

## DOE Workshop - Measuring Life-Cycle Greenhouse Gas Emissions from Water Resource Recovery Facilities

## Plenary Presentation (Breakout 4)

January 23-24, 2024

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## Agenda

- Overview of WRF
- Why is this topic important to utilities?
- WRF's research subtopic on Climate Mitigation and examples of GHG related projects
- Execution considerations
- Questions & Answers

# About WRF (The Water Research Foundation)

Our Purpose: To advance the science of water to improve the quality of life for all communities.



Identify, fund, & manage research for the water sector Convene experts & sector representatives to identify and collaborate on priority water research Educate decisionmakers on the science of water



### **BY THE NUMBERS**

#### AS OF 8/31/2023

SUBSCRIBERS			FUNDED RESEARCH			RESEARCH PORTFOLIO	
٥	963	UTILITIES		\$81	MILLION	Q	264 ACTIVE PROJECTS
<b>0</b> 0	129	SOLUTION PROVIDERS Manufacturers & Consultants	<u>(@</u> )	\$49	MILLION CASH Contractually Funded Research	1000	66 CO-FUNDED PROJECTS 137 CO-FUNDERS
<b>22</b> 2	<b>49</b> wr	RFSTAFF	\$	\$32	MILLION COST SHARE	Î	<ul> <li>FEDERAL/STATE GRANTS</li> <li>FEDERAL CONTRACTS</li> <li>PRIVATE GRANTS</li> </ul>

\$.78 OF EVERY DOLLAR SUPPORTS PROGRAM SERVICES

RESEARCH PRIORITY | TAILORED COLLABORATION | EMERGING OPPORTUNITIES | GRANTS/AWARDS | PAUL L. BUSCH AWARD | FACILITATED & UNSOLICITED RESEARCH



Climate Risk Assessment & Adaptation, Communication, Environmental Justice, Digital Transformation

#### **WRF's Climate Change Research**

- Summary:
  - WRF's climate change topic hub
  - WRF's research portfolios include over <u>80</u>
     <u>climate change studies</u> across wastewater, stormwater, drinking water, and reuse water.
    - Climate Risk Assessment
    - Climate Adaptation
    - Climate Mitigation / GHGs



#### **Climate Change-Related Projects**

Climate change is altering our natural hydrologic cycle, creating uncertainty when it comes to the quality and quantity of water sources. WRF research helps the water sector plan for and prevent the impacts of climate change, from understanding potential impacts to implementing adaptation strategies and mitigating root causes. WRF's research on climate change covers the key areas of:

#### Climate Adaptation Climate Mitigation Climate Risk Assessment

WRF research tracks potential outcomes, considering a variety of possibilities, and provides resources and tools to help facilities identify and address risks and vulnerabilities. WRF also provides the science to help utilities create better adaptation plans, respond more effectively to severe weather, and improve infrastructure and operations to meet changing needs, including the production of onsite energy systems and back-up power to protect critical services. And by pioneering approaches to improve energy efficiency, including process optimization, improved energy management, and the use of renewable energy, WRF is also helping the water sector decrease the activity that is driving these changes.

#### **CLIMATE ADAPTATION**

Integrating Climate Change Impacts with Wet Weather Management, Capital Improvement, and Stream Network Enhancement [5176]

The project objectives are: (1) to enhance precipitation projection and modeling techniques with risk-based criteria to mitigate risks for utilities (e.g., sewer overflows, flooding, stream network deterioration); (2) to advance current practices for climate change rainfall statistics and projections by region and identify research gaps and other areas for refinement; and (3) to advance an integrated and risk-based approach for adapting water infrastructure systems and capital improvement planning to climate change while enhancing the protection of stream networks to meet receiving water quality requirements and mitigate wet weather flows.

#### To be completed in 2025.

Related Topics: Flooding, Resilience, Sewer Overflows, Stormwater, Wet Weather Management

#### Incorporating Equity and Social Dimension into Community Climate Adaptation Planning and Watershed Management [5180]

The project objectives are: [1] to identify appropriate metrics and measures for building resilient communities with equity and social considerations that blend lived experience of the community with technical expertise; (2) to WASTEWATER develop holistic mitigation strategies, including planning-level costs to reconcile the social 8 inequities associated with community climate STORMWATER adaptation and watershed management; (3) to develop or modify an easy-to-use supporting 03 WATER REUSE triple bottom line (TBL) tool and analysis framework that incorporates the ability to identify who receives the benefits and who pays for them so utilities can better assess equity implications of various options; and [4] to identify the leadership roles and engagement opportunities for communities when defining resilience and desired benefits for their communities (e.g., utilities and municipalities).

#### To be completed in 2025.

Related Topics: Community Resilience, Equity, Integrated Planning & Water Management, Social Dimension, Stakeholder Engagement

### **Research Subtopic:**

#### "Climate Change Mitigation: Addressing Greenhouse Gases"

- This research will provide best practices, methods, processes, and tools for effective planning and operational management to cost-effectively reduce and mitigate greenhouse gas (GHG) emissions to contribute to carbon neutrality by water utilities and municipalities.

- By collaborating with partners beyond the water sector, this research will focus on advancement in **GHG accounting and emission reductions**, **decarbonization strategies**, **carbon capture** associated with water utilities, and may support carbon emission trading. FIFTH NATIONAL CLIMATE ASSESSMENT
Chapter 1 | Overview



https://nca2023.globalchange.gov/

### **Ongoing Research on GHGs and Climate Mitigation (1)**

- <u>5188</u> "Establishing Industry-Wide Guidance for Water Utility Life Cycle Greenhouse Gas Emission Inventories"
- Project Objectives
  - Develop a utility-facing guidance document and a supporting spreadsheet tool that captures current best practices for developing a utility GHG inventory over the life cycle of capital and operational emissions.

- <u>5187</u> "Beyond Net Zero: Advancing Interdependencies Between Utility Greenhouse Gas Emission Reductions and Water-Energy-Food Nexus"
- Project Objectives
  - Develop a decision support framework and operational guidelines for WRRFs and synthesize case studies for Net-Zero Carbon and Beyond.



Climate Change 2022 Mitigation of Climate Change



### **Ongoing Research on GHGs and Climate Mitigation (2)**

- 5255 "Developing a GHG Emissions Library for Unit Processes by Water Utilities and Decentralized Systems"
- Project Objectives
  - Develop a standardized approach and establish a "GHG Emissions Library" with a basic framework in place that allows future updates as GHG emissions data from unit processes become more available.

- 5251 "Advancing the Understanding of Nitrous Oxide Emissions Through Enhanced Whole-Plant Monitoring and Quantification"
- Project Objectives
  - Provide accurate whole-plant N<sub>2</sub>O emissions estimates for WRRFs by employing continuous online monitoring (for a minimum one-year period) and develop guidance on related process conditions.

## **Ongoing Research on GHGs and Climate Mitigation (3)**

- 5220 "Sewer Methane Methods for Everyone"
- Project Objectives
  - To estimate the collection system (sewer) methane using new methodologies of progressively increasing accuracy and localinfrastructure specificity.
  - To enhance our knowledge of this hard-to-measure GHG source.

- 5072 "Mitigation Strategy Plan for Direct GHG Emissions from BNR Processes in New York City"
- Project Objectives
  - To develop a process specific N2O monitoring and mitigation strategy plan for BNR, which can also be followed for other processes, to control N2O production and emissions from the operations at WRRFs.

#### **Greenhouse Gas Emissions from Wastewater Treatment Operations**

(with "Public Plus" access)



Greenhouse Nitrogen Emissions from Wastewater Treatment Operations: Phase II MOLECULAR LEVEL THROUGH WHOLE REACTOR LEVEL CHARACTERIZATION

Co-published by

- Project Objectives / Outcomes
  - Continued the research into microbiological pathways involved in the formation and emission of nitrous oxide from wastewater treatment processes.
  - Provided insight into the mechanisms influencing emissions and direction to create environmentally sustainable BNR operating strategies and configurations.
- "Phase II" Report Published in 2015

(WRF Projects <u>1791</u> and <u>1792</u>)

#### **Greenhouse Gas Emissions Inventory and Energy Management**

(with "Public Plus" access)



Toolbox for Water Utility Energy and Greenhouse Gas Emission Management

Subject Area: Management and Customer Relations



(WRF Project <u>4224</u>)

- Project Objectives / Outcomes
  - Evaluated and compared the process models, impact assessment methods, and performance indicators used by water utilities on GHG emissions.
  - Identified how the supporting tools can be used to support management decisions at water utilities.

• Published in 2013

# WRF 5220 | Sewer Methane Methods for Everyone

- Develop methodologies for estimating collection system methane emissions
- CH4 sources represent a sizeable chunk of utility emissions



Budget: \$450K | Duration: 3 Years | Lead: Brown & Caldwell

# Food for thought?

- What are utilities doing about GHG emissions (estimation, monitoring, mitigation)?
- Emissions factors?
- GHG Emissions database?
- Collaborations?
- How to connect the dots with IPCC?











# Questions / Suggestions?

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