

# SLUDGE MANAGEMENT

## Avast! Why sewage sludge is bound for the rocks – and how to turn her around

*Contradictory laws for handling wastewater residues have us all at sea. Lashing these into line must top the rescue plan. Matthew Hattingh reports on a recent workshop hosted by the Water Research Commission (WRC).*



Across crystal waters, in the distance, shimmers an emerald green city – where the words “sustainability” and “circular economy” echo on the wind. When it comes to wastewater management, and more particularly, the mountains of sludge we produce, South Africa has a vast raft of legislation, regulations and guidelines. (The WRC guidelines, for example, for the utilisation and disposal of wastewater sludge, run to five volumes.)

We hope the many policies and rules will transport us to the

promised shore of environmental and community health. Trouble is, it’s an ungainly craft, with the different laws acting against each other like sails set by a fractious crew. And as we flounder, new technologies are devised to get us there. Sometimes the laws prevent their launch, over others, doubts linger. If a technology or process worked well abroad, would it work here and could we afford it?

South Africa urgently needs to get shipshape on sludge. An estimated 31% of the country’s households aren’t sewered –

with the 63 000 or so dry tons produced daily mostly ending in pit latrines and seldom collected for processing. Recent WRC research and a Green Drop report, found 877 wastewater treatment plants producing 1 750 dry tons of sludge daily, with 1 100 tons being untreated primary sludge and the rest secondary, partially treated sludge. Many plants struggle to handle this waste.

To help the sector navigate better, the WRC recently co-hosted a workshop on sludge management. The August online meeting briefed guests on three interrelated WRC sludge management research projects, which focused on updating the guidelines, trends and advances in the sector, and strategies to recover resources from sanitation waste. Workshop guests heard why some rules required straightening out so they might work together better, and why others should be “thrown into the dustbin”.

They learnt how sludge, a costly environmental headache, might be refashioned as resources, including methane, solid biofuel and hydrogen for energy, as well as other high-value materials, such as proteins and plastics. But guests were reminded that sanitation waste has a yuck factor that puts the public off – a whiffy headwind to progress.

Dr Sudhir Pillay, the WRC’s research manager for sanitation, sketched the extent of the sludge problem and noted that many municipalities were finding it difficult to deal with. And

because they couldn’t meet standards for downstream use, they were increasingly stockpiling sludge. Pillay said the WRC was reviewing its research strategy to understand why this was happening and what could be done to improve matters.

The workshop viewed a sanitation flow diagram developed by consultants Zutari, showing sludge at its different stages in South Africa, from containment through to emptying, transport, treatment and disposal. Worrying findings included that 58% of municipalities and other utilities were failing to reuse or dispose of sludge appropriately. Some 70% of wastewater systems have a high-risk rating and 39% are in a critical state, with consequences for human health and the environment.

Pillay added that the Department of Water and Sanitation launched a faecal sludge management strategy last year, but “a big gap” persisted, with neither the know-how in the country to develop plants to treat it, nor the capacity to manage these.

Dr Heidi Snyman, instrumental in drafting the WRC’s sludge guidelines in the noughties during her tenure there, agreed the training needs of municipalities were “very high, even at metro level”, although there were “pockets of excellence, which we need to capitalise on”. Now a consultant and co-chief executive of bioremediation company iWater, Snyman acknowledged calls for the adoption of a circular economy and the need for innovation, but stressed that constraints must first be addressed.



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*If managed correctly, sludge can be reused as, for example, fertiliser in agriculture fields. In South Africa, only 15% of sewage sludge is being recycled or reused.*



*Sludge pellets, used typically in agriculture applications.*

"The legislation is not on our side for innovation, for smart thinking," she said, recommending "dialogue with our regulators". Quoting Pillay, she reminded the webinar that removing organic materials from wastewater creates residues or sludges which must be disposed of or used. These needed classification – to know what was in it. In practice, however, 62% of utilities were not classifying their sludge. So, their sludge didn't meet guidelines for particular end-products, like fertiliser.

Even when municipal and other wastewater officials have the capacity to do their jobs, contradictory laws make it difficult. Officials must bear in mind the Water Act and regulations governing authorisations and licensing for different forms of water use and waste discharge. They also must be mindful of the Environmental Management Waste Act and adhere to its requirements for different categories of waste, consultative processes and authorisations.

All this could be "quite cumbersome", said Snyman, "It's almost that if we follow the rules, if we follow the legislation in place, we actually are not going to be protecting the environment, and we're also not going to be using it [the sludge] beneficially." She noted that nearly 20 years after WRC-funded research first uncovered confusion in the sector over sludge disposal in landfills, it persisted. "And sadly, the practice of stockpiling sludges is again common practice." Many municipal landfill sites were refusing to accept sludge from their sister wastewater treatment departments, "based absolutely on inaccurate information".

Snyman agreed there were better options to dumping sludge

in landfills, but felt it had its merits. Provided the sludge was sufficiently dry, it could be added to day cover – the soil used to dress landfills, isolating it from the weather, and limiting the spread of disease and odours. Sludge could also help kickstart the processes that break down landfill waste and produce methane, which could be used for energy generation. She said the WRC's 2009 guidelines were no longer relevant and an update was needed to rescue the sector from its muddle and to ensure guidelines reflected changing economic realities. She noted that in the early 2000s electricity was cheaper than now, making landfill methane gas projects more compelling today.

Sludge management guidelines needed to be revised to take on circular economy principles, SABS standards for non-sewered systems, and concerns over environmental health and emerging contaminants. These included per- and polyfluoroalkyl (PFAS) substances – or "forever chemicals" for their persistence in the environment – which might be toxic even in tiny quantities. Snyman said problems were not in individual pieces of legislation, but that these pieces of legislation were not aligned: "Revision and the update of the guidelines will provide improved long-term sustainability planning and management."

Volumes 3 and 5 of the guidelines should be "thrown in the dustbin", said Snyman, although she stressed the science underpinning them remained relevant. Officials faced a "lot of resistance from the public" over recycling and putting sludges to good use. Because "people don't understand", there is a "huge need for educational awareness".

Francois Gouws of water innovation consultancy Isle Utilities,

told the workshop that only 15% of sewage sludge was being recycled or reused. "This indicates massive opportunities for circular economy expansion, such as the adoption of sludge beneficiation and reuse," he said. Gouws welcomed the 2022 inclusion of sludge management categories in the Green Drop wastewater evaluation scorecard. This created incentives to utilities to improve compliance.

He shared a few findings from a literary research report Isle was helping prepare for the WRC, stressing that whatever tools or technology were used, environmental considerations and energy efficiency needed to be considered. The business case for any solution and how it fitted into the circular economy was important too. "Is there a market for the beneficiated product? Who would value this product enough to buy it? Is the beneficiated product part of a circular loop, once it is used," said Gouws. "We're needing municipalities to... partner with these private sector companies, and they don't always have the capacity or the resources to... contribute a certain amount towards, say... every ton of sludge."

Answering a question from the floor, Gouws said South Africa could innovate – "we have fantastic ideas" – and localise international technology, but cautioned that "markets are not being created to make it economically viable". Like Snyman, Gouws referenced legislative hurdles to innovation and its funding, urging continued investigations into and support for innovative procurement and business models. He said the project's draft research strategy for the country identified short-, medium- and long-term priorities.

Short-term, included developing sanitation flow diagrams for individual wastewater works to aid decision-making; interim strategies for dealing with stockpiled sludge; and investigation of and support for the markets that develop technologies. Medium-term focus would be on improving the capacity of staff to operate and manage new technologies. "A lack of skilled operators has consistently emerged... as a reason for failed or inefficient implementation of advanced sludge management," said Gouws.

Up to and beyond 2035, the focus remained on advanced treatment and recovery technologies, with PFAs, endocrine disruptors, and microplastics all areas of concern. Dr Eustina Musvoto, of consultants TruSense, shared findings from a WRC research project on opportunities to recover resources from sanitation waste.

The project sought to understand the quality and quantity of sanitation waste available. Its objective was to develop plans and a national policy to assist municipalities in recovering resources, by adopting circular economy principles. Musvoto spoke of the hundreds of tons of sludge nutrients and other high-value contents going to waste daily, stressing that about half of the country's activated sludge wastewater treatment plants were "energy guzzlers". She noted that the biggest potential market for sludge lay in the energy it contained. "The priority would be for plants to try... to become as energy efficient as possible, and probably move towards energy neutrality. If the energy is generated and used on-site, then you don't even have to deal with regulations concerning energy generation and feeding that

into the grid."

Extracting energy from sludge rather than making products from it was also easier for the public to swallow. The study included analysis of a number of feasible technologies for recovering energy and other resources from faecal and wastewater sludge. Musvoto went into detail here, mentioning several processes. Like Snyman and Gouws, she flagged legislative and other hurdles to waste recovery, and the feasibility of resource recovery technologies. Although recovering resources from waste, particularly energy, was "known to be very feasible", the joined-up thinking for this to happen was missing.

"Legacy technologies such as activated sludge processes as well as anaerobic digesters," were not up to standard to recover biogas, nor could they be easily retooled. And, because of the cost and long life cycles of these assets, they couldn't be made redundant either. The absence of "supportive policies and incentives to attract private sector investment" further frustrated efforts to produce products from waste.

Responding to a question from Dr Ashton Mpfu, a senior consultant at Isle Utilities, who wanted to know what low-hanging fruit the sector ought to pluck, Musvoto felt there was a strong case for upgrading anaerobic digesters at large, 20 megalitres-a-day plants to collect biogas. Procurement systems preventing municipalities from readily procuring innovative technologies were another obstacle, with the Public Finance Management Act prescribing partnerships between public entities and private companies.

Despite numerous well-meaning reforms over the years to become fair, equitable, transparent, competitive and cost-effective, "the legislation is still rigid", Musvoto said, which often puts the kibosh on innovation. Municipal budgets tied officials to rigid planning timelines which could "make it impossible to introduce new projects or programmes". In addition, the question of price remained a key determining factor in procurement and "a huge hindrance" to innovation.

In response, workshop guest Rajiv Paladh, a public sector funding and procurement expert, with Bosch Capital, pointed out that municipalities now have greater discretion on pricing: "If you plan appropriately and identify a strategic need for a particular innovation, you can justify procuring (innovations) even though it's not the lowest capital cost. Value for money includes other sorts of financial and non-financial benefits," he said.

Musvoto called for changes: for public procurement to adopt more innovative and sustainable systems. This must be part of a multi-pronged approach that would include "adequate regulatory mechanisms, financial instruments and incentives to support public and private engagement in circular economy pathways".

Pull for the shore, sailor!