



Proposal for the Steps to be taken to develop and implement a domestic waste water pollution avoidance system that is in accordance with the EU Circular Economy Principles for the recycling of Phosphorus and Nitrogen

GOALS TO BE ACHIEVED

- To largely eliminate the wasting of nitrate and phosphate as happens at present when percolating waste water or treated waste water containing these elements into the ground after septic tanks and conventional domestic waste water treatment systems.
- Instead to recover and to reuse the largest source of nitrogen and phosphorus from domestic waste water, which is in the urine and the toilet solids; to grow food crops without the presence of pharmaceuticals or toxic metals, in accordance with the EU Circular Economy principles
http://europa.eu/rapid/press-release_IP-15-6203_en.htm “Closing the loop: Commission adopts ambitious new Circular Economy Package to boost competitiveness, create jobs and generate sustainable growth - to facilitate the recognition of organic and waste-based fertilisers in the single market and support the role of bio-nutrients”
https://en.wikipedia.org/wiki/Circular_economy “A circular economy is a regenerative system in which resource input and **waste**, emission, and energy leakage are minimised”
- To avoid or prevent the discharge of ingested pharmaceuticals from single house effluents from entering the aquatic environment in upper river catchment areas.
<https://www.irishtimes.com/news/science/the-undiluted-truth-about-chemicals-in-our-waters-1.439674> Irish Times article about pharmaceuticals in waste water
<https://epha.org/the-european-commission-must-fulfil-their-obligation-to-reduce-pharmaceutical-pollution/> Concern from NGOs about this problem.

In doing the above to begin taking the first steps to return our rivers and streams to their former pristine water standard. <http://www.thejournal.ie/ireland-water-quality->

[3573358-Aug2017/ https://www.irishtimes.com/news/environment/unwelcome-declines-in-irish-water-quality-1.3203878](https://www.irishtimes.com/news/environment/unwelcome-declines-in-irish-water-quality-1.3203878)
http://www.epa.ie/licences/lic_eDMS/090151b2803026fe.pdf Irish EPA report on the pollution threat to Pearl Mussels

To achieve the above goals by implementing low technology methods in homes as follows:

1. Systems will need to have a very low operation and running cost for it to be popular with the home owner
2. Ideally systems will be safe to operate by the average home owner who has an interest in gardening, making compost or growing vegetables. The systems must be safe to operate and must involve no expense for the purchase of harsh chemicals that might be hazardous to handle
3. For optimum environmental performance the system must minimise power for pumping and should absorb rather than emit greenhouse gases.
4. The system must therefore be appropriate for use in single autonomous family homes and therefore should require no national sludge collection system or infrastructure for its operation outside of the home.

RECOMMENDED RESEARCH AND IMPLEMENTATION STEPS

STEP 1 - Obtain a budget to carry out a review of the existing academic research on phosphorus recycling and the removal of pharmaceuticals from domestic waste water

- The review of existing research is to confirm or disprove the assertion that phosphorus rock is an economically finite resource, that its eventual depletion is inevitable and that a scarcity of phosphorus, if we don't begin to recycle it urgently, has the potential to cause a world food supply crisis sometime in the future. <http://phosphorusplatform.eu/links-and-resources/p-facts> “Phosphorus is essential for worldwide food security”
- The review of existing academic research is required to confirm or disprove the assertion that phosphorus at some future date will have to be sourced only by recycling it from organic waste. If this assertion proves to be true; examine the evidence and review the academic studies that suggest that feeding the world's population can only be achieved in the future by abandoning our linear food waste disposal system and our present linear waste water treatment and disposal system. Is there any academic research that supports the idea of transforming our present linear waste water treatment system to become a circular closed-loop nutrient resource recovery system?
- Research the present methods being used to recover and recycle phosphorus in various parts of the 3rd world by separating urine and toilet solids; in situations where the purchase of mineral fertilizer is already too expensive. Are there lessons to be learned also for the people in Europe when phosphorus rock fertilizer eventually becomes too expensive and scarce?
- Assess the climate change implications that arise from depending on natural gas using the “Harber and Bosch” method for the manufacture of ammonia as the other essential constituent of fertilizer. Assess the scale of the greenhouse

gas emissions by using this method. Research the scale of fossil fuel energy use that arises from this method of making Ammonia for fertilizer. Confirm, correct or disprove claims that this “Harber and Bosch” process uses 5% of the worlds, fossil fuel natural gas production for the making of ammonia fertilizer and contributes 30% of the energy expenditure for agriculture. Research the inflationary cost implications for the manufacture of Ammonia, the price for mineral fertilizer to farmers and the knock on price increases to consumers as a result of any future natural gas shortages or any subsequent increase in the price or of commercial mineral fertilizer to farmers. How vulnerable is world food production by our dependence on the Harber Bosch ammonia manufacturing method?

<http://www.the-compost-gardener.com/haber-process.html>

<http://people.idsia.ch/~juergen/haberbosch.html>

<http://www.resilience.org/stories/2006-06-11/implications-fossil-fuel-dependence-food-system/>

- Review any existing academic research into the “*Environmental impact of recycling nutrients in human excreta to agriculture compared with enhanced waste water treatment*”
<http://www.sciencedirect.com/science/article/pii/S0048969714008158>
Assess if there are low levels of ammonia being lost to the atmosphere from using urine in hydroponic systems to produce green leaf or biomass fertilizer using the Herr Ltd method. Estimate and compare the ammonia loss or emissions from the Herr domestic hydroponic method to the ammonia emissions and losses that are identified in the above mentioned study, where separated urine is stored for months and then applied directly to the land to grow farm crops. http://www.wecf.eu/cms/download/2007/WP-26_web-07.pdf Examples of urine separation in Sweden: “*Urine Diverting Toilets in Climates with Cold Winters*”
- Assess the potential of removing the very small volume of urine and faeces from the much larger volume of grey water as a method of avoiding domestic waste water pollution. What is the potential of this method for re-establishing pristine water conditions in upstream river catchments that would otherwise be affected by diffused pollution from septic tanks? For this assessment ignore other potential water pollution sources in river catchments such as farming or forestry.
- Assess how quickly we need to act on the matter of recycling nitrogen and phosphorus? Given our culturally slow response to the challenge of climate change. Do we need to begin installing the resource recovery systems now? Please propose various options aimed at developing a new national cultural awareness on the need to recycle key resources.
- Conclusion and the Recommendations? After completing the above research will it be possible to conclude that single homeowners in river catchment areas “must” be encouraged or incentivised to separate, recover and manage human urine and toilet solids. Will it be possible to conclude that this nutrient source separation is a necessary step or element to clean rivers and streams and return them to their former pristine status? Can it be concluded that urine separation should be implemented for new buildings immediately – or should we wait until the food price crisis as a result of Phosphorus resource depletion is upon us before acting?

STEP 2 A - Obtain a budget for an academic study to visit and assess the effectiveness, the advantages and disadvantages of the few existing pilot demonstration systems that use the Herr Urine Hydroponic systems that convert the nutrients in human urine to green leaf biomass

- Assess the ability and the level of success of an indoor glazed Herr hydroponic system that grows plants from human urine to achieve a zero liquid discharge, thereby more fully protecting any outdoor receiving aquatic environment from the pollution of nitrogen, phosphorus, potassium or ingested pharmaceuticals.
- Assess the effectiveness of an outdoor Herr hydroponic system that grows plants from human urine – without the need for a glasshouse or poly tunnel.
- Assess the economics and installation costs of incorporating such systems in new single houses in river catchment areas.

STEP 2B As part of a separate academic study, obtain a budget to install a Herr type urine hydroponic system, a toilet composting system and a kitchen waste composting system - for a real family home of 2 adults and 3 children; as a pilot demonstration of domestic phosphorus and nitrogen recycling

To scale up and install a single natural botanically based hydroponic system to separate and recover Nitrogen and Phosphorus nutrients from separated human urine using urine separating toilets for a family group of 5 persons.

To provide a toilet composting system to recover Nitrogen and Phosphorus from toilet solids in a house that uses flush toilets for a family of 5 persons.

To provide 3 or 4 permanent concrete composting chambers at the house for the waste vegetable matter, the harvested urine fertilized comfrey, and the 9 month composted toilet solids; so that an extended composting period with annual turning of the pile can be achieved over a period of at least 3 full years.

To analysis the finished compost for toxic metals and pharmaceuticals, at interim periods and at the end of the last 3 year composting period. To assess if this integrated domestic nutrient recovery system can be safely and conveniently operated by the family. To test the finished material to see that no toxins remain that would

To choose a suitable family who are building a new home and appoint an academic to supervise the data collection, the documentation and the operation of the system by the family. To be sure to have this data collection, the research and any measurements peer reviewed by another independent academic. See Step 6 below

STEP 3 - Academic study using a laboratory scale system that is already in progress to measure removal rates of nutrients from human urine using the Herr Urine Hydroponic system

Work is to be started shortly in Dundalk DKIT to assess the potential for comfrey plants to remove and bio accumulate nutrients such as N. P and K for human

urine under artificial light. The purpose is to be able to scale urine nutrient recycling systems for single domestic houses of 3 to 5 people by growing plants to bio absorb the nutrients. The system will remove the nutrients in human urine in winter where there will be insufficient natural light, using artificial electric lights. This artificial lighting will complement any natural light in winter. Thus the continuous operating photosynthetic system growing plants to bio absorb nutrients will avoid the ammonia loss problems that arise from long term storage of urine. The Swedish system of storage of urine leads to ammonia waste emissions and losses. We want to improve further on the Scandinavian method of recycling nutrients on fields by minimising ammonia losses in storage tanks and during application on crops in fields. In addition the Herr System will add a further stage of cutting and composting the harvested hydroponically grown leaves so that they can be composted long enough to breakdown any absorbed pharmaceuticals, antibiotics or hormones. <http://www.freedrinkingwater.com/water-news/remove-pharmaceuticals-from-water-not-cheap.htm> Conventional domestic or municipal sewage treatment plants are not designed to remove pharmaceutical pollution.

STEP 4 - To draft new wording for the Irish building regulations and the EPA Code of Practice for domestic sewage treatment systems; that mandates or requires the recovery and the recycling of Nitrogen and Phosphorus from waste water from rural houses for the purpose of growing food crops

To obtain funding for a suitably trained person with a background in Irish Parliamentary Law, Environmental Law and Irish Planning to assist with the following:

To write a new section for Part H of the Irish Building Regulations that deals with the plumbing standards required for the separation of human urine in new or refurbished Irish houses.

To clarify the legal issues of who is permitted to recycle phosphorus from human urine. To set the regulations that will apply before starting the phosphorus recycling programme or business from “domestically sourced” human urine.

STEP 5 – Drafting a new SI (Statutory Instrument) for nitrogen and phosphorus recycling to grow food crops

A Statutory Instrument already exists for the spreading of municipal sewage sludge onto farm land. This is to set limits for toxic metals in the sewage sludge. But no recognition is given in Ireland yet to the use of human urine as a fertilizer. Urine also contains large quantities of nutrients and which have very low levels of toxic metals.

To write a new draft SI “Statutory Instrument” that sets the requirements and standards, the training for architects, home owners, farmers, and urine collection contractors for the collection, storage and use of human urine to grow food crops.

To write a new SI that will set the operational regulations and legal obligations that will apply for “struvite” production from human urine in single houses or by

community groups or by a mobile struvite van/ lorry that would or could be operated “Irish Water”.

This new SI will also establish a national structure for the formal training of architects, plumbers, developers and home owners, for the installation of Herr Hydroponic nutrient recycling systems and the other phosphorus separation and recycling methods

The new SI will establish a fund for the education of the public on the issue of Phosphorus depletion by TV and Radio. This funding will provide for the writing of the new environmental syllabus for secondary schools on resource depletion in general; particularly with regard to fossil fuels, natural gas, oil and phosphorus.

STEP 6 – Inclusion of the various options for Phosphorus recycling form single houses in the EPA Regulations for waste water treatment Systems for populations of less than 10 people

Under the Irish EPA STRIVE Research programme to request that a formal study be conducted as a pilot demonstration project; for nutrient recovery and recycling from waste water and from kitchen waste from a single family house.

ORDER OF STEPS

Please note that the implementation of these steps may well have to happen in any order. In my view however the creation of a circular economy in Ireland for nitrogen and phosphorus for single houses located in upper river catchment areas will require almost all of these steps to be taken to be successful

Regards
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