CBJ Utility Biosolids Brief
Waste re-processing and reuse via pyrolysis processing

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Executive Summary

In order to affect a significant reduction in its O+M costs for secure biosolids disposal CBJ Utility staff prepared, submitted and was recently awarded ~$2M of a 100% forgivable loan through ADEC's SRF program in 'Emerging Contaminants.' This loan/grant provides funding to conduct a design phase for a BioForceTech, (BFT; https://bioforcetech.com) biosolids pyrolysis project in Juneau. BFT pyrolysis is a multi-staged thermal processing method recently shown to process biosolids into a beneficial product (biochar) while also destroying and/or containing PFAS emissions to safe levels. Once this step has been completed, the CBJ will make a determination as to project readiness, seek funding for a full installation and construct/consign this addition to the biosolids processing system.

1.) Background

a. Municipal Biosolids:

Sewage from households, businesses, and industries dischargers are biologically treated as a combined waste at public-owned wastewater treatment plants. Once wastewaters have been processed to acceptable levels, the liquids are separated from the residual solids, sanitized and safely discharged to receiving water bodies. The residual solids are separated and treated physically and chemically to produce nutrient-rich, semi-solid materials known as biosolids, which are comprised of remnant organic materials and other substances that are not affected by biological treatment processes.

At lower latitudes and in warmer climates, municipal biosolids are most commonly recycled as a fertilizer and soil amendment provided that they are sufficiently free from hazardous substances (i.e. metals, fuels and synthetic organic compounds). Other common uses for biosolids include bricks and construction material, vitrification (glass manufacture), bio-fuels, and fuel substitutes (cement works).

b. PFAS:

Since the 1940s, a new and large (<15,000) class of fluorine-based chemical compounds, known as PFAS (Per- and polyfluoroalkyl substances) had been developed and introduced into a range of popular consumer products including:

- cleaning products, paints, fire-fighting foams, water-resistant fabrics, and nonstick cookware, and
- shampoo, dental floss, nail polish, and eye makeup.

In 1998, the EPA was alerted to the health effects of PFAS, exposure to which at very low levels has now been linked to cancer, liver and kidney damage, cardiovascular diseases, obesity, and diabetes. Further, PFAS compounds do not readily degrade in any sector of the environment (air, water, land), earning them the moniker of 'forever chemicals.' The combination of their toxicity and longevity have made PFAS compounds a major environmental problem, rife with legal and regulatory liabilities.

The ubiquitous presence of these compounds in domestic and industrial waste streams has also created a crisis for biosolids reuse and/or disposal, since PFAS is not broken down in municipal waste treatment facilities and becomes concentrated in the remnant materials. Traditional biosolids reuse/disposal methods, in particular, agricultural land application, has been significantly affected across the U.S., as communities and regulatory bodies have sought to limit the redistribution of PFAS into foods and potable waters. Other reuse/disposal methods, including thermal processes, have been similarly curtailed due to the refractory nature of PFAS compounds.

2.) Juneau's biosolids disposal strategy

a. Current status:

Until 2010, the CBJ Utility had disposed of its biosolids through thermal destruction in an incinerator located at the Juneau/Douglas treatment plant. The CBJ decommissioned its incinerator in 2010 due to systemic failure. The Utility now barges its biosolids to Seattle and then transports them by train to Arlington, Oregon, where they are disposed into a secure landfill.

Cost and logistic issues associated with transport and disposal of 'wet' biosolids subsequently prompted the Utility to add a biosolids dryer to its treatment train, which reduces shipping weight and handling constraints. Currently, the Utility spends between $1.2-2.8M/year for biosolids shipping to Oregon (disposal costs are separate). A biosolids crusher is now also being added to further reduce shipping costs through volume reduction. The drier/crusher installations at the CBJ Utility were logical steps in addressing the biosolids disposal issue, but provide only an interim solution to this matter.

Concurrent with the CBJ Utility's use and optimization of shipping and secure landfill disposal of its biosolids, the PFAS matter had become increasingly problematic. A series of Federal regulatory actions commenced ca. 2002 through the EPA and have been becoming steadily more stringent with improvements to PFAS monitoring methods and an increasing understanding of human health effects.

Following the decommissioning of the CBJ incinerator, the Utility began to monitor for PFAS in its biosolids to determine the potential suitability for alternate reuse/disposal methods. The CBJ detected PFAS in its biosolids and continued monitoring has shown that this is now a persistent issue. Coincidentally, the biosolids processing and disposal methods that the CBJ currently uses also provide the best interim solution for controlling PFAS emissions or release from biosolids processing and limiting the CBJ's PFAS liabilities. Fugitive emissions from the dryer are passed through activated carbon, which

captures gaseous materials, including volatilized PFAS. And the recipient landfill is certified for receipt and disposal of hazardous materials, including PFAS. These control and disposal mechanisms are currently adequate to manage biosolids and PFAS. But, this de facto approach is costly and is unsustainable over the longer term due to secure landfill limitations.

b. Objectives and Desired Status:

A principal objective for the CBJ Utility is provide safe and adequate services to the community in a cost-effective manner. A major and recurring cost component for the Utility is the secure reuse/disposal of its biosolids. There are several components to the biosolids process that factor into the cost equation:

1.) Processing, Handling and Packaging
2.) Transportation (intermodal)
3.) Disposal fees
4.) Beneficial product offsets product and heat

For Utilities located in the continental US it had been relatively easy (until the advent of PFAS) to minimize these cost components through the beneficial use of processed biosolids for soil and agricultural supplements. Biosolids need only be dewatered (not dried) prior to transport. Transport distances are relatively short. Landfill disposal fees are not required. And in some instances, biosolids may be of monetary value to a consumer.

Conversely, the circumstances for Juneau add significant costs to the Utility's operations. Climate and landscape conditions do not allow for the beneficial use of biosolids as soil/agricultural supplements. Biosolids need to be dewatered, dried and crushed for optimal transportation. The nearest location of a secure landfill able to accept Juneau's biosolids is 2000 miles away and requires multi-modal transport venues. Disposal fees at secure landfills are costly, there are no consumers willing to pay for any of Juneau's biosolids products and we cannot even recover the heat capacity from these carbon by-products.

The desired status for Juneau is to find the means to reduce or eliminate the costs associated with items 1-3 and realize cost offsets through item 4. PFAS makes realization of this goal much harder, but not impossible.

c. Next Steps:

Given the circumstances, Juneau's most attractive option for addressing the biosolids disposal cost issue is to reintroduce a local thermal destruction method for those materials. Eliminating transportation and disposal fees alone would reduce O+M costs by $2-3M/year. Unfortunately, the increasing presence of PFAS in biosolids has complicated thermal processing options since fugitive emissions of PFAS are likely under typical combustion temperatures and gas resident times.

Fortunately, a multi-staged thermal processing method recently been shown to process biosolids into a beneficial product (biochar) while also destroying and/or containing PFAS emissions to safe levels. A California-based company, BioForceTech, (BFT; https://bioforcetech.com), has developed a pyrolysis-based technology for this purpose and now has 14 installations in place with 32 systems operating under strict Federal and State regulatory control (https://bioforcetech.com/equipment/installations).

CBJ Utility personnel has personally visited and inspected BFT installation and has been closely monitoring the development of BFT's pyrolysis product for over 4 years. The system is fully compatible with Juneau's existing biosolids processing train and would radically change items 2-4 of the biosolids cost component issues identified above. And with BFT's increasing success in addressing the regulatory considerations for PFAS, this approach now looks suitable for use in Juneau.

To facilitate the introduction of this biosolids 'solution' for the CBJ Utility, staff prepared, submitted and was recently awarded ~$2M of a 100% forgivable loan through ADEC's SRF program in 'Emerging Contaminants.' This loan/grant provides funding to conduct a design phase for a BFT pyrolysis project in Juneau, locking down construction methods and costs for a complete installation and securing regulatory approval. Once this step has been completed, the CBJ will make a determination as to project readiness, seek funding for a full installation and construct/consign this addition to the biosolids processing system.