Alternative Method To Remove Nitrate And Phosphorus From Waste Water Based On A Swedish Invention And Used In Denmark, Germany, Holland, Austria, New Zealand, Australia, China…

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References

- Bibbi Söderberg idea and design.
- Swedish Department of Environment.
- BB Innovation&Co Dubbletten design.(www.dubbletten.nu)
- Wost Man Ecology AB.(www.wost-man-ecology.se)
- EAWAG, Swiss Federal Institut for Environmental science and Technology/ Novaquatis

What Do We Know About Sewage and Nutrients?

	URINE	FECES	**OTHER SOURCES** Laundry, Shower, dishwasher,kitchen wastes
NITROGEN	**80% to 90%**	**10% to 20%**	**+/- 5%**
PHOSPHORUS	**45% to 65%**	**35% to 50%**	**+/- 5%**
POTASSIUM	**60% to 80%**	**10% to 20%**	

What Do We Know About Urine ?

Also Called Yellow Water

- Human being discharge .33 gallons/ 1.25 liters of urine per day. (Gutt Tornsen 1978 study system design master class part II and personal testing).
- A family of four people discharge about 1.33 gallons of urine per day/ 5 liters per day.
- A family of three people discharge about 1 gallon of urine per day/ 3.76 liters per day.
- Urine represents less than 1% of our total sewage.

Three different styles of urine diverting toilet/NoMix toilet

Study By NOVAQUATIS

A Branch of EAWAG

Swiss Federal Institute Of Aquatic Science And Technology

4 Projects From 1997 to 2006

NoMix toilet is a urine diverting toilet

- Private apartment

4 apartments with NoMix toilet

For household measurements

Urine collected 1st year 60% to 75%

- EAWAG office building Government building

For institutional setting with well-educated participants

Urine collected 1st year > 90%

- Vocational college2004/2006 university of applied science of northwest Switzerland

3 NoMix toilets, 6 waterless urinal

- Basel Landschaft cantonal library with 200 000 visitors per year. All toilets are NoMix/urine separator

Acceptance From the Public

1750 persons surveyed:

- Well accepted and highly favorable
- 79% call it a great idea.
- 84% would move in residence with NoMix toilet.
- 72% would eat food fertilized with urine provided that health risk are excluded.

Public is prepared to give this unconventional technology a chance provided cost is affordable, meets modern sanitary and safety standards and problem occurred during testing are fixed.

Problem Encountered

- Regular drain line blockage due to crystallization build up (salt precipitation deposit) of waste. Fixed with bigger drain line and dilution.Advice 2” drain line and .15 liter/flush for dilution.
- Smell occurring with non diluted/waterless toilet. Fixed with dilution flushing toilet with water. .1 to .2 liter per flush. Better result with rain water (different mineralogy).
- Men may need to sit to urinate unless can aim properly.

Problems have been fixed with last generation of toilet manufactured in July 2008.

TKN/ Nitrogen Input and Output With Urine Separator Toilet

	Input	80% reduction	Output (80% reduction at source + 30% denitrification in drainfield and soil)
Per Residence	29 Lbs/Yr.	-23 Lbs/Yr.	4.2 Lbs/Yr
Per person	10 Lbs/Yr.	-8 Lbs/Yr.	1.4 Lbs/Yr.

Calculation based on the Mactec/DOH Phase I study

Disposal Solution For Yellow Water Tank

Mini passive system with denitrification for 2 gallons per day high concentration of TKN.
Mini performance base system.
Evaporation with coils/heating element with power supplied by 2 solar panels 5 hours of sunlight to evaporate 4 gallons at 250°F. Need to study redeposition of evaporated material.
Flower/plant bed with liner capable of absorbing 2 gallons of yellow water/day and resist pH 9.
Discharge yellow water inside 1500 gallons and collect once/year at time of inspection. Install auto dial with alarm system.

Disposal Solution For Yellow Water Tank with Holding/Storage Tank

- 1500 gallons at 1.5 gallons/day gives 1000 days of storage.
- Treated by treatment plant (Need to check if facility can receive this form of high nutrients waste).
- Can recycle waste as fertilizer (phosphate, nitrate, potassium).
- No more phosphate mine in America in next 20/30 years

  reserve are in hostile countries but can be provided in recycling yellow water.

Cost of Urine Separator

Standard toilet $ 200.00 Urine Separator $1000.00	Difference +$ 800.00 per toilet X2 = $ 1,600.00
Installation of 2 inches pvc schedule 40 at construction time / plumbing cost	Difference + $ 500.00
Installation of 1500 gallons holding tank with riser and concrete round cover resistant to pH 9	Difference + $2,500.00

Total **$ 4.600.00**

30 Years Breakdown

- Passive system about $50,000.00
- PBTS about $70,000.00
- Urine separator about $16,000.00

  ($ 4,600.00 initial installation + $ 4,000.00 for standard septic system + $8,000.00 with yearly service of system)

Conclusion

- Very cost effective technology for nutrient removal.

- No technology can separate nitrate and phosphorus as efficiently and as cheaply as the urine diverting toilet.

www.novaquatis.eawag.ch

www.dubbletten.nu

www.wost-man-ecology.se