteriorated but, nevertheless, will help rather than harm the process because of their calcium contribution. The occasional newspaper used for litter for puppies or kittens may, if torn up a bit, also be included.

What should not be put in the Multrum?

Cans, glass, plastic, chemic... product will be safe in (including such things as Saniflu... and other "sanitary" agents) or la... amounts of liquid of any kind. Nor should any large quantities of dry or bulky organic wastes such as cardboard boxes or newspapers be included which can easily be disposed of hygienically by other means. Also, any materials which could get hung up on the air ducts and impede the settling of the mass such as straw, hay or newspapers should be either shredded before being put in or not be put in at all. Absolutely no paints or other toxic substances should be put in which might damage garden plants on which the humus is used.

Multrum, sho... spect.

...m and ...ce

How many people can use it?

It is difficult to calculate precise usage parameters due to the enormous variety of combinations of influential factors (e.g. temperature, humidity, nature of material introduced, ventilation). However, it is known that approximately six people can use the most standard Multrum (9' long) on a full-time basis, without the addition of a mid-section. For each mid-section added, up to four more people can use the system. If use is intermittent or seasonal, even more people could use it.

Does it have to be in continuous, year-round use to work?

The dimensions of the container as well as the nature of the process are such that it can take large fluctuations in use. All waste materials bring with them the microorganisms which effect their own destruction. Even if there is no input for long periods of time enough organisms will have survived so that, in combination with those introduced with the fresh wastes, the normal population will be restored quickly.

Is the addition of kitchen garbage necessary?

Yes, the addition of kitchen garbage (or some other material high in cellulose such as leaves, sawdust, shredded hay or straw) is necessary. The high cellulose content of these materials provides a source of carbon, one of the cell-building materials necessary for growth of the organisms. These materials absorb and enable the conversion of the nitrogen in the urine to a stable form which is usable to plants. Also, as pathogenic (disease-producing) organisms, along with other predators, are consumed by the cellulose decomposers, the presence of material high in cellulose helps to ensure

Must the toilet chute invariably be connected to the upper end of the tank, and the garbage chute to the middle chamber?

Yes. The reason for this is that the microorganisms which consume cellulose (of which the garbage is largely composed) need nitrogen in order to do so. There is relatively little nitrogen in garbage but a great deal in urine. But the nitrogen in urine is in a form which cannot be used by the cellulose-consuming organisms. Necessary transformation takes place as the urine passes through the soil-like layer along the bottom of the container. It is then drawn up into the waste mass of garbage by capillary action as nitrate which the bacteria can use. If the positions of garbage and toilet wastes were reversed, the garbage-eating microorganisms would not get the benefit of the nitrogen from the urine which would drain directly into the removal chamber.

Is the process in the Multrum sensitive to variations and/or extremes in temperature?

The microorganisms which do the work in the Multrum are quite adaptable with respect to temperature. Although they function best at approximately human body temperature, as temperatures fall their activity will slow down until they are finally dormant, resuming activity as soon as it warms up again. If temperatures rise higher than the optimal range used for this group of microorganisms, some may die, but there will always be enough left to multiply rapidly again once temperatures are suitable. Only intense, thorough and prolonged heating of the entire mass would sterilize it.

Does the container need to be heated?

If the Multrum is being used by a large number of people or ambient temperatures are really low, it may be necessary to add a small amount of heat in order to keep the rate of decomposition to the rate of input.

Is an exhaust fan necessary?

Ordinarily, not, but if for some reason it is impossible to install the vent pipe correctly, or if one wants to insure against the infrequent possibility of odor caused by downdrafts, it can be installed.

How high does the vent stack have to be?

This depends on the conditions of site and installation, but 20 feet above the toilet or garbage opening, whichever is higher, is generally adequate to insure a continuous natural draft. Where the draft is insufficient and cannot be sufficiently improved by increasing the vent height, or where less height is preferred, draft strength can be enhanced by a small exhaust fan installed in the vent pipe.

Does the Multrum have to be insulated?

This depends on a combination of rate of use and ambient temperatures. In cold climates where it is exposed to low winter temperatures (e.g., in unheated basements or outdoors) and where use is regular and heavy, insulation will help to conserve the heat generated by the activity of the microorganisms, thus helping to maintain a constant and adequate rate of decomposition.

Could the heat generated in the Multrum affect the temperature of a basement?

Probably not, for it gives off very little heat because the outer edges of the waste mass function as insulation for the warm, actively decomposing interior part. Also, the heat generated by the process is used to evaporate the liquid and to enhance the draft.

How often does the Multrum have to be emptied?

The excrement and garbage chambers are never emptied. But after the finished compost begins to appear in the storage chamber (two to four years after start-up), some can be removed whenever needed. Frequency and quantity are dependent on the use characteristics of the household. In any case, the Multrum is never emptied, and only the surplus is removed from the storage chamber, which is large enough to store up to ten years' worth of compost from an average family (4-6) before removal of any material is necessary.

Is the end product (humus) free of germs (disease-producing organisms)?

The final product is as free of pathogenic organisms as any good garden soil. That is to say, whatever pathogens can survive the competition of ordinary soil bacteria, as well as the unfavorable climate, may be present in the humus produced by the Multrum. Very few pathogenic organisms are able to survive these conditions.

continued on page 55

Continued from page 46

Clivus Multrum

What about viruses — are they destroyed by the process?

Such viruses as hepatitis, which find water to be a better medium for their existence than soil, should die sooner in the Multrum than, for example, in a sewage treatment plant. Any viruses which can survive extended periods of time in ordinary soil conditions could be present in the humus from the Multrum.

Is the end product safe to use in gardens?

Research and experience in Sweden suggest that it is. Further research is being done in the United States to confirm that it is free of pathogenic organisms which could be transmitted through vegetables which have used nutrients from the Multrum compost. Furthermore, since no industrial waste products (heavy metals, toxic chemicals, etc.) which are always present in sewage treatment plants are introduced to the Multrum, the end product will be correspondingly free of these materials. It should be noted, however, that the compost from the Multrum is highly concentrated as far as such nutrients as nitrogen are concerned, and should be used sparingly or in solution.

Does the heat produce temperatures high enough to kill harmful bacteria and other pathogenic organisms?

No. The process in the Multrum produces temperatures up to 90°F, which is not high enough to kill most pathogenic organisms (which, after all, live in the human body at 98.6°F). It is not the heat in this process, but the long period of time (2-4 years) during which these organisms are subjected to the competition and predation from other organisms and generally unfavourable environment (from their point of view) in the Multrum which destroys them.

How much compost is produced?

Theoretically, if all oxidizable (decomposable) materials were oxidized, and the multrum were used as the only toilet and kitchen waste depository, about 80 pounds of humus would be produced per person per year. But because use is bound to be in some ways irregular (people work during the day and go on vacations), it will be more on the order of one to two buckets per person per year.

What are the fertilizing qualities of the end product?

Roughly the same as other organic fertilizers — high in humus, all major nutrients (nitrogen, phosphorous, potassium, calcium) and in all trace elements that were present in the wastes. An analysis made in Finland on compost from a Multrum showed the N-P-K (nitrogen-phosphorous-potassium) ratio to be 20-12-14.

Does it produce methane?

No. Only anaerobic decomposition produces methane. The Multrum is an aerobic process, decomposition being effected by microorganisms using oxygen.

Can the Multrum be used in multi-family, multi-story buildings?

Yes. Because of a recently-developed system that enables the horizontal transportation of both toilet and kitchen wastes, this has been made possible.

Can the tank be set in ground that is habitually or seasonally wet?

No. Although the container is itself impervious to water, it should be placed on a drained surface to prevent a flooded basement from floating the tank.

Can the Multrum be installed at high altitudes?

Yes. But cold winter weather combined with continuous use may necessitate supplementary heat or insulation to maintain an adequate rate of decomposition. Because water evaporates more easily at high altitudes, if such conditions permit, some extra liquid may be added to maintain optimal humidity.

How about the desert?

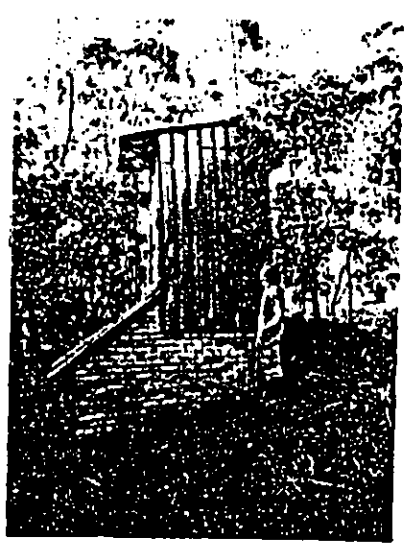
As with very cold climates, if the Multrum is installed in desert areas, it should be insulated to protect the process from the great fluctuations in temperature occurring between day and night in order to maintain an even rate of decomposition.

What is the difference between the Multrum and an outhouse?

(1) The Multrum is a waste treatment system which is most frequently placed *in* the house.
(2) There are no odors escaping into the house from the Multrum.
(3) Decomposition in the Multrum is *aerobic;* an aerobic in an outhouse. This means that the decomposition is more complete and even the odors which escape through the vent are unlike the powerful ones produced by an outhouse.
(4) The valuable nutrients contained in the waste materials are not lost through leaching.
(5) There is no polluting of subsurface water through leaching.

What is to be done with the wash-water that is not treated in the Multrum?

The bath, dish and washwater from households (sometimes called "grey water") is to be distinguished in several respects from ordinary sewage, which contains toilet wastes. The most important difference is that it is low in nitrogen, which makes it easier to treat in two important ways:
(1) It is oxidized (broken down from organic or unstable to inorganic and stable matter) considerably faster than regular sewage. This is due to the relative absence of organic matter in washwater as compared to sewage.
(2) It doesn't give rise to hazardous concentrations of nitrates in the ground water, which frequently is the case with septic tank effluent (sewage), which is infiltrated into the ground. From a theoretical point of view, therefore, grey water could be safely infiltrated into the topsoil without causing damage to ground water, provided that the soil below the infiltration pipes is permeable and porous, and provided also that the distance between the leaching pipes and the water table is at least 4'. Also, since the use of the Multrum saves up to 50% of a household's water, a leaching field could be correspondingly reduced.



Paul Nicholas' clivus Multrum - see article page 3

Problem	Possible Reason	Response
lor comes out of the chutes well as out of the container.	The air pressure in the house is lower than inside the tank.	Turn on the fan. If no fan is installed, order one from the CM office.
	More specifically, this lower pressure can be caused by competition from exhaust fan, an open fireplace, a wood stove drawing air from the house.	Allow more air to enter rooms (from outside the house) where such devices exist.
	Wind conditions cause a downdraft at the top of the ventilation pipe.	Put a rotary turbine on the top of the vent, if this has not already been done.
	The temperature in your basement is much lower than outside.	Insulate both the container and the vent pipe better.
	There are obstructions in the vent pipe such as spider webs, or the insect screen at the top of the vent is covered by dead flies, leaves, etc.	"Sweep" the vent stack with a rag on a string and clean the screen.
	The vent pipe is disconnected somewhere.	Follow the vent all the way up to check for such possible disconnections and correct them.
lor can be detected even ough the air goes properly wn the chutes.	The chutes are leaking.	Check the seams in the chutes to see whether liquid can leak out at any point (especially the toilet chute(s)).
	The fan pushes foul air through air leaks in the vent stack.	Go over the vent pipes with duct tape and a caulking gun.
lor is strong from the vent on e roof.	The process leans towards putrefaction (becomes partially anaerobic).	Increase the draft (i.e., turn on or increase the RPM of the fan).
quid builds up fast in the orage chamber and has an mmonia odor.	The compost pile is not firmly sitting on the bottom of the container. (Under certain conditions the material gets hung up on the air ducts, preventing the liquid from being absorbed by the waste pile.)	"Stoke" the garbage pile.
	There is almost no organic material in the area between the toilet wastes and the storage chamber.	Add at least a bale of peat moss as an absorber media for breakdown of the urine and evaporation.
quid builds up fast but esn't smell.	There is enough peat moss in the bottom but the garbage pile does not absorb enough.	Stoke the garbage pile, especially if it is dry on the top. This can be a perfectly normal condition following a high input of liquid. NOTE: **No odor** indicates no **health hazard.**
	The input of garbage is small in relation to the toilet waste.	Fill the garbage section with peat moss, leaves, or sawdust.
	Water vapor condenses on the inside of the container and the ventilation pipe and drains back through the pile.	Insulate the container and the ventilation pipe along its entire run. If there is already some insulation you may still need to add more.
	It is just constantly too cold in the area where the Multrum is installed.	Install an electric light bulb in the storage chamber. Be sure there is no fire risk from overheating. Consult an electrician.
Insects are flying up the chutes.	Many insects orient themselves toward odor. If the draft is faint or reversed they may get out.	Increase the draft. Check to see if there is a liquid buildup with odor; if so, follow that instruction.
Insects are too numerous.	The prey/predator balance is offset.	Use an organic insecticide (like Pyrenone) according to the directions.* Rake up some grass and leaves and add this for a richer predator life in the composter.
The insect population temporarily gets out of control.	It is possible that an explosion of one particular species may occur.	Keep a no-pest strip accessible as an insurance for such conditions. Hang the no-pest strip in the chutes under the toilet and garbage chutes under the toilet and garbage lids. This will only kill those insects that stay in the chutes without affecting the microbes in the compost pile. The downdraft will prevent fumes from no-pest strip from entering home.

* Editor's note: Although not mentioned in the Clivus Multrum literature, we have learned of other mild insecticides that reportedly work in keeping down flying insects without seeming to interfere with the decomposition process. Baytex, available from some composting toilet dealers, is effective on gnats and midges; Pratt's White Fly Spray is available from people who sell greenhouse pest control products and Hargate (made from mineral oil, sesame oil, and pyrethrum) is effective on flying insects and can be gotten from Walnut Acres, Penns Creek, PA 17862. Mothballs have varied success in controlling grain moths. Some people we talked to say they do the trick, others feel they're not worth bothering with.

Goodbye to the Flush Toilet

While it is not necessary for a CM owner to be a soil microbiologist, he or she will have to learn how to live with a live and active biological process in the house. If you already have a thriving compost pile then you'll understand a bit better than other people how to get along with your composting toilet. The CM people make these recommendations in their owner's manual.

DO:

1. Keep the toilet seat and garbage inlet closed when not in use.
2. Keep the air inlet and outlet free of obstruction.
3. Put in organic kitchen wastes including all foods, grease, bones, lint from laundry machines, fireplace ashes (cool), vacuum cleaner bag contents, and other household dirt, cat litter, etc.
4. Put in organic outdoor wastes including weeds, grass clippings, leaves, seaweed, peat moss, etc.
5. Put in organic waste from industry and agriculture including sawdust, pressed apples from cider press, etc.
6. Put in all toilet wastes including sanitary napkins, tampons, disposable diapers (after removing plastic covers), etc.
7. Use only soap and a wet brush or paper towel to wash the inlets.

DO NOT:

1. Put in inorganic wastes including cans, bottles, plastic of all kinds, etc. These materials will not decompose and will take up space.
2. Put in organic waste including chemicals, antiseptics, drugs, antibiotics, other medicines, darkroom wastes, etc. These materials will damage the process by killing sections of the decomposing organisms.
3. Put in certain organic wastes including large volumes of newspaper, cardboard, or colored paper. Although these will decompose, they contain certain toxic dyes and inks that will harm the process.
4. Put in lighted cigarettes or warm ashes; if they're hot enough they could start a fire in the tank.
5. Put in large quantities of liquid (i.e., more than one gallon at a time). The unit is not designed to accommodate any liquid other than urine. Too much liquid will not be readily evaporated and the system will go anaerobic.

Excerpted from "Goodbye to the Flush Toilet

OPERATING HINTS for the Clivus

We had been concerned, at the Minimum Cost Housing Group, with developing an on-site design for a one-household toilet that would use little or no water and could be used in high density settlements. It was our intention to produce a design which could be adapted to slums and squatter settlements in underdeveloped countries, and which could be realized in a variety of materials.

We started this work in 1972 with a survey of existing alternative sanitation systems, which grew into the publication, *Stop the Five Gallon Flush*,* still being updated and enlarged. It seemed to us at the time that composting would be the ideal basis for our work. This had been a traditional system for handling human waste in south Asia for centuries, in the rural areas. It usually consisted of a hole in the ground into which excreta and organic waste were thrown. When the hole was full, additional organic matter would be added and the hole covered up, to be dug up some time later. The humus was used as fertilizer in the fields. This avoided the handling of fresh fecal matter, which was the cause of so much disease in countries such as China and India (see chapter 4).

The question was, "Could composting be 'urbanized' and used in high density settlements?" We found that in fact someone had already begun work in this direction. The system developed was called the Clivus Multrum. We became convinced that the Clivus Multrum was the most promising of the "composting toilets," a number of which were being marketed both in Europe and the United States. The two problems that had to be resolved were: (1) Could the Clivus be built in an on-site version at a low enough cost, and could it be made out of locally available materials in underdeveloped countries; and (2) Would the Clivus operate in various tropical climates?

The Clivus Multrum is made out of fiberglass, a much too expensive material for poor countries. The first prototype we built in 1974 was out of asbestos-cement, factory molded. This proved to be still too costly, and extremely heavy. We next built two on-site toilets out of cement blocks in owner-built houses in Québec in 1975. These have been operating successfully since. A third unit was just completed in a house north of Ottawa. All of these Clivuses, now christened the Clivus Minimus, were in cellars.*

veloped country was completed in Magsaysay Village in the Tondo area of Manila. The Tondo is a squatter settlement of 160,000 people, three-quarters of whom have no waste disposal facilities at all. The prevalent system is euphemistically called "wrap-and-throw"! The Minimus chamber is built out of cement blocks, plastered inside, and has a concrete bottom. The vent pipe is galvanized metal, and the air ducts are PVC. The total material cost (not including labor) was U.S. $55. The construction time was six man-days. Half a dozen Clivus Minimus toilets have been built, both in the Tondo and in a resettlement area outside Manila.†

At the moment it seems that, for the Philippines at least, the cost of construction is acceptable. We will be trying the Minimus in India and adapting it to local materials and conditions. The Manila Minimus is built above ground, as a high water table and seasonal floods make burial too expensive. In other situations the Minimus would be buried, and humus retrieved through a "manhole."

The operation of the Minimus in hot climates remains to be seen, and the Manila models will show the problems, if any, of ventilation in hot/humid situations. It is too early yet to tell, though the fact that hot temperatures will certainly speed up the composting process itself is promising.

It should be stressed that there is no one "design" for the Minimus. It must be adapted to meet local climatic conditions, available building materials, local skills, and conditions. The application of composting sanitation technology to developing countries cannot be on a piecemeal basis. It must be done on a community (not individual) scale and integrated with social and educational development. It was precisely in such a way that rural composting toilets were introduced to North Vietnam during the years 1961–1965. As a result of this program of rural sanitation it has been reported that over 600,000 tons of fertilizer were produced annually in this fashion!

It is for this reason that the Minimum Cost Housing Group has not produced do-it-yourself plans for the Minimus and does not contemplate doing so in the near future.* The use of the Minimus represents a significant shift in cultural patterns and habits and must be clearly understood by the users in order to be successful.

A plastic roof-vent stack, with a snow and rain cover, creates suction to pull odors up through air holes in the storage chamber right under the unloading door, then through upside-down V-shaped air ducts in the chamber, and up and out the stack. In addition to pulling odors up and out, the ventilation system also provides the oxygen needed for aerobic composting.

The vent pipe must be kept warm to prevent water vapor from condensing and running back into the heap. All of the vent pipe that passes through areas that can get colder than 60° F (15.5° C) should be insulated to prevent water vapor from condensing on the inside of the vent pipe. This means all sections of the pipe passing through unheated attics as well as those sections exposed to the outside. (New units come with insulation for that part of the pipe that runs through unheated parts of the house. Owners must supply insulation for the pipe that's exposed to the outdoors.) And it is recommended that there be 15 feet of vent above the highest opening in the house (which is most commonly the toilet seat).

Before being put into operation or even before finishing assembly of the chamber, the Clivus must be primed. This involves spreading a minimum of three bales of peat moss over the entire bottom of the unit, followed by three inches of garden soil, leaves, and other garden rakings. The peat soaks up urine and its ammonia, and the filtering process of soil and garbage by the peat favors de-nitrifying bacteria leading to an increase in the range of species specializing in the breakdown of organic matter.

The composting or moldering process requires about a three to one ratio of cellulose to human waste, and it may be necessary to add more cellulose from time to time in the form of paper, sawdust, leaves, and such to maintain this ratio. The CM people say that once the equilibrium of the processes going on in the pile is reached (which should happen during the second year of operation) the unit will function with almost no maintenance at all.

Theoretically, the heat produced from the bacterial activity in the chambers should be sufficient to evaporate the liquid, but in practice this has not always been the case. A small heater or light bulb can be installed in the storage chamber to be turned on only if liquid starts to accumulate, which has happened in a number of instances causing an anaerobic process to set in, with its characteristically foul odors. As soon as the heater or bulb has evaporated enough of the liquid, it should be turned off. (The CM people caution that installation of either a light bulb or heater should be checked by an electrician, as an improperly installed unit can cause overheating and a possible fire.)

Abby Rockefeller is quick to point out that the brown liquid that can accumulate in the bottom of the storage tank is not urine but a sort of compost "tea." As we discovered on examining the liquid ourselves, it has no unpleasant odor. Abby recommends that instead of fooling around with a light bulb or heater, owners should simply remove the liquid when it begins to build up and use it to fertilize house plants or other ornamentals.

Exerpted from "Goodbye to the Flush Toilet"

Competing Bills

G. Stevens
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} for any correspondence from Council

Leigh Davidson 27-11-94

Designs app clivus multrum
avail in stock
$2500 approved by
U NSW Dept of Health
effluents 'grey water' (from house)
(reed bed) system
Steiner school
Robin Frances may have one at [illegible]
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Effrem?
Mark Norris on Rural Res
effluent.
Greenbelt system.
Rotoloo
Clivus Multrum

University of Tasmania
at Hobart

Department of Geography
and Environmental Studies
Telephone (002) 202463

Centre for
Environmental Studies
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GPO Box 252C
Hobart Tasmania
Australia 7001

Mark Ansar
via Carsan
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PROPOSAL FOR THREE MONITORED TRIALS OF A BATCH COMPOST TOILET

SUBMISSION TO:

LISMORE CITY COUNCIL

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OCTOBER 1992

1.0 INTRODUCTION

The problem of human waste disposal in areas not served by a conventional sewerage system has had a difficult history. The northern rivers region of NSW poses particular difficulties due its high rainfall and in many areas low soil permeability. Pit toilets and septic tanks are used in considerable numbers in rural areas, and there are many instances where this results in environmental, health or aesthetic nuisance.

Concern about these issues, and a generally increased awareness in the community about the impact of human waste disposal have led to a number of householders installing, or wishing to install, composting toilets, either commercially manufactured or owner-built.

Currently, the regulations that apply to the commercially manufactured compost toilets allow the installation of only one brand and only outside of the scavenging area for current or likely reticulated sewerage schemes. Owner-built compost toilets are only permitted in the form of trials, and in the Lismore City Council area there is currently a monitoring program of such installations underway as a part of postgraduate research [Sandra Saffton pers. comm. 1992].

One of the difficulties with owner-built composting toilets is that they are almost all different, although based on a limited number of designs which have appeared in the quite extensive literature on the subject (see the reference list). Local and State health authorities have been resistant to approving installations without adequate information based on operating trials under local conditions. Until recently, no such data existed. Licences have been issued to the commercially available composting model on the basis of an assessment of existing installations, although the details of that assessment are not available [Terry Lustig pers. comm. 1991].

The commercially available composting toilets are relatively expensive ($3,000 - $6,000) and in some cases (e.g. Rota-Loo) require electricity to operate a de-humidifying element. This has been a deterrent to many householders who would otherwise be interested, and an incentive for the owner-builder to experiment with modified designs. What has been lacking is a standardised design for the owner-builder that is inexpensive, safe, easy to operate and has as many pre-assembled components as possible. A carefully monitored design would assist local authorities who may feel more comfortable giving approval to new requests if they had experience with the performance of that design in a variety of applications.

This submission includes a proposal for the installation and extensive trialling of a simple and standardised compost toilet. The toilet would be a batch system using two or more modified 240 litre mobile garbage bins and fan forced ventilation. It is proposed to construct three operating toilets and trial them for at least twelve months in three different domestic situations in Lismore, North Lismore and Stoney Chute within the Lismore local government area. It is proposed that the toilets would be extensively monitored for their performance in cooperation with Lismore City Council staff.

2.0 DESIGN PRINCIPLES

The main principles for the successful operation of a composting toilet are to ensure:

- Adequate aeration of the pile through ventilation
- Isolation from human contact and the environment until complete composting has taken place
- Protection against excessive heat loss during cold weather
- Appropriate carbon-nitrogen ratios through use of supplementary organic material
- Appropriate moisture content
- Neutral pH
- Reduction of smell in the toilet room through ventilation
- Exclusion of insects, especially flies, from the compost chamber
- Adequate provision of information for users of the toilet
- Adequate instrumentation and monitoring

3.0 OPERATING PARAMETERS

Composting toilets can tolerate a reasonable variation in operating parameters, but excessive departure from one or several can cause failure, usually in the form of inadequate composting. Problems can often compound each other. For example, too low a carbon-nitrogen ratio can result in low pH, and inadequate ventilation can result in too high a moisture content. The most important operating parameters are shown below, along with optimum values [Hupping Stoner1977 and others].

temperature	40-60°C when composting
carbon-nitrogen ratio	25-35
moisture content	between 50 and 70%
pH	neutral (7)

4.0 A DRAFT LOW COST DESIGN

In addition to the principles shown in Section 2.0 above, the proposed design considers the following:

- Simplicity in design, construction and operation
- Maximise use of off-the-shelf components
- Maximise pre-assembly and therefore minimise building requirements
- Adequate chamber size
- Low energy requirements
- Utilise a simple method for the addition of supplementary organic matter
- Ease of maintenance
- Incorporation of simple and low-cost monitoring devices and methods
- Elimination of the need for contact with composting material
- Clear instructions for users

The draft design presented here uses a batch composting system with separate chambers.

The chambers are composed of modified 240 litre mobile garbage bins, which are an inexpensive, off-the-shelf item. The capacity depends on the expected usage rate, and experience and the literature suggests that 240 litres is appropriate for the average household. A 360L bin is also available, although not as cheaply as for the 240L, but the design principles and sketches shown here will be the same except for scale.

As shown in the accompanying diagrams (Figures 1-3) the ventilation is achieved through a mesh-covered cut-out, perforated chutes and a mesh false floor.

Air enters the bin through the mesh-covered cut-out at the base of the bin and comes in contact with the bottom of the compost pile through the mesh false floor. In addition there are three perforated ventilation chutes placed vertically up three walls of the bin to provide further contact with the pile. These can be constructed from lengths of 100mm PVC stormwater pipe which are cut lengthways and have a number of 8mm holes drilled in them throughout their length. These chutes are held in place by metal strapping (or saddles) and rest on the mesh false floor. The ventilation is provided (as in the case of the ROTA-LOO) by an electric rotating fan located internally in the vent pipe. This vent pipe is connected by a tee-piece to the 415 mm PVC tube which forms the connection between the pedestal and the top of the operating bin. A low

point in the vent pipe is utilised to catch and drain condensation which would otherwise drip back into the compost bin [Corben pers. comm.].

As previously indicated,the vent pipe is designed to provide ventilation not only for the bin which is in use, but also for the first bin which has already been filled. This enables further composting time and avoids fresh wastes being added to the first pile. Access to this second bin is achieved with a branch in the vent pipe connecting via an elbow to the sealed lid of the second bin.

The metal mesh false floor in the mobile bin is held up by four 6mm threaded rods which extend across the width of the bin and are secured by nuts on either end. For cold climates a heating element can be laid on top of this mesh false floor, with the terminals protruding outside the bin on the rear (wheel) side. A second mesh floor is placed on top of the element (forming a 'sandwich') and secured in place by two 6mm threaded rods as before (See figure 2).

If a heating element was used, the thermostat which controls the element would be located about 150mm above the false floor and held inside a hollow metal tubing which extends across the width of the bin.

The lid of the mobile garbage bin is removed and a thick rubber or neoprene seal placed on the top lip. As shown in Figure3, the bin is positioned underneath the pedestal opening and the whole bin is jacked or wedged up to form a tight fitting seal with a 415mm PVC tube using (for example) an automobile screw jack. This screw jack is located between the wheels of the mobile bin, and the handle is accessible from the rear (wheel) side of the bin.

4.1 LIQUID HANDLING

An average 5-person household produces 5 litres of urine per day [Laak 1974 cited in Lombardo 1981]. Most of this liquid will be absorbed by the pile or lost through evaporation. Excess liquid will drain through the false floor mesh to the base of the chamber and will be dealt with in one of two ways:

(i) In the rural trial, an overflow tube will be installed on the side of the chamber, below the air intake mesh. This tube will drain filtered excess liquid to an absorption trench.

(ii) In the two urban trials, excess liquid will drain to an electric urn which acts as a holding tank. The electric element in this urn will be activated by a float switch and controlled by a thermostat and timer designed to bring the liquid up to 75°C for 10 minutes. This is sufficient

to destroy all excreted pathogenic organisms [Feacham 1983, cited in Fordham 1990] and allows the liquid to be drained off once cooled and used as manure. The urn is sealed except for a bleed to the main vent pipe to remove odours.

4.2 SUPPLEMENTARY ORGANIC MATERIAL

Human faeces and urine are rich in nitrogen, with a carbon-nitrogen (C:N) ratio of about 7 and 0.8 respectively. The optimum C:N ratio is about 25-35 and it is therefore important to add material to increase the carbon content. The most appropriate material to use in a domestic application is organic kitchen waste as the carbon is easily accessible. Other suitable material for this application would be a mixture of sawdust, fine dry chaff and a small quantity of dolomite to correct any tendency towards acidity. While it is possible to design an automatic hopper system that provides a 'flush' of bulking agent after each use, material will be added manually by the users for this proposed trial .

5.0 MONITORING

In order to maximise the information from the trial it is proposed that the operating conditions of the toilets be monitored, particularly the temperature and the carbon-nitrogen ratio. While this can be done most effectively with a datalogger, thermocouples, moisture sensors, pH meters and so on, there are cheaper and simpler ways of achieving the same end. In the absence of a datalogger, the temperature of the compost pile and the outside temperature can be monitored manually by the use of a cheap digital indoor/outdoor thermometer with a display in the toilet room which can be read on a regular basis and the result entered in a log book, along with usage.

Moisture content can be monitored using a tensiometer and the pH can be determined periodically. Holes will be provided in the accessible side of the bin which can be sealed with rubber stoppers to allow a thin scoop to be inserted.

Testing for pathogens, ova, cysts and parasites will be carried out on the composted material in the first batch at the point when the second bin is full. Regular bacteriological tests of each batch of the drain-off liquid will be undertaken.

6.0 OPERATION AND MANAGEMENT

The main operating requirements of the toilet are the addition of bulking agent and the monitoring. Also, when the operating bin is full, the bins will need to be changed over. It is anticipated that this will only happen once in the twelve month trial. To change the bins would involve a simple process of lowering the bin that is in use by releasing the screw jack, placing the lid on the bin and fastening it with bolts, wheeling it to one side and attaching the extension vent pipe, as shown in Figure 3. The advantage this system offers is the elimination of handling of the waste material. Also, if the wastes are adequately composted then the weight of the material and the capacity of the bins become less of a constraint.

A clear informative notice for visitors or users unfamiliar with waterless toilets would be provided.

Monitoring of the waste material (other than temperature probes) would only be undertaken by the Principal Investigators and contact with all wastes, including wastes that appear to be fully composted, would be avoided. Similarly any probes, scoops or other items introduced into the chamber would be disinfected or isolated from contact.

At the point where the second bin is full, and after the contents of the first bin are tested for pathogens, these contents would be disposed of, with Council permission, under 30cm of topsoil. The bins can be emptied directly into a shallow trench, avoiding any contact with the material.

7.0 ACKNOWLEDGEMENTS

The compost toilet design proposed here has been developed following an extensive review of a range of designs, both owner-built and commercially manufactured. Many designs and assessments of their performance are to be found in the references at the end of this submission. Others have resulted from first hand experience of owner builders in Australia. For key aspects of the design, we would like to acknowledge the designs developed by Lindsay Corben from Nimbin, NSW and Brian Woodward from Wollombi, NSW.

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Carol Hupping Stoner (ed) (1977) "Goodbye to the Flush Toilet", Rodale Press, Emmaus PA.

Brian Woodward, architect and owner-builder of a batch composting toilets, Wollombi NSW.

FIGURE ONE

PROPOSED DESIGN - BIN MODIFICATIONS

- The automobile screw jack is for raising the bin for an airtight fit against the toilet room floor. A wooden cross-piece (not shown) would be used under the base to even out the load.
- The mesh-covered cut-out is shown, this would be held in place by metal strapping bolted to the bin wall. The internal details of the false floor are shown in Figure 2.
- The perforated chutes are shown with the metal saddles that hold them in place.

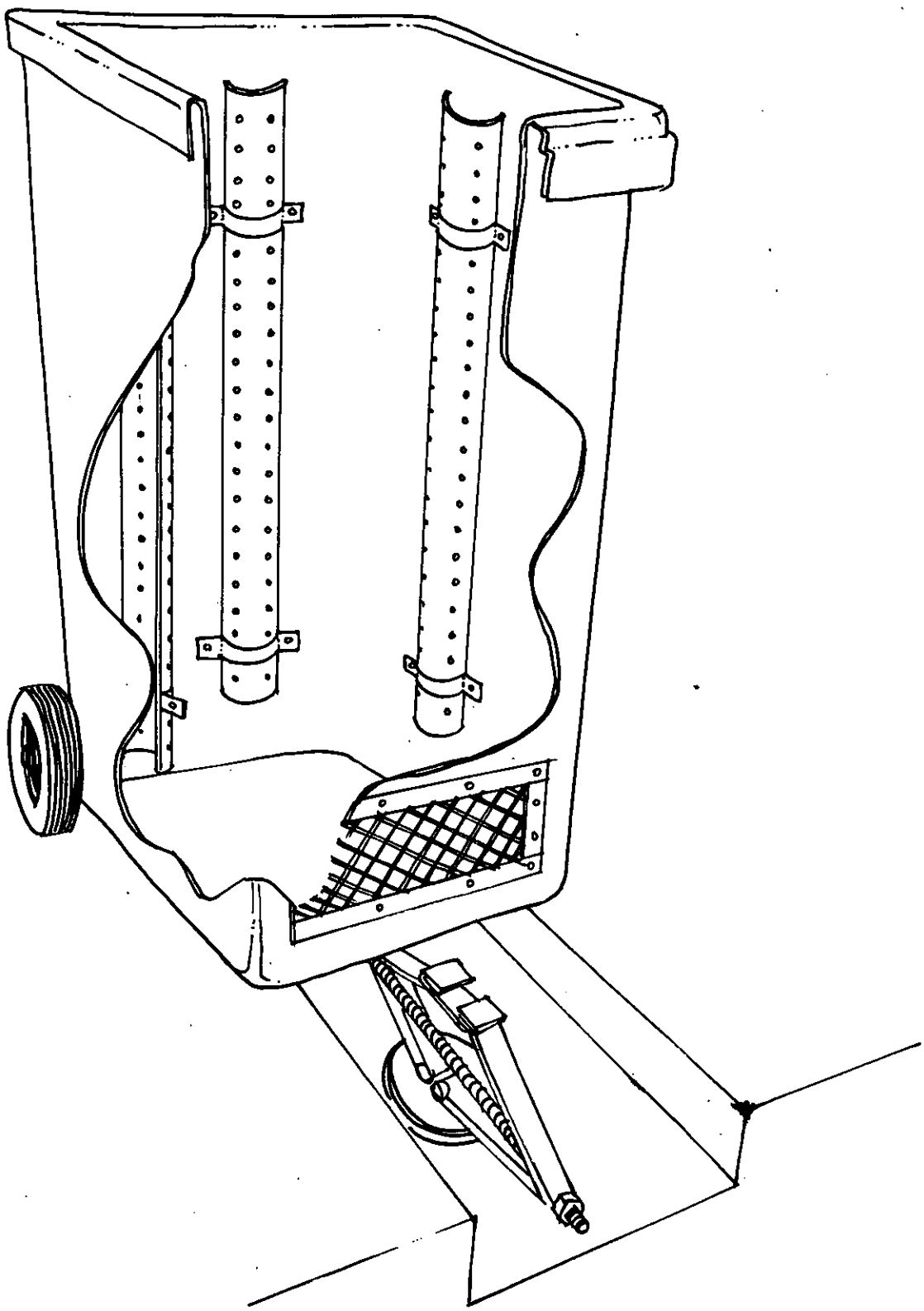


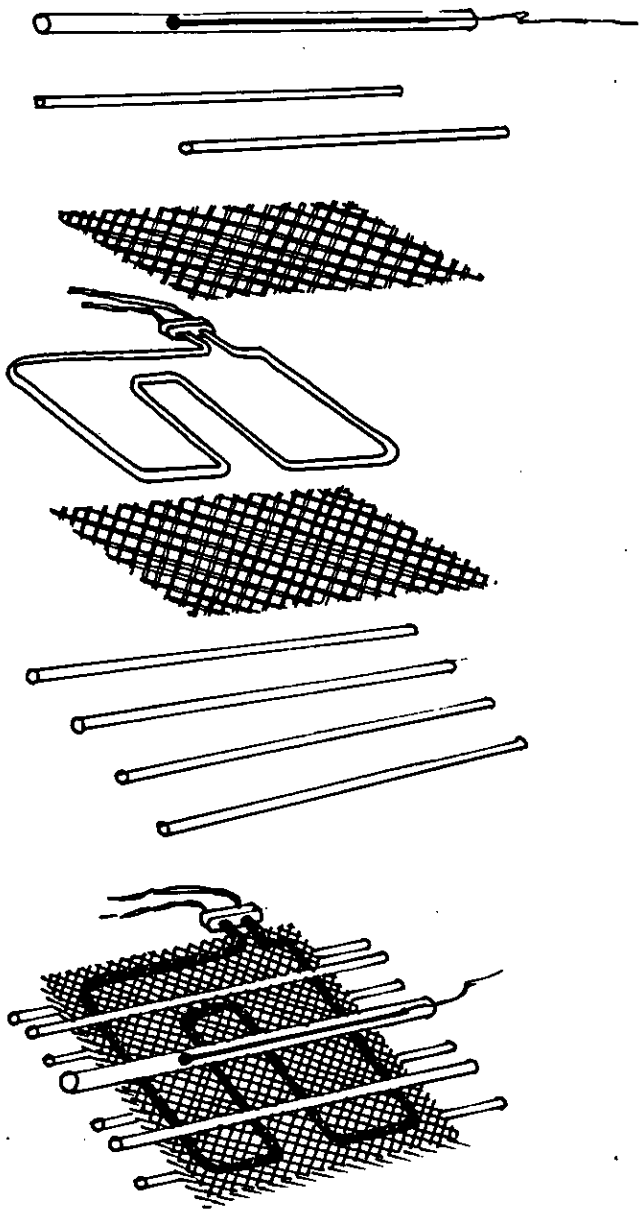
FIGURE TWO

PROPOSED DESIGN - FALSE FLOOR AND OPTIONAL HEATING ELEMENT

- The bottom diagram shows the false floor in place. If a heating element was used the thermostat would be positioned about 150mm above the false floor.

- The second from bottom diagram shows the false floor mesh 'sandwich' with the heating element.

- The top diagram shows an exploded view of the components of the false floor and thermostat. From the bottom is shown the four threaded metal rods which hold the false floor in place, the first metal mesh, the heating element, the second metal mesh and the two threaded metal rods which holds the 'sandwich' in place. The thermostat is inserted in a length of thin tubing which extends across the width of the bin at a height of about 150mm above the false floor.



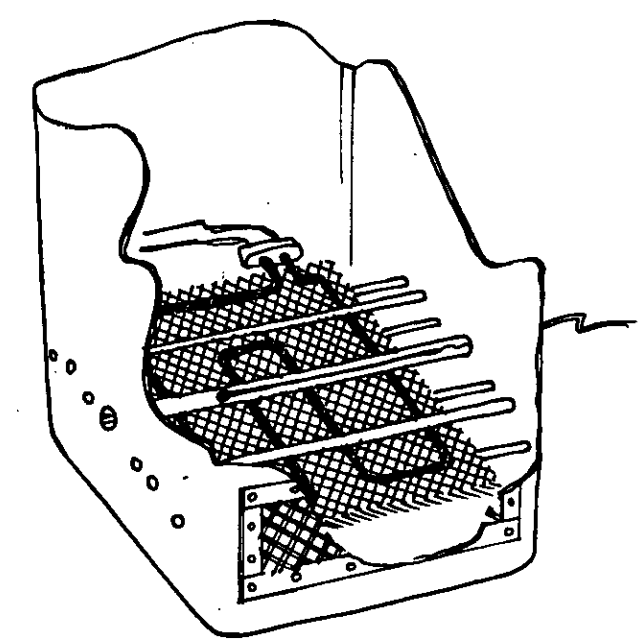
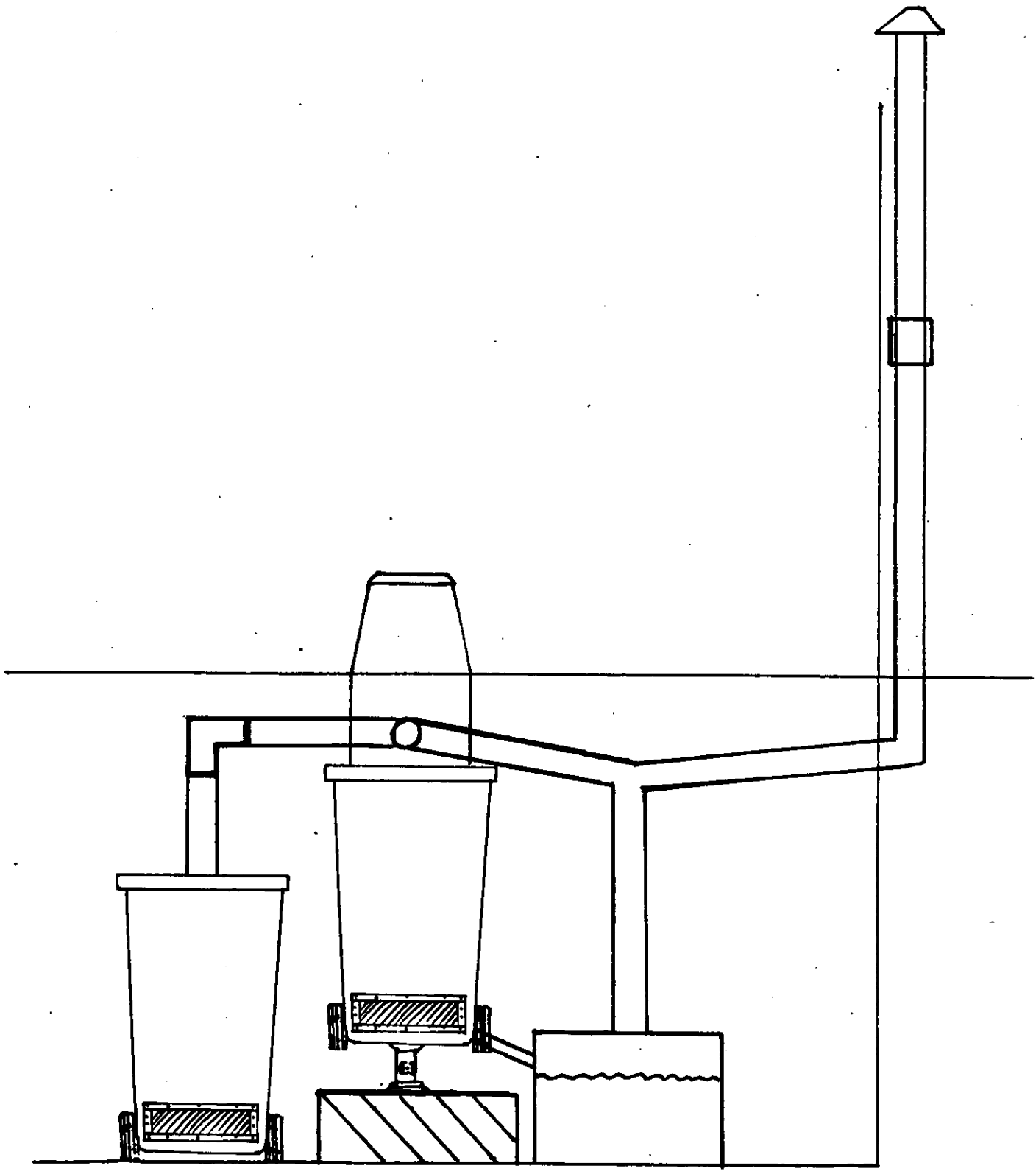


FIGURE THREE

PROPOSED DESIGN - FRONT SECTION

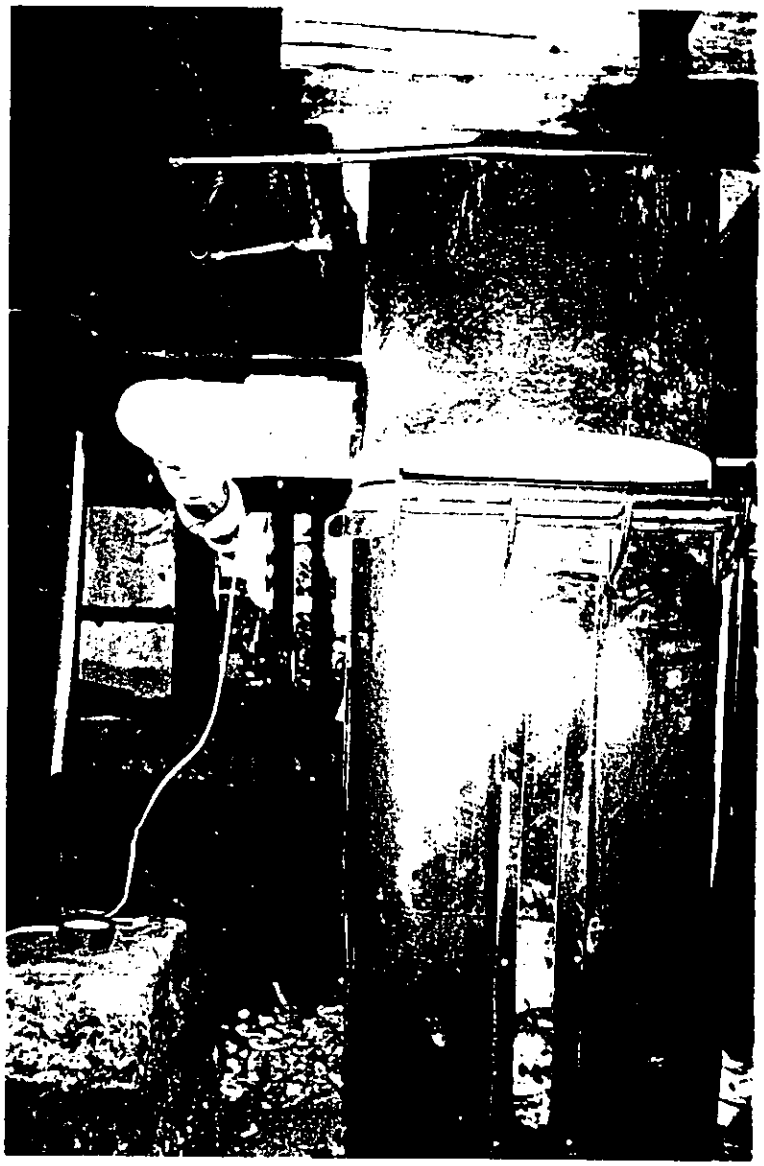
- The right hand bin is in operation, with the vent pipe shown and the vent pipe extension to the second bin. The excess liquid drain, holding tank and vent are also shown.

- A 415mm PVC tube acts as a connecting piece between the pedestal and the top of the operating bin.



Centre for Environmental Studies
University of Tasmania

PROTOTYPE UNDER TRIAL WATERLESS TOILETS FOR URBAN USE



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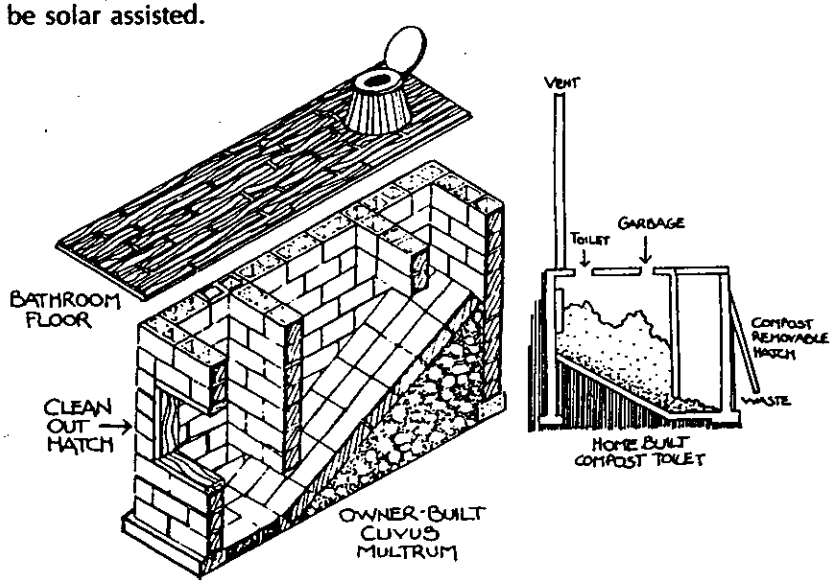
"MULTRUM" TYPE COMPOST LATRINE

Developed in Sweden about 45 years ago, this system consists of a receptacle with a slanting floor, air conduits, and a storage chamber at the lower end of the receptacle. A tube connects the commode in the bathroom with the receptacle and there is often a special chute in the kitchen for scraps. The manufactured "Clivus Multrum" system is based on this design. The receptacle can be made of concrete or assembled from prefabricated fiberglass parts. The decomposition process may be solar assisted.



The floor of the receptacle is inclined about 30 degrees and covered with a starter bed of peat moss and humus-rich garden soil mixed with grass cuttings. This is to absorb liquid and provide microbes for oxidizing the urine. As the system is used, a compost heap builds up in the receptacle. The slope of the floor causes new deposits to slowly push the older compost toward the bottom of the receptacle to the storage chamber. As it moves downward, the decomposition process reduces the heap to less than 10 per cent of the original volume.

$15

WE ALL LIVE DOWNSTREAM

A Guide to Waste Treatment That Stops Water Pollution.

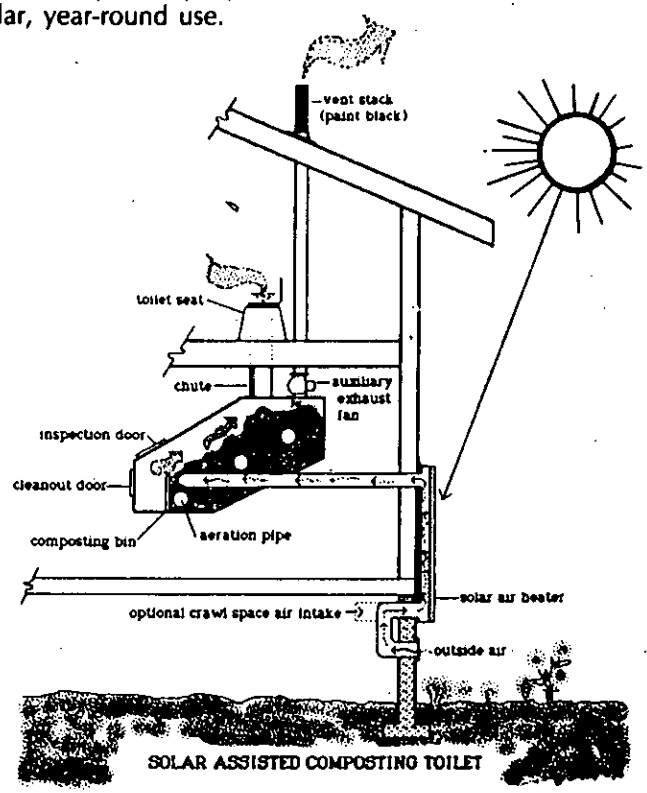
THE NATIONAL WATER CENTER

Eureka Springs, Arkansas

By Pat Costner
with Holly Gettings and Glenna Booth

chamber. This is a very slow process, and it may take five years before the first humus needs to be removed. After that once per year is usually sufficient.

The maximum number of users a multrum can accommodate depends on temperature of the receptacle area, humidity, amount and type of kitchen refuse, the proportion of urine to feces and volume of the receptacle. Usually 8-10 people would be the maximum for one unit in regular, year-round use.



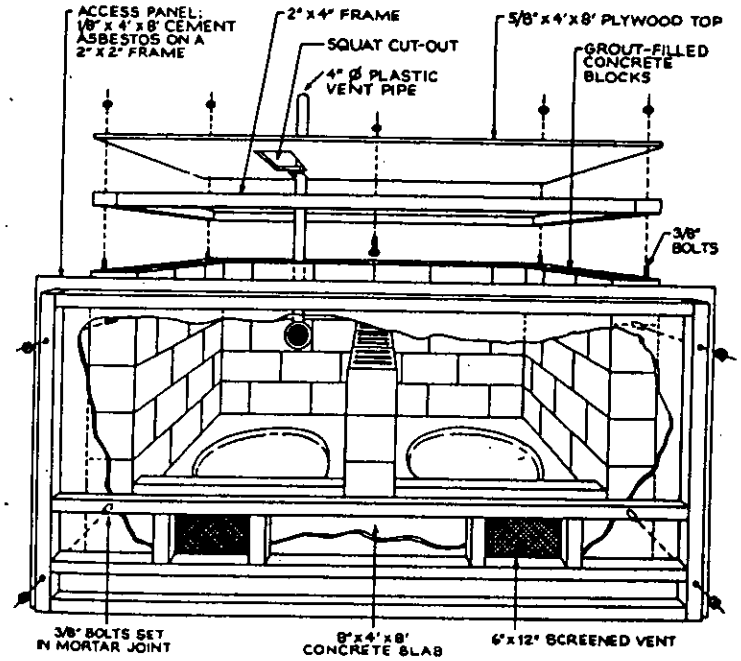
SOLAR ASSISTED COMPOSTING TOILET

The plans presented here are for a "Solar Assisted Composting Toilet" produced by Ron Hughes of the Arkansas Energy Office, One Capitol Mall, Little Rock, AR 72201. 1-800-482-1122. You may obtain a list of suppliers for components and general information for this system from this address or from The Water Center. New Life Farm has also published a fact sheet on composting toilets which includes plans for this system. Write New Life Farm, P.O. Box 129, Drury, MO 65638 or The Water Center.

FARROLONES COMPOSTING PRIVY

This composter consists of a two-chamber concrete box 4'x4'x8'. It has a plywood top with an opening over one chamber. The front of the box has two removable plywood doors with screened air inlet vents. There is also a 12" square plywood vent stack which is screened on top. The compost pile in the first chamber is turned and mixed with a pitchfork or shovel used just for this purpose. After 6 months, the pile

another 6 months of composting, then removed as clean, dry humus.

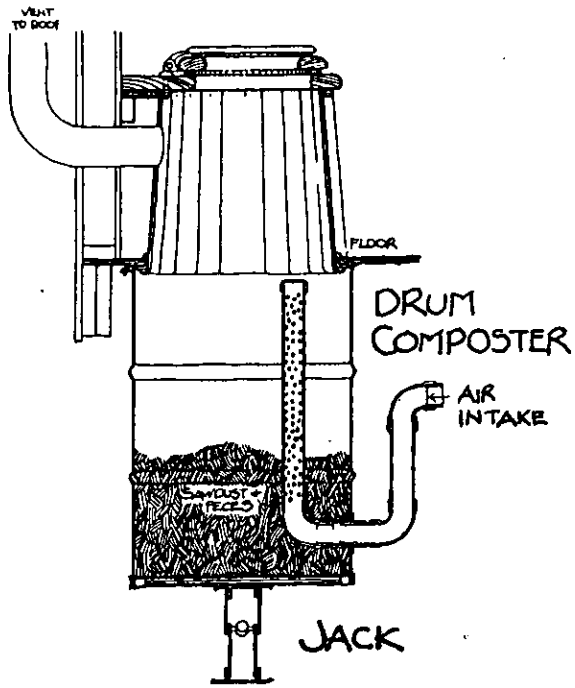


The construction of this system is detailed in "Technical Bulletin No. 1, Composting Privy" available from The Farallones Institute, 15290 Coleman Valley Road, Occidental, CA 95465. Cost is $2.00. It also contains good general and specific information on composters and the decomposition process.

DRUM COMPOSTER

This is one of the simplest owner-built systems and one of the cheapest. It consists of an open-top 55 gallon drum with perforated plastic tubes inside to admit air. A wood seat with a sealed lid can be made to fit tight on top of the drum itself, or the drum can be jacked up under a hole in the floor and covered by a commode or squat plate with a tight lid. It will take two people about three months to fill the drum. It is then resealed, removed, and allowed to sit in a sunny spot until the decompostion process is completed. The drum can then be cleaned out (except for a little left for "starter") and reused.

Good drums usually cost $10-20. Get those with removable tops, a clamp that holds the lid tight, and a lining of baked-on phenolic resin (incorrectly call "teflon lined") inside to prevent rusting. The best sources for this type of drum are farm feed mills (molasses), honey farms and food processing plants. The drum should have a flat black exterior and a two inch bung hole on the side, near the bottom for the vent pipe. Air intake pipes inside the drum are made from 2" perforated plastic pipe. Another pipe goes an inch or two inside the drum and serves as



an exhaust stack; it must extend higher than the seat. Air passages through the drum are the most important part of the system. They provide oxygen and take away moisture and carbon dioxide.

As with other decomposition systems, the drum composter requires a "starter culture", 10-15" of dry hay, peat moss, etc. After the first start-up, the drum is never completely emptied to provide starter for the next batch. Material other than human waste must be added such as peat moss, chopped leaves or cotton seed hulls. Sawdust may be used sparingly, but it should be from hardwoods. The compost requires mixing. The drum may be recapped and rolled once or twice, or a short wooden fork is hung inside the toilet and used for turning. A urine diverter will make this system function more effectively.

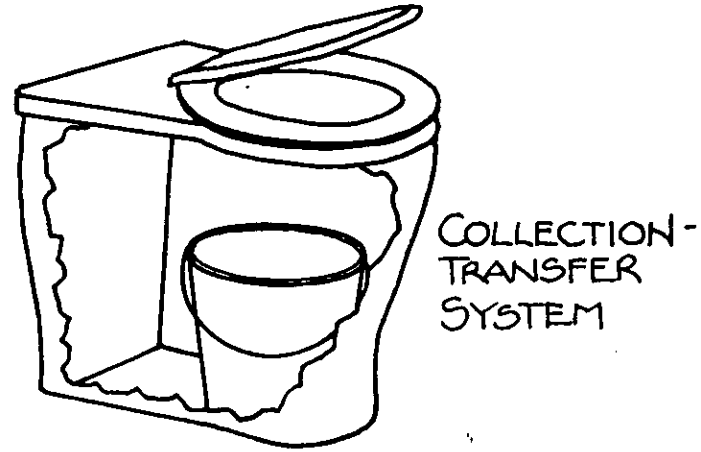
This drum design has been presented by the Farrollones Institute and others. "55 Gallon Drum Compost Toilet Guidebook & Plans" is available from Stan Slaughter, Rt 17, Vale Road, Kansas City, Mo 64138 (816) 765-6125 or from The Water Center.

COLLECTION-TRANSFER SYSTEM

This is a simple, low-cost decomposition system in which the commode itself is not directly connected to the large composting bin. A smaller receptacle is periodically emptied into the large compost bin. If designed and operated properly, it is essentially odorless, both in daily use and in transfer.

In one version of this system, a sealed, vented wooden commode that holds a 2-5 gallon receptacle is installed inside the house. With every use, the system is "flushed" with a cup or more of dry soil, sawdust, peat moss, etc. When convenient, the portable receptacle is emptied

into a large composting bin, drum or vault that is located outside the house.



In a more complex system, the commode and shelter are built above ground on stilts, with the area underneath lined with heavy gauge plastic and screened in for ventilation. A washtub-size container with handles is placed, on bricks, under the toilet seat. The commode closes with an airtight lid and is removable to allow access to the tub from above. The lower back part of the system is also removable or hinged for tub removal. A vent pipe from the tub area is added for further ventilation, especially if the system is installed indoors. For indoor use, the commode must be placed against an outside wall for access to the waste tub.

Small holes are punched in the bottom of the tub to prevent moisture accumulation. The key to successful operation of this system is to eliminate excess moisture in the waste tub. A urine diverter is used. Feces are covered with wood ashes or dry dirt. Toilet paper is placed in a waste-paper basket. (It dries in a day and can be used for fire tinder.)

The compost bin consists of four compartments arranged in a square. These are made of rough lumber or slabs. Each bin is about 4'x4'x4', with a removable wall for easy turning and removal of compost. The bins are lined with heavy waterproof plastic and covered by screens. Perforated plastic pipe can be inserted through openings in the sides of the bins to increase air flow through the compost.

When the first bin is filled with wastes transferred from the privy and kitchen scraps, the compost is shifted to the next bin. This process is followed for each bin until they are all full. Then the clean, dry humus is removed from the fourth bin and can be spread on the garden or orchard.

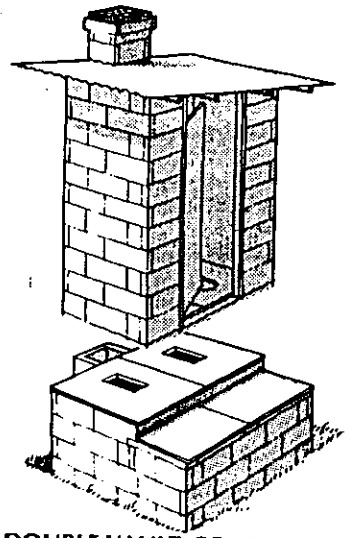
This collection-transfer system is labor-intensive in its use. But it does the job and can be constructed for around $100. It would probably be most suitable for a rural setting.

Information for this system was taken from "A Simple Low-Cost Rural Compost-Privy", an article by D.P. Grimmer and M.A. Schliekelman published by Appropriate Technology Research, 1938 Hano Rd., Santa Fe, NM 87501.

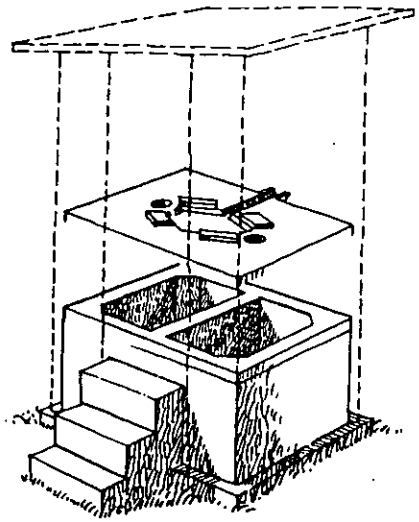
DOUBLE-VAULT COMPOSTER

This is a compact, versatile unit whose basic structure can be varied in a number of ways. It was developed in North Vietnam in the 1950's. The Farralones Composting Privy seems to be based on this plan also.

As with any system, if there is a tight receptacle, there will be no groundwater pollution. If there is a chance of seepage, the system must be placed downhill from the well or other water supply. If the area where you are building is flat and waterlogged, you should place it on a mound and provide a watertight floor.



DOUBLE-VAULT COMPOSTER



VIETNAMESE
DOUBLE-VAULT COMPOSTER

VIETNAMESE DOUBLE-VAULT COMPOSTER

The basic idea behind this double-vault system is two chambers and a urine diverter. One chamber is used until two-thirds full, then sealed, and the other chamber is used until two-thirds full. The first chamber is then emptied of what has become clean, dry humus. This is done through an easily accessible door in the rear of the chamber.

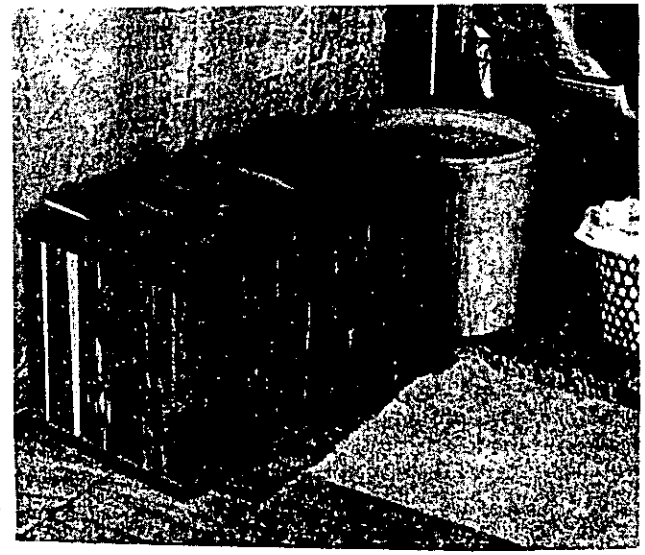
It is important that the commode seat or squat plate have a cover that seals well to minimize insects. Before first time use, the floor of the chamber is sprinkled with powdered earth to absorb moisture from the feces and provide some of the micro-organisms for the decomposition process. After each use, the dry absorbant (sawdust, peat moss, dry soil, ashes, etc.) are sprinkled over the feces to absorb moisture, curtail bad odors and insects. Urine is drained away and collected in a jar — either empty or filled with ashes.

OFFSET DOUBLE-VAULT COMPOSTER

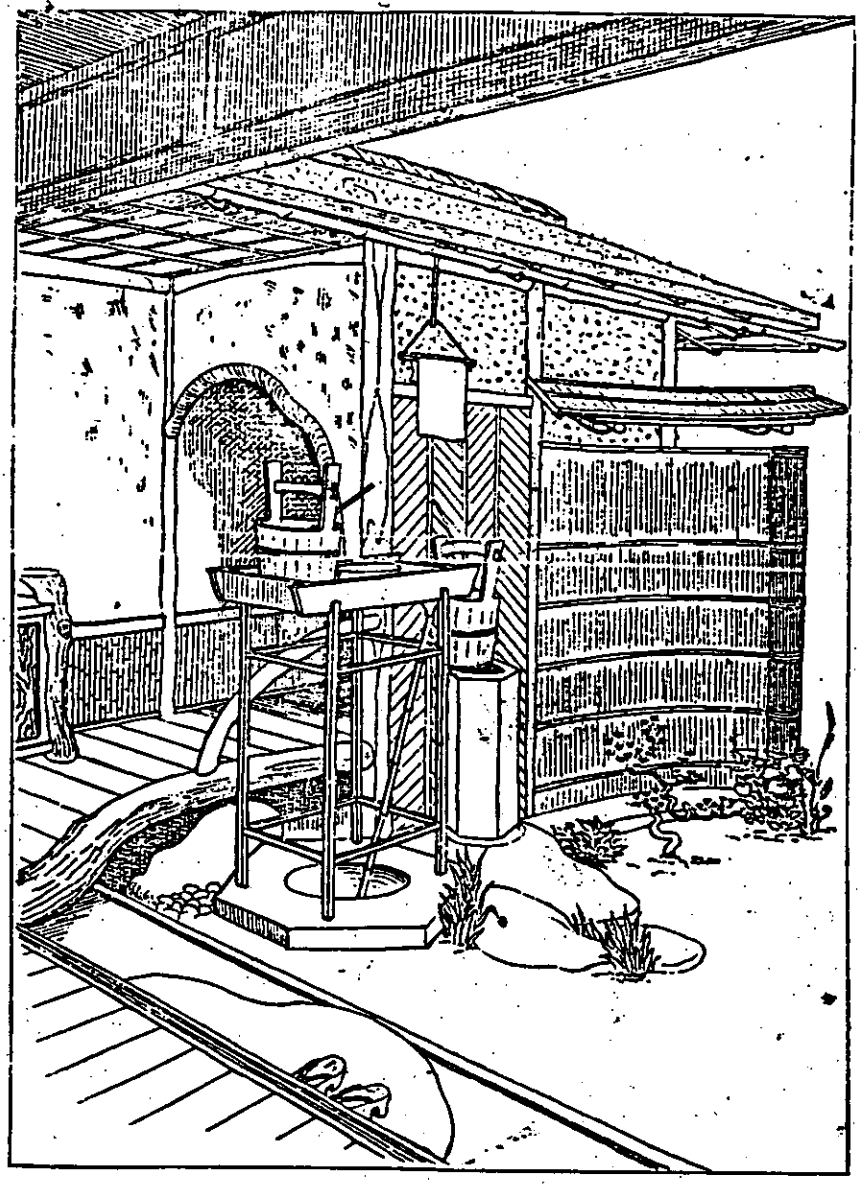
A variation of the double-vault composter is one in which the collection receptacles are not located under the commode or squatting slab, but placed to the side and connected by a chute. In Mexico a solar-heated double-vault composter has been developed. There is a seat riser above a baffle between the two chambers, which directs input to one of the chambers. When that chamber is full, a handle is turned and the input falls into the other chamber.

The chambers extend outside and are covered with black painted aluminum sheet lids which face south. These act as solar collectors and increase evaporation and raise the temperature of the compost pile. The capacity of the system can be increased by manually using a hoe to shift the pile to the rear of the chamber. This means that the system has to be emptied once a year at most with regular use by 6-8 people.

An excellent book on low-cost decomposition systems is "Sanitation without Water" by Uno Winblad and Wen Kilama, published by the World Health Organization. It gives details for the construction of these systems and many others, as well as general maintenance information.



The Farallones Institute
15290 Coleman Valley Road / Occidental, California 95465



Privy of Inn in Hachi-ishi Village, Nikko.

Technical Bulletin NO.1

COMPOSTING PRIVY

SHIT THROUGH HISTORY: A SHORT PHILOSOPHICAL DISCOURSE

"dein eigenes scheisse stinkt nicht" -- Albert Einstein

Put yourself in the position of a future archeologist sifting through the material remains of our culture some hundreds of years from now. What will he make of the curiously shaped ceramic bowl in each house, hooked up through miles of pipe to a central factory of tanks, stirrers , cookers and ponds, empyting into a river, lake or ocean?

"By early in the twentieth century urban earthlings had devised a highly ingenious food production system whereby algae were cultivated in large centralized farms and piped directly into a ceramic food receptable in each home."

Our future archeologist would have to be a genius to guess at the destructiveness and insanity of present day "sanitary engineering."

Mix one part excreta with one hundred parts clean water. Send the mixture through pipes to a central station where billions are spent in futile attempts to separate the two. Then dump the effluent, now poisoned with chemicals but still rich in nutrients, into the nearest body of water. The nutrients feed algae who soon use up all the oxygen in the water, eventually destroying all aquatic life that may have survived the chemical residues.

All this adds up to a strange balance sheet: the soil is starved for the natural benefits of human manure, garbage and organic materials that go down the toilet, the drain and to the dump. So agribusiness shoots it up with artificial fertilizers made largely from petroleum. These synthetics are not absorbed by the soil and leach out to pollute rivers and oceans. We each use eight to ten thousand gallons of fresh water to flush away material that could be returned to the earth to maintain its fertility. Our excreta - not "wastes" but misplaced resources - end up destroying food chains, food supply and water quality in rivers and oceans.

Nations endure only as long as their topsoil. How did it come to pass that we devised such an enormously wasteful and expensive system to "solve" a simple problem? Excreta is the only substance of material value that we ever return to the earth. Indeed, our body "waste" is truly a resource out of place.

Wendell Berry suggests that a primary criterion for a successful culture is to realize a balanced relation between the processes of growth and the processes of decay. He notes that our society, which exclusively values growth and looks upon the processes and products of decay as "waste", is radically out of balance.

The way to handle shit also reflects our attitude towards the body and its functions. The development of Mr. Crapper's water closet and urban sewer systems coincides with the ascendance of Victorian priggishness typified by clothing that disguised the body's true form from head to foot. The gleaming white functional bathroom was perfected in the twenties - a period noted for its crusade against "germs" - those nasty creatures in the Listerine ads. One wonders how the bacteria that sustain our lives ever survived the rhetoric of the antiseptic hygiene age.

East and West developed very different attitudes and practices in relation to the human body and its processes. In China and Japan, "night soil" has been scrupulously collected for centuries to fertilize the fields. A nineteenth century visitor to Japan tells us that in Hiroshima in the renting of poorer tenement houses, if three persons occupied a room together the sewage paid the rent of one, and if five occupied the same room no rent was charged. Farmers vied with each other to build the most beautiful roadside privy in hopes of attracting the favors of travellers who needed to relieve themselves.

Rational excreta disposal systems in the Orient grew out of its importance to agriculture. Carts travelled through the cities collecting the precious stuff and carrying it off to dung heaps where it decomposed. In the West no such practice existed. Chamber pots were emptied into the back yard or street. Some of the streets were designed so that gutters would carry off the filth during a rain. Most of the time, city streets were not pleasant places to be: it is easy to smell how shit got a bad name.

In nature, water carries off wastes, and excreta is just another nasty waste. Early sewerage systems emulated natural process. The open gutters, washed clean only by rain, were gradually put underground to minimize the appalling stench and mess. In the 1800's, it was discovered that many then common epidemic diseases were transmitted through micro-organisms in feces. But by then the psychological and technological die had been cast. The basically unsound practice of dumping excreta into any convenient body of water was rationalized. The flush toilet eliminated direct contact with excreta. The smell and mess was removed from city streets and put into underground pipes. Methods to "treat" sewage by settling out solids, adding chemicals to kill bacteria, and more recently, aeration to speed decompostion, were invented.

We assume that by "flushing and forgetting" we are rid of the problem, when we have only compounded it by moving it to another place. Every tenderfoot camper knows not to shit upstream from camp, yet present urban cutlure provides us no alternative. It is estimated that a quarter of all urban sewage is dumped into the water. In Oakland and San Francisco raw sewage is dumped into San Francisco Bay during the rainy season because the plants cannot handle the additional volume of storm drainage. The rivers, bays, and oceans around half of our urban areas are cesspools. The "waste" we seek so hard to ignore threatens to bury us.

FUNCTIONS

The compost privy is designed to decompose human excrement and organic household waste in a safe and sanitary manner without the use of water or plumbing. The compost privy takes the place of the flush toilet, the septic tank and the garbage can.

ADVANTAGES

1. You can use the compost privy where sewer hookups or septic tanks are unavailable or not practical.

2. The compost privy saves water normally flushed through the toilet, about half the annual domestic water consumption: 7,000 - 10,000 gallons per person is saved each year.

3. The compost privy can be built by amateur builders using common materials and common tools for less than $300, a savings of up to several thousand dollars over the usual flush toilet/plumbing/septic tank combination.

4. The compost privy returns valuable nutrients and humus to the soil. Between 1-2 cubic feet of humus are produced from each person's excreta in a year.

5. The compost prviy allows you the use of the squatting position, which is the healthiest posture for defectaion.

6. By taking care of your own shit, it doesn't get dumped on someone else.

LIMITATIONS

1. The compost privy does not receive waste water other than urine. Household waste water from sinks, bath and shower may be diverted into the garden, recycled through a solar still or emptied into a sump pit and leaching lines.

2. The proper operation of the privy requires your attention: a simple ritual, 30 minutes twice a month to turn the pile. You are managing a complex biological machine that has no moving parts.

3. The compost privy requires floor space of 4 x 8 feet with a four foot deep holding tank underneath that must be accessible on one side.

4. Compost privies have been designed by experts in public health and sanitation primarily for use in rural agricultural areas throughout the world. However, local building and health officials are likely to be unfamiliar with them, and reluctant to grant permits for their use. One purpose of this Bulletin is to provide local officials with evidence that the compost privy meets acceptable standards of public health and safety.

DESCRIPTION

The privy consists of a two-chamber concrete box 4'x 4'x 8' outside dimension. Each chamber has a capacity of one cubic yard. The plywood top is fitted with an opening "squat plate" over one chamber to receive excrement, household wastes and additional high carbon content organic matter. The front of the box has two removable plywood doors with screened air inlet vents. A twelve inch square plywood vent stack, screened on top, allows passage of exhaust gases up and out. Once or twice a month the pile is turned and mixed with a pitch fork and/or flat shovel stored within the compost chamber and used exclusively for this purpose. After six months, the pile is turned to the storage compartment to the left (or right) for at least 6 months of final composting and aging before it is removed for use in the orchard or flower garden. As an added factor of safety we recommend not using the compost directly in the vegetable garden but on fruit trees and shrubs or ornamental plantings.

THEORY AND PRACTICE OF OPERATION

Composting is the term applied to any man-managed process of bacterial decomposition that returns organic materials to the soil in the form of humus. Two types of decomposition occur in nature through the action of bacteria and other micro-organisms.

Aerobic decomposition occurs, for example, on the forest floor. Dead leaves, animal remains, feces and other materials are stirred and broken up by animal and insect life. Bacteria that live in the presence of oxygen process the material through a series of chemical changes which reduce its mass to about one twentieth of its initial volume. The results of the process are a nitrogen -rich, earthy humus and carbon dioxide, both necessary to plant life. In nature, the process of building topsoil through aerobic decomposition is extremely slow. It takes hundreds of years to build an inch of topsoil.

Anaerobic fermentation is a decomposition process produced through the action of bacteria that live without oxygen, as in a swamp, marsh or manure pile. Dead organic material goes through a series of chemical changes to produce humus, nitrogen, carbon dioxide and gassy by products that give the anaerobic process its distinctively unpleasant odor.

Because it is more rapid, ordorless and produces higher temperatures, aerobic decomposition is the process we want to occur in the compost privy. To maintain the privy as an aerobic composter, the following factors must be considered:

Aeration:
Aerobic bacteria live only in the presence of oxygen. To insure good aeration from the start, place 12 inches of loose, dry straw or grass over four inches of sawdust on the bottom of the chamber. Additional aeration is supplied by turning the pile at least twice a month, and by air flowing through the vents, over the pile, and up the vent stack. In turning the pile, fold the outside layer into the center. The more often the pile is turned, the quicker decomposition takes place under optimum conditions.

Moisture content:
The ideal aerobic compost pile is moist but not wet, fluffy and loose, not dense and matted. Since feces are 65-80% moisture, light, dry material such as peat moss, dry leaves, chopped dry grass or straw must be added after each use to keep the pile from becoming too wet.

Temperature:
The temperature at the center of the aerobic pile can reach 160°F., and regularly reaches 135°F. Maintaining optimum temperature means the pile must be large enough to insulate its center, and it must be turned often (twice a month) to supply oxygen and incorporate freshly deposited material.

Size of pile:
The optimum size of an aerobic pile is a cubic yard. A smaller pile doesn't hold the heat well. In starting the privy composting process, additional organic materials should be added to build the pile as quickly as possible. Feces should not compose more than a quarter of the total mass. Each compartment in the privy holds a cubic yard.

/N ratio:

Organic material contains varying amounts of carbon and nitrogen. Feces contain about 6% nitrogen, urine 15-18%. The optimum environment for the micro-organisms decomposing the pile is 30 parts of Carbon to each part of Nitrogen. Too much nitrogen or other absorbant organic material slows or changes the process. Throw in a 1 lb. coffee can of sawdust after each use of the privy.

CALCULATIONS

Feces should constitute no more than 20-25% of the composting material. Human waste per person per day averages 1/2 lb. feces (moist weight) plus 1 quart urine. A yearly average equals about 180 lb. feces, 80 gal. urine. At 11#/gal. and 7 gal/cubic foot, this equals 3 cu. ft. feces, 10 cu. ft. urine. Decomposition reduces this raw wet volume to one twentieth its original volume, or about one cubic foot per person per year. (We use 7,000 - 10,000 gal. of water per person per year to flush away what naturally reduces to something you could lug around in a five gallon can!) Government sources say to size a privy at 2 cu. ft. /person/year. Figuring a volume of other orgainc waste five times that of human waste, two 3'x 3' x3' compartments would serve a family of four for a year.

Caluclations based on 6 month use by four persons:

Daily Input

Feces: 1/2 #/person/day (0.15# dry weight) 6% Nitrogen C/N ratio = 7

Urine: 1 qt./ person/day (0.15# dry solids) 16% Nitrogen C/N ratio = 1

Kitchen garbage: 1# (dry basis) 2% Nitrogen C/N ratio = 25

Toilet paper:

Sawdust and peatmoss: Nitrogen = 0.15% C/N ratio = 400 100#/month

Quantities for 150 days (6 month period) 4 people

Feces: .15 x 4 x 150 = 90# x 6% = 5.4% N x 7 = 37.8# C

Urine: .15 x 4 x 150 = 90# x 16% = 14.4# N x 1 = 14.4# C

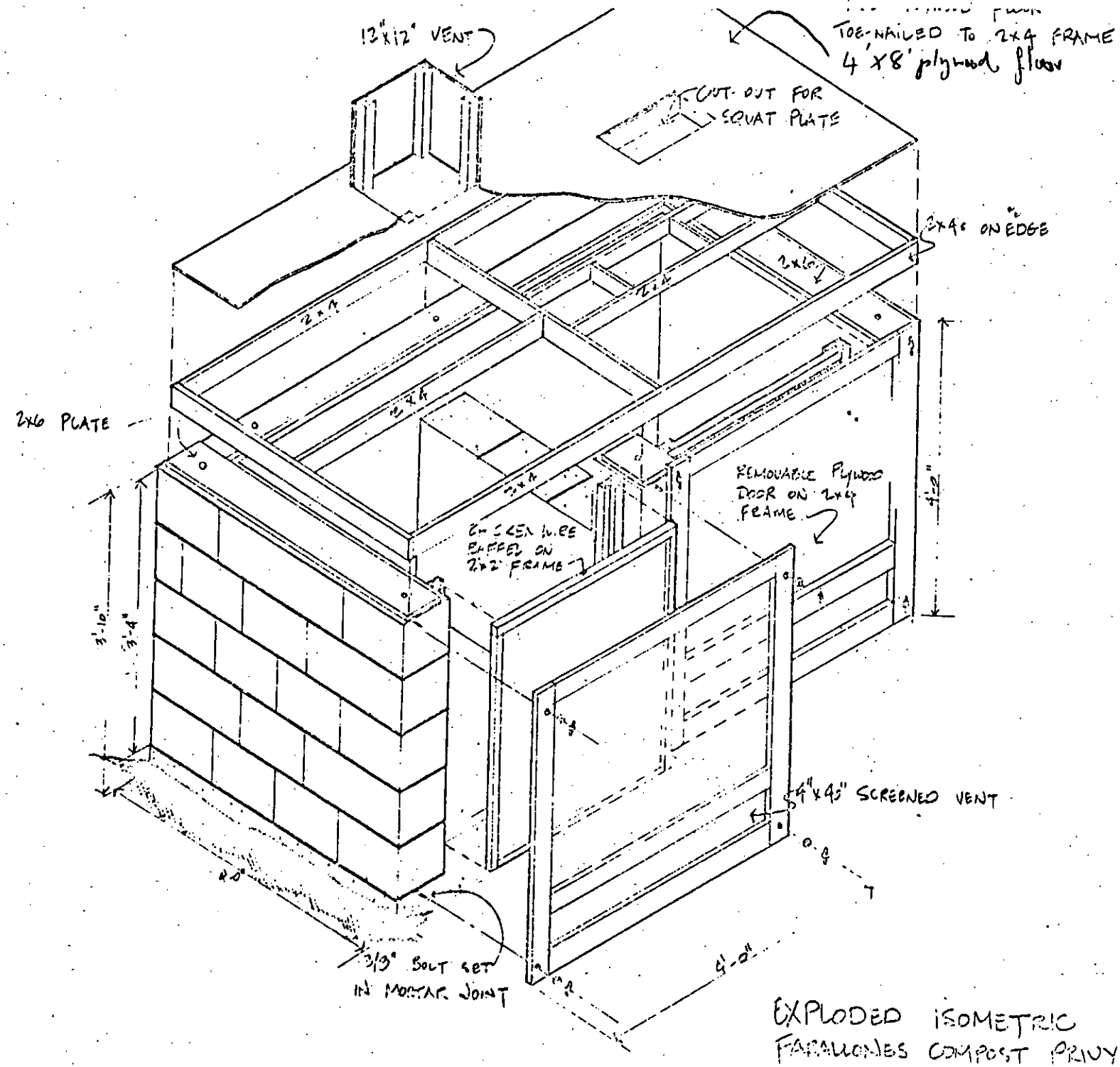
Garbage: 1.0 x 150 = 150# x 2% = 3.0# N x 25 = 75.0# C

Sawdust/Peatmoss: 600# x .15% = 0.9# N x 400 = 360.0# C

Total 23.7# N 487.2# C

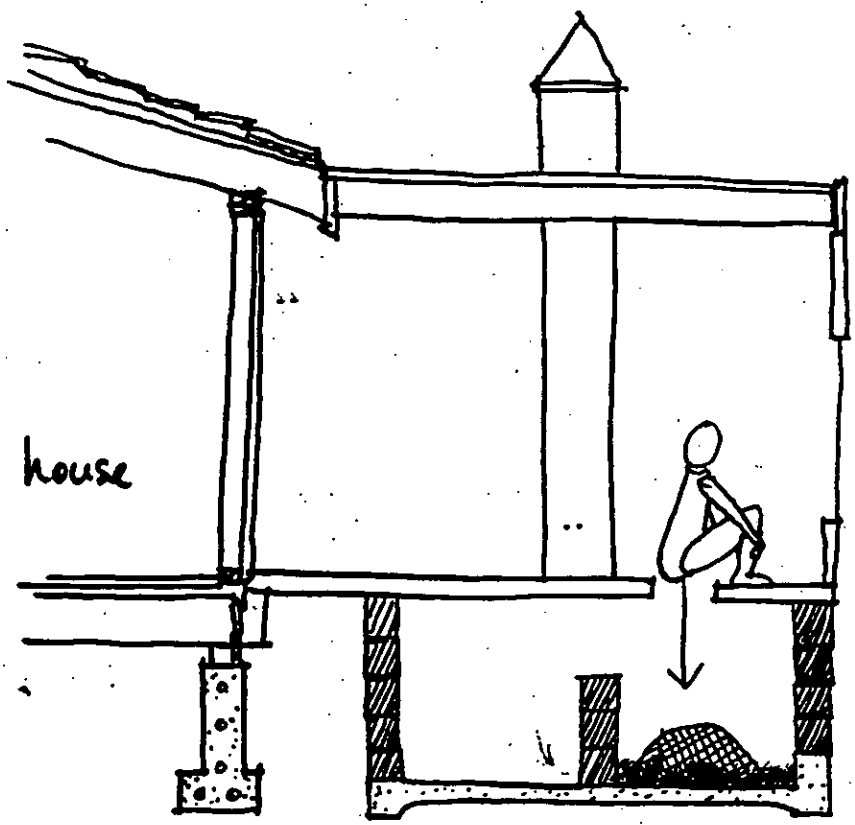
C/N = 21 (toilet paper raises this closer to 25)

Total mass @ 50# cu. ft. = 1 cu. yard



EXPLODED ISOMETRIC
FARALLONES COMPOST PRIVY

LAYOUT & LOCATION



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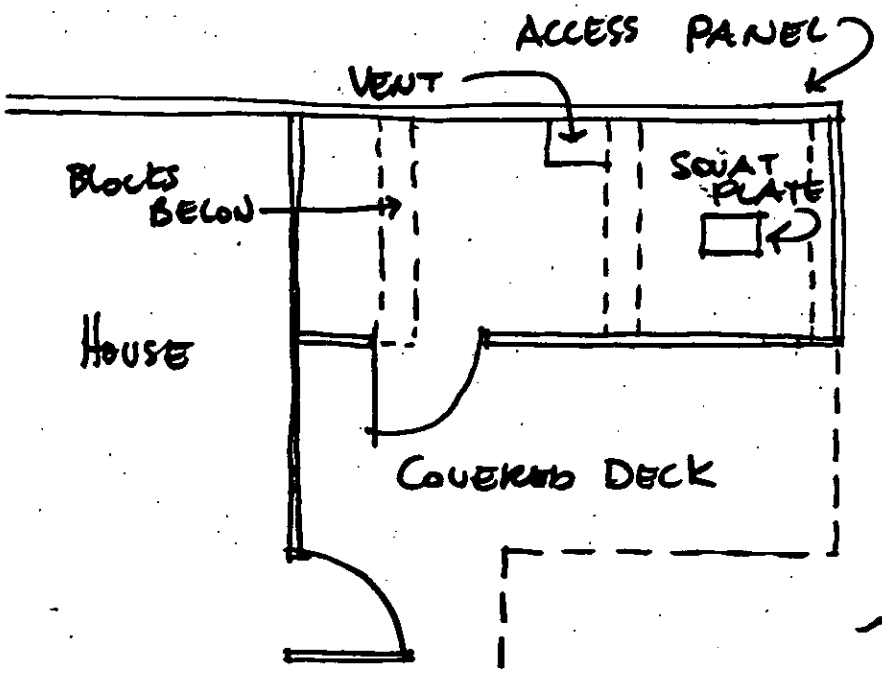


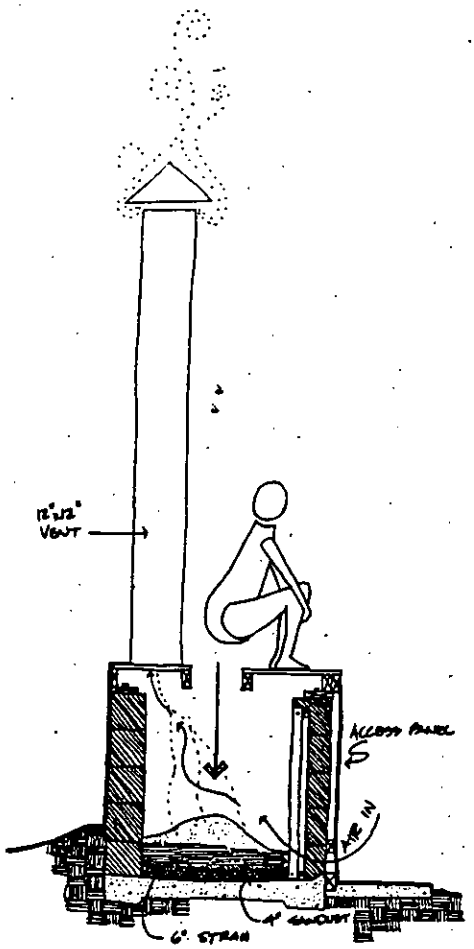
PLAN

THIS DRAWING SHOWS THE COMPOSTING PRIVY ADDED ON TO AN EXISTING HOUSE.

THE PRIVY MAY BE ENCLOSED IN A NEW OR EXISTING HOUSE CONNECTED OR FREESTANDING.

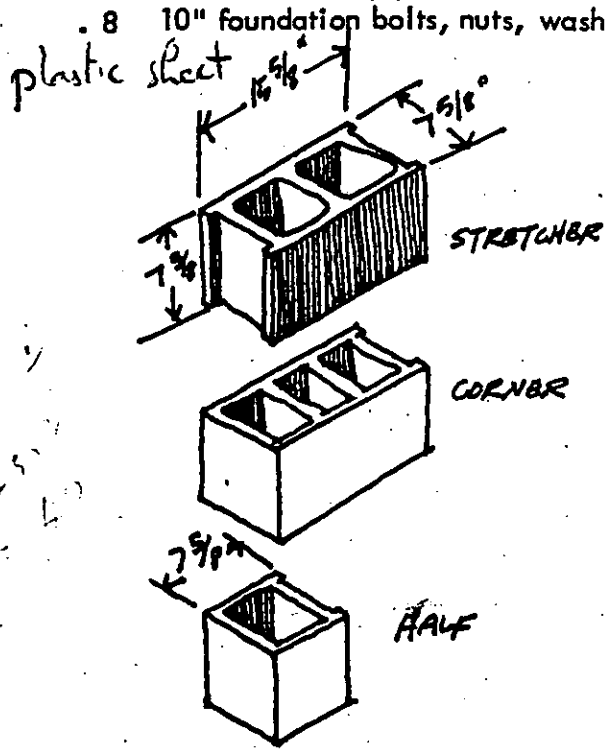
THE ACCESS PANEL SHOULD BE ON AN OUTSIDE WALL. FOR A HOUSE BUILT ON GRADE, ADJUST FLOOR LEVEL OR DIG OUT TO PROVIDE ACCESS.

IN HOUSES WITH A BASEMENT THE PRIVY CHAMBER COULD BE BUILT IN.



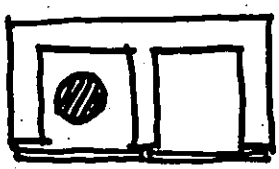
MATERIALS NEEDED

- 2/3 cu. yard concrete for slab & grout
- one sack mortar
- concrete blocks:
  - 40 8x16 stretchers
  - 20 8x16 corners
  - 10 half blocks
- 2 2'x6'x8' redwood plates
- 2 2'x4'x8' redwood boards
- 14 2'x4'x4' redwood boards
- 2 2'x2'x4' redwood boards
- 40 lin. ft. rebar 3/8" 4' lengths
- 8 7"x3/8" diam. galv. carriage bolts with wingnuts
- 1 sheet 4'x8'x5/8" plywood
- 8 10" foundation bolts, nuts, washers

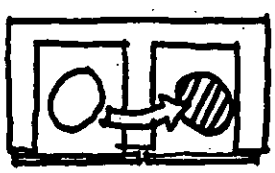


PLAN.
SECTION

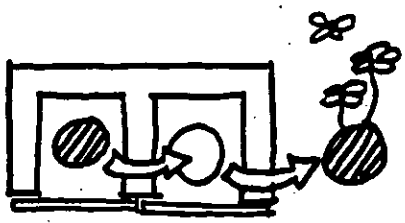
ROTATION PROCESS



SIX MONTHS OF USE TURNED EVERY OTHER WEEK OR AS NEEDED



AFTER SIX MONTHS THE ALE IS MOVED TO THE AGING COMPARTMENT.



AFTER ONE YEAR THE FIRST ALE IS READY FOR USE IN THE ORCHARD. REPEAT PROCESS.

CONSTRUCTION SEQUENCE

1. Level site, layout, place vertical rebar
2. Pour slab
3. Lay blocks, cure 24 hours
4. Fabricate top, access panels
5. Place vent stack
6. Make squat plate
7. Build enclosure

SQUATTING

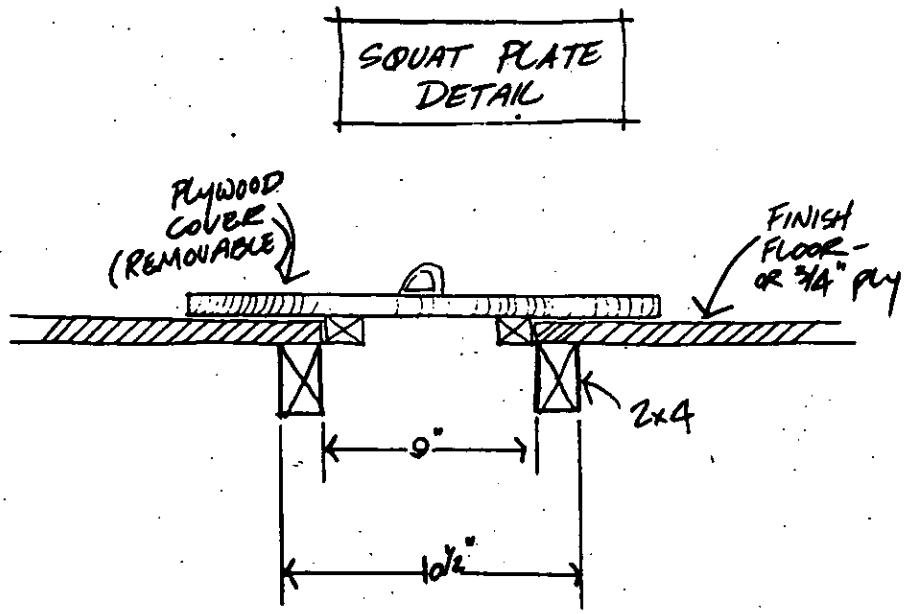
The ideal posture for defecation is the squatting position, with the thighs flexed upon the abdomen. In this way the capacity of the abdominal cavity is greatly diminished and intra-abdominal pressure increased, thus encouraging the expulsion of the fecal mass. The modern toilet seat in many instances is too high even for some adults. The practice of having young children use adult toilet seats is to be deplored. Bekus, Gastro-Enterology, p. 511

Man's natural attitude during defecation is a squatting one, such as may be observed amongst field workers or natives. Fashion, in the guise of the ordinary water closet, forbids the emptying of the lower bowel in the way Nature intended...It is no overstatement to say that the adoption of the squatting attitutde would in itself help in no small measure to remedy the greatest physical vice of the white race, the constipation that has become a contentment. Hornibrook, The Culture of the Abdomen, p.75

It should be mentioned in this connection that a very common cause for unsatisfactory results...is improper height of the toilet seat. It is usually too high. An ideal seat would place the body in the position naturally assumed by man in primitive conditions. The seat should be low enough to bring the knees above the seat level. Williams, Personal Hygiene Applied, p. 374

The high toilet seat may prevent complete evacuation. The natural position for defecation, assumed by primitive races, is the squatting position...When the thighs are pressed against the abdominal muscles in this position, the pressure within the abdomen is greatly increased so that the rectum is more completely emptied. Our toilets are not constructed according to physiological requirements. Aaron, Our Common Ailment, p.66

Quotes on the virtues of squatting, from
The Owner Built Home, Ken Kern

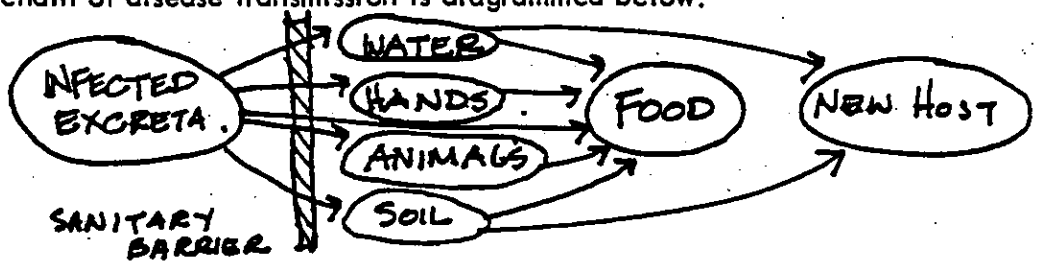


STILL NOT CONVINCED? OK, BUILD AN 18" SQUARE BOX 14" HIGH & ATTACH A TOILET SEAT W/ TIGHT COVER.

PUBLIC HEALTH CONSIDERATIONS

Diseases can be transmi tted through micro-organisms (pathogens) in human feces. Fecal-borne bacterial diseases include typhoid, para-typhoid and cholera. Protozoa found in feces tranmit amoebic dysentery and other intestinal ailments. Worm eggs and other intestinal parasites are also carried in feces. Lack of basic precautions in the disposal of human excreta continues as a major cause for ill health in the world. The need for basic procedures to protect public health is very real.

Any acceptable method of excreta disposal must provide a barrier between raw excreta and possible means for the transmission of disease. Disease from the feces of infected persons can be carried to new hosts through contact with soils, water, animals, or hands. The chain of disease transmission is diagrammed below:



Fecal matter may directly pollute drinking water. Cholera epidemics in the Orient have been traced to the use of raw human manure as fertilizer, washing into drinking supplies. Leaf and root vegetables grown in infected soil can transmit disease. Insects and rodents who come in contact with infected material transmit disease by contaminating footstuffs. Unwashed hands that have been in contact with infected soil, water or feces are a common carrier.

The purpose of laws regulating the design and construction of individual household excreta disposal systems is to make sure that an adequate sanitary barrier is provided so that public health is protected. Sanitation and public health experts have developed criteria and designs for a number of types of acceptable low cost systems that are in use throughout the world. The compost privy constructed and used as described in this Bulletin meets the following accepted criteria that insure a sanitary barrier:

1. Excreta cannot come into contact with surface soil, surface water or ground water.
   In the composting privy, all waste materials, with the exception of "grey" (dirty) water from sinks and baths, goes directly into the concrete chamber which is sealed from contact with the ground. A concrete slab and curb prevents seepage. No water enters the system and the liquids in the pile escape as vapor through the vent or are oxidized by micro-organisms. "Greywater" may be run into a holding tank to allow scum and grease to float to the top, and then dispersed through leaching lines or directly into the garden. Since water consumption is halved through the use of the privy, the number of feet of leaching line or holding capacity will be similarly reduced. 40 gal/person/day would be adequate.

2. Excreta cannot be accessible to insects or animals or children.
   The concrete design is impervious to penetration by pests. Insect screening at the vents prevents flies from entering. If the prviy is freestanding from the house, it should be provided with a screen door. The main insect problem is flies, which can pass through a 1/8" crack. Flies are attracted by smell and seek light. Sprinkling sawdust on fresh material, and of course, keeping the lid or cover down when the privy is not in use will prevent any fly nuisance.

3. There should be no noticeable odor or unsightly conditions.
There will be no odor if the design and operating instructions are followed carefully. Make sure the cover fits tight and the vent is unobstructed. If odor becomes noticeable it is due to one or more of the following reasons:
   - Pile is too small, or wrong proportions, unable to maintain hot temperatures
   - Too wet (add more dry sawdust or peatmoss - turn and mix the pile)
   - Too high nitrogen (add more sawdust or peatmoss, high C/N material - too much nitrogen smells like ammonia.)
   - Anaerobic process will smell like rotten eggs. (Not enough oxygen - turn the pile)

4. Compost technique should be simple. Material should not be handled directly. Maintenance should be minimal.
At least twice a month, the pile should be turned with a pitchfork. The top, bottom, sides of the pile should become the new center of the pile, the old center becomes the outside. Every six months, the entire pile is shifted to the right-hand side (or left) compartment, and removed six months later. Keep the access panel well fastened. The pitchfork used to turn the pile should be stored inside the chamber and reserved solely for this job.

5. Construction must be durable.
The concrete provides a tight, sealed chamber, impervious to weather, bacterial action and other conditions.

6. Finished material must be free from pathogens and safe to build the soil.
Laboratory and field experiments confirm that pathogens cannot survive the normally high temperatures of aerobic composting, nor do they survive very long in material that is allowed to age. Proper composting and lengthy exposure to the elements are the cornerstones to purification. Beyond this, only sterilizing all finished material with heat to kill all micro-organisms, good and bad, can guarantee complete safety.

The test procedure followed to study pathogen survival is to inoculate a batch of material with known pathogens, follow specific composting and aging procedures, and then analyze the material in the laboratory.

Westerberg and Wiley (Applied Microbiology, Dec. 69) inoculated sewage sludge in an aerobic composter with polio virus, salmonella, ascaris eggs and candida albicans. The temperature of 116-130°F. maintained for three days killed all indicator pathogens. Gotaas confirms similar experimental results, indicating that few organisms are able to survive temperatures of 120°F. for more than an hour. He suggests that natural "biological antagonisms" in the pile negatively affect the survival of pathogens.

Other evidence indicates tha simple aging kills pathogens. Rodale reports (Organic Gardening and Farming, Feb. 1972, p. 45) experiments by Bernard Kenner of the Environmental Protection Agency. Raw sewage inoculated with salmonella was applied directly to the soil. Indicator pathogens survived a maximum of 21 weeks.

HEALTH DEPARTMENT APPROVAL

Several Counties in Northern California have granted permits to groups and individuals to construct and maintain a compost privy on an experimental basis. At first, septic tank. leach field systems were required for disposal of greywater and as back up for the privy. Now some Counties are accepting a positive soil percolation test as proof of back up capability without requiring construction of the system itself.

Before you go to your County for a permit for your privy:

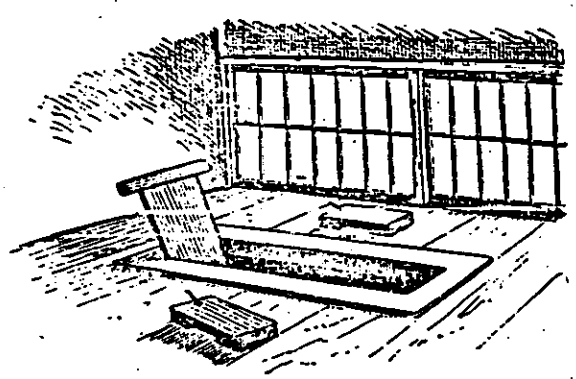
1. Read all the literature on composting you can, especially the works of Golueke and Gotaas (see bibliography) and familiarize yourself with the process.

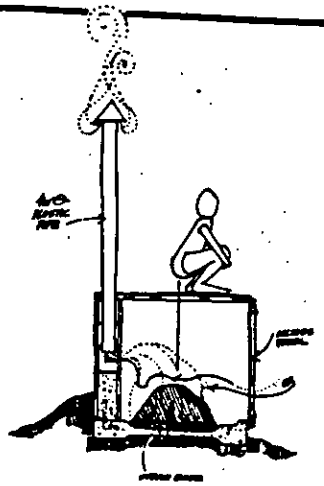
2. Prepare an outline of your maintenance procedures, including turning process (eg. turn pile early in the morning before fly activity; turn twice a month or more if necessary; store turning fork inside privy vault).

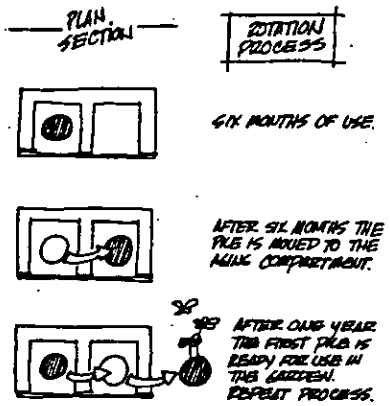
3. If you plan to test the aged compost for pathogens you should contact a State-approved laboratory about a Standard Fecal Analysis (Shigella Salmonella and Parasite Ovum) and include this in your procedures.

Be persistant with your Health Department. They are generally concerned about individuals being competant to manage their own excrement. You must allay their fears with your knowledge of the composting process and attention to details in your procedures. Don't be bullied!

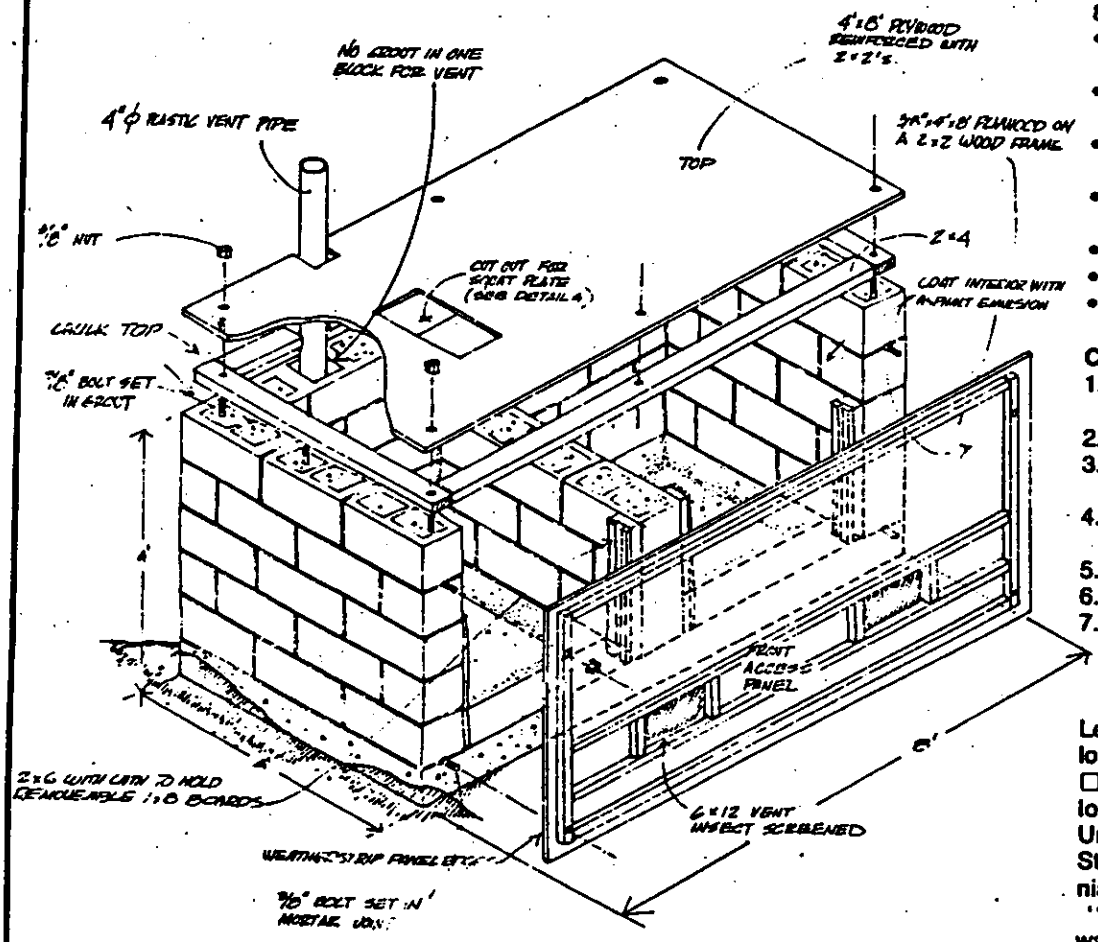
The California State Office of Appropriate Technology is conducting a state-wide study to evaluate alternative sanitation devices, including composting privys. You might refer your Health Department to them for more information.

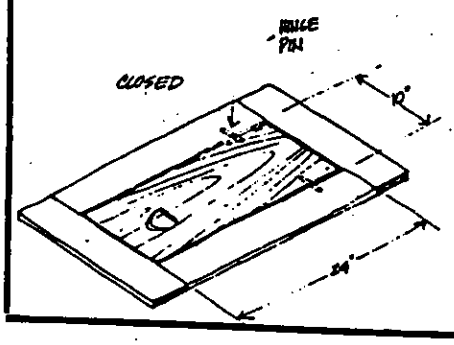


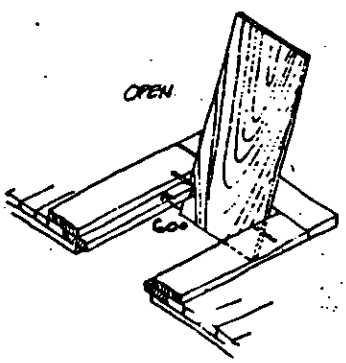




FARRALONES COMPOSTING PRIVY







Materials Needed

- 2/3 cubic yard concrete for slab and grout
- one sack mortar
- concrete blocks

40-8 in x 16 in stretchers
20-8 in x 16 in corners
8 half blocks

- 40 linear ft rebar ⅜ in, 4 ft lengths
- 1 sheet 4 ft x 8 ft x ⅝ in plywood
- 1 sheet 4 ft x 8 ft x ⅜ in plywood
- 5 off 2 x 4 x 8 ft redwood plates
- 6 off 2 x 2 x 8 ft runners
- 4 sq ft insect screening
- 12 ft x 4 in diameter plastic pipe for vent

Construction Sequence

1. Level site, layout, place vertical rebar
2. Pour slab
3. Lay blocks, cure 24 hours
4. Fabricate top, access panel
5. Place vent pipe
6. Make squat plate
7. Build enclosure

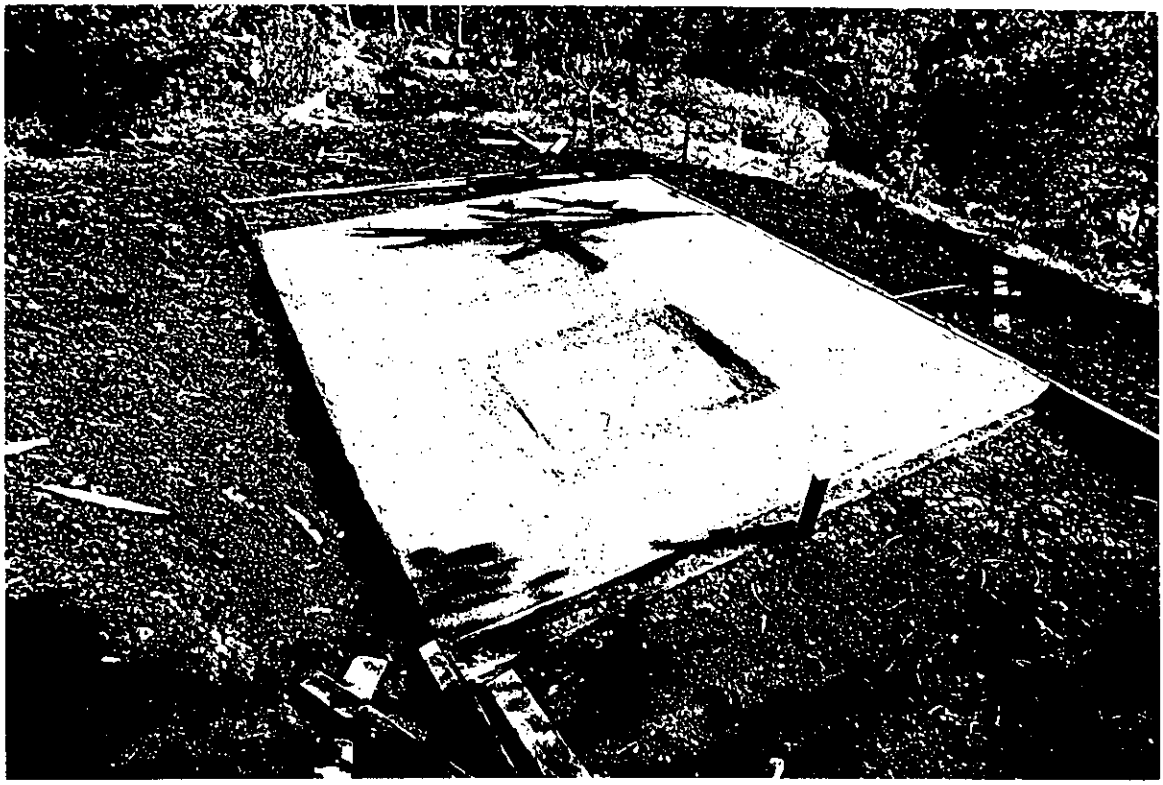
The Farralones Composting Privy

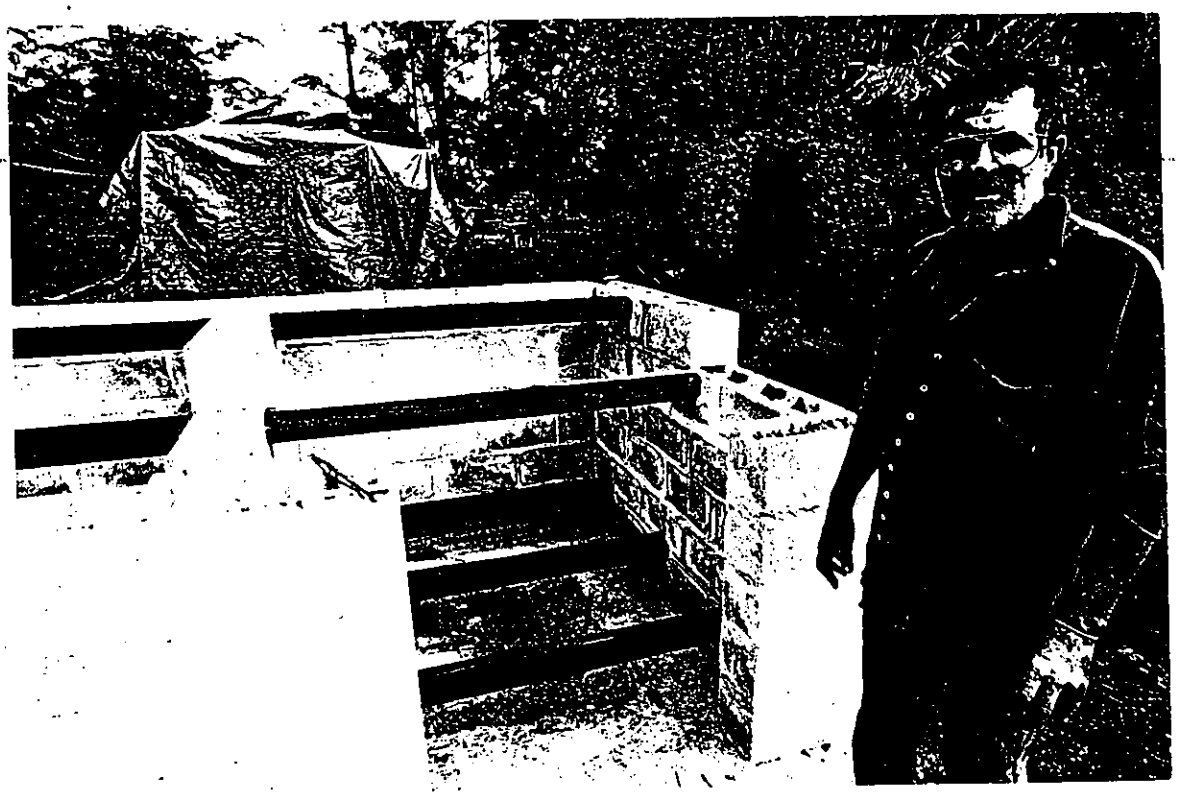
Leaflet, 17 pages, Farralones Institute, 1976

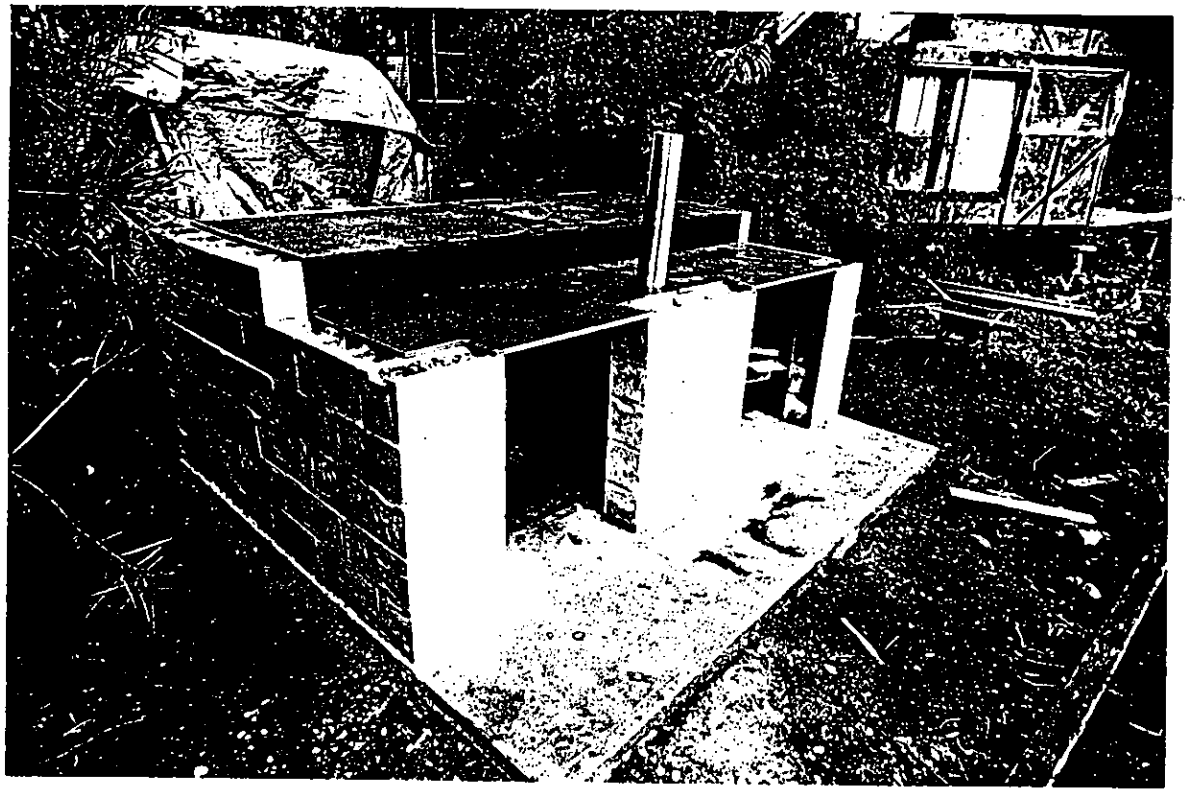
☐$US 4.00 from Farralones Institute, Integral Urban House, 1516 Fifth Street, Berkeley, California 94710, USA.

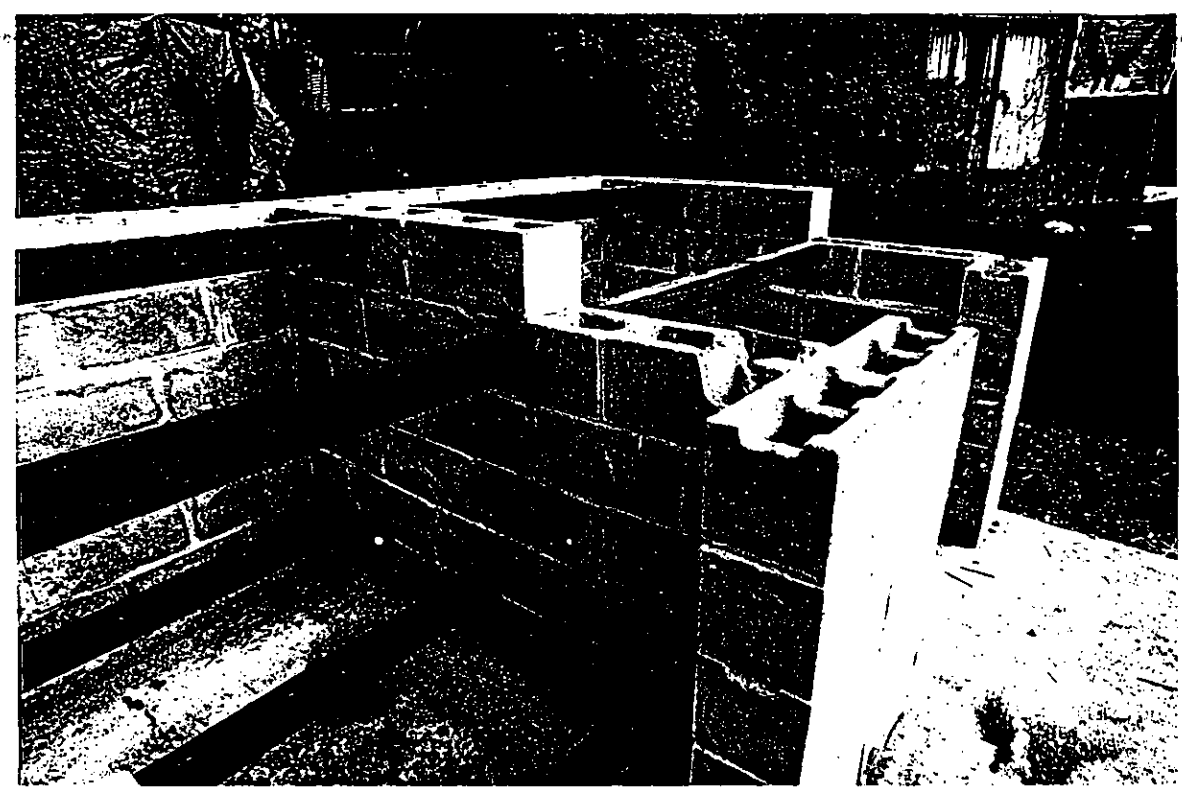
"Our composting toilet was based on the Farralones Composting Privy, but as we do not have concrete corner blocks in our area, we ended up using 65 stretcher blocks. This was the only change. Our information was based on a leaflet from the Nimbin Homebuilders' Association, PO Nimbin, NSW 2480. Send SAE to ask its price."

Chris Martin

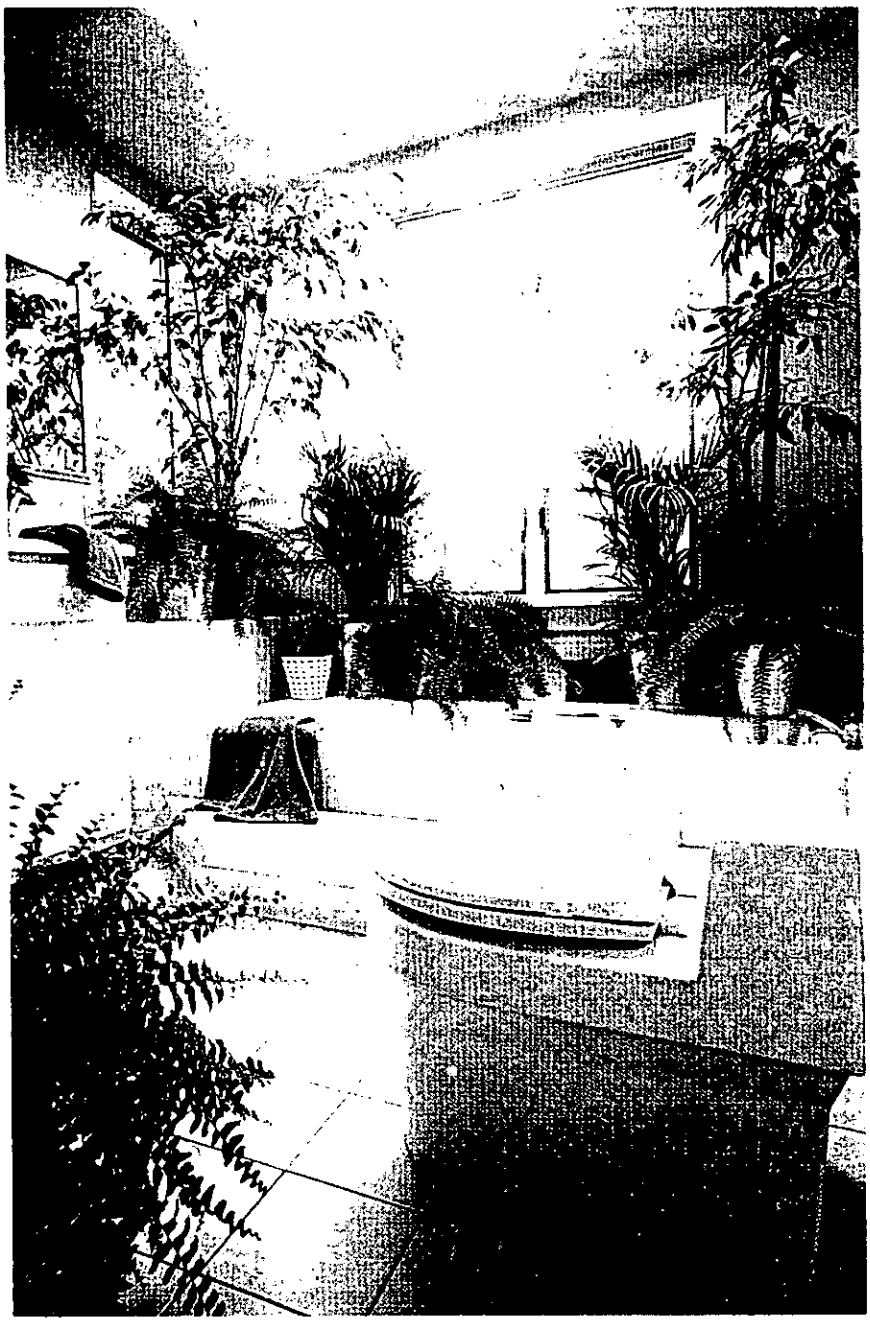








QUESTIONS and ANSWERS



Clivus Multrum Australia Pty. Ltd.

Organic Waste Treatment System

14 Johnson Street — P.O. Box 105 Oakleigh, Victoria 3166
Telephone (03) 569 8466

1. What can be put into the Multrum?

Besides urine and excrement, toilet paper, kleenex, tampons, sanitary napkins, disposable diapers (not the plastic part) and similar bathroom wastes can go in the toilet. Practically all organic kitchen and household wastes — especially those which could be a potential odor problem — can go in the garbage chute. These include cooking liquids, paper towels, grease and fat, dust pan and even vacuum cleaner refuse, vegetable and meat scraps, peelings, and even bones and eggshells. Some large bones will emerge incompletely deteriorated but will help rather than harm the process because of their calcium contribution. Newspaper used for pet litter may, if torn up a bit, also be included.

2. What should not be put in the Multrum?

Cans, glass, plastic, chemicals (including such things as saniflush and other "sanitary" agents) or large amounts of liquid of any kind. Nor should large quantities of unshredded newspaper which can easily be disposed of by other means be included. Corrugated cardboard when present in larger than minute quantities should be omitted because it contains boron, a plant toxicant. Also, any materials which could get hung up on the air ducts and impede the settling of the mass such as straw or hay should be either shredded before being put in or not put in at all. Absolutely no paints or other toxic substances which might damage plants on which the humus is to be used should be put in.

3. Is the addition of kitchen garbage necessary?

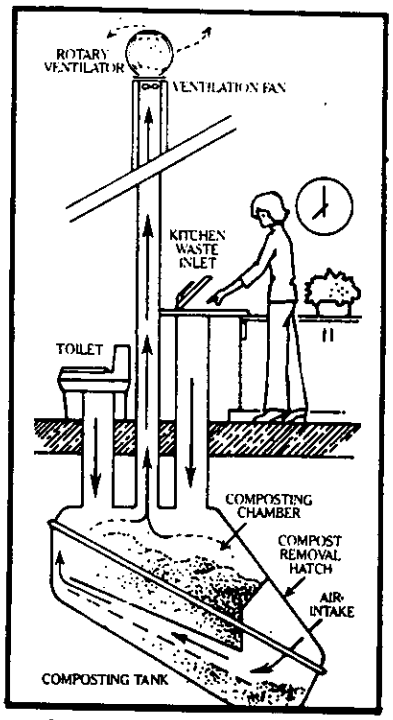
Yes, the addition of kitchen garbage, or some other material high in cellulose such as leaves, sawdust, shredded hay or straw, is necessary. This cellulose material is needed to absorb the liquids, thereby preventing "waterlogging" and the resultant anaerobic conditions. This material further enhances aeration by giving the pile a loose structure. The decomposition of the cellulose material also provides the heat energy needed to evaporate the water. Another important function is to form a compost pile large enough to promote stability during external temperature and humidity variations. Finally, the cellulose material provides carbon and growing surface for those organisms which will take in and convert nitrogen and other nutrients to stable forms.

4. How often does the Multrum have to be emptied?

The chamber where decomposition takes place is never emptied. Only the material which has passed under the lower partition and into the storage chamber is to be removed. Frequency of removal and quantity of material are dependent on the use characteristics of the household. The storage chamber is large enough to store several years' worth of compost from an average family (4–6) before removal of any material is necessary.

5. How much compost is produced?

If the Multrum were used as the only toilet and kitchen waste depository, about 80 pounds of compost (about 20 pounds on a dry weight basis) would be produced per person per year. This would amount to about one and one half cubic feet per person per year. But, because use is bound to be somewhat irregular (people work during the day and go on vacations), the actual amount will probably be somewhat less.



Simplicity in waste treatment without pollution of air, water or land.

6. What are the Fertilizing qualities of the end product?

Multrum compost is an excellent soil amendment because it is high in organic matter (58% on a dry weight basis) as well as plant nutrients. The percentages of major plant nutrients — nitrogen, phosphorus, and potassium (the "N-P-K" (in terms of N, P_2O_5, K_2O) are 2.4%, 3.6%, and 3.9%. Thus, about 3 lbs. of dry weight (about 10 lb. "wet" weight) is roughly equivalent to 1 lb. of "10-10-10" fertilizer. The minor plant nutrients, calcium, magnesium, and sulfur, as well as several trace nutrients, are also present in significant amounts. For additional information ask for our literature titled "Chemical Analysis of Clivus Multrum Compost".

7. Is the end product safe to use in gardens?

Chemical analysis of compost samples from seven Multrum units has shown that detected amounts of potentially toxic metals are well below those levels considered acceptable for composted sewage sludge to be applied to agricultural soils. Analysis for soluble salts which might be harmful to soil and plant life shows that Multrum compost can safely be applied at the rate of 1.6 dry tons per acre, which is equivalent to 104 pounds "wet" weight of compost on a 20 × 20 garden plot. This rate of application will give a nitrogen application rate of 90 pounds per acre, which is considered moderately high. It is important to note that about 72% of the nitrogen in Multrum compost is bound organically, so that it will be released slowly. Since no industrial waste products (toxic chemicals, etc.) which are usually present in sewage treatment plants are introduced to the Multrum, the end product will be free of these materials. (For additional information ask for our literature titled "Chemical Analysis of Multrum Compost End Product".)

8. Is the end product (compost) free of disease-producing organisms?

Bacteriological analysis of samples from 9 Multrum units showed that Multrum compost has a bacterial composition similar to that of soil. In particular, the numbers of pathogenic

bacteria found in the Multrum compost were very low, and the kinds (species) of pathogenic bacteria were those which also occur widely in soil. It is also noteworthy that neither this study nor a separate study of 8 additional Swedish units found any fecal coliform bacteria (which are indicators of fecal contamination). Pathogenic organisms are not likely to survive 2-4 years in the Multrum chamber because conditions there are unfavorable to them: — The temperature is too low much of the time (optimal conditions for these organisms are those of the human body), there is no "host" organism, and they are likely to be consumed by the organisms that bring about the composting process. For additional information ask for our literature titled "Analysis of Bacterial Populations in the Final Product of Clivus Multrum."

9. What about viruses — are they destroyed by the process?

Such viruses as hepatitis, which find water to be a better medium for their existence than soil, will probably die sooner in the Multrum than in a sewage treatment plant. Any viruses which can survive extended periods of time in ordinary soil conditions could be present in the humus from the Multrum. Compared to waterborne sewage systems, the Multrum is certainly less likely to either support viruses or to spread them.

10. Why doesn't it smell?

A natural draft, like that in a chimney, causes a suction effect toward the vent opening above the roof, which in turn causes air to be drawn in through the air inlet under the compost storage chamber door. However, whenever the garbage chute or toilet are opened, air will also be drawn *down* these openings into the container and up the vent. Actually, a minute amount of air is being constantly drawn down the toilet and garbage chutes even when they are closed, so that the toilet room and kitchen are ventilated by the Multrum and kept free of odors. The small exhaust fan, recommended for most installations, will insure against the infrequent possibility of odor caused by downdrafts in the vent.

11. Would any odor coming from the vent above the roof be offensive or constitute air pollution?

Aerobic decomposition does not produce noxious gases (carbon dioxide and water vapor are the main waste products of the micro-organisms in this process). There is consequently, less odor from the Multrum vent than from the plumbing vents on most houses.

12. Don't the chutes and toilet stool get soiled and produce odors?

Soiling is infrequent due to the large diameter of the stool and chute. Odor is not a problem even when there is soiling because the draft is maintained carrying odors down toilet and kitchen waste chutes when the lids are open.

13. How high does the vent stack have to be?

This depends on the conditions of site and installation, but 20 feet above the toilet or garbage opening, whichever is higher, is generally adequate to achieve a natural draft. Draft strength can be enhanced by a small exhaust fan installed in the vent. (See question 10.)

14. Does it produce methane?

As the Multrum is effectively aerobic, no significant amounts of methane are produced. The methane (CH_4) measurable in the stack gas accounts for roughly ½ of 1% of the organic matter being decomposed. Carbon dioxide and water vapor constitute the major gaseous products from this system.

15. How many people can use it?

It is difficult to calculate precise usage parameters due to the enormous variety of combinations of influential factors (e.g., temperature, humidity, nature of material introduced). It is known that up to 12 people can use one Multrum year-round, given the addition of extending midsections. If use is intermittent or seasonal, of course more people could use it. In public facilities where there is a higher proportion of urine to feces than is usual in family situations, these figures change significantly. (For further information, ask for "Clivus Multrum in Public Facilities.")

16. Does it have to be in continuous, year-round use to work?

The dimensions of the container as well as the nature of the process are such that it can take large fluctuations in use. All waste materials bring with them the microorganisms which effect their own destruction. Even if there is no input for long periods of time enough organisms will have survived so that, in combination with those introduced with the fresh wastes, the population will quickly increase.

17. What happens if it fills up?

If used with reasonable consideration to the recommended numbers of people per Multrum as well as to the effect of certain conditions (ambient temperatures, humidity, etc.) it will not fill up. The process is continuous with regard to both the decomposition and the slow glacier-like movement of the mass towards the removal chamber. The container is designed so that the rate of input to some extent regulates the rate of motion towards the storage chamber (i.e., the heavier the mass is the faster it moves). The process does, in fact, work best when the container is nearly full during continuous use.

18. Why must the container be so big?

The large operating volume of an almost full container is the only practical guarantee against extreme conditions that would harm the decomposition (e.g., drying out, getting too wet, too hot or too cold, changes in PH etc.) Small piles of decomposing matter (less than 4' × 4') need to be "coddled" (watered, stirred, etc.) to prevent these conditions from disrupting the process.

19. Can the Multrum ever go out of commission?

The Multrum is an environment which supports a great variety of living creatures essential to the process. These have specific environmental requirements which must be considered. If substantial quantities of disinfectants, drain cleaner or fumigants (i.e., bacterial poisons) are introduced, the number of organisms that carry on decomposition can be reduced to the point where the process will cease. Flooding or limiting the entry of air into the Multrum will shift the aerobic action to the undesirable anaerobic for as long as these conditions persist.

20. Is the process in the Multrum sensitive to variations and/or extremes in temperature?

The microorganisms which do the work in the Multrum are quite flexible with respect to temperature. Although they function best between room temperature and human body temperature, if the temperatures go lower, their activity will slow down until they are finally dormant, only to resume activity when it warms up again. If temperatures go higher than the optimal range used for this group of microorganisms, some may die, but there will always be enough left to multiply rapidly again when temperatures are suitable, unless of course, the entire mass is subjected to intense and prolonged heat, which would sterilize it.

21. What if something valuable falls down either chute? Can it be recovered?

An access port is provided with the system to be located in a convenient position after the tank is installed to allow for the recovery of objects inadvertently dropped in. Nothing is ever really lost in the Multrum. Everything is retrievable either sooner or later, and if it is inorganic (e.g. spoons and forks), it will show hardly any effects of the process.

22. Could insects and rodents be a problem?

The wastes deposited in the Multrum certainly constitute an attractive nutrient source for both rodents and insects. However, the screening on the air inlets and outlets and the necessarily tight lids on all access ports (toilet or garbage lids) make it quite unlikely for the former to ever enter the container. Insects are a more complex problem because many species are to be regarded as beneficial decomposers. When uncontrolled by natural predators, insects can increase rapidly in numbers and become a nuisance. Such occurrences are increasingly unlikely as a healthy balance between predators and decomposers gets established in this mini eco-system. Several organic pesticides, available on the market or through this company, can be used to control such pests (e.g., fruit flies) during this period. Pesticides containing chlorinated hydrocarbons or nerve poisons are not recommended.

23. Does it use any water at all?

Conventional toilets use water to transport the wastes to a central treatment plant (if not a river, lake or ocean). As the Multrum is the "treatment plant" and is located in the house directly under or close to the toilet, there is no need for water to perform this function. Wastes enter the Multrum from the toilet or kitchen refuse opening directly by gravity through vertical chutes. Any water used in connection with the Multrum is for cleaning purposes only, and for this very small amounts are needed.

24. How much water is saved when a Multrum is used instead of a flush toilet?

An average family of four uses 40,000 to 50,000 gallons per year of fresh water to flush toilets alone. Use of the Multrum permits a saving of all this water, which generally accounts for 40-50% of the total water used in the home.

25. Does the Multrum have to be insulated?

The Multrum standard model is pre-insulated with ½" polyurethane foam. This conserves the heat generated by the activity of the microorganisms, helping to maintain a constant and adequate rate of decomposition. Under extremely cold conditions, additional insulation should be added. The large container, recommended for public installations only, is not pre-insulated, and insulation must be applied by the purchaser, if site conditions dictate.

26. Could the heat generated in the Multrum affect the temperature of a basement?

The heat generated by the decomposition process in the Multrum is equivalent to that of a 40 watt light bulb per person using the unit (or one kilowatt hour per person per day). This heat can be recovered by means of a heat exchanger placed in the vent itself. The contribution to household heat would be significant in a well insulated house. Note also that the vent system equipped with a heat exchanger can serve as a controlled ventilation system for a well insulated house allowing a potential saving of up to 30% in fuel usage. The company does not sell or recommend any particular heat exchanger.

27. Can it be used in urban areas in multi-story dwellings?

There is in principle no limit to the type of building in which this system can be used. Its present design and dimensions, however, make it most readily adaptable to 1, 2 or 3 story buildings in rural or urban areas.

28. Can it be attached to a second story toilet?

Although the rather large diameter of the chute must be considered when designing the house with this arrangement in mind, two toilets can be connected to one Clivus Multrum tank. If one bathroom is on the floor above the other, the lower toilet may be located slightly to the side of the chute coming down from the floor above, and the two chutes enter the tank in the cellar, side by side. It is also possible to have two toilets back-to-back on the same floor connecting to a single Multrum unit.

29. Can the tank be set in ground that is habitually or seasonally wet?

The container is impervious to water, but it should be placed on a drained surface to prevent a flooded basement from floating the tank. It should not, however, be placed so deep that water can enter the air intake point.

30. Can the Multrum be installed at high altitudes?

Yes, but cold winter weather combined with continuous use may necessitate supplementary heat and/or insulation to maintain an adequate rate of decomposition.

31. How about the desert?

The Multrum is insulated to protect the process from the great fluctuations in temperature occurring between day and night. Warm, dry desert air should serve only to enhance the process of decomposition by keeping it warm and rapidly evaporating the liquid. In some cases the decomposing pile might get too dry, necessitating the addition of some liquid.

32. What is the difference between the Multrum and a pit privy?

a) A Multrum can be installed either in a house or in an outhouse.

b) Where the Multrum is used, toilet odors are drawn down the toilet chute. (see Question 10.)

c) The effectively aerobic decomposition in the Multrum, as opposed to the anaerobic decomposition (putrifaction) in a privy, does not create foul odors leaving through the vent.

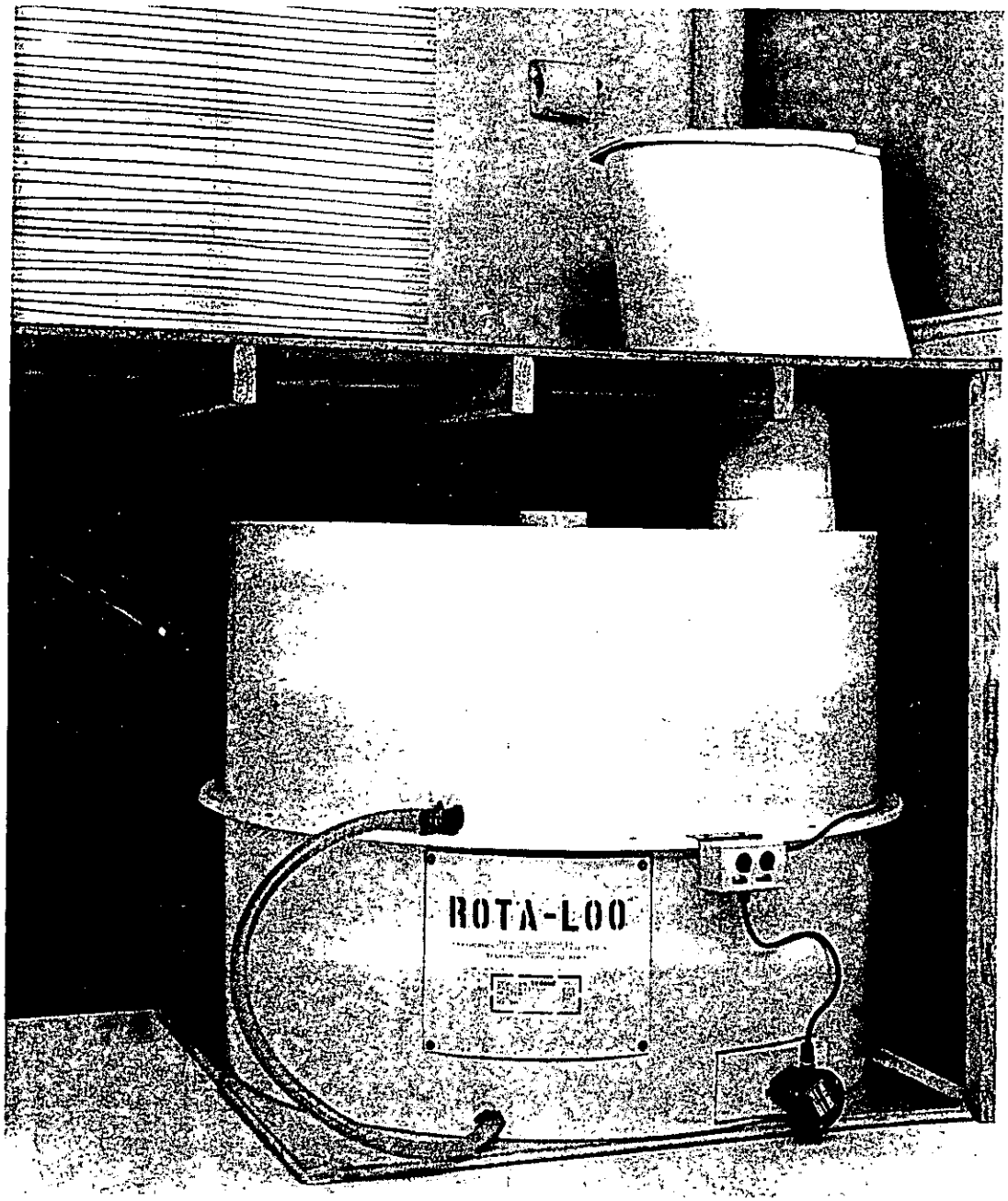
d) The Multrum container is impervious and hence conserves the nutrients for eventual return to the topsoil, and contains and destroys disease-causing organisms. A privy allows nutrients and disease-causing organisms to leach into the ground, possibly polluting wells and waterways, and wasting nutrients.

33. What is to be done with the washwater, given that it is not treated in the Multrum?

The bath, dish and wash water from households (sometimes called "greywater") is to be distinguished in several respects from ordinary sewage which contains toilet wastes. Washwater contains only 10% of the nitrogen and very few of the disease-causing organisms. Therefore, the potential for pollution of groundwater by nitrates and disease organisms is greatly reduced compared to that of ordinary sewage disposed by a septic system. Furthermore, the organic pollutants in washwater are more easily decomposed than those in sewage, so that treatment of these substances is more likely to be complete in the soil. Greywater could be infiltrated into the topsoil with less danger of causing damage to ground water, provided that the soil below the leaching bed is permeable and the distance between the bottom of the leaching bed and the water table is at least 4 feet. Because a Multrum saves 40% of the household's water, the size of the leaching field could be correspondingly reduced. Additional information on this topic is available upon request, and prospective Multrum buyers should contact local health officials to determine local greywater treatment requirements.

ROTA-LOO

The waterless composting toilet



No Water

No Drainage

No Odour

No Chemicals

Easy To Maintain

Simple To Use

Low Cost Installation

Environmentally Sound

Rota-Loo is a self-contained toilet system that is as simple, clean and hygienic as the conventional water closet–but doesn't use a single drop of water. Just nature's own efficient processes.

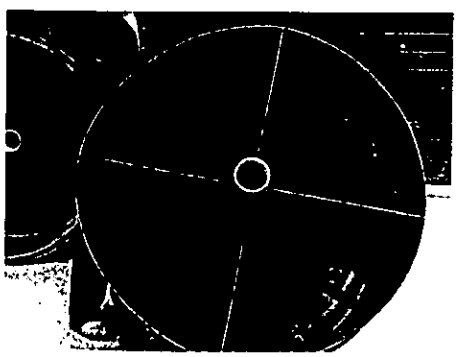
Rota-Loo uses naturally occurring aerobic organisms to break down organic wastes into harmless humus, which looks and smells like garden compost.

And, because *Rota-Loo* is completely self-contained, there is no need for septic pits, plumbing or drainage. Which means you can install a *Rota-Loo* anywhere, even next to ecologically sensitive waterways.

Rota-Loo has been designed to cater for year-round use by a family of five to six. The whole system is easy to maintain and needs emptying only once during every one to three years, depending on usage.

Here's how Rota-Loo works.

The system takes its name from a unique four-chambered waste collection tank which is installed immediately beneath the toilet room. As each chamber is filled, the tank is rotated to bring the next chamber into use.



Liquid is evaporated from the waste by a small heater in the bottom of the tank, and a fan draws the vapour up through the vent pipe to the atmosphere.

The solid waste remaining in the tank is then slowly converted to humus by naturally occurring aerobic organisms.

When all four chambers of the tank have been used, humus in the first chamber may be removed and buried in the earth. The empty chamber is once again ready for use.

Odourless

The fan and *Rota-Loo's* own natural venting system ensure that there is no odour associated with the composting process. Both the fan and the low-powered heater are economical to run from a standard 240 volt AC power outlet. A 12 volt DC fan is also available to run from a solar module.

The fan runs continuously while the house is occupied, drawing air through the system and venting to the atmosphere. This also ensures that all odours are evacuated from the toilet room even when the toilet is in use.

If the house is unoccupied for more than a couple of days, the fan may be switched off and then the natural venting of the system will disperse odours.

The heater is used to evaporate liquid from the system only when needed. The rising level of liquid in the waste tank is shown on a liquid indicator tube. The heater is switched on and the liquid evaporates.

During summer in warm climates, the heater may need to be used as little as one day per week, while in winter in cold mountain regions, this time may be needed to be extended to five to six days, depending on usage.

Installation

Rota-Loo is simple to install for a handyperson in less than a day. Full instructions and advice are supplied with each unit.

The *Rota-Loo* tank should be placed on an insulating pad on a dry, level surface. It is also important to insulate the tank and vent pipe in regions where the ambient temperature is likely to fall below 18° Celsius for more than a few days. This will aid the aerobic organisms to continue the composting process.

The support surface for the tank should be capable of holding the weight of a full tank–approximately 500kgs. Because the *Rota-Loo* tank is round, the position of the toilet pedestal, vent pipe connection and service hatch may be located in any one of a number of combinations. The vent pipe may be installed to pass vertically through the toilet room, or through an outside wall at 45 degrees and then up an outside wall.

Environmentally Safe

The end product of the *Rota-Loo* waste composting process is humus. To assist in the composting process, a handful of kitchen scraps, chopped up vegetable peelings and perhaps once a week, some grass clippings, straw or hay can be added to the *Rota-Loo* tank.

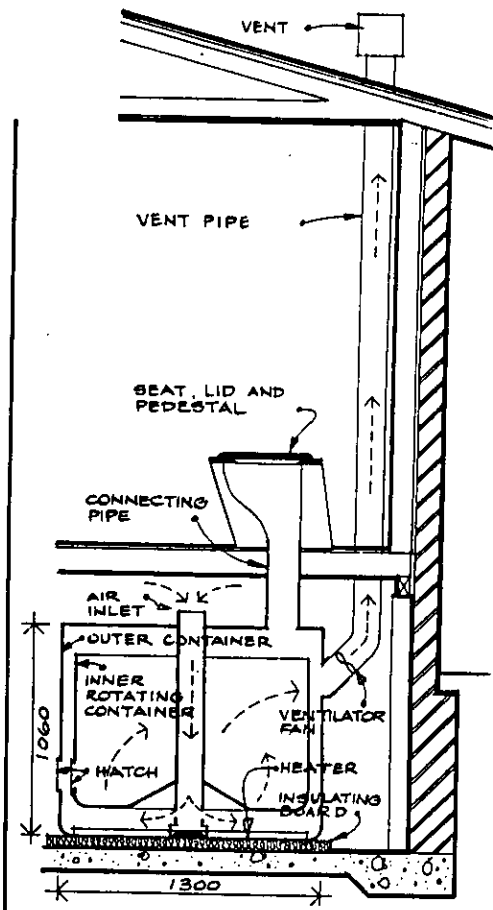
The end product should be disposed of in accordance with local Health Department regulations. In some cases, this means burying the humus in the earth to a depth of 30cms (12 inches) and covered with 20cms (8 inches) of soil.

Versatile

Rota-Loo is designed to be installed beneath the toilet room. It is ideally suited to high set and split level buildings. However, if the building is built on a flat slab with no space below, *Rota-Loo* may be just as easily installed outside the main building. On a sloping site, the slope may be excavated to accommodate the *Rota-Loo* tank.

Cleaning

The seat, bowl and pedestal may be cleaned with water and a mild liquid cleaner or detergent, ensuring no cleaner enters the *Rota-Loo* chamber. Use disinfectant only on a damp sponge.



Specifications

Rota-Loo is manufactured from durable fibreglass-reinforced isothalic chemical-resistant resins. The external tank is coated with a tough, white gel coating.

Overall dimensions are: Diameter 1300mm including flange; height 1060mm including flanges. Overall dimensions of the toilet pedestal are: length 520mm; width 450mm; height 420mm.

A *Rota-Loo* package consists of: outer tank, internal rotating tank, fan motor assembly– 20w, heating unit - 200w, toilet pedestal with seat and lid, metal emptying chute, liquid level indicator, dual switch; power lead, rain cover.

Electrical rating: 240 volt. 220 Watts (max). 50 Hz.

A complete set of care maintenance and installation instructions is supplied with every unit.

Rota-Loo carries a 12-month factory warranty and is approved by Australian Health Departments.

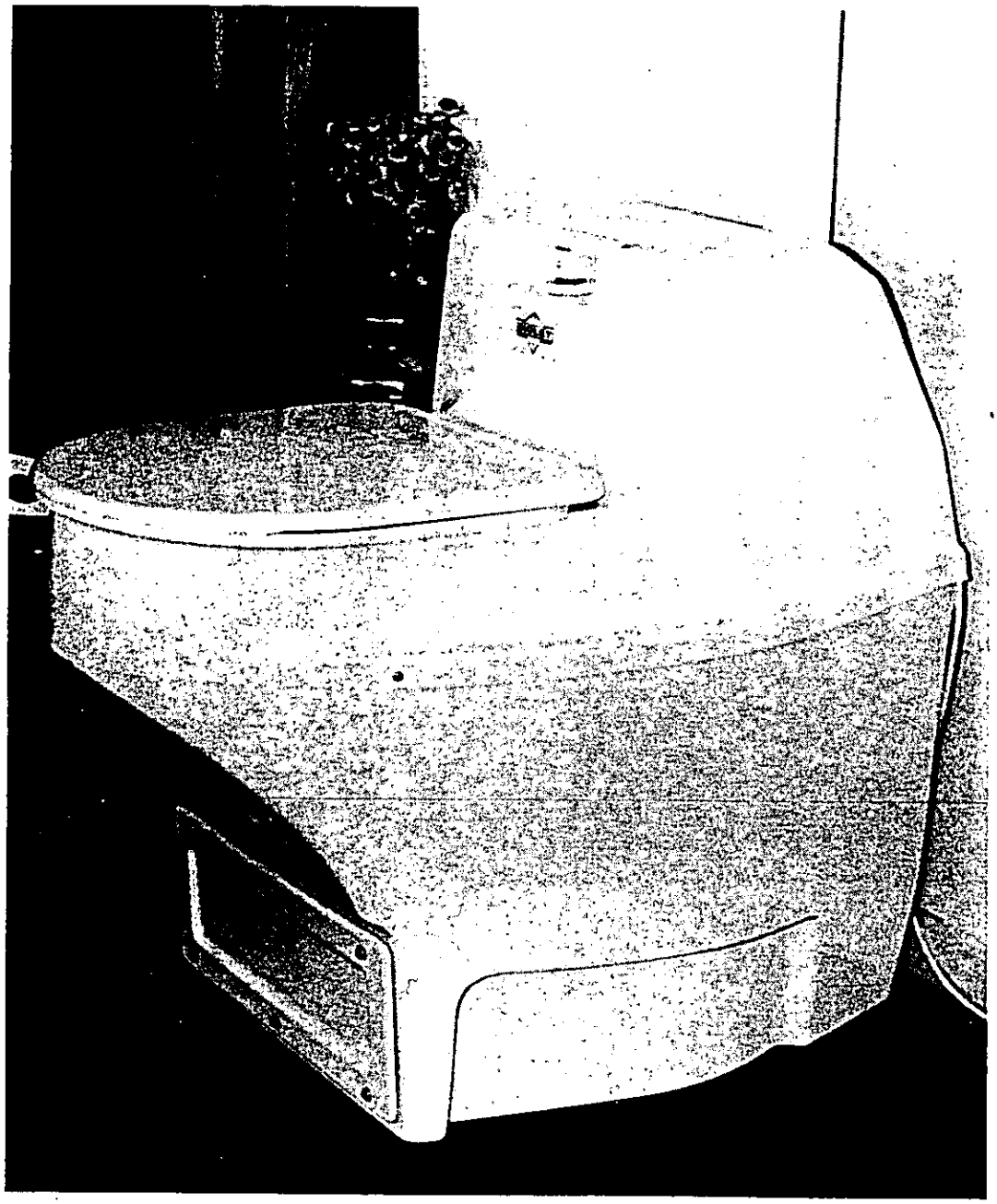
To purchase a *Rota-Loo* please contact:

ROTA-LOO is manufactured in Australia and distributed by

Environment Equipment Pty Ltd,
1/32 Jarrah Drive, Braeside, Victoria, 3195.

BIOLET

The biological composting toilet



No water

No drainage

No odour

No chemicals

Easy to maintain

Simple to use

Low cost installation

Environmentally sound

The Australian-made *Biolet* is a self-contained waterless toilet system ideal for holiday homes and as a convenience in isolated locations with infrequent visitors.

Instead of using water to carry wastes away, *Biolet* uses naturally occurring aerobic organisms to break down organic wastes into harmless humus which looks and smells like garden compost.

Biolet is also the ideal alternative to a septic system for the small household of two adults and a child.

Because *Biolet* is completely self-contained, there is no need for plumbing, drainage or septic pits. Which means you can install *Biolet* anywhere, even next to ecologically sensitive waterways.

A correctly installed and maintained *Biolet* is odour free, is easy to clean and absolutely safe for you and the environment.

BIOLET

Here's how Biolet works

Your *Biolet* toilet comes ready to install. All that is needed is an electrical outlet and the connection of a simple ventilation pipe for *Biolet* to go into immediate operation in any toilet room.

Biolet works on the principle of converting solid toilet wastes to humus through the operation of naturally occurring aerobic organisms. The first step in this process is the removal of excess liquid from the waste. This typically reduces the volume of waste by more than 90%.

Liquid is evaporated from the waste in the *Biolet* with the help of a low powered heater. A small fan blows warmed air through the composting waste and draws vapour up through the vent pipe to the atmosphere. The continuous venting system also ensures that there is no odour associated with the composting process.

Installation

Biolet is simple to install for a handyperson in a couple of hours. Full instructions and advice are supplied with each unit.

The *Biolet* should be positioned against the wall of the toilet room. Drill a hole through the wall or ceiling for the supplied ventilation pipe and connect the ventilation pipe to the toilet.

If the ventilation pipe has to pass through unheated spaces, ensure the pipe is well insulated.

The warm air provided by the heater and fan also assists in the breakdown of the solid waste by supplying the aerobic organisms with oxygen. Agitation of the rake mechanism also ensures proper aeration of the compost as it continues to break down into environmentally safe humus.

After a period of from 3 to 6 months (depending on usage) humus may be removed from the collecting tray. The humus should be disposed of in accordance with local Health Department regulations. In some cases, this means burying the humus in the earth to a depth of 30 cms (12 inches) and covered with 20 cms (8 inches) of soil.

Start up

To activate the aerobic organisms which will break down wastes into harmless humus, we supply you with a humus-starter. The starter is simply distributed evenly inside the *Biolet* which is then ready for operation. Humus starter supplies the original micro-organisms which start breaking down the waste.

Maintenance

The only maintenance your *Biolet* will need is periodic mixing of the compost using the rake handle and removal of humus when the humus-tray is full. This is fully explained in the owner's guide supplied with each *Biolet*.

Biolet is not recommended for use by persons who use antibiotic or diuretic medicines for extended periods of time.

Empty the supplied humus-starter into the toilet. Connect the power cord to the nearest earthed 240 Volt AC power outlet and check the *Biolet* thermostat in accordance with the owner's guide.

Your *Biolet* is now ready for operation.

Cleaning

The seat bowl and pedestal may be cleaned with water and a mild liquid cleaner or detergent, ensuring no cleaner enters the composting chamber. Use disinfectant only on a damp sponge as it may interfere with the proper operation of the aerobic organisms.

Specifications

Biolet is manufactured from strong, durable fibreglass and is fitted with a tough polyurethane seat. All internal fittings are made from stainless steel.

Overall dimensions: Height 700mm; Width 530mm; Depth 780mm.

Necessary floorspace in front of *Biolet* for emptying the humus-tray is 600mm x 1000mm.

Vent pipe: The vent pipe and insulation may be purchased from your local plumbing supply store or your *Biolet* supplier.

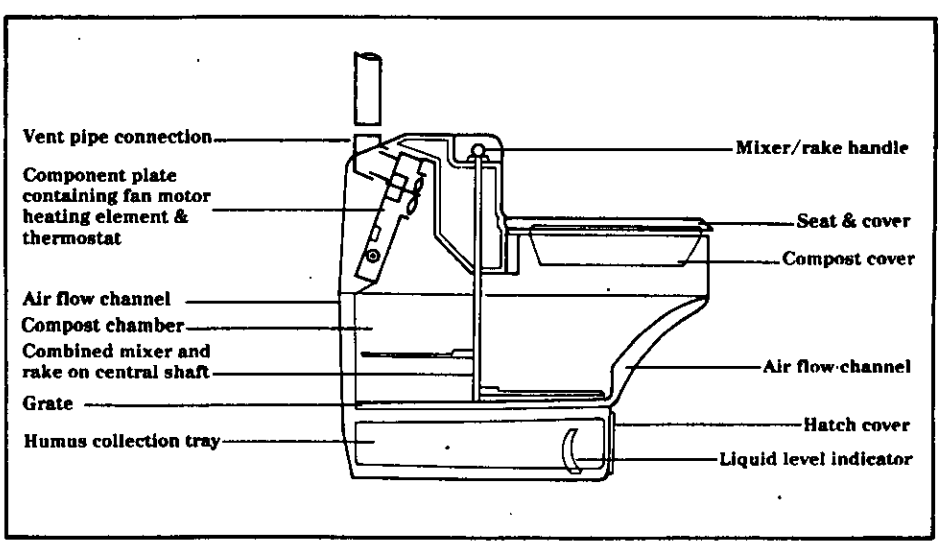
Capacity per unit:

Biolet is designed for intermittent use in holiday homes or similar locations by up to 6 persons. It is not recommended for year round use in these locations by more than three persons.

Biolet can handle occasional overloads of short duration. A transparent, external fluid-level indicator warns of overuse. In this case excess fluids may be drained off and disposed of.

Biolet carries a 12 month factory warranty. *Biolet* is approved by Australian Health departments.

Please Note: In full time residential situations we recommend the installation of our Rota-loo biological composting toilet which has the capacity to permanently cater for a family of up to 6 persons.



To purchase a *Biolet* please contact:

BIOLET is manufactured in Australia and distributed by

Environment Equipment Pty Ltd
1/32 Jarrah Drive, Braeside,
Victoria, 3195.
Telephone: (03) 587 2447
Fax: (03) 587 2082

DOWMUS

Composting Toilet . . .

Your solution to the problems of septic, flush and other toilet systems.

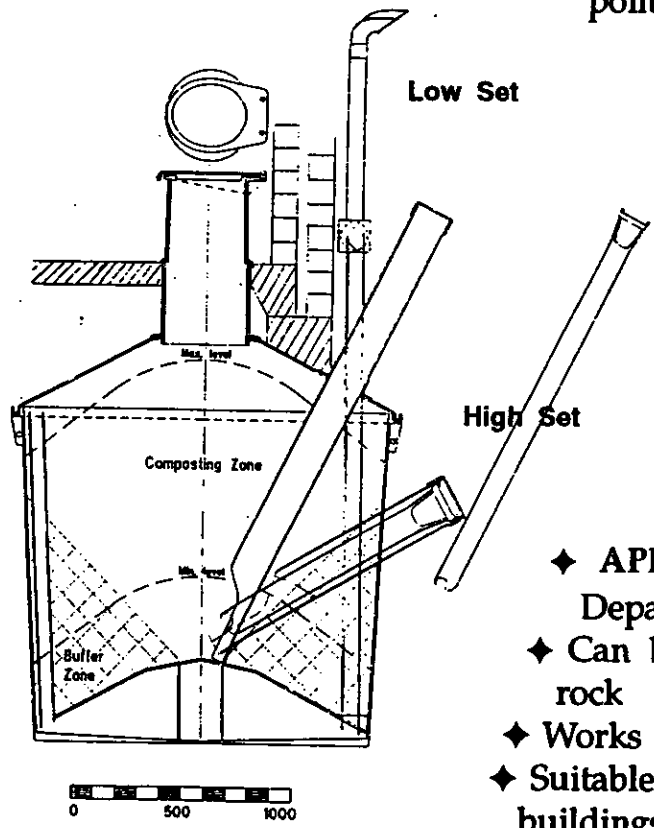
DOWMUS *is a state-of-the-art, low cost, hygienic, waterless toilet system, Australian designed and manufactured to safely convert your sewage, paper and kitchen scraps into valuable compost.*

Printed on 100% Recycled Paper - Recycle it in your DOWMUS

What's so good about DOWMUS?

- ✦ **REDUCES** costs
- ✦ Saves precious clean water
- ✦ Cuts water usage by an average of 20%
- ✦ No water connection necessary
- ✦ Requires no soakage/transpiration areas
- ✦ No expensive plumbing or clogged drains
- ✦ No pumpout required
- ✦ No chemicals to add
- ✦ No ongoing maintenance charges

- ✦ **RECYCLES** compostable wastes conveniently
- ✦ Major component 100% recycled plastic
- ✦ Recycles nutrients reducing water pollution



- ✦ **PRODUCES** valuable garden compost
- ✦ Has no polluting discharges
- ✦ Easy to operate & maintain
- ✦ No noisy flush
- ✦ Easy clean non-stain toilet chute
- ✦ No lingering odors in toilet or bathroom

- ✦ **APPROVED** by the Queensland Health Department
- ✦ Can be used on any soil type, even rock
- ✦ Works well in high water table areas
- ✦ Suitable for all domestic and public buildings
- ✦ Planning a concrete slab house? No problem.

SITE AND INSTALLATION REQUIREMENTS

The main component of the system consists of a robust injection molded plastic chamber. The dimensions of this chamber are 1.76 metres wide and 1.76 metres high. The chamber should ideally be installed prior to floor construction. Plan to allow a space of 1.8 - 2 metres x 1.8 - 2 m below the intended floor /slab base. In low-set and slab on ground construction this will require excavation of a hole 2 metres wide and at least 1.8 metres deep

After installation the chamber can be backfilled with clean soft fill.

HIGHSET & LOWSET SUPPORTED HOUSES

The toilet can be located anywhere on the external wall of the floor plan in this type of construction.

CONCRETE SLAB-ON-GROUND HOUSES

In this type of construction the toilet can be located anywhere adjacent to the external wall of the floor plan. The footing will need to be suspended over the composting chamber.

Installation is usually necessary prior to floor construction in all lowset houses.

FOR MORE INFORMATION CONTACT:

DOWMUS PTY LTD
PO BOX 51
MAPLETON
QLD. 4560
Phone 074- **414 144** or **018 190 583**
Fax 074- **414 653**
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This paper examines the foundation of sewerage technology from an historical and sociological perspective, and explores possible solutions to the political , social, technical, and environmental problems that water-carriage sewage disposal has created. The difficulties individuals and communities encounter in obtaining official approval for alternative systems such as composting and other on-site treatments, are also discussed.