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PROJECT NO.

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A Utility Response Plan Outline for Unexpected Emergencies

A Utility Response Plan Outline for Unexpected Emergencies:

High-Consequence
Pathogenic Organisms in Wastewater
at Water Resource Recovery Facilities

2018



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Highlights

WRRFs today are faced with the need to respond to unexpected and unusual emergencies. Having a Utility Response Plan is the first step. This document provides an outline of a general plan, adaptable by utilities to meet their specific needs. Developing and implementing a specific plan is enabled by peer-to-peer networking.

After events leading to contamination of several U.S. buildings following the post-9/11 anthrax attacks and continuing to present times with emerging pathogens like Ebola and antibiotic resistant bacteria, wastewater utilities are very interested in understanding the issues they face for acceptance of biocontaminated wastewater¹ in emergency situations. To help utilities prepare for issues related to biocontaminated wastewater, in 2015, the Water Research Foundation (WRF, formerly known as WE&RF), in partnership with the U.S. Environmental Protection Agency (EPA), National Homeland Security Research Center (NHSRC), and the National Science Foundation (NSF), hosted an expert workshop to engage with subject matter experts and wastewater utility stakeholders on a number of topics surrounding high consequence pathogens in wastewater collection and treatment systems, should such pathogens enter the systems as a result of an emergency situation. One overarching concern identified (WE&RF, 2016) was the need for unified, sole-source guidelines. One aspect of this was an action to develop, in cooperation with an interagency group, a utility response plan.

The Utility Response Plan (URP) outline presented here was developed with input from the wastewater industry through a series of workshops, surveys, and other discussions to provide a basis for the potential acceptance of biocontaminated wastewater at water resource recovery facilities (WRRFs). While it is an interim step towards sole source guidance, this document may be of immediate benefit to WRRFs because it can be adapted to help WRRFs prepare to respond to a wide range of emergency situations. Biocontaminated wastewater is but one example; extreme weather and other natural disasters, intake of chemicals including PCBs, cybersecurity breaches, and physical threats, are others.

This Utility Response Plan Outline incorporates results from a Utility Response Survey developed and administered by WE&EF, comments from several utilities, and other previous guidance documents. Together, they address technical, regulatory, and organizational issues of importance for acceptance of biocontaminated wastewater at WRRFs. In addition, the Outline and its supporting documents contain many elements that provide benefits for development of response plan(s) for utilities' specific concerns.

Utility Response Plan Outline Takeaways:

- Provides items of interest for a Utility Response Plan, for response to many types of incidents.
- Identifies sources of information relevant to their development of a Utility Response Plan for biocontaminated wastewater, using *Bacillus anthracis* as an example pathogen.
- Identifies utilities that are available to provide additional assistance (peer-to-peer networking), which could be the most useful aspect in dealing with unforeseen incidents.

Keywords: Biocontaminated wastewater, EPA, Utility Response Plan, WRF, WRRFs, emergency planning, policies.

¹Biocontaminated wastewater refers to wastewater/sewage contaminated with "high-consequence pathogens" (e.g., bacteria, including spores, as well as viruses and other pathogens, including anthrax, Ebola, etc.) that are introduced into wastewater either intentionally (e.g., with malicious or criminal intent, through managed discharge, etc.) or inadvertently (e.g., by accidental or unintended discharge, resulting from a natural disasters, etc.). Biocontaminated wastewater is assumed to be untreated at its source prior to discharge. It is separate from sanitary sewage routinely processed by your facility.

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Acronyms and Abbreviations

| | |
|--------|--|
| APTIM | APTIM Federal Services LLC |
| AWWA | American Water Works Association |
| CASA | California Association of Sanitation Agencies |
| CDC | Centers for Disease Control |
| CWS | Community Water Systems |
| DHS | Department of Homeland Security |
| EAPs | Emergency Action Procedures |
| EMS | Emergency Medical Services |
| EOC | Emergency Operations Center |
| EPA | U.S. Environmental Protection Agency |
| FEMA | Federal Emergency Management Agency |
| HACCP | Hazard Analysis and Critical Control Points |
| HHS | Health and Human Services |
| HRSD | Hampton Roads Sanitation District |
| LACSD | Los Angeles County Sanitation District |
| LLE | Local Law Enforcement |
| LRN | Laboratory Response Network |
| MWCOG | Metropolitan Washington Council of Governments |
| MWRDGC | Metropolitan Water Reclamation District of Greater Chicago |
| NHSRC | National Homeland Security Research Center |
| NIH | National Institutes of Health |
| NPDES | National Pollutant Discharge Elimination System |
| NSF | National Science Foundation |
| OCSD | Orange County Sanitation District |
| ORD | Office of Research and Development |
| OSHA | Occupational Safety and Health Administration |
| PPE | Personal Protective Equipment |
| SCADA | Supervisory Control and Data Acquisition |
| SSO | Storm Sewer Overflow |
| URP | Utility Response Plan |
| VA | Vulnerability Assessment |
| WA | Work Assignment |
| WERF | Water Environment Research Foundation |
| WE&RF | Water Environment & Reuse Foundation |
| WRF | Water Research Foundation |
| WRRFs | Water Resource Recovery Facilities |

Executive Summary

This general Utility Response Plan Outline was developed during ongoing work to address recommendations from the “Collaborative Workshop on Handling, Management, and Treatment of High-Consequence Biocontaminated Wastewater by Water Resource Recovery Facilities (WRRFs),” hosted by the Water Environment & Reuse Foundation (WE&RF) in partnership with the EPA’s National Homeland Security Research Center (NHRSC) and the National Science Foundation (NSF) in November 2015. The Utility Response Plan Outline provides a basis for the potential acceptance of wastewater contaminated with biocontaminated wastewater.

Biocontaminated wastewater refers to wastewater/sewage contaminated with “high-consequence pathogens” (e.g., bacteria, including spores, as well as viruses and other pathogens, including anthrax, Ebola, etc.) that are introduced into wastewater either intentionally (e.g., with malicious or criminal intent, through managed discharge, etc.) or inadvertently (e.g., by accidental or unintended discharge, resulting from a natural disasters, etc.). Biocontaminated wastewater is assumed to be untreated at its source prior to discharge. It is separate from sanitary sewage routinely processed by your facility.

A Utility Response Plan is designed to serve as a roadmap on how a utility can proceed in the event of an emergency situation. Thus, a Plan developed for one purpose (like biocontaminated wastewater) has application in other emergencies. The Utility Response Plan Outline is generalized, and can be adapted to specific utilities and potential emergencies they are concerned about.

This document contains three Chapters. Chapter 1 of this report provides an introduction, including the project background and objective. Chapter 2 of the document provides the development approach for the Utility Response Plan. This includes consideration of previous guidance documents, developing a survey specific to biocontaminated wastewater, and a follow-up meeting with utilities to discuss comments on the draft Utility Response Plan. The survey, sent to nine WRRFs with responses received from each, was divided into the following seven sections, described in more detail in Appendix A:

1. Facility Organization
2. Utility Response Plans for the Acceptance of Biocontaminated Wastewaters
3. Guidelines for Accepting Biocontaminated Wastewater
4. Safety and Health Considerations
5. Communications
6. Data Gaps
7. Recommendations/Suggestions

A standalone summary of the Survey results, sanitized to protect the utility respondents’ identification, is included in Appendix B of this document. A follow-up meeting was held at DC Water in Washington, D.C., in July 2017, to discuss the results of the survey and vet out the feasibility of implementation of the Utility Response Plan. Participants included facilities without current emergency response plans.

Chapter 3 contains the Utility Response Plan Outline, with is divided into the following eight sections:

1. Introduction
2. Emergency Planning Process
3. Emergency Response Plan – Policies
4. Emergency Action Procedures (EAPs)
5. Incident-Specific Emergency Action Procedures (EAPs)
6. Next Steps
7. Annexes
8. References and Links

Many parts of the Outline in Chapter 3 are common to responses to many types of emergencies. This includes:

- Peer networking with other utilities that have experience managing contaminated wastewater or with local laboratories that have related expertise is encouraged. The document includes several references to such resources (Chapter 3, subsections VIII.J and III.C.3.h).
- A 24-hour Emergency Command Center is incorporated as part of the Chain-of-Command chart developed in coordination with the Local Emergency Planning Committee (Chapter 3, subsections III.B and III.C.1.g).
- Communication messaging, both internal with utility employees and external with stakeholders/customers/public, is an important part of the Utility Response Plan (Chapter 3, subsections III.C and IV.Y). This includes a list of what may constitute an executive management team (Chapter 3, subsection III.C.1).
- Training and drills are encouraged (Chapter 3, subsection III.G), including communication with other utilities to attend training courses offered by them.

Utility responses involving the specific application of acceptance of biocontaminated wastewater (the topic of the 2015 WE&RF workshop report) are enabled by information in three appendices included with this report: 1) the WE&RF survey, 2) the survey results, and 3) information resources relevant for utility responses to biocontaminated (e.g., with *Bacillus anthracis* or Ebola virus) wastewater.

The next steps to help utilities prepare for issues related to biocontaminated wastewater include coordination of relevant government agencies with the wastewater industry to facilitate implementation of response plans, particularly for less studied pathogens. The end result will be that utilities are prepared to respond not only to biocontaminated wastewater incidents, but other unexpected and unusual incidents for which they have had no previous need to do. Biocontaminated wastewater is but one example; extreme weather and other natural disasters, intake of chemicals including PCBs, cybersecurity breaches, and physical threats, are others.

CHAPTER 1

Introduction

1.1 Background

WRRFs today are faced with the need to respond to unexpected and unusual emergencies that threaten the resilience of the communities they serve.

The Water Research Foundation (formerly known as the Water Environment & Reuse Foundation or WE&RF), in partnership with the U.S. Environmental Protection Agency (EPA), NHRSC, and the National Science Foundation (NSF), hosted an expert workshop on November 17-18, 2015, in Alexandria, Virginia, to engage with subject matter experts and wastewater utility stakeholders on a number of topics surrounding high-consequence pathogens in wastewater collection and treatment systems, should such pathogens enter the systems as a result of an emergency situation. During the Workshop, wastewater utility stakeholders expressed concerns about accepting biocontaminated wastewater at WRRFs. One overarching concern identified was the need for unified, single source guidelines.

Biocontaminated wastewater refers to wastewater/sewage contaminated with “high-consequence pathogens” (e.g., bacteria, including spores, as well as viruses and other pathogens, including anthrax, Ebola, etc.) that are introduced into wastewater either intentionally (e.g., with malicious or criminal intent, through managed discharge, etc.) or inadvertently (e.g., by accidental or unintended discharge, resulting from a natural disaster, etc.). Biocontaminated wastewater is assumed to be untreated at its source prior to discharge. It is separate from sanitary sewage routinely processed by your facility.

One aspect of the need for unified, single source guidelines was an action to develop, in cooperation with an interagency group, a utility response plan. The Utility Response Plan (URP) outline presented here was developed with input from the wastewater industry to provide a basis for the potential acceptance of wastewater contaminated with high-consequence pathogenic organisms at water resource recovery facilities (WRRFs). While it is an interim step towards single source guidelines, this document may be of immediate benefit to WRRFs in planning response to a wide range of emergency incidents.

Biocontaminated wastewater is but one example; extreme weather and other natural disasters, intake of chemicals including PCBs, cybersecurity breaches, and physical threats, are others.

1.2 Objective

This document, a Wastewater Utility Response Plan Outline, identifies the types of information desirable within the Utility Response Plan specific to the applicable wastewater facility. This Outline does not include details about this information and does not include specific regulatory information about the WRRF, names of individuals, telephone numbers, etc. that would be required in the Utility Response Plan. This Outline incorporates the experience of several utilities, so while not developed for any specific utility, could be readily adapted by utilities to meet their specific needs and requirements.

CHAPTER 2

Utility Response Plan Development Approach

2.1 WE&RF Survey

WE&RF developed a survey requesting information from WRRFs on their facilities, their ability to accept biocontaminated wastewater, and additional information desired before accepting biocontaminated wastewater. The survey form was sent to nine (9) facilities, and responses were received from each utility. The results of this survey were incorporated into the Utility Response Plan Outline. A copy of the WE&RF survey form is included in Appendix A. Results from the survey are included in Appendix B.

Specific items of interest for the Utility Response Plan Outline included the following:

- Guidelines for WRRFs to accept biocontaminated wastewater, including pretreatment requirements.
- Health and safety concerns for WRRF workers.
- Communication concerns, both with the public and WRRF workers.
- Other issues, including data gaps in knowledge of biocontaminated wastewater treatment.
- Approvals from state and local authorities.

2.2 WE&RF Workshop

A follow-up meeting to the survey effort was held on July 19, 2017, at DC Water in Washington, D.C. WE&RF hosted the workshop to discuss the survey results and to obtain utility input for finalizing the Utility Response Plan Outline. Participants included facilities with and without current or planned Utility Response Plans. Results from the follow-up meeting have been incorporated into this report, as appropriate.

2.3 Incorporation of Guidance Documents

EPA published two guidance documents for Community Water Systems (CWS) and wastewater utilities to develop emergency response plans: Large Water System Emergency Response Plan Outline: Guidance to Assist Community Water Systems in Complying with the Public Health Security and Bioterrorism Preparedness and Response Act of 2002 (U.S. EPA, 2003) and Emergency Response Plan Guidance for Small and Medium Community Water Systems to Comply with the Public Health Security and Bioterrorism Preparedness and Response Act of 2002 (U.S. EPA, 2004). In 2004, in collaboration with EPA, WE&RF published an Emergency Response Plan Guidance for Wastewater Systems (WERF, 2004).

These existing guidance documents, which were not specifically developed for biocontaminated wastewater, were utilized to develop the Utility Response Plan Outline for WRRFs. Information gathered from the survey and follow-up workshop conducted by WE&RF was incorporated into the Utility Response Plan Outline presented in Chapter 3.

CHAPTER 3

Utility Response Plan Outline

- I. **Introduction.** Emergency response planning is an essential part of managing a WRRF. The introduction should identify the requirement to have a documented Utility Response Plan, the goal(s) of the plan, and control and accessibility of the plan.
- II. **Emergency Planning Process**
 - A. Planning Partnerships – The planning process should include those parties that will help the WRRF in an emergency situation. In addition to first responders, regulators, etc., include hospitals, labs, etc. that may discharge wastewater impacted with high-consequence pathogens (hospitals will be included both as a resource in case of emergency and as a source of wastewater).
 1. Consider peer networking. Include other WRRFs or groups that may have additional experience in dealing with contaminated wastewater and may be willing to help with training and incident command. Several WRRFs with relevant experience and organizations to contact are included in Section VIII (References and Links).
 - B. General Emergency Response Policies, Procedures, Actions, Documents – A short synopsis of the overall emergency management structure. Include discharge plans (on-site chlorination, peracetic acid drip, autoclave, etc.) for facilities that may discharge wastewater impacted with high-consequence pathogens. Prepare an action plan for receiving wastewater impacted with high-consequence pathogens.
 - C. Scenarios – Provide a summary of Vulnerability Assessment (VA) findings on discharge wastewater impacted with high-consequence pathogens.
 1. Incorporate the Hazard Analysis and Critical Control Points (HACCP). The HACCP is a systematic preventive approach to safety from biological, chemical, and physical hazards in processes that can cause the process to be unsafe and designs/measurements to reduce these risks to a safe level.
 2. Identify potential sources of contamination and map the likely route from the source to the WRRF.
- III. **Emergency Response Plan – Policies**
 - A. System Specific Information
 1. National Pollutant Discharge Elimination System (NPDES) Permit Number, Owner, Contact Person
 2. Population served and service connections
 3. System Components
 - a) Pipes and constructed conveyances
 - b) Physical barriers
 - c) Isolation valves
 - d) Water collection, pretreatment, treatment, storage, and collection facilities
 - e) Electronic, computer, or other automated systems

- f) Emergency power generators (onsite & portable)
 - g) The use, storage, or handling of various chemicals
 - h) The operation and maintenance of such system components
- B. Chain-of-Command Chart Developed in Coordination with Local Emergency Planning Committee (Internal and/or External Responders, or both) – **A 24-Hour Emergency Command Center**
1. Develop a detailed flowchart/schematic describing how to proceed and the people/organizations to be contacted in the event of an emergency. Possible people/organizations to be contacted are included in Section C below. The information required for each contact includes the following:
 - a) Contact Name
 - b) Organization and Emergency Response Responsibility. Include all responsibilities in a checklist/bullet format.
 - c) Telephone Number(s) (hardwire, cell phones, faxes, e-mail)
 - d) 24-hour Emergency Communications Center Telephone for all involved parties (e.g., federal, state, county, regional, city, etc.)
- C. Communication Procedures: Who, What, When. During most emergencies, it will be necessary to quickly notify a variety of parties, both internal and external. This list must be updated on a routine basis as personnel and contact information change.
1. Internal Notification Lists
 - a) Director/General Manager
 - b) Facility Manager
 - c) Chief Engineer
 - d) Impacted Personnel
 - e) Non-Impacted Personnel
 - f) Trade Unions
 - g) Other (24-hour emergency command center number)
 2. Local Notification
 - a) Head of local government (i.e., Mayor, City Manager, Chairman of Board, etc.)
 - b) Public Safety Officials – Fire, Local Law Enforcement (LLE), Police, Emergency Medical Services (EMS), Safety
 - c) Other Government Entities: Health, Schools, Parks, Finance, Electric, etc.
 - d) Local Hospitals
 - e) Water Utilities
 3. External Notification Lists
 - a) State environmental regulatory agency (or agencies)
 - b) US Environmental Protection Agency (EPA)
 - c) Centers for Disease Control (CDC)
 - d) State Police
 - e) State Health Department (lab)
 - f) Department of Homeland Security (DHS)
 - g) Occupational Safety and Health Administration (OSHA)
 - h) Laboratory network. The Integrated Consortium of Laboratory Networks (ICLN) coordinates federally sponsored analytical laboratory services for chemical, biological, radiological, and nuclear incidents. Member networks especially applicable for purposes of this document are EPA's Environmental Response Laboratory Network and CDC's Laboratory Response Network.
 - i) Critical customers (special considerations for hospitals, Federal, State, and County government centers, etc.)

- j) Service/Mutual Aid
 - k) Residential and commercial customers not previously notified
 - l) Solid Waste Haulers
 - m) Biosolids Disposal
 - n) Water Reuse
 - o) Support Services (laundry, housekeeping, etc.)
4. Public/Media Notification: When and How to Communicate
- a) Who communicates to the Public/Media (e.g., CDC, National Institutes of Health (NIH), Department of Health)? The source must be credible and have accurate information from the first statement issued to the public.
- D. Personnel Safety – Include how staff, emergency responders, and the public should respond to discharge wastewater impacted with high-consequence pathogens. Are evacuations necessary? Impacted and non-impacted personnel may be affected differently. **Include personal protective equipment (PPE) required for workers.**
- 1. Stop routine work.
 - 2. Limit/ban access to contaminated areas.
 - 3. Identify potential sources of contamination, and map likely route(s) from the source to the WRRF.
- E. Equipment – Include any additional treatment **equipment and chemicals** that may be necessary to reduce risks (e.g., chlorine disinfection, barriers, sorbents, flow interception and containment)
- F. Property Protection
- G. Training, Exercises, and Drills – Include a schedule of training, exercises, and drills based on discharge wastewater impacted with high-consequence pathogens. Include PPE use and additional equipment/chemicals, if necessary.
- 1. Include awareness, training drill opportunities, inspector certification programs, and other training resources (e.g., parks department activities or coordination). All training should be followed by exercises/drills to ensure that the material has been assimilated and personnel are prepared. For example, the use of dyes as a surrogate for contaminants can, in some cases, show if the PPE is being used correctly or if there is bodily contact with the contaminants.
 - 2. Training on tracking and eradicating discharges and PPE usage.
 - 3. Communicate with other utilities regarding your training and drill schedule and their schedules. It may be possible to attend training courses that are offered by other utilities.
 - 4. Conferences. Attending conferences to network with other utilities and to hear about their experiences may allow for improved preparedness and future assistance.
- H. Assessment/Checklist
- 1. Sampling points
 - 2. Analyses
 - 3. Who is responding?
 - 4. Who certifies it is decontaminated?
 - 5. What happens if the storm sewer overflow (SSO) flows into a basement?
- IV. **Emergency Action Procedures (EAPs).** These are detailed procedures used in the event of an operational emergency or malevolent act.
- A. Event classification/severity of emergency. Classify a *Threat* vs. a *Credible Threat*

- B. Responsibilities of Emergency Director
- C. Responsibilities of Incident Commander
- D. Emergency Operations Center (EOC) activation
- E. Division internal communications and reporting
- F. External communications and notifications
- G. Emergency telephone list (division internal contacts)
- H. Emergency telephone list (off-site responders, agencies, state 24-hr emergency phone number, state and US EPA, state health department, CDC, DHS, OSHA, and others to be notified)
- I. Mutual Aid Agreements
- J. Contact list of available emergency contractor services/equipment
- K. Emergency equipment list (including inventory for each facility)
- L. Security and access control during emergencies
- M. Facility evacuation and lockdown and personnel accountability
- N. Treatment and transport of injured personnel (including chemical/biological/radiological exposure)
- O. List of available laboratories for emergency use
- P. Emergency sampling and analysis (chemical/biological/radiological)
- Q. Water use restrictions during emergencies
- R. Isolation plans for supply, treatment, storage, and collection systems
- S. Mitigation plans for neutralizing, flushing, disinfecting tanks, pump station, or collection systems, including shock chlorination
- T. Protection of vital records during emergencies
- U. Recordkeeping and reporting (Federal Emergency Management Agency (FEMA), OSHA, state and US EPA, state health department, CDC, OSHA, and other requirements)
- V. Emergency program training, drills, and tabletop exercises
- W. Assessment of emergency management plan and procedures
- X. Crime scene preservation training plans
- Y. Communication Plans:
 - 1. Internal – Impacted and Non-impacted personnel
 - 2. Police
 - 3. Fire
 - 4. Local Government
 - 5. State and U.S. EPA
 - 6. State Health Department and CDC
 - 7. DHS
 - 8. OSHA
 - 9. Media
 - 10. Others as needed
- Z. Administration and logistics, including EOC, when established

- AA. Equipment needs/maintenance of equipment
- BB. Recovery and restoration of operations
- CC. Emergency event closeout and recovery

V. **Incident-Specific Emergency Action Procedures.** These are action procedures that identify specific steps in responding to an operational emergency or malevolent act.

- A. General Response to Terrorist Threats (Other than Bomb Threat and Incident-Specific Threats)
 - 1. Classify a *Threat* vs. a *Credible Threat*.
- B. Incident-Specific Response to Man-Made or Technological Emergencies
 - 1. Contamination Event (Articulated threat with unspecified materials. Contamination may be chemical, biological, biotoxin, or radiological)
 - a) Contaminated water may be in collection system.
 - b) Contaminated water may be held at contamination site – accept or refuse?
 - 2. Notification from Health Officials of Potential Water Contamination
 - a) Contaminated water may have been released to collection system.
 - b) Contaminated water may be held at contamination site – accept or refuse?
 - 3. Intrusion through Supervisory Control and Data Acquisition (SCADA)
 - a) Alert employees issue PPE to employees
 - b) Notify state and US EPA, state health department, and CDC
 - c) Trace source of contamination/flow interception and containment
 - d) Monitor treatment process/evaluate permit discharge/increase disinfection doses
 - e) Monitor workers for exposure
 - f) Suspend recycled water deliveries
 - g) Suspend non-essential maintenance work
 - h) Collection and treatment system decontamination
- C. Significant structural damage resulting from intentional act
- D. Customer complaints
- E. Severe weather response (e.g., snow, ice, temperature, lightning)
- F. Flood response
- G. Hurricane and/or tornado response
- H. Fire response
- I. Explosion response
- J. Major vehicle response
- K. Electrical power outage response
- L. Transportation accident response – barge, plan, train, semi-trailer/tanker
- M. Contaminated/tampered with water treatment chemicals
- N. Earthquake response
- O. Disgruntled employee response (i.e., workplace violence)
- P. Vandalism response
- Q. Bomb threat response

- R. Civil disturbance/riot/strike
- S. Armed intruder response
- T. Suspicious mail handling and reporting
- U. Hazardous chemical spill/release response (including Safety Data Sheets)

VI. Next Steps

- A. Plan Review and Approval
- B. Practice and Plan to Update (as necessary; once every year recommended)
 - 1. Training requirements
 - 2. Who is responsible for conducting training, exercises, and emergency drills
 - 3. Update and assessment requirements
 - 4. Incident-specific exercises/drills

VII. Annexes

- A. Facility and Location Information
 - 1. Facility maps
 - 2. Facility drawings
 - 3. Facility descriptions/layout
 - 4. Others as necessary

VIII. References and Links

- A. Department of Homeland Security – <http://www.dhs.gov/dhspublic>
- B. Environmental Protection Agency – <http://www.epa.gov>
- C. Health and Human Services (HHS) – <http://www.hhs.gov>
- D. National Institutes of Health – <http://www.nih.gov>
- E. The American Water Works Association (AWWA) – <http://www.awwa.org>
- F. The Center for Disease Control and Prevention – <http://www.bt.cdc.gov>
- G. Federal Emergency Management Agency – <http://www.fema.gov>
- H. Local Emergency Planning Committees – <http://www.epa.gov/ceppo/lepclist.htm>
- I. Integrated Consortium of Laboratory Networks – <http://www.icln.org>
- J. Other WRRFs with experience managing contaminated wastewater, including the following:
 - 1. DC Water, Office of Emergency Management (Ebola Concept of Operations, incident command training, drills, etc.)
 - 2. Metropolitan Water Reclamation District of Greater Chicago (Ebola Operation Plan)
 - 3. Orange County Sanitation District (Ebola Response Plan)

Application to High Consequence Pathogens

Chapter 3 is intended to be a general plan outline – and not developed for a specific utility – but could be readily adapted by utilities to meet a utility’s specific needs and requirements. Chapter 3 was developed as an outline of a Utility Response Plan because of the immense diversity in policy, management, construction practices, etc. across the wastewater industry, as well as technical details surrounding the multitude of potential high consequence pathogens of interest. It is designed to serve as a roadmap on how a utility can proceed in the event of an emergency situation involving intentional or accidental contamination of wastewater with high consequence pathogens (e.g., bacteria, including antibiotic resistant ones, as well as specific viruses and other pathogens, including anthrax, Ebola, etc.). The Utility Response Plan Outline was designed using *Bacillus anthracis* (anthrax) spores as a model high consequence pathogen.

In applying Chapter 3 to WRRF contamination with high consequence pathogens, there are many challenges throughout the Outline as the response progresses. WRRFs may wish to consider that:

- Many of the elements in Chapter 3 could apply to other types of emergency responses, in addition to contamination incidents. Thus, adoption of a response plan, as outlined in Chapter 3, many reap multiple benefits in terms of emergency preparedness.
- The Survey results in Appendix B provide examples of how other WRRFs have addressed the need and implementation of response plans for high consequence pathogens
- The main challenges specific to decontamination, treatment, and handling of pathogens (or other types of contaminants for that matter) are contained in Chapter 3, Section V.B. Appendix C provides discussion and technical information for *Bacillus anthracis* and Ebola virus. Many of the information sources in Appendix C are also applicable to other organisms, particularly with regards to management principles and technical aspects of treatment of organisms. However, WRRFs should seek technical experts to effectively apply knowledge from one contaminant to an unstudied contaminant.
- Access to technical experts is one of many benefits to peer-to-peer networking. VIII.J lists some available peers, and other peer networks specific to the WRRFs locale and planning process should be developed.

The Power of Peer-to-Peer Networks

The specific application to high consequence pathogens in the previous section relies on peer networks for technical advice. In conclusion, it cannot be overemphasized that a general principle is that many organizations and government agencies will be involved in the response to many other types of contamination and non-contamination emergencies. WRRFs should develop the ability to coordinate as efficiently as possible with the organizations and agencies, so that WRRFs can continue to provide their critical services while not jeopardizing their workers and continuity of operations. It is hoped that they can use the Utility Response Plan Outline as a guide to their understanding issues faced by WRRFs, and thereby optimize their internal and external coordination, whether at the local, state, multi-regional, or federal levels.

Next Steps

The outline for a utility response plan presented in this document is an intermediary development in helping WRRFs prepare for issues related to biocontaminated wastewater. Next steps toward this goal includes coordination of relevant government agencies with the wastewater industry to facilitate implementation of response plans, particularly for less studied pathogens.

The end result will be that utilities are prepared to respond not only to biocontaminated wastewater incidents, but other unexpected and unusual incidents for which they have had no previous need to do. Biocontaminated wastewater is but one example; extreme weather and other natural disasters, intake of chemicals including PCBs, cybersecurity breaches, and physical threats, are others.

References

U.S Environmental Protection Agency (U.S. EPA). Large Water System Emergency Response Plan Outline: Guidance to Assist Community Water Systems in Complying with the Public Health Security and Bioterrorism Preparedness and Response Act of 2002. EPA 810-F-03-007, 2003, <https://www.epa.gov/sites/production/files/2015-03/documents/erp-long-outline.pdf> accessed Sept 2018.

U.S Environmental Protection Agency (U.S. EPA). Emergency Response Plan Guidance for Small and Medium Community Water Systems to Comply with the Public Health Security and Bioterrorism Preparedness and Response Act of 2002. EPA 816-R-04-002, 2004, https://www.epa.gov/sites/production/files/2015-04/documents/2004_04_27_watersecurity_pubs_small_medium_erp_guidance040704.pdf accessed Sept 2018

Water Environment Research Foundation (WERF). Emergency Response Plan Guidance for Wastewater Systems, Final Report, WERF Stock No. 03CTS4S, 2004, <https://werf.org/a/ka/Search/ResearchProfile.aspx?ReportId=03-CTS-4S> accessed Sept 2018.

Water Environment & Reuse Foundation (WE&RF). Collaborative Workshop on Handling, Management, and Treatment of Biocontaminated Wastewater by Water Resource Recovery Facilities, WERF7W15, 2016, <http://werf.org/a/ka/Search/ResearchProfile.aspx?ReportId=WERF7W15> accessed Sept 2018.

APPENDIX A

WE&RF Survey

The survey, which is reproduced below, was circulated to nine utilities, in compliance with the Paperwork Reduction Act. The survey was divided into the following seven sections, designed to cover topics deemed important to the development of a Utility Response Plan:

1. Facility Organization
 - Design capacity/average daily flow
 - Historical acceptance of biocontaminated wastewater
 - Previous episodes and types of high-consequence pathogens encountered
 - Whether the utility has been previously requested to accept biocontaminated wastewater
2. Utility Response Plans for the Acceptance of Biocontaminated Wastewaters
 - Current availability of Utility Response Plan
 - Willingness to share Plan
 - Facility's response to accidental/intentional discharge of biocontaminated wastewater to collection system
 - Supplies and equipment in place to contain biocontaminated wastewater
 - Chemicals, equipment, protocols, and procedures to disinfect biocontaminated wastewater
3. Guidelines for Accepting Biocontaminated Wastewater
 - Pretreatment/testing requirements
 - Time notice required to accept a planned biocontaminated wastewater event
 - Permitting agencies/non-government organizations for review of guidelines
 - How regulatory agencies could assist in the process
4. Safety and Health Considerations
 - Engineering controls/personal protective equipment (PPE)
 - Safety training
 - Availability of PPE
 - Training exercises
5. Communications
 - Agreements with local emergency managers/first responders/hospitals
 - Communication with elected officials/public/utility workers
 - Utility task force for communications
6. Data Gaps
 - Technical
 - Non-technical
7. Recommendations/Suggestions

Survey of Facilities for the Adoption of a Utility Response Plan for Wastewater Contaminated with High-Consequence Pathogens

Please Submit Survey by Tuesday, February 28, 2017

The Water Environment & Reuse Foundation (WE&RF, formerly the Water Environment Research Foundation, WERF), in partnership with the U.S. Environmental Protection Agency (EPA), National Homeland Security Research Center (NHSRC), and the National Science Foundation (NSF), hosted an expert workshop on November 17-18, 2015, in Alexandria, Virginia, to engage with subject matter experts and wastewater utility stakeholders on a number of topics surrounding high-consequence pathogens in wastewater collection and treatment systems, should such pathogens enter the systems as a result of an emergency situation. A report describing the workshop is available at

<https://www.werf.org/a/ka/Search/ResearchProfile.aspx?ReportId=WERF7W15>

During the workshop, wastewater utility stakeholders expressed concerns about accepting biocontaminated wastewater at Water Resource Recovery Facilities (WRRFs)/Publicly Owned Treatment Works (POTWs)/etc. Based on these concerns, this survey was developed to collect data to support the development of a wastewater utility response plan for the acceptance of biocontaminated wastewaters. This will be a **general** plan not developed for any specific utility, designed using *Bacillus anthracis* (anthrax) spores as a model high-consequence pathogen.

Biocontaminated wastewater can be conveyed to WRRFs in several manners, including:

- Unannounced discharge to the wastewater collection system from a hospital, a decontamination activity (including runoff), or a terrorist threat.
- Planned discharge to the wastewater collection system from a hospital or a decontamination activity.
- Collection from a hospital or decontamination activity and transport to the WRRF. The collected wastewater can be either pretreated or untreated prior to hauling to the WRRF.

This survey follows the order of the November 2015 workshop summary and is divided into the following seven sections: Facility or Organization, Utility Response Plans for the Acceptance of Biocontaminated Wastewaters, Guidelines for Accepting Waste, Safety and Health Concerns, Communications, Data Gaps, and Recommendations/Suggestions. Your responses will not be attributed to you or your organization unless you indicate otherwise in Question 1. We estimate that this survey will take you 15-20 minutes to complete.

We look forward to hearing from you regarding your cooperation in this survey. **Please submit your responses to this survey by Tuesday, February 28, 2017.** If you have any questions regarding this survey, please contact any of the following:

Morgan Brown: Program Assistant/Project
Coordinator – WE&RF
571-384-2114 Mbrown@werf.org

Radha Krishnan, P.E.: Program Leader – APTIM
513-782-4730 Radha.Krishnan@aptim.com
Sue Witt: Project Engineer – APTIM
513-782-4726 Sue.Witt@aptim.com

In the context of the questions below, biocontaminated wastewater refers to wastewater/sewage contaminated with “high-consequence pathogens” (e.g., bacteria, including spores, as well as viruses and other pathogens, including anthrax, Ebola, etc.) that are introduced into wastewater either intentionally (e.g., with malicious or criminal intent, through managed discharge, etc.) or inadvertently (e.g., by accidental or unintended discharge, resulting from a natural disasters, etc.). Biocontaminated wastewater is assumed to be untreated at its source prior to discharge. It is separate from sanitary sewage routinely processed by your facility.

Please Submit Survey by Tuesday, February 28, 2017

I. Facility or Organization (this section is required only if you would like to offer additional information or clarification, if necessary)

WRRF/POTW/Treatment Plant or Organization Name: _____
Contact Name: _____
Address: _____
Phone Number: _____
Email Address: _____
Facility Design Capacity (million gallons per day or mgd): _____
Average Daily Flow (mgd): _____

II. Utility Response Plans for the Acceptance of Biocontaminated Wastewaters

1. Has your facility ever accepted biocontaminated wastewater? Y N N/A
2. If yes, when and where have there been occurrences, and which high-consequence pathogens were accepted? _____
3. If yes, what restrictions are in place? _____
4. If no, have you ever been asked to accept biocontaminated wastewater and did not accept? Why Not? _____
5. Does your facility currently have a utility response plan for the acceptance of biocontaminated wastewaters? Y N N/A
6. If yes, would you be willing to share the plan? Y N N/A

III. Guidelines for Accepting Waste

7. What would be your facility's response to biocontaminated wastewater unknowingly being discharged to your wastewater collection system (accidental/terrorist)? _____
8. Do you have supplies and equipment to contain biocontaminated wastewater and reduce its impact on your facility (barriers, containment, sorbents, etc.)? _____
9. Do you have chemicals, equipment, protocols, and/or procedures to disinfect biocontaminated wastewater and reduce its impact on your facility (e.g., as applicable, bleach and vinegar, chlorine dioxide, peracetic acid, etc.)? _____
10. If pretreatment/testing requirements were established and followed/met, would your facility accept biocontaminated wastewater that was a) discharged to the wastewater collection system from a hospital or a decontamination activity as a planned event, or b) collected at a hospital/decontamination activity and hauled to your facility? _____
11. How much notice would your facility need in order to accept a planned biocontaminated wastewater event? _____

12. The participants of the 2015 Workshop recommended that an interagency, interdisciplinary workgroup be established to holistically review proper management, handling, and communication needed for utilities to accept biocontaminated wastewater. Which authorizing/permitting agencies or nongovernment organizations would be most trusted in developing guidelines for accepting biocontaminated wastewater? _____

13. How could regulatory agencies make acceptance of biocontaminated wastewater more feasible at your facility? _____

IV. Safety and Health Concerns

IX. Workers can be exposed to biocontamination in both the wastewater collection system and the wastewater treatment process.

14. Do you believe that engineering controls/personal protective equipment (PPE) are available to protect workers in these environments in the event of biocontaminated wastewater being accepted by your facility? _____

15. Do you believe that workers will continue to perform their duties if given suitable training to protect themselves in the event of biocontaminated wastewater being accepted by your facility? _____

16. Do you currently have sufficient PPE in place to protect your workers in the event of biocontaminated wastewater being accepted by your facility? _____

17. Have your workers been trained for the possibility of biocontaminated wastewater being accepted by your facility and the use of appropriate PPE (including training exercises)? _____

V. Communications

X. The findings of the 2015 Workshop recommend that coordinated, unified communication is needed for utilities to accept biocontaminated wastewater.

18. Do you have agreements with local emergency managers/first responders/hospitals/etc. to inform you in the event that biocontaminated wastewater has been discharged? _____

19. With proper communication, do you believe that elected officials/the public/workers will support the acceptance of biocontaminated wastewater at your facility? _____

20. Who would make up the task force to inform elected officials/the public/workers that biocontaminated wastewater is being accepted at your facility? _____

21. What would make elected officials/the public/workers more likely to support the acceptance of biocontaminated wastewater at your facility? _____

VI. Data Gaps

22. What additional data would you like to see generated to better develop a utility response plan for the acceptance of biocontaminated wastewaters? _____

23. Other than technical data, what other factors could hinder you from developing and implementing a utility response plan? _____

VII. Recommendations/Suggestions

We welcome your recommendation and suggestions in developing the most appropriate guidance and utility response plan for handling high-consequence pathogens.

Need to provide more information for this survey? Please e-mail Morgan Brown at mbrown@werf.org. Thank you for your time and cooperation!

APPENDIX B

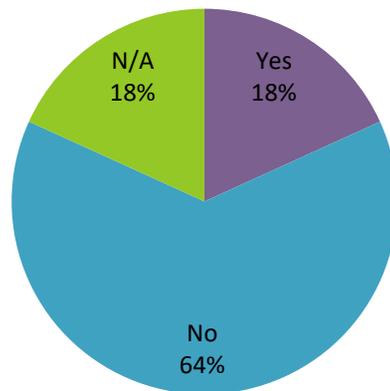
Survey Results

The following is a summary of responses to the survey described in Appendix A for the adoption of a utility response plan for biocontaminated wastewater. Characteristics of the responding utilities are provided in the table below. Responses to individual questions follow.

WRRF/POTW/Treatment Plant Name/Number, Facility Design Capacity and Flow:

| Plant Name | Design Capacity | Average Daily Flow |
|------------|--|---------------------------------|
| Plant 1 | N/A | N/A |
| Plant 2 | 14 Facilities; Capacity range 40-310 MGD dry weather capacity. | 100 |
| Plant 3 | 200 | |
| Plant 4 | 249 MGD (All Plants Combined) | 152.7 MGD (All Plants Combined) |
| Plant 5 | 705 | 58.2 and 45.2 MGD each |
| Plant 6 | Multiple facilities. | For the 14 plants, 1.1 MGD |
| Plant 7 | Two plants, 75 MGD each | Multiple facilities. |

1. Has your facility ever accepted biocontaminated wastewater?



2. If yes, when and where have there been occurrences, and which high-consequence pathogens were accepted?

- 2013, Ebola waste from National Institutes of Health (NIH)
- 2014 - Wastewater from Ebola patient potentially from two locations.
- Our agency does not regulate or monitor any such facilities that discharge high-consequence biocontaminated wastewaters as none is currently operating within our service area. However, we do regulate and monitor hospitals, medical clinics and other types of healthcare facilities that do discharge wastewaters that likely contain human cell and tissue biomass and body fluids, and may occasionally be contaminated with selected pathogenic wastes.
- Our facility has never knowingly accepted biocontaminated wastewater.

If yes, what restrictions are in place?

- Chlorination at a hospital waste line. Additional PPE required.
- Discharge plan developed with facility
- Our Sewage Waste Control Ordinance contains several generic discharge prohibitions for such wastes as follows: Section 2. Discharge Prohibitions b. "substances sufficient to create a public nuisance or hazard to life, to cause injury or acute worker health or safety problems....." c. "Water or wastes containing toxic substances in quantities which are sufficient to interfere with the biological processes of the water reclamation facilities." f. "Potentially Infectious Medical Wastes unless they comply with the state Administrative Code.

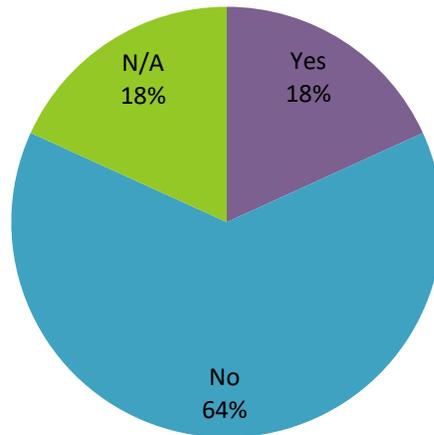
3. If no, have you ever been asked to accept biocontaminated wastewater and did not accept? Why Not?

- No. We have never been asked to accept biocontaminated wastewater. (three respondents)
- Because of the absence of such biocontaminated wastewater discharges within our service area at present, we are not sure that the our agency is in need of any regulatory guidance, nor do we see a need to design or implement specific monitoring tests or protocols to deal

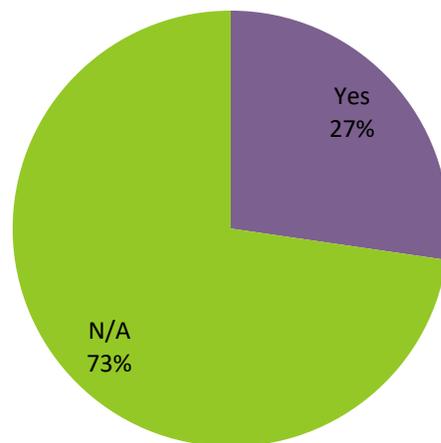
with such discharges. From our standpoint, public and worker concerns may arise from any epidemiological emergency or outbreak that gets heavily publicized (e.g., Ebola), but most have little to do with our agency or the wastewater industry in general as they are not caused by water-borne pathogens. We never had a formal request of any kind from a generator or hauler to accept such wastes.

- We have been asked to accept discharged of untreated Ebola wastewater, e.g., feces, urine, vomit, blood untreated. This request came in January 2015 before the state of the science about how Ebola behaves in the environment was developed. We required these wastes to be pretreated prior to discharge in accordance with State Public Health guidelines which provide a single statewide approach including pre-treatment of the waste before it is discharged into the sewer via toilets, drains, and showers to address the need for an approach that might be workable for both hospitals and local sanitation agencies.
- We also denied permission to the Federal government to discharge Anthrax wastewater into our system.

4. Does your facility currently have a utility response plan for the acceptance of biocontaminated wastewaters?



5. If yes, would you be willing to share the plan?



6. What would be your facility's response to biocontaminated wastewater unknowingly being discharged to your wastewater collection system (accidental/terrorist)?

- Track back and eradicate; provide PPE to all our workers who might be exposed.
- Depends on detection period. We would activate our incident management team and follow our all hazards response plan. Treat the incident under our Critical Response Plan and notify state and EPA
- Our facility would want to report this due to possible permit violations with the Department of Environmental Quality (DEQ) and have all employees who may have had possible contact with the wastewater evaluated medically for potential exposure. If possible, track the discharge and cease the discharge until further guidance is provided regarding the measures needed to accept the biocontaminated wastewater.

- Immediate responses to biocontaminated wastewater being discharged into our collection and treatment system would include: suspending recycled water deliveries; suspending non-essential sewer and treatment plant maintenance work to minimize worker exposure; monitoring of the treatment process, and if possible, quality of recycled water until analyses indicate the recycled water is safe to use; identifying the source of the discharge as soon as possible; and issuing a press release as appropriate with available pertinent information, including the threat level and extent of the contamination event. Depending on the contaminant, our agency could also increase disinfection doses as an added measure.
- Our plant(s) have control of industrial waste discharge to the collecting sewer system and waterways and the reduction of those offending discharges. This is accomplished via administration of the Sewage and Waste Control Ordinance and the U.S. EPA approved Pretreatment Program. Full implementation of the Pretreatment Program and increased surveillance of the industry will insure that the District operations, including solids disposal, meet regulatory requirements. Our facilities do not regulate or monitor any such facilities that discharge high-consequence biocontaminated wastewaters as none is currently operating within our service area. However, we do regulate and monitor hospitals, medical clinics and other types of healthcare facilities that do discharge wastewater that likely contain human cell and tissue biomass and body fluids, and may be occasionally contaminated with selected pathogenic wastes.
- Prechlorination, PPE requirements, transparent communication and training with staff.

7. Do you have supplies and equipment to contain biocontaminated wastewater and reduce its impact on your facility (barriers, containment, sorbents, etc.)?

- No (four respondents)
- Limited abilities to contain
- Not in sufficient quantities. It would most likely be very diluted because it would be mixed with other wastewater within the conveyance system. We do have barriers, sorbents and containment capabilities for oil/fuel spills. However, we do not have dedicated equipment for biocontaminated wastewater.
- Our location and the federal response to an incident rather than our preparedness
- We have spill containment
- Our agency has equipment and supplies necessary to contain small-volume sewer spills, but not specifically for biocontaminated wastewater events. It is unclear how barriers, containment, or sorbents would be applicable to the discharge volumes typically seen by our facilities.
- There is flow interception and containment kits for chemical discharges.

8. Do you have chemicals, equipment, protocols, and/or procedures to disinfect biocontaminated wastewater and reduce its impact on your facility (e.g., as applicable, bleach and vinegar, chlorine dioxide, peracetic acid, etc.)?

- No
- Each of our plants has spill containment and control emergency plan.
- Some equipment and chemicals such as sodium hypochlorite for prechlorination or chlorine for disinfection of recycled water and effluent discharge, but no protocols or procedures in place specifically to disinfect biocontaminated wastewater.
- If aware of receiving biocontaminated wastewater, our facility would arrange for additional chlorine addition and procure the appropriate chemicals.
- The size of our utility makes it prohibitively expensive
- We can procure the necessary chemicals

9. If pretreatment/testing requirements were established and followed/met, would your facility accept biocontaminated wastewater that was a) discharged to the wastewater collection system from a hospital or a decontamination activity as a planned event, or b) collected at a hospital/decontamination activity and hauled to your facility?

- Yes (four respondents)
- Possibly (1 respondent). As long as the pretreatment requirements were scientifically based and supportable, then it is hoped that wastewater plants would accept such waste.
- Because of absence of such biocontaminated wastewater discharges within our service area at present, when a request is made the pretreatment protocol is followed to check the waste discharge quality load to our plant.
- Hauling to our facility would not be an option. We do not allow industrial wastewater to be hauled to our treatment plants (this would be considered industrial). For discharge into the collection system, it would depend on our facility's implementation of the Sustainable Water Initiative for Tomorrow (SWIFT) project and the ability to render the biocontaminated wastewater inactive at the source. If the discharge of biocontaminated wastewater jeopardizes our facility's ability to perform aquifer injection, then we would not accept. There is one treatment plant that may be able to accept this wastewater, but only after guidance/assurance is provided that worker/public/environmental safety would not be impacted....specifically by pretreatment measures implemented by the source facility.
- Probably not if the aquifer recharge project is approved

10. How much notice would your facility need in order to accept a planned biocontaminated wastewater event?

- 2 weeks minimum
- 2 hours minimum.
- As much time as possible to prepare the facilities and workers. Preliminary testing may be required.
- Our treatment plants are designed to treat municipal domestic wastewater and are not set up for industrial waste or biocontaminated wastewater treatment so we would most likely not want to accept a planned biocontaminated wastewater event. Our standard for other notifications range from 2 weeks to 30 days. It would depend on what guidance recommends in the way of preparation, handling and treatment.

- The time required would depend on the severity of the contamination, the decontamination requirements, and volume of discharge.
- We have not established a firm plan, however due to pretesting check, minimum three months' notice will be required.
- Probably 12 hours or as much time as possible

11. The participants of the 2015 Workshop recommended that an interagency, interdisciplinary workgroup be established to holistically review proper management, handling, and communication needed for utilities to accept biocontaminated wastewater. Which authorizing/permitting agencies or nongovernment organizations would be most trusted in developing guidelines for accepting biocontaminated wastewater?

- Centers for Disease Control and Prevention (CDC), EPA, State Health Departments, and State Regulatory Agencies, Academia, Department of Homeland Security, Wastewater treatment plants or their representatives, OSHA, County Safety Directors, Village City Officials Hospital Centers University Hospital Safety Director, National Association of Clean Water Agencies, and Water Environment & Reuse Foundation, the military, local regulatory agencies, and Industry associations

12. How could regulatory agencies make acceptance of biocontaminated wastewater more feasible at your facility?

- Allow for a waiver from compliance if the biology/processes are negatively affected.
- Ensure no ramifications if permit measures are violated due to acceptance of the waste
- Having scientifically supported protocols in place for emerging bio-contaminants which could be implemented to ensure appropriate pre-treatment of infected individual wastewater and communication among all impacted stakeholders.
- There is PIMW discharge prohibition unless they comply with the state Administrative Code. Pretreatment of any industrial wastes detrimental to the wastewater treatment works or its proper and efficient operation and maintenance. Effectively eliminates offensive or dangerous discharges into the public sewer system Specific limits on the quantity and quality of wastes discharged by industrial users Mandated per the States Environmental Protection Agency.
- In addition to the concerns with worker/public/environmental safety, it must not impact our SWIFT initiative. The affected facility must be able to pretreat the biocontaminated wastewater due to our treatment plant design.
- Regulatory agencies could make acceptance of biocontaminated wastewater more feasible by providing clear information on analytical methods for measuring pathogens (or a laboratory network that could be utilized if needed), risks associated with pathogens (transmission pathways, dose-response, survival/persistence in various matrices, disinfection efficacies of various disinfectants), containment/de-contamination measures required for specific pathogens, limitations on financial and legal liability, and clear regulatory guidance on ramifications.
- Through proper research, education, training, and funding.
- Proper handling and disinfection procedures would have to be developed to prove that receiving the wastewater will not affect our workers, public health or wastewater reuse abilities
- A verbal conversation is needed.

13. Do you believe that engineering controls/personal protective equipment (PPE) are available to protect workers in these environments in the event of biocontaminated wastewater being accepted by your facility?

- Yes (3 respondents)
- Given the nature of the work (involving long spools of cable and heavy equipment), it may be difficult to provide complete containment/disinfection for work within collection systems. However, we are equipped with protective gear such as goggles, coveralls, and a suit if entry into a sewer is necessary at any time. Depending on the degree or level of contamination and if sewer access is necessary, this work could be contracted out to an appropriate specialist who might be better equipped to handle the incident.
- It is going to be variable depending on the agent of interest and the level of control necessary. Pretreatment would be preferred so that agents can be managed at the source rather than in the collection system.
- No, our agency is set up and designed to treat domestic wastewater, not industrial wastewater. We do have PPE; however, our PPE is primarily for chemicals that we handle as a part of normal, domestic wastewater treatment.
- Possibly, if it is a controlled discharge
- Yes, at some facilities, but not at all facilities that may not be informed and aware of the risks. There may be issues with long-term supply for multi week event.
- When workers are aware of the biocontamination and can properly prepare

14. Do you believe that workers will continue to perform their duties if given suitable training to protect themselves in the event of biocontaminated wastewater being accepted by your facility?

- Yes (three respondents) with good, timely safety training with effective PPE.
- In most cases Yes. However, it should be noted that PPE's should not be required for everyday duties since it is far less likely to be an accepted requirement except in rare and unusual cases.
- Possibly, some may refuse.
- Workers would likely have significant concerns; it is unknown whether any would refuse to perform their duties under these circumstances. The response would likely depend on the location, extent, and severity of contamination.

15. Do you currently have sufficient PPE in place to protect your workers in the event of biocontaminated wastewater being accepted by your facility?

- Yes
- Yes but only for short term events
- No (3 respondents) or not fully
- Don't know
- Our agency maintains an inventory of PPE to protect workers at all times, and are equipped with "Level A" self-encapsulated suits with breathing apparatus at specific water reclamation plant sites.

16. Have your workers been trained for the possibility of biocontaminated wastewater being accepted by your facility and the use of appropriate PPE (including training exercises)?

- Yes
- No (3 respondents)
- All supervisors were trained after the Ebola outbreak, but not all the frontline workers.
- Employees on staff since 2014 have.
- No, because we are not set up or designed to treat biocontaminated wastewater.
- Our Plants Operators receive "Level A" training in the use of appropriate PPE for potential chlorine gas leaks. This level of training is likely to be sufficient for biocontamination events.

17. Do you have agreements with local emergency managers/first responders/hospitals/etc. to inform you in the event that biocontaminated wastewater has been discharged?

- No (3 respondents)
- Yes (3 respondents)
- Nothing official
- Our hospitals that hold Industrial Wastewater Discharge Permits have in-ground containment tanks for contaminated wash water (no connection to sanitary sewer). Other measures have not been taken to address what to do with biocontaminated wastewater generated in the patient's room.
- Yes, we request that hospitals notify us if they have a patient who is suspected of or known to have Ebola. Additionally, we are part of a countywide Ebola Task Force that ensures information flows as quickly and smoothly as possible between County agencies during emergency outbreaks. We regularly interact with the County Fire Department Health Hazardous Materials Division to keep each other informed of any extraordinary activities (i.e., hazardous materials being discharged).

18. With proper communication, do you believe that elected officials/the public/workers will support the acceptance of biocontaminated wastewater at your facility?

- Yes (2), with some reluctance.
- No
- As long as the contaminated wastewater is effectively managed or if not, that appropriate communication and emergency protocols are in place to ensure the safety of workers.
- Possibly, but could not guarantee. The SWIFT project makes it more difficult to make this happen.
- Our agency believe elected officials/the public/workers will support the acceptance of biocontaminated wastewater if given clear information on risks associated with pathogens and contamination, containment/de-contamination measures required for specific pathogens, and a credible plan to ensure that public health would not be threatened.

19. Who would make up the task force to inform elected officials/the public/workers that biocontaminated wastewater is being accepted at your facility?

- Wastewater Managers; Hospital personnel; Local health Departments; U.S. EPA; Department of Public Health County Safety Directors; State EPA City/Village Managers Emergency Trauma Centers; Hospitals City Homeland Security Officer Local Unions; State and Local Health Officials; State Regulators; Water Utility officials; General Managers and assignees; State Office of Emergency Management; State Department of Health and Mental Hygiene; DEP Office of Environmental Health and Safety; Public Information Officers (to inform elected officials depending on the severity of the discharge being accepted).
- *During the recent Ebola concerns in the United States, our agency sent out a document to all employees informing them of the associated risks.*
- Our facility has a communications department and they would have this responsibility along with our General Manager. Operations and the Water Quality would provide the technical information, but the GM and Communications would deliver the message.
- Our internal PIO and the Incident Management Team

20. What would make elected officials/the public/workers more likely to support the acceptance of biocontaminated wastewater at your facility?

- Assurance from health professionals/experts that the appropriate pre-treatment or management protocols are effective and in-place based on sound science.
- Education and proof that the biocontaminated wastewater will not affect aquifer recharge/potable reuse
- Elected officials/the public/workers would be more likely to support the acceptance of biocontaminated wastewater if there was sufficient data or research to support claims that the discharge would not result in any further outbreaks or public safety concerns, and if clear information was provided in a timely manner.
- Federal Guidance from EPA and CDC.
- Guaranteeing that the biocontaminated wastewater could be inactivated/removed prior to leaving the treatment plant so that it does not affect the aquifer recharge project, receiving waterways or affect public/environmental health.
- Research results, successful case studies, table top exercises
- Safe and responsible waste handling to reduce the occupational and environmental health risks that occur during the storage, treatment, transport, transfer, and disposal Untreated PIMW is banned from all landfills in Illinois
- Would difficult with current skepticism
- Good decision-making information.

21. What additional data would you like to see generated to better develop a utility response plan for the acceptance of biocontaminated wastewaters?

- An inter-agency expert panel convened to develop appropriate responses, effective management, and clear communication channels to inform such response plans.
- Fate and transport of biocontaminants in sanitary wastewater.
- Fate, transport, survival, effectiveness of containment and disinfection, pathogenicity and likelihood of secondary transmission, effectiveness of PPEs.
- National guidance plan.

- Need information about whether the biocontaminant can be disinfected before acceptance, and if the material can be contained and/or added to the system at a chosen point, so as not to get into the collection systems. In addition, it is important to know the survival/persistence of the contaminant(s).
- Our agency would like to see a database of potential pathogens of concern, clear information on analytical methods for measuring pathogens (or a laboratory network that could be utilized if needed), risks associated with pathogens (transmission pathways, dose-response, survival/persistence in various matrices, disinfection efficacies of various disinfectants), and disinfection/decontamination protocols for wastewater and facilities/infrastructure/equipment.
- The data that was outlined during the workshop
- The necessary data that was mentioned during the Collaborative Biocontaminated Wastewater Workshop addressed what our plant considered a priority. This was, of course, prior to the SWIFT project. Our plant would also have a vested interest in determining the effects of accepting biocontaminated wastewater and water reuse projects. Would accepting biocontaminated wastewater prohibit water reuse projects? Would we no longer be able to perform aquifer recharge, especially when that aquifer is a source of drinking water for some?
- Treatment guidance, background testing, federal planning support. clear roles and responsibilities

22. Other than technical data, what other factors could hinder you from developing and implementing a utility response plan?

- Coordination among agencies, more certainty on regulatory requirements and liabilities, knowledge of appropriate PPE to protect workers from specific pathogens, and a significant investment of staff time would be necessary to implement a utility response plan. Clear guidelines and/or a template response plan would be very helpful for developing a plan.
- Coordination with other facilities, agencies
- Lack of specific monitoring tests or protocols to deal with such discharges.
- Need clear communication between health professionals, hospital personnel, wastewater treatment agencies, and regulatory agencies.
- Not sure about hindering our ability to develop a utility response plan, but depending on the outcome of research, our SWIFT Project may dictate that our plant's response is to prohibit this type of discharge into the sanitary sewer...zero discharge policy.
- Public hysteria which can only be overcome through effective communication and public education by trusted leaders.
- Public education

We welcome your recommendation and suggestions in developing the most appropriate guidance and utility response plan for handling high-consequence pathogens.

- Convene an inter-agency expert panel to review this issue and develop recommended approaches for the effective management of biocontaminated wastewater from hospital patients infected with such agents.
- Maybe getting an organization like WHO involved.
- Media hype to be averted quickly by national health officials and with a message based on scientific data. Potentially Infectious Medical Waste management at the Hospital level to be checked and control of any discharges to utilities.
- More research results and case studies are always helpful.
- Thank you for allowing us to participate in the workshop and the survey. We hope that the appropriate individuals are utilized to help provide guidance to all publicly owned treatment works.

APPENDIX C

Literature Review for WRRF Response for Biocontaminated Wastewater

1.0 SCOPE

The scope of the review includes scientific reports relevant issues faced by WRRFs in response to contamination with *Bacillus anthracis* (anthrax) spores or Ebola virus. Other organisms are beyond the scope of this review, although this review's results may be helpful for other organisms. However, expert analysis may be required to apply results for other organisms besides *Bacillus anthracis* and Ebola virus.

2.0 LITERATURE SEARCH APPROACH

To provide an applicable literature search, APTIM queried several internet-based technology databases. This database search was supplemented with APTIM's own experience in water/wastewater treatment and discussions of the issue with current researchers in the field. The database search identified a number of articles that addressed specific aspects of the problem. APTIM also consulted with experts at Water Environment & Reuse Foundation (WE&RF).

The articles were subjected to two screening approaches. Initially, the articles were accepted or rejected depending on the expected applicability of the information in the article based on the titles. On acceptance for review, the articles were reviewed in detail for applicability and implementability. Some articles were then rejected if the articles did not relate to the study.

The following sources were used in this literature survey:

- A Google search on “biologically contaminated wastewater treatment” (e.g., anthrax wastewater, utility response plan, etc.) provided several articles.
- A search of WE&RF's website also located several pertinent articles.
- The Web of Science™ database was used to search articles over the past 50 years (1970-2017). The Web of Science™ database provides quick, powerful access to the world's leading citation databases. Content covers over 12,000 highest impact journals worldwide and over 160,000 conference proceedings. The list of terms used to search this database included the following (with the number of “hits” of each term in parentheses): wastewater (90,543), anthrax (6,453), utility response plan (all three words- but not in order, 790), “utility response plan” (all three words – in order, 0), biocontaminated (11), wastewater + anthrax (3), and utility response plan + anthrax (0). Combinations of these terms were then used to narrow down the search. The titles and abstracts of the articles were then used to determine if the article should be reviewed. None of the articles were determined to be directly relevant, based on the titles.
- The American Chemical Society (ACS) web search page was used with the following search terms: biocontaminated, utility response plan, anthrax, and wastewater. Twelve citations were identified in the numerous ACS journals when searching anthrax and wastewater. No citations

for utility response plan or biocontaminated were located. The titles of all citations were reviewed; however, no articles were determined to be directly relevant.

- A search of the American Water Works Association (AWWA) website (search terms: biocontaminated, utility response plan, anthrax, and wastewater) resulted in three hits for utility response plan and 15 hits for anthrax. One of these articles included both keywords; however, it dealt with drinking water facilities and maintaining operation during a flu pandemic, and no articles were determined to be directly relevant.
- The EPA (Drinking Water and Wastewater Resilience; Water Security; Water System Security and Resilience in Homeland Security Research; and Science and Technology) website was searched. The Drinking Water and Wastewater Resilience section had information on developing emergency response plans for small and medium (serving populations between 3,301 and 99,999) and large community water systems (serving populations of 100,000 and greater). However, these guidance documents on developing emergency response plans did not specifically involve the acceptance of biocontaminated wastewater.

3.0 LITERATURE SUMMARY

The literature search identified many articles by title. The titles were the first screening criteria; based on the titles alone, 19 articles were selected for complete review. The complete articles are included in Appendix A. Table 1 provides a list of articles and a summary of the articles from the state of the science literature review.

Table 1. Literature Search Results.

| Number | Author, Title, Date, Availability | Summary |
|--------|---|---|
| 1 | Arduino, Matthew J. Ebola and Other Emerging Health Threats in Sewage and Wastewater: Protecting Workers from Potential Exposures. NACWA Pretreatment Conference, 2015 http://www.werf.org/CMDownload.aspx?ContentKey=c4642699-34be-4814-9956-82b6c4c2577b&ContentItemKey=a23b1814-fe02-440f-a1c1-d3c4a61ce030 accessed September 2018 | A Powerpoint presentation discusses transmission routes of Ebola; similar persistence to other enveloped viruses of concern. Recommends appropriate PPE and basic hygiene practices to protect against exposure to infectious agents. |
| 2 | California Association of Sanitation Agencies (CASA). Revised Consensus Recommendations for Dialogue between the Wastewater Sector and Hospitals on the Management of Wastewater Generated by Patients Infected with the Ebola Virus, 2015. http://casaweb.org | A memo describes the method to pre-treat all wastewater (toilets, showers, and sinks) with bleach, alcohol quaternary ammonia, or calcium hypochlorite. Hospitals should also inform the local wastewater agency of patients suspected or known to be infected with Ebola. |

| Number | Author, Title, Date, Availability | Summary |
|--------|--|--|
| 3 | California Department of Public Health (CDPH). Ebola Virus Disease Medical Waste Management – Interim Guidelines, 2014. https://www.cdph.ca.gov/ | Provides guidance for handling/treating Ebola-generated waste. Includes a section for handling of untreated sewage. Existing CDC and WHO guidance documents suggest that patient discharges/waste can be safely disposed of in sanitary sewers; however, it should be noted that local sanitation districts may not allow the disposal of untreated or pre-treated sewage from a patient infected with Ebola. |
| 4 | Centers for Disease Control and Prevention (CDC). Interim Guidance for Managers and Workers Handling Untreated Sewage from Individuals with Ebola in the United States. 2014. https://www.cdc.gov/ | The World Health Organization recommends that human wastes, including waste from Ebola patients such as vomitus and feces, be disposed of through a sanitary sewer. There has been no evidence to date that Ebola can be transmitted via exposure to sewage. Provides recommendations for workers on the types of personal protective equipment (PPE) to be used and proper hygiene for the safe handling of untreated sewage that may contain Ebola virus. |
| 5 | Centers for Disease Control and Prevention (CDC). Frequently Asked Questions (FAQs) on Interim Guidance for Managers and Workers Handling Untreated Sewage from Suspected or Confirmed Individuals with Ebola in the U.S. 2014. https://www.cdc.gov | A list of questions and answers about the use of sewers for conveying Ebola-contaminated wastewater and the likelihood of contracting Ebola from wastewater. The CDC does not currently recommend disinfection of patient’s waste in the toilet before disposal in sanitary sewer systems. |
| 6 | District of Columbia Water and Sewer Authority (DCWASA). Wastewater Management and Minimization Guidance for Healthcare Facilities. 2006. http://www.dcwater.com | Provides guidance to aid hospitals with managing their liquid chemical wastes and complying with DC law. States that prions, biological agents, and other infectious agents (treated and untreated) shall not be disposed to the sewer. If anthrax decontamination is precautionary only, then the wastewater is acceptable if treated with a 10% bleach solution for 30-minute contact time prior to discharge. |
| 7 | Gallardo, Vicente J., Donald A. Schupp, John L. Heckman, E. Radha Krishnan, Eugene W. Rice. Inactivation of Bacillus Spores in Wash Waters using Chlorine Bleach at Different Temperatures and pH, https://www.ncbi.nlm.nih.gov/pubmed/28646570 | This draft journal article discusses methods to inactivate anthrax surrogate spores in bench-scale with different wash waters, temperatures, and pH. |

| Number | Author, Title, Date, Availability | Summary |
|--------|---|--|
| 8 | Lillis, Karin. Handling Medical Waste in an Era of Emerging Pathogens: Advice from Expert Facilities. Infection Control Today (ICT), 2015. https://www.infectioncontroltoday.com/environmental-hygiene/handling-medical-waste-era-emerging-pathogens-advice-expert-facilities accessed September 2018 | The article discusses issues related to treating patients with Ebola at a hospital in Nebraska. Discusses issues of disposing of wastewater to sanitary sewers. |
| 9 | Muhammad, N., Gallardo, V. J., Schupp, D. A., Krishnan, E. R., Minamyer, K. S., and Rice, E. W. 2014. Inactivation of Bacillus Spores in Decontamination Wash Down Wastewater Using Chlorine Bleach Solution, Can. J. Civil Eng., 41(1): 40-47. | This peer-reviewed journal article discusses methods to inactivate anthrax surrogate spores at bench- and pilot-scale. |
| 10 | National Association of Clean Water Agencies (NACWA). Planning for Decontamination Wastewater: A Guide for Utilities. 2005. https://www2.nacwa.org | The purpose of the guide is to ensure that managers of wastewater utilities are cognizant of the pre-planning necessary to prevent, detect, and/or recover from the impacts of decontamination wastewater containing chemical, biological, and/or radiological (CBR) substances. |
| 11 | U.S. Army Institute of Public Health. Standard Operating Procedure: Ebola Virus Disease Waste Management in the Medical Treatment Facility. 2014. https://phc.amedd.army.mil/ | An SOP developed to assure the safe collection, removal, transport, and disposal of Ebola Virus Disease (EVD) waste from all medical treatment facilities (MTFs) generation areas in a manner that is safe to personnel and the environment and in compliance with all applicable regulations. Does not specifically address WRRFs. |
| 12 | U.S. Department of Energy (DOE). Waste Disposal Workshops: Anthrax-Contaminated Waste. PNNL-SA-69994, 2010. https://nwrct.pnnl.gov/PDFs/WasteDisposal201003.pdf | Provides results of three workshops to help develop policies, methods, plans, and applied technologies to restore large urban areas, DoD installations, and critical infrastructure following the release of a biological agent, such as anthrax. Does not specifically address WRRFs. |
| 13 | US National Response Team (NRT), (2011) NRT Quick Reference Guide, Bacillus anthracis. http://www.nrt.org | A two-page summary of anthrax including characteristics, health effects, personnel safety, decontamination/cleanup, waste disposal, etc. |

| Number | Author, Title, Date, Availability | Summary |
|--------|--|---|
| 14 | US National Response Team (NRT), (2005) Technical Assistance for Anthrax Response. Interim-Final Draft. http://www.nrt.org | The NRT comprises 16 federal agencies that have major responsibilities in environmental protection, transportation, emergency management, worker safety and public health. The document was developed as a technical resource specifically for the response to an actual or suspected terrorist release of anthrax. It includes federal plans and roles, first response, health and safety considerations, sampling and analysis, waste collection and decontamination, and communications. Appendix E includes guidelines for discharging anthrax decontamination wastewater to POTWs. |
| 15 | Water Environment Research Foundation (WERF). Collaborative Workshop on Handling, Management, and Treatment of Biocontaminated Wastewater by Water Resource Recovery Facilities. WERF7W15, Workshop Summary Report, 2016. http://www.werf.org | The Water Environment Research Foundation (WERF, known as the Water Environment & Reuse Foundation, WE&RF at the time of this report composition), in partnership with the U.S. Environmental Protection Agency (EPA), National Homeland Security Research Center (NHSRC), and the National Science Foundation (NSF), hosted an expert workshop on November 17-18, 2015, in Alexandria, Virginia, to engage with subject matter experts and wastewater utility stakeholders on a number of topics surrounding high-consequence pathogens in wastewater collection and treatment systems, should such pathogens enter the systems as a result of an emergency situation. |
| 16 | Water Environment Research Foundation (WERF). A Method to Protect Workers Exposed to Ebola and Other Pathogens Discharged in Hospital Sewer Systems, Protecting Wastewater Treatment Plant Operators from Emerging Pathogens. WERF3C15, 2015. http://www.werf.org | A two-page Executive Summary describing the results of a one-day workshop discussing existing protocols for the management of liquid waste from infected Ebola patients. It recommends disinfecting liquid patient waste prior to discharging to sewer to eliminate infection risk under all scenarios. |

| Number | Author, Title, Date, Availability | Summary |
|--------|---|---|
| 17 | Water Environment Research Foundation (WERF). Ebola and Collection Workers: Is There a Risk? Risks from Ebola Discharge from Hospitals to Sewer Workers. WERF4C15, 2015. http://www.werf.org | A two-page Executive Summary describing a study to assess the potential risks to sewer workers in the sewer line serving a hospital receiving Ebola patients. The results of this study suggest that full compliance with CDC guidance to wear a properly fitted, NIOSH-approved N-95 respirator during handling of untreated sewage leads to reduced aerosol exposure and a lower risk profile for Ebola illness. |
| 18 | Water Environment Research Foundation (WERF). Identify, Screen, and Treat Contaminants to Ensure Wastewater Security. WERF 03CTS2SW, 2003. http://www.werf.org | A two-page Executive Summary describing a study to assimilate and provide high-quality information to wastewater collection and treatment facility personnel and their communities so that they are better equipped to safely respond to the introduction of hazardous materials into wastewater collection and treatment systems. The research team recommended that new and emerging technologies and analytical techniques be evaluated to determine the usefulness of these technologies and techniques. |
| 19 | Water Research Foundation (WRF). Hospital Wastewater Practices and Contaminants of Emerging Concern in Water and Survey on Treatment Practices for Mitigating CECs in Hospital Wastewater. Project 4616, Completion 2018. http://www.werf.org | WRF is currently conducting a project to improve the understanding of current practices to reduce the loading of contaminants of emerging concern (CECs) being discharged from hospitals and other healthcare facilities. A questionnaire has been developed, and the study is currently scheduled to be completed in 2018. |

4.0 DISCUSSION / CONCLUSION

There were relatively few articles discussing utility response plans for the acceptance of anthrax-contaminated wastewater. The literature search identified 19 articles relevant to the handling of biocontaminated wastewater at WRRFs. The majority of research on the biocontaminated wastewater was generated during anthrax- or Ebola-related activities.



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