Water Environment Federation: Biosolids National Convening

Background Issues Memo and Discussion Document

Introduction

Biosolids practitioners today face an array of pressures that are both challenging and potentially advantageous. While decades of studies have shown that biosolids can be safely used for the production of agricultural crops and in other uses, news headlines, some activist groups, and several local and state government action signals a body of growing concern. How can biosolids practitioners prepare for the future, positioning their programs to address current and emerging challenges while also preparing to leverage opportunities? To explore these areas, the Water Environment Federation (WEF) convened a gathering of biosolids practitioners and experts from across North America in November 2019 to contribute their knowledge to a strategic conversation.

This background issues memo and discussion document was prepared to support this dialogue. To help convening participants as they prepare for participation in this conversation, WEF conducted 10 interviews and 8 facilitated listening sessions with experts in the field around the United States and Canada and also conducted a background desk analysis of current issues facing biosolids management. This memo reflects those conversations as well as the discussions – ideas, concerns, and actions – that were raised during the November 2019 workshop.

This paper is organized into the following topic areas:

- **Section 1: Gaps and Disinvestment in Oversight**
- **Section 2: Contaminants of Emerging Concern**
- **Section 3: Collaboration and Communication**
- **Section 4: Research Needs**
- **Section 5: Market Pressures and Trends**
- **Section 6: Workforce Pressures**
- **Section 7: Proposed Agenda for Action**

This discussion document reflects insights and perspectives gathered from independent interviews and listening sessions as well as convening attendees. Readers should be aware that these diverse individuals offered independent, and sometimes divergent, perspectives. This synthesis seeks to convey a range of the input that was shared without implying complete agreement across all sources.

Section 1: Gaps and Disinvestment in Oversight

In November 2018, the EPA Office of Inspector General (OIG) released a report pointing to gaps in the Agency's implementation of its own Biosolids Rule. The report articulated concern about the resources that EPA has allocated to the biosolids program. For example, in 2013, EPA consolidated its oversight of biosolids compliance monitoring

and enforcement into the Biosolids Center of Excellence, located in EPA Region 7, which had only two staff. Inspections for biosolids at wastewater treatment facilities were de-emphasized in favor of other issues. The report suggested this gap presents an important vulnerability for the biosolids program. Interview and listening session participants supported the idea that biosolids programs have experienced a trend of reduced staffing, and that these reductions comprise a vulnerability for the future of biosolids management. During the convening, EPA provided an update on current and planned activities, and shared that the Agency plans to increase its resources dedicated to biosolids oversight, catch up on biannual reviews, work on a screening model for identifying pollutants that should go on for full risk assessment, improve engagement with EPA regions and stakeholders, work to make the website more accessible and transparent, and work on a process to address resource recovery. Many of these efforts will satisfy some topics raised by the OIG report.

Need for Investment in Oversight

Interview and listening session participants signaled that, to facilitate a secure future for biosolids utilization, including improved public perception, there is a need for increased investment in federal and state oversight, including inspections, compliance monitoring, and reporting. In general, interview and listening session participants emphasized that this gap should be addressed, with some variability of their perspectives on the degree and importance of the gap.

- Convening participants discussed the need to examine opportunities for Part 503 Rule updates based on a combination of new technological advances and enhanced science related to such parameters as vector attraction, pathogen reduction, nuisance conditions, and contaminants of emerging concern (CECs). Additionally, participants discussed the concept of creating a "Part 504" regulatory framework to provide greater clarity and certainty to the process of gaining approval for innovative products (alternative approval mechanism for innovative product validation) that currently fall under the "derived from sewage sludge" clause of the Part 503 regulation.
- Meeting participants also signaled one of the most effective ways to maintain and enhance support for biosolids beneficial use is to ensure both biosolids products and management programs are of the highest quality. In this context, participants discussed seeking to elevate the importance of well-run biosolids programs with the executive management of utilities, defining and promoting the elements of an effective, well-run biosolids program, providing guidance for effective municipal contracts with biosolids land application contractors, and ensuring the full range of biosolids benefits are better characterized through research and more effectively communicated through renewed public engagement initiatives.
- Interview and listening session participants signaled concern that the biosolids oversight program has been "hollowed out" over time. They noted that biosolids oversight has changed, having once had fairly robust staffing across most states and EPA regions. By contrast, in the current situation, staffing and expertise across states and EPA regions are spotty. Even where staffing does remain sufficient, there remains vulnerability to upcoming staff retirements. Convening participants expressed that disinvestment had undermined both capacity (the number of individuals engaged in biosolids oversight and management) and capability (the depth of knowledge available to the sector). To address these conditions, participants discussed: establishing a nationwide system of training and mentoring designed to leverage current biosolids professionals with deep knowledge to assist new recruits advance their knowledge; creating standardized training templates (that can be tailored at the state level) to reduce the burden of providing

training at the state level; enhancing investment in inspector training; and improving on (both accessibility and content) existing biosolids information clearinghouse capabilities.

- Interview and listening session participants shared concern that EPA is conducting only very limited review of required reporting, and that there are very limited state and federal staff resources available to answer questions from practitioners and concerned citizens.
- Some participants emphasized that disinvestment in oversight also creates an opening for critics of biosolids to promote negative claims. They noted that a lack of expertise in both state and federal agencies has created a "thin bench" to address complicated issues that may confuse the public. There is a need to give confidence to the public that there is sufficient oversight. Participants also expressed that having a strong foundation of oversight and enforcement is essential for a robust and well-accepted biosolids program.
- Interviewees and listening session participants expressed concern at disinvestment in state coordinator positions. States have limited funding available for biosolids work. Some states only have one person, or even one part of one FTE, in charge of biosolids regulations. Some interview and listening session participants expressed that this results in a lack of opportunities to discuss and network within each state, reducing opportunities for knowledge-sharing. The disinvestment has also left a gap in the support that utilities had previously been able to draw on to clarify with the public misperceptions about their programs and to reassure communities when concerns did emerge. For example, a biosolids practitioner participating in the interviews reflected on the fact that they previously relied on a local 503 designee for help when communities raised concerns about land application. That person has retired, and with no replacement, there is now no similar assistance available.
- States have limited resources for investigating newly emergent contaminants and rely on the federal government for guidance. Federal investment in oversight should include issuance of guidance documents in order to improve state- and local-level common understanding of best practices. This should help to reduce general perception of unknowns around biosolids among the public.
- EPA should adopt an approach of being proactive and responsive to newly emerging issues facing biosolids practitioners. For example, when another contaminant emerges into public concern, EPA might avoid the large gap between science and public concern such as that which currently exists around some contaminants that have captured public attention.
- Part of the disinvestment at the federal level has been in education and training, and that has led to a thinning out of the expertise available to implement the program. Education and training for biosolids coordinators is needed. Investment from the federal level should also include increased support for training to increase the number of skilled biosolids practitioners.
- Three positive developments to address some of the above concerns are that 1) there is a state coordinator listserv communication tool in place which allows state coordinators to pose questions of others in similar positions in order to gain understanding, 2) EPA has quadrupled its headquarters staff for the biosolids program in the past year, and 3) EPA is reconvening the national coordinator meeting which had been held from 1998 – 2008 which will bring together state and federal biosolids regulators to add to their knowledge base.
- Convening participants signaled the importance of maintaining (and enhancing) a forward-looking agenda that will propel biosolids management innovation. Several ideas were shared in support of maintaining emphasis on innovation: leveraging the LIFT program to find and catalogue emergent technologies and

practices, as well as advocate for advance technology funding in such contexts as the SRF, Farm Bill, DOE, and private equity; considering formation of an urban utilities subgroup to focus on making connections between biosolids and community resiliency (including the relationship to GSI, high-rate treatment, and remediation efforts); and making a connection between advanced biosolids management technologies and addressing climate concerns (e.g., energy and resource recovery).

Section 2: Contaminants of Emerging Concern

CECs are substances that have been newly discovered in the environment or may be a substance that has been known for a long time but is generating increased interest in the scientific community due to new information about its impacts on public health or the environment. These contaminants are often unregulated or are regulated at a level that may no longer be considered (at least by some) adequately protective of human and ecological health. Rising public concern and emergent science related to CECs in biosolids has increased pressure on biosolids programs and managers in certain parts of the country, signaling a need to better prepare for and respond to these pressures.

Uncertainty Over the Risk of CECs in Biosolids

Although rebutted from within EPA and by external parties, the OIG report's claims related to health risks from CECs in biosolids has contributed to rising public concerns about the safety of biosolids.

- The OIG report stated that biosolids contain 352 contaminants (including 61 that are listed as acutely hazardous, hazardous, or priority pollutants in other EPA programs) for which the Agency does not have complete risk assessment information, and therefore cannot state that biosolids pose no risk to the public through land application.
- In response to the report, EPA's Office of Water (OW) and Office of Enforcement and Compliance Assurance (OECA) disagreed with the science in the OIG report, arguing that the occurrence of pollutants in biosolids does not necessarily mean that there is a risk to human health and the environment.
- Some biosolids researchers and practitioners have rebutted the OIG report findings, pointing out that most CECs have low concentrations or persistence in biosolids and are low-risk; and that most of the 61 hazardous chemicals listed in the report have been previously assessed in some way by EPA.[1]

[1] Pepper, I., Kester, G., Basta, N., Zearley, A., & Batjika, R. (2019). Allegations Against Land Application: Fact vs. Fiction [PowerPoint slides].

- Microplastics are another emerging concern; while most public focus is on their presence in the ocean, it is known that microplastics are present in soils. Interviews suggested that research is needed into effects on human health and the environment, including impacts on soil microbial communities.

Need for Guidance at the Federal Level

Biosolids have made headlines around the country as public concern spikes in some places around the presence of CECs within them after they have been applied to agricultural land and other areas. Interviewees and listening session participants shared that guidance at the federal level could help states effectively and consistently assess and address the presence of CECs in biosolids.

- Interview and listening session participants emphasized the need for federal guidance and regulation around CECs, especially per- and polyfluoroalkyl substances (PFAS). Some states and localities have issued bans and moratoria on the application of biosolids in light of concerns about CECs; federal guidance could help bring more consistency to the assessment of and response to CECs in biosolids. In this context, convening participants signaled support for: enhanced CEC research and development of risk assessment methods; the formation of a CEC Technical Review Committee that could provide a rapid response capability when new CECs emerge (review available literature, coordinate review, formulate a response, disseminate to states, etc.); establishing the capability to monitor developments on a state-by-state basis; and the preparation of a water sector policy statement in support of extended producer responsibility regarding persistent compounds.
- Participants signaled that a lack of risk assessment tools related to finding and assessing CECs, especially PFAS, in biosolids has led to a need to find ways to conduct those tests. The OIG report described this lack of tools to perform risk assessments on pollutants found in biosolids, indicating that it prevents EPA from completing assessments on pollutants and determining whether they pose an acceptable or unacceptable level of risk. To meet the need for such tools, some states have created new testing methods or adapted methods that were created for other purposes (e.g., drinking water). This has resulted in a patchwork of methods across jurisdictions that leads to variations in testing results. EPA's response to the OIG report concurred with the recommendation that the Agency should develop a probabilistic risk assessment tool and screening tool for biosolids land application, and noted that EPA is already working to complete a Biosolids Screening Tool that will perform risk assessments on pollutants – identifying pollutants, pathways, and receptors of greatest interest, and informing decisions about the need to perform additional risk assessments.
- Small states in particular have very limited resources for investigating CECs and rely on the federal government for guidance. The more that can be done to reduce unknowns in biosolids, the better, in order to speak effectively to public concern.

Uncertainty Around the Future of State- and Local-level Regulation

- Due to emerging concerns about the presence of PFAS in biosolids, some states and localities are taking regulatory action that goes beyond the existing 40 CFR 503 rule, which has established requirements for use and disposal of biosolids since 1993. These new actions are limited in geographic scope but cause waves

of concern across biosolids practitioners due to the uncertainty of how other states and localities might follow.

- Some state- and local-level actions around CECs and biosolids include:
    - The city of Marinette, Wisconsin, stopped distributing biosolids to farms after noting PFAS readings.
    - In Maine, a dairy farm was forced to shut down after its milk subsequently tested positive for the presence of PFAS; despite the fact that the PFAS levels could have been caused by paper mill sludge and not biosolids. The state considered a total ban on biosolids land application, and subsequently passed a requirement that all biosolids must be tested for PFAS before application.
    - Michigan ordered several wastewater treatment facilities to stop distributing biosolids to farms, and officials have begun systematically testing biosolids at wastewater facilities throughout the state.
    - In Vermont, there is pressure and movement toward declaring a moratorium on biosolids application; some state legislators have called for a moratorium.[2]
    - Community groups in Onalaska, Washington are protesting biosolids land application permits due to concern about potential health risks.
    - California has adopted notification Levels for PFOA and PFOS in the single digit parts per trillion level.
    - The California Association of Sanitation Agencies (CASA) has released a PFAS Fact Sheet to put use and management in perspective.

Section 3: Collaboration and Communication

Interview and listening session participants expressed that there is a need for significantly improved collaboration and communication across all actors, including between federal and state agencies, academia, the public, and others. This improved communication can serve to reduce pressures and improve the outlook for biosolids management into the future.

Communication with the Public

- The biosolids marketplace is very vulnerable to erosion in public confidence; decline in public trust can suppress demand for biosolids products. At the same time, managing biosolids is critical to public health. Therefore, some interviewees said that outreach to the public must be consistent and compelling.

[2] Gribkoff, Elizabeth. "Senator worries sludge spreading could worsen PFAS contamination." VT Digger, April 15, 2019.

- Meeting participants signaled support for research into "social science" around biosolids; i.e., communications and public relations research into effective communications strategies. Focus groups could help determine the best way to tell the story of biosolids.
- Much of the wave of sentiment against biosolids that results from fears around PFAS could be curbed by better communication about the environmental benefits of biosolids. Social media has raised the ability for the public to rapidly receive information, and in the case of CECs, that information may incorrectly convey the level of risk. There is a need to formulate an effective approach around communicating risk to the public in ways that helps people identify the facts that are based on credible science. Meeting attendees noted a need to improve the understanding among the media, the general public, and elected officials of the relative risk of CECs compared to background levels and in different exposure pathways. Some people also shared ideas for how utility systems, especially small ones, might best be supported in their need to better communicate about biosolids application. Those ideas included establishing a national-level champion to promote the benefits of biosolids and be available for communication when needs arise; establishing regional and state organizations (such as the Northeast Biosolids Association) where they don't already exist to provide regionally tailored communications support; establishing a technical expert in each region who can be deployed to communicate with the public or elected officials; and cultivating knowledge among all staff at a utility system to speak about the benefits of biosolids. There are gaps in public understanding about the benefits of biosolids. Interviewees shared the idea that one piece of the approach to address this issue should be to position biosolids at the center of an overall resource recovery strategy for communities. Such a communications strategy could include an articulation of the multiple benefits of biosolids, including those related to climate mitigation: carbon sequestration, renewable energy, etc. The foundation of creating and maintaining public trust and confidence in biosolids is that utilities should run strong, unassailable programs, so that communications to the public can be built from that strength. Clearly communicating the environmental benefits of biosolids to the public will enhance the credibility of biosolids programs and provide a buffer to criticism. These benefits include socioeconomic benefits, climate change mitigation, soil health benefits, increased crop production, reduced need for irrigation, and necessary management of organic waste material for municipalities. Effective public communication requires setting the narrative to pursue the positive message about the benefits of biosolids. This could constitute an important step toward shifting opposition.
- Meeting participants expressed a sense that the water sector has missed a substantial opportunity to convey the role biosolids beneficial reuse plays in community sustainability and circular/green economy initiatives. To address this need, meeting participants suggested a WEF-led advocacy strategy designed to elevate public and decision-maker appreciation of the full range of biosolids benefits. This strategy could help establish a foundation of trust with the public to spread a positive story about the role biosolids can play as a pillar of sustainability in a green economy. Actions should include building a beneficial relationship with the media, communicating with the public about the urgency of doing something with biosolids and the benefits of land application, and conducting demonstration projects. There was interest expressed to link this strategy to other organizations that may share common cause (such as the Soil Health Institute) and reach to other key partners in the agricultural community and NGO environmental and ecosystem health/sustainability communities.
- In light of public concern about biosolids, particularly related to CECs, farmers and fertilizer companies are left wondering what to do and fearful of consumer backlash. Interview participants said that there is a need

for proactive communication to help farmers and fertilizer companies to address this issue. Farmers and agricultural groups, sustainability and green solution advocates, and environmental advocates are all potential partners for biosolids practitioners. While some within these groups have recently expressed concerns about biosolids, there is potential to share key information related to the full range of sustainability benefits provided by biosolids. This information can position biosolids within these key advocacy communities as a pillar of and critical to achieving sustainability and circular economy aspirations.

- Some members of the public express concern when one state has stricter standards than another on regulating biosolids. In this context, it is challenging to communicate effectively with the public in a way that can assure them that one state's standards are as safe and protective as another state's standards.
- Interviews flagged a concern that some vendors promote their products or services in part by pointing out the negative aspects or drawbacks of competing products or services. This may serve individual vendors well in terms of sales but can also create an overall negative impression of biosolids management in the sector.

Collaboration between Academia and Industry

- Interview and listening session participants noted that academic research institutions and biosolids practitioners should improve on existing channels of communication, communicating about the state of research as well as needs for future research. There should be a two-way exchange that elevates everyone's understanding of the ways biosolids travel in the environment and the relative risk they pose to human health.

Communication between Federal and State Agencies

- There is a need for improved relationships and better communication across agency silos, and from the federal level to states. Meeting participants suggested that there should be more meetings and webinars where EPA and states can communicate and coordinate about what actions should be taken.
- Interview and listening session participants signaled support for EPA's efforts to improve coordination and communication among headquarters, the regional offices, and state agencies. EPA has begun efforts to convene meetings with the states and tribes.
- Resources for education, training, communications, and networking around biosolids information would be highly beneficial.

Biosolids Coordination Opportunities Across Practitioners

- A platform for biosolids coordination could be extremely valuable. This could serve practitioners across industry, academia, federal, state, and local regulators, and others.
- Such a platform could help boost coordination and communication in the face of reduced federal investment in oversight.
- The platform could feature a compilation of resources for education, training, communication, and networking of biosolids information such as new biosolids treatments, engineering technologies, and any related issues.

- Where some organizations have had capacity to conduct their own risk assessments, it would be valuable to share that information more widely. For example, King County Washington produced public-facing material characterizing, for example, ibuprofen levels in biosolids; more similar risk assessments and improved widespread sharing of these communication materials would be helpful.
- There is an opportunity for biosolids practitioners in wastewater treatment to collaborate with solid and yard waste haulers, who must spend money to find disposal options for large quantities of waste. There is potential for connecting wastewater treatment plant managers with waste haulers to look for opportunities to combine wet and dry wastes (e.g. construction debris and yard waste) to take mutual advantage of economic opportunities such as composting and thermal treatment.

Section 4: Research Needs

To the extent that land application programs have achieved success today, interviews and listening sessions attributed, at least in part, this success to the body of research that was done to support the original 503 program by generating needed data; as well as effective pretreatment programs that improved the quality of biosolids. New research, therefore, might offer the same benefit for improving the landscape for biosolids into the future. A 2002 report from the National Research Council stated, "There is no documented scientific evidence that the [Biosolids Rule] has failed to protect public health. However, additional scientific work is needed to reduce persistent uncertainty about the potential for adverse human health effects from exposure to biosolids."[3] Some interview and listening session participants signaled that additional research could indeed be of substantial help to biosolids practitioners, as it could create a more sound scientific basis for effectively characterizing risk associated with biosolids and act to counter advocacy initiatives and related public perceptions based on less substantial or at times mischaracterized evidence.

The Water Research Foundation (WRF) will convene in early 2020 to discuss research needs related to biosolids. The November 2019 WEF convening can serve as a fertile source of ideas and suggestions that can feed into the upcoming WRF conference. The W4170 Multi-State Research Committee has for decades led research efforts on biosolids land application and is a body with whom the biosolids sector should be better engaged. Many topics raised by interviewees have or can be addressed by the Committee.

Need for Information to Examine Impacts of Biosolids

- The OIG report indicated that EPA needs more information to fully examine the health effects and ecological impacts of biosolids applied to land. Some interview and listening session participants shared this

[3] Schillachi, William. "EPA Urged by OIG to Assess Unregulated Pollutants in Biosolids." EHS Daily Advisor. January 25, 2019.

sentiment, signaling that more scientific research is needed to reduce uncertainty about the potential for adverse health effects. They indicated that the lack of information about CECs' interactions, long-term build-up in soils, leaching into waterways, and uptake into crops and the food system leaves a gap in the sector's ability to respond to CEC-related concerns. Meeting participants, similarly, signaled support for research on PFAS-focused questions, including toxicity, fate and exposure, and relative risk in biosolids. They expressed that there is a need for development of a standard research and assessment process for CECs that can be used both now and in the future for other chemicals that emerge into public attention. Questions in need of scientific exploration include the plant uptake rate of CECs from biosolids, effects of long-term storage, accumulation in cattle that graze on biosolids-applied land, and the composition of incinerator stack emissions from combustion of biosolids.

- Listening session and interview participants signaled an interest in better understanding the impact of land application practices on groundwater. To help fill that information gap, one state requires groundwater monitoring wells for all biosolids land application sites, these data help determine if groundwater has been impacted by application and supports making adjustments in permittee's biosolids land application programs as needed.
- Research is needed on nutrient impacts of land application. In Florida, excessive phosphorus concentrations in surface water after biosolids land application nearby caused substantial concern. Given the acknowledged interest in the potential for land application of biosolids to contribute to nutrient enrichment conditions in waterbodies, further research that better characterizes the link between application practices and nutrient runoff into waterbodies will be helpful. Meeting participants discussed research questions around nutrients, including identifying the comparative contribution of different nutrient sources of algal blooms; the role biosolids may play in sustainable phosphorus conversion; and the micronutrient makeup of biosolids.
- Important research has already been done into indicator viruses that could potentially be used to assess sewage contamination, including phage and peppermild mottle virus; more research is needed into these potentially useful indicators.
- Research into biosolids product odor, including new and innovative processes that might generate a lower odor product, are needed. Meeting participants expressed a need for more research into biosolids odors. Specific areas of inquiry include how to reduce odors, determining odors from new technologies and better understanding odors from existing technologies, and determining the effect of odor-reducing products on biosolids' efficacy and quality.
- Research is also needed into the fate of PFAS within thermal processes; whether it is destroyed or volatilized is an important question. Participants signaled an interest in more research into the benefits of hydrothermal liquefaction; a more complete understanding of pyrolysis and gasification technologies; and the benefits of phosphorus extraction. Participants expressed support for a process that would bring new technologies to market more quickly, suggesting there might be a way for WEF or others to identify new markets and help foster their development.
- In some cases research has been done, but not effectively communicated with practitioners; so better communication and outreach is necessary. There is a need for better support for collaboration among regional biosolids organizations and wastewater treatment organizations to promote valuable research initiatives; for example, a regionally-based organization funds research into how to best use biosolids; there should be ways to make that research accessible to more utilities. Convening attendees said that there is a

need for research into the benefits of biosolids. Specific areas of inquiry include the amount of carbon sequestration that biosolids provide; comparison of the carbon footprint of biosolids vs. commercial fertilizers; crop yield benefits from biosolids-treated land; whether biosolids-grown crops show increased drought resistance; and benefits of biosolids on an ecosystem scale.

Section 5: Market Pressures and Trends

Interview and listening session participants signaled concern about several driving forces in the market that are creating a squeeze across biosolids management options – landfill, incineration, and land application – that limits management options or raises costs in some geographic areas. At the same time, new uses for biosolids are opening opportunities for utilities. Landfill capacity, in general, is under pressure and in some localities communities are banning organic wastes from landfills, including biosolids. Land application is under pressure from reduced availability of proximate farmland. Incineration is also under new pressure, as sewage sludge incinerators have come under more strict regulations. For some utilities, these pressures combine to create a three-way squeeze that, in particular, is leading to greatly increasing costs for solids management.

Landfill Pressures

Landfill capacity is under pressure from several driving forces. In some places, communities are banning organic wastes from landfills, including biosolids. This contributes to a trend in which some utilities are paying much higher prices to landfill their solids either because local fees are higher or because they have to transport the solids long distances to locales that still accept organic waste. Organic waste bans also divert food waste, some of which goes to wastewater treatment plants. These utilities can, in some instances, use the food waste to produce renewable energy, but this also results in greater production of biosolids.

- Particularly on the east and west coast of the U.S., landfills are an increasingly cost-prohibitive option for biosolids disposal. In some localities, tip fees have doubled or tripled over recent years.
- New polices and regulations are limiting the disposal of organic waste in landfills. A new law in California will severely restrict the landfilling of organic waste by 2025. In Pennsylvania and Virginia, odors from landfills that have received biosolids are an area of emerging concern. In some states, landfills are already refusing biosolids due to concerns about odor, capacity limitations, or even PFAS concerns. Other jurisdictions, such as Seattle and Austin, have diversion requirements for organic materials in landfills. The combined effect of these pressures will mean that residential organic material is in need of an alternative place to go. Restrictions/limitations have also emerged related to changes in practices/requirements for Alternative Daily Cover, as well as some events related to landfill structural failures associated with biosolids use.
- Lack of available landfill space results in a need for more storage options, more land for application, and more trucking to carry biosolids farther away – either to different landfills, or to areas where they can be applied to that land. These are all restricting factors.

Incineration Pressures

Sewage sludge incinerators recently came under much more strict regulations, as EPA issued a final rule in 2019 that more tightly restricts the pollution that they can emit. These regulations have increased pressure that has

moved utilities away from using incineration as a management option. Incineration has been declining, but still represents 15-20 percent of biosolids management in the U.S. Now that pressures on landfill and land application are mounting, as both of those options are becoming increasingly expensive, there is an emergence of reconsidering incineration as a management option.

Land Application Pressures

Due to the pressures described above on landfilling and incineration, land application is becoming a more attractive option, even more so than in the past. Despite that trend, land application is vulnerable to several pressing trends, including concern about CECs and other potential health impacts.

- Pressure on landfill capacity impacts increasing prices for landfilling; wastewater utilities are getting priced out of the market. Some listening session and interview participants shared a concern that landfills will follow California's example one day and stop accepting biosolids. This puts pressure on alternatives such as land application.
- Urbanization and suburbanization (i.e., sprawl) have reduced the amount of farmland in production that is within close driving distance of major centers of population. This leaves fewer easily accessible land application sites for some utilities.
- Population growth, especially in urban areas, exacerbates this issue as more waste is created and overwhelms available rural land application sites, necessitating more depositing into landfills.
- California is considering new regulations to make it illegal to ban local land application. In combination with the landfill ban on organic material, this could mean much more organic food waste will be digested and more biosolids will be land-applied. In other states and localities, however, there is movement toward banning land application of biosolids.
- Odors from land application of biosolids remain a persistent pressure, as some localities have enacted regulations to address public concerns about odors resulting from land application.
- Lack of storage options for biosolids presents another pressure on land application. There are times of the year when land application is not practical or possible, such as in the winter when the ground is frozen, and storage capacity is a necessity.
- Land application acceptance follows regional trends. New England as a region is displaying momentum toward restricting land application of biosolids, whereas in other parts of the country, acceptance of land application is still the norm. In California, land application is stable or improving after a long period of vulnerability, as the conversation pivots to multi-benefits like improving soils and mitigating climate change. This can also be seen to an extent in Washington and Oregon.
- Some listening session and interview participants noted concern about potential impacts from land application on nutrient runoff and pollution in water bodies as a current trend. In Florida, some localities have banned land application of biosolids due to concerns about nutrient pollution. Some states are adopting phosphorus indices that can limit land application.
- Agricultural land that has been treated with biosolids is currently ineligible for USDA Organic certification. Similarly, the international Global GAP standard prohibits the use of biosolids, precluding the export of any crops grown with the use of biosolids to any nation subscribed to the standard. These bans present significant challenges to the acceptance of biosolids.

Emerging Markets

- In order to address the combined pressures against landfilling, land application, and incineration of biosolids, there is a need for bold forward-thinking innovation to discover new opportunities. Whether through new technologies, new markets, or other pathways, there must be creative approaches to address the issue of what will be done with biosolids long into the future.
- Opportunities are present in emergent and new marketplaces. The use of biosolids in reclaimed land, on lands damaged by wildfires, and other potential new projects can help demonstrate and document the benefits of biosolids use.
- Markets are diversifying, as biosolids are applied to horticulture, landscaping, turf, topsoil, and site reclamation projects.
- Co-digestion of biosolids is a promising trend, as new, emerging partnerships between solid waste and wastewater sectors promise to divert organic waste to wastewater digesters and create renewable energy. This trend represents an effort to connect the landfill sector, regulators, and the wastewater sector to divert organic material to treatment plants. The renewable energy that is generated from co-digestion can be used to produce heat, electricity, transportation fuel, and the export of electricity and/or renewable natural gas.
- Emerging technologies such as gasification and pyrolysis are quickly evolving. These treatment processes hold the potential to generate renewable energy while reducing the volume of biosolids; however, the economic viability of these processes can vary across geographic regions. Interviews indicated that further research is warranted on internal treatment options, including thermal treatment. These options should be considered as management options as experience grows when appropriate.
- Composting is an approach with potential especially in regions where rainy seasons limit the opportunity for land application. A composted product is dryer and can be more appealing to farmers, especially in areas where no-till farming is taking place.

Section 6: Workforce Pressures

Contractors who are skilled in applying biosolids to the land are retiring and are not being replaced at an adequate pace. There is a need to recruit, attract, and train a new generation of biosolids operators. Interviews also suggested that developing certification requirements could help biosolids programs identify quality land-application contractors.

Need for Workforce Improvements

- People who were trained when biosolids programs formed in response to the 503 regulations are now retiring. There is a need to replace them by training younger individuals, both as skilled contractors and also in the oversight and monitoring realm.
- Education opportunities for biosolids coordinators are needed. Some states only have one person in charge of biosolids regulations, which eliminates the possibility of discussion and networking within each state. A consequence of disinvestment in oversight has been the loss of skill and knowledge around biosolids.
- Some interview and listening session participants signaled the need for a certification that would provide a third-party stamp of approval for contractors. Similarly, a set of best performance practices for contractors

to demonstrate that they are meeting standards would be beneficial for wastewater utilities to more easily seek out qualified companies.

- The lack of truck drivers for transporting biosolids is a significant pressure and increasing issue.

Section 7: Proposed Agenda for Action

Attendees at the November 2019 biosolids convening emphasized several key cross-cutting areas for proposed action going forward. The below listed items summarize those discussions and the collective vision for advancing the future of biosolids.

1. **Establishing a High-Profile Biosolids Champion Capability.** Participants saw the need for strong, focused, high-profile, and on-going advocacy for biosolids that could take the form of some combination of a single, designated individual and an empowered steering committee charged to establish and carry out a biosolids advocacy agenda (see Attachment D for one leadership model that was presented/discussed). Also in this context, participants discussed enhancing collaboration among existing biosolids-related groups (e.g., RBC, 4170, etc.) to better leverage knowledge and expand influence.
2. **Creating a Research Plan for CECs.** Participants viewed CECs as a substantial vulnerability to biosolids management options and signaled a need for a research agenda focused on risk assessment protocols, the ability to speak to the comparative risk aspects of CECs in biosolids, and treatment process options.
3. **Developing CEC Communication Materials.** As a direct corollary to the research plan for CECs, participants saw an urgent need for CEC communication materials focused on improved risk communication (including comparative risk), as well as indicating the current and anticipated progress on CEC research.
4. **Enhancing Benefits of Biosolids Communications.** Participants believed conducting additional research on the full range of biosolids benefits then communicating those in the context of community sustainability and the circular/green economy can substantially elevate public and decision-maker appreciation of the value of biosolids. This area of discussion included the interest in engaging in social science research to better understand how best to reach and communicate with a full range of community interests.
5. **Building Broader Partnerships.** Expanding on the need for greater and more effective biosolids advocacy efforts, participants signaled a need for building new or stronger partnerships with key constituencies including community sustainability/green economy advocates, agricultural leaders (e.g., American Farm Bureau), soil health proponents, and environmental NGOs.
6. **Re-invigorating the ABC Biosolids Operator Land Application Certification Initiative.** With the importance of well-run biosolids programs recognized by participants as a cornerstone of public credibility and acceptance, interest was expressed in drawing on past efforts by ABC to provide a basis for operator certification.
7. **Engaging LIFT to Move a Next Generation Agenda Forward.** In response to interest in maintaining a focus on biosolids management process and technology innovation, participants saw a role for the LIFT program to coordinate with other established biosolids groups (e.g., RBC) to prepare and advance an innovation agenda.
8. **Defining a Sustainable Program.** Participants believed an opportunity exists to leverage existing materials (such as those created for the National Biosolids Partnership) to define and communicate what the elements are of an effective and sustainable biosolids program.

9. **Preparing an Advocacy Letter for Submission to EPA.** Meeting participants saw a need for the preparation of a letter to EPA to 1) support its enhanced biosolids program efforts, 2) advocate for increased funding for training and coordination efforts with the states, and 3) further emphasize the need for risk assessment tools and guidance relating to CECs.

Conclusion

Biosolids management today is at a pivotal moment. The interviews, listening sessions, desk research, and national convening signal a range of issues and ideas about the current state and future path of biosolids management. Challenges and pressures are cause for legitimate concern about the future of land application of biosolids and various market, public perception, and regulatory pressures across all aspects of biosolids management present a complex decision context for utility managers. At the same time, there are important reasons for substantial optimism as the sector looks to opportunities in the future.

Many people are concerned about a need for greater investment in oversight of biosolids management at the federal and state levels, in support of effective implementation of EPA's Biosolids Rule. There is growing concern about the issue of CECs, particularly PFAS, as localities and states move toward regulating biosolids based on contamination concerns. Federal guidance on CECs and biosolids is needed to better speak to increasing public concerns and to assist scientists and states by reducing unknowns. Resources for collaboration and communication across all actors in the biosolids community, including the public, industry, academics, regulators, and contractors, would improve awareness and understanding and open opportunities for knowledge-sharing. Further research is needed on the impacts of biosolids to address concerns about health and ecological impacts. Market pressures, such as reduced landfill capacity and population growth, are an increasing challenge for biosolids management. The availability of a skilled workforce for biosolids application and oversight is a looming issue as older practitioners begin to retire.

Moving forward, a strategic plan for action can be instrumental in supporting a positive trend into the future for biosolids. This action agenda could include establishing a highly visible biosolids champion on the national level; developing and executing a research plan to learn much more about CECs; improving communications with the public about the benefits of biosolids; building partnerships with new constituencies; exploring operator land application certification; engaging LIFT to coordinate with other established groups to prepare and advance a new agenda for biosolids; defining and communicating the elements of an effective program; and preparing a letter to EPA to support and advocate for biosolids efforts.