'NON-PROPRIETARY' COMPOSTING TOILET FAQ:

1. **What is a composting toilet system?** – A composting toilet does not require the use of water or electricity and is a way to contain and control the composting of excrement, toilet paper, and carbon additive in an unsaturated, aerobic environment.
2. **How does the composting process work?** Thermophilic (bacteria living above 113°F) and/or mesophilic (bacteria living at 68-113°F) aerobic bacteria and fungi break down wastes through the composting process. The composting process requires:
    a. Heat – composting is most efficient at temperatures of 65°F to 135°F (meso-thermophilic). If sufficient mass and food is available the temperature will be maintained by the respective microorganism populations until food resources are consumed.
    b. Aeration – to maintain aerobic microorganism populations which facilitate the processing of the compost.
    c. Moisture – range of 40-70% (like a well-wrung sponge) to maintain microorganisms.
    d. Carbon:Nitrogen Ratio – about 30:1 is ideal.
    e. Microorganisms – To facilitate a quicker start in new composting bins an inoculation with a microbe starter or a shovel of finished compost may be desired.
3. **What is the end product of the composting process and what is its appropriate use?**
    a. Composting toilets remove most of the biological oxygen demand (BOD) and reduce waste volume to 10-30% of original volume.
    b. The result is "humanure" (not the same as treated sewage sludge which may contain industrial wastes). Fecal coliforms and other pathogens are deactivated in the composting process (minimum required composting time is dependent on temperature and intended use).
    c. Humanure is a stable, soil-like material called "humus". Humus is a common soil conditioner critical to agricultural systems.
    d. Recommended to use composted humanure (similar to residential greywater re-use) on-site only, distributed in mulch basins around fruit trees, and not to come in contact with edible portions of food producing plants.
4. **Why would someone in Arizona want to use a composting toilet?**
    a. Conserves potable water by not flushing, ~ 10gpcd, 3650gal/yr/person;
    b. Conserves energy: 45-550 kWh/yr/person (enough energy to light a 100 W bulb for ~450 - 5550 hours) for sourcing water and treating waste water (*depending on pumping distance, depth, quality of source water, and other variations)*(source: Lancaster 2012)
    c. Conserves additional water by conserving energy: 23gal – 282gal/yr/person (*based on coal power*) (source: Lancaster 2012)
    d. Creates a renewable on-site soil building resource, humanure which helps return nutrients to the soil:
        i. An average person can fertilize 15-30ft^2 of crops based on organic content
        ii. Adds a locally-sourced, stable, organic material to soil
    e. Rural: an alternative to septic systems. Septic systems may be too expensive or soil constraints too limiting (e.g. low percolation, high water tables, shallow soil, or rough terrain)
    f. Urban: desire to expand bathroom w/ sustainable technologies, reduce need for new/upgraded waste treatment facility
    g. More cost-effective to treat waste on-site than it is to build and maintain a central sewer system
    h. Nutrients are kept in tight biological cycles without causing problems to receiving waters

   i. Moving from disposal based thinking to resource utilization

5. **What regulations exist for composting toilets in Arizona?** Composting toilet regulations in Arizona address performance standards, design requirements, operation, and maintenance requirements as well as the disposition of the non-toilet "wastewater" flow (sinks, laundry, etc).
6. **What is a site-built composting toilet?** A "site-built" composting toilet refers to a system that can be constructed on-site as compared to a pre-fabricated, commercially available composting toilet. The Composting Toilet Research Action Pilot spearheaded by Watershed Management Group (WMG) is evaluating two basic "site-built" designs (designs are publically available for free). If the systems prove to be robust in durability, user likeability, and effectively minimize pathogen risks, the designs will be proposed to ADEQ to be listed as selection options under ADEQ's 4.03 General Permit under Aquifer Protection.
   a. Standard permit cost = $500-$1000+
   b. # of Composting Toilet permits issued between 2005-2007: 35
   c. Non-proprietary Permit cost = $1000 to review design + $1000 for the permit (if design approved)
   d. # of residents who have applied for a non-proprietary composting toilet permit: 0
   e. # of residents with non-proprietary composting toilets in urban Tucson: Estimated 50-100+
7. **Why would someone choose a "non-proprietary" (or "site-built") composting toilet over a commercially purchased and certified system?**
   a. system is cheaper in cost ($200-$400 vs $1,200-$6,000)
   b. desire for simplicity
   c. custom fit or design based on site constraints
   d. often better performance
   e. easily repaired if needed, fewer moving parts, gadgets, and gizmos to break or require costly repairs
8. **What about controlling odors, flies, and common pathogens?**
   a. Odors – odor is considered information in the management of the system. If odors are present then management is required typically in the form of 1) aerating and/or 2) adding carbonaceous cover material to maintain the C:N ratio.
   b. Flies – flies are a potential vector of pathogens to humans. Flies and other insects can be easily controlled by ensuring the system is well sealed. In outdoor environments a fly trap is effective at attracting flies if they gain access and prevents them from exiting the system.
   c. Common pathogens – fecal coliforms (i.e. E.coli), *ascaris lumbricoides* (roundworm), Cryptosporidum and enteric viruses (e.g. norovirus); *According to Dr. Chuck Gerba (UA Research Professor), ascaris is not a common pathogen in Arizona.*
9. **What about the diverted urine from a composting toilet?** – urine accounts for ~90% of N and 50% of P in household wastewater but only 1% of the flow volume. Urine is typically sterile. If stored for a short period of time potential pathogens in urine are deactivated.
   a. Corresponding N-P-K values of urine are 11-1.5-2
   b. The ammonia (NH_4) in urine must undergo nitrification to be plant useable. This occurs in aerobic environments which make it ideal to apply urine to well-mulched soil and promote plant uptake of nitrate.
   c. Conventional septic tanks remove only ~1-3% of nitrogen and then a total of 21-25% if an additional soil absorption system is included. By diverting urine and applying to well-mulched soil a majority of the nitrogen is made plant available.

d. Based on 1 adult consuming 550lbs of cereals per year, ~70% of the consumed cereal crop could be fertilized based on urine alone (and an additional 13% accounting for humanure). (Drangert, 1998)

10. What are the associated environmental and health risks to a community with individuals using and maintaining (site-built) composting toilets and utilizing diverted urine?

a. As long as the composting material remains on site and contained until treatment is complete there are no environmental health risks. If the material has been composted completely all of the pathogens (disease causing organism) should have been destroyed. It is important that the material during composting be contained as to ensure that rainfall events cannot carry the material off-site.

b. Urine utilization: Ingestion of crops contaminated with urine resulted in risks of $<10^{-5}$ after a 3-week ($<10^{-7}$ after 4 weeks) withholding period between fertilizing and harvesting. (Höglund et al, 2002)

11. What does a community gain with the use of 'site-built' composting toilets and a standard permitting process?

a. Potentially reduces number of systems unknown to regulators and ensures specified standards are met

b. Reduces need to import/mine soil nutrient amendments saving 216-621 lbs CO_2 per year

c. Reduces strain on limited potable water supplies and aging waste water infrastructure

12. Where can I learn more?

a. David Del Porto and Carol Steinfeld, The Composting Toilet System Book

b. Drangert, J. 1998. Fighting the urine blindness to provide more sanitation options. Water SA. 24(2): 157-164.

c. Ecosanres.org --> Jönsson et al., 2004. Guidelines on the Use of Urine and Faeces in Crop Production. EcoSanRes. Stockholm Environment Institute.

d. Höglund, C. et al. 2002. Microbia risk assessment of source-separated urine used in agriculture. Waste Management and Research. 20: 150-161.

e. Joseph Jenkins, The Humanure Handbook, http://humanurehandbook.com

f. Brad Lancaster, www.harvestingrainwater.com/water-energy-carbon-nexus

g. David Omick, www.omick.net

h. Recode Oregon, www.recodeoregon.org/composting-toilets-in-oregon

i. Rich Earth Institute, www.richearthinstitute.org

j. U.S. Environmental Protection Agency. 1999. Water Efficiency Technology Fact Sheet, Composting Toilets. EPA 832-F-99-066.

k. Watershed Management Group, www.watershedmg.org/soil-stewards