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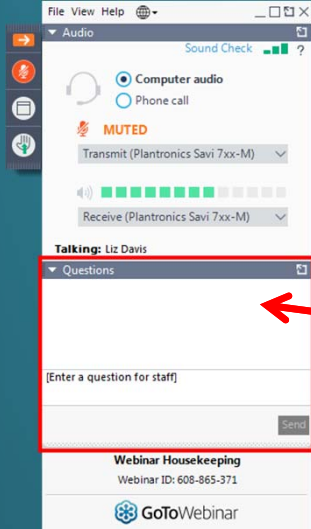
**CDC and EPA Wastewater Based
Epidemiology (WBE) Program:
Building a Surveillance Program Based on
Wastewater Sampling**

Recorded Wednesday, July 15, 2020
Introduced by Claudio Ternieden
Senior Director, WEF Government Affairs




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How to Participate Today



- **Audio Modes**
 - Listen using Mic & Speakers
 - Or, select “Use Telephone” and dial the conference (please remember long distance phone charges apply).
- **Submit your questions using the Questions pane.**
- **A recording will be available for replay shortly after this webcast.**

 Water Environment Federation
The water quality people

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COVID-19 Sewage Surveillance

Assessing utility to inform public health action

Amy E. Kirby, PhD MPH and Mia Mattioli, PhD

Waterborne Disease Prevention Branch
Division of Foodborne, Waterborne and Environmental Diseases

Community Interventions and Critical Populations Task Force
COVID-19 Response



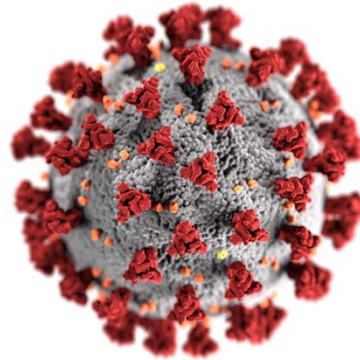
cdc.gov/coronavirus



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Topics Covered

- Introduction to Sewage Surveillance
- Current State of the Science
- Potential for Targeted Use Cases
- Limitations of Sewage Surveillance
- CDC's Implementation Plan for Community Sewage Surveillance
- Risk from Water and Wastewater



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Introduction to Sewage Surveillance



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The New York Times

Australia to Detect Coronavirus Spread by Testing Raw Sewage

By Reuters

April 16, 2020, 3:30 a.m. ET

The New York Times

Is It Safe to Come Out of Lockdown? Check the Sewer

Wastewater could provide early, painless and localized data about the rise or fall of coronavirus levels.

The New York Times

Some scientists are using sewage to measure the prevalence of coronavirus in their communities

By Alec Snyder and Susannah Cullinane, CNN

Updated 7:45 PM ET, Sun April 26, 2020

CNN.com

POOP could help stop the pandemic. Really.

Wastewater offers a promising way to track the virus, a top CDC doctor says.

Politico

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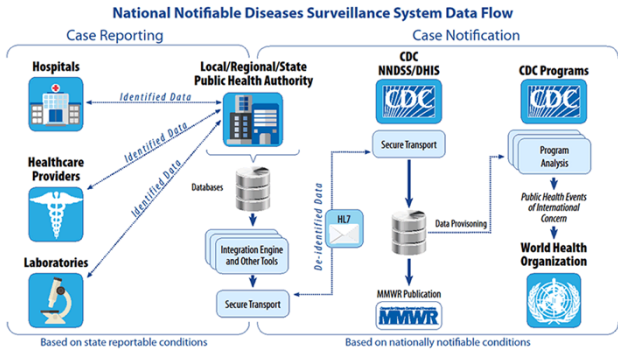
Sewage | A Surveillance Resource

- Dozens of researchers across the US and worldwide
- States considering mandating wastewater utility monitoring
- SARS-CoV-2 sewage data are currently becoming available: AZ, CA, OR, LA, MI, FL, PA, WA, MA, WI, SC, TX, OH, VA, NY, UT, MO...

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National Sewage Surveillance | CDC's Role

- Ensure data comparability across jurisdictions
- Analyze data to provide public health interpretation and guidance
- Summarize and make national data available for states and public
- Support inter-health agency communication for public health action



COVID-19 Sewage Surveillance | Public Health Toolbox

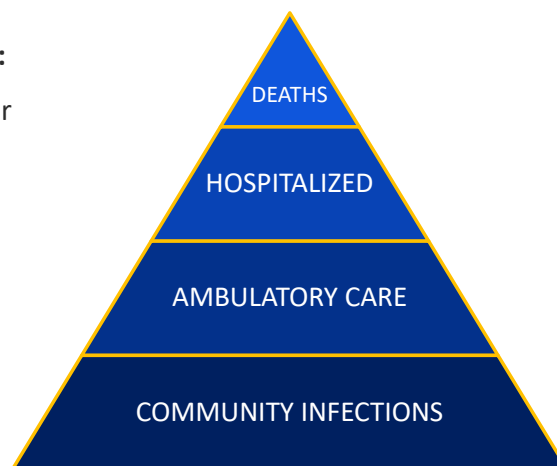
- Sewage is an efficient pooled sample of community (or sub-community) infection prevalence
- Captures sub-clinical infections
- Independent of healthcare-seeking behavior and testing access
- Data available within days of shedding onset versus up to 2-week lag for other surveillance data



How Health Departments Can Use Sewage Data to Make Response Decisions

Sewage data will complement case- and symptom-based surveillance by providing:

- Resolution to conflicting clinical indicator trends
- Infection data for communities where testing data are not available
- Understanding of sub-county variability
- Infection information during sub-clinical phases



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Sewage Surveillance Data



Current potential: *based on state of the science*

- Provide county and sub-county level total infection **trends**
- **Leading indicator** of potential infection increases following reopening of communities
- **Early warning** to inform re-closure decisions – particularly for high-risk facilities like senior living centers, university campuses, prisons, nursing homes
- **Tracking** virus evolution and global origin upon emergence in US

More data needed: **estimating overall daily infection prevalence within a sewershed**

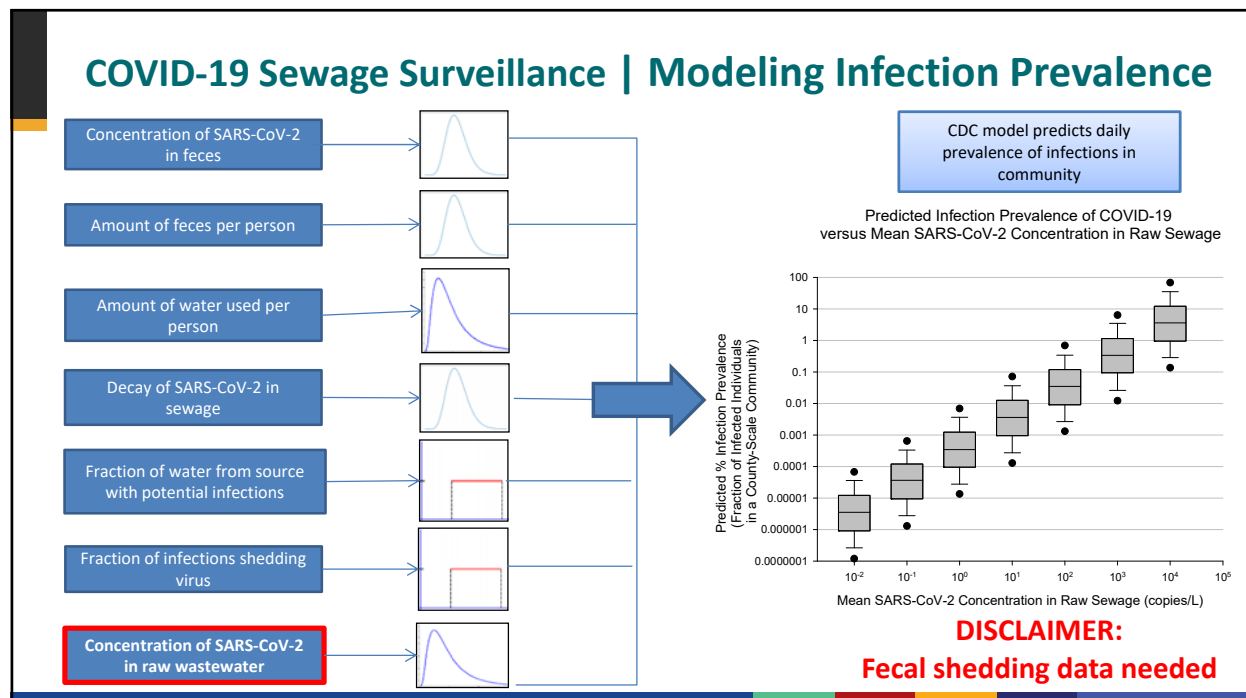


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Current State of the Science



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COVID-19 Sewage Surveillance | CDC Assessment

- Identifying minimum data needed for public health use of sewage data
 - Utility operation
 - Population served
 - Quality assessment/quality control
- Compatibility of testing methods, inter-laboratory performance, and infection models
 - Concentration method
 - Genomic detection target
 - Normalization parameter performance
 - Comparing CDC model to others

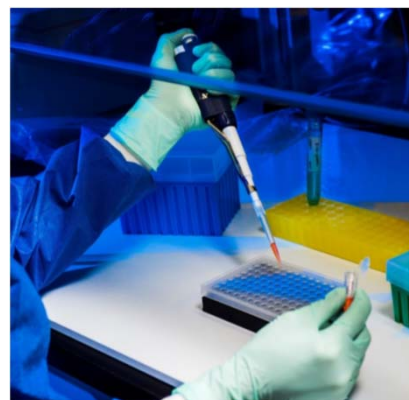


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COVID-19 Sewage Surveillance | Assessment Metrics

Success will be determined by retrospectively evaluating usefulness of sewage data to the response

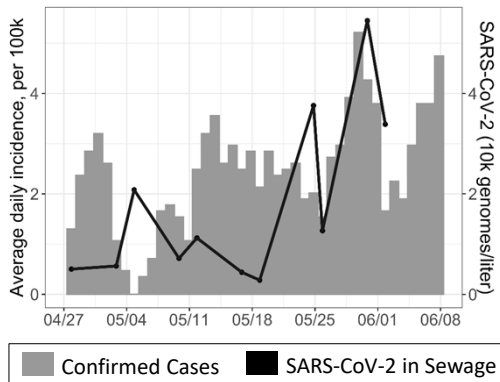
- Emergence/Disappearance
 - **Timeliness** of sewage detection as leading indicator of emergence
 - Establishing **sewage testing method detection limit** related to minimum infection prevalence
- Trend Evaluation
 - **Timeliness** of sewage concentration as leading trend indicator compared to clinical reporting
 - Tracking sewage concentration **changes** as indicator of meaningful clinical changes



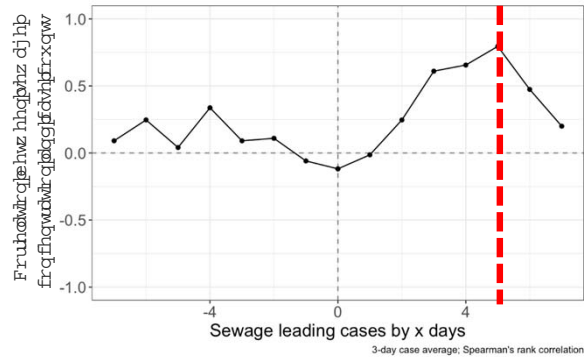
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SARS-CoV-2 Sewage Assessment | Case Association

Sewage concentrations correlate with confirmed cases ~4-6 days in the future.



Time Series

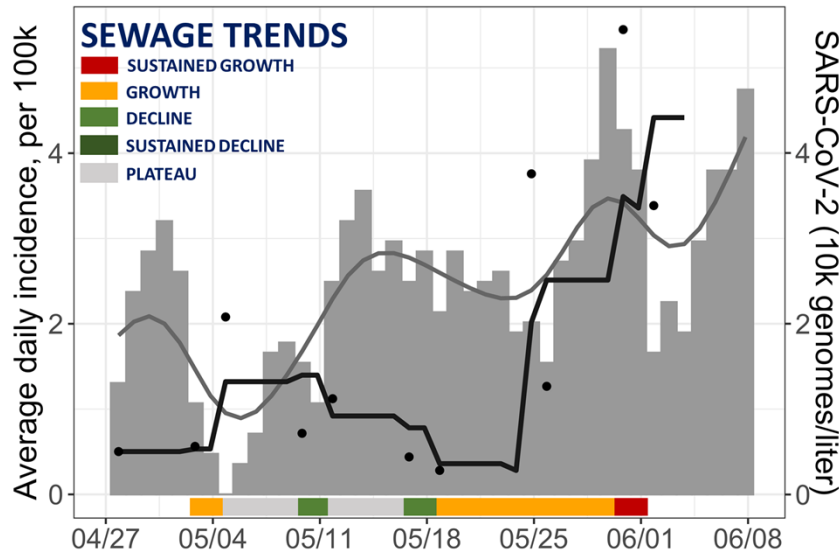


Correlation



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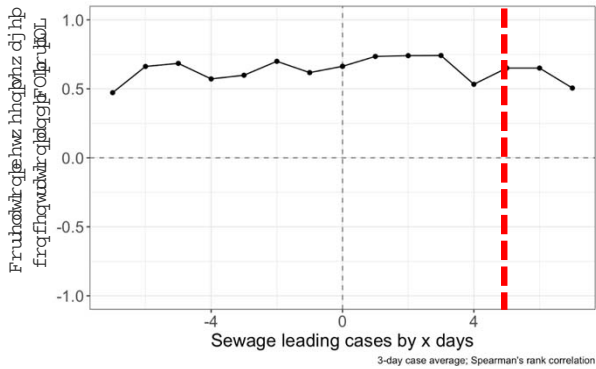
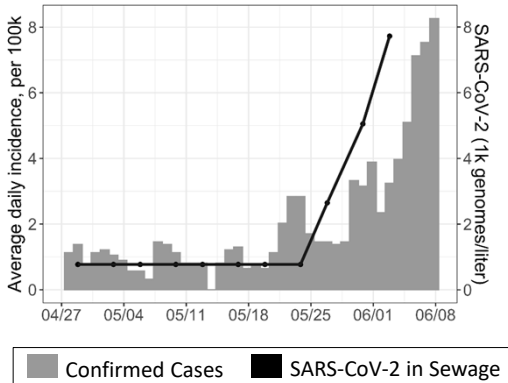
SARS-CoV-2 Sewage Assessment | Trends



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SARS-CoV-2 Sewage Assessment | Case Data

Sewage captured the Memorial Day-associated spike in cases in Southeast



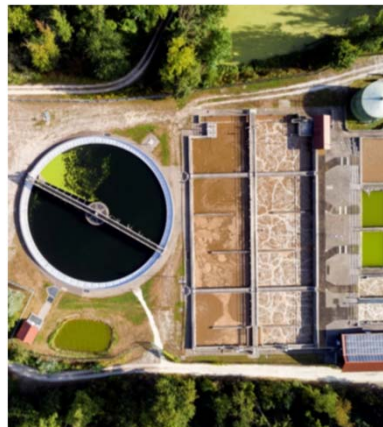
COVID-19 Sewage Assessment | Quality Data Are Key

- Updating model parameters as new science is available to estimate prevalence: fecal virus titer
- Understanding and coordinating
 - Sampling plan design for data use
 - Sample collection procedures
 - Testing data methods and quality
 - Normalization of data over time
- Partnering with EPA for standardization and recommendations by use case: treatment plants, universities, nursing homes, etc.



COVID-19 Sewage Assessment | Targeted Use

- **Universities**
 - Challenge: mixture of resident and daily commuting inputters into waste stream
 - Benefit: high-risk site but similar to community modeling with often on-campus treatment system
- **Nursing Homes / Prisons**
 - Challenge: isolating waste stream within sewer system and small percentage of commuting input
 - Benefit: stable residency contributing to waste stream and can pair with routine clinical testing
- **Food Processing Facilities**
 - Challenge: high use of water for production with low-density human fecal input
 - Benefit: detection alone informative and could pair with clinical testing (serology, nasal, fecal wipes)



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COVID-19 Sewage Assessment | Limitations

- Decentralized wastewater treatment facilities will not be captured
- ~25% of US residences are not connected to sewer
- Low incidence may be below the limit of detection
- Cannot be used to “clear” or “lock down” a community or facility
- May be impacted by pre-treatment of sewage for odor or worker safety



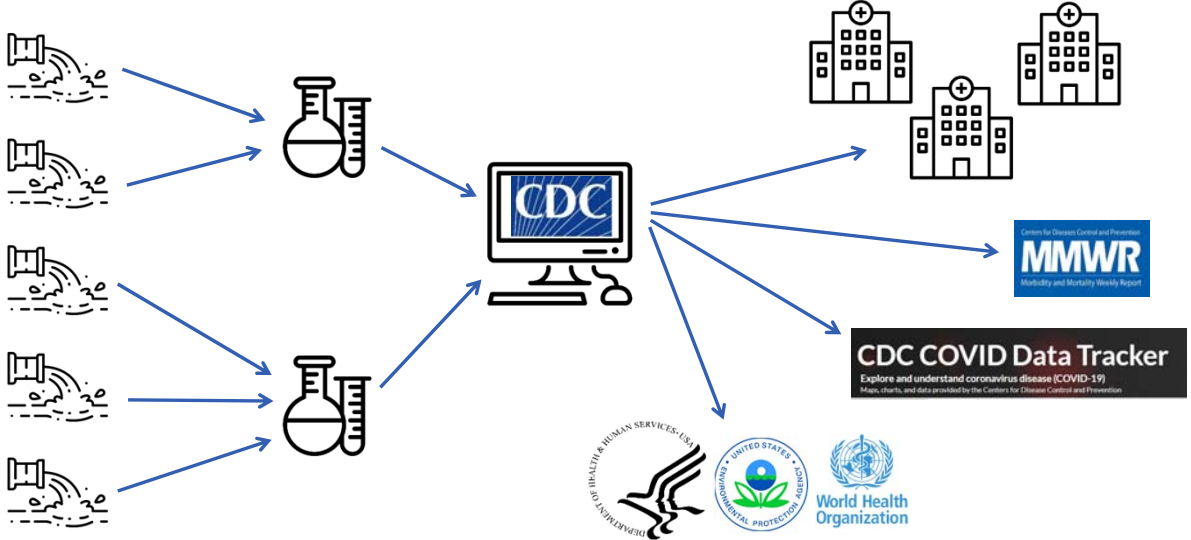
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CDC's Implementation Plan



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National Wastewater Surveillance System (NWSS)



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NWSS Implementation Timeframe

2-6 months

- Establish sentinel network of utilities and labs
- Stand up data portal at CDC
- Develop best practices
- Continued evaluation of performance and utility

6-18 months

- Finalize system standards, processes, requirements
- Consolidate methods to standard method(s)
- Onboard PHLs and EHLs for sustainability
- Scale to national



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Operational Activities

Staffing



- Microbiologists, environmental engineers, data analysts
- Quality manager
- Epidemiologists



Data Portal

- Working to stand up DCIPHER data portal



Federal Lab Support

- CDC BSL2+ lab for sewage testing
- Method development with EPA



Funding Utility and Lab Partners

- Ongoing discussions with CDC program managers to determine optimal funding mechanisms for external partners



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CDC Support and Coordination | Near Term

- **External partner awareness and support**
 - Website for HD/utilities needed to provide support for ongoing activities
 - State and local HD support and coordination
- **Preparing for anticipated operational phase**
 - Communication with HD and labs
 - Sentinel site selection and support
 - Sewage testing by CDC national lab
 - Targeted use assessment: universities, nursing homes/prisons, food facilities



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Coordination Activities | Leveraging Existing Capacity



Interagency coordination

- EPA-HHS-CDC-DHS-DoD Interagency Coordination Group
- EPA-CDC-HHS Implementation Coordination Team



Coordination with other CDC teams to evaluate targeted use cases

- Prisons: CDC COVID-19 Corrections Unit, EPA
- LTCFs: CDC COVID-19 Infection Prevention and Control Team
- Universities: CDC COVID-19 Community Guidance Unit
- Meatpacking: CDC COVID-19 Food Systems Work Group
- Low-Resource Settings: CDC COVID-19 International TF, Gates Foundation



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CDC Sewage Surveillance | Long Term

National Wastewater Surveillance System (NWSS)

- Data collection at CDC to facilitate national disease surveillance interpretation and public health action
- National CDC laboratory to support testing
- Incorporation of other health targets that can be assessed in sewage
- State and local HD support and capacity building
 - Sampling and testing
 - Data compilation/interpretation
- Key Partners
 - EPA
 - **Stakeholder organizations:** health and water
 - **Academia and Industry**



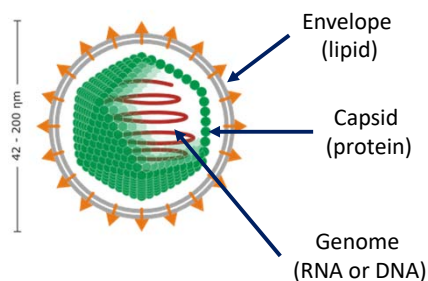
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Risk From Water and Wastewater



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PCR Detection Does Not Mean Virus Is Infectious



- Culture of live virus requires an intact virus particle
- PCR detects specific regions of the viral genome
 - Damage to the envelope, capsid or genome does not necessarily prevent PCR detection



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COVID-19: Wastewater Risk

Table 1
Persistence of SARS-CoV in different waters at 20 °C^a

Water samples	Detection time (day)								
	0	1	2	3	4	5	6	8	14
309th hospital	+	+	+	-	-	-	-	-	-
Domestic sewage	+	+	+	-	-	-	-	-	-
Dechl tap wat ^b	+	+	+	-	-	-	-	-	-
PBS	+	+	+	+	+	+	+	+	+

Table 2
Persistence of SARS-CoV in different waters at 4 °C^a

Water samples	Detection time (day)								
	0	1	2	3	4	5	6	8	14
309th hospital	+	+	+	+	+	+	+	+	+
Domestic sewage	+	+	+	+	+	+	+	+	+
Dechl tap wat ^b	+	+	+	+	+	+	+	+	+
PBS	+	+	+	+	+	+	+	+	+

Wang et al. 2005 J Vir Methods

- Remains unclear whether virus in feces is infectious
- Treatment methods and disinfection are expected to be effective
- There is no epidemiological evidence of higher infection rate in wastewater workers
- Workers should use standard PPE following task-specific risk assessments



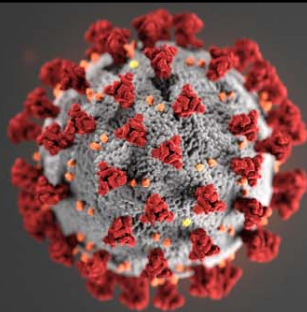
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SARS-CoV-2 and Drinking Water

- No epidemiologic evidence that drinking water exposure is a risk for COVID-19
- Treatment methods are expected to be effective
- Chlorine, chloramines are effective against SARS-CoV-2
- Possible contamination source most likely wastewater
 - Unknown whether virus in wastewater is infectious
- **Boil advisories-** recent advisories have been misinterpreted to be due to COVID-19 and have caused concern about safety of handwashing
 - adding boil advisory guidance to CDC Water and COVID webpage



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For more information, contact CDC
 1-800-CDC-INFO (232-4636)
 TTY: 1-888-232-6348 www.cdc.gov

The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.



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