Environmental Health NEWS

Opinion: A solution to the challenge of land-disposed sewage sludge

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Sludge in the wheat fields of Douglas County, Washington.
(Credit: Richard Honour)

For the sake of our health and the health of our land, we need to abolish land-disposed sewage sludge, but where will it go? The challenge and the solution are clear: Sewage sludge—consisting of semi-liquid waste obtained from processing municipal sewage—is toxic waste, and must be reduced to safer material with little or no toxicity in preparation for safe disposal. But by what technology, and at what cost to whom? Our air, soil, water and food are at risk.

Using federal data, we estimate that about 60 percent of nearly 100 million wet tons of sewage sludge from nearly 20,000 municipal wastewater treatment plants in the U.S. is disposed each year on the nation's farms, forests and rangelands, and it's all toxic waste.

Human exposure to sewage sludge toxics, such as in crop plants, food animal feed crops, runoff to ground and surface waters, and air, affects us all. The need for a solution is clear. Toxic sewage sludge cannot be repurposed or reused somewhere else; it remains as toxic waste until decomposed by high heat, far beyond what may be provided by incineration.

Sewage sludge can be processed safely by several forms of enhanced thermal decomposition to yield heat for energy, clean exhaust gas equivalent to ambient air, and nearly inert ash that can be land-filled or used for the production of fire bricks or other industrial products. As it stands, toxic sewage sludge is disposed in our forests and on our farms and rangelands, simply because we fail to embrace existing thermal decomposition technologies that easily reduce sewage sludge and its toxic chemicals, metals and pathogens to basic elements that can be repurposed safely.

Several thermal decomposition technologies have been applied to toxic sewage sludge, including conventional incineration, co-incineration, pyrolysis and Plasma* Arc Gasification (PAG). PAG offers a cost-efficient method to reduce toxic sewage sludge to basic elements in the presence of very high heat by a technology and engineering system that may be constructed at nearly any location. No other existing, emerging or contemplated thermal decomposition waste-to-energy technology appears to match the potential of PAG for sewage sludge reduction, energy production, cost effectiveness and human and environmental benefit, and it is easily scalable.

Identifying the proper solution for each location becomes the challenge, as a function of the quality and quantity of the raw sewage or other carbon-rich waste inflows, plus the expected quality of the resulting heat, heat-to-energy, exhaust and ash products, all as a function of available budget.

PAG is based on super-heating waste (not burning), including common wastes such as sewage sludge, to produce a gas that can be burned for energy production. The idea is not new, but scaling

King County's Loop trucks haul sewage sludge over the Cascades on the I-90 from Seattle to the farms of eastern and central Washington. (Credit: Richard Honour)

the process to the size needed to convert millions of tons of toxic sewage sludge to heat for energy, clean exhaust and an ash product represents a new direction.
PAG transforms carbon-rich organic waste into long chain hydrocarbons in the form of a hydrogen-rich synthetic gas, which is used to generate clean heat and power. In the PAG process, the waste feedstock (such as sewage sludge) is streamed into a gasifier in dry or slurry form, where it reacts in an oxygen-starved environment with steam at elevated pressure and temperature.

The resulting synthetic gas is composed of about 85 percent carbon monoxide and hydrogen, with a small amount of carbon dioxide. The process results in minimal or greatly reduced emissions.

Building a new plant employing existing PAG technology to consume 150,000 tons of sewage sludge per year is achievable, and can be constructed to accommodate other solid wastes as well, including municipal, agricultural, industrial or medical wastes, that have similar chemical characteristics. Pre-recovery of recyclable plastics, metals and paper from the in-stream flows can be designed into the process.

PAG is cleaner than incineration, because the waste material is super-heated and converted from a solid, to a liquid, to a gas (a vapor), and then to plasma. A PAG plant generates little or no solid, liquid or gas pollution, which provides positive human and environmental health benefits.

Perceived disadvantages of PAG center on a general reluctance to engage a new technology, more so in light of possible adverse economic impacts that would be experienced by deeply-entrenched sewage sludge disposal businesses that have been hauling and land-disposing sewage sludge for decades.

Although Plasma Arc Gasification plants use a significant amount of energy, most of the energy they generate is used for self-powering or sold on the power grid, yielding a carbon-negative system, with substantial greenhouse gas reduction. A typical plant would produce synthetic gas that can be burned for energy, plus enough electricity to power perhaps 10,000 homes.

*Plasma is a form of matter, beyond a solid, liquid or gas, consisting of nearly equal numbers of positively and negatively charged electrons.

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**Editor's note: Two sentences were removed that referred to an overseas sewage incinerator that does not use PAG*

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