TERMS OF REFERENCE FOR A DIRECTED WRC PROJECT

THEME	**Water Quality and Health**
TITLE	**Detection and Assessment of Contaminants of Emerging Concern (CECs) in Non-Sewered Sanitation (NSS) Systems**
TOR NUMBER	**1010022**

Rationale

Contaminants of Emerging Concern (CECs) represent synthetic or naturally occurring compounds which can pose a risk to human health and the environment. Several studies have reported their presence across the water value chain including freshwater systems (surface and groundwater), wastewater, treated water, as well as in sludges, soil, and sediments. This raises concerns about potential exposures and risks within the ecosystem through the different water uses, as well as management and reuse of sludges. Commonly detected classes of CECs include pharmaceuticals and personal care products, industrial chemicals, agricultural chemicals, and others. Research has shown that some of these compounds can persist in the environment, bioaccumulate in organisms, and have negative effects on human health and the environment. The testing of CECs in Non-Sewered Sanitation (NSS) systems has been scant and lacks a coordinated approach; there have been a few localised cases on struvite-derived urine and exploratory studies by universities who developed NSS applications. In the former example, 12 CECs were detected in source-separated urine in Durban, South Africa (Bischel et al., 2015). SMX and TMP were part of the CECs detected and are usually prescribed for long-term use in patients with compromised immune systems (Bischel et al., 2015). This finding highlights the implications for resource recovery technology approaches and the need to take into account CECs in re-use principles.

Several engagements undertaken by the strategic government initiatives have highlighted the need to create and co-ordinate research on CECs in water value chain. Every year, new compounds or molecules are detected in water samples that have been previously unknown. There is a duality that exists as part of regulatory and compliance requirements; it becomes nearly financially impossible to test for every CEC for regulatory purposes yet at the same time, it is part of regulation to understand what risks are to public health and the environment. This challenge occurs across the water value chain. In 2015, the EU Water Framework Directive published a watch list, priority substances and CECs as part of their coordination strategy.

This study WILL NOT explore all CECs in NSS applications and their possible effect on public health and the environment. Although there is a gap in the research, the specific aim is to provide a risk assessment of the water quality or re-use products from profiling selected CECs from NSS applications. This project should mostly focus on water reuse applications including those from

the WRC SASTEP portfolio. Other NSS applications (by-products, urine separated streams and sludges for example) are a secondary priority but should not be excluded.

The success of the proposal will be determined by the methodological approach. The proposer can test multiple sites and use a combination of Non-Targeted Screening (NTS) and priority CECs testing in NSS applications. The end product should fill the knowledge gap on CECs in NSS applications. Comparison to conventional treatment process should be included in the analysis, if possible. Another key output is contribution to the local coordination of transdisciplinary CECs water research activities and knowledge transfer of methods for monitoring CECs.

Objectives*:*

The objectives of the project are to:

1. Provide a comprehensive literature background on CECs including current state of knowledge on NSS applications and water reuse. This review should be submitted as a scientific article.
2. Provide a clear implementation plan: the number of sites, facilitate buy-in from SASTEP commercial partners and other implementers, ethics application, data management, knowledge dissemination and be involved in current and future CEC WRC activities, including possible partnership and contribution to a national CEC knowledge hub (see this document for other Directed Calls).
3. Provide the basis for a Standard Operating Protocol (SOP) for CECs in NSS systems: Evaluate and select appropriate detection technologies that are capable of accurately identifying and quantifying targeted contaminants. Regular communication and coordination with other CEC research groups may be required to deliver this result.
4. Selected NSS resource recovery implications: For example, from water reuse, urine-diverting flush, dry sanitation systems, solid and liquid fertilizers, biochar from NSS systems.
5. Assessment of CECs: This assessment will provide a comprehensive understanding of the potential risks associated with the presence of these contaminants and fine-tune subsequent testing for CECs in NSS applications. The water reuse assessment should be paired existing knowledge from conventional water reuse systems to assist with implementation strategies.
6. Knowledge dissemination.

Specific Objectives:

This project aims to collate existing knowledge on CECs in NSS applications, fill the knowledge gap on CECs in NSS applications in South Africa and contribute to the standardisation of approaches used for CEC water samples. The successful proposal is expected to be involved in other WRC-funded CEC projects; current and planned, including the revision of national CECs knowledge hub (Research Manager: Dr Eunice Ubomba-Jaswa). An annual CEC Reference Group may be held to assist with the local coordination and communication and knowledge sharing.

This project will also contribute to global NSS research aimed exploring the removal of pollutants at point-of-source in comparison to centralised reticulated systems.

Expected Deliverables:

The deliverables below may be sub-divided by the proposers, if desired, into not more three deliverables per financial year. The first year deliverables include Project Implementation Report and a final deliverable of the print-ready final report of 20% of the total project cost.

1. Reports on key aspects researched as per specific objectives
2. Workshop/s with key stakeholders
3. Draft Final Report
4. Final Report

Total Budget: R 1 400 000.00 (Including VAT)
Year 1: R 600 000.00 (including VAT)
Duration: 4 years

References:

Bischel HN, Özel Duygan BD, Strande L, McArdell CS, Udert KM, Kohn T. Pathogens and pharmaceuticals in source-separated urine in eThekwini, South Africa. Water Res. 2015 Nov 15;85:57-65. doi: 10.1016/j.watres.2015.08.022. Epub 2015 Aug 14. PMID: 26302215.

Other resources:

https://www.sciencedirect.com/science/article/abs/pii/S0045653520329350
https://wrcwebsite.azurewebsites.net/wp-content/uploads/mdocs/3105-1-23%20final.pdf