Air Issues & Regulations Committee

A Committee of the Bay Area Clean Water Agencies

Quarterly Meeting

March 19, 2025

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Agenda

- Introductions
- BACWA-Bay Area Air District (Air District) Implementation Workgroup
- Air District Rule Development
- Air District Permit Prioritization
- Air District Standard Permit Conditions
- CARB Statewide Air Toxics Pooled Emissions Study
- Nitrous Oxide Emissions from WRFs
- CARB Advanced Clean Fleet Regulations Implementation Update
- 2025 State Legislative Update
- Open Discussion/Member Updates
- Adjourn

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Introducing the Bay Area Air District

Bay Area Air District

- Preferred name is "Bay Area Air District" or "Air District"

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BACWA-Air District Implementation Workgroup Updates from January 13th Meeting

- Updates
  - Permit Prioritization
- Outlook on Engagement
  - Update from Air District on Strategic Plan and Resulting Rulemaking Priorities
  - Update from BACWA on Status of Edits to Standard Permit Conditions
  - Update from Air District on Future BACT Determination Process and Guidebook Updates
  - Update from Air District on Status of Rule 11-18 Amendments
  - Update from BACWA on the CASA Statewide Air Toxics Pooled Emissions Study Coordination
- Other Opportunities for Collaboration between BACWA and Air District

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Air District Implementation Workgroup Upcoming on April 21st

- Possible Topics
  - Update from Air District on Strategic Plan and Resulting Rulemaking Priorities
  - Update from Air District on Anaerobic Digester White Paper
  - Permit Prioritization
  - Air District Source Testing
  - Update from Air District on Future BACT Determination Process/Manager and Guidebook Updates
  - Update from Air District on Status of Rule 11-18 Amendments
  - Update from BACWA on the CASA Statewide Air Toxics Pooled Emissions Study Coordination
- Other Opportunities for Collaboration between BACWA and Air District

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Air District Rule Development

- Current Rule Development
  - Rule 11-18, Regulation 2 Back-up Generators, etc.
- Considered Rule Development
  - Regulation 2 Permitting Efficiencies/BACT, Rule 11-18 Phase 2 Facilities, Rule 2-5 Toxics NSR/Cumulative Impacts, etc.
- Potential Rule Development
- Anaerobic Digestion White Paper
  - BACWA meet with Air District September 30
  - Air District outreach to facilities?
  - White Paper draft anticipated Spring 2025

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Proposed Amendments to Rule 11-18: Risk Reduction from Air Toxics emissions at Existing Facilities

- Originally adopted in 2017 to address significant risk from existing facilities
- Annual update of facilities list based on prioritization score (check your facility's PS)
- Concept Paper & Proposed Amendments (December 2023)
- Air District response to BACWA Comment Letter (2/29/2024)
  - Simultaneous review of Preliminary HRA by facility and public
  - POTWs status in Phase II to allow for participation in Pooled Emission Study
  - Early risk reduction to the extent feasible
  - HRAs performed by consultant v. Air District staff
- Air District issued updated Implementation Procedures (April 2024)
- Anticipated draft language ~~late summer/early fall 2024~~ (Q1 2025)
- Anticipate additional updates to IP based on proposed amended rule

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Air District Permit Prioritization

- Strategic Plan Alignment
- Proposed Positions
  - Engineering Program Manager
  - BACT Coordinator
- Next Steps
  - Air District has requested estimate of future permit application increase
- Suggestions as to how to respond to this request?
  - Number of upcoming CIP projects
  - Other ideas?

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Air District Standard Permit Conditions

- Developing standard permit conditions (SPCs) to help streamline permitting
- SPCs for 3 processes in development
  1. Cogeneration Engines
  2. Anaerobic Digesters
  3. Food Waste Receiving Stations
- BACWA to return comments to Air District
- Next SPC expected to be Headworks

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CARB Statewide Air Toxics Pooled Emissions Study: Criteria Pollutants & Air Toxics Reporting (CTR)

- AB 617 and AB 2588 were updated to "harmonize" air monitoring, reporting, & emission reductions from stationary sources in CA for a long list of compounds
- **POTWs must participate in a two-step process (individually or as a group) to determine a shortlist of compounds to be monitored and reported**
  1. Scan air space of unit processes to determine detectable compounds
  2. Perform sampling and analysis to ultimately quantify emissions of detectable compounds (Mimic 1990 Pooled Emissions Estimation Program, PEEP, but broader in scope)
- Report business-as-usual through 2028 while performing two-step process (reporting begins in 2029 for 2028 data)

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CARB Statewide Air Toxics Pooled Emissions Study: Latest PES Activities

- Two-step process is being achieved in two Phases
  1)Develop applicable plan/protocol to perform two step process (**current activity**)
  2)Scan & quantify emissions (according to approved plan/protocol for performing two-step process)
- Presented Approach to Air Districts for feedback
  - Met with SCAQMD, San Diego APCSD, San Joaquin APCD, and Bay Area Air District
  - Met with CAPCOA, which formed a CTR Uniformity Group to support review/approval of plan/protocol
  - Met with CARB's team March 18
- PES Steering Committee working with Yorke Engineering to draft plan/protocol

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Updates & Next Steps

- BACWA invoicing impacted agencies
- Fee schedule remains unchanged
- CASA's Air Toxics Subgroup open to all PES participants with next meeting April 11th

FY 2024: Pay July 1, 2024	FY 2025: Pay July 1, 2024	FY 2026: Pay July 1, 2025*	FY 2027: Pay July 1, 2026
$200 per MGD	$1,000 per MGD	TBD, budget ~$1,250 per MGD	TBD, budget ~$1,250 per MGD
*BACWA is fronting costs for its members and will include amount in annual invoices to individual agencies.			

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Nitrous Oxide Emissions from WRFs

Bay Area Clean Water Agencies
Air Committee Quarterly Meeting
March 19, 2025

Krishna Pagilla, PhD, PE, BCEE
University of Nevada, Reno

University of Nevada, Reno

Outline

1. Brief Summary of Carbon Footprints of WRFs
2. Nitrous Oxide (N_2O) Emissions from WRFs
3. Findings of N_2O Emissions Studies – Then and Now
4. Discussion

What is a Carbon Footprint?

- The sum of **greenhouse gas (GHG) emissions** caused directly and indirectly by an individual, organization, event, or product
- *Measured in **CO2 equivalence** (CO2e) in metric tons per year*

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What emissions are normally included?

GHGs included:

- **Carbon dioxide (CO_2)**
- **Methane (CH_4)**
- **Nitrous oxide (N_2O)**
- Hydrofluorocarbons (HFCs)
- Chlorofluorocarbons (CFCs)
- Sulfur hexafluoride (SF_6)

GHGs normally not included:

- Water vapor
- Ozone (O_3)
- CO_2 from biogenic sources
- NO_x
- Carbon monoxide (CO)
- Sulfur dioxide (SO_2)
- Volatile organic compounds (VOCs)

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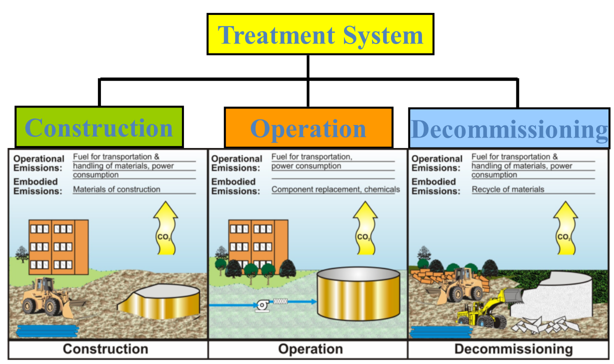
Global Warming Potentials (GWP), CO2e

- GWP based on the radiative effect of 1 kg of gas over 100 years (IPCC 2007), compared to CO2

Gas	GWP over 100 yrs (kg CO_2e / kg of gas)
CO_2	1
CH_4	25
N_2O	298
SF_6	23,900
HFCs	12 – 11,700
PFCs	6,500 – 9,200

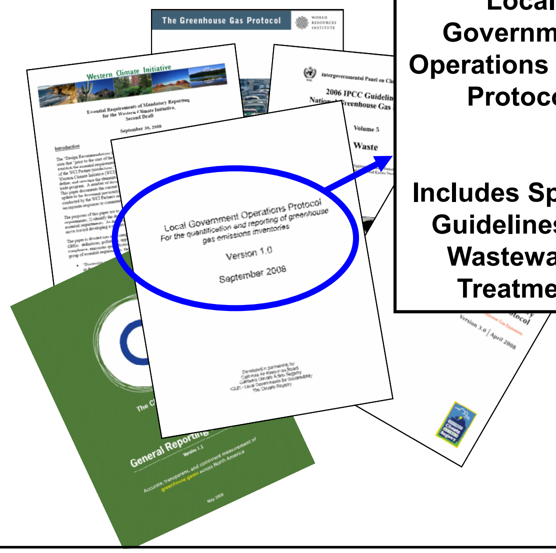
Carbon Footprinting Procedure

- Boundary definition
  - Whole system or subset
  - Timescale
- Data collection and analysis
  - Actual measurement
  - Using published emission inventory guidelines
  - Environmental product declarations (e.g. ITT)
- Interpretation of results



Published Protocols for Carbon Footprinting

- Intergovernmental Panel on Climate Change (IPCC)
- World Resource Institute (WRI)
- US EPA Climate Leaders
- UK Water Industrial Research (WIR)
- ICLEI- Local Gov. for Sustainability



Local Government Operations (LGO) Protocol

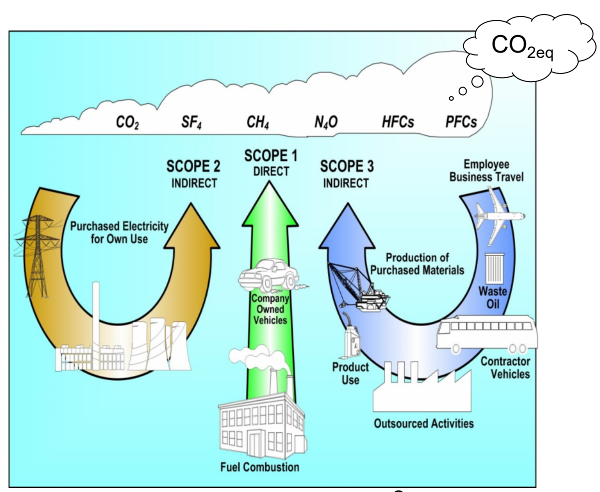
Includes Specific Guidelines for Wastewater Treatment

LGO and WRI Protocols include Scope Definitions in Accounting

Scope 1
Process or operational emissions

Scope 2
Purchased power

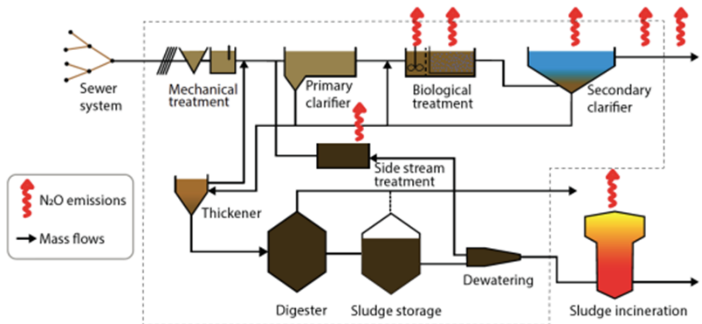
Scope 3
Chemicals
Embodied carbon



Source: WRI/WBCSD

Nitrous Oxide (N_2O)

- Emitted from
  - Biological N Removal Processes
  - Secondary Treatment
  - Effluent Discharge Emissions
  - Incomplete Combustion Sources
  - Land Application of Biosolids



Possible Nitrous Oxide (N_2O) Pathways

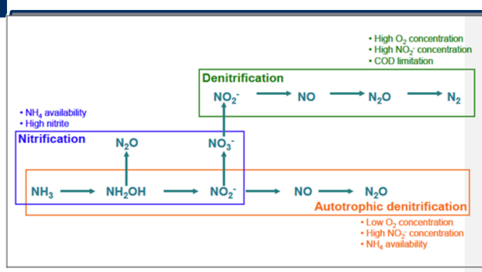
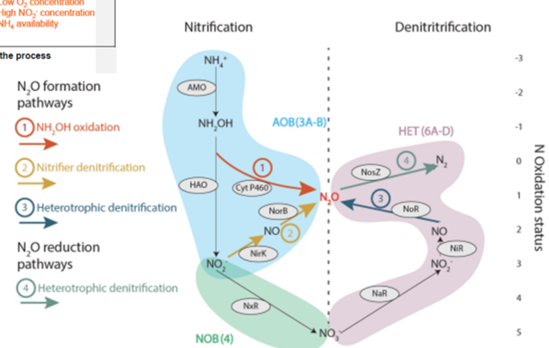


Figure 1 Schematic overview of the possible routes of N_2O emission and the process parameters that were found to influence the formation of N_2O.

Ref. STOWA 2011

- Influencing Factors:
  1. High NH_4-N and High NO_2-N in Nitrification
  2. Low DO, High NO_2-N, and NH_4-N Availability in Autotrophic Denitrification
  3. High DO, High NO_2-N, BOD/COD Limitation in Heterotrophic Denitrification



N_2O emissions from activated sludge processes (Ahn et al., 2010. EST; Ahn et al., 2010, WER; Rassamee et al., 2011, B&B)

- National Study Funded by Water Environment Research Foundation (WERF U4R07)
  - Existing Method was Based on Emission Factors for Non-BNR (3.2 g N_2O/population equivalents (PE)/year) and BNR (7.0 g N_2O/population equivalents (PE)/year) WRFs. WRFs contribute about 1.6% of N2O Global Emissions including Effluent Emissions (0.5% of Effluent N).
  - Goals: 1. Develop a database of N2O emissions based on standard protocol, 2. Determine key operational and process factors correlated with N2O emissions
  - 12 Water Reclamation Facilities and a Lot of Bench Scale Work
  - USEPA Reviewed Protocol for Direct Measurement
  - Measured Plant Process Data including Performance and Operations Data

N_2O emissions from activated sludge processes, 2008-2009: Results of a national monitoring survey in the United States (Ahn et al., 2010)

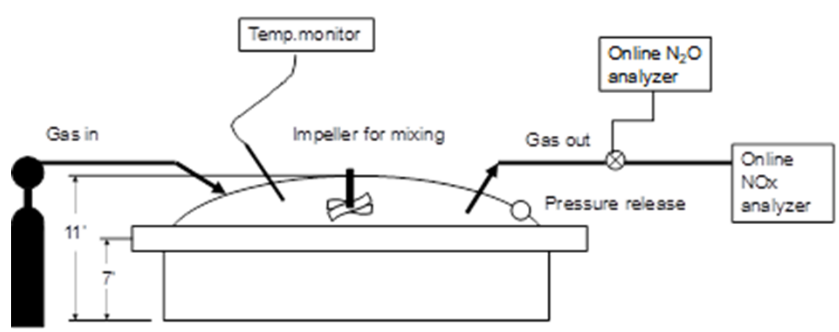


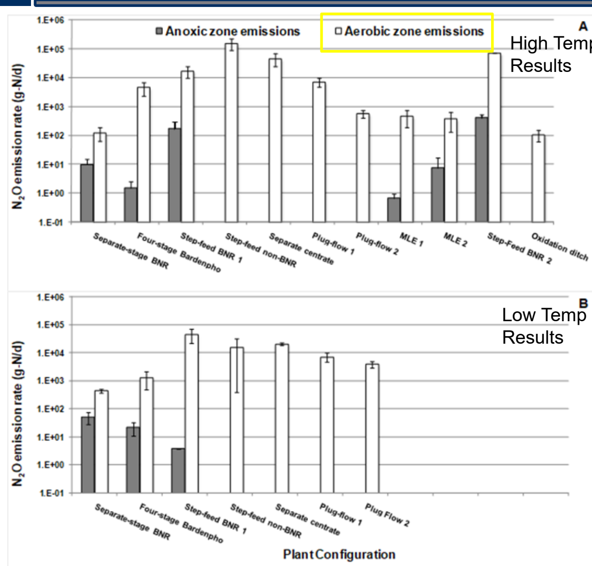
Figure 1: Full-scale measurement of nitrogen gases will be done using the USEPA surface emission isolation flux chamber (modified from (1))

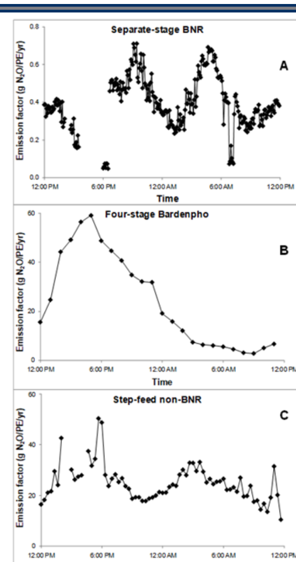
Results from National Study

Table I: Summary of N_2O fluxes and emission factors measured at full-scale WWTPs

Plant Configuration	Temp(°C)	Q (MGD)	% influent TKN emitted as N_2O	% TN removed emitted as N_2O	Emission factor ($g\ N_2O/PE/yr$)
Separate-stage BNR	15 ± 0.48	23	0.03 ± 0.00	0.03 ± 0.01	1.2 ± 0.18
	23 ± 0.28	27	0.01 ± 0.00	0.01 ± 0.00	0.28 ± 0.13
Four-stage Bardenpho	14 ± 0.26	7.8	0.16 ± 0.10	0.19 ± 0.12	9.8 ± 6.1
	23 ± 0.20	8.1	0.60 ± 0.29	0.66 ± 0.32	33 ± 16
Step-feed BNR 1	19 ± 0.22	29	1.6 ± 0.83	2.9 ± 1.5	92 ± 47
	25 ± 0.28	30	0.62 ± 0.27	0.90 ± 0.39	33 ± 14
Step-feed non-BNR	17 ± 0.12	71	0.18 ± 0.18	0.37 ± 0.36	13 ± 13
	26 ± 0.81	93	1.8 ± 0.79	3.3 ± 1.5	97 ± 43
Separate centrate*	30 ± 2.3	2.0	0.24 ± 0.02	0.63 ± 0.06	*
	34 ± 0.32	1.6	0.54 ± 0.16	0.96 ± 0.32	*
Plug-flow 1	11 ± 0.20	18	0.40 ± 0.14	0.92 ± 0.32	23 ± 7.9
	23 ± 0.46	15	0.41 ± 0.14	0.70 ± 0.24	28 ± 9.6
Plug-flow 2	11 ± 0.41	8.7	0.62 ± 0.15	1.7 ± 0.41	26 ± 6.4
	22 ± 0.58	6.6	0.09 ± 0.03	0.22 ± 0.06	5.0 ± 1.4
MLE 1	26 ± 1.8	4.0	0.07 ± 0.04	0.09 ± 0.05	6.8 ± 3.5
MLE 2	26 ± 0.17	4.1	0.06 ± 0.02	0.07 ± 0.03	5.4 ± 2.0
Step-feed BNR 2	29 ± 0.18	14	1.5 ± 0.02	1.7 ± 0.02	140 ± 1.2
Oxidation ditch	19 ± 0.58	3.4	0.03 ± 0.01	0.03 ± 0.01	1.8 ± 0.77
Step-feed BNR 3	24 ± 0.78	57	0.05 ± 0.03	0.06 ± 0.03	4.1 ± 2.2

Results from National Study (2008-2009)
Anoxic and Aerobic Zones
Diurnal Variability





Bench Scale Work (Rassamee et al., 2011)

Table II. SBR operating sequence for each experimental condition.

Operating condition	Sequence	Duration
Fully aerobic (DO = 6–7 mg/L)	Feeding + aerobic	7 min
	Aerobic	9 h 53 min
	Settling	1 h 35 min
	Decant	25 min
Anoxic–aerobic at high DO (DO = 4–6 mg/L during aeration)	Feeding	7 min
	Anoxic	1 h 53 min
	Aerobic	8 h
	Settling	1 h 35 min
	Decant	25 min
Anoxic–aerobic at low DO (DO = 1–3 mg/L during aeration)	Feeding	7 min
	Anoxic	1 h 53 min
	Aerobic	8 h
	Settling	1 h 35 min
	Decant	25 min
Intermittent aeration (DO = 0–6 mg/L), air pump was on for 30 min and off for 60 min	Feeding + aerobic	7 min
	Intermittent aeration	10 h
	Settling	1 h 35 min
	Decant	25 min

Bench Scale Work (Rassamee et al., 2011)

Table III. Summary of reactor performance for each operating condition.

Operating conditions	Cycle	TN (mg N/L) at the beginning of cycle	COD (mg/L) at the beginning of cycle	COD/N ratio	Maximum N_2O (aq) (μg N/L)	Maximum N_2O (aq) (% of TN at the beginning of the cycle)	N_2O mass (μg)	% N_2O–N/TN–N
Fully aerobic	1	22.9	28	1.22	230.9	1.01	136.78	0.20
	2	24.2	21	0.87	203.2	0.84	153.75	0.21
	3	22.3	18	0.81	88	0.39	134.9	0.20
	4	20.5	45	2.2	31.2	0.15	147.95	0.24
	5	20.6	44	2.14	3.5	0.02	104.4	0.17
Anoxic–aerobic at high DO	1	15.3	116	7.59	36.4	0.24	30.07	0.07
	2	14.3	113	7.9	19.8	0.14	20.10	0.05
	3	17	38	2.24	10.4	0.06	11.37	0.02
	4	18.1	22	1.22	8.6	0.05	17.47	0.03
	5	16.6	32	1.92	5.5	0.03	44.08	0.09
Anoxic–aerobic at low DO	1	8.1	14	1.74	38.2	0.47	5.12	0.02
	2	7.8	17	2.18	15.9	0.2	7.10	0.03
	3	8.4	6	0.72	5.5	0.07	6.20	0.02
	4	9.8	18	1.84	4.7	0.05	10.10	0.03
	5	7.2	13	1.8	0	0	0	0
Intermittent aeration	1	15.6	32	2.05	133	0.85	173.46	0.37
	2	20.6	38	1.84	49.6	0.24	119.25	0.19
	3	10.5	31	2.95	31.8	0.3	122.8	0.39
	4	10	29	2.9	28.8	0.29	110.2	0.37
	5	9.9	131	13.23	0	0	0	0

Key Findings from Our Work (Then)

- Aerobic N2O emissions are more than anoxic emissions
- High variability among WRFs and within WRF diurnally
- Single emission factor for all WRFs is not appropriate
- High Nitrite, Ammonium, and DO Concentrations were positively correlated to N2O Emissions; Other factors may play an indirect role
- BNR processes that minimize transient conditions and achieve complete N removal (low TN effluents) are likely to have lower N2O emissions

Table 11 Risk matrix to determine risk level of N_2O emission.

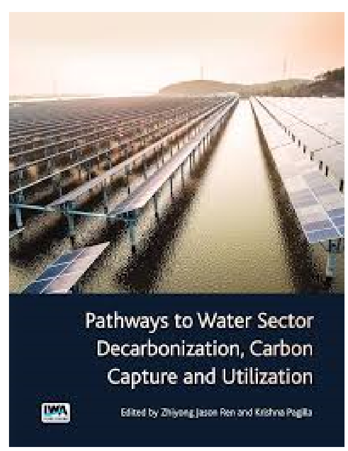
Risk on N_2O	High	Medium	Low
Parameter			
Effluent total nitrogen (mg/l)	> 10	5 - 10	< 5
Range in N-concentration in plant	H	M	L
Load variations (daily)	H	M	L
Maximum NO_2 concentration (mg N/l) anywhere in plant	> 0.5*	0.2 – 0.5	0.2

Ref. STOWA 2011

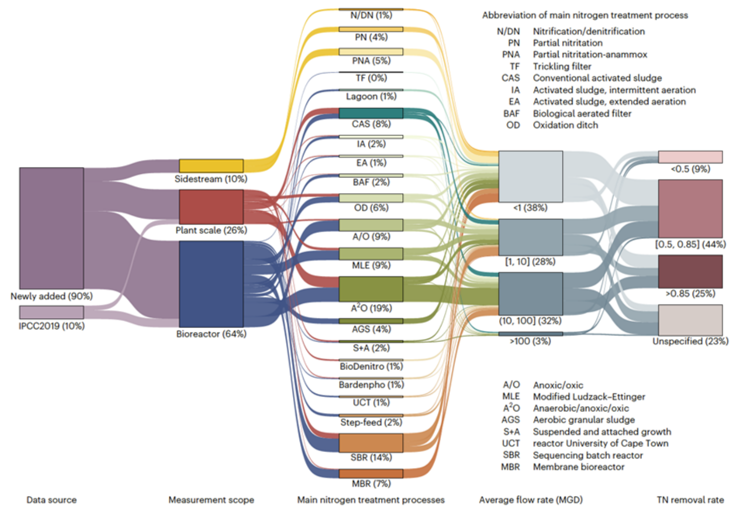
Key Findings from Recent Work (Now)

Oversimplification and Mis-estimation of Nitrous Oxide Emissions from Wastewater Treatment Plants, 2024 – Cuihong Song, Jun-Jie Zhu, John Willis, Daniel Moore, Mark Zondlo, ***Zhiyong Jason Ren****, Nature Sustainability*

- 376 N2O Emission Observations from 119 Publications were Analyzed Using Data Mining Tools
- Facilities Include Plant Scale, Bioreactor, and Sidestream Processes
- Insights Gained were classified based on Process Type, BNR vs. Non-BNR, Low Emission (<1% EF) vs. High Emission (>1% EF), and Locations within WRF.



Key Findings from Recent Work (Now)
Ren's Study Details



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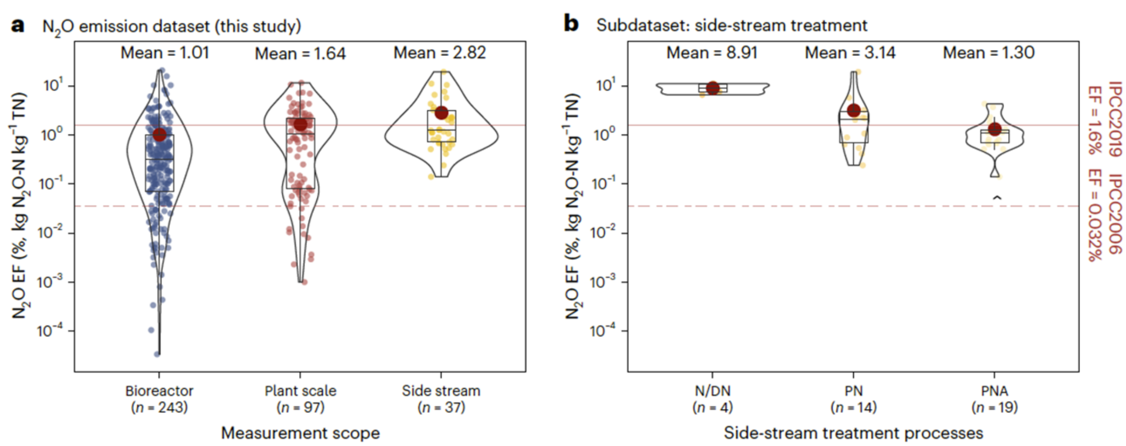
Key Findings from Recent Work (Now)
N2O Emission Factors



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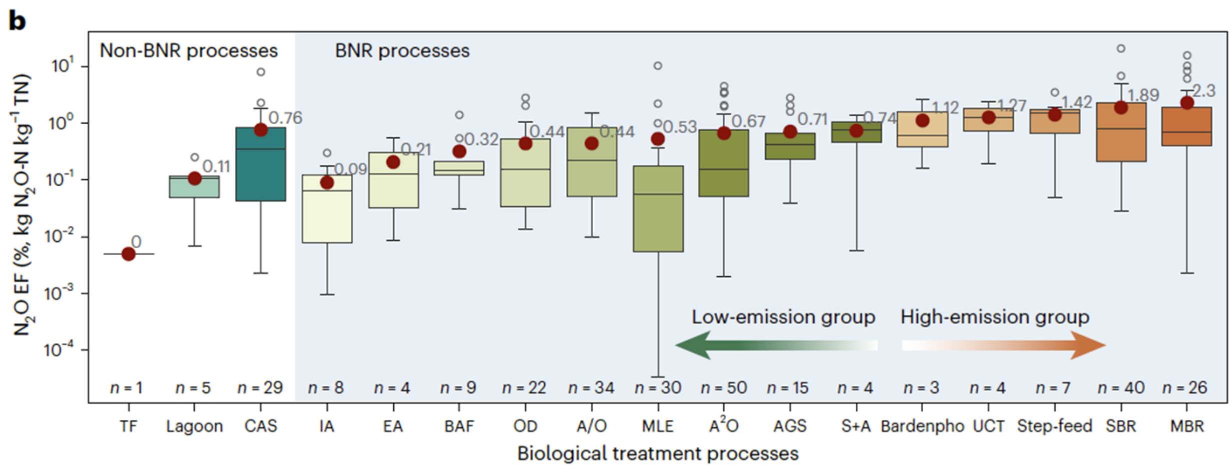
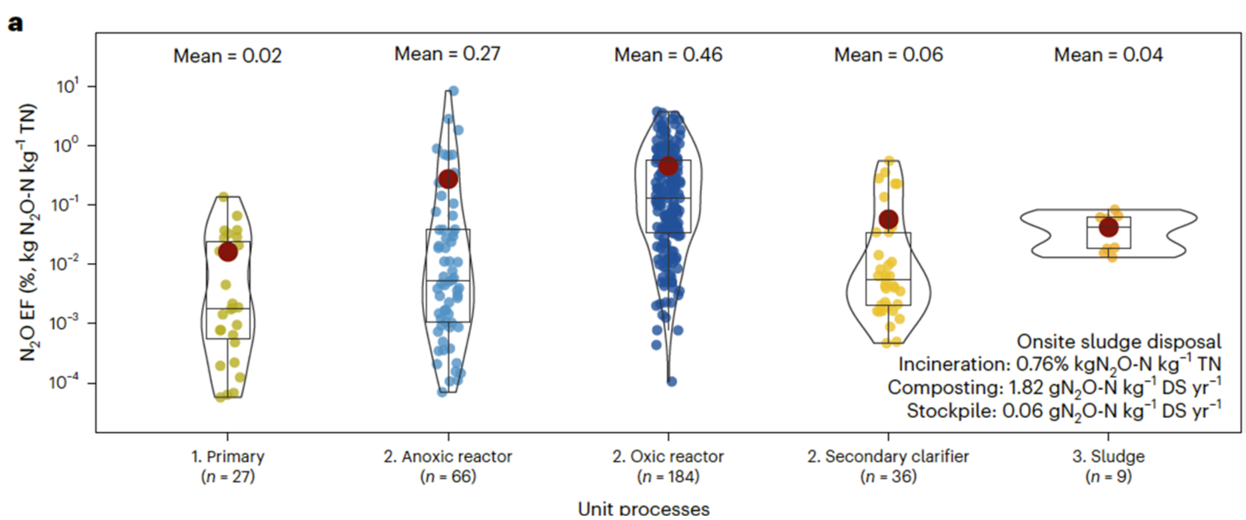
Key Findings from Recent Work (Now)

Process Type Emission Factors



Key Findings from Recent Work (Now)

WRF Locations and N2O Emissions



Summary

- BNR WRFs Emit N2O at Various Levels – Variability is Common
- Need Facility Approach for Accurate Estimation
- Many Process Factors (Temperature, DO, pH, Ammonium Levels, C/N Ratio, Aeration Rate/Type, and Transient Conditions) Are Responsible, but DO and Transient Conditions are Dominant Factors for N2O Emissions
- Low TN Plant have Lower Risk of N2O Emissions
- Understanding of N2O Emission at a Facility is Directly Related to Understanding of the BNR Operations and Performance
- N2O Emissions in WRFs Account Constitute Majority of the Total Direct (Scope 1) GHG Emissions

Discussion
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2025 State Legislative Process

- 2025 Bills introduced by February 21st
- CASA used key words to filter bills, which are organized under the following categories:
  - Air Quality – focused on south coast, SB 318 (BARCT), SB 526 (PM10)
  - Hydrogen
  - Low Carbon Fuel Standard
  - Natural & Working Lands – SB 285 (natural approaches)
  - Organics Diversion/Biomethane under SB 1383 – AB 70 (pyrolysis, pipeline injection)
  - Scoping Plan Update
  - Vehicles – AB 496 (appeals committee, daily usage/emergency vehicle exemptions)
  - Other (adaptation related)
- Welcome to participate in CASA's review!

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CARB's ACF Regulations/Resolution

Applies to gross veh

1. State & Local Government Agency Fleets

(cities, counties, special districts, State agencies)

Contain requirements/s

CARB withdrew Waiver Request from EPA January 13th. No waiver means the ACF Environmental Analysis is not valid.

Without waiver, CARB cannot enforce ACF Regulations on manufacturers – CARB maintains they have enforcement authority over State & Local Government Agency Fleets (purchasers). If you opted into High Priority & Federal Fleet Requirements, you must remain in compliance with those requirements.

CARB has also stated the Advanced Clean Truck (ACT) Regs are sufficient to drive implementation of infrastructure.

Four lawsuits have been filed. Settlement discussions underway with CA Trucking Association regarding ACT Regulations. EPA is working to undo waivers for ACT, and reopen rulemaking.

CARB continues to address AB 1594 Requirements into the ACF Regulations

Signed October 8, 2023, applies to public agencies – community water systems, water districts, wastewater treatment providers.

Authorizes public agencies to "…*purchase traditional replacements for medium- and heavy-duty vehicles at the end of their useful life…when needed to maintain reliable service and respond to major foreseeable events…**without regard to the model year of the vehicle being replaced***."

- March 25th CARB re-opened ACF regulations to incorporate AB 1594 requirements
- CASA submitted comments May 20th and September 3rd, met w/ CARB staff June 26th
- CASA continues coordinating with CMUA, ACWA, SCPPA, NTPA to have united voice
- Workshop held October 3rd to discuss Draft Rulemaking Language (released Oct 1st):
  - Definition of a public agency utility.
  - Definition of traditional utility-specialized vehicles (Class 3-8 vehicles).
  - Early access to Daily Usage & ZEV Purchase exemptions
- November 1st CASA submitted comments
- Preview of revised Draft Regulatory Language released February 7th
- **45-day Regulatory Package was to be released end of March – CARB staff has postponed this to address public agency feedback**

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Open Discussion / Member Updates

- Other topics?

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Open Discussion / Member Updates

- BACWA/Air District Implementation Workgroup Meeting – April 21st
- CWEA Annual Conference – April 22 – 25 (Palm Springs, CA)
- BACWA – May 2nd (David Brower Center, Berkeley, CA)
- CASA 2025 Annual Conference – August 13-15 (San Diego, CA)

- **Next Quarterly Meeting: May 21, in person**
  - **Hosted by West County Wastewater**

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Thank You – Happy Spring!

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