DHS/NIST Workshop: <u>S</u>tandards to Support an Enduring Capability in <u>W</u>aste<u>w</u>ater <u>S</u>urveillance for Public Health

DAY 1: MONDAY, JUNE 14, 2021

Welcome & Introductory Remarks

Mr. Philip J. Mattson
Standards Executive
Department of Homeland Security (DHS), Science and Technology Directorate (S&T) | USA
Philip.mattson@hq.dhs.gov

Mr. Philip J. Mattson serves as the Department of Homeland Security (DHS) Standards Executive and Senior Standards Advisor in the DHS Science and Technology Directorate (S&T). He coordinates standards and conformity assessment activities across the Department and manages a broad portfolio of standards development activities including detection and personal protective equipment standards and response robot test method development.

Mr. Mattson is the DHS representative to the Interagency Committee on Standards Policy, and currently chairs the ASTM E54 Committee on Homeland Security Applications. He serves on the Board of Directors of the American National Standards Institute (ANSI) and also serves on several ASTM Technical Committees, the ANSI Unmanned Aircraft Systems Standardization Collaborative Steering Committee, and on standing committees in ANSI, the Society for Standards Professionals and in the Interagency Board for Emergency Preparedness and Response.

He holds a bachelor's degree in Nuclear Engineering Technology from Oregon State University, and a master's degree in Nuclear Physics from the Naval Postgraduate School. He has extensive training in nuclear weapons and radiological incident management and is a registered Professional Engineer. Mr. Mattson is a retired U.S. Army officer; serving over 20 years as a combat engineer and nuclear physicist.

U.S. Senator Gary Peters (MI)
Chair of the Homeland Security & Governmental Affairs Committee
U.S. Senate | USA


Mr. Robert B. Newman
Director of Engagement and Partnerships, Office of Strategy and Policy
Department of Homeland Security (DHS) | USA
robert.newman@hq.dhs.gov

Mr. Robert Newman has been with DHS S&T for over 2 years. He has served as a senior advisor to the under secretary and led the program office before assuming his new duties as Director of Engagement and Partnerships. In his new role, Mr. Newman leads efforts to identify technologies that can lead to new strategies for DHS for the security of our country and then to partner with organizations that can facilitate the adoption of those technologies. Mr. Newman is a retired Air Force general officer and has worked in the homeland security arena in state government for two Virginia governors.
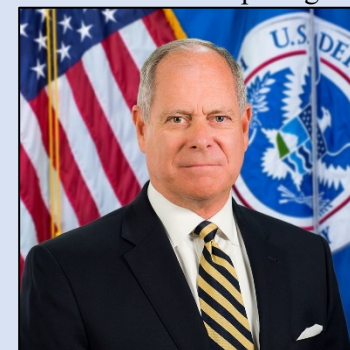
Dr. Eric K. Lin
Acting Associate Director for Laboratory Programs
National Institute of Standards and Technology (NIST) | USA

Dr. Eric K. Lin is currently serving as the Acting Associate Director for Laboratory Programs at the National Institute of Standards and Technology (NIST). In this role, he provides direction and operational guidance for all of NIST's scientific and technical laboratory, among other duties. Before this role, Dr. Lin served as Director of the Material Measurement Laboratory (MML) at the National Institute of Standards and Technology (NIST). MML activities include fundamental research in the composition, structure and properties of industrial, biological, and environmental materials and processes, to the development and dissemination of certified reference materials, critically evaluated data and other measurement quality assurance programs. His contributions have been recognized with the Presidential Early Career Award for Scientists and Engineers (PECASE), the Department of Commerce Silver Medal, and the William P. Slichter Award.

Mr. Joseph Hamel
Director, ASPR Program Office for Innovation and Industrial Base Expansion (IBx)
Office of the Assistant Secretary for Preparedness and Response (ASPR)
Department of Health and Human Services (HHS) | USA
joseph.hamel@hhs.gov

Mr. Joseph Hamel is the Director, ASPR Program Office for Innovation and Industrial Base Expansion (IBx) for the Department of Health and Human Services (HHS) Office of the Assistant Secretary for Preparedness and Response (ASPR). He received his BA in molecular biology from Colgate University and his MS in biotechnology from John Hopkins University. Prior to joining the ASPR, Hamel worked as a biologist for the US Army, where he also served as a team leader and chief of planning and policy. Later, Mr. Hamel was a program director for the Department of Homeland Security, and then a program manager at Johns Hopkins University's applied physics laboratory. You can find him on Twitter (@JoeHamel9).


Dr. Nancy J. Lin
Biomaterials Group Leader, Material Measurement Laboratory
National Institute of Standards and Technology (NIST) | USA
nancy.lin@nist.gov

Talk Title: Overview and Goals for the 2021 SWWS Workshop

Dr. Nancy J. Lin is the Leader of the Biomaterials Group in the Biosystems and Biomaterials Division of the Material Measurement Laboratory at NIST. Her research focuses on developing measurements and standards to enable the detection and quantification of microbes and microbial communities, with an emphasis on total and viable cell count for microbial cell reference materials, biofilm-material interactions, antimicrobial efficacy, and biosurveillance. Dr. Lin holds a BS in Mechanical Engineering from Valparaiso University and a PhD in Biomedical Engineering from Case Western Reserve University.
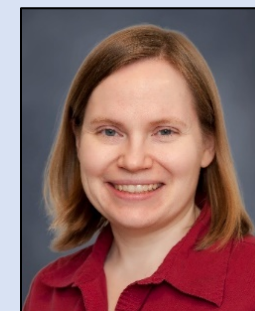
SWWS 101: Introduction to Wastewater Surveillance (WWS)

Session Chair: **Dr. Michael Focazio**
Environmental Health Research Program Coordinator
U.S. Geological Survey (USGS) | USA
mfocazio@usgs.gov

Dr. Michael Focazio earned his Ph.D. from the University of Connecticut. He has been a scientist and manager with U.S. Geological Survey for 30 years with research areas including drinking water, wastewater, environmental contaminants, ecosystems and human exposures. Dr. Focazio also serves on National Sewage Surveillance Interagency Leadership committee.

Speakers

Dr. Amy E. Kirby *(Keynote Presentation)*
National Wastewater Surveillance System Program Lead
Centers for Disease Control and Prevention (CDC) | USA
agk1@cdc.gov

Talk Title: National Wastewater Surveillance System: Implementation for COVID and Beyond
The National Wastewater Surveillance System (NWSS) launched in 2020 to coordinate wastewater surveillance programs implemented by state, tribal, local, and territorial health departments to support the COVID-19 pandemic response. Community-level infection trends for SARS-CoV-2 can be efficiently tracked through wastewater testing, providing an early indicator of changing infections trends in the community. Municipal wastewater surveillance is unique in that it can provide systematic information on both symptomatic and asymptomatic SARS-CoV-2 infections, and it is not influenced by healthcare access or clinical testing capacity. Robust and sustainable implementation of wastewater surveillance requires public health capacity for wastewater sampling, testing, analysis, and interpretation, as well as effective partnerships between wastewater utilities and public health departments. As of January 2021, the network comprises 33 jurisdictions. State and local public health agencies have used wastewater surveillance data to generate alerts to local jurisdictions, allocate mobile testing resources, evaluate potential testing artifacts in clinical surveillance, refine health messaging, and forecast hospital resource needs. NWSS provides a robust, highly

adaptable platform for community-level disease surveillance that can be expanded to collect data on multiple pathogens, such as antibiotic resistant bacteria and enteric pathogens, and leveraged for rapid assessment of emerging threats and preparedness for future pandemics.

Dr. Amy E. Kirby is an Environmental Microbiologist in the Waterborne Disease Prevention Branch and the Program Lead for the National Wastewater Surveillance System (NWSS) at the Centers for Disease Control and Prevention (CDC). She has a Bachelor of Science in Agriculture (BSA, major: Microbiology) from the University of Georgia, a PhD in Microbiology from the University of Buffalo, SUNY, and a Master's of Public Health in Epidemiology from Emory University. At CDC, Dr. Kirby is interested in leveraging environmental microbiology methods to measure pathogens, antibiotic resistance genes, and other health indicators in natural and man-made water systems. This data can be used to estimate health risks from environmental exposures, as well as measures of the health of the surrounding communities. Since February 2020, she has been working on the COVID-19 response as part of the Water, Sanitation, and Hygiene team. As part of that team, she led the development and implementation of NWSS.

Dr. Kate R. Griffiths
Senior Molecular Biologist
National Measurement Institute of Australia | Australia
kate.griffiths@measurement.gov.au

Talk Title: Australia's ColoSSoS Project: Inter-laboratory Study for SARS-CoV-2 in Wastewater
The WaterRA ColoSSoS project was initiated in the start of 2020 to co-ordinate the development of a national sampling and testing program for SARS-CoV-2 in wastewater within Australia. Once methods were developed across the country, the next phase was to compare the performance between the different testing approaches through participation in an inter-laboratory study. Twelve labs participated, representing a mix of water utilities, commercial labs, government labs and university research groups. Participants were provided with replicates of wastewater, inactivated SARS-CoV-2 virus for spiking and calibrant sets developed by Australia's National Measurement Institute. These calibrant sets consisted of a six-point dilution series of the inactivated virus quantified in "Copy Number Concentration of SARS-CoV-2 genome equivalents" using RT-dPCR. By providing the calibrant, all results were reported in the same units, allowing direct comparison of quantitative data from each lab. This study allowed protocols to be assessed, considering reproducibility, yield and RNA purity, identifying areas for improvement to increase testing consistency across the country.

Dr. Kate R. Griffiths is a senior molecular biologist working in the Bioanalysis Section of Australia's National Measurement Institute. She has many roles, including developing methods and managing the accredited DNA testing service, providing measurement uncertainty training to support biological measurements and designing bespoke DNA reference materials to achieve comparable quantitative data.

Dr. Judith Wong
Director
National Environment Agency | Singapore
Judith_Wong@nea.gov.sg

Talk Title: Singapore's National Wastewater Based Surveillance Programme for COVID-19: Analytical Standards, Controls and Reference Materials

Singapore's National Environment Agency, together with its partners, have developed a surveillance programme to monitor the presence of SARS-CoV-2 in wastewaters. Three use cases have been established. First, the surveillance at wastewater reclamation plants and at wide-area sentinel regional nodes provides situational awareness of COVID-19 spread in Singapore. Second, the monitoring of high-density living premises including workers' dormitories, nursing homes and student hostels provides early warning of emerging case(s), and thirdly, surveillance at clusters that have developed in the community provides an indicator if further case(s) are present. In the latter two use cases, data has translated into public health action, where targeted swab tests conducted have supported early case identification and isolation. As the programme relies on a network of testing laboratories, we will also describe analytical standards and proficiency testing criteria that have been implemented to ensure that tests conducted across laboratories are of high quality. Practical troubleshooting steps and corrective and preventive actions will also be discussed.

Dr. Judith Wong is the Director of the Microbiology and Molecular Epidemiology Division at the National Environmental Agency in Singapore. She oversees various COVID-19 related surveillance and research initiatives, including the development of Singapore's national wastewater-based epidemiology programme. The wastewater surveillance programme which she has set-up currently surveys wastewaters from more than a hundred sites across the country. Dr. Wong's other scientific interests include dengue diagnostics and surveillance, and the understanding anti-microbial resistance in the environment.

Dr. Shane Synder
Professor of Civil & Environmental Engineering and Executive Director of the Nanyang Environment & Water Research Institute (NEWRI)
Nanyang Technological University (NTU) | Singapore
ssnyder@ntu.edu.sg

Talk Title: Wastewater Based Epidemiology: Monitoring of SARS-CoV-2 and Related Markers in Singapore

The presentation focusses on optimisation to achieve a robust validated testing protocol for Covid-19 viral RNA.

Dr. Shane Snyder is a Professor of Civil & Environmental Engineering and is the Executive Director of the Nanyang Environment & Water Research Institute (NEWRI) at Nanyang Technological University (NTU), Singapore. For over 20 years, Dr. Snyder's research has focused on

water quality, treatment, and sustainability, which resulted in over 300 published manuscripts with 28,000 citations. He serves as the Editor-in-Chief for the American Chemical Society journal, Environmental Science & Technology Water and is a Fellow of the International Water Association. Prof. Snyder was featured among the top 25 leading water researchers globally by Lux Research, and was awarded the Dr. Pankaj Parekh Research Innovation Award and the Agilent Thought Leader Award. Prof Snyder and his team were awarded the Nanyang Humanitarian Award for their philanthropic work in water and sanitation, which has benefited over two million people in underserved communities in Asia.

Dr. Beverley Margaret Stinson
Executive Vice President
AECOM | USA
Beverley.Stinson@aecom.com

Talk Title: Wastewater Infrastructure & Operations for an Enduring Public Health Partnership

Dr. Beverley Margaret Stinson is the Executive Vice President of AECOM Global Water with a technical background in water and wastewater treatment processes. Dr. Stinson has extensive experience nationally and internationally with wastewater epidemiology programs and a detailed understanding of wastewater infrastructure and operations. She will share her perspectives on the opportunity and challenges of establishing a sustainable and enduring wastewater surveillance program for the protection of Public Health.

SWWS 201: Sampling

Session Chair: **Ms. Renee Stevens**
Program Manager
Department of Homeland Security (DHS) | USA
renee.stevens@hq.dhs.gov

Ms. Renee Stevens is currently on detail within DHS from Customs and Border Protection to the Science and Technology Directorate (S&T). In her role at S&T, Ms. Stevens coordinates voluntary consensus standards and related projects for DHS mission needs, including the integration of standards for unmanned aircraft systems (UAS).

Speakers

Mr. Claudio Ternieden
Senior Director of Government Affairs
The Waters Environment Federation

Talk Title: Utilities Perspectives and Needs

Mr. Claudio Ternieden is Sr. Director of Government Affairs & Strategic Partnerships for the Water Environment Federation (WEF). Ternieden is responsible for leading WEF's regulatory and legislative activities, including WEF's Global Programs. Ternieden is part of WEF's team working on wastewater-based epidemiology, coordinating with other organizations in the water sector such as municipalities, state agencies and universities. Ternieden served on WEF's Blue Ribbon Panel on wastewater operator safety due to COVID-19. Before coming to WEF, Claudio worked with Concurrent Technologies Corporation (CTC), a Department of Defense technologies innovator and integrator, and before that with the Water Environment Research Foundation (WERF) (now The Water Research Foundation) helping lead innovative research in infrastructure, disinfection, wet weather management, emerging contaminants, stormwater, climate adaptation, resilience, water reuse and decentralized systems. Ternieden has also worked with the American Association of Airport Executives (AAAE) where he worked in regulatory and legislative issues associated with environmental management at airports. Previously, he worked with the US EPA in Washington, DC and helped in the development of numerous federal regulations. Before the US EPA, Ternieden worked with the State of Indiana Department of Environmental Management (IDEM) supporting the implementation of the State's Great Lakes Water Quality Standards in NPDES permits, the

pretreatment program, operators' certification program and the implementation of the drinking water capacity development program. Before working for the State of Indiana, Ternieden directed the City of Elkhart, IN pretreatment enforcement program. As part of his work with WEF over the last two years, Ternieden organized, presented and moderated sessions on technology innovation and transfer, water reuse and regulatory policy in Rio de Janeiro and Brasilia, Brazil, and in Cartagena de Indias, Colombia. As a volunteer, Ternieden has also organized and executed delegation visits to Addis Ababa, Ethiopia as part of development projects on water and sanitation with PRIDE (a non-profit organization doing development work in Ethiopia)

Mr. Patrick J. Phillips
Quality Assurance Specialist
US Geological Survey (USGS) | USA
pjphilli@usgs.gov

Talk Title: USGS Experience in Wastewater Sampling: 3 Issues to Guide Wastewater Surveillance for Public Health
The talk examines three crucial questions to guide wastewater sampling based on USGS experiences.

Mr. Patrick Phillips has been a USGS employee for over 35 years, focusing on data quality and the understanding of links between wastewater and public health.

Dr. Aruni Bhatnagar
Professor of Medicine
University of Louisville | USA
aruni@louisville.edu

Talk Title: Case Study-Wastewater Monitoring for COVID-19 in Louisville

Dr. Aruni Bhatnagar is Professor of Medicine and Distinguished University Scholar at the University of Louisville. He is the Director of the Christina Lee Brown Envirome Institute and Co-Director of the American Heart Association Tobacco Regulation Center. He is a leading expert on the mechanisms by which environmental exposures such as air pollution affect cardiovascular disease risk. Dr. Bhatnagar's initial work involved the purification and characterization of aldose reductase and its role in diabetic complications. To this end, he established the identity of this enzyme in several tissues and investigated its structural, kinetic, and inhibitory properties. His work has shown that increasing NO availability prevents aldose reductase activation and sorbitol accumulation in diabetic tissues. Additionally, his recent studies show that glucose activates multiple protein kinases and that the activation of these kinases is required for the inflammatory effects of glucose in vascular tissues. At UofL, Dr.

Bhatnagar's work also led to elucidation of the mechanisms by which free radicals and lipid peroxidation products affect the function of individual ion channels. He was the leader of a Program Project Grant from the NIEHS to study the cardiovascular toxicity of environmental aldehydes. In this program-project he directed a large multi-disciplinary team of investigators studying the molecular and cellular mechanisms of aldehyde toxicity. His studies at UofL have led to the development of the new field of Environmental Cardiology. He was the Deputy Editor of Circulation Research for 10 years. He has participated in over 50 NIH review panels and chaired several review panels. He was the recipient of the President's Award for Outstanding Scholarship, Research and Creative Activity, University of Louisville, and Partner in Healthcare Award – Contributing to Greater Louisville Healthcare Community, in 2007. In 2007, he also received the first Outstanding Faculty Mentor of Graduate Students, and the Outstanding Mentor Award from the Conference of Southern Graduate Schools. In 2017, he was designated Research Exemplar by Washington University. Dr. Bhatnagar has published 340 peer-reviewed manuscripts, 25 book chapters and reviews and over 200 abstracts. He has mentored 48 graduate students and post-doctoral fellows in his laboratory and has served on the dissertation committee of 18 Ph.D. students.

Mr. Kaushal Trivedi
Business Development Manager
Teledyne ISCO | USA
Kaushal.Trivedi@Teledyne.com

Talk Title: Wastewater Sampling for WBE Surveillance
Analysis of wastewater provides an early alert of WBE before symptoms surface out in individuals and clinical tests are performed. Proactive actions can be taken to prevent pandemic with alerts. In this presentation you will learn how to collect wastewater samples for WBE surveillance. Sampling types and methods will be presented. The location and purpose (WBE prevalence vs Trend) impact types and methods.

Mr. Kaushal Trivedi earned a Bachelor's in Electronics Engineering and a Bachelor's in Physics. Mr. Trivedi has been a water and wastewater professional for 32 years and spent with the last 21 years at Teledyne ISCO. He has managed large product portfolios of open channel flow meters and automatic samplers. He has also been involved in product development of field measurement technologies, interface protocols, m2m (machine to machine) remote communication, as well as sever and cloud-based software. Mr. Trivedi lives in Lincoln Nebraska, USA.

Dr. Aaron W. Bivins
Post-Doctoral Research Fellow
University of Notre Dame | USA
abivins@nd.edu

Talk Title: <u>Building-level Wastewater Monitoring for COVID-19 using Tampon Swabs and RT-LAMP for Rapid SARS-CoV-2 RNA Detection</u>
We piloted a wastewater surveillance workflow using tampons as passive swabs and reverse transcription loop-mediated isothermal amplification (RT-LAMP) to detect SARS-CoV-2 RNA in wastewater. Results for the developed workflow were available same day, with a time to result following tampon swab collection of approximately three hours. The workflow demonstrated a same-day positive predictive value (PPV) of 33% and negative predictive value (NPV) of 80% for incident COVID-19 cases. Even with lower analytical sensitivity the tampon swab and RT-LAMP workflow offers a cost-effective and rapid approach that could be leveraged for scalable same-day building-level wastewater monitoring for COVID-19.

Dr. Aaron W. Bivins is a public health engineer leading research at the intersection of microbiology, civil engineering systems, and human health. He seeks to characterize interactions between humans and pathogens mediated by water of all kinds – drinking, surface, ground, waste, and reuse. In response to the COVID-19 pandemic, he established the COVID-19 Wastewater-based Epidemiology (WBE) Collaborative, a global research collaboration. Dr. Bivins has led the development of robust and sensitive methods for detecting and quantifying SARS-CoV-2 RNA in wastewater and has contributed to WBE efforts throughout the state of Indiana. His research activity builds on his professional experience designing and permitting various hydraulic infrastructure including water distribution, wastewater collection, and stormwater systems.

Panel Discussion: <u>**Need for Standards to Support Wastewater Sampling**</u>

Moderator: **Ms. Sarah Wright**
Environmental Laboratories Manager
Association of Public Health Laboratories | USA
wright.sarah@gmail.com

Ms. Sarah Wright, MS, is an environmental laboratories manager at the Association of Public Health Laboratories in Silver Spring, MD. In this role, she works to strengthen state and local environmental laboratories. Current projects include working with the CDC National Wastewater Surveillance System to build public health laboratory wastewater surveillance testing capacity. Previously, she conducted watershed assessments in Wisconsin for the City of Racine and worked on national water policy at The Johnson Foundation at Wingspread. She has a master's degree in environmental monitoring from Ohio University and an environmental science and policy degree from Duke University.

Panelists:

Mr. John Birkner, Jr.
Manager Technical Services
Bergen County Utilities Authority | USA
jbirkner@bcua.org

Mr. John Birkner, Jr. attended Bergen Community College and Ramapo College as an undergraduate student. He has continued professional studies at Rutgers University/Cooke College and California State University with a focus on industrial wastewater treatment and wastewater microbiology.

Mr. Birkner is employed in the wastewater treatment industry where he is the Manager of Technical Services for the Bergen County Utilities Authority. Previously he was employed with Envirogen Technologies and Bigler Associates where served as the Industrial Pretreatment Program Manager at the Northwest Bergen county Utilities Authority and the Two Bridges Sewerage Authority. He has served 12 years as mayor of Westwood, NJ and currently sits on the Board of Trustees for Hackensack Riverkeeper, Inc. & Comprehensive Behavioral Health Care.

Dr. Raul A. Gonzalez
Environmental Scientist
Hampton Roads Sanitation District | USA
rgonzalez@hrsd.com

Dr. Raul A. Gonzalez is an Environmental Scientist at Hampton Roads Sanitation District (HRSD) where he applies molecular methods to manmade infrastructure and their adjacent waters. His current projects use DNA-based markers for a variety of applications, including identifying compromised sewer infrastructure and quantifying pathogen removal of various wastewater and water reuse treatment trains.

Dr. Rochelle Holm
Researcher
University of Louisville | USA
Rochelle.holm@louisville.edu

Dr. Rochelle Holm has broad interests in water and sanitation technologies to improve the well-being of the most vulnerable population groups, ranging from fecal sludge management to rural water supply. Her current research includes pathogen detection in pit latrines, SARS-COV-2 surveillance in wastewater, and the role of occupational mobility on the effects of household water, sanitation and hygiene access. Dr. Holm is currently with the University of Louisville, and also holds a faculty appointment at Mzuzu University, in Malawi, Africa.

Mr. Greg Kester
Director of Renewable Resources Programs
California Association of Sanitation Agencies (CASA) | USA
gkester@casaweb.org

Mr. Greg Kester is the Director of Renewable Resource Programs for the California Association of Sanitation Agencies (CASA). Mr. Kester serves as both the technical and programmatic contact for CASA members and conduit for emerging issues on the state and federal levels on all biosolids, renewable energy, and climate change mitigation issues. Recently this has included issues related to SARS-CoV-2 and wastewater-based epidemiology. He has worked with the wastewater sector in California, along with researchers and public health officials to advance the use of WBE since the pandemic began. He holds a BS in Civil and Environmental Engineering from the University of Wisconsin – Madison.

Mr. Bruce E. Smith
Environmental Engineer
Environmental Protection Agency (EPA) | USA
smith.bruce@epa.gov

Mr. Bruce E. Smith, now with EPA's Office of Research and Development, is formerly the Assistant Superintendent of the Compliance Services Division with the Metropolitan Sewer District of Greater Cincinnati, Ohio. In addition to regulatory compliance and divisional administrative duties he also led the innovation efforts, including applied research, and was actively involved in the district's efforts to identify, evaluate and adopt innovative technologies for the management and control of wet weather flows. He was a key team member developing MSDGC's next phase of its $3+ billion Wet Weather Improvement Program. Mr. Smith has served as a Senior Engineer with MSDGC managing large capital projects with Ohio EPA from 1990 – 2007 in its Surface Water Division.

Mr. Smith has a BS Chemical Engineering from the University of Cincinnati where he also completed Environmental Engineering Masters course curriculum. He has also served as an adjunct instructor at Cincinnati State Technical College from 2006 - 2016.

Mr. David Swain
Associate Vice President
AECOM | USA
David.swain@aecom.com

Mr. David Swain is a Department Manager with the EHS Practice of AECOM. Mr. Swain is currently supervising the field sampling effort on a wastewater sampling project for the Commonwealth of Kentucky. He has extensive experience with field environmental assessments and sampling of soil, soil vapor, ground water, wastewater, air and sediment.

Closing Remarks for Day 1

Mr. Philip J. Mattson
Department of Homeland Security (DHS), Science and Technology Directorate (S&T) | USA

Dr. Nancy J. Lin
National Institute of Standards and Technology (NIST) | USA

DAY 2: TUESDAY, JUNE 15, 2021

Welcome & Logistics

Mr. Philip J. Mattson
Department of Homeland Security (DHS), Science and Technology Directorate (S&T) | USA

Dr. Nancy J. Lin
National Institute of Standards and Technology (NIST) | USA

SWWS 202: Testing Methods


Session Chair: **Ms. Sally C. Gutierrez**
Senior Advisor for Water
Environmental Protection Agency (EPA) | USA
Gutierrez.sally@epa.gov

Ms. Sally C. Gutierrez has recently returned to the Office of Research and Development as Senior Advisor to the Director of the Center for Environmental Solutions and Emergency Response. She is assisting in the development of wastewater-based epidemiology as an early warning of Covid-19 infections in communities, PFAS treatment for water matrices and advancing diversity, equity and inclusion.
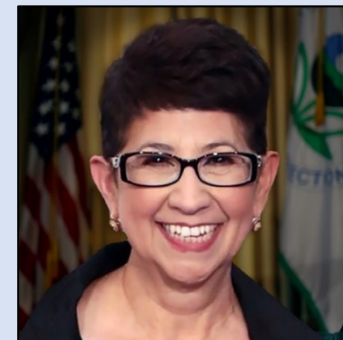
From 2018 to mid-2000, she served as the Acting Director of Water Permits Division in the Office of Wastewater Management, Office of Water at USEPA in Washington, DC. She was responsible for leading the Agency's largest environmental permitting program, covering more than 800,000 wastewater facilities in the US through the National Pollutant Discharge Elimination Program. These include permits for stormwater, animal feeding operations, construction sites, and municipal and industrial wastewater. Before taking the detail to Washington DC, she was the Director of EPA's Environmental Technology Innovation Cluster Development and Support Program within the ORD. The program advanced environmental protection in tandem with economic development through the formation of public private partnerships. She was the lead on EPA's efforts to leverage its research and development capability in Cincinnati, Ohio with community-based assets to establish the region as a water technology innovation hub and leading an effort to network water innovation clusters across the globe. Prior to this new appointment, she was the Director of the National Risk Management Research Laboratory (NRMRL) in Cincinnati, Ohio for 8 years. NRMRL was one of three Federal research laboratories within the USEPA's ORD and consisted of 400 scientists and support staff. The Laboratory was responsible for conducting

engineering and environmental technology research to support the Agency in policy and regulatory development and implementation. She was the Director of the Water Supply and Water Resources Division in NRMRL before becoming its Director and was responsible for leading a national technology demonstration program for control of arsenic in drinking water. Before coming to USEPA she was responsible for administering water programs for the State of Texas environmental agency in the areas of drinking water, water monitoring, wastewater permitting, dam safety, water rights and utility rates. She is a hydrologist by training and has completed over 21 years of service at EPA. When first appointed in 2000, she was the first Hispanic woman career Senior Executive Service member hired by USEPA.

Speakers

Dr. Christobel M. Ferguson
Chief Innovation Officer
The Water Research Foundation | USA
christobelf@gmail.com

Talk Title: Global Update on Wastewater Surveillance for SARS-CoV-2
In April 2020, The Water Research Foundation (WRF) convened global leaders in an international summit to identify best practices and high-priority research needs around wastewater-based epidemiology (WBE) in response to the COVID-19 pandemic. Because WBE approaches have continued to develop over the past 12 months, WRF convened a follow-up global symposium to share updates on WBE activities from around the world, with a focus on how this information is being used to support health agencies in their COVID-19 response.

Dr. Christobel M. Ferguson has a Biomedical Science degree and a Master of Science from the University of Technology Sydney and a Ph.D. from the University of New South Wales. Dr. Ferguson has led scientific, technical, research and consulting teams in the Australian water and environment sector for over 30 years and in early 2020 joined the Water Research Foundation as their Chief Innovation Officer. Her focus is supporting the implementation of innovation and new technologies to solve complex problems facing the water resource sector to enable utilities to mitigate risk and improve performance.


Dr. Nichole Brinkman
Biologist
US Environmental Protection Agency (EPA) | USA
brinkman.nichole@epa.gov

Talk Title: Overview of the Ohio Wastewater Monitoring Network

Dr. Nichole Brinkman is a Biologist with USEPA's Office of Research and Development. Her research focuses on the presence and dissemination of waterborne pathogens and antimicrobial resistance determinants in the environment. Nichole received her Ph.D. in Biological Sciences from the University of Cincinnati.
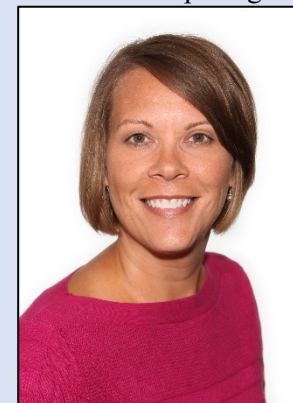
Ms. Rebecca Fugitt
Assistant Chief, Bureau of Environmental Health and Radiation Protection
Ohio Department of Health | USA
rebecca.fugitt@odh.ohio.gov

Talk Title: Overview of the Ohio Wastewater Monitoring Network

Ms. Rebecca Fugitt is the Assistant Chief of the Bureau of Environmental Health and Radiation Protection at the Ohio Department of Health where she oversees programs related to residential water and sewage, harmful algal blooms, fish consumption advisories and health assessment, Legionella, radioactive materials licensing, X-ray registration and inspection, and radiation health and safety. She holds a B.S. and M.S. degrees in Geological Sciences from Ohio University and is a registered sanitarian in the state of Ohio. She was the program manager for the Residential Water and Sewage program at ODH for 19 years, and program manager for the Water Resources Section at the Ohio Department of Natural Resources for 11 years. Prior to joining the state, Rebecca served as a research hydrogeologist for the National Ground Water Association.

Dr. Alexandria B. Boehm
Professor of Civil and Environmental Engineering
Stanford University | USA
aboehm@stanford.edu

Talk Title: Scalable, Sensitive, Representative, and Comparable Approach for High Throughput SARS-CoV-2 RNA Analysis in Settled Solids
We have been quantifying "pan-SARS-CoV-2" RNA targets (N, S, ORF1a) and variant mutations (HV69-70, E484K/N501Y) in settled solids from eight wastewater treatment plants in Northern California on a daily basis since November 2020. A focus on SARS-CoV-2 RNA in solids

enabled us to scale-up our measurements with a commercial lab partner. Samples were collected daily and results were posted to a website within 24-hours. SARS-CoV-2 RNA in daily samples correlated to incidence COVID-19 cases in the sewersheds; a 1 log10 increase in SARS-CoV-2 RNA in settled solids corresponds to a 0.58 log10 (4X) increase in sewershed incidence rate. SARS-CoV-2 RNA signals measured with the commercial laboratory partner were comparable across plants and to measurements conducted in a university laboratory when normalized by pepper mild mottle virus PMMoV RNA. Results suggest that SARS-CoV-2 RNA should be detectable in settled solids for COVID-19 incidence rates at least as low as 1/100,000. Variant mutations are detectable in settled solids matching clinical data on variant circulation. These sensitive, representative, scalable, and comparable methods will be valuable for future efforts to scale-up wastewater-based epidemiology.

Dr. Alexandria B. Boehm is a Professor with the Department of Civil and Environmental Engineering, at Stanford University. Dr. Boehm is also a Senior Fellow of the Woods Institute for the Environment and a Faculty Fellow at the Center for Innovation in Global Health. She received her Ph.D. in Environmental Engineering from the University of California, Irvine, and holds an M.S. in Environmental Engineering from the same university and a B.S. in Engineering and Applied Science from California Institute of Technology. (See full bio at www.stanford.edu/~aboehm).

Dr. Jordan J. Schmidt
Director, Product Applications
LuminUltra Technologies | Canada
Jordan.schmidt@luminultra.com

Talk Title: Reducing Erosion: Using a Rapid Deployable Testing Solution to Reduce Time Between Sampling and Action
Wastewater surveillance has become a useful tool for monitoring the trend of COVID-19 cases at a community level. Wastewater testing for SARS-CoV-2, the virus that causes COVID-19, is a non-invasive method that delivers accurate results that have been shown to give advanced warning of clinical case trends. Conventional methods typically require specialized equipment and skilled operators to pre-concentrate large volumes of wastewater prior to analysis for SARS-CoV-2. LuminUltra® has developed the GeneCount® SARS-CoV-2 Wastewater Test Kit for extracting SARS-CoV-2 RNA directly from a 1 mL sample of raw wastewater using magnetic binding bead technology thereby removing the need for pre-concentrating samples. Furthermore, it allows for simultaneous testing of both the liquid and solids fraction of the wastewater increasing the accuracy of the result. By simplifying the protocol testing can be done near-sample reducing the time between sampling and action.

Dr. Jordan J. Schmidt is the Director of Product Applications at LuminUltra Technologies. Dr. Schmidt holds a PhD in Civil Engineering specializing in wastewater treatment. During his academic career he spent time assessing treatment systems in one of the most remote areas of the world - the Canadian Arctic. This experience reinforced his need for rapid, accurate tools to be used in a variety of environments and lab infrastructure. At LuminUltra, Dr. Schmidt spends his days developing and supporting customers with our accurate, rapid, field-ready tests kits for the measurement of microorganisms.

Dr. Brian Swalla
Staff Scientist
IDEXX Laboratories, Inc. | USA
brian-swalla@idexx.com

Talk Title: The Importance of Validation for Wastewater Surveillance
Wastewater surveillance has delivered actionable public health data over the course of the COVID-19 pandemic. Because of the urgent nature of the pandemic, the extent of validation for currently used methods varies widely. Many methods were deployed before significant data was gathered on performance, and may not have been widely tested with a diversity of wastewater samples. As wastewater surveillance moves into the mainstream, it is critical that methods be thoroughly validated using real-world wastewater samples, that the validation captures as much natural variation as possible (such as ensuring the validation is performed with samples from many different geographies), and that validation data be made available to laboratories interested in using the method. Such data are critical to evaluate method performance capabilities and limitations, facilitate successful adoption in new laboratories, and ensure consistent and reliable results can be achieved over time.

Dr. Brian Swalla received a Ph.D. in Microbiology from the University of Illinois and has 17+ years of experience developing new technologies and products in a wide array of microbiological and molecular applications, including microbial and protein biocatalysts, cellulosic biofuels, and water quality. Since 2011, he has worked for IDEXX Laboratories Inc. on new products for water microbiology, where he is currently a Staff Scientist and most recently led the technical development and validation of a RT-qPCR test for SARS-CoV-2 in wastewater.

Ms. Carolyn Reifsnyder
Director, Global Product Marketing, Digital Biology Group
Bio-Rad Laboratories | USA
carolyn_reifsnyder@bio-rad.com

Talk Title: SARS-CoV-2 Quantification in Wastewater by Droplet Digital PCR

Ms. Carolyn Reifsnyder leads a high-performing team of product marketers and application scientists in the development and execution of DBG's strategic plans and product roadmaps to conceive, incubate and launch differentiated products to customers in the translational research, biopharma and molecular diagnostic markets. (See full bio at: https://www.linkedin.com/in/carolyn-reifsnyder-a269102/.)

Dr. Michael Bussmann
Associate Director, Global Product Management - dPCR
QIAGEN | Germany
michael.bussmann@qiagen.com

Talk Title: <u>Nanoplate Digital PCR for Wastewater Surveillance</u>

Dr. Michael Bussmann has spent 6 years at QIAGEN Product Management for Assay Technologies. He has 10 years industry experience in total and earned his Ph.D. in Biochemistry.

Dr. Ellen M. Beasley
CSO
Pangolin Health | USA
ellen.beasley@panoglinhealth.com

Talk Title: <u>SARS-CoV-2 Variant Profiling in Wastewater by Sequencing</u>
Novel viral strains continue to emerge and to spread, complicating management and containment of the COVID-19 pandemic. A smaller number of "Variants of Concern" and "Variants of Interest" have been defined by the CDC and WHO. Of these, at present, 13 variants, all have multiple mutations documented in the spike protein gene, as well as further mutations across their entire genome. Next generation sequencing (NGS) of the S gene allows unambiguous quantitative identification of these strains in wastewater samples. The advantages of this approach are that it is less likely to require frequent versioning of the assay as new strains emerge, and the results generally have multiple points of support for viral strain identification or elimination. Disadvantages are the complexity of developing a robust amplicon set for profiling S gene mutations, which covers all variants and avoids positioning primers over variants; and the data management and analysis pipeline required for analysis and interpretation of the results. We have a version 1 assay that provides excellent profiling of the current CDC Variant Strains. We have been able to apply this assay to longitudinal characterization of a specific outbreak, by testing dorms on a campus to ascertain and describe variant succession.

Dr. Ellen M. Beasley is an experienced biotechnology executive with a history of working at the intersection between diagnostics and genomics. She has had success moving technology into products, DNS sequencing technologies, intellectual property, and diagnostic test development (LDT & IVD). Dr. Beasley has a passion for team development, organizational design, communication, and collaboration. (full bio at https://www.linkedin.com/in/ellen-beasley-b58577/)

Mr. Ryan Gregerson
Product Marketing Manager
BioFire Defense | USA
Ryan.Gregerson@BioFireDefense.com

Talk Title: BioFire Defense Overview

Dr. Roberto J. Barbero
Chief Business Officer
Ceres Nanosciences | USA
rbarbero@ceresnano.com

Talk Title: Viral Concentration with Nanotrap Magnetic Virus Particles
Nanotrap Magnetic Virus Particles, from Ceres Nanosciences, rapidly capture and concentrate SARS-CoV-2 from raw sewage, requiring no filtration or centrifugation. Automated and manual methods available. The automated method enables 96 raw sewage samples to be processed in 4.5 hours (from concentration to RT-qPCR result) and has higher recovery efficiencies than conventionally used methods for viral wastewater concentration. At University of California San Diego campus, the automated method has been used to process over 9,500 samples from 121 autosamplers covering 350 buildings. The sensitivity of the high-throughput protocol was shown to detect 1 asymptomatic individual in a building of 415 residents. To date, nearly 85% of the individual cases on the UCSD campus have been preceded by positive wastewater samples. Extracted RNA samples from this high-throughput method can be used for genome sequencing.

Dr. Roberto J. Barbero has over 15 years of experience operating across a range of responsibilities in the biotechnology sector, including in public policy, product development, process engineering, R&D, quality control, manufacturing, and customer-facing roles in startups, at MIT, and in the White House. Dr. Barbero has extensive experience building and maintaining strategic partnerships with leading foundations, universities, private research institutes, non-profit organizations, federal agencies, and companies across a variety of scientific and technical topics.

In the White House, Dr. Barbero spent more than four years developing and implementing policy on global and national life science issues, including the BRAIN Initiative, the Precision Medicine Initiative, biotechnology regulatory policy, emerging biotechnologies, genome editing, reducing the organ transplant waiting list, cancer diagnostics for the developing world, the federal government's response to the Zika virus, student innovation and entrepreneurship, and federal R&D agency budgets.

Dr. Barbero received his Ph.D in biological engineering from MIT, where he led or co-led projects on antimicrobial peptides, carbon capture, and industrial biocatalysts. He was named an MIT Presidential Fellow and a Siebel Scholar and his research resulted in four publications and two

granted patents. Before graduate school, he spent five years working for three biotechnology startups – GlycoFi (acquired by Merck), Quantum Dot Corporation (acquired by Invitrogen), and Nanostream. He also holds A.B. and B.E. degrees in engineering sciences from Dartmouth College. (full bio at https://www.linkedin.com/in/robbie-barbero-6b18a31/)

Panel Discussion: **Need for Standards to Support Testing Methods**

Moderator: **Dr. Jay L. Garland**
Associate Director for Research, Office of Research and Development
Environmental Protection Agency (EPA) | USA
garland.jay@epa.gov

Dr. Jay L. Garland joined the EPA's Office of Research and Development in 2011. Dr. Garland received a Ph.D. in Environment Science from the University of Virginia and spent over 20 years working on NASA's efforts to develop closed, bioregenerative life support systems for extended human spaceflight. NASA recognized him for innovative technical achievements four separate times. He has worked on a range of topics, including methods for microbial community analysis, factors affecting survival of human associated pathogens, and various biological approaches for recycling wastes. Dr. Garland has completed visiting fellowships and professorships at the Institute for Environment Sciences in Japan, the University of Innsbruck in Austria, and the University of Buenos Aires in Argentina. His current efforts focus on advancing innovative approaches to water infrastructure, including decentralized water reuse, and mitigating risks associated with antimicrobial resistance in the water cycle.

Panelists:

Dr. Kartik Chandran
Professor of Environmental Engineering
Columbia University | USA
kc2288@columbia.edu

Dr. Kartik Chandran is an environmental engineer at Columbia University, where he is a Professor in the Department of Earth and Environmental Engineering. He primarily works on the interface between environmental molecular and microbiology, environmental biotechnology and environmental engineering. Applications of his work have ranged from energy and resource efficient treatment of nitrogen containing wastewater streams, development and implementation of sustainable approaches to sanitation to novel models for resource recovery. Under his stewardship, the directions of biological wastewater treatment and biological nutrient removal were established for the first time ever in the history of Columbia University. In 2015, he received the MacArthur Fellowship for his innovative work on "integrating microbial ecology, molecular biology, and engineering to transform wastewater from a troublesome pollutant to a valuable resource". (See full bio at: www.columbia.edu/~kc2288)

Mr. Kahlil Lawless
Microbiology Segment Manager – Americas
Illumina | Canada
klawless@illumina.com

Mr. Kahlil Lawless is currently the Agrigenomics and Microbiology Segment Manager for the Americas at Illumina, based in Toronto, Canada. After studying genetics at Victoria University of Wellington in New Zealand he worked in Australia as a researcher and molecular biologist in the Department of Primary Industries and the Environment before joining Illumina.

Dr. Mia Mattioli
Environmental Engineer
Centers for Disease Control and Prevention (CDC) | USA
kuk9@cdc.gov

Dr. Mia Mattioli is the Principle Investigator for the CDC's Waterborne Disease Prevention Branch's Domestic WASH Lab within Environmental Microbiology and Engineering Laboratory Team. Her research focuses on the intersection between the environment and human health with a specific interest in the relationship between, and fate and transport of, fecal indicators and enteric pathogens. Her lab is engaged in a wide range of environmental research areas including drinking water, irrigation water, wastewater, recreational water, soil, food, water distribution systems, and the development of advanced molecular detection technologies. Dr. Mattioli also leads CDC's environmental investigations of waterborne outbreak responses and currently serves as the Science Lead for the CDC National Wastewater Surveillance System. She has a Bachelor of Science in Biological Engineering from the University of Georgia and a Master and Ph.D. in Environmental Engineering from Stanford University.

Dr. Gertjan Medema
Principal Microbiologist
KWR

Dr. Martin Shafer
Senior Scientist
University of Wisconsin-Madison, State Laboratory of Hygiene | USA
mmshafer@wisc.edu

Dr. Matt Shafer is a Senior Scientist with the University of Wisconsin-Madison State Laboratory of Hygiene (WSLH). He is an environmental biogeochemist, working at the interface of chemistry, biology and toxicology. He serves as research lead at the Environmental Health Division of the WSLH, directs the WSLH Trace Element Research Group, and oversees Quality Assurance for the National Atmospheric Deposition Program (NADP). His research program addresses the cycling of metals and emerging contaminants in aquatic, biologic, and atmospheric systems with a focus on the interface of environmental chemistry and human health. Dr. Shafer's current studies focus on interrelationships between trace element speciation and biological effect and element source attribution using elemental and isotopic fingerprinting. He is an expert in the analytical chemistry (particularly plasma mass spectrometry and electrochemistry) of metals in clinical and environmental matrices and helped develop many of the clean sampling and analytical approaches for trace elements now used by the scientific and regulatory communities. His research group developed

new tools for quantification of the oxidative activity of atmospheric aerosols and has applied this toolbox to address chemical drivers of aerosol-associated toxicity in a large body of publications. Dr. Shafer has authored and co-authored more than 185 peer reviewed manuscripts.

SWWS 203: Data Reporting and Analytics

Session Chair: **Mr. Paul Storella**
Senior Vice President Water Business Line
AECOM | USA
paul.storella@aecom.com

Mr. Paul Storella leads the New York Metro Water Business Line and AECOM's national SARS CoV-2 wastewater surveillance program. The Water business line provides planning, design, and construction/program management services for large-scale water and wastewater infrastructure projects throughout the globe. Under Paul's leadership, the Water has expanded AECOM's portfolio to include a number of wastewater surveillance projects including the Bergen County Utility Authority and the Commonwealth of Kentucky Department of Corrections programs. In his more than 30-year career, Paul has worked on many significant water and wastewater projects, including the Deer Island Sewage Treatment Plant, the centerpiece of the Massachusetts Water Resource Authority's program to protect Boston Harbor; the F. Wayne Hill Water Resources Center in Atlanta, a tertiary treatment facility; and the US Agency for International Development's expansion of the wastewater collection system in Alexandria, Egypt.

Speakers

Dr. Wiley Jennings
Health Scientist
Centers for Disease Control and Prevention (CDC) | USA
oht6@cdc.gov

Talk Title: Available Data Tools: National Wastewater Surveillance System
This talk will provide an overview of CDC's National Wastewater Surveillance System DCIPHER data platform, data submission process, and analytics. It will touch on the utility of standard materials for data comparability and the CDC-NCBI collaboration to develop a BioSample attribute package for submission of wastewater surveillance sequencing data to NCBI.

Dr. Wiley Jennings serves as the Data Lead for CDC's National Wastewater Surveillance System. He holds a Ph.D. in Environmental Engineering and Science from Stanford University.
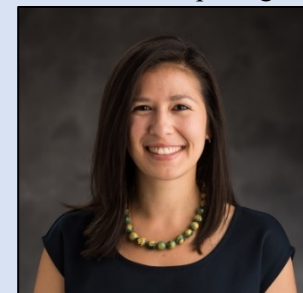

Dr. Lauren Stadler
Assistant Professor
Rice University | USA
lauren.stadler@rice.edu

Talk Title: SARS-CoV-2 Wastewater Surveillance and Public Health Applications in Houston, TX
In this talk we describe the SARS-CoV-2 wastewater monitoring program implemented in Houston, TX. In this collaborative effort, we have been collecting, processing, and analyzing weekly wastewater samples over the past 13 months from 39 wastewater treatment plants in Houston that serve 2.3M+ people, 53 schools, and 22 congregate living facilities. We describe the types of data that are generated, and how the data are used to inform public health action, both at the wastewater treatment plant level, and at upstream (manhole) sampling locations.

Dr. Lauren Stadler is an assistant professor in the Department of Civil and Environmental Engineering at Rice University. Her research is focused on advancing sustainable and safe wastewater management systems that can be used to generate valuable resources and monitored to inform public health.

Dr. Loren Hopkins
City of Houston Chief Environmental Science Officer, Chief of the Bureau of Community and Children's Environmental Health at the Houston Health Department, and a Professor in the Practice in the Department of Statistics at Rice University
Houston Health Department and Rice University | USA
loren.hopkins@houstontx.gov

Talk Title: SARS-CoV-2 Wastewater Surveillance and Public Health Applications in Houston, TX
In this talk we describe the SARS-CoV-2 wastewater monitoring program implemented in Houston, TX. In this collaborative effort, we have been collecting, processing, and analyzing weekly wastewater samples over the past 13 months from 39 wastewater treatment plants in Houston that serve 2.3M+ people, 53 schools, and 22 congregate living facilities. We describe the types of data that are generated, and how the data are used to inform public health action, both at the wastewater treatment plant level, and at upstream (manhole) sampling locations.

Dr. Loren Hopkins is the City of Houston Chief Environmental Science Officer, Chief of the Bureau of Community and Children's Environmental Health at the Houston Health Department, and a Professor in the Practice in the Department of Statistics at Rice University. In this dual capacity, she conducts applied research and uses the results to inform policies at the City of Houston to improve the health of the community. She leads the city's COVID-19 data science team.

Ms. Aparna Keshaviah
Senior Statistician
Mathematica | USA
akeshaviah@mathematica-mpr.com

Talk Title: <u>Translating Wastewater Data for Policymaking</u>
With hundreds of communities across the country now implementing wastewater surveillance for the SARS-CoV-2 virus, standards for analysis and reporting are needed to ensure that the resulting data are reliable and comparable. More work is needed to identify robust metrics for reporting wastewater viral concentrations and criteria for triggering alerts and action. To communicate findings for policymakers charged with pandemic management and response decisions, lab results can be presented alongside administrative data sources that officials are already monitoring. Such data contextualization should move beyond confirmed cases to also include local and regional indicators of risk and population vulnerability. Aligning and synthesizing wastewater data with community data can provide a more holistic picture of the threat, facilitate data triangulation, and yield novel policy insights. For the opioid epidemic, such approaches have been used to predict the need for overdose response, assess the impacts of law enforcement, and measure black-market activity.

Ms. Aparna Keshaviah is a senior statistician at Mathematica who brings advanced analytics and innovative data to clarify urgent questions across multiple public health arenas. Her translational approach to wastewater surveillance uses data integration and dynamic visualization to help officials manage infectious diseases and drug epidemics. Her work aims to communicate scientific findings to technical audiences, academic research communities, and the general public alike. Prior to joining Mathematica, she conducted head-to-head comparisons of the safety and efficacy of breast cancer treatments to help clinicians tailor patient management decisions. She also analyzed and validated psychiatric symptom profiles to inform the diagnosis and treatment of debilitating mental health conditions. Her research has been widely published in leading journals such as the New England Journal of Medicine, JAMA Psychiatry, and Environmental Health Perspectives. Ms. Keshaviah is a 2006-2007 Fulbright fellow and holds a Master's degree in biostatistics from the Harvard School of Public Health.

Dr. Mariana Matus
CEO and Cofounder
Biobot Analytics, Inc. | USA
mariana@biobot.io

Talk Title: <u>Biobot: Building early warning health analytics from data available in our sewers</u>
Over the past year, Biobot has tested close to ten thousand wastewater samples from across the U.S. for SARS-CoV-2. The communities that have worked with Biobot include large metro areas, cities, rural areas, Indian territories, as well as building-level communities such as nursing homes, prison systems, places of work, and places of study. More recently, Biobot got an award from HHS to collect a nationwide dataset covering 320 communities and 100 million people. Outside some early method development, the vast majority of Biobot's data has been produced with a single standardized method that relies on commercially-available kits. The depth of data collected plus close collaborations with public health officials and academics have highlighted three successful applications of wastewater epidemiology data: i) Independent confirmation of clinical data trends; ii) Outbreak detection in a background of little disease activity; iii) Nationwide ranking based on all other recent samples. Before Covid-19, Biobot had an opioid use monitoring product on the market to inform harm-reduction programs in cities.

Dr. Mariana Matus is CEO and Cofounder at Biobot Analytics where she leads the development of a wastewater epidemiology data platform to make public health more proactive and equitable. With a background in microbiology and computational biology, Dr. Matus specialized in wastewater epidemiology in Professor Eric Alm's laboratory at the Biological Engineering Department at MIT. Through Biobot, aims to bring wastewater epidemiology platform across the globe to serve all of the world's cities and stop outbreaks before they become pandemics. She values wastewater epidemiology for its accurate and privacy-protected data as an invaluable tool for public health and public safety officials.

Ms. Ana Grace Alvarado
Graduate Student
University of California Merced | USA
aalvarado55@ucmerced.edu

Talk Title: <u>Rapid Fire – Global COVID-19 Wastewater Monitoring Efforts: Development of the COVIDPoops19 Dashboard</u>
A year since the declaration of the global coronavirus disease 2019 (COVID-19) pandemic there have been over 110 million cases and 2.5 million deaths. Using methods to track community spread of other viruses such as poliovirus, environmental virologists and those in the wastewater-based epidemiology (WBE) field quickly adapted their existing methods to detect SARS-CoV-2 RNA in wastewater. Unlike COVID-19 case and mortality data, there was not a global dashboard to track wastewater monitoring of SARS-CoV-2 RNA worldwide. Here, we'll discuss the development of the

COVIDPoops19 dashboard to disseminate information regarding sites, universities, research institutions and private laboratories in countries that are involved in WBE for SARS-CoV-2. Methods to assemble the dashboard combined standard literature review, direct submissions, and daily, social media keyword searches. Over 200 universities, 1,000 sites, and 50 countries with 59 dashboards monitor wastewater for SARS-CoV-2 RNA. However, data is not widely shared publicly or accessible to researchers to inform public health actions, meta-analysis, better coordinate, and determine equitable distribution of monitoring sites. For WBE to be used to its full potential during COVID-19 and beyond, show us the data.

Ms. Ana Grace F. Alvarado is a graduate student in Environmental Systems at the University of California Merced. She received a BA in Chemistry and Hispanic Studies at the College of Saint Benedict in Minnesota and her research interests include Life Cycle Assessment, the effects of COVID-19 on the food supply chain, and how wastewater based epidemiology can be used to inform actions to improve public health.

Panel Discussion: **Need for Standards to Support Data Reporting and Analytics**

*Moderator***: Mr. Paul Storella** (see above for photo and bio)
Senior Vice President Water Business Line
AECOM | USA
paul.storella@aecom.com

Panelists:

Dr. Ellie Graeden
Chief Executive Officer
Talus Analytics | USA
egraeden@talusanalytics.com

Dr. Ellie Graeden is the founder and CEO of Talus Analytics and an associate adjunct professor with the Georgetown University Center for Global Health Science and Security (GHSS). She leads an interdisciplinary research and development team that applies data analysis, modeling, and visualization to solve challenging problems at the intersection of policy, science, and strategy. Dr. Graeden has applied her expertise to developing quantitative approaches for global-scale decision making. With an emphasis on applying the best available data to decision making during emergencies, she has led projects in support of FEMA

and the White House National Security Council to coordinate data-driven decision making for public health emergencies and other hazards. Most recently, Dr. Graeden and her team have worked with CDC National Center of Immunization and Respiratory Diseases to develop platforms for health care visibility, vaccination coverage, and response efforts for influenza and COVID-19. In collaboration with the Georgetown University GHHS, her team helped lead development of a comprehensive inventory of policies implemented to mitigate COVID-19 and model the impact of those policies.

Dr. Graeden earned her undergraduate degree in microbiology from Oregon State University and her doctorate in biology from the Massachusetts Institute of Technology (MIT), where she held a National Science Foundation Graduate Research Fellowship. She was named a 2013 Emerging Leader in Biosecurity Fellow with the Johns Hopkins Bloomberg School of Public Health Center for Health Security.

Mr. Robert Greenberg
CEO
G&H International Services, Inc. | USA
rgreenberg@ghinternational.com

Talk Title: Ensuring Trusted Data to Ensure Trustworthy Analysis

Mr. Robert Greenberg is founder and Chief Executive Officer of G&H International Services Inc., a Washington D.C. based and national consulting firm that provides services to enhance the safety and security of communities across the nation. G&H is a national leader in developing processes and the cost-effective technical capabilities to enable organizations to identify, acquire, store, manage, share, analyze and report on the data needed to make timely and informed decisions. During the COVID 19 pandemic G&H developed logistics management systems for various State emergency management agencies and partnered with AECOM to develop the Data Integrity and Reporting System as a chain of custody system for quality control over the data being analyzed from wastewater sampling.

Mrs. Stacie Reckling
GIS Analyst
NC Department of Health and Human Services, Division of Public Health | USA
Stacie.reckling@dhhs.nc.gov

Mrs. Stacie Reckling is a GIS analyst at the NC Department of Health and Human Services. She also works as a Research Associate at the Center for Geospatial Analytics at NC State University. By wearing 'two hats' Mrs. Reckling can use her geospatial research to enhance public health programs. Her creative thinking has led to the development of new GIS methods for wastewater surveillance including systematic sewershed

delineation, and population weighted estimates of COVID-19 cases in the sewershed. In her free time, she enjoys hiking with her family, fiber arts and brewing new flavors of kombucha.

Dr. Rachel R. Spurbeck
Senior Genomics Research Scientist
Battelle Memorial Institute | USA
spurbeck@battelle.org

Dr. Rachel R. Spurbeck is a senior genomics research scientist at Battelle Memorial Institute and serves as a subject matter expert and principal investigator for wastewater-based epidemiology, metagenomics, forensic genomics, and emerging genomic technology studies. She has over 15 years of professional laboratory experience and is trained in genetics, bacterial pathogenesis, and biotechnology research and development. Dr. Spurbeck previously worked in the biotechnology industry, developing novel Next Generation Sequencing (NGS) library preparation kits and applications for whole genome sequencing, targeted sequencing methods including both amplicon and hybridization sequencing, transcriptomics, metagenomics, and epigenomics. She has published 19 peer-reviewed publications and book chapters with two manuscripts currently in press (full bibliography is at https://www.ncbi.nlm.nih.gov/sites/myncbi/1bgwvVrdtVTQQr/bibliography/57543137/public/?sort=date&direction=ascending).

Dr. Spurbeck will bring experience with wastewater sequencing the whole genome of SARS-CoV-2 to detect variants of importance to diagnostics and vaccine efficacy to the proposed study. She is currently the principal investigator on National Science Foundation grant number 2033137 where her team has successfully sequenced and distinguished variants in SARS-CoV-2 across time and space within the city of Toledo, Ohio. Her genomics laboratory will contribute biweekly sequencing for sites within the Ohio Coronavirus Wastewater Monitoring Network.

SWWS 204: Role of Standards in Supporting the Use of WWS Data

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Session Chair: **Dr. Ted Smith**
Associate Professor
University of Louisville School of Medicine | USA
ted.smith@louisville.edu

Dr. Ted Smith has a breadth of experience and record of accomplishment in the academic, civic, and private sectors that will contribute to the success of the proposed research. In his career, he has specifically focused on delivering new models and methods for clinical research. Many of Dr. Smith's projects have included robust engagement between academic institutions and local government, and they often involve applications of new technologies with significant community participation. His interest in novel technological approaches dates back to his graduate and post-doctoral studies when he was awarded a NASA graduate fellowship to develop first-generation virtual environment technology studies to demonstrate a promising theory of sensorimotor integration which has since informed a generation of virtual reality space medical applications. Dr. Smith possess a decade of experience in developing new applications of digital technology for respiratory disease, directly associated with environmental factors such as air pollution. He also has extensive experience working in local government, having served as the city of Louisville, Kentucky's first Chief Innovation Officer. In that role, a major focus of his work was translating research to provide public health benefits. Dr. Smith's work was funded, in part, by the Robert Wood Johnson Foundation and was foundational to the city government prioritizing place-based clinical research. In his recent role as the Research Translation Core leader for the Louisville Superfund Research Center he has developed place-based environmental monitoring methods. Most recently, these methods have included wastewater monitoring of SARS-CoV-2 in Louisville Metropolitan area. Today Dr. Smith leads the adaptation and build-out of the university's wastewater-based epidemiology capability.

Speakers

Dr. Sandra McLellan
Professor
University of Wisconsin School of Freshwater Sciences | USA
mclellan@uwm.edu

Talk Title: Communicating Sewage Surveillance Data for a Public Health Response

Dr. Sandra McLellan's training in clinical laboratory sciences, medical microbiology, and environmental toxicology has given her the unique skill set to pursue questions related to microorganisms that flux between the primary habitat of human hosts and environmental reservoirs. For the past 12+ years Dr. McLellan has been funded by NIH to identify new indicators of waterborne disease by sequencing sewage and other fecal pollution sources and characterizing the microbial population structure. In her lab she has used novel computational approaches to detect ecologically relevant patterns and thus identified a number of human cut microbiome members that are specific to humans, highly abundant, and appear to be "steady state" in human population. She has also developed a sequenced based source identification platform FORENSIC that she has made available to the larger scientific community as an open source, web-based tool. A primary goal of her lab is to translate their discoveries into tools that can be used by public health. (See full bio at https://www.ncbi.nlm.nih.gov/myncbi/sandra.mclellan.1/cv/497151/)

Panel Discussion: Need for Standards to Support Data Reporting and Analytics

Moderator: **Dr. Ted Smith** (see above for photo and bio)
Associate Professor
University of Louisville School of Medicine | USA
ted.smith@louisville.edu

<u>Panelists:</u>

Major Michael Dietrich, Ph.D.
Bioenvironmental Engineering Flight Commander
U.S. Air Force | USA

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Ms. Rosa Inchausti
Deputy City Manager
City of Tempe | USA
Rosa_inchausti@tempe.gov

Ms. Rosa Inchausti's 28 years with the City have included many firsts. She began her career as the first bilingual Marriage and Family Therapist then forged the City's diversity efforts as the first Diversity Director. Her most recent promotion was to the role of the first Strategic Management and Diversity Director. In this role she is responsible for transforming the organization into a data-driven municipality and aligning the City Council's priorities into an actionable Strategic Plan. As co-chair of Tempe's Technology and Innovation Steering Committee, Ms. Inchausti identifies and recommends the adoption of new technologies and innovations that advance the quality of life for residents and businesses. Two notable projects that stemmed from this role was the creation of a roadmap for the integration of Autonomous Vehicles into a municipality and the launch of wastewater epidemiology via municipal infrastructure. Ms. Inchausti's areas of responsibility are Special Projects: Public Safety Advisory Task Force and Covid19 Recovery efforts. Most importantly, Ms. Inchausti's true passion and dedication is in prioritizing equity and inclusion in all city operations.

Ms. Inchausti was raised in Southern California and received a Bachelor's degree in Psychology from Loyola Marymount University. She then moved to Arizona and received a Master's in Counseling from Northern Arizona University. She has been a proud resident of Tempe for over 25 years where she raised her daughters Alexia and Andrianna.
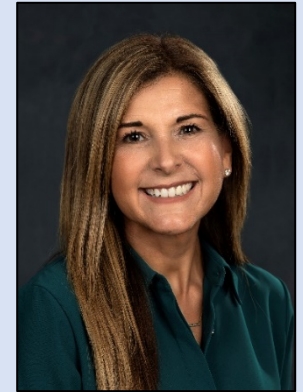
Dr. Nathan LaCross
Wastewater Surveillance Program Manager
Utah Department of Health | USA
nlacross@utah.gov

Dr. Nathan LaCross is an epidemiologist with the COVID Active Response Team at the Utah Department of Health (UDOH). He received a Master of Public Health in 2006 and a doctorate in epidemiology in 2011, both from the University of Michigan. He first joined the Utah Department of Health in 2013 working with the Environmental Epidemiology Program on environmental health issues in Utah. Since March of 2020, he has been working on COVID-19 surveillance and assisting the state's pandemic response. In November 2020, Dr. LaCross moved to a new position within UDOH to manage Utah's wastewater surveillance program.

Dr. Sandra McLellan (see above for photo and bio)
Professor
University of Wisconsin School of Freshwater Sciences | USA
mclellan@uwm.edu

Halley Reeves
Vice President of Community Health Impact
Oklahoma University Medicine | USA
Halley.Reeves@oumedicine.com

Closing Remarks for Day 2

Mr. Philip J. Mattson
Department of Homeland Security (DHS), Science and Technology Directorate (S&T) | USA

Dr. Nancy J. Lin
National Institute of Standards and Technology (NIST) | USA

DAY 3: FRIDAY, JUNE 18, 2021

Welcome & Logistics

Mr. Philip J. Mattson
Department of Homeland Security (DHS), Science and Technology Directorate (S&T) | USA

Dr. Nancy J. Lin
National Institute of Standards and Technology (NIST) | USA

SWWS 301: Building an Enduring Capability

Session Chair: **Mr. Philip J. Mattson**
Standards Executive
Department of Homeland Security (DHS), Science and Technology Directorate (S&T) | USA
Philip.mattson@hq.dhs.gov

Mr. Philip J. Mattson serves as the Department of Homeland Security (DHS) Standards Executive and Senior Standards Advisor in the DHS Science and Technology Directorate (S&T). He coordinates standards and conformity assessment activities across the Department and manages a broad portfolio of standards development activities including detection and personal protective equipment standards and response robot test method development.

Mr. Mattson is the DHS representative to the Interagency Committee on Standards Policy, and currently chairs the ASTM E54 Committee on Homeland Security Applications. He serves on the Board of Directors of the American National Standards Institute (ANSI) and also serves on several ASTM Technical Committees, the ANSI Unmanned Aircraft Systems Standardization Collaborative Steering Committee, and on standing committees in ANSI, the Society for Standards Professionals and in the Interagency Board for Emergency Preparedness and Response.

He holds a bachelor's degree in Nuclear Engineering Technology from Oregon State University, and a master's degree in Nuclear Physics from the Naval Postgraduate School. He has extensive training in nuclear weapons and radiological incident management and is a registered Professional Engineer. Mr. Mattson is a retired U.S. Army officer; serving over 20 years as a combat engineer and nuclear physicist.

Speakers

Dr. Kimberli Miller
Wildlife Disease Specialist
U.S. Geological Survey (USGS) National Wildlife Health Center | USA
kjmiller@usgs.gov

Talk Title: Making It Count-Keeping It Available: Wildlife Disease Situational Awareness
Healthy and resilient wildlife, domestic animal, plant, human, and water resources all contribute to a healthy thriving ecosystem. Compounding stressors affect resiliency and can lead to disease outbreaks. Worldwide, over 40% of emerging diseases are estimated to have a wildlife connection1. Knowing where and when wildlife diseases are occurring and what species are involved is important for not only for understanding immediate disease risks but also the factors contributing to wildlife resiliency. The USGS National Wildlife Health Center (NWHC) is the only federal Biosafety level 3 diagnostic and research facility in the US focused on wildlife health and disease. Working with State, Federal, and Tribal partners, NWHC has amassed an extensive 45+ year collection of wildlife diagnostic and mortality event information including passive and active disease surveillance. In addition, state department of natural resource agencies generate data through their own wildlife health programs. These disparate data sources are important for real-time situational awareness and biosurveillance efforts but difficult to access. To address this data sharing need, NWHC created the Wildlife Health Information Sharing Partnership-event reporting system (WHISPers) through partnership and funding by the Department of Homeland Security – Countering Weapons of Mass Destruction - National Biosurveillance Integration Center. This on-going project has required careful attention and creative solutions to curating disease data for public and partner use. (Jones and others. 2008. Global trends in emerging infectious diseases. Nature.)

Dr. Kimberli Miller has been a Wildlife Disease Specialist at the USGS National Wildlife Health Center since 1992. She has a Doctor of Veterinary Medicine degree and a BS degree in Animal Science from the University of Missouri-Columbia. Since joining the NWHC, Kim has worked on disease issues and questions across the country. This work has allowed Kim to practice non-traditional veterinary medicine and be involved in wildlife conservation on a large scale. One long term project involved representing NWHC as a founding partner in reintroducing whooping cranes to the Eastern US. Presently her efforts have been focused on data management and making Center wildlife mortality information more available for use by internal and external users. She has a DVM and a BS in Animal Science from University of Missouri-Columbia.

Dr. Jayne B. Morrow
Assistant Vice President of Research and Economic Development
Montana State University | USA
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Talk Title: <u>Documentary Standards for Biological Response</u>

Dr. Jayne B. Morrow has led a broad portfolio of research program and science policy development relevant to a range of priorities in the United States and abroad including dynamic technical and policy challenges presented by the biosurveillance and biological threat response communities. Dr. Morrow has demonstrated a career working across stakeholders to foster engagement, create strategic vision and build consensus including development of standards on a range of technical program and public policy areas including national security, environmental health, public health and safety and law enforcement for response to Anthrax, Ebola, SARS-CoV-2 and applied these same principles to the analytical characterization of the opioid epidemic. Dr. Morrow formerly led national science and technology (S&T) strategic policy development as the Executive Director of the National Science and Technology Council in the Executive Office of the President during the Obama Administration. Prior to that position she led biothreat response and metrology for biological science programs at the National Institute of Standards and Technology. Her research efforts have resulted in 45 peer-reviewed articles, reports and standards; over 200 technical presentations and operational exercises. Recently, to enhance the response to COVID-19, Dr. Morrow partnered with motivated volunteers to form a non-for-profit entity, CLEAN2020 Summit, to bring together leaders from business, policy, standards development, science and engineering to better understand current knowledge and identify opportunities to work together to control viral transmission in the built environment. These efforts continue to help translate the research, standards and guidance into practice. She currently serves as the Assistant Vice President of Research and Economic Development at Montana State University where she is working to develop stronger connections between science, technology and research among academia, industry and government agencies. She has a B.Sc. degree in Civil Engineering from Montana State University as well as a M.S. and Ph.D. in Environmental Engineering with a specialty in molecular and microbiology from the University of Connecticut.

Dr. Orin C. Shanks
Senior Scientist
Environmental Protection Agency (EPA) | USA
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Talk Title: <u>Development and Performance of NIST SRM 2917 for Molecular Recreational Water Quality Testing</u>

Dr. Orin Shanks is a Senior Scientist for the United States Environmental Protection Agency in the Office of Research and Development Center for Environmental Measurement and Modeling. Dr. Shanks has been with the EPA for over 15 years. His chief research interests include molecular

method development and implementation, fecal source identification, nucleic acid fate and transport, and wastewater surveillance. Dr. Shanks received his undergraduate and master's degrees from the University of Wyoming and his Ph.D. from Oregon State University.

Ms. Patsy Root
Regulatory Affairs Manager
IDEXX Water | USA
patsy-root@idexx.com

Talk Title: Draft Accreditation Checklist for Wastewater COVID PCR Testing
This talk will review the need for, and development of, a checklist for laboratories to follow when performing and requesting accreditation for methods that test for SARS CoV-2 virus in wastewater.

Ms. Patsy Root received her M.S. in Biochemistry from University of Maine, Orono. Ms. Root has over 14 years' experience in water microbiology, water-related regulations and environmental laboratory accreditation. She has worked with a variety of regulatory agencies worldwide in attaining regulatory approval for IDEXX methods and on Validation/verification of methods. She is a long-time participant in various standards development organizations including with TNI, Standard Methods for the Examination of Water and Wastewater and ASHRAE. Ms. Root is an active member of the following organizations:

- American Public Health Laboratories; Environmental Laboratory Science Committee, member ASHRAE, Standard 188:2015, Guideline 12:2000, ASHRAE 514 on Legionellosis prevention
- American Water Works Association (AWWA), member
- AOAC, Water and Wastewater subcommittee, Chair
- American Council of Independent Laboratories (ACIL),
- Environmental Science Section (ESS), member
- Wastewater/COVID Accreditation Task Group, Chair
- Canadian Water Works Association (CWWA), Drinking Water Committee, member
- Environmental Laboratory Advisory Board (ELAB), a US EPA Federal Advisory Committee Act (FACA) Board, reporting the US EPA Administrator; past Chair
- National Environmental Monitoring Conference (NEMC), Session Coordinator
- Standard Method for the Examination of Water and Wastewater, Part 9000, reviewer and contributor; Part 9213 Joint Task Group
- TNI, The National Environmental Laboratory Accreditation Conference
- Executive Board of Directors, Secretary of the Board
- Policy Committee, Chair

- Microbiology Expert Committee, Past Co-Chair
- Microbiology Proficiency Testing Committee, member

Dr. Amy E. Kirby
National Wastewater Surveillance System Program Lead
Centers for Disease Control and Prevention (CDC) | USA
agk1@cdc.gov

Talk Title: Enduring Capability: NWSS Perspective

Dr. Amy E. Kirby is an Environmental Microbiologist in the Waterborne Disease Prevention Branch and the Program Lead for the National Wastewater Surveillance System (NWSS) at the Centers for Disease Control and Prevention (CDC). She has a Bachelor of Science in Agriculture (BSA, major: Microbiology) from the University of Georgia, a PhD in Microbiology from the University of Buffalo, SUNY, and a Master's of Public Health in Epidemiology from Emory University. At CDC, Dr. Kirby is interested in leveraging environmental microbiology methods to measure pathogens, antibiotic resistance genes, and other health indicators in natural and man-made water systems. This data can be used to estimate health risks from environmental exposures, as well as measures of the health of the surrounding communities. Since February 2020, she has been working on the COVID-19 response as part of the Water, Sanitation, and Hygiene team. As part of that team, she led the development and implementation of NWSS.

DHS

Talk Title: Enduring Capability: Biosurveillance Perspective

Dr. Tonya Lynn Nichols
Senior Science Advisor
Environmental Protection Agency (EPA) | USA
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Talk Title: Enduring Capability: One Health Perspective

Mr. Jeffrey A. Wenzel
Chief, Bureau of Environmental Epidemiology
Missouri Department of Health and Senior Services | USA
Jeff.Wenzel@health.mo.gov

Talk Title: <u>Enduring Capability: Public Health Decision Maker Perspective</u>
Presentation will discuss what would be needed for the nation to build an enduring capability in wastewater surveillance overall as it relates to standards (e.g., documentary standards, reference, materials, methods and data comparability).

Mr. Jeffrey A. Wenzel has worked for the Missouri Department of Health and Senior Services for 19 years. During that time, he has served multiple roles including laboratory scientist, environmental specialist, epidemiologist, and has served in his current role of Bureau Chief of the Bureau of Environmental Epidemiology for the last 3 years.

Dr. George A. Conway
Director
Deschutes County Health Services Department | USA
george.conway@deschutes.org

Talk Title: <u>Enduring Capability: A Local Health Department Perspective</u>
We have piloted and now routinely use wastewater sampling for supplemental SARS-CoV2 (COVID-19) genomic surveillance. This method is promising for early detection of arrival or re-emergence of pathogens, and also adds to our local screening for variants of interest (more pathogenic or more readily transmissible strains). To become a generally effective, reliable surveillance tool for early warning for this and other pathogens, the methods used for concentrating and testing samples will need to be better standardized, and the overall detection level made more sensitive, reliable, and reproducible in different laboratories.

George A. Conway, MD, MPH is a physician and epidemiologist known for his work in outbreak investigation, epidemic response, environmental health, and human adaptation to extreme environments. Director of the Health Services Department for Deschutes County, Oregon since 2016, Dr. Conway previously served in multiple senior level positions with the US Centers for Disease Control and Prevention (CDC), including 2012 through 2015 as CDC Senior Advisor to the Chinese Centers for Disease Control and as Public Health Attaché for the U.S. Embassy in Beijing, concentrating on the epidemiology and mitigation of air pollution health effects and epidemic response. He also served as Senior Medical Officer and Epidemiologist for the United Nations Mission for Ebola Emergency Response in Liberia during the West Africa epidemic, November 2014 to June 2015.

Dr. Larry Madoff
Medical Director, Bureau of Infectious Disease and Lab Science
Massachusetts Department of Public Health | USA
larry.madoff@mass.gov

Talk Title: Wastewater Surveillance for COVID in Massachusetts

Dr. Larry Madoff is an infectious disease physician specializing in the epidemiology of emerging pathogens, bacterial pathogenesis, and international health. He is Professor of Medicine at the University of Massachusetts Medical School and Lecturer on Medicine at Harvard Medical School. Dr. Madoff serves as Medical Director of the Bureau of Infectious Disease and Laboratory Sciences for the Massachusetts Department of Public Health.

Dr. Madoff directed the International Society for Infectious Diseases' Program for Monitoring Emerging Diseases (ProMED), from 2002 to 2021. He is a member of the American Society for Microbiology, Massachusetts Medical Society, past President of the U.S. Lancefield Streptococcal Research Society, a Fellow of the Infectious Diseases Society of America and a Fellow of the American College of Physicians. A graduate of Yale College and Tufts Medical School, he performed his Internal Medicine Residency at New York Hospital-Cornell Medical Center and his Infectious Disease Fellowship at the Harvard Medical School-Longwood program.

Panel Discussion: **Enduring Capability and Role of Standards**

*Moderator***: Mr. Philip J. Mattson** (see above for photo and bio)
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Panelists:

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CONCURRENT BREAKOUT SESSIONS

SWWS 302: Methods and Data Comparability Breakout

Session Co-Leads

Dr. Scott A. Jackson

Leader of Microbial Metrology Group, Material Measurement Laboratory
National Institute of Standards and Technology (NIST) | USA
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Dr. Scott A. Jackson leads efforts internationally to improve microbiome and pathogen detection measurements through the development of standards. (See full bio at: https://www.linkedin.com/in/thescottjackson/)

Dr. Mia Mattioli

Environmental Engineer
Centers for Disease Control and Prevention (CDC) | USA
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Dr. Mia Mattioli is the Principle Investigator for the CDC's Waterborne Disease Prevention Branch's Domestic WASH Lab within Environmental Microbiology and Engineering Laboratory Team. Her research focuses on the intersection between the environment and human health with a specific interest in the relationship between, and fate and transport of, fecal indicators and enteric pathogens. Her lab is engaged in a wide range of environmental research areas including drinking water, irrigation water, wastewater, recreational water, soil, food, water distribution systems, and the development of advanced molecular detection technologies. Dr. Mattioli also leads CDC's environmental investigations of waterborne outbreak responses and currently serves as the Science Lead for the CDC National Wastewater Surveillance System. She has a Bachelor of Science in Biological Engineering from the University of Georgia and a Master and Ph.D. in Environmental Engineering from Stanford University.

Ms. Sarah Wright
Environmental Laboratories Manager
Association of Public Health Laboratories | USA
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Ms. Sarah Wright, MS, is an environmental laboratories manager at the Association of Public Health Laboratories in Silver Spring, MD. In this role, she works to strengthen state and local environmental laboratories. Current projects include working with the CDC National Wastewater Surveillance System to build public health laboratory wastewater surveillance testing capacity. Previously, she conducted watershed assessments in Wisconsin for the City of Racine and worked on national water policy at The Johnson Foundation at Wingspread. She has a master's degree in environmental monitoring from Ohio University and an environmental science and policy degree from Duke University.

Session Scribe: **Dr. Paulina K. Piotrowski**
Research Chemist
National Institute of Standards and Technology (NIST) | USA
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Dr. Paulina Piotrowski is currently a Research Chemist within the Organic Chemical Metrology Group at the National Institute of Standards and Technology (NIST) in Gaithersburg, MD. Dr. Piotrowski is an expert in untargeted mass spectrometry-based analyses of complex matrix samples. At NIST, she develops omics-based measurement techniques and standards for the microbiome and complex microbial systems.

SWWS 303: Reference Materials Breakout

Session Co-Leads

Dr. Katrice A. Lippa
Leader, Organic Chemical Metrology Group
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Dr. Katrice Lippa obtained her Ph.D. in environmental chemistry from Johns Hopkins University in 2002 and then joined NIST as a research chemist after completing an NRC postdoctoral fellowship in 2005. Dr. Lippa is currently Leader of the Organic Chemical Metrology Group within the Material Measurement Laboratory at NIST, a position she has held since 2016. She manages numerous laboratory QA/QC products and programs for clinical diagnostics and metabolomics, food nutrition and safety, natural and plant-based products, chemical manufacturing, forensics and drug standard sectors.

Dr. Orin C. Shanks
Senior Scientist
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Dr. Orin Shanks is a Senior Scientist for the United States Environmental Protection Agency in the Office of Research and Development Center for Environmental Measurement and Modeling. Dr. Shanks has been with the EPA for over 15 years. His chief research interests include molecular method development and implementation, fecal source identification, nucleic acid fate and transport, and wastewater surveillance. Dr. Shanks received his undergraduate and master's degrees from the University of Wyoming and his Ph.D. from Oregon State University.

Ms. Briana Benton
Technical Manager
ATCC | USA
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Ms. Briana Benton is the Technical Manager for ATCC's Sequencing and Bioinformatics Center (SBC). She is a key member leading the development of the ATCC Genome Portal and is currently responsible for the next-generation sequencing (NGS) of the various collections within

ATCC. During her time with ATCC, she has developed numerous microbiome standards, as well as molecular assays for the authentication of infectious viral and bacterial pathogens.

Session Scribe: **Dr. Stephanie L. Servetas**
Microbiologist
National Institute of Standards and Technology (NIST) | USA
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Dr. Stephanie L. Servetas is a microbiologist in the Complex Microbial Systems Group at the National Institute of Standards and Technology (NIST). Her research is focused on whole cell and multi-omic measurements of microbial communities, both natural and contrived. While at NIST, Dr. Servetas has worked on the development of reference materials for pathogen detection and development of the Whole Stool Gut Microbiome reference material.

SWWS 304: Documentary Standards – Guidance Documents Breakout

Session Co-Leads

Dr. Nancy J. Lin
Biomaterials Group Leader, Material Measurement Laboratory
National Institute of Standards and Technology (NIST) | USA
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Dr. Nancy J. Lin is the Leader of the Biomaterials Group in the Biosystems and Biomaterials Division of the Material Measurement Laboratory at NIST. Her research focuses on developing measurements and standards to enable the detection and quantification of microbes and microbial communities, with an emphasis on total and viable cell count for microbial cell reference materials, biofilm-material interactions, antimicrobial efficacy, and biosurveillance. Dr. Lin holds a BS in Mechanical Engineering from Valparaiso University and a PhD in Biomedical Engineering from Case Western Reserve University.

Ms. Patsy Root
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Ms. Patsy Root received her M.S. in Biochemistry from University of Maine, Orono. Ms. Root has over 14 years' experience in water microbiology, water-related regulations and environmental laboratory accreditation. She has worked with a variety of regulatory agencies worldwide in attaining regulatory approval for IDEXX methods and on Validation/verification of methods. She is a long-time participant in various standards development organizations including with TNI, Standard Methods for the Examination of Water and Wastewater and ASHRAE.

Session Scribe: **Dr. Sandra Da Silva**
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SWWS 401: Summary of Breakout Sessions

Session Chair: **Mr. Yonas Nebiyeloul-Kifle**
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Mr. Yonas Nebiyeloul-Kifle coordinates voluntary consensus standards and related measurement science R&D projects for DHS mission needs to include grants, procurement, systems engineering, S&T policy and tech-transfer projects.

Final Remarks & Next Steps

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Dr. Nancy J. Lin
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