

Small water disinfection systems: UV light & the role of women in remote communities

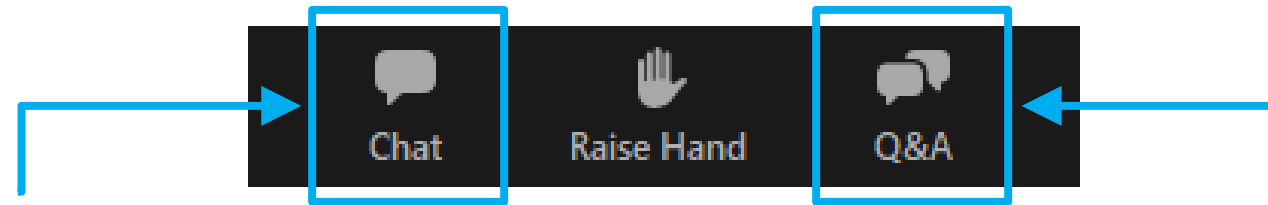
31/01/2022

WEBINAR INFORMATION



- This webinar will be **recorded and made available “on-demand”** on the IWA website, with presentation slides, and other information.
- The **speakers** are responsible for **securing copyright permissions** for any work that they will present of which they are not the legal copyright holder.
- The opinions, hypothesis, conclusions or recommendations contained in the presentations and other materials are the **sole responsibility of the speaker(s)** and do not necessarily reflect IWA opinion.

WEBINAR INFORMATION



- **'Chat' box:** please use this for general requests and for interactive activities.
- **'Q&A' box:** please use this to send questions to the panelists. (We will answer these during the discussions)

Please Note: Attendees' microphones are muted. We cannot respond to 'Raise Hand'.

IWA SANITATION AND WATER MANAGEMENT IN DEVELOPING COUNTRIES SG



CONNECT PLUS Home Feeds Community Treasure Learn

Specialist Group | Sanitation and Water Management in Developing Countries

Feeds Events Members

Yanchen Liu
Posted in Sanitation and Water Management in Developing Countries | 4 months ago

13th IWA Conference on Instrumentation, Control and Automation (ICA2022)
16 Oct 2022 | System Integration Date
11 Sep 2022 - Early Bird Registration Closes
Registration Notice & Virtual Exhibition
17-21 October 2022 - Beijing, China

Deadline of early-bird registration for ICA2022 is approaching!
We are pleased to invite you to participate in 13th IWA Conference on Instrumentation, Control and Automation (ICA2022). The early bird registration will be closed on 25 September 2022. We look forward to seeing you and extending our discussion of water-system ICA in this digital era.
[See More](#)

Group Admins
Rachna Sakari
Group Admin
Samuela Guida
Group Admin

This SG encompasses water supply and sanitation services and their interrelation with river basin management. The Group has a bottom-up approach and identifies regional focal points.

www.iwaconnectplus.org/group/feeds?CommunityKey=a0M4K000027glxUAA

Join the IWA SG on IWA Connect+

Introduction to IUVA SDG taskforce

HADAS MAMANE, TEL-AVIV UNIVERSITY, ISRAEL

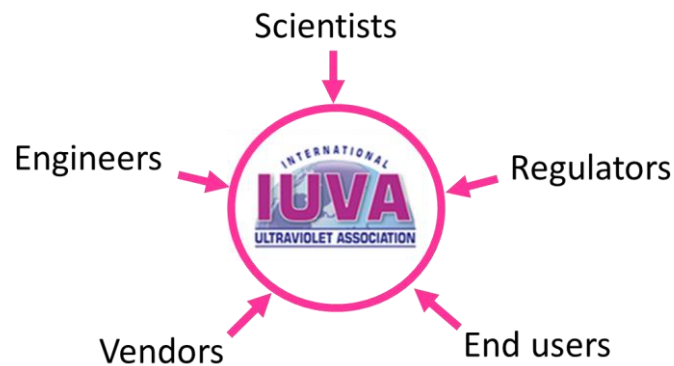


INTERNATIONAL ULTRAVIOLET ASSOCIATION



A forum for discussion of scientific and technological issues related to UV

<https://iuva.org/>



800+ members ~ 50 countries

CORONAVIRUS / COVID-19
IUVVA UV Disinfection for COVID-19
Advancing the sciences, engineering & applications of ultraviolet technologies to enhance the quality of human life & to protect the environment.

WAVELENGTH
UV PODCAST BY IUVVA-YP

COVID-19

UV IN THE NEWS

Enhancing the New Normalcy with Ultraviolet (UV) Disinfection
Video: Part One
Video: Part Two
Download Presentations

Far UV-C Radiation: Current State-Of Knowledge
Watch Webinar Video
Download Presentations
Far UV-C Radiation: Current State-of Knowledge (New Update May 2021)

LATEST UPDATES
Global Lighting Association and International Ultraviolet Association to cooperate on UV disinfection technology
July 12, 2022

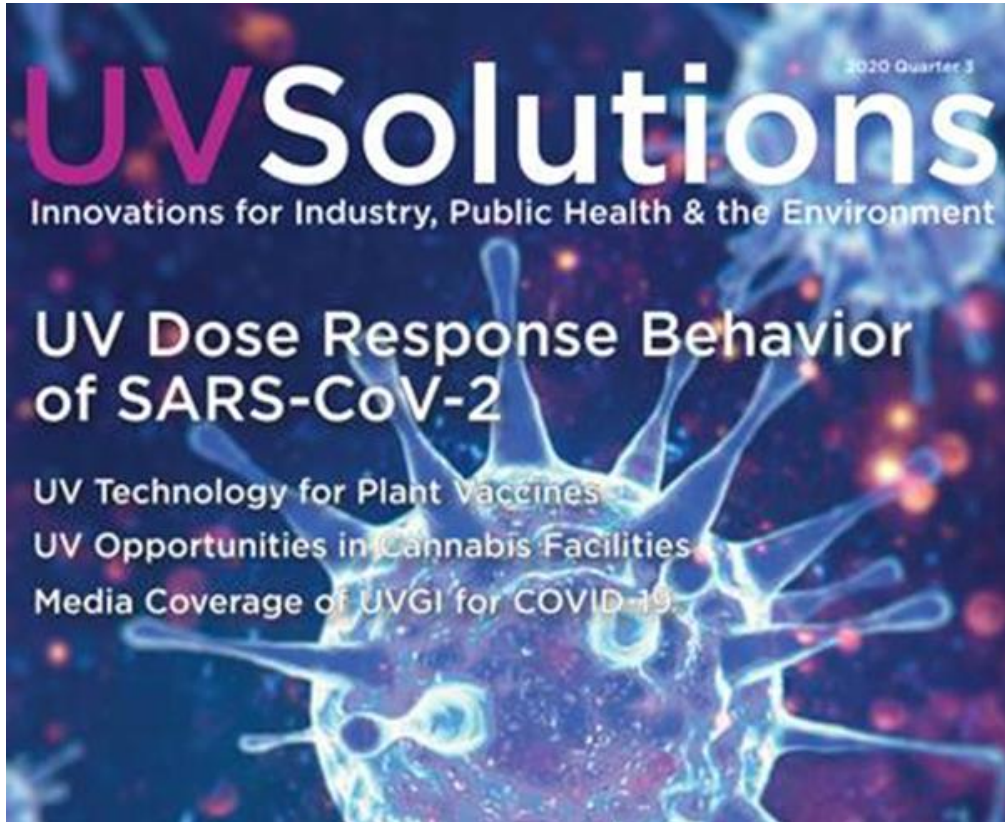


WAVELENGTH - THE ESSENTIAL UV PODCAST BY OUR IUVA YOUNG PROFESSIONALS



<https://open.spotify.com/show/1yLvRWt0ZooY7M001bdoq4>

INTERNATIONAL ULTRAVIOLET ASSOCIATION



<https://uvsolutionsmag.com/>



Association News



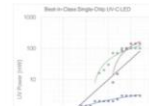
The Quest for UV Treatment Validation



Mobile UV-C Devices: User Education is Key



Lighting Up the Meat Sector for Enhanced Safety and Extended Shelf...



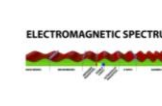
2022 State of the Industry: UV-C LEDs and Their Applications



Young Professionals News



From Promising Emerging Treatment to Commercialization



Essentials of Germicidal Irradiation for Reduction of Microorganisms



IUA and FDA Working Together on N95 Decontamination Issues



UV-C Tunnels Transporting Food within Processing Plants



Novel UV-C Sensor Technology for Use in Air and Surface Disinfection...



Practical Information on Sizing and Design Approaches for UV AOP Systems

IUVA - UN SUSTAINABLE DEVELOPMENT GOALS TASK FORCE



Nathan Moore
University of Toronto
Task Force Leader



Hadas Mamane
Tel Aviv University
Task Force Chair

<https://www.iuva.org/UN-Sustainable-Development-Goals-Task-Force>

How are we doing this? Meetings with organizations



UN SDG TASK FORCE

How are we doing this? sessions, webinars, podcasts

PANEL 2: APPLICATIONS IN LOW-INCOME COMMUNITIES

PANELISTS:



S. KANMANI
Anna University

FERMÍN REYGADAS
Fundacion Cantaro Azul

EVAN THOMAS
UC Boulder

TONNIE TELGENHOF
Nedap

KARLYE WONG
University of Toronto

CHAIRS:



HADAS MAMANE
Tel Aviv University

JOHN MAIYO
Purdue University

EARLY ADOPTION OF UV IN DEVELOPING COUNTRIES AND LOW-INCOME COMMUNITIES HAS LARGELY FOCUSED ON DRINKING WATER TREATMENT. UV BASED WATER SYSTEMS FACE SEVERAL BARRIERS TO THEIR ADOPTION IN THESE LOW RESOURCE SETTINGS. WATER SYSTEMS IN

Symposium, boulder, 2022

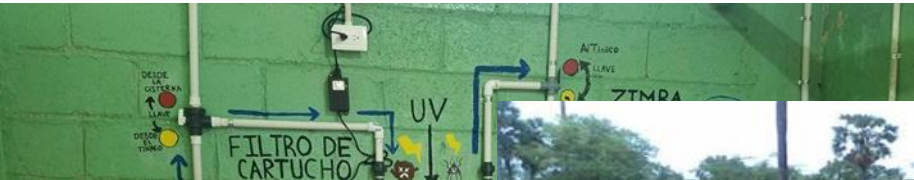


Webinar: UV Applications in Low Resource Settings, on YouTube

UN SDG TASK FORCE



How are we doing this? Whitepaper with case studies on opportunities, challenges, and lessons learned



UN SDG TASK FORCE

How are we doing this? Mapping case studies



Link to the map: <https://www.iuva.org/UN-Sustainable-Development-Goals-Task-Force>

MODERATOR & SPEAKERS



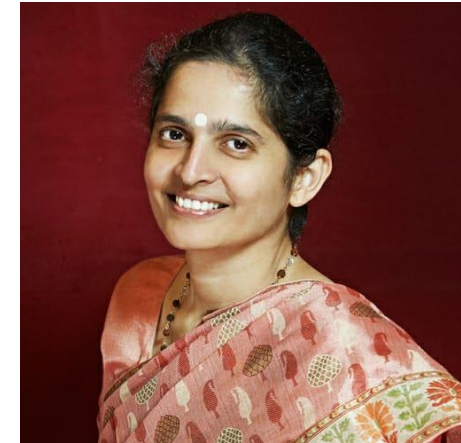
Hadas Mamane, Tel-Aviv
University, Israel
(Moderator)



Natalie Hull
Ohio State University,
United States



Ane Galdos Balzategi
Cántaro Azul/Ulster
University, Mexico



Bhavani Rao, Amrita
University,
India

AGENDA

- Welcome, housekeeping rules, introduction
Hadas Mamane and Rachel Gehr (moderators)
- Women in WASH: Perspectives from Rural India
Bhavani Rao
- Overcoming challenges of implementing UV technologies in small, rural water systems
Natalie Hull
- Women's perception of change and impact on their lives of a novel HWTS UV disinfection system
Ane Galdos Balzategi
- Q&A Discussion
Speakers & Moderator
- Final remarks and conclusion
Hadas Mamane and Rachel Gehr (moderators)

Women in WASH: Perspectives from Rural India

DR. BHAVANI RAO, AMRITA UNIVERSITY, INDIA





INDIA'S WATER CRISIS



70% of India's water sources are contaminated

Water levels in major reservoirs have fallen to 21% of the average of the last decade.



54% of the country's groundwater is declining faster than it is being replenished.

75% of households do not have drinking water on the premises



84% of rural households do not have access to piped water.

Declining water table in most regions, with an increasing presence of toxic elements





WASH IN INDIA



Many Indians face high to extreme water stress (NITI Aayog)



Dependence on an increasingly erratic monsoon increases this challenge



Lack of water connections & toilets leads to water-borne illnesses, stunting, and death.

India has 18% of the world's population but only 4% of its water resources



About 15% of India's population (~229 million) practices open defecation

More than 6% of India's population of 1.38 billion (approx. 91 million), lack access to safe water



A photograph of a group of women standing in a line in a rural setting. They are dressed in traditional Indian attire, including sarees and headscarves. The background shows a brick wall and a corrugated metal roof. A yellow sign with Hindi text is visible on the left. The title 'WOMEN, WATER AND SANITATION' is overlaid in the center in a bold, teal font.

WOMEN, WATER AND SANITATION

Women's Water-Fetching Responsibility

- Affects women's health, workloads, and caloric expenditure.
- Time Poverty – Education and Livelihood

Sanitation Access and Gender-Based Violence

- Evidence of sanitation-related gender-based violence

Women's Water, Sanitation and Hygiene Needs

- Increased need of water for hydration, sanitation and hygiene during menstruation, pregnancy, the postnatal period, and caring for sick family members or young children

Link With Sustainable Development Goals

- Direct Link between **SDG 6** and **SDG 5**
- Target 6.2 of **SDG** - 'access to equitable sanitation and hygiene and women and girls' needs.
- **SDG 10** - reduce inequalities - access to clean water & sanitation

Pandori
Padiyal

Nani Borvail
Moti Borvail
Dongril
Nani Vav
Moti Vav

Bhanwal
Malra

Kanti

Dunda
Udaikha
Khattukha

Chandmari

Deogan

Ratanpur
Hadlyabad
Tenduni
Morasia
Ichari

Sarai Nooruddin
Nagla purabiya
Hemraj
Dr.Khera

Majebdaari
Krishnarampuram
Ramnagar
Kalinagar

research.

Juna Kattiwada
Golamba
Muljipura
Haveli Kheda

We work in more than 100+ rural communities across India. One of the main areas of work includes women' empowerment, water and sanitation.

Jivamritam Project – providing clean drinking water to 250 communities

Deurbal
Taraibeda
Karanji
Malgaon

Vada Malkopon

Ransai
Sargachiwadi
Banglachiwadi

Gudipadichariv

Bindhyagiri
Mundasai
Guptapada
Haridamada

Byse

Komalikudi
Valaramkunnu
Amritapuri
Azheekal

Ettimadai
Sadwayi
Pudupathi
Chinnampathi
Aiyapathi
Muruganpathy
Siruvani
Madurai

SUMMARY OF ACHIEVEMENTS & IMPACT



the international water association

CRPF: Gender Conversations



Supported by: Amrita Vishwa Vidyapeetham & CSR

101 Villages & Amrita SREE



Supported by: MA MATH

Trained & Certified: 1844

Courses: Basic Sewing Operator, MS Office, Fabric Painting, Artificial Jewellery Making, Soap Making,

WE: Sanitation I & II



Supported by: MA MATH

188 Women Trained

327 Toilets Built

Villages/13 states

WADI



Supported by: NABARD & Amrita Vishwa Vidyapeetham

Amrita PMKVY



Supported by: MSDE, NSDC

Trained: 919 (2018 - 2019)

9 Training Centers

5 States

WE: CSDP



Supported by: UNDEF

21 Community Organizers

300 Champions

5000 Change Agents

30,000 Indirect Beneficiaries

WISE 2.0



Supported by: Israel Consulate, CSR & Amrita Vishwa Vidyapeetham

Areas of Impact

Evaluation Research

- Empowerment Studies
- Education
- Business/Management
- Economics
- Social Work
- Computational Social Sciences

SUMMARY OF IMPACT

Students Trained: **6000+**

Trainers Trained: **200 +**

Villages: **60+** in 19 States

NUF WATER FILTRATION SYSTEM

- a Joint clean water initiative between Amrita, Tel-Aviv University and Consulate of Israel to South India were formed to provide NUF-500 filtrations systems for five flood affected villages in Kerala.
- The NUF 500 water filtration system is ideal for disaster situations. Manually operated, circular economy, easily maintained.



WOMEN EMPOWERMENT: COMMUNITY SANITATION THROUGH DEMOCRATIC PARTICIPATION (WE:CSDP)



- Target: 21 villages in India, targeted 5,000 women, with an indirect impact on 30,000 individuals.
- Empowering women from rural communities to champion sanitation and community development towards ODF status for their communities.

WISE PROJECT

- The Women in Sustaining the Environment Project (in partnership with the Consulate of Israel and Tel Aviv University), aims to equip rural women with the technologies they need to successfully monitor and maintain local drinking water supplies.
- Ten water ambassadors will be trained as part of the project to monitor water quality in 1000 households in Dongarampur.





Making Drinking Water Accessible For All

Jal Jeevan Mission



Har Ghar Jal
Jal Jeevan Mission



Rural women **no longer have to walk the extra mile** to fetch drinking water

6.35 crore rural households get tap water connection since launch

Households given access to pipe water

3.23 Crore
17% coverage



9.57 Crore
50% coverage



- It is a community approach to water and includes information, education and communication as a key component of the mission.
- Women have a key role to play in the Paani Samithi
- 60% of the budget at the Panchayat level is reserved for Jal Jeevan efforts.



Making Drinking Water Accessible For All



Jal Jeevan Mission



Har Ghar Jal
Jal Jeevan Mission



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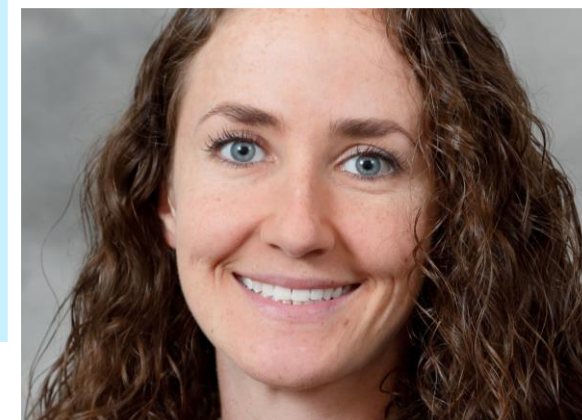
LINKING JAL JEEVAN MISSION AND THE WISE PROJECT

The water ambassadors trained under the WISE project and the Paani Samithi.

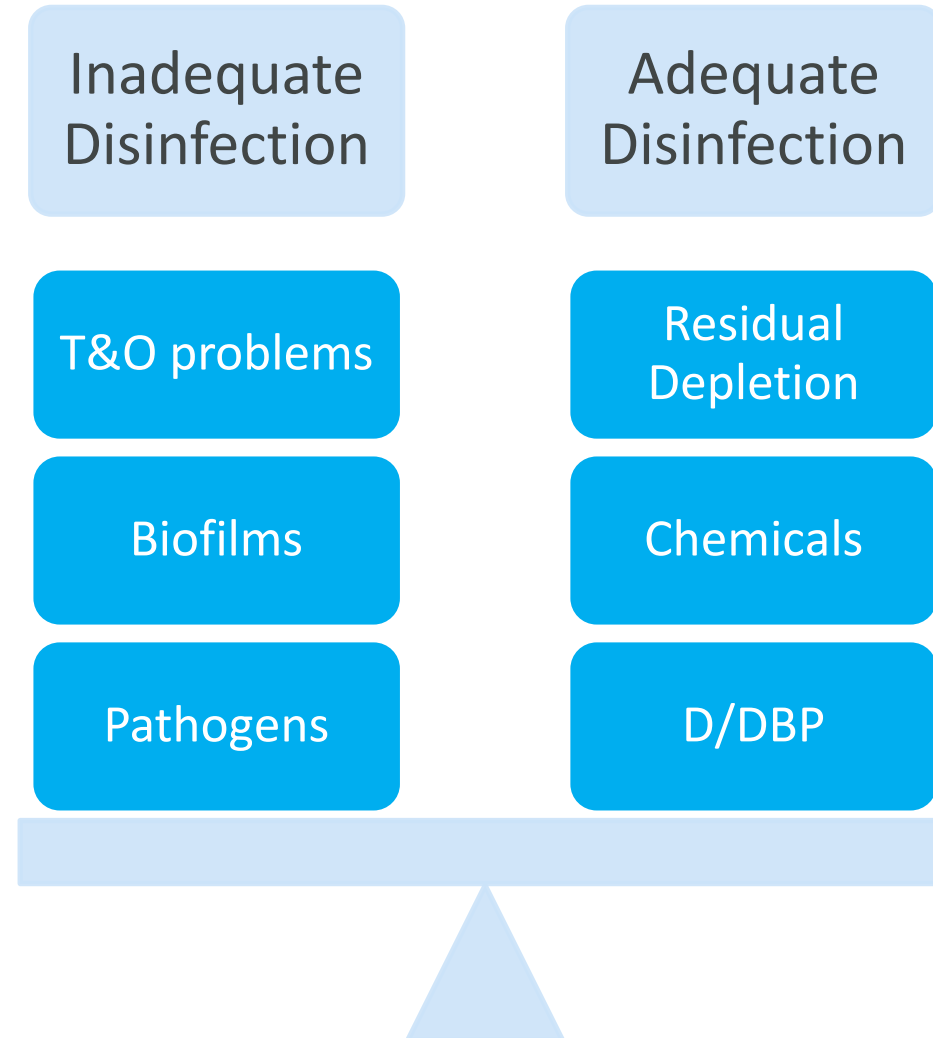
- Knowledge of what kind of system is best suited for their community
- Ensuring that the money allocated through the Jal Jeevan Mission is indeed being used for it.

Overcoming challenges of implementing UV technologies in small, rural water systems

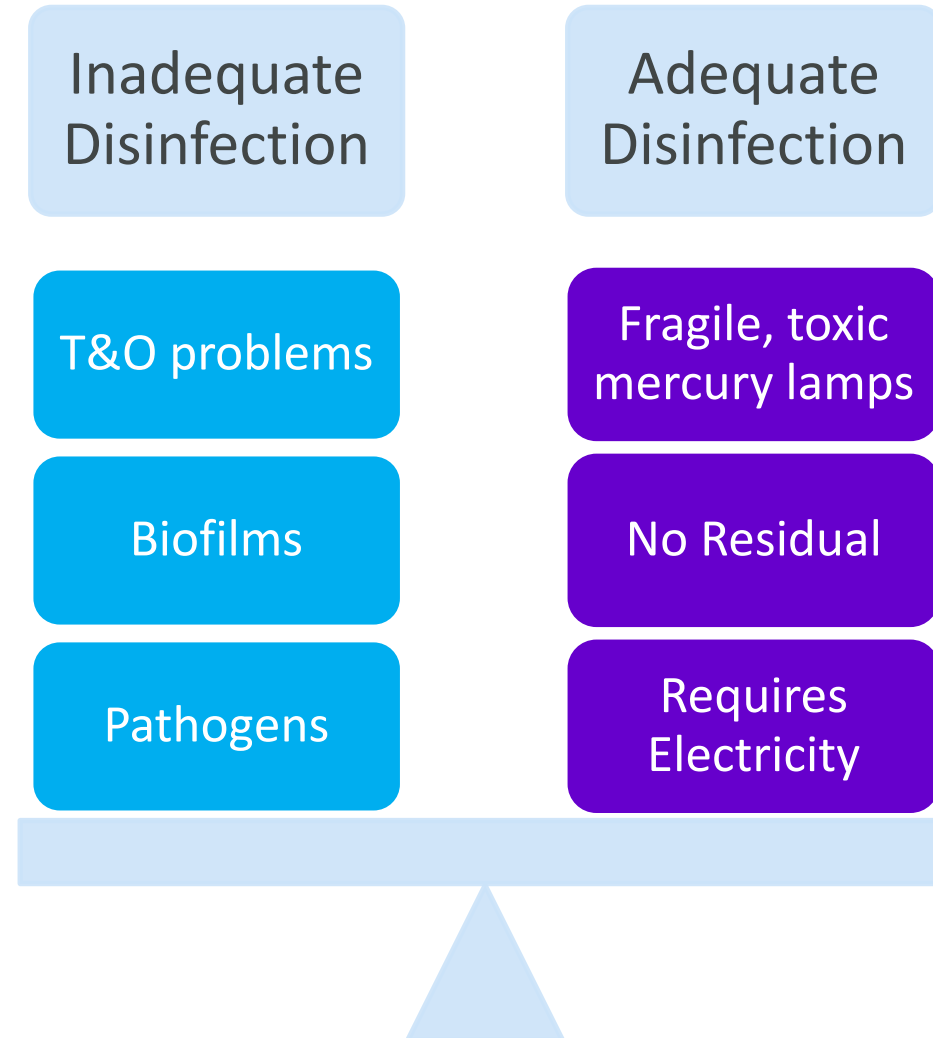
Dr. Natalie Hull
The Ohio State University



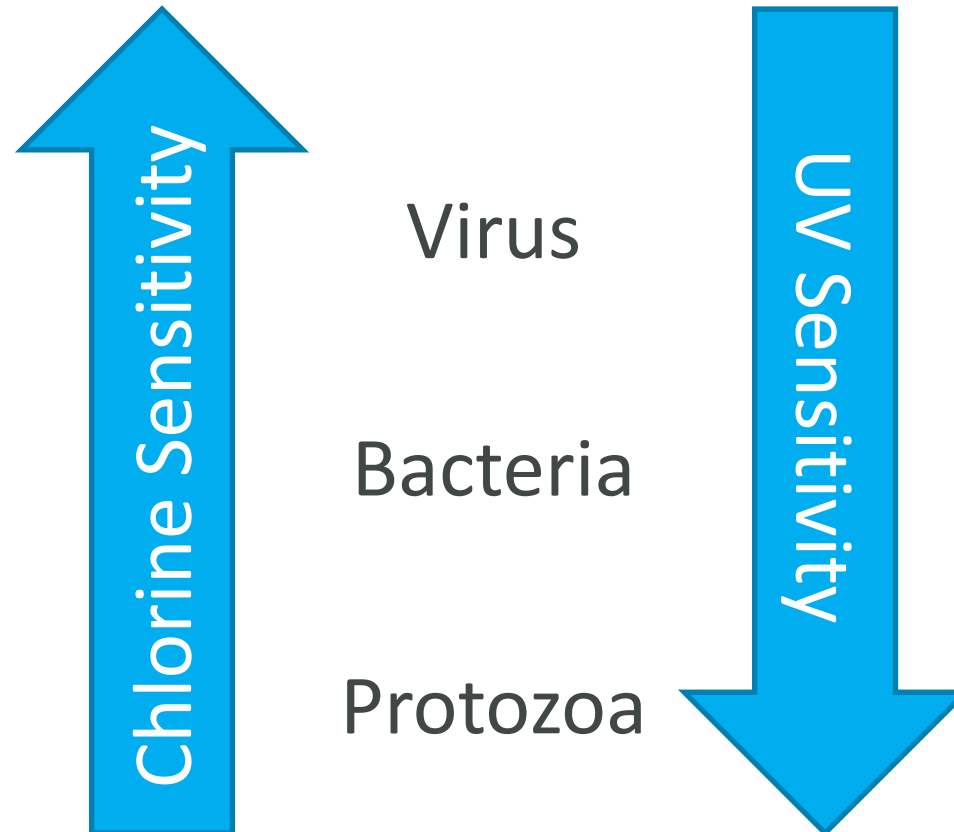
CHLORINE IS COMMONLY USED FOR MANAGING MICROBIOLOGICAL WATER QUALITY



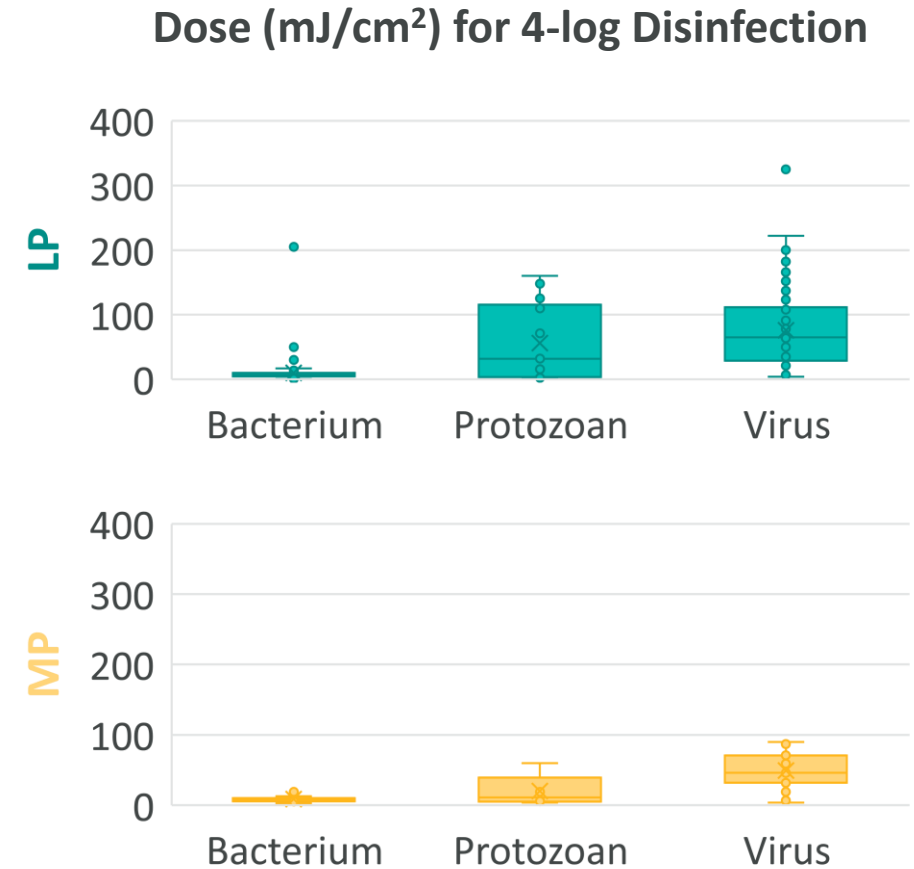
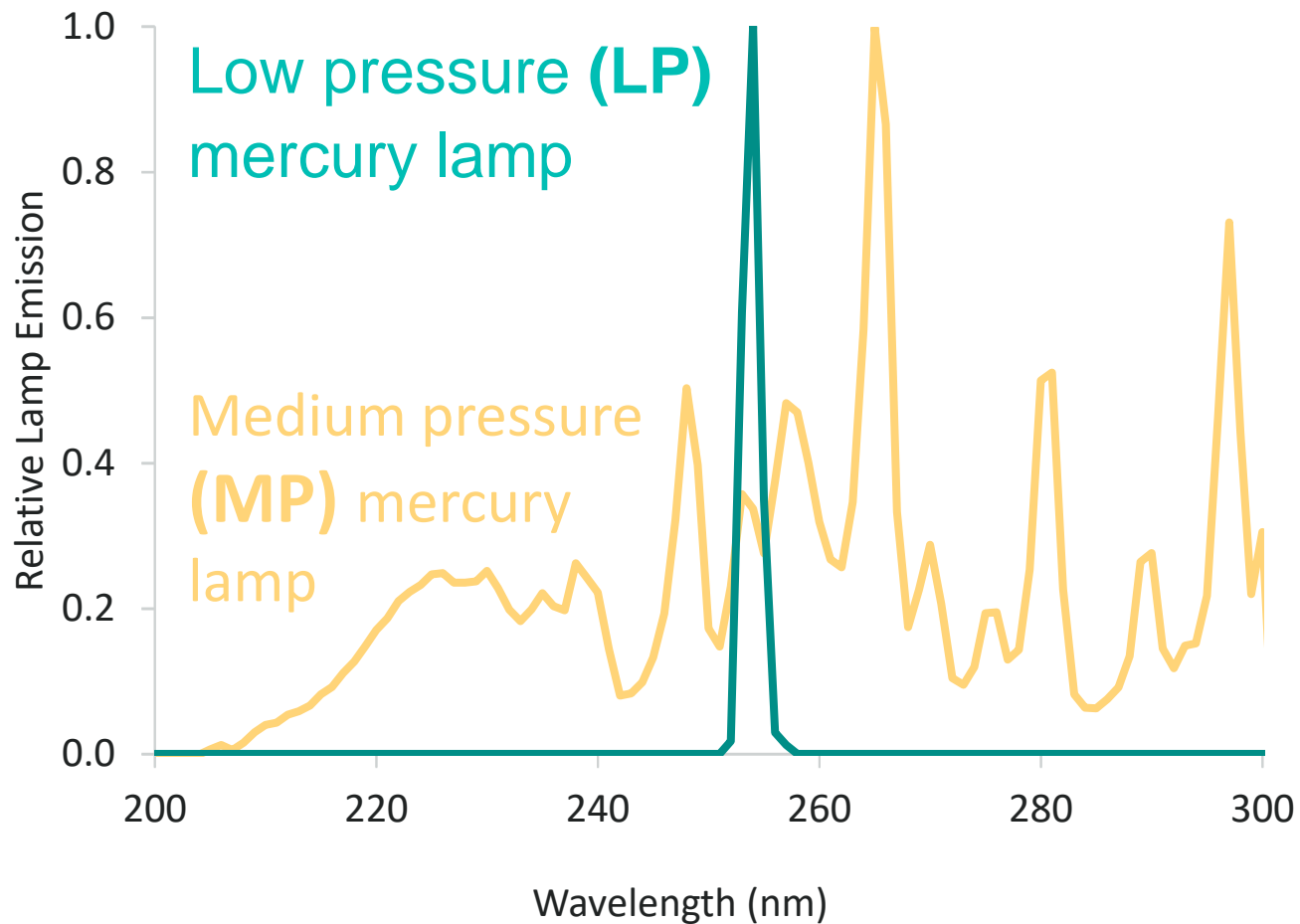
UV IS ALSO USED FOR MANAGING MICROBIAL WATER QUALITY



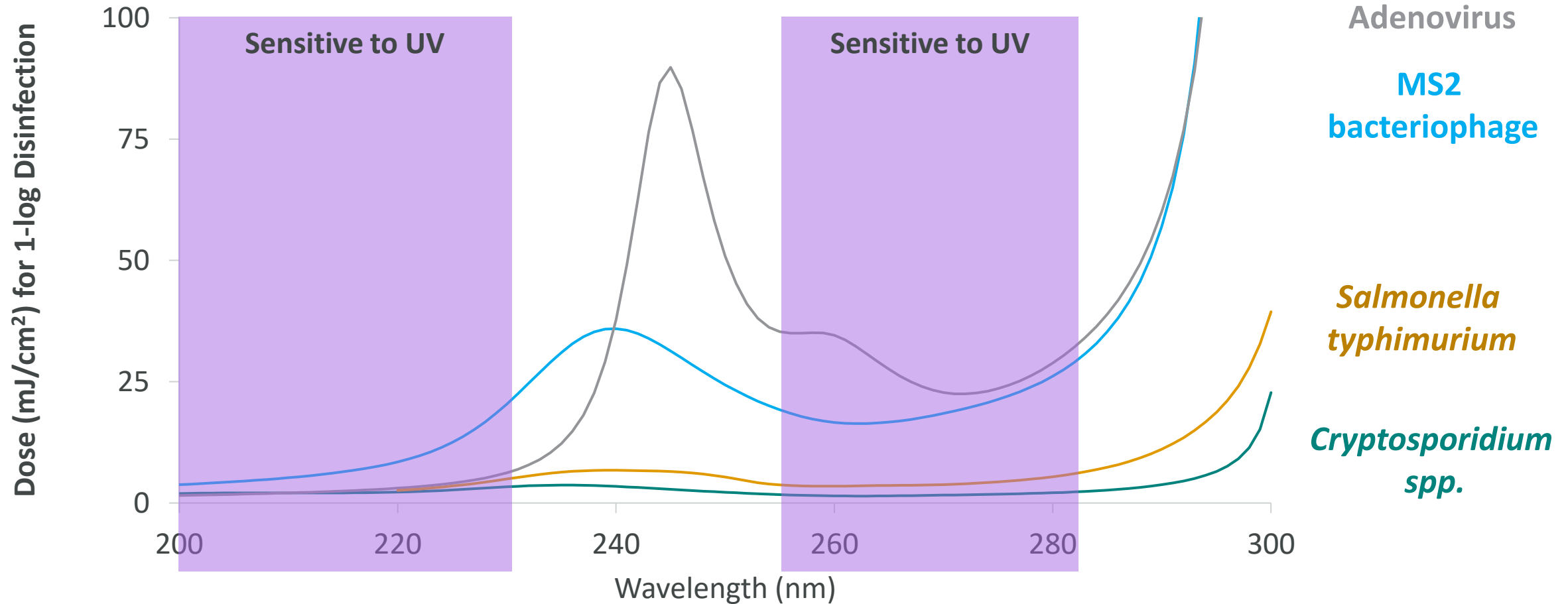
UV COMPLEMENTS CHLORINE DISINFECTION



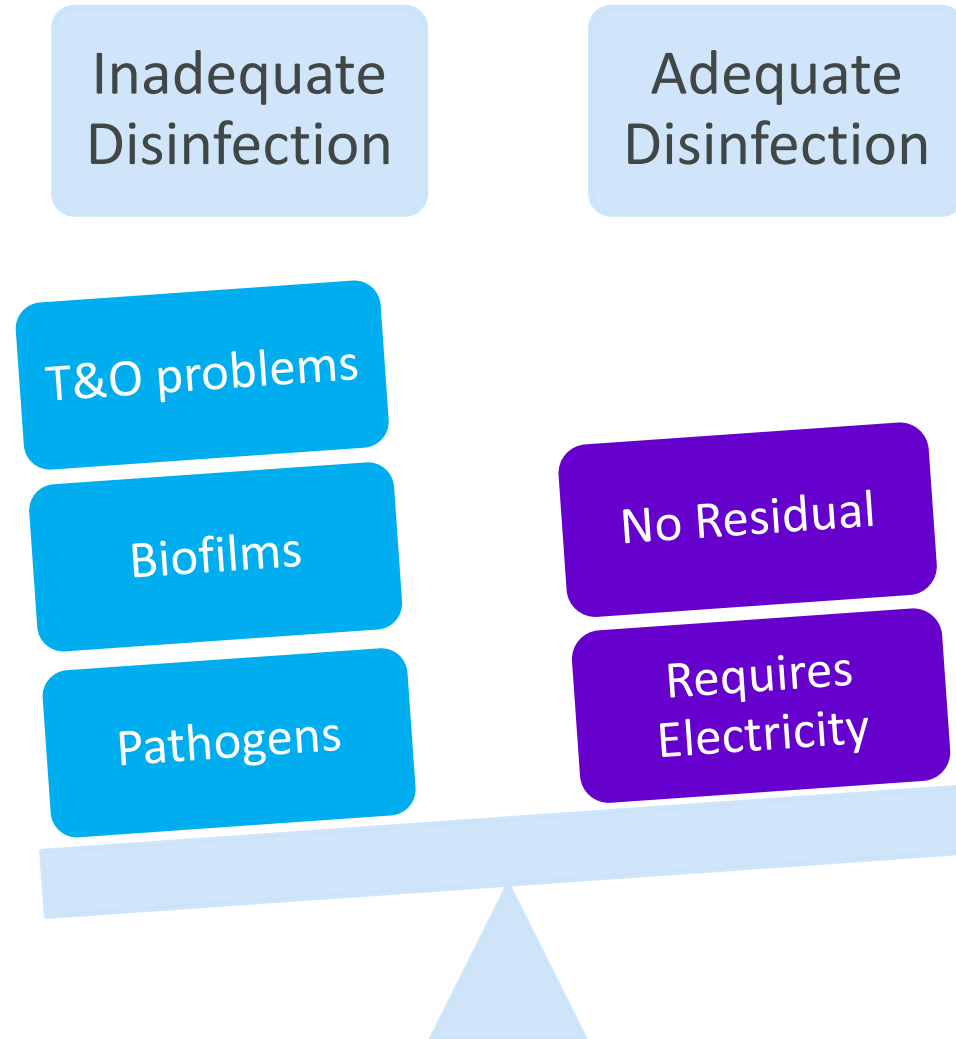
MERCURY BASED UV HAS A PROVEN HISTORY OF DISINFECTION



UV DISINFECTION CAN BE WAVELENGTH-OPTIMIZED

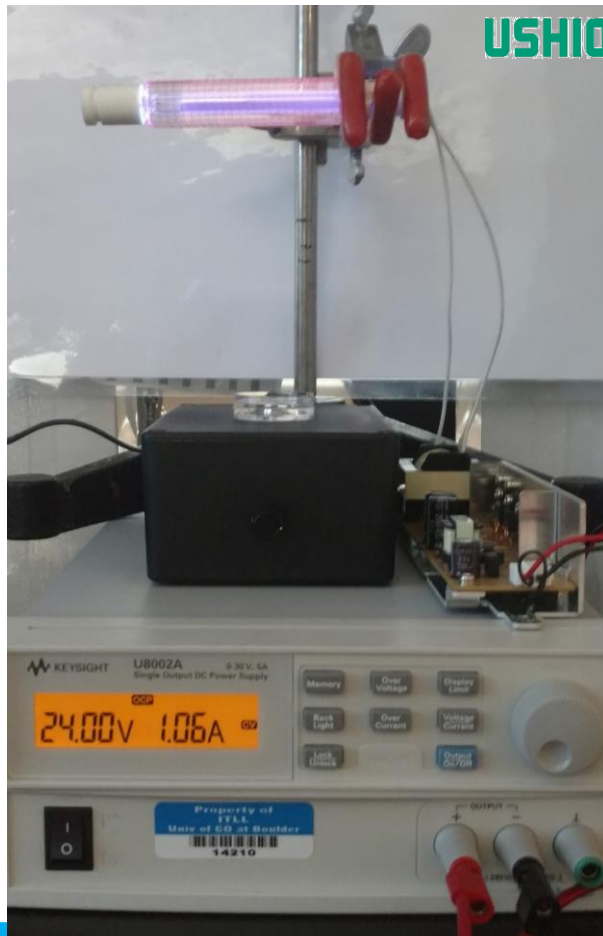


MERCURY-FREE UV FOR MANAGING MICROBIAL WATER QUALITY



MERCURY FREE UV SOURCES ENABLE WAVELENGTH TAILORED DISINFECTION OPTIMIZATION

KrCl Excimer lamp (Excilamp)



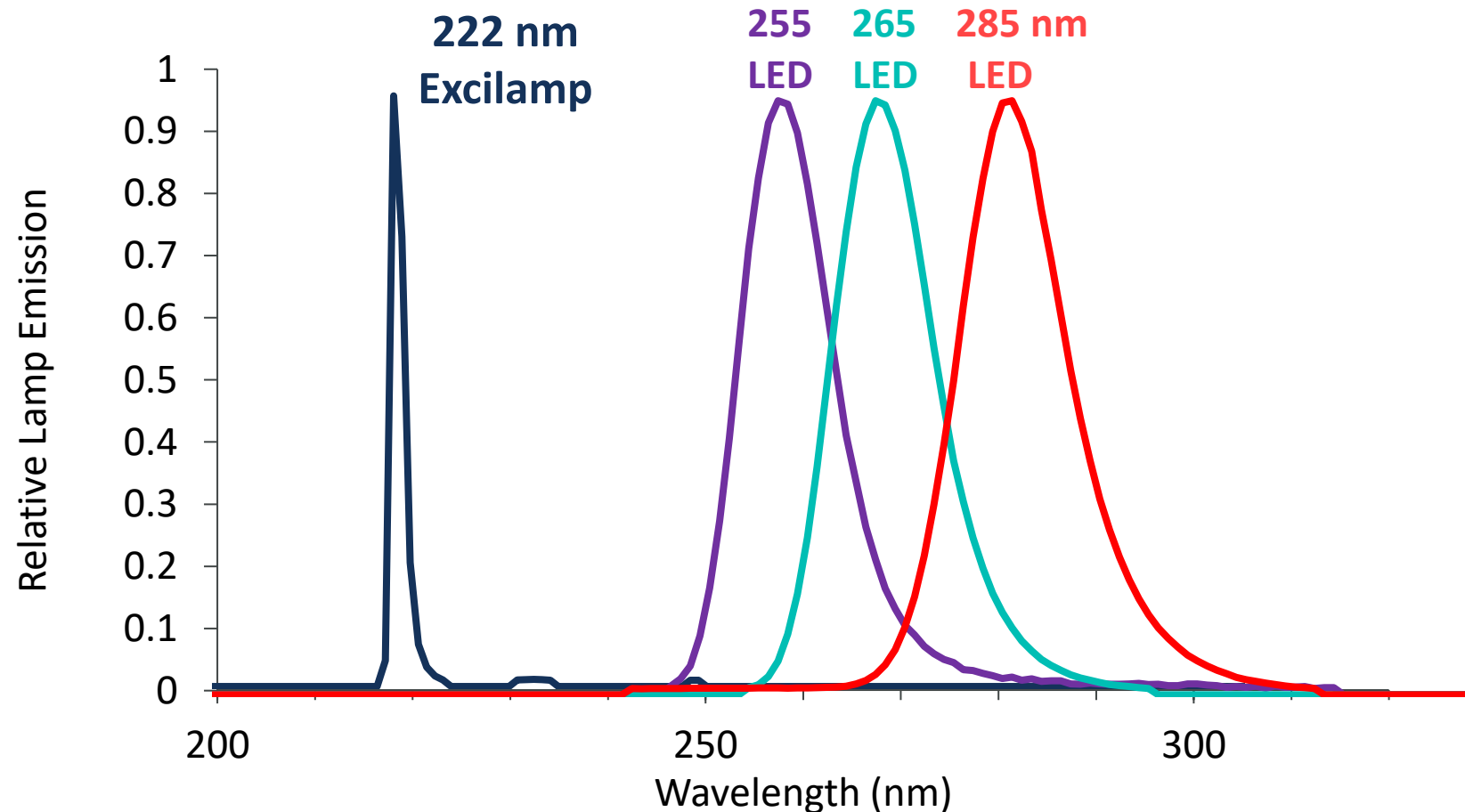
Light Emitting Diodes (LEDs)



MERCURY FREE UV SOURCES ENABLE WAVELENGTH TAILORED DISINFECTION OPTIMIZATION

KrCl Excimer lamp (Excilamp)

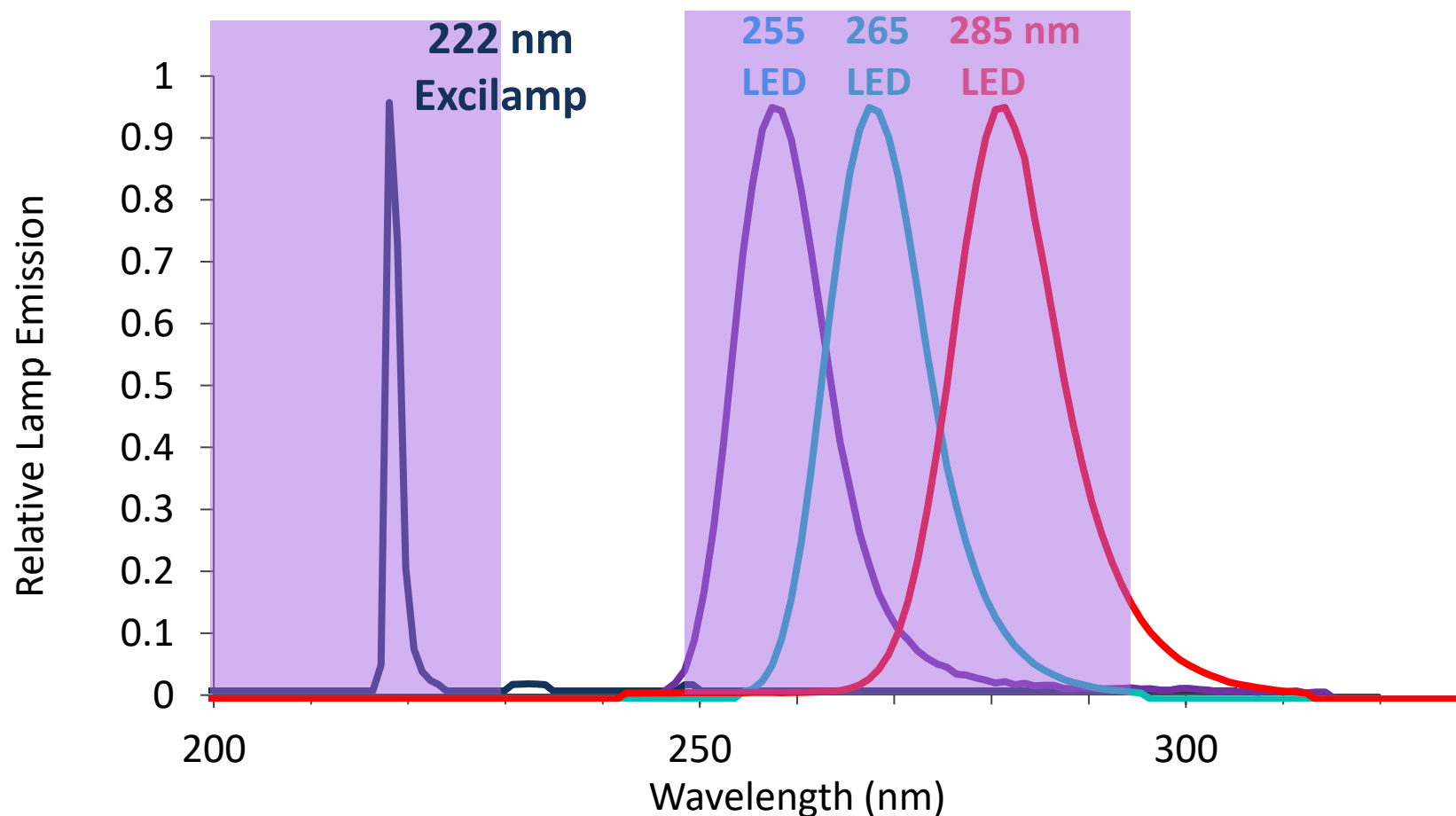
Light Emitting Diodes (LEDs)



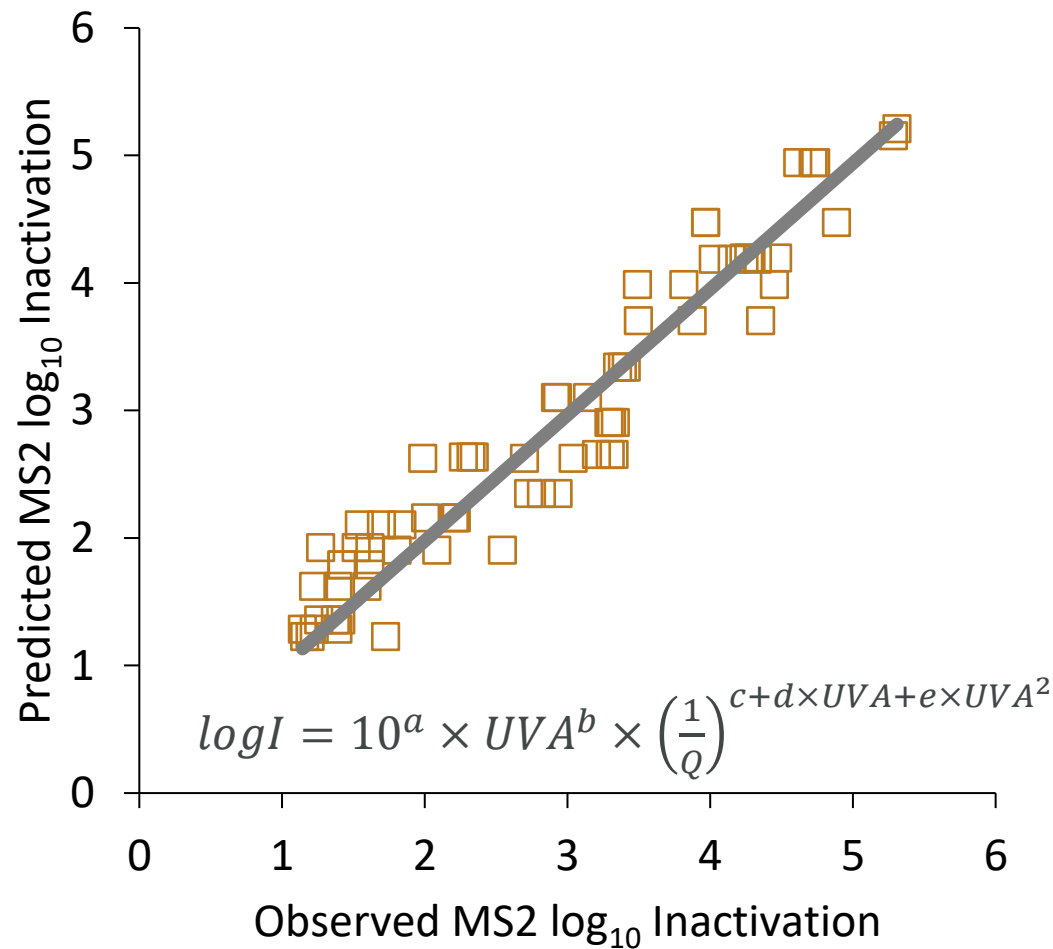
MERCURY FREE UV SOURCES ENABLE WAVELENGTH TAILORED DISINFECTION OPTIMIZATION

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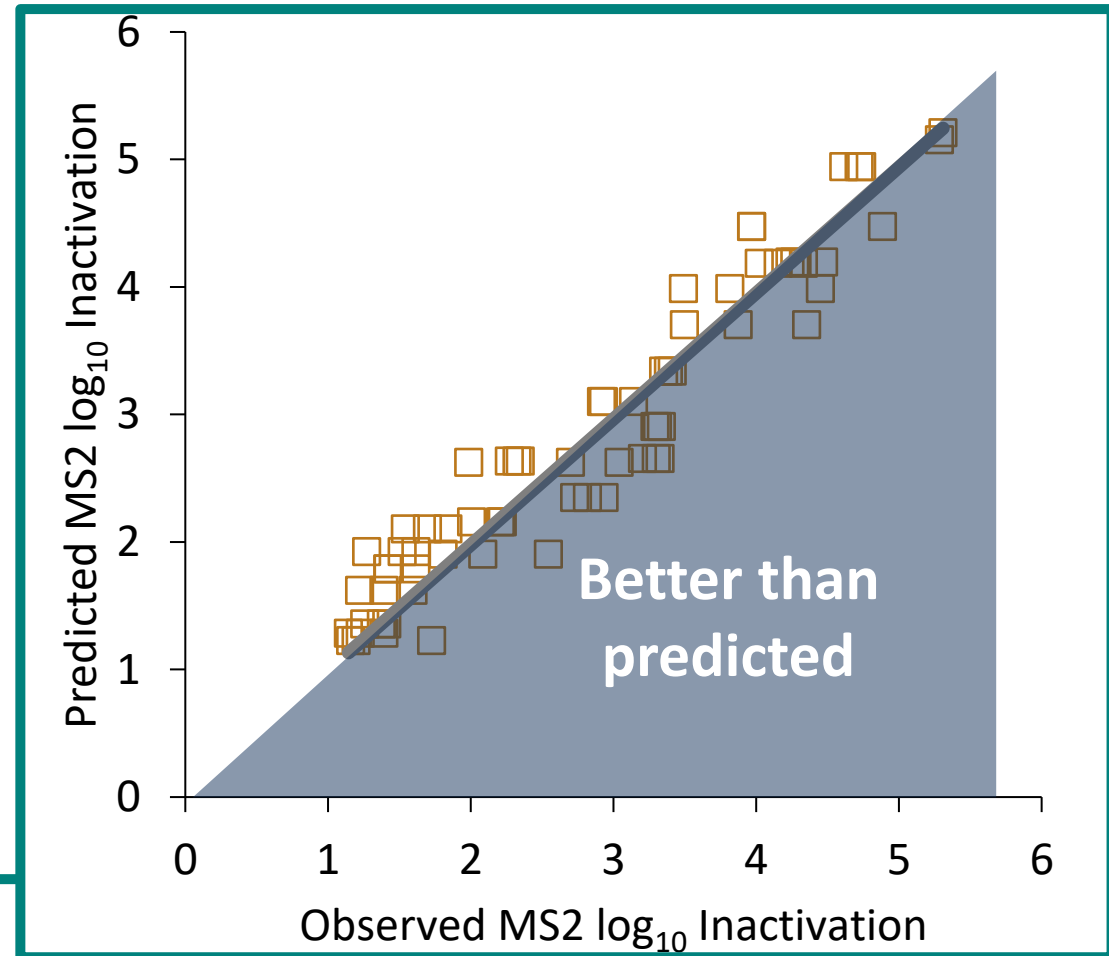
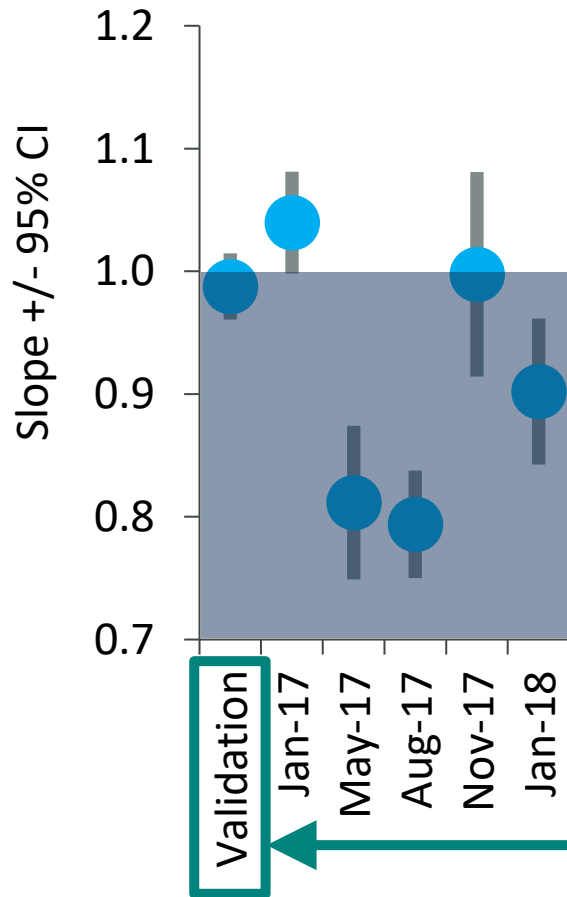
Light Emitting Diodes (LEDs)



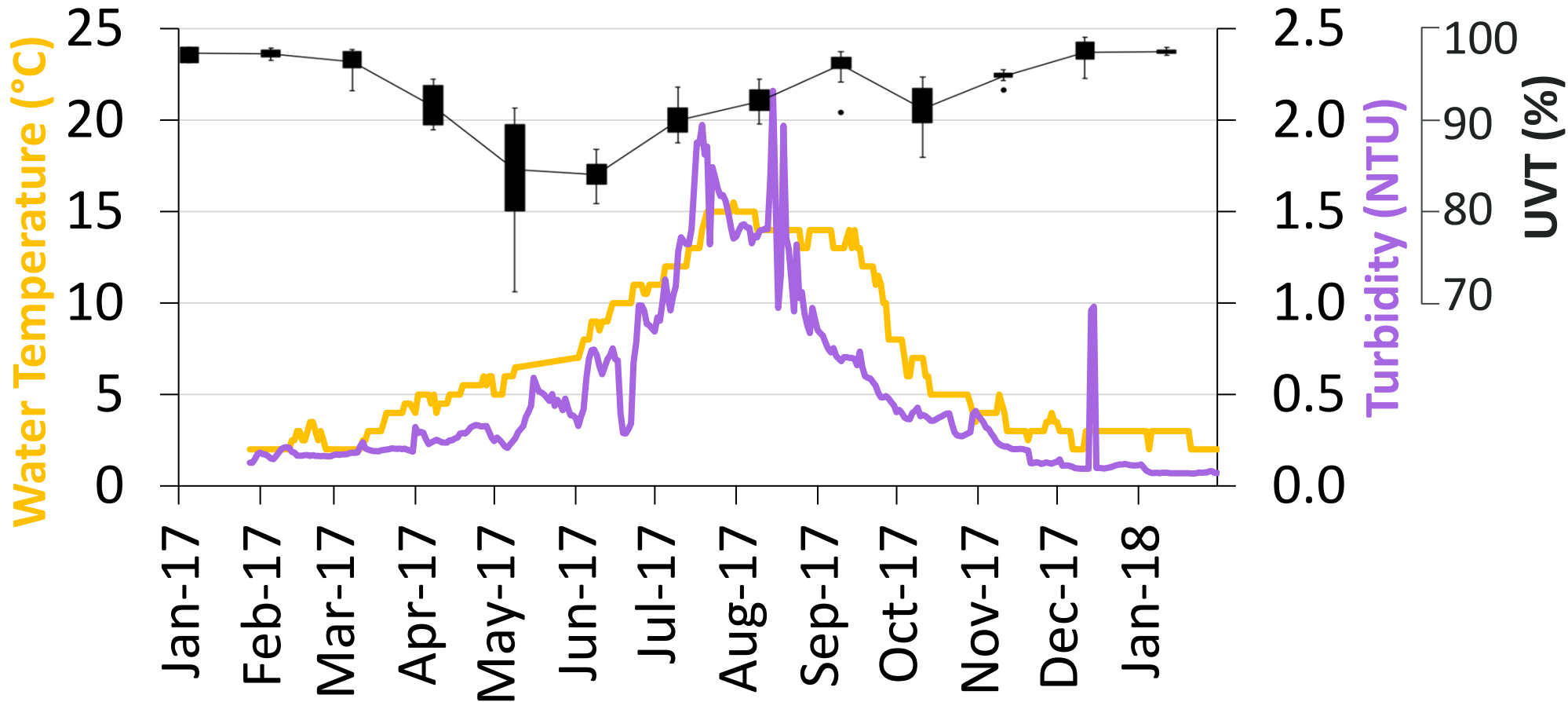
UV LED BENCH SCALE OPERATIONAL VALIDATION



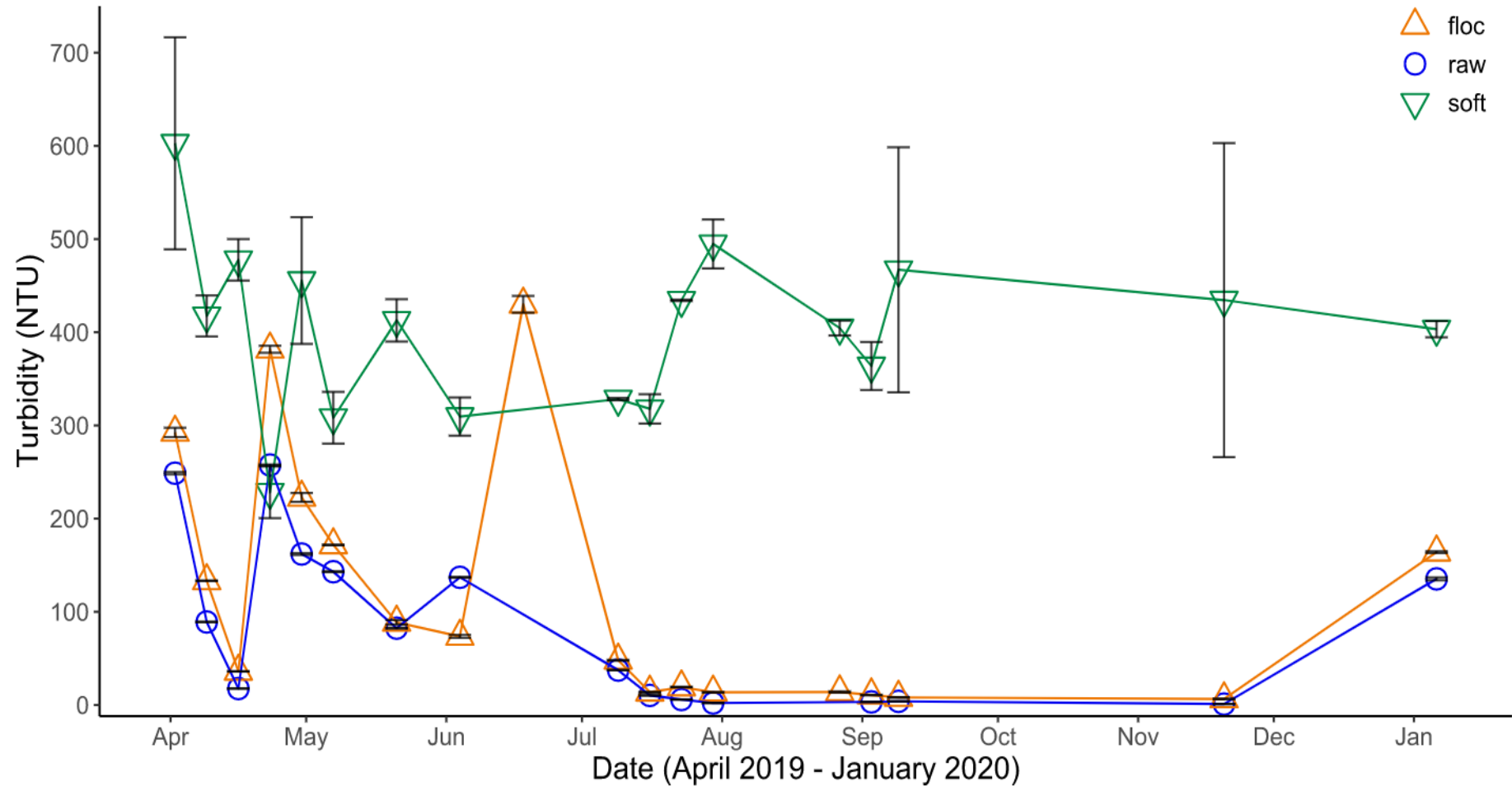
UV LED BENCH SCALE OPERATIONAL VALIDATION TRANSLATED TO SUCCESSFUL FIELD DEMONSTRATION



UV LED BENCH SCALE OPERATIONAL VALIDATION TRANSLATED TO SUCCESSFUL FIELD DEMONSTRATION DESPITE CHALLENGING TURBIDITY AND UVT CONDITIONS



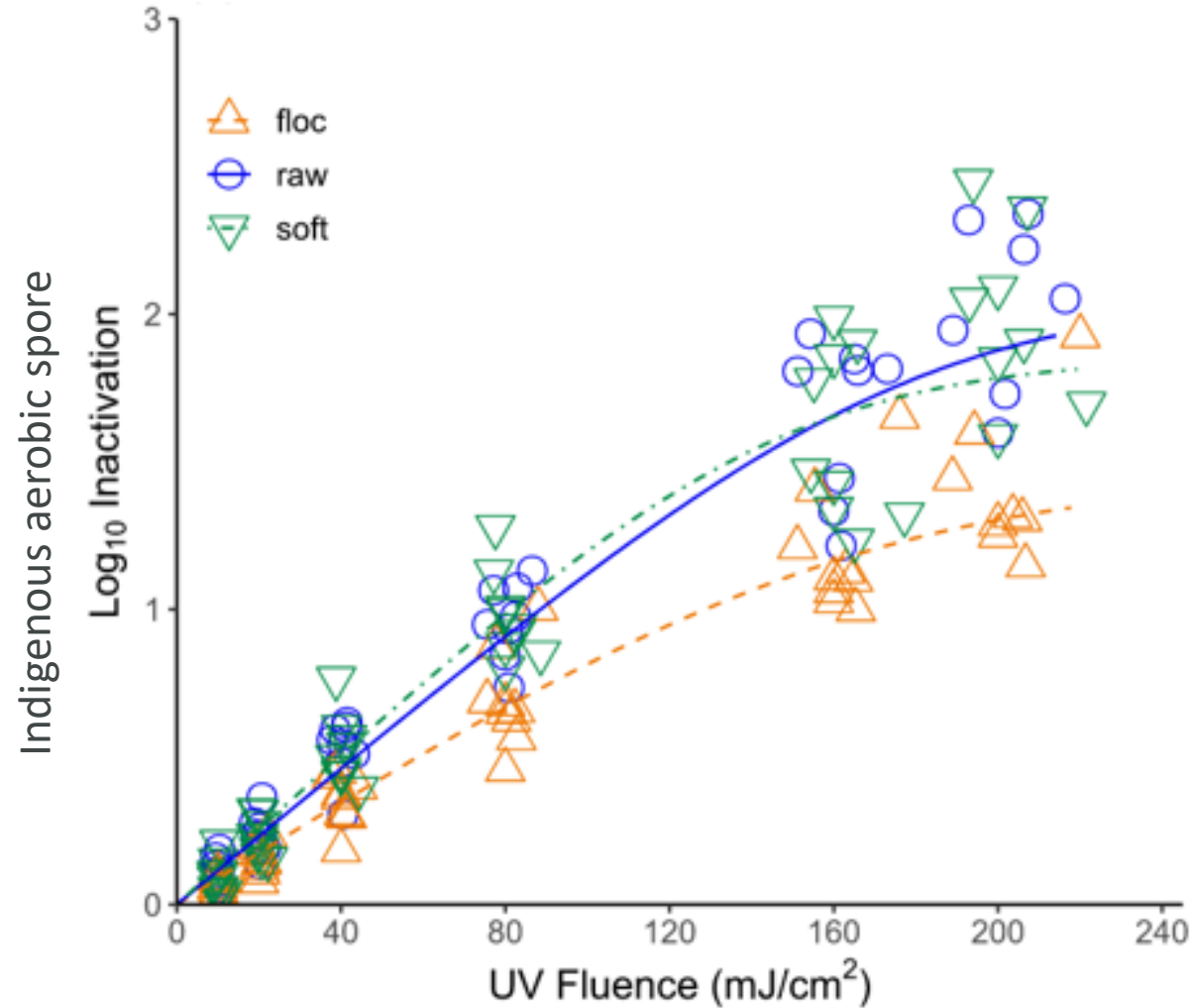
EVEN UNDER VERY HIGH TURBIDITY CONDITIONS



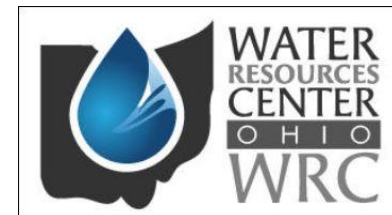
Judith Straathof



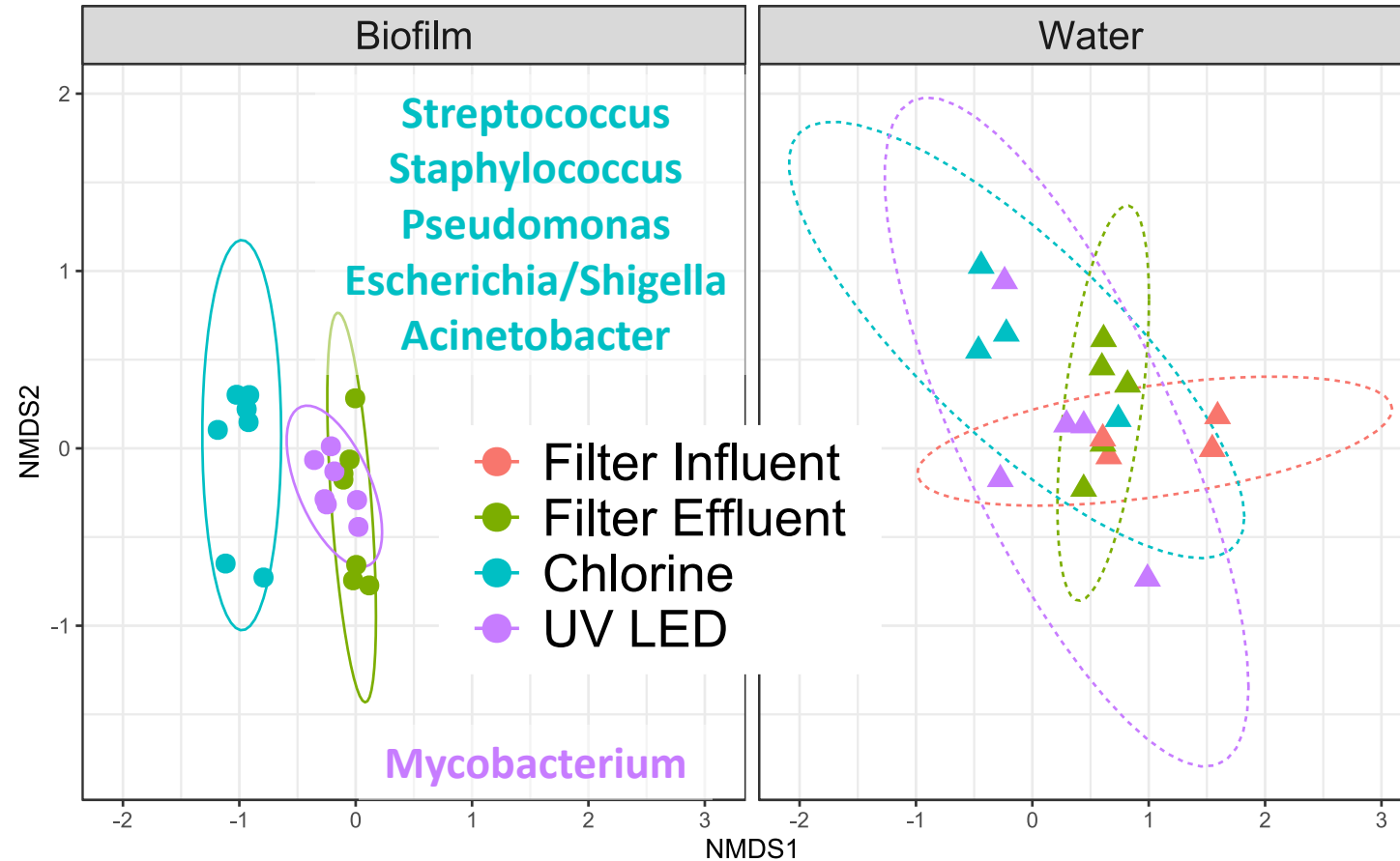
EVEN UNDER VERY HIGH TURBIDITY CONDITIONS UV₂₅₄ DISINFECTION CAN BE PREDICTABLE



Judith Straathof



UV LED BIOFILM MICROBIOMES HAD FEWER PROBLEMATIC GENERA



Yijing Liu

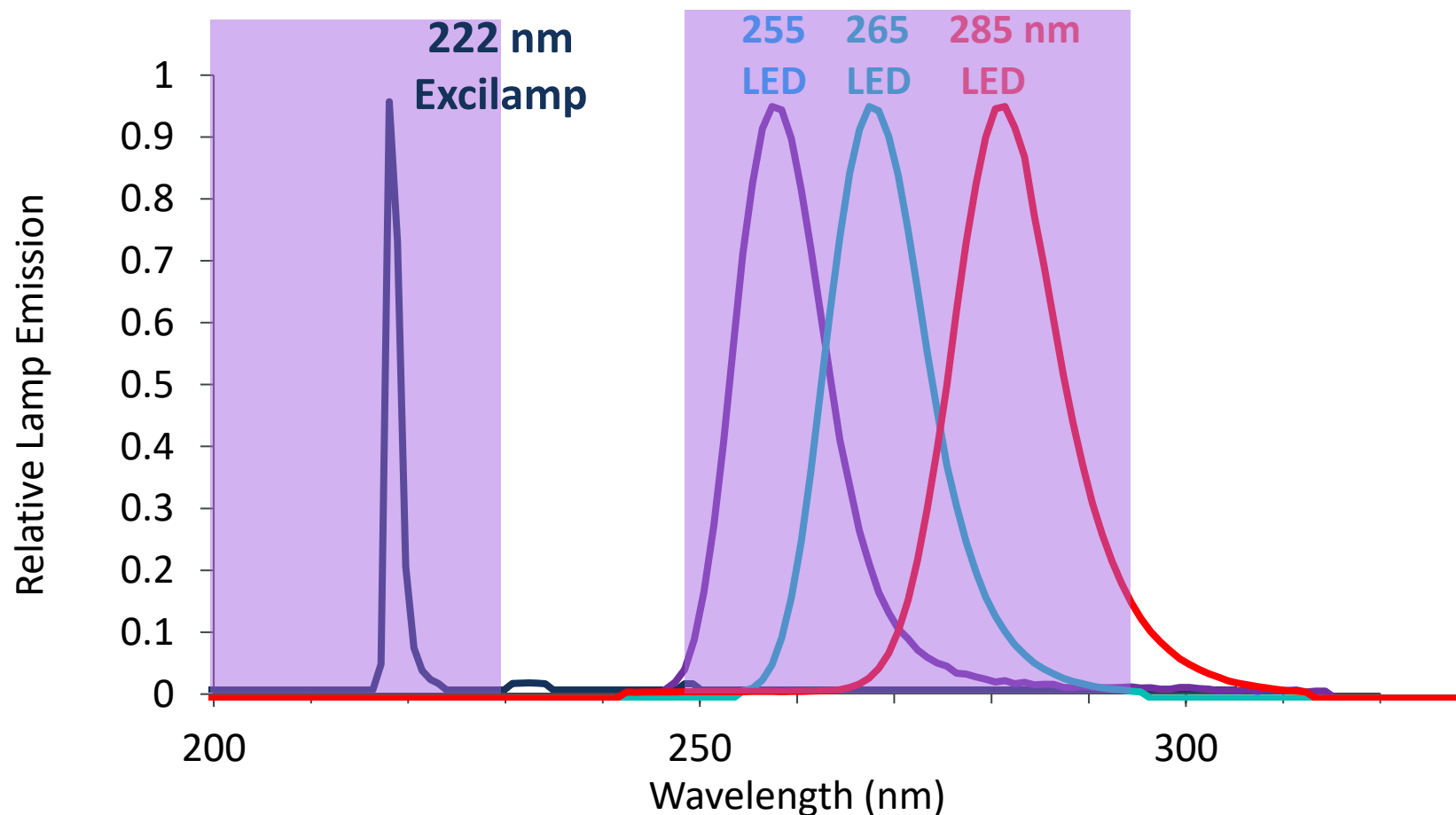


Amanda Killian

MERCURY FREE UV SOURCES ENABLE WAVELENGTH TAILORED DISINFECTION OPTIMIZATION

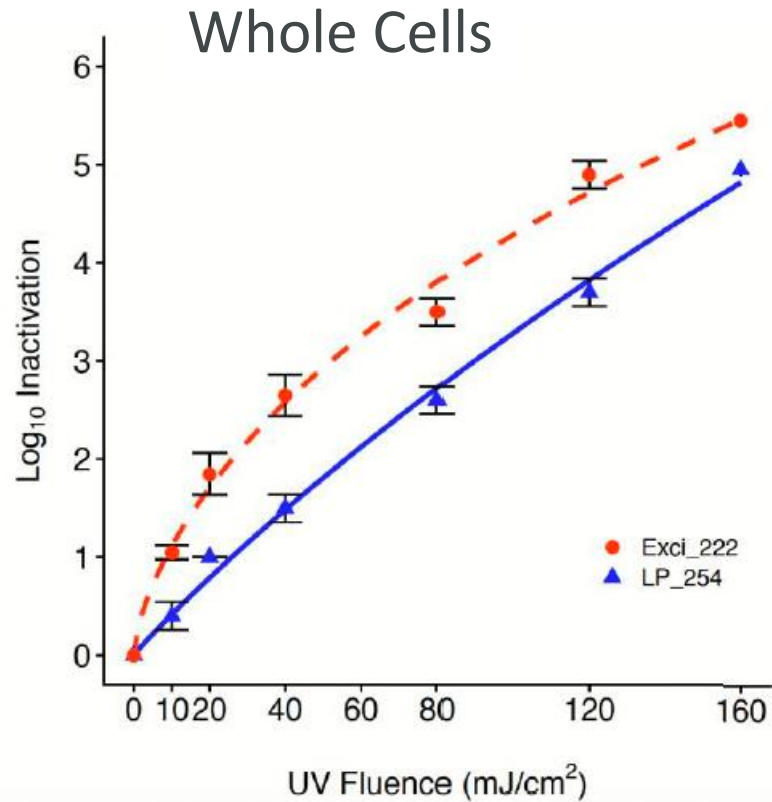
KrCl Excimer lamp (Excilamp)

Light Emitting Diodes (LEDs)



222 NM DISINFECTS ANTIBIOTIC RESISTANT *B. SUBTILIS* > 254 NM

Disinfection



Yijing Liu

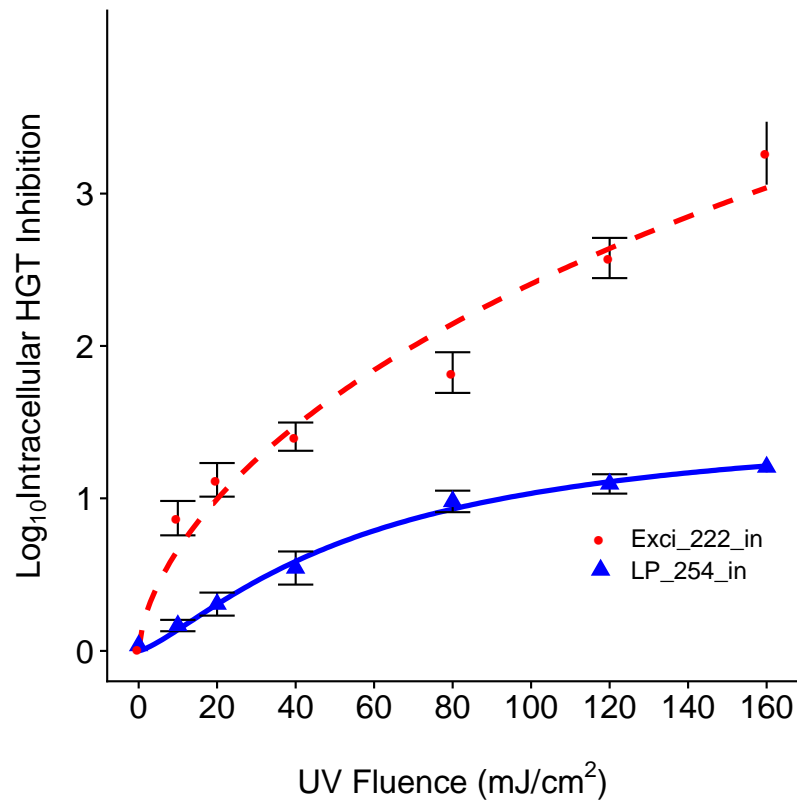


Bacillus Genetic Stock Center

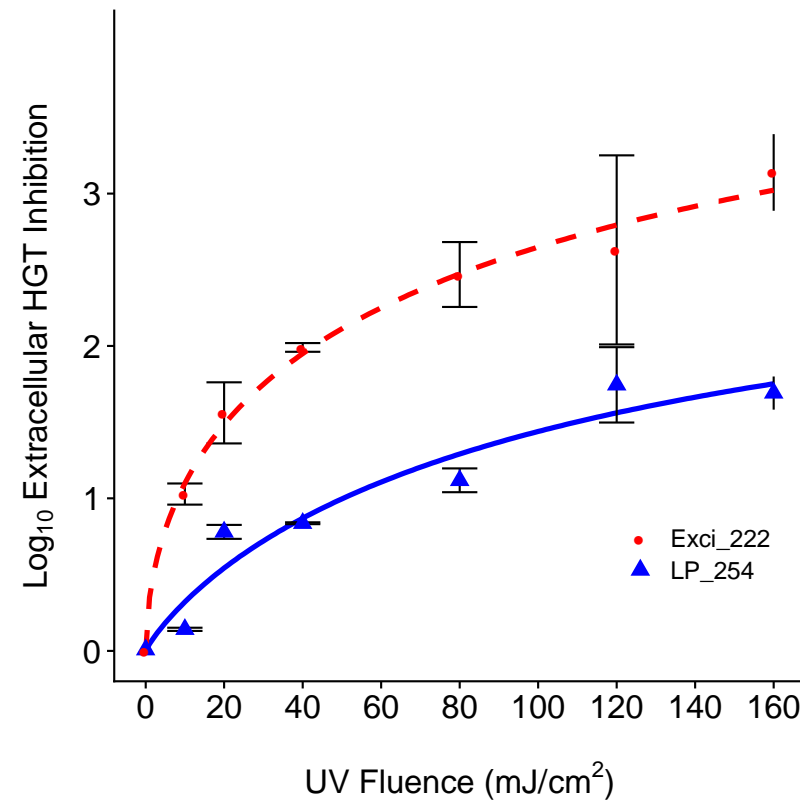
222 NM DISINFECTS ANTIBIOTIC RESISTANT *B. SUBTILIS* > 254 NM AND BETTER PREVENTS HORIZONTAL RESISTANCE GENE TRANSFER

Inhibition of HGT

Whole Cells



Extracted DNA

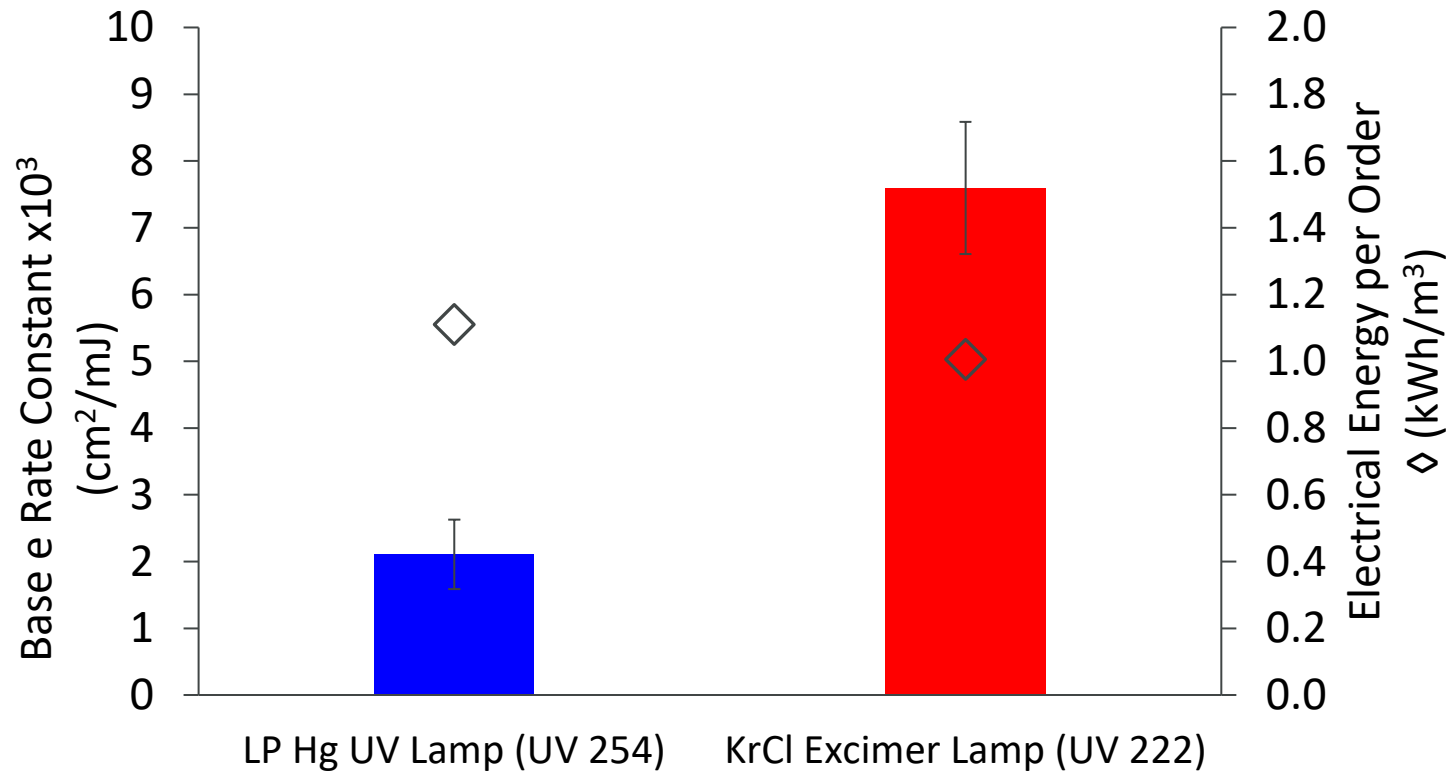


Yijing Liu

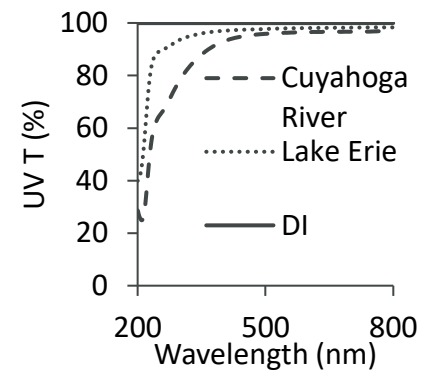


Bacillus Genetic Stock Center

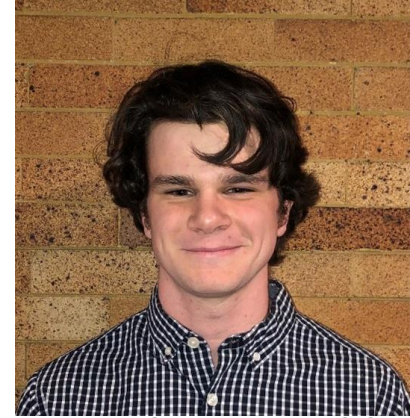
222 NM DEGRADES ALGAL TOXIN MICROCYSTIN-LR > 254 NM



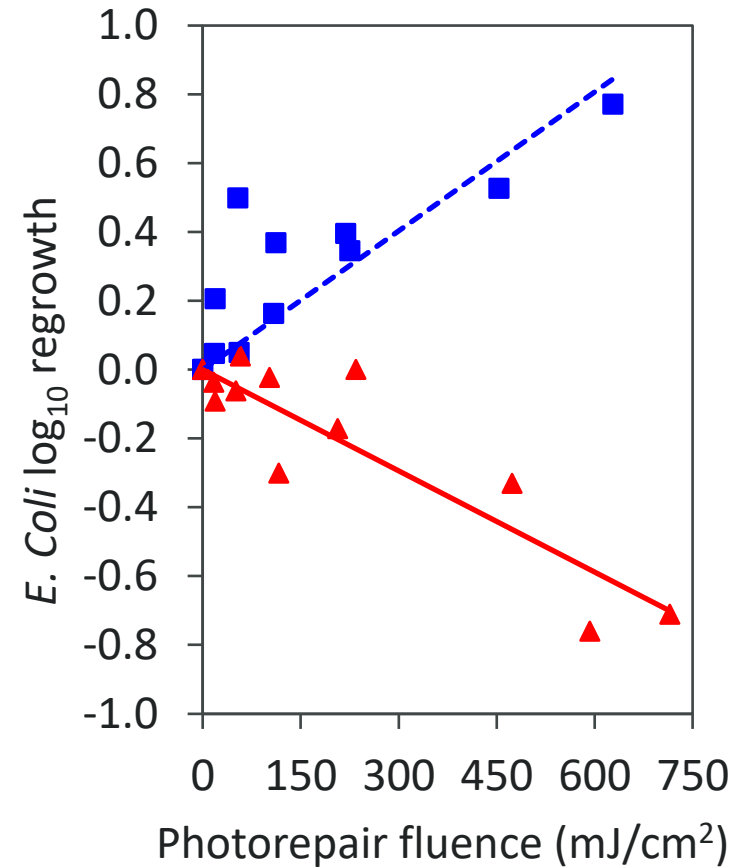
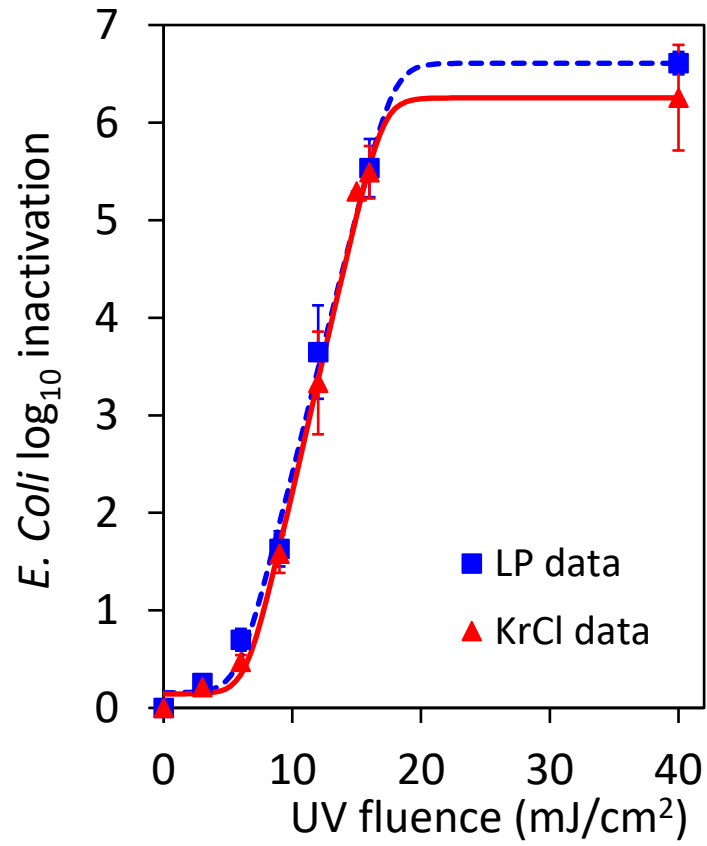
Zanna Leciejewski



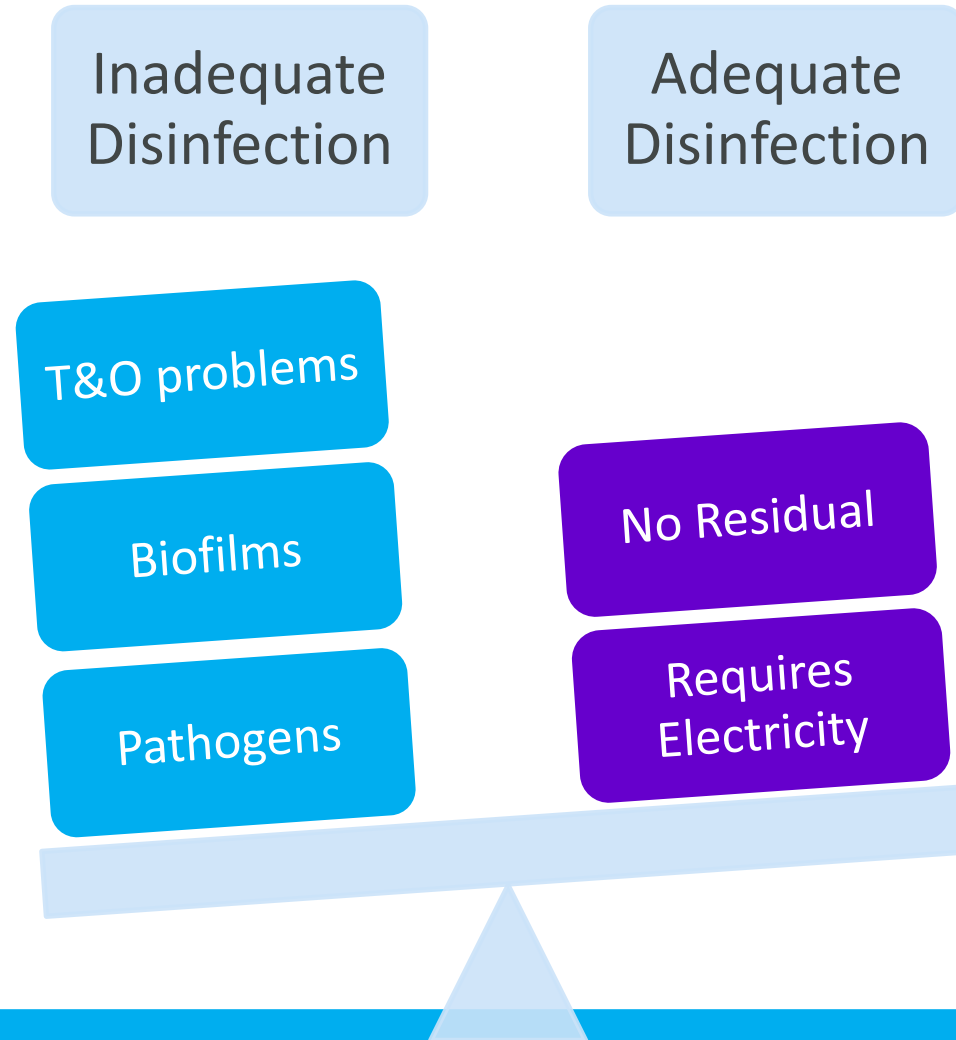
222 NM REDUCES *E. COIL* REGROWTH > 254 NM



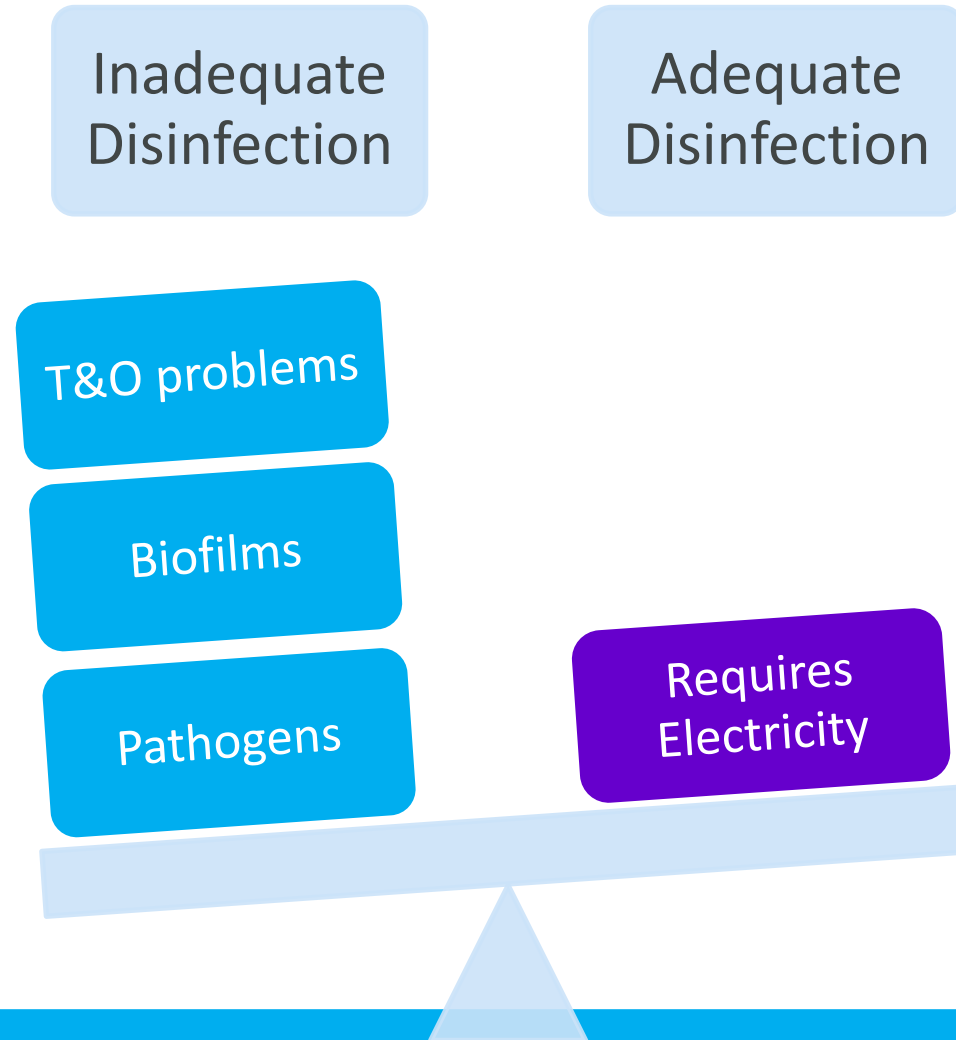
David McDonald



MERCURY-FREE UV FOR MANAGING MICROBIAL WATER QUALITY



MERCURY-FREE UV FOR MANAGING MICROBIAL WATER QUALITY THROUGHOUT DISTRIBUTION



MERCURY-FREE UV FOR MANAGING MICROBIAL WATER QUALITY THROUGHOUT DISTRIBUTION

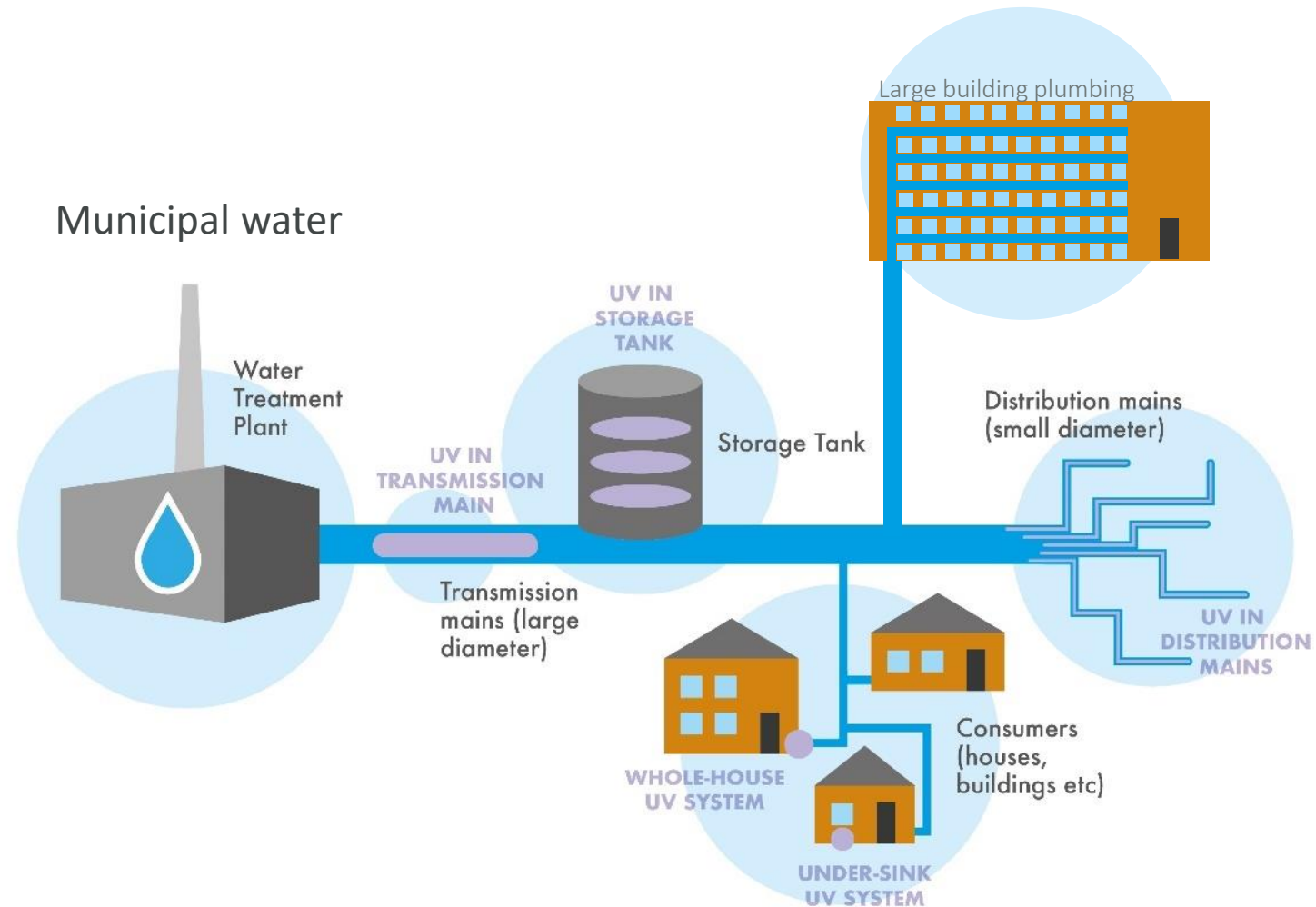
POU devices



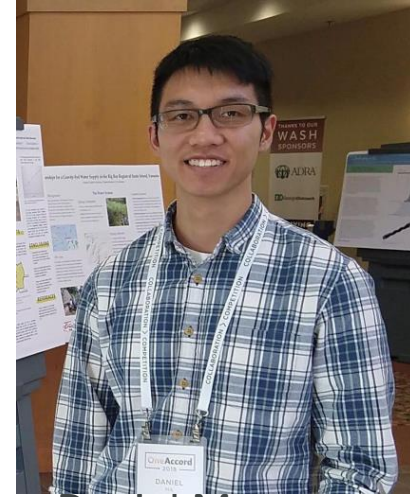
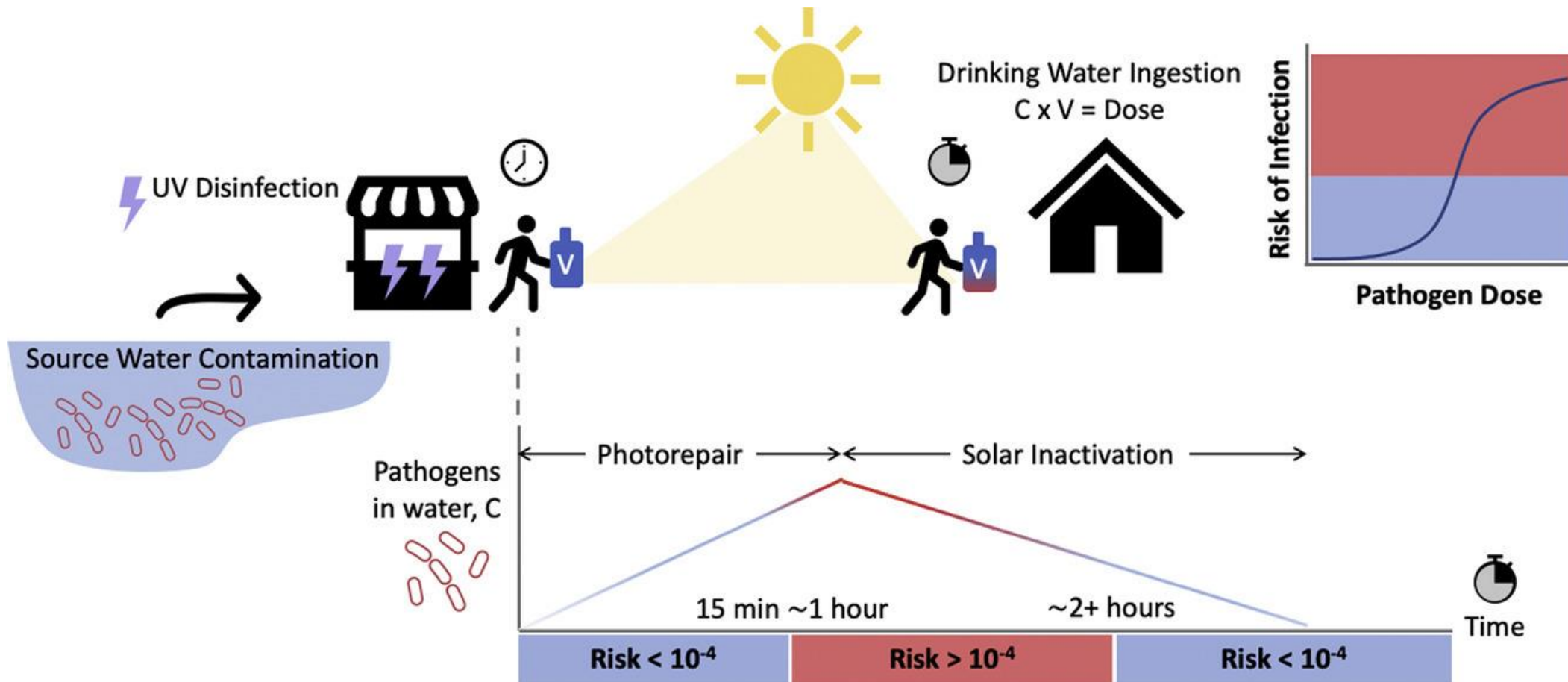
Well water



Municipal water

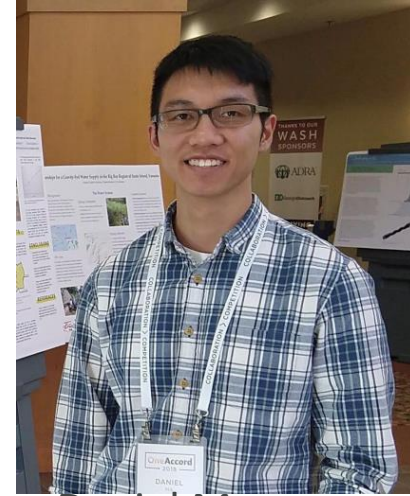
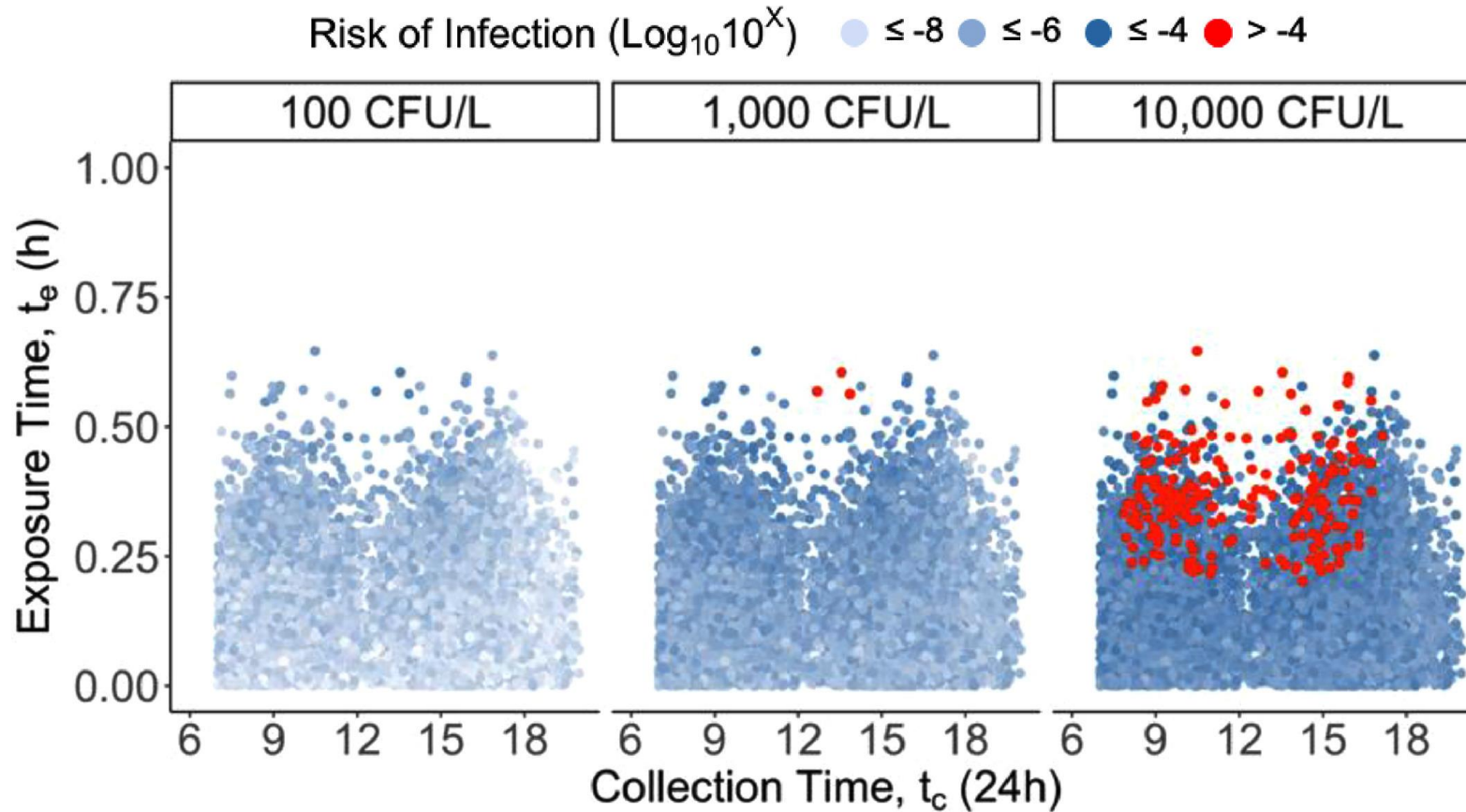


RISK CAN BE USED TO INFORM UV WATER SYSTEM PLANNING

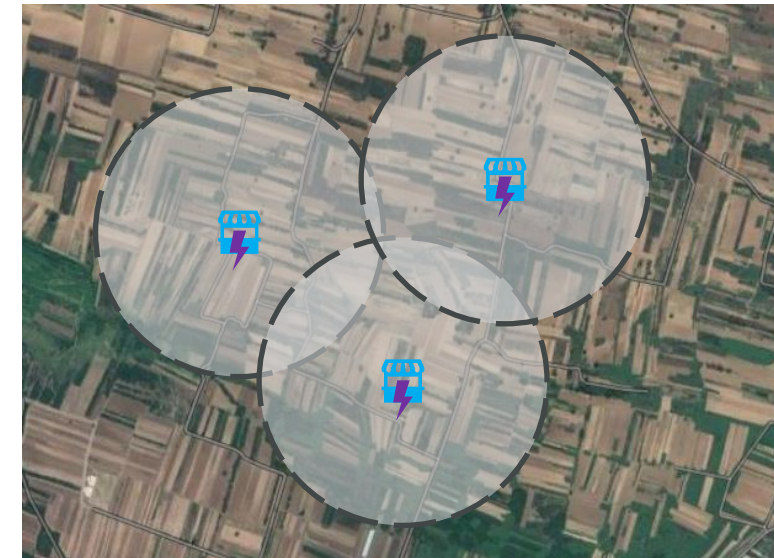


Daniel Ma

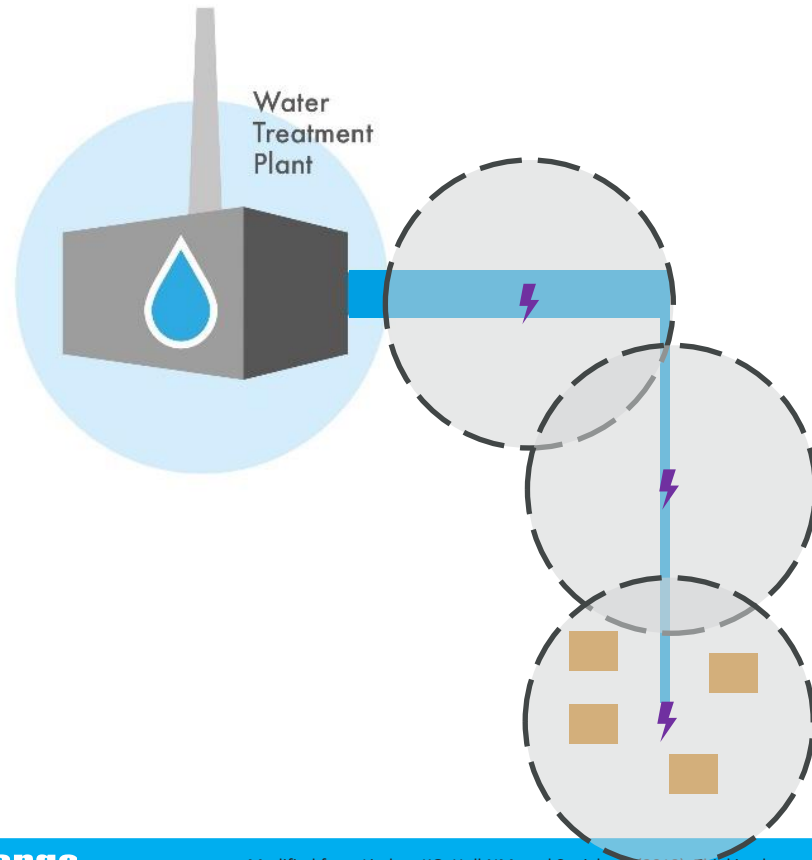
RISK CAN BE USED TO INFORM UV WATER SYSTEM PLANNING



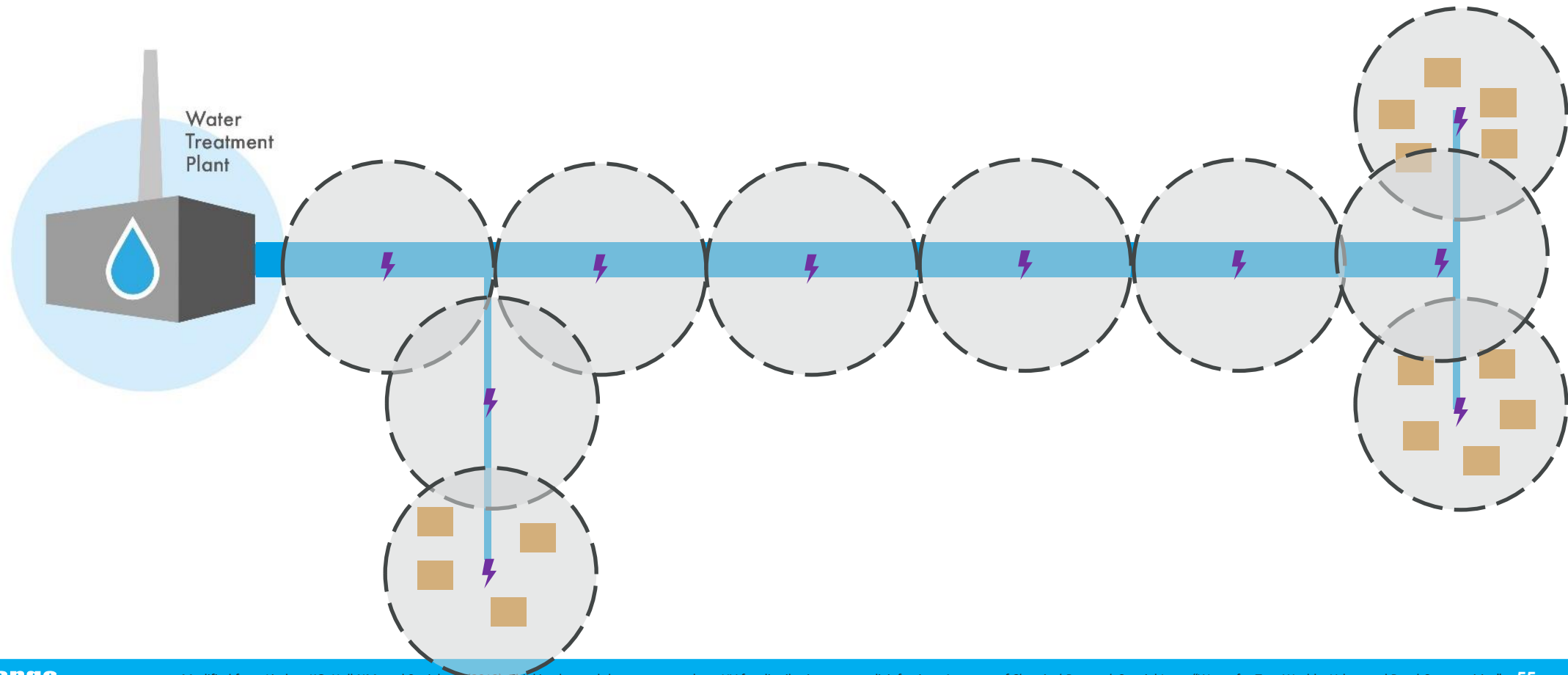
Daniel Ma



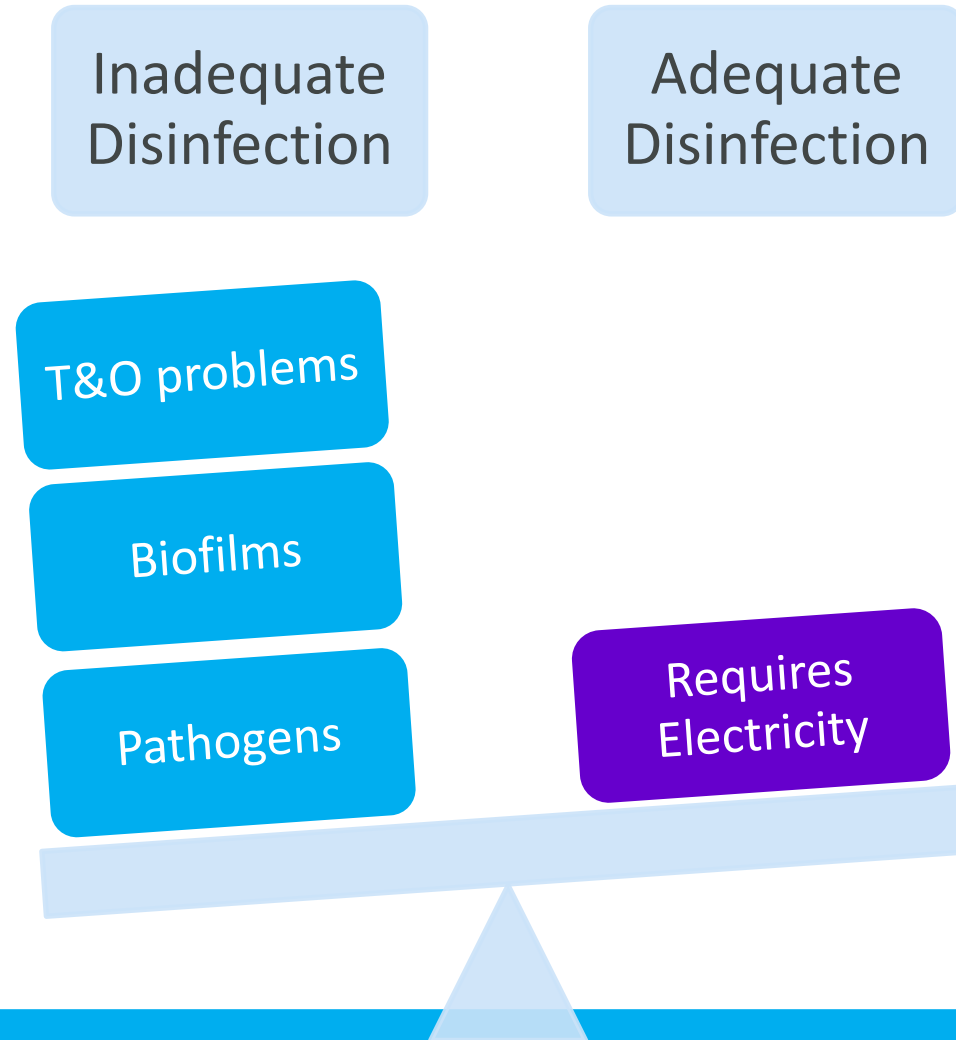
RISK CAN BE USED TO INFORM UV WATER SYSTEM PLANNING



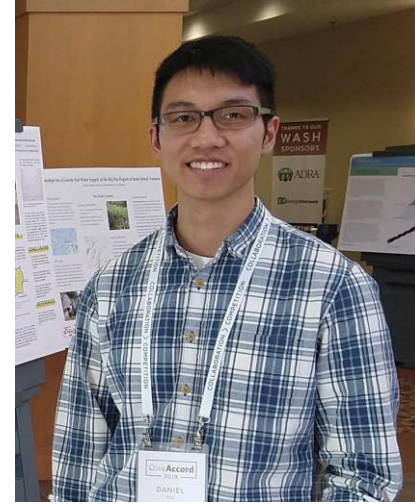
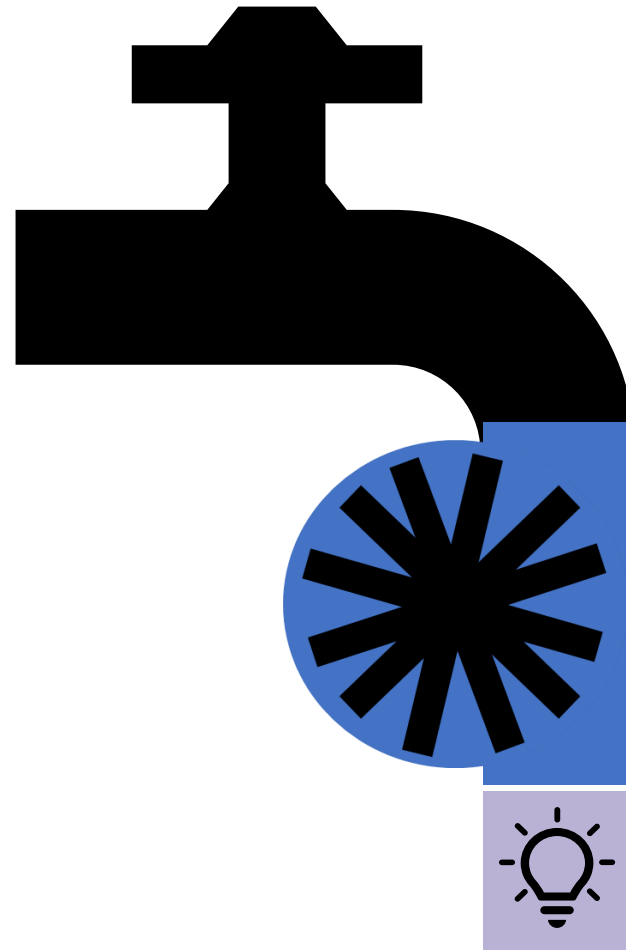
RISK CAN BE USED TO INFORM UV WATER SYSTEM PLANNING



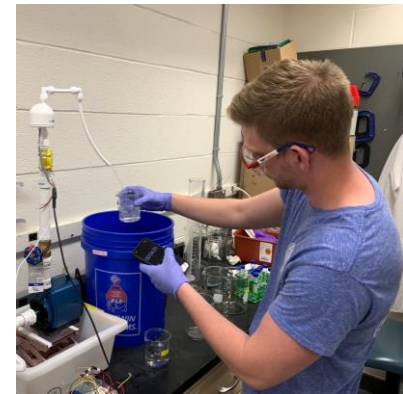
MERCURY-FREE UV FOR MANAGING MICROBIAL WATER QUALITY THROUGHOUT DISTRIBUTION



MERCURY-FREE UV + HYDROPOWER FOR MANAGING MICROBIAL WATER QUALITY THROUGHOUT DISTRIBUTION



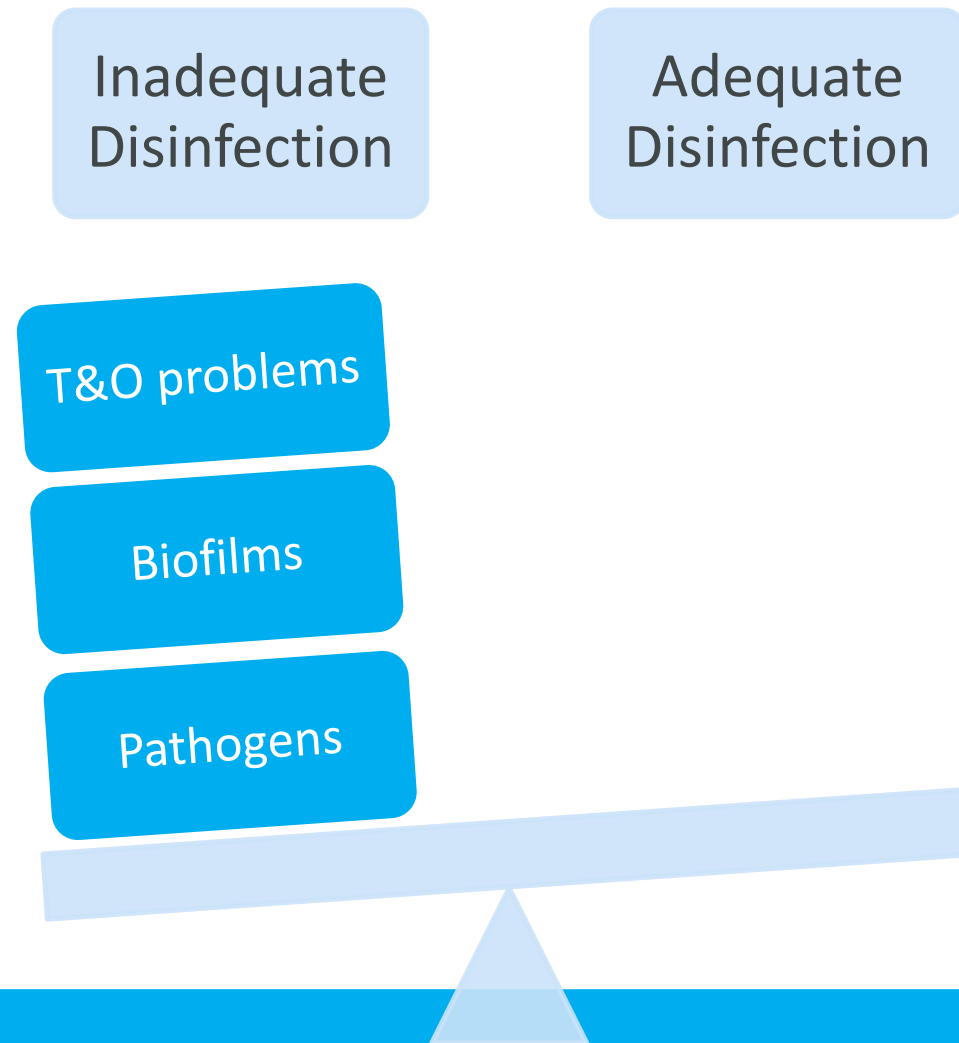
Daniel Ma



Jake Huff

Dr. Clarissa Belloni
MAE Capstone

ADDRESSING BOUNDARIES FOR UV DISINFECTION



OVERCOMING CHALLENGES OF IMPLEMENTING UV TECHNOLOGIES IN SMALL, RURAL WATER SYSTEMS

- UV LED disinfected water 1 year with low cost and no maintenance
- Promising possibilities for wavelength optimization
- Risk based planning and tech advancements enable distribution UV

Women's perception of change and impact on their lives of a novel HWTS UV disinfection system

ANE GALDOS BALZATEGUI / CÁNTARO AZUL



HOUSEHOLD LEVEL WATER SOLUTIONS: THE CHALLENGE

- A necessary solution in a short, medium term for some contexts.
- Challenge in the quantity and quality of the water.
- Burden for the end users (Operation and Maintenance).

Gender roles in water management

Women are water managers at the household level: responsible for ensuring enough water every day for all the needs of the family.

- Transportation to the household
- Storage and distribution within the household
- Administration (smart use)
- Drinking water treatment



THE DESIGN

PURPOSES

1. Increase treated water availability in the household to **fulfill the human right to water (50-100 liters per person per day)**.
2. Provide access to treated water at key points in the household to **simplify exclusive use of treated water**.
3. Avoid water storage after treatment to **reduce the risk of re-contamination**.







HOUSEHOLD WATER TREATMENT AND SAFE STORAGE (HWTS) SYSTEM

- **Point-of-entry system**, designed to supply at least the minimum 50 liters of safe water per person per day, established by the human right to water.
- The **water is piped and distributed to taps** at different points in the household. At least:
 - Kitchen
 - Hygiene setting



WATER QUALITY FEEDBACK




Resultados de Calidad de Agua para Beber

Nombre del cooperante: ██████████ Código del hogar: ME08H16 **Visita 3**
 Fecha de visita: 09/11/21 ID: 6

Foto del punto de colecta



Foto del resultado de E. coli



Resultado:

0 NMP de E.coli

Punto de colecta: Llave del sistema de agua segura

Notas sobre la muestra: 0

Riesgo para la salud:

●
 Agua segura

¿Qué significan estos resultados?

●	Alto, esta agua NO es segura para beber , podría causarte enfermedades. Es mejor dar algún tratamiento (hervir, clorar o desinfectar con el sistema) antes de beberla. También hay que evitar almacenarla o hacerlo en un recipiente limpio y tapado.
●	Precaución, esta agua NO es segura para beber . Es mejor dar algún tratamiento (hervir, clorar o desinfectar con el sistema) antes de beberla. También hay que evitar almacenarla o hacerlo en un recipiente limpio y tapado.
●	El agua está un poco contaminada . Es mejor dar algún tratamiento (hervir, clorar o desinfectar con el sistema) antes de beberla. También hay que evitar almacenarla o hacerlo en un recipiente limpio y tapado.
●	El agua está limpia , se puede consumir sin ningún problema.

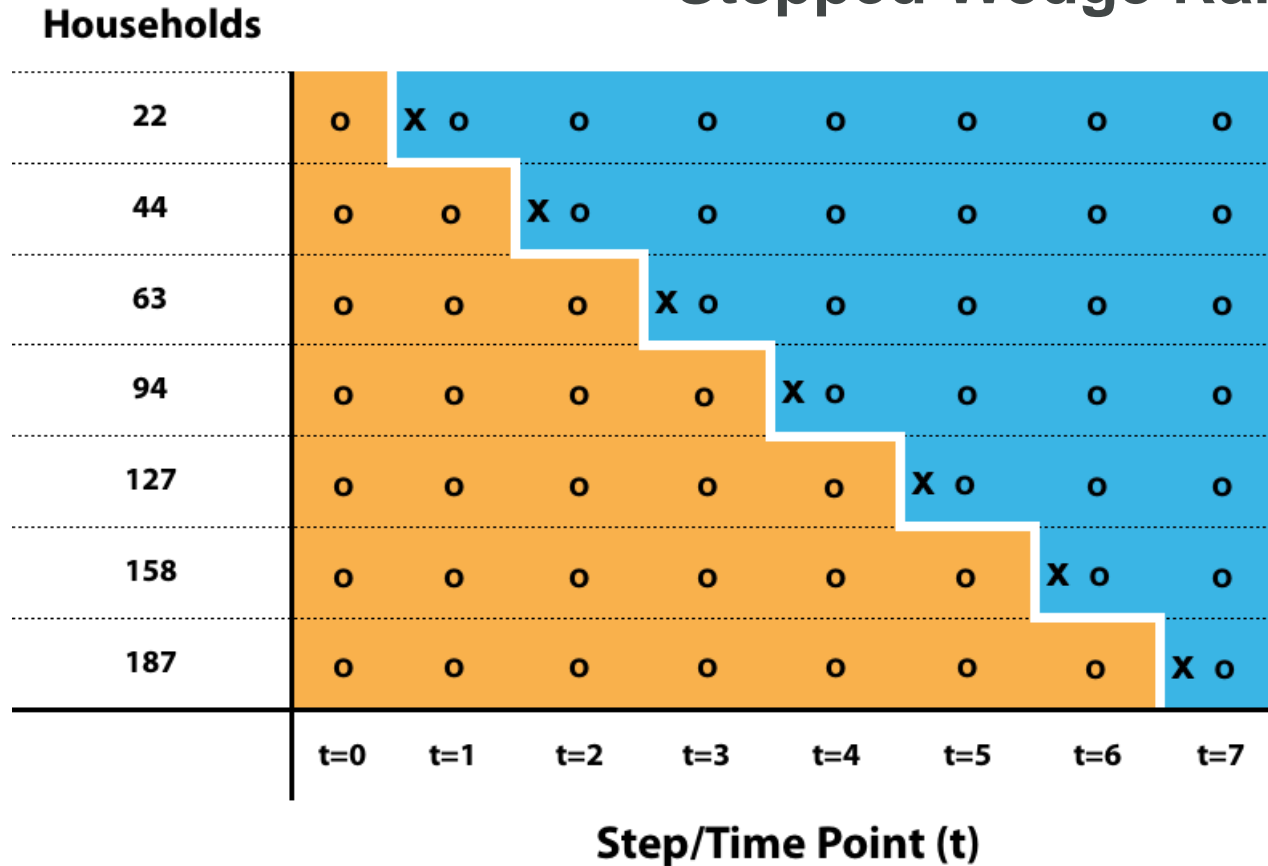
Notas técnicas:

- El método utilizado fue Número Más Probable mediante la técnica de bolsas compartimentadas. Detalles técnicos: Acuagema (BT EC+ TC) (Compartment Bag Test) Most Probable Number (MPN) Kit.
- Este método está aprobado por la NOM-210-SSA1-2014: Productos y Servicios. Métodos de Pruebas Microbiológicas. Determinación de Microorganismos Indicadores. Determinación de Microorganismos Patógenos.
- El resultado de E. coli está categorizado según la tabla de riesgo de inspecciones sanitarias de la Organización Mundial de la Salud (OMS, 4ª Edición, tabla 3.4).

Para más información contactar a los técnicos comunitarios en Chímik. O bien a Ludo Pedro, Mónica Camacho ó Ane Galdós al teléfono 967 631 5817 en horarios de 9 am a 3 pm, ó escribir a los correos: ludco_pedro@cantarozul.org, monica@cantarozul.org y ane@cantarozul.org.

STUDY DESIGN

Stepped Wedge Randomized Trial



Sample	187 HH
Number of observations	8
Duration of each step	2 months
Total follow up time	15 month

O= Observation

X= Intervention

Before Intervention

After Intervention

METHODOLOGY

Quantitative data

- Observations
- Surveys
- Water quality tests
- Main indicators
 - Water Quality
 - Water use practices



Qualitative data

- Four focal groups
- Six interviews
- Reflection sessions with the field team
- Research question

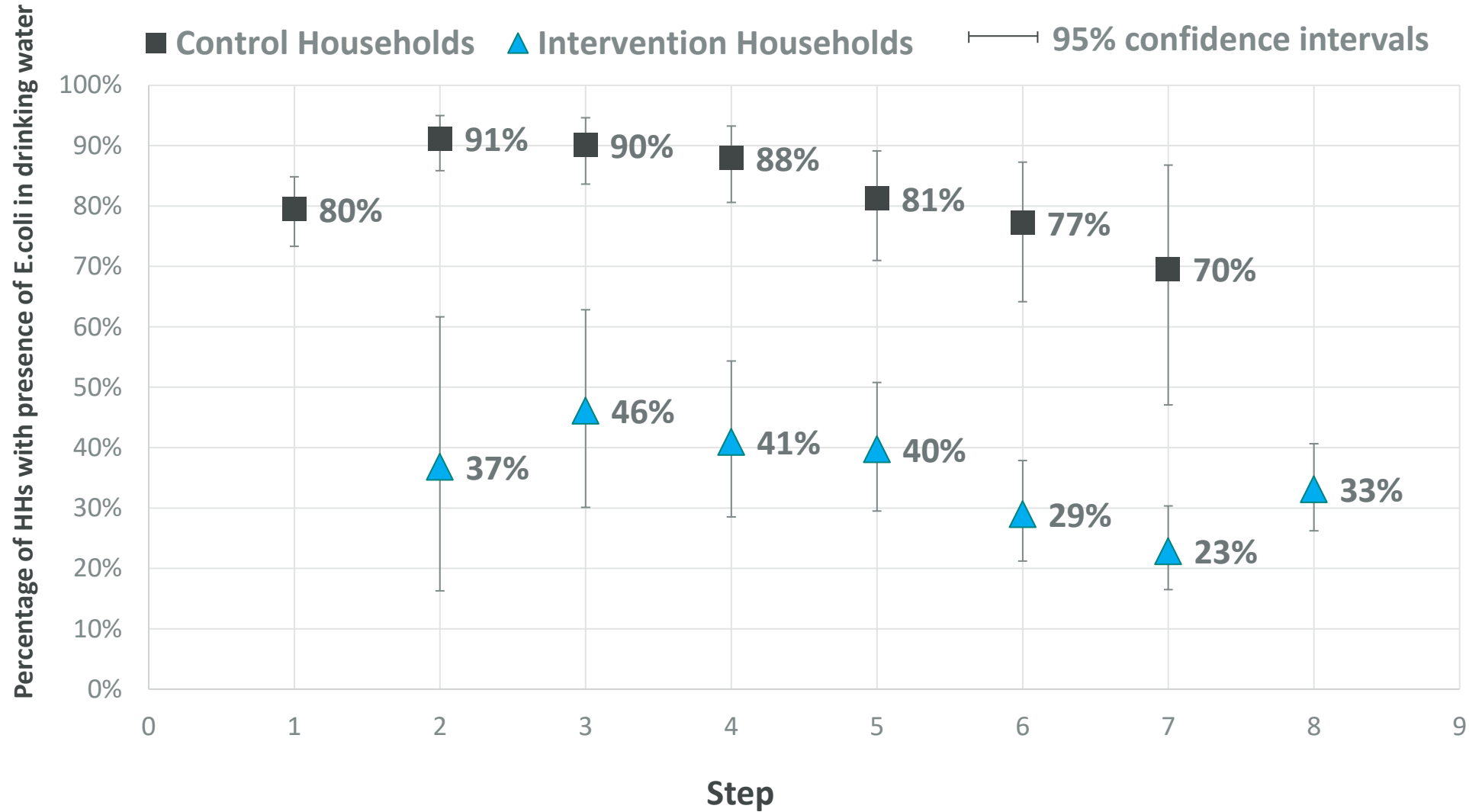
What are the aspects that women name when expressing the changes they perceive after the intervention?



DRINKING WATER IN THE HOUSEHOLDS

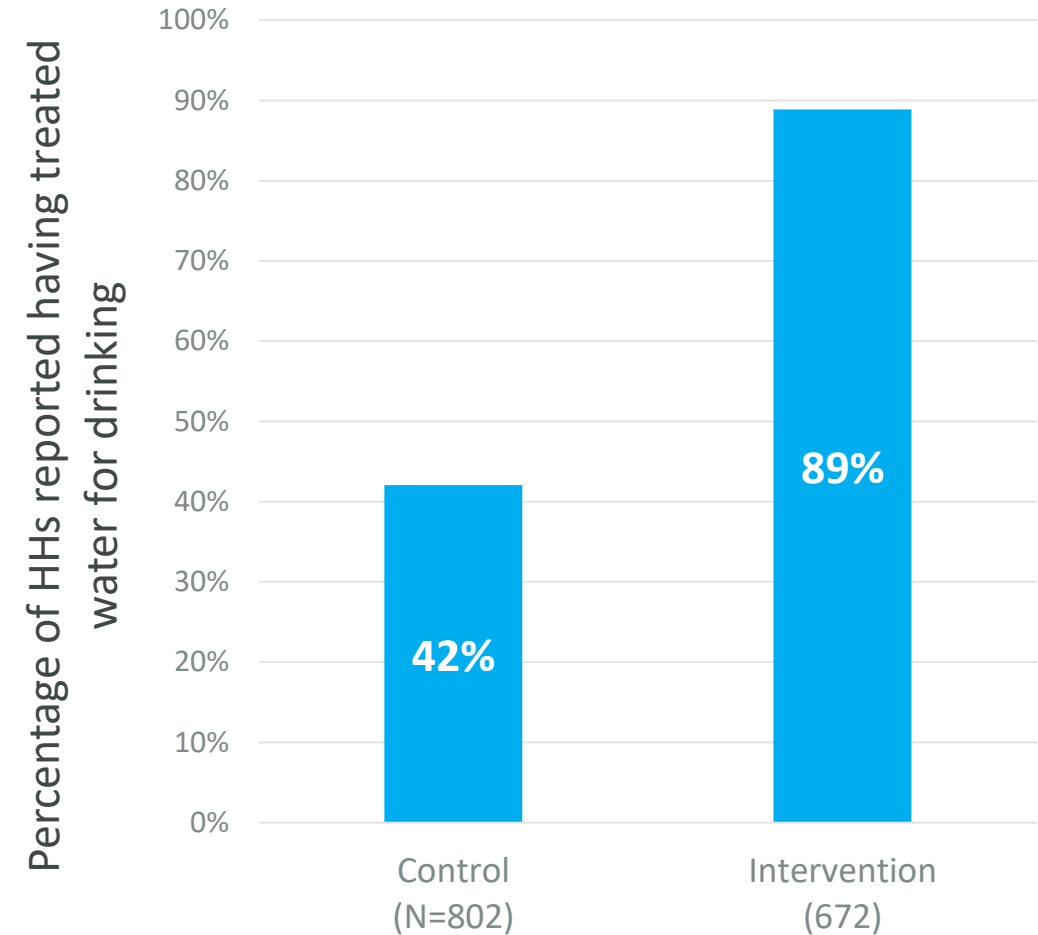


PERCENTAGE OF HHS WITH PRESENCE OF *E. COLI* IN DRINKING WATER



WATER USE PRACTICES

- Most households discontinued the **practice of storing water in multiple containers** after the installation of the SAFEWATER systems.
- Change in the habit of drinking treated water, as it increased from **42%** to **89%**.
- Only **9.5%** of respondents in intervention households with access to disinfected water reported drinking from a point of access different than the taps of the system.



WOMEN'S PERCEPTIONS OF CHANGE IN THEIR LIVES

Life is easier

Physical Health

Quality of life

“It has changed our
way of life”

Mental Health

Security

LIFE IS EASIER

- “we no longer boil the water”
- “I fetch less water and wood”
- “I don’t have to walk long distances”
- “before I had to carry clothes long distances”
- “safe water is in every home”
- “now the water is close by, even inside the house”
- “It is easier to serve the water”
- “It is easier to store water”



PHYSICAL HEALTH

- “we have noticed that children get less sick from diarrhea and stomach ache”
- “We also get sick less”
- “My back doesn't hurt so much anymore”



MENTAL HEALTH

- “I feel calmer not having to fetch water, now when I need it I have it at home”
- “Before, I would wake up at five in the morning thinking that I had to go fetch water and my back would hurt a lot”
- “I feel calmer because the water is clean, I'm afraid of bacteria”
- “Before we suffered a lot. Children sometimes also fetched the water and they suffered”



SECURITY

- “we are many people in the community. Sometimes at three in the morning we keep waiting for the water to sprout, we arrive home at 5:30 in the morning”
- “we fought over water, because there is very little, whoever stays last gets pure mud”
- “the water is safer, it no longer has bacteria”



TAKES AWAY



1. Solutions must be designed to make life easier. It's not just about technology. They must be contextualized.
2. The biggest challenge is to guarantee continued access to safe water. Operation and maintenance are key points to consider in the design of an intervention.



SAFE
WATER

Testimonials



Cántaro Azul

Ane Galdos Balzategui
ane@cantaroazul.org



The Safe Water Project in Mexico was funded by:



Q&A Discussion

MODERATOR & SPEAKERS

Final remarks & Conclusion

MODERATOR: HADAS MAMANE & RACHEL GEHR

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