

# ***Build your own Composting Toilet and save water.***

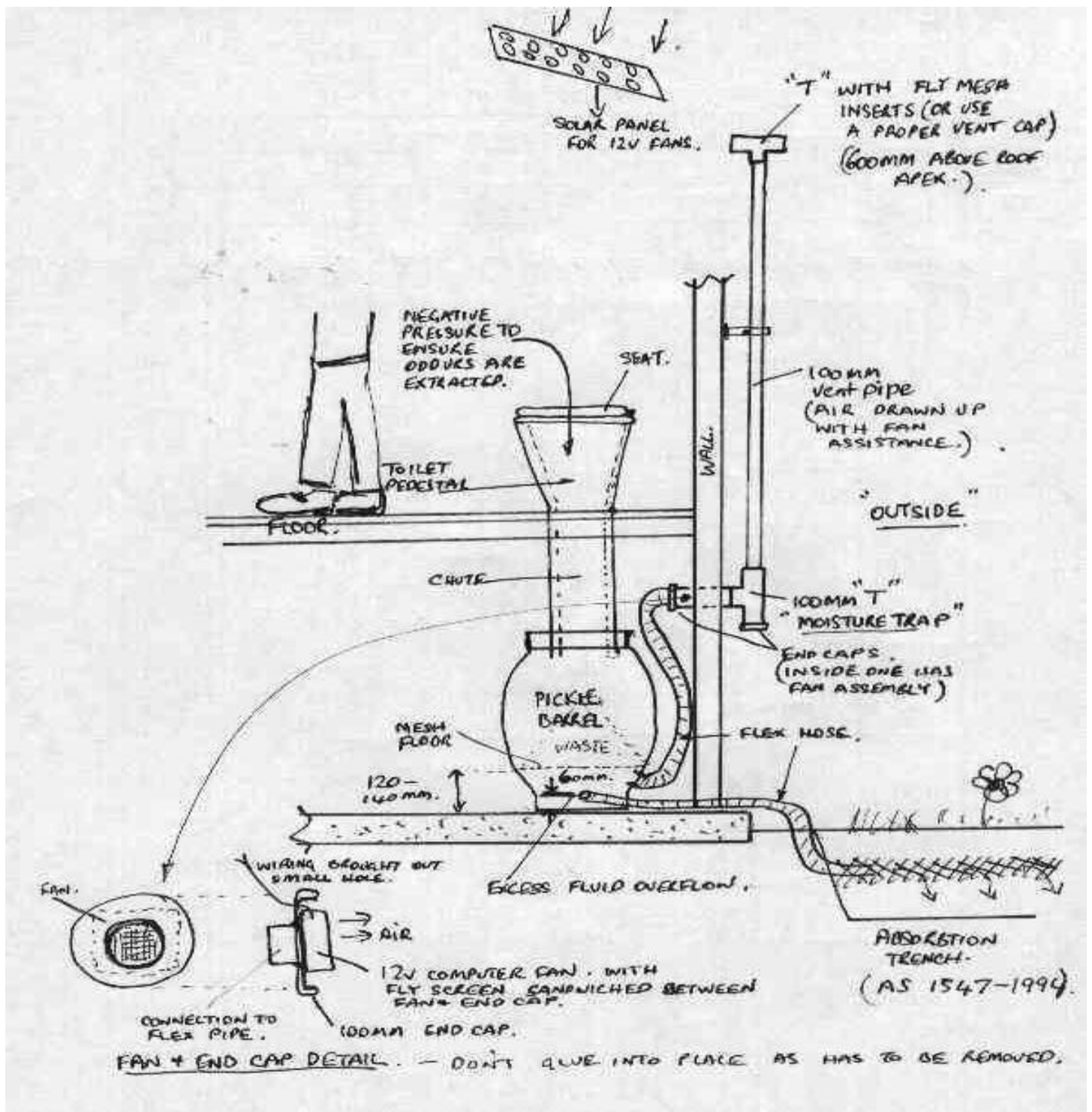
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.. Chris.***

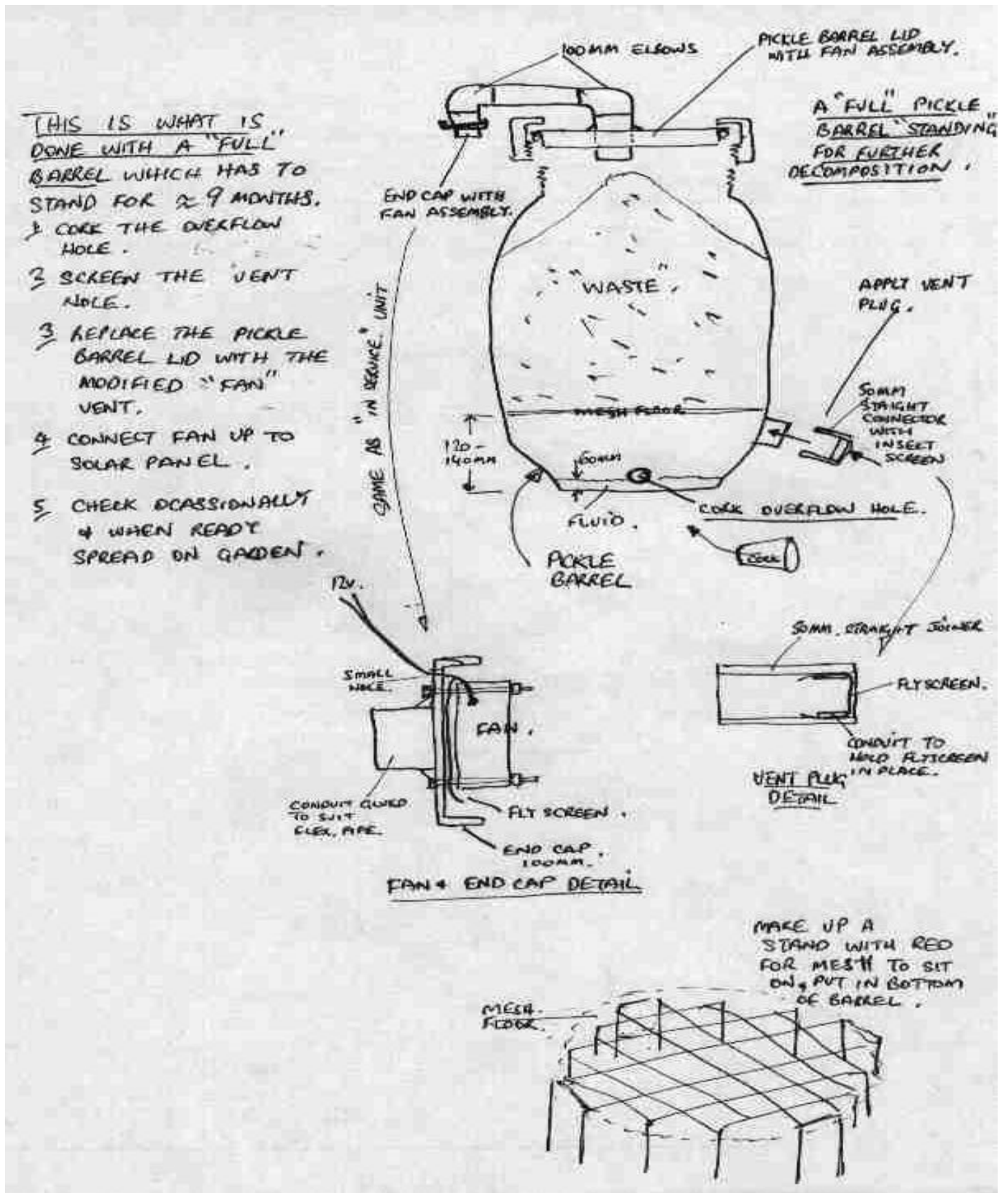
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This is a project I have yet to finish, I have to provide proper toiletries for the family ( and any visitors ) at our bush block. There are many designs about and all are pretty similar, achieving the same thing in slightly different ways , but I like this because it is simple and straight forward. It is similar to "Nature Loo" , (EMAIL- natloo@ozemail.com.au.) Their design however uses a specially designed chamber which optimises air flow through the compost heap and has better dimensions for the task. The version here is a variation of a couple of designs, using cheaply available bits, and using the building codes recommended for vents, trenches etc.

Materials needed are: 2 (or more) black "pickle barrels" , these can be picked up cheaply from 20-50 dollars. Their about 1 metre high and a bit over 500mm wide, and very useful to have for all sorts of jobs ( sorry) around the property .Unfortunately their value has been recognized by some and the price adjusted ! A few metres of 100mm storm water pipe for the vent pipe, two 100mm " T" sections, 2, 100mm end caps some 50-80 mm flexible hose, 10 metres of uv stabilised 20-30 mm hose , a circular piece of gauze ~ 3/32 pitch and about 400mm dia, (cut later to size ) , about 1 square metre of floor reo , A few 12v computer fans, and a toilet pedestal, with an air tight seat . This has to be a "through" pedestal type specially designed for this sort of application. Many places sell them or if you are a budding potter , have a go! You will also need a chute to connect the toilet pedestal to the barrel , this has to be the right size diameter (~400mm) to match your pedestal, smooth on the inside , and long enough to reach down to the barrel. Lastly you will need a 10w solar panel. ( Not an orange one ! ) I'm still waiting for the solar panel price reduction after the thin film breakthrough , which could potentially see solar panels at 1/10 the current price, I think the fuel companies will be dropping panel prices any day now . . . . .



It works like this; waste is dropped from the pedestal ( your's or other organic waste ) it drops down the chute to land on the gauze floor in the barrel. The chute and pedestal have to be wide enough so the dropping waste will not touch the sides ( aids cleaning! ) Liquids will drop through the gauze and collect in the bottom of the barrel. The computer fans help with the evaporation of the liquids by circulating the air and drawing it out of the barrel and out the vent. This is an aerobic breakdown of the waste with water vapor and carbon dioxide as the main bi-products. In this process most pathogens are killed. With the correct moisture levels, oxygen supply and temperature the waste decomposes to a compost ready for the garden. With this system a useful bi-product is generated and literally tens of thousands of litres of clean drinking water per household is saved every year.



A more in depth look: There is basically two types of decomposition we are interested in, Anaerobic and Aerobic. Anaerobic decomposition uses bacteria that survive without oxygen, the decomposition produces methane and sulphur dioxide gases. ( So if you throw a cigarette down the chute and it blows up in your face , your using the wrong de-composition method! ) This system uses aerobic decomposition, using bacteria that survives in oxygen. ( they can survive in O<sub>2</sub> levels as low as 0.5% ) Some systems move or rotate the waste to aerate it, this speeds the decomposition process up, this system doesn't require that . An optimum temperature and moisture level ( ~ 50% ) needs to be fostered

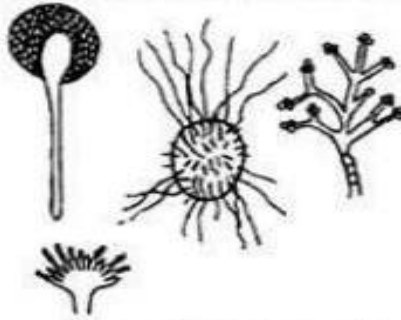
to enhance decomposition. At 4deg. virtually no activity takes place, at 20 to 40 degrees the mesophyllic bacteria work. As the temperature rises above 40 degrees, mesophyllic populations are replaced by thermophilic populations. This stage produces the fastest decomposition. In the later stages of decomposition, the mesophyllic organisms which are still present in the cooler outer surfaces of the waste pile move back to the centre. Most pathogens are killed in the composts thermophilic stage which rises above 55 degrees. So checking the temperature and consistency of the compost is a good way of checking if it has converted properly. The correct moisture content / humidity level is attained by first separating the liquids via the "mesh floor" . This allows oxygen to be drawn into the waste as liquid is removed, preventing anaerobic decomposition. The humidity level is maintained by having a pool of liquid below the solid wastes in a "closed" system. ( Below 40% the waste will "dry" and not decompose rapidly, above 60% there is a possibility of anaerobic decomposition because of oxygen starvation due to saturated liquids. - you will know as "rotten egg" gas is produced . ) The pickle barrel is made from a thick black plastic which absorbs radiant heat and aids in composting and the correct humidity as well.

It is very important to maintain a good environment for bacteria. ( just as you have to for septic systems ). Don't put any inhibitory substances into the waste such as disinfectants, and other chemicals. If the PH levels are upset the decomposition process can stop too. Give them plenty of carbo's and oxygen and they will do the rest. You can throw any organic substances down there, just as you would treat a "normal" compost heap. Ladies sanitary products and the like should be disposed of else where as it takes up needless space and is slow to decompose. It is a good idea to "kick start" your toilet with some old compost , from the last batch, or if your just starting, use some commercial mushroom compost or similar. It is also a good idea to put straw , grass etc on the mesh floor as this will also help to separate solids from liquids. You can also introduce worms into the system as well to further aid in decomposition. Red , tiger worms etc will multiply rapidly in a 20 - 30 degree environment, eggs hatch in about 21 days, and 1 worm produces about 150 per year. The population will "balance" to their food supply . (They will re-treat to the outer surfaces when it gets to hot. ). They have a "sweet tooth" and will thrive on spoiled fruits, skins, molasses or plain granular sugar. Aristotle called them the intestines of the soil, and they will produce casts "richer" than what they ingest and their own weight in casts every 24 hours.

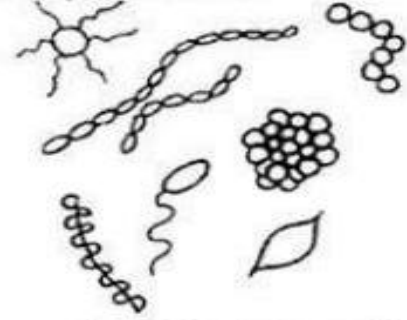
## COMPOST MICROORGANISMS MAGNIFIED 1,000 TIMES



**Actinomycetes**  
100 thousand - 100 million  
per gram of compost



**Fungi**  
10 thousand - 1 million  
per gram of compost



**Bacteria**  
100 million - 1 billion  
per gram of compost

## MICROORGANISMS IN COMPOST

### Actinomycetes

*Actinobifida chromogena*  
*Microbispora bispora*  
*Micropolyspora faeni*  
*Nocardia* sp.  
*Pseudocardia thermophila*  
*Streptomyces rectus*  
*S. thermofuscus*  
*S. thermoviolaceus*  
*S. thermovulgaris*  
*S. violaceus-ruber*  
*Thermoactinomyces sacchari*  
*T. vulgaris*  
*Thermomonospora curvata*  
*T. viridis*

### Fungi

*Aspergillus fumigatus*  
*Humicola grisea*  
*H. insolens*  
*H. lanuginosa*  
*Malbranchea pulchella*  
*Myriococcum thermophilum*  
*Paecilomyces variotti*  
*Papulaspora thermophila*  
*Scytalidium thermophilum*  
*Sporotrichum thermophile*

### Bacteria

*Alcaligenes faecalis*  
*Bacillus brevis*  
*B. circulans* complex  
*B. coagulans* type A  
*B. coagulans* type B  
*B. licheniformis*  
*B. megaterium*  
*B. pumilus*  
*B. sphaericus*  
*B. stearothermophilus*  
*B. subtilis*  
*Clostridium thermocellum*  
*Escherichia coli*  
*Flavobacterium* sp.  
*Pseudomonas* sp.  
*Serratia* sp.  
*Thermus* sp.

Construction: The system doesn't have to "exacting", The important bit is to get the "environment" right for composting. The gauze floor sits about 140mm from the bottom of the barrel on the reo table ( see diag ) , The gauze is a good fit to the barrel at "this" height" ( stop solids falling into liquids ) The "sucking" vent is positioned 10mm or so below the gauze floor and the liquid overflow is about 60mm above the barrel bottom. The chute is a snug fit into the pickle barrel lid so the system is effectively "closed", with the toilet seat down. Oh, this will please the ladies, the seat HAS to be closed at all times unless using it. It may be an idea to install a "time back on" switch to turn the fan off while the user feeds the little critters, as the down draft may "bother" some people. This "downdraft" negative pressure also keeps odors from rising so the "toilet" smells "fresh". The fan assembly is open to changes too. If your fan is too big to fit inside the 100mm pipe you will have to build a box for it with the pipe connections to that. Remember to use gauze ( fly screen ) to stop insects getting into the system. ( you don't want too breed flies! - and this won't happen if you keep the lid down and insect baffle the vents. ) The absorption trench is built per your countries building codes, usually a 20 metre long gravel trench. (Australia - AS 1547-1994 ) , In the event of a high fluid intake the overflow conducts the excess away , this should not normally happen as evaporation takes care of most fluids. - The diagrams convey the gist of things, good luck.

The unit will probably last a couple of people 9 months before it fills and will require changing, depending on usage. You will need to install an empty "pickle" barrel and re-connect the pipes. The

barrel will be very heavy to move so have one of those "material handling" two wheel trollies there to help you shift it. The "full" pickle barrel will need to stand for a further 9 months to complete the decomposition process, it is best if you place it in a "warm" position. Another computer fan will need to be attached to the "standing" barrel. You may note that the "working barrel" fan and the "standing barrel" fan are identical for obvious reasons. Having a spare or two is also a good idea even though they last for a few years. You may even have to resort to a second "standing" barrel if your usage is fairly high . The final 2 phases of composting take place now, the cooling and curing phase. The cooling phase is important to because the funguses have a go at things. They are able to breakdown the "harder" organic materials. The curing period provides a margin of extra safety for the pathogens to die out. If you haven't introduced worms to the system , this "standing" phase would be a good time. Have a look from time to time , turn the compost over if necessary, and apply to the garden when it's ready. Human waste is high in nitrogen (6% dry weight ) and carbon ( 50% carbon dry weight, Carbon /Nitrogen ratio 6-10 ) , it is closest to fowl manure as a comparison , so don't burn your plants.

**COMPOSITION OF HUMANURE**

**Fecal Material:  
0.3-0.6 pounds per person per day  
(135-270 grams), wet weight.**

Organic Matter (dry weight) .....	88-97%
Moisture Content .....	66-80%
Nitrogen .....	5-7%
Phosphorous .....	3-5.4%
Potassium .....	1-2.5%
Carbon .....	40-55%
Calcium .....	4-5%
C/N Ratio .....	5-10

**Urine:  
1.75-2.25 pints per person per day  
(1.0-1.3 liters)**

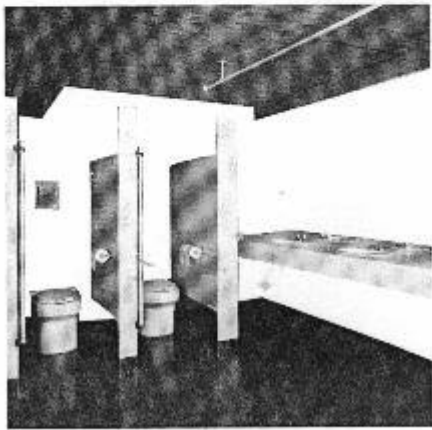
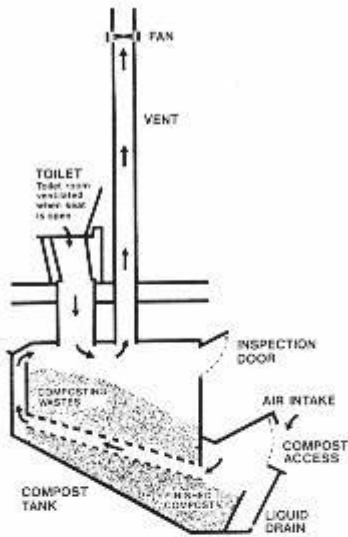
Moisture .....	93-96%
Nitrogen .....	15-19%
Phosphorous .....	2.5-5%
Potassium .....	3 -4.5%
Carbon .....	11-17%
Calcium .....	4.5-6%

**COMPARISONS OF DIFFERENT TYPES OF MANURES**

<u>Manure</u>	<u>% Moisture</u>	<u>% Nitrogen</u>	<u>% Phosphorous</u>	<u>% Potassium</u>
Human .....	66-80	5-7	3-5.4	1.0-2.5
Cattle .....	80	1.67	1.11	0.56
Horse .....	75	2.29	1.25	1.38
Sheep .....	68	3.75	1.87	1.25
Pig .....	82	3.75	1.87	1.25
Hen .....	56	6.27	5.92	3.27
Pigeon .....	52	5.68	5.74	3.23
Sewage .....	---	5-10	2.5-4.5	3.0-4.5

When you consider the tens of thousands of litres of clean water required for flushing the toilet per household per year ; the more than double that of grey water that is used to additionally flush the pipes and dilute sewerage. The staggering amount of clean rainwater collected on every household's roof that goes down the gutter and wasted . . . , It is little wonder we have water problems. It is clearly unsustainable !

Disclaimer : Finally I have to say, If you build this it is entirely your responsibility. Ensure it follows "your" building codes and it is made in a way to ensure life and property are protected..



Here is another system for interests sake, compost toilets that looks like the real thing!

As a final note, greywater can be used on your gardens and lawn without problems, it is advisable to install a "skum" trap before pumping it out though. Rainwater should be caught in a tank off the house as well, not wasted down the gutters. We might all be a little healthier if we had pure water to drink rather than piped water that has to be "processed" to make it "safe" for consumption. - Have you ever noticed tap water does bugger all for plants compared to natural rain. . . . .



### **A couple of LINKS to further information. . . .**

**WEBLIFE** - This site has some on-line books, I recomend you look at HUMANURE as it covers composting and composting toilets very thoughtly ! , Excellent reading! , "Humunure" also has a lot of good links too, so there is no point in me providing them again.

**NATURE LOO** - If you just wish to buy and not build a compost toilet, this company makes a system similar to the one described, they are here in Brisbane, provide a good professional product with support, to get you going. ( so to speak )

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