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## Water System Preparedness for Pandemic Influenza

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**Wright State University – Master in Public Health  
Culminating Experience  
Water System Preparedness for Pandemic Influenza  
February 1, 2008  
Phil Van Atta**

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## **ACRONYMS**

AWWA	American Water Works Association
CDC	Centers for Disease Control and Prevention
CI/KR	Critical Infrastructure/Key Resources
COOP	Continuity of Operations
DHHS	U.S. Department of Health and Human Services
DHS	U.S. Department of Homeland Security
EPA	Environmental Protection Agency
FEMA	Federal Emergency Management Agency
GISN	Global Information Surveillance Network
IHR	International Health Regulations
NICs	National Information Centers
OEPA	Ohio Environmental Protection Agency
PDD	Presidential Decision Directive
WARN	Water Agency Response Network
WHO	World Health Organization
WHO CCs	World Health Organization Collaborating Centers
WSCC	Water Sector Coordinating Council

## **ABSTRACT**

This project involved an investigation of water utility preparedness and best practices for pandemic influenza. A pandemic could cause serious disruptions to the operations of critical infrastructure, including drinking water systems. These disruptions could be caused by staffing shortages, power disruptions, and shortages of chemicals and other supplies. Ensuring continuity of operations for drinking water systems is crucial to protect public health and safety, and to the economy of all communities. Literature searches, interviews, and a survey of Ohio water systems indicated that water systems in Ohio and across the United States are preparing for pandemic influenza. Pandemic influenza preparation and response plans for health departments, based on CDC guidelines, can be easily found online. Business continuity plans and templates for the development of government agency pandemic influenza plans are also readily accessible. However, templates for developing pandemic influenza plans for water systems were not discovered during this investigation. A template pandemic influenza plan for water systems was developed as a result of this project.

## I. INTRODUCTION

Flu pandemics in the 20<sup>th</sup> century occurred in 1918, 1957 and 1968. Public health and medical experts believe that another flu pandemic could occur at any time (CDC, 2007; Fauci, 2006). Pandemics occur when a virulent influenza virus undergoes genetic shift and human to human transmission occurs readily. There is concern among public health officials that the avian influenza virus A (H5N1) could undergo genetic changes and cause a pandemic (Taubenberger, Morens, & Fauci, 2007 and CDC, 2007). Avian and human influenza viruses could recombine in intermediate hosts, such as has happened in pigs, to form new viral strains that are lethal to humans (Greene, 2006).

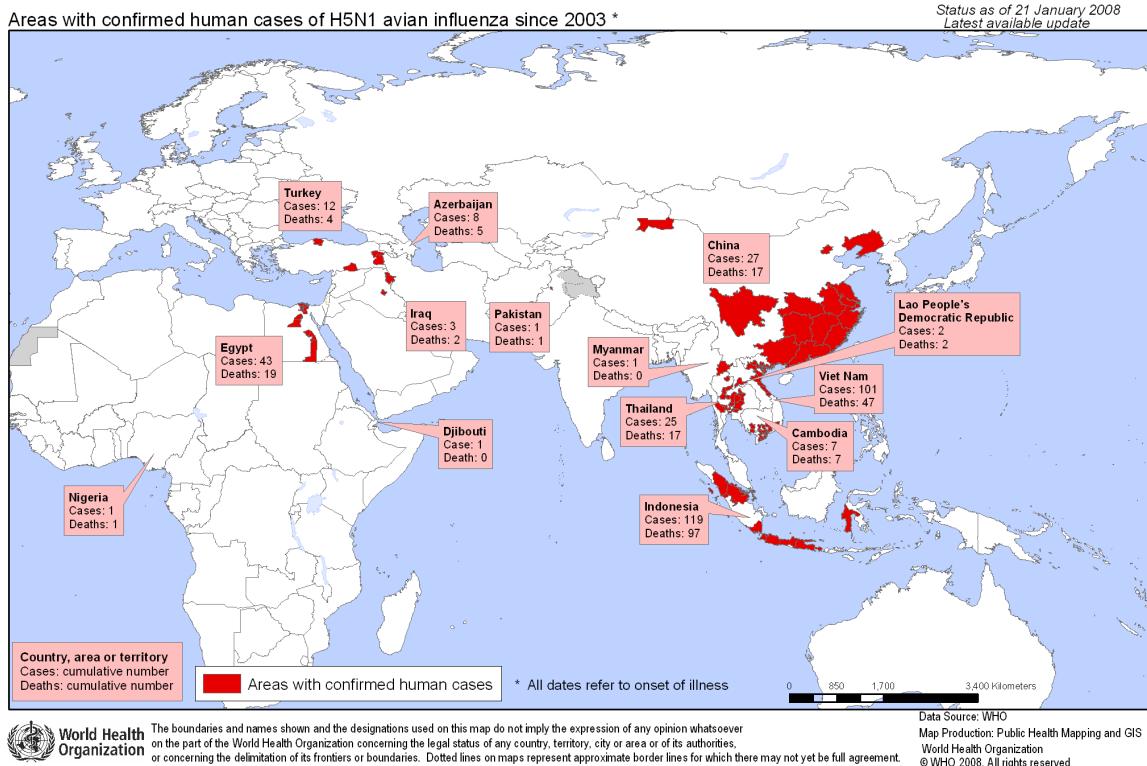
Avian influenza viruses can spread between wild birds and domestic birds. Migratory waterfowl can infect other birds directly or through fecal contamination of water used by domestic birds. Currently, human avian influenza H5N1 cases are associated with close contact with contaminated chickens and other poultry (WHO, 2008). There is some statistical and laboratory evidence indicating that limited, non-sustained human-human transmission of H5N1 may have occurred (WHO, 2008; Yang et al., 2007; Uyeke & Bresee, 2007). If H5N1 undergoes genetic shift and becomes easily transmissible between humans, pandemic influenza could spread rapidly. Because of increased global commerce and international travel, diseases can now spread rapidly throughout the world which would likely make a pandemic in the 21 century much more deadly than in the past.

A Centers for Disease Control and Prevention (CDC) study of disease rates for a new pandemic estimated that in the United States, 40 – 100 million people could be sickened. The CDC study provided a “most likely estimate” death toll of 89,000 –

300,000, with “best case” to “worst case” death toll range of 75,000 – 422,000 (CDC, 2007). The World Health Organization uses a “conservative estimate” of 2 – 7.4 million worldwide deaths for a mild pandemic as in 1957. The number of deaths could be much higher if a new pandemic had death rates similar to the 1918 pandemic (WHO, 2007).

Avian Influenza virus H5N1 has a high mortality rate. As of January 21, 2008 there were 352 reported human cases of H5N1 influenza world wide with a death rate of 62 %. These cases were mostly confined to Asia with other cases in the Middle East and Africa. Most of the cases were related to handling or close contact with poultry with the possibility of some human-human transmission (WHO, 2008).

Figure 1 - World Health Organization - Global Map of H5N1, January 2008



Response to a modern pandemic would be greatly improved compared to the three influenza pandemics of the last 100 years. Scientists have a better understanding of influenza viruses, including H5N1, and host species. It is known that eliminating sick birds reduces the possibility of transmission of influenza. Anti-viral drugs are available and there is better knowledge of how to improve vaccines. Antibiotics are available for secondary infections related to influenza (Greene, 2006).

Since 2005 a great deal of pandemic influenza preparation has been undertaken or planned by public health agencies, governments, private industries, and public utilities in the United States. All states were required to develop pandemic influenza plans (U.S. DHHS, 2006). Vaccine and anti-viral production and research have been accelerated to meet expected demands.

Recent scientific advances and increased vaccine manufacturing capacity have prompted experts to increase their projections of how many pandemic influenza vaccine courses can be made available in the coming years. Last spring, the World Health Organization (WHO) and vaccine manufacturers reported that about 100 million courses of pandemic influenza vaccine based on the H5N1 avian influenza strain could be produced immediately with standard technology. Experts now anticipate that global production capacity will rise to 4.5 billion pandemic immunization courses per year in 2010. It would take 6.7 billion immunization courses to protect the whole world. In 2007, manufacturers increased production capacity of trivalent (three viral strains) seasonal influenza vaccines to an estimated 565 million doses, from 350 million doses produced in 2006 (WHO, 2007).

Influenza vaccine production is based on monitoring of seasonal and potentially pandemic influenza viruses. The Global Influenza Surveillance Network (GISN) gathers influenza virus information from National Influenza Centers (NICs) and WHO Collaborating Centers. International Health Regulations (IHR) requires member states to report cases of human influenza that are caused by novel viruses, such as H5N1. In 2004, the GISN started gathering H5N1 virus information so that the WHO could develop and provide H5N1 candidate vaccine viruses to vaccine producers. Manufacturers have used these candidate viruses to produce and test H5N1 vaccines. Production and widespread distribution of vaccines is critical for the control of influenza. Because of its pathogenicity to eggs and poultry, the development of H5N1 vaccine is more complicated than the production of seasonal vaccines. Reverse genetics is used to make the virus less pathogenic so that it can be grown in eggs and produced safely (WHO, 2007).

In April 2007, the United States government approved a pre-pandemic vaccine for H5N1. According to the national Strategy for Pandemic Influenza Implementation Plan One Year Summary issued in July 2007, enough pre-pandemic vaccine is available to treat 6 million people, with plans to stockpile enough pre-pandemic vaccine for 20 million people. Federal and state stockpiles contain enough antiviral medications for 50 million people (U.S. Homeland Security Council, 2007).

In addition to widespread illness and fatalities, a pandemic flu epidemic could create major disruptions to the global economy. A pandemic could cause up to \$800 billion dollars in economic losses world wide (World Bank, 2007). The U.S. Congressional Budget Office estimated that a modern pandemic with an effect similar to 1918's pandemic could cause a loss of national income of approximately \$600 billion in

the United States (U.S. Homeland Security Council, 2006). Operations of critical infrastructure, including drinking water systems, would be greatly affected by staffing shortages, power disruptions, and shortages of chemicals and other supplies.

There are approximately 160,000 public water systems in the United States, serving 84% of the nation through the provision of water for domestic, industrial, and commercial use (U.S. DHS, 2007). Ensuring continuity of operations for drinking water systems is crucial to maintaining the health and economy of all communities. Water is necessary for drinking, cooking, fire protection, and basic hygiene. Businesses, factories, hospitals, clinics and other public health infrastructure need water to maintain operations. Homes, businesses, and communities are dependent on a continuous supply of water from public water systems to enable the conveyance and treatment of sewage.

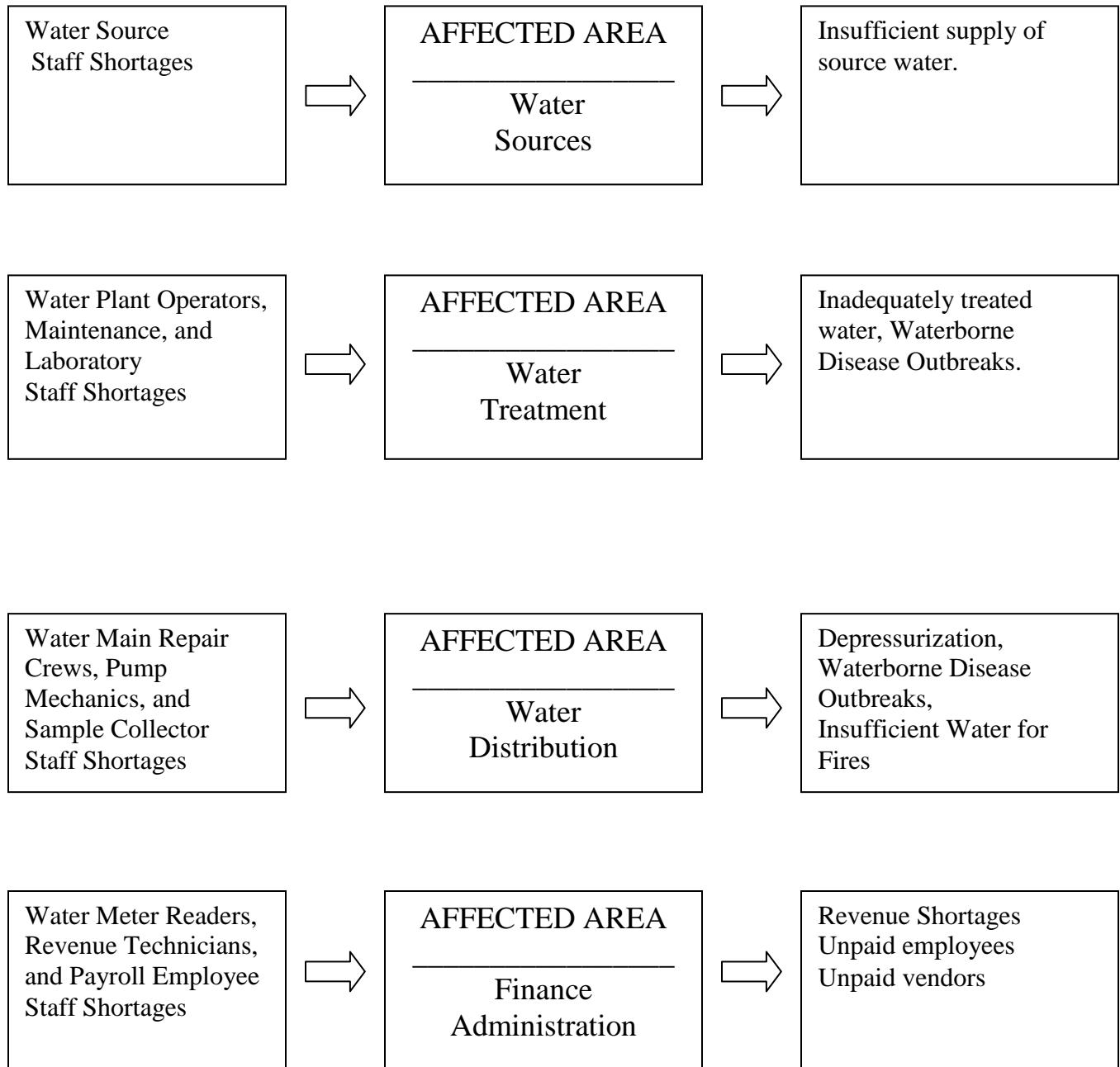
The public health implications are enormous if water suppliers cannot maintain essential operations. Inadequately treated water could lead to waterborne disease outbreaks. The largest waterborne disease outbreak in the United States was caused when heavy spring rains and runoff from animal feedlots combined with treatment plant changes to cause an outbreak of cryptosporidiosis in Milwaukee in 1993. This outbreak caused over 400,000 illnesses and at least 40 deaths (Craun & Calderon, 2001). Sufficient quantities of water at adequate pressure are also needed to fight fires and prevent backflow contamination of water mains.

In the event of a pandemic flu, community water systems could face critical shortages of personnel to maintain and operate well fields, intake structures, treatment plants, pumping stations, and distribution systems. Labor shortages could also affect water quality testing, vehicle repair, administration, and payroll systems. Influenza

caused labor shortages in transportation, energy, and other sectors could lead to insufficient power, parts, general supplies, and water treatment chemicals (Figure 2).

To prepare for labor shortages water utilities need to plan to use “skeleton” teams that have diverse skills for operations, maintenance and repair. Essential personnel will need to be identified in advance and protected from illness during pandemics. Operations of water systems could be disrupted by shortages of essential personnel in many areas including source conveyance, treatment, distribution, engineering, maintenance, water quality monitoring and finance/payroll. Contingency plans or systems need to be developed for alternate sources of chemicals and other supplies, and emergency power. Water systems need to identify essential functions and critical resources to prepare for events such as pandemic influenza that can threaten continuity of operations.

Figure 2 – Example: Employee Absence and Potential Water System Disruptions



Water system preparation for pandemic influenza could also include developing the capacity to generate chemicals on site. It may be necessary to acquire equipment and develop onsite procedures to produce sodium hypochlorite in the event that supply

disruptions prevent deliveries of disinfection chemicals. Water systems will need to establish or reinforce procurement systems that enable cash payments for necessary supplies. Emergency supplies that are cached at strategic location could become vital for supporting personnel during the weeks or months of a pandemic. In addition, a “wellness system” will be necessary for screening employees for illness and isolating healthy employees. In 2004, eight major water and wastewater organizations formed the Water Sector Coordinating Council (WSCC) to reduce water sector vulnerabilities. One of the 14 focus issues for the WSCC is pandemic influenza (American Water Works Association, 2007).

Business continuity planning (BCP) is a comprehensive, proactive planning process that ensures that an entity remains functioning during and following emergencies (ASIS, 2005; Security and Prosperity Partnership, 2007). BCP includes strategies, procedures, and resources used by an organization to respond, recover and resume operations in the event of substantial disruptive incidents (Moore, 2000). Continuity of operations (COOP) planning specifically describes preparation, response and recovery actions that are necessary to ensure that critical services or products are produced and delivered during and following specified emergencies (FEMA, 2007). American Water Works Association Research Project 2929 defined business continuity for water systems as, “activities that ensure that the water utility is able to continue its business of providing water services to its customers until normal business functions assume a state of normalcy” (AWWARF, 2006).

## **II. PURPOSE**

This project involved an investigation of water utility preparations for pandemic influenza in the United States. Another objective of the project was determining “best practices” for water utility continuity of operations during pandemics. The final project objective was to develop a template plan for water utility pandemic influenza continuity of operations planning. The main focus of this plan is maintaining operations and protecting employees.

This culminating experience project also resulted in the development of a draft pandemic continuity of operations plan for the City of Dayton’s Division of Water Supply and Treatment. A separate general template plan will be developed for other divisions within the City of Dayton Water Department. For security reasons, these two plans were not attached to the culminating experience manuscript.

### **III. REVIEW OF LITERATURE**

The World Health Organization, the United States government and health departments across the United States have developed Pandemic Flu response plans or protocols. In 1999 the Centers for Disease Control and Prevention (CDC) tasked states to prepare plans for pandemic influenza and provided guidelines (USDHHS, 2007). In May, 2006 the United States Government's Homeland Security Council released the National Strategy for Pandemic Influenza Implementation Plan. In April, 2007 the U.S. Department of Homeland Security (DHS) released "Pandemic Influenza Best Practices and Model Protocols" for use by state, local, tribal and territorial personnel when developing best practices for pandemic plans or training programs (US DHS, 2007). In July, 2007 the Department of Health and Human Services issued the "One Year Summary of National Strategy for Pandemic Influenza Implementation Plan (USDHHS, 2007).

The main goals of the U.S. government's response plan for pandemic influenza are to limit the spread of a pandemic; mitigate disease, suffering, and death; sustain infrastructure, and lessen the impact on the economy and society (CDC, 2007). An effort is being made to produce enough vaccine within six months of a pandemic to inoculate the entire U.S. population. The U.S. government has contracted with six manufacturers to achieve this goal by 2011 and to stockpile pandemic vaccine doses ahead of time for 20 million people (USDHHS, 2007).

In 1998, President Clinton issued Presidential Directive 63 that identified water as one of the nation's critical infrastructure sectors (USDHS memo, 2006). In September, 2006 the U.S. DHS released the "Pandemic Influenza Preparedness, Response, and

Recovery Guide for Critical Infrastructure and Key Resources". This guide listed water as one of seventeen Critical Infrastructure/Key Resources sectors. Each sector collaborates with the Department of Homeland Security and sector-specific government agencies (US DHS, 2006).

In May 2007, the U.S. DHS released "Water - Critical Infrastructure and Key Resources Sector-Specific Plan as input to the National Infrastructure Protection Plan" (USDHS, 2007). U.S. government plans emphasize the need for critical infrastructure sectors, including water, to prepare continuity of operations plans for pandemic influenza and other hazards. Continuity of operations (COOP) planning or plans have written procedures that systems or business can use to plan or respond to emergencies that threaten continuation of essential operations. These plans identify critical components for continuity of operations; identifying and protecting essential personnel, cross training of employees, securing alternate supplies, ensuring emergency power sources, and maintaining critical functions.

The July, 2007 federal government summary of the national pandemic influenza plan stated that the U.S. Environmental Protection Agency (USEPA) is responsible for preparing the water sector for pandemic influenza by, "engaging federal, state, and local partners in order to develop and promote the establishment of mutual aid and assistance agreements..."(USDHHS, 2007). In addition, President Bush has tasked USEPA to assist the nation's critical drinking water and wastewater infrastructure, collectively known as the water sector, to maintain operations in the event of an influenza pandemic (U.S. DHS, 2007). The USEPA, the Ohio Environmental Protection Agency (OEPA),

the CDC, and various other agencies have issued fact sheets about Pandemic Influenza and preparedness sheets that discuss business continuity.

### **Public Health Agency Planning For Pandemic Influenza**

State and local health department pandemic influenza plans were also reviewed for this project. Occasionally these plans made passing references to critical infrastructure or public water supply. Usually, the only reference to drinking water was a mention for a need to stockpile bottled water for staff. One plan stated, “work with public water system, local public health, (et al.) to assure safety of water supply” (Minnesota Department of Public Health, 2006). The South Carolina Department of Health and Environmental Control web site had a brief reference to potential labor shortages, “Absenteeism may affect critical supplies such as water and electric...” (South Carolina Department of Health and Environmental Control, 2007).

Pandemic influenza preparation is a relatively new area of emergency preparation for water systems. Pandemic influenza preparation is not specifically covered in American Water Works Association (AWWA) or AWWW Research Foundation (AWWARF) books and manuals released as of October 2007. The OEPA released its first public document for water system pandemic influenza preparation in late 2006. This document is a two page questionnaire for water and wastewater plant owners and operators. The OEPA does not include pandemic influenza in the template plan for Drinking Water Supply Emergency Plan that was developed for public water systems (OEPA web page, 2007).

It is considered unlikely that properly treated drinking water can serve as a mode of transmission for the H5N1 virus. However, very little literature exists for this subject. Literature that discusses drinking water treatment and other viruses, such as Norwalk-like and Hepatitis A, is readily available (Chalapati et al., 1988; Salvato, 2003; American Water Works Association, 1999).

Some bodies of water could be contaminated by dead birds or the feces of infected birds. Chicken feces are sometimes used as a cheap protein source for fish farms in Asia. Conventionally treated water should not pose a health risk even if the water source is an open reservoir that is accessed by infected water birds (Cooperative Research Centre, 2007). A Netherlands study of Avian Influenza Virus infection via water also concluded that the risk of drinking water transmission is negligible (Achijven et al., 2005).

According to a review of evidence by the World Health Organization it appears to be unlikely that H5N1 can be transmitted through effectively treated drinking water or sewage (WHO, 2006). It is believed that traditional methods of water treatment, coagulation and filtration followed by disinfection, will reduce any avian influenza virus present in the water to insignificant numbers. The avian influenza virus has an outer protein envelope that is susceptible to damage by oxidants such as chlorine. This would destroy the infectivity of the virus (WHO, 2006). The United States Department of Agriculture and the Environmental Protection Agency conducted research which indicated that typical chlorine levels used by public water systems are adequate to inactivate H5N1 virus. Filtration is also effective for removing the virus (USEPA, 2007).

## **Continuity of Operations Planning by Water Systems**

Government agencies emphasize the need for critical infrastructure sectors such as water to prepare plans for continuity of operations. However, few water utilities address continuity of operations in their emergency response plans (American Water Works Association, 2006). The USEPA and the OEPA encourage water utilities to prepare for supply disruptions and employee shortages in the event of pandemic influenza (OEPA, 2007). The USEPA is working with the Departments of Homeland Security and Health and Human Services to give water system workers priority access to vaccines and antiviral drugs. In the event of a pandemic influenza outbreak, water and sewer systems would experience decreased staffing levels because of illness. Ensuring that enough employees are available to perform essential services is seen as the most significant factor for maintaining continuity of operations (American Water Works Association, 2006).

Existing software products could be used by water utilities to develop continuity of operations plans. These products include RAMSAFE, Phoenix, and Disaster Recovery Systems (Westby & Saldanha, 2004). One of the objectives of the American Water Works Association Research Foundation Project 2929 was to identify best practices for water utility emergency plans and planning programs (AWWARF, 2006). The project investigated business continuity planning in the water sector but did not investigate pandemic influenza preparedness.

#### **IV. METHODS**

This project included a survey of medium and large water systems in Ohio to determine the extent of preparations for pandemic flu. It was decided to only survey medium and large water systems due to considerations of data manageability and the belief that small systems were not likely to have pandemic influenza plans. Water system size was determined from Ohio Environmental Protection Agency records for the number of people supplied with water (Ohio EPA, 2007). The survey was approved for exempt status by the Wright State University Institutional Review Board. Data from the survey was accumulated for descriptive statistical analysis of the current state of preparedness of water systems in Ohio.

Surveys were delivered by mail and/or email to a total of 86 medium and large water systems. For purposes of this study, water systems that served a population in the range of 20,000 to 99,999 were designated as medium size. Water systems that served a population of at least 100,000 were characterized as large systems. Survey results were grouped by these system size ranges; 20,000 – 49,999, 50,000 - 99,999, 100,000-199,999, and greater than 199,000.

Most of the surveys were sent via mail. Some surveys were emailed to contacts at larger water systems if an email recipient was identified as likely to respond to the survey. Surveys were delivered by mail or email to a total of 86 medium and large water systems. A copy of the survey is attached in Appendix B.

An effort was made to collect pandemic continuity of operation plans along with returned surveys, through requests to water utilities, and through internet searches. These plans were to be collected for comparison with utility industry and federal government

standards for continuity of operations to determine best practices for water utility continuity of operations during pandemics. Benchmarks for water system continuity of operations and public health preparedness were established from critical areas identified by the USEPA and the American Water Works Association.

Information for this project was also gathered from presentations delivered at water industry conferences and seminars. Phone conversations were held with key personnel in water systems that have written pandemic influenza continuity of operations plans or were currently working on a plan. Other discussions were held with public health officials and emergency preparedness experts to verify critical areas for pandemic influenza preparedness. The relationship between public health preparedness and critical infrastructure, especially drinking water, was one of the areas examined.

Existing pandemic flu plans were reviewed to determine applicability and adaptability for inclusion in a template plan for water utility pandemic continuity of operations. Some of the essential components for this template were also determined from USEPA and Department of Homeland Security documents. Critical infrastructure continuity of operations check lists in business continuity documents were used to verify that the template included necessary elements.

## V. RESULTS

### **Ohio Water System Pandemic Influenza Preparedness**

A total of 50 (58%) completed pandemic influenza preparedness surveys were returned in September and October, 2007 from medium and large Ohio water systems. Forty-six publicly owned water systems and four privately owned systems returned surveys. One completed survey indicated that it served a population (9500) less than the target size of at least 20,000. This survey was not included in data summaries. Although public records indicated that five systems were in the two largest system categories, surveys were received from six systems for each of these categories. It is possible that the number of surveys received was greater than the number of pre-identified systems, five for each category, because these systems actually serve more customers than are indicated in Ohio EPA online records.

One surveyed utility indicated that the local health department “would handle” their pandemic influenza planning. Eighty-eight percent of the targeted systems returning surveys indicated that they either have a plan, in some cases incorporated into their main emergency response plan (ERP), or they intend to develop a plan. Twelve percent of the systems indicated that they did not have a plan or an intention to develop a plan. Two systems reported that they address one potential impact of pandemic influenza, staffing reductions in their existing emergency response plans, but did not indicate having a plan that addressed other areas of pandemic influenza planning, e.g. social distancing.

Only eight percent of surveyed water systems had participated in training related to pandemic influenza planning and response. A majority of systems, 86 percent, indicated an interest in pandemic influenza preparedness training. Interest in training

ranged from 67 percent for the 100,000 – 199,000 system category to 100 percent for the 50,000 – 99,999 system category.

Table 1 - Summary of Ohio Water System Survey

System Size	20,000 - 49,999	50,000 - 99,999	100,000 - 199,999	≥200,000	Total
Have a plan.	4	5	1	3	13
Working on a plan.	1	0	1	1	3
Intend to develop a plan.	10	3	2	1	16
Pan Flu included in ERP	7	2	2	1	12
Have participated in training.	2	1	1	0	4
Would participate in training	23	11	4	5	43
Number of systems in category	60	16	5*	5*	86
Public systems returning surveys	25	10	6	5	46
Private systems returning surveys	2	1	0	1	4
Total surveys returned	27	11	6	6	50
Surveys returned %	45%	69%	100%*	100%*	58%

\* The number of surveys returned was greater than the number of systems in these categories as identified in regulatory records.

Figure 3 – Ohio Water Systems Currently Working On Pandemic Influenza Plan

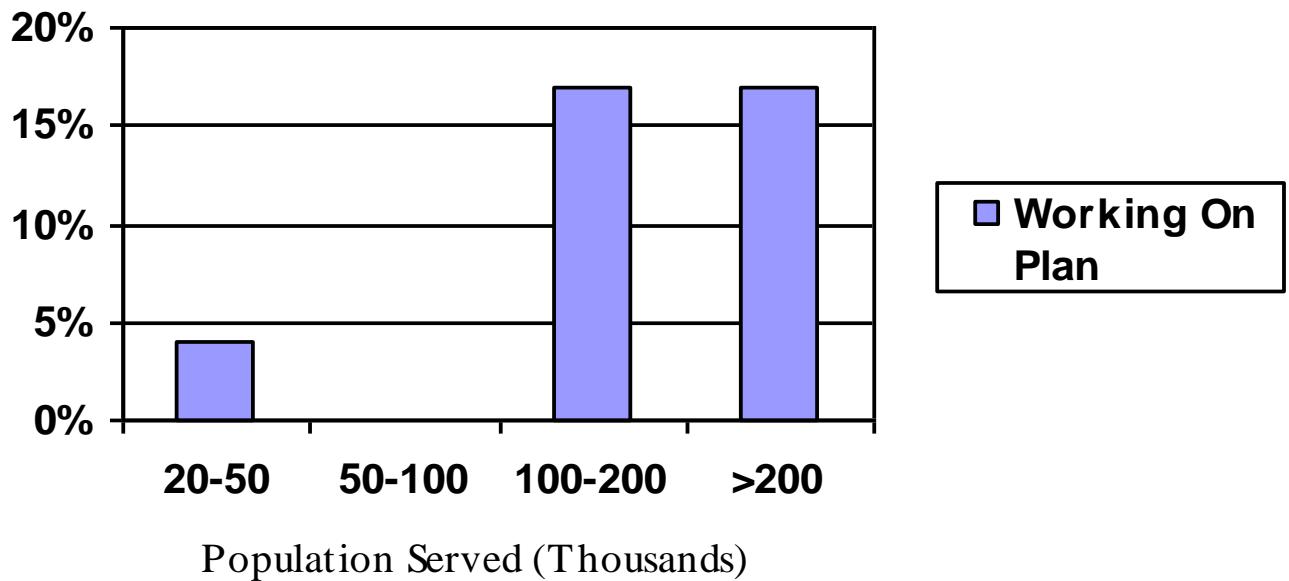


Figure 4 – Ohio Water Systems With Pandemic Influenza Plan

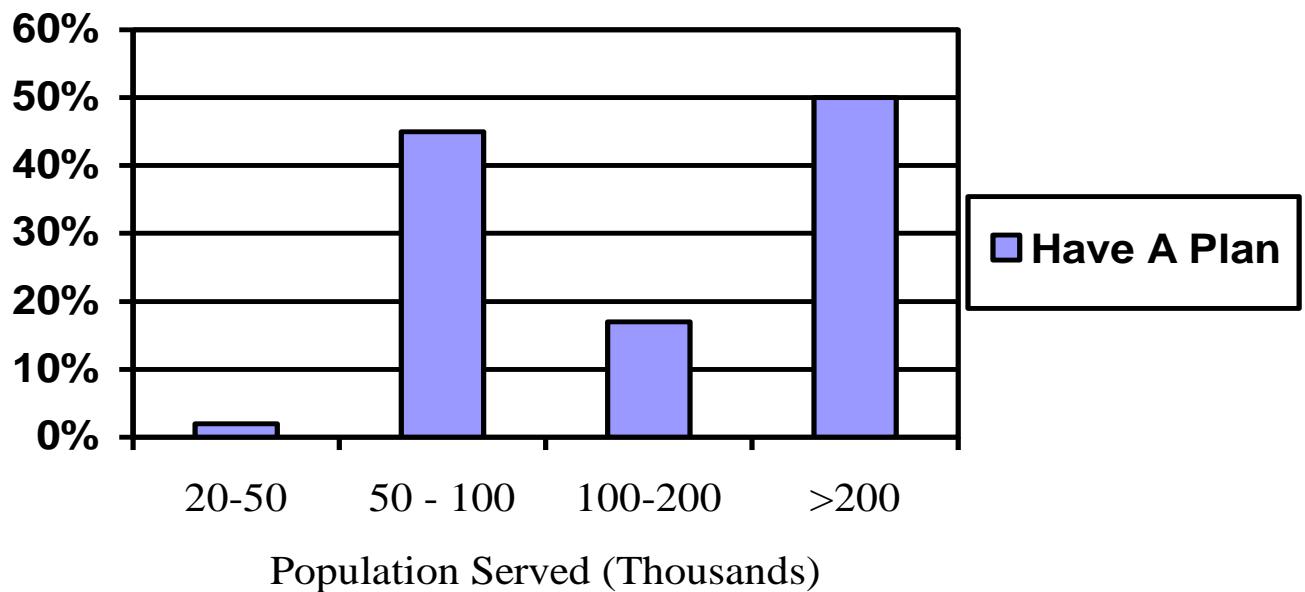


Figure 5 – Ohio Water Systems Intending To Develop A Pandemic Influenza Plan

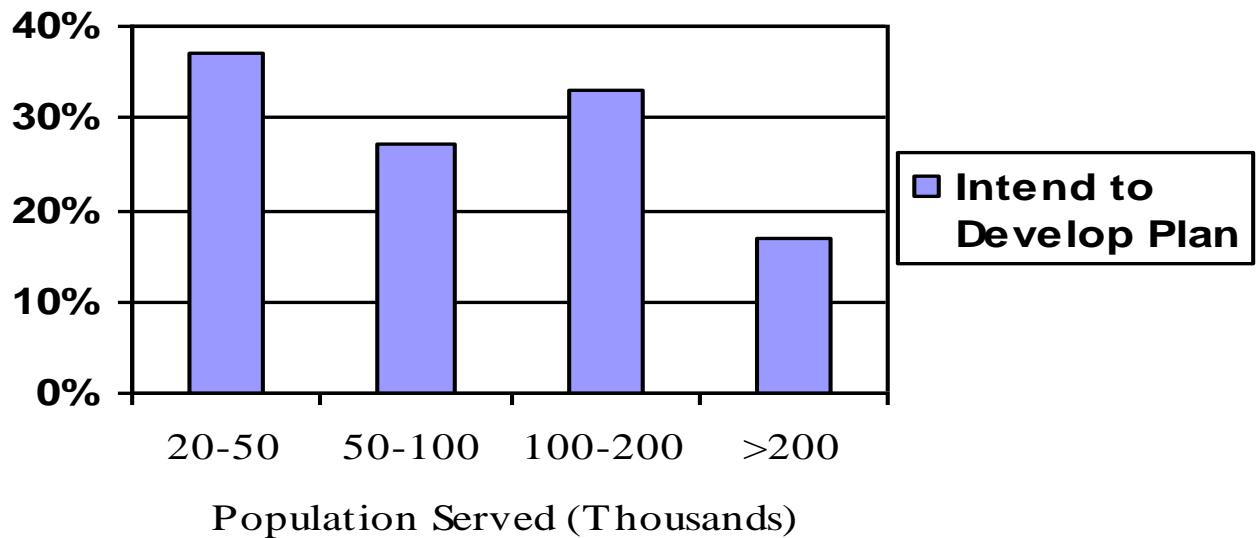


Figure 6 – Ohio Water Systems: Pandemic Influenza Included in ERP

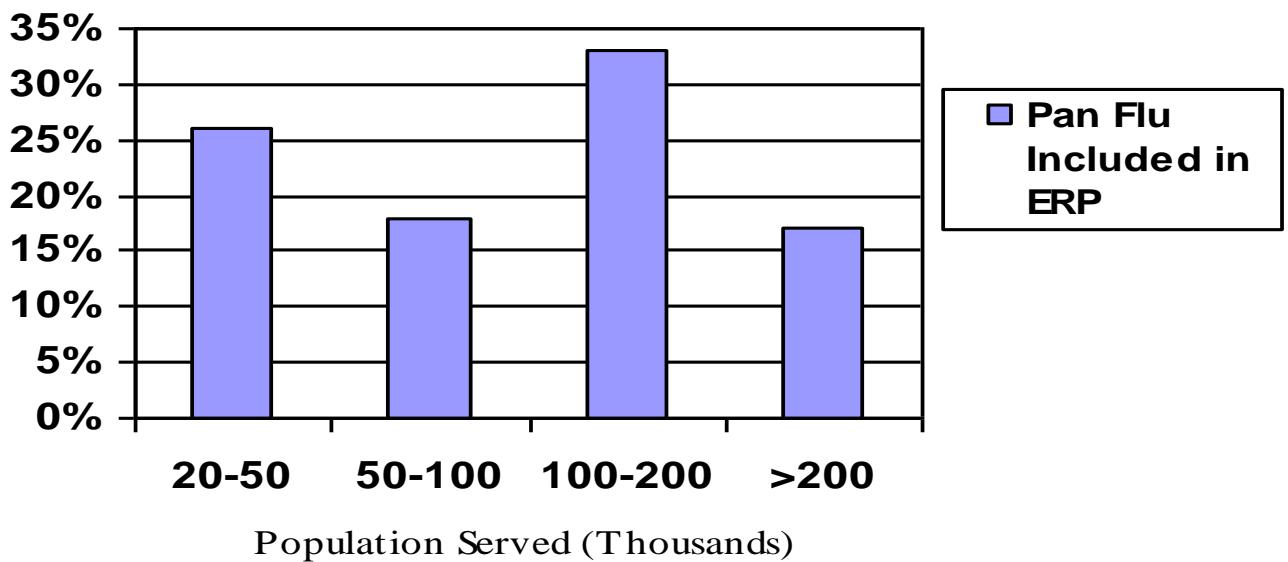
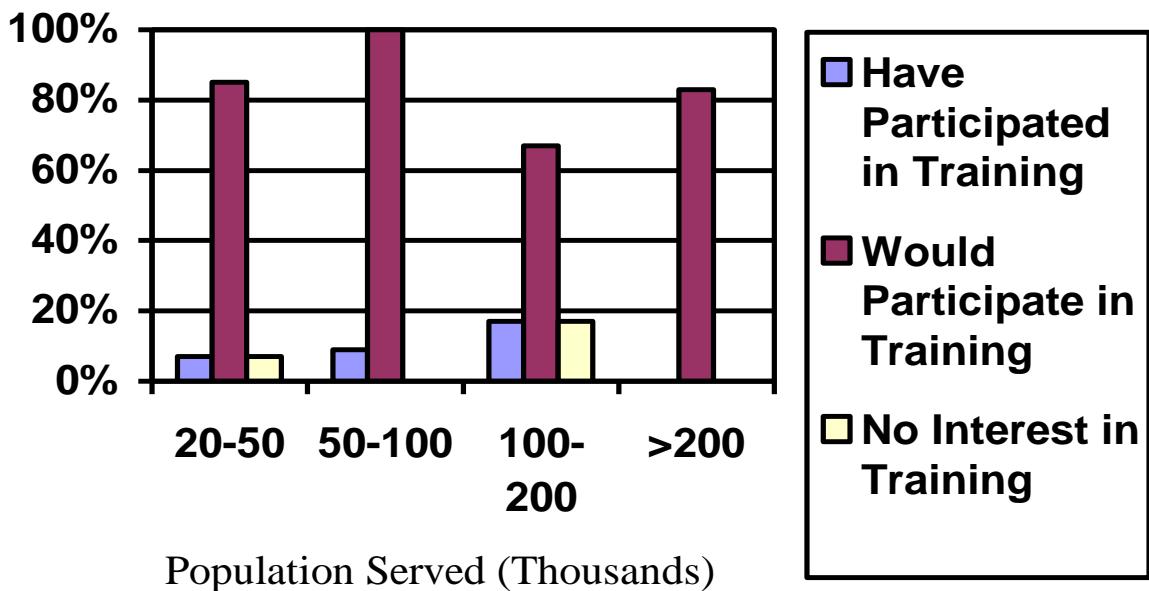


Figure 7 – Ohio Water Systems – Pandemic Influenza Training Status



### **Existing Pandemic Influenza Plans**

Thirteen of the fifty Ohio water systems returning surveys indicated that they had existing pandemic influenza plans. Three of the four privately owned and operated water systems indicated that they have existing pandemic influenza plans. One Ohio water system provided a pandemic influenza plan for this project. Two systems from outside Ohio allowed viewing of their pandemic influenza plans. Security concerns were voiced by other water systems when requests to view their pandemic influenza plans were denied.

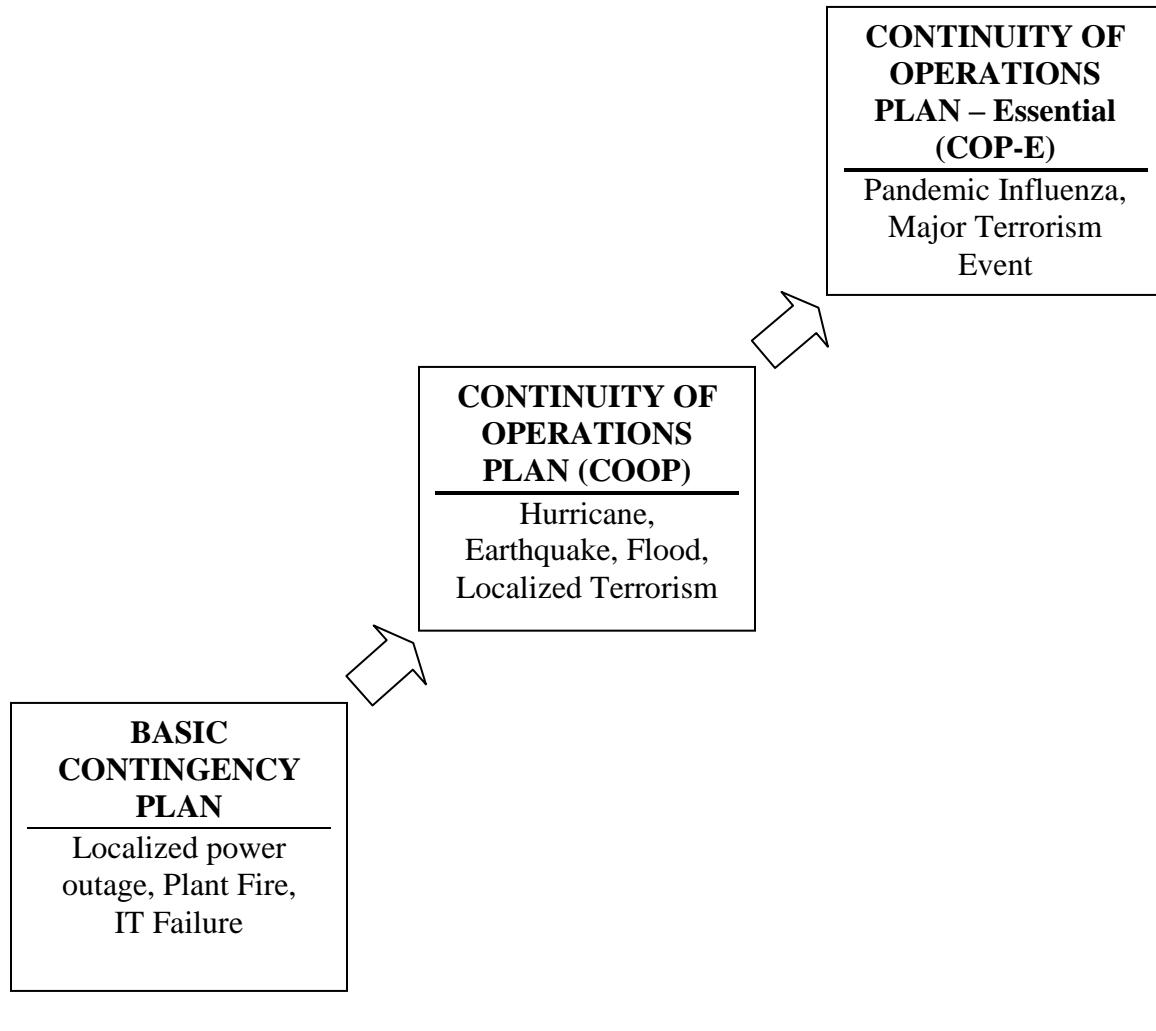
## VI. DISCUSSION

### **United States Critical Infrastructure - Pandemic Influenza Preparedness**

Federal and private Critical Infrastructure and Key Resources (CI/KR) sectors are preparing for pandemic flu through sector specific councils. Water is one of the 17 identified sectors in the U.S. Homeland Security document Pandemic Influenza Preparedness, Response, and Recovery Guide for Critical Infrastructure and Key Resources. There is a strong interdependence between water and other critical sectors. Water is indispensable to other sectors but dependent on energy, transportation, and chemical sectors to maintain operations. Although officially designed for the private sector, which encompasses eighty-five percent of critical infrastructure resources, this Guide provides pandemic planning and background materials that can be used by both public and private critical infrastructure.

The main objective of the Guide is to stimulate CI/KR owner-operators to “develop and integrate effective continuity of operations plans that ensure essential services remain functional and essential goods remain available in the event of a pandemic” (USDHS, 2006). Continuity of operations would be challenged by the reduction in available workers due to illness, and disruption in the movement of people and goods. The Guide categorizes pandemic influenza as an extreme challenge to continuity of operations and promotes development of a Continuity of Operations Plan – Essential (COP-E) as an extension of a Continuity of Operations Plan (COOP) that address emergencies like hurricanes or earthquakes. Basic Contingency Plans are designed for routine challenges like power outages (see Figure 8).

Figure 8 – Disaster Planning Continuum<sup>1</sup>



<sup>1</sup> Adapted from Pandemic Influenza Preparedness, Response, and Recovery Guide for Critical Infrastructure and Key Resources (U.S. Department of Homeland Security, 2006).

The U.S. Environmental Protection Agency is responsible for coordinating pandemic influenza preparedness for the drinking water sector in the United States. When the Guide is finalized, water sector specific information will be one of the annexes

of the Pandemic Influenza Preparedness, Response, and Recovery Guide for Critical Infrastructure and Key Resources. This information will identify specific measures that water systems can undertake to maintain continuity of operations in the event of pandemic influenza (USDHS, 2006).

Existing pandemic influenza template plans for water systems were not located in the literature or through an online search of government documents. The Federal Emergency Management Agency (FEMA) website has downloadable template documents for continuity of operations plans with a separate pandemic influenza appendix. These documents are designed for government agencies (USDHS, 2007). The official government pandemic influenza preparedness website provides downloadable planning documents and checklists for businesses.

The U.S. EPA and Ohio EPA have regulatory responsibility for drinking water systems. As of February 1, 2008, neither agency provided pandemic influenza template plans for water systems. The Ohio EPA has a Drinking Water Supply Emergency Plan guidance document and template that water systems can use for development of system specific emergency plans. The guidance document has a list of man-made or natural disasters that water systems should prepare for but does not include pandemic influenza or continuity of operations (OEPA, 2007).

The Federal Emergency Management Agency and the Ohio Emergency Management Agency stress the need for individuals and families to prepare and store emergency kits that contain food, water, and emergency supplies (USDHS, 2008 and OEMA, 2008). The American Red Cross provides check lists and emergency kits that households can use for emergency planning and preparation (American Red Cross,

2008). Water systems should inform their customers of the importance of emergency kits and encourage customers to store a three day supply of water to prepare for potential supply disruptions. This information could be provided at water utility web sites or disseminated through annual reports, water bills, or the USEPA required, Consumer Confidence Report.

### **Public Health Agency Coordination with Critical Infrastructure**

In the United States, state health departments have primacy for public health programs. States delegate control of health programs to local health departments, including pandemic influenza preparedness. State and local health departments have developed pandemic influenza plans in all 50 states.

A search of public health department pandemic influenza plans revealed that the only reference to public water supplies was usually in the section that listed prioritization for vaccination and distribution of antiviral medications. Prioritization of vaccination and distribution of antivirals follows guidance from the U.S. Department of Health and Human Services Pandemic Influenza Plan. Public utility personnel are in Tier 2, subtier B (Table 2) for vaccinations and Tier 8 (Table 3) for distribution of antivirals (USDHS, 2005).

Table 2 – Vaccination Prioritization

Priority Groups for Vaccination						
Tier 1	Subtier A	Subtier B	Subtier C	Subtier D		
	-Health care workers & vaccinators	-Infants and elderly with high risk condition	-Pregnant women -Contacts of infants and immuno-compromised persons	-Public health personnel critical to pandemic response -Key government positions		
Tier 2	Subtier A		Subtier B			
	<ul style="list-style-type: none"> <li>-Infants and elderly</li> <li>-Persons 6 months to 64 years with one high-risk condition</li> </ul>		<ul style="list-style-type: none"> <li>-Remainder of public health workforce</li> <li>-Public safety personnel (fire, police)</li> <li>-Transportation personnel</li> <li>-Telecommunications personnel</li> <li><b>-Public utility personnel</b></li> </ul>			
Tier 3	<ul style="list-style-type: none"> <li>-Key government health decision makers</li> <li>-Funeral directors/embalmers</li> </ul>					
Tier 4	<ul style="list-style-type: none"> <li>-Healthy persons 2 to 64 years not included in Tiers 1 - 3</li> </ul>					

**Table 3 – Prioritization for Distribution of Antiviral Medications**

Priority Groups for Antiviral Medications	
Tier	Group
1	Patients admitted to hospital with influenza
2	Health care workers with direct patient contact, and Emergency Medical Services personnel directly involved with patient transport
3	Highest risk outpatients with influenza: immunocompromised persons and pregnant women
4	Public health personnel critical to pandemic response, vaccinators, public safety, and key government officials
5	Increased risk outpatients with influenza: children 12 to 23 months, persons $\geq 65$ years, persons with underlying medical conditions
6	Outbreak response in nursing homes and other residential settings
7	Health care workers in Emergency Department, Intensive Care Unit, dialysis, and Emergency Medical Services settings
8	<b>Critical infrastructure personnel in vaccination priority group Tier 2, Subtier B, and health care workers without direct patient contact</b>
9	Other outpatients with influenza not included in Tiers 1-8
10	Highest risk outpatients
11	Other health care workers with direct patient contact

Any other references to public water supplies or other critical infrastructure in public health pandemic plans were usually quite brief. One plan stated, “Work with public water supply, local public health, etc. to assure safety of water supply” (Minnesota Dept. of Health, 2006). A September 2007 report by the Congressional Research Service provided an analysis of state pandemic influenza preparedness plans authored by public health officials. The report stated that only 11 of the state plans mentioned essential services other than public health and healthcare services. Only seven of the plans

mentioned continuity of essential services, including public utilities (Congressional Research Service, 2007).

Public health agencies have continuity of operations plans to ensure that they will be able to provide vaccinations, disease control, and other essential public health services in the event of a pandemic. However, these essential services would be greatly impacted if water or other utilities were disrupted. Major disruptions of water systems caused by pandemics could potentially cause waterborne disease outbreaks that overwhelm health care systems and public health services. Also, reductions in water system staffing caused by pandemics could impact the repair of pumps or broken water pipelines. This could cause loss of water service for public health facilities and impact the delivery of public health services.

### **Water System Preparation for Pandemic Influenza in the United States**

Water systems across the United States have developed plans or have started preparing for pandemic influenza. The City of Denver water utility, which serves 1.2 million customers, started upgrading its emergency plan to include pandemic influenza in 2006. Denver's preparations included creating 37 emergency kits to be stored at water treatment plants and key pumping stations. The kits contain enough food to feed one or two people for three days, a sleeping bag, portable stove, cook kit, toilet paper, flashlights and batteries, duct tape, rope, first-aid supplies, masks, gloves, and hand sanitizer. If the utility is alerted of early stages of pandemic influenza, Denver's plan includes cross-training for key positions and a gradual shut-down of non-essential operations.

The City of Tacoma, Washington held a pandemic influenza training exercise in December 2006. This exercise tested the utility's response to a pandemic that reduced staffing by 40 percent. After an evaluation of the exercise the City of Tacoma began a cross training program for water utility employees. This program allows people in different positions to fill in as water plant operators or other positions in an emergency (AWWA, 2007).

The American Water Works Association (AWWA) convened a panel of regulatory, water system and public health experts in early May 2006 to address water utility preparedness for a flu pandemic. The panel's discussions, reported in the June 2006 Journal of the AWWA, emphasized the importance of water utility preparations for pandemic influenza and the need to partner with public health officials (AWWA, 2006). Topics discussed included employees returning to work after recovering from influenza. These employees will be vital for maintaining operations because of their acquired immunity.

The USEPA and the Department of Homeland Security are jointly developing a bird flu preparedness guide for water and wastewater systems. The Association of Metropolitan Water Agencies (AMWA) developed a pandemic influenza reference guide and checklist for water utilities. This document was released to AMWA members or subscribers to the Water Information Sharing and Analysis Center (AMWA, 2007). The Massachusetts Water Resources Authority and the South Florida Water Management District have developed continuity of operations plans for pandemic influenza (Brown & Caldwell, 2006).

Water utilities should establish partnerships with public health agencies and emergency officials to provide early warning of pandemic influenza and to enhance preparation for pandemic influenza. Joint training exercises would benefit both water systems and public health agencies. Water systems could benefit by obtaining information from public health agencies about influenza protection measures and advance knowledge of pandemic influenza outbreaks. Regular communications from public health agencies about influenza-type illnesses could provide early notice of pandemic influenza or potential bio-terrorism. Influenza-type illnesses can be a symptom of a bioterrorism agent such as anthrax (Gensheimer et al., 2003).

Public health agencies could improve sections of their pandemic plans to enhance support for water systems that provide drinking water and sanitation for the community. This support could include advance planning of vaccinations for water system personnel. These efforts by water systems and public health could improve the public health and critical infrastructure components of pandemic influenza plans for both sectors.

To ensure effectiveness, pandemic influenza continuity of operations plans should be flexible, easy to read, and capable of quick implementation. One half of utilities surveyed in a 2006 American Water Works Association Research Foundation study said their (all hazards) emergency plans were cumbersome. The time sensitive nature of emergencies makes ease of use very important.

To prepare for pandemics or other emergencies water utilities should stockpile emergency supplies, develop alternate sources or systems for power and treatment chemicals; and acquire backup communication systems that could include radios with multiple channels, all-in-one wireless communication devices, ham radios, and satellite

internet service. To support telecommuting, water systems could buildup information technology systems by increasing bandwidth, adding redundant servers, etc. Preparation for pandemic influenza and establishing mutual aid agreements can prepare a water utility for natural disasters or other emergencies that affect continuity of operations, including terrorism.

Ensuring that enough employees are available to perform essential services is seen as the most significant factor for maintaining continuity of operations. Cross training of employees can provide a line of succession for management positions and backup employees for operational positions. Encouraging seasonal influenza vaccination is one measure that water systems can take to protect the health of their work force before a pandemic. During pandemics social distancing, hygiene measures, and access to anti-virals and virus specific vaccination will be crucial. Establishing a relationship in advance with local public health officials could facilitate the distribution of anti-virals and vaccines to water system personnel. Treatment of employees with influenza will be problematic because the health care system will be overwhelmed by a pandemic.

### **Water System Preparation for Pandemic Influenza in Ohio**

The Ohio EPA participated with public health and other agencies in a Pandemic Influenza “functional” exercise conducted from January 24 – February 6, 2007. Six pandemic influenza target areas were tested during the exercise; planning, communications, isolation, incident management, medical surge, and public health epidemiology and laboratory testing. During the exercise, Ohio EPA activated its pandemic influenza plan and called several water systems to determine how those systems would respond to various scenarios. At least one utility was contacted to

determine how it would respond to a supply disruption for disinfection chemicals. The Ohio EPA objective for this exercise was to maintain “safe” water supplies by performing the agency’s essential functions, regulatory, outreach/assistance, and administration (OEPA, 2007). This exercise is scheduled to be conducted again in February 2008.

In 2007 utilities and agencies in Ohio began developing an Ohio Water Assistance and Response Network (WARN) system. Utilities that register with Ohio WARN would be prepared to assist or receive assistance from other utilities in the event of emergencies, including pandemic influenza. This assistance could come in the form of providing operators, equipment or supplies (Ohio Section AWWA, 2007). However, mutual aid would be hindered or prevented if pandemic influenza reduced the staff or supplies of water utilities throughout Ohio.

### **Continuity of Operations Planning - Best Practices**

The most critical issue for water utilities in the event of pandemic influenza is maintaining continuity of operations. A reduced work force, and potential disruption of supplies, chemicals, and energy would create major challenges to continuity of operations. Other challenges could include inadequate bandwidth for telecommuting, inadequate funding, and lack of preparation.

A review of literature, including water industry publications, indicated that few water utilities address continuity of operations in their emergency response plans. Continuity of Operations Plans (COOP) can be developed for different emergency planning scenarios, including pandemic influenza. Essential elements of a COOP include identification of essential functions, critical services, essential staff positions, and

critical resources. Essential functions for water systems include disinfection, filtration, maintenance, repairs, and pumping. An example of criteria used to determine critical services and necessary COOP components is presented in Table 4.

Table 4 – Example of Criteria for Developing Water Utility COOP

Components for Development of Continuity of Operations Plans (COOP)	
Category	Examples
1. Identify Essential Functions	Provide potable water.
2. Identify Critical Services	Pump water
	Disinfect water
3. Identify Critical Resources	Electricity for pumping
	Chlorine for Disinfection
4. Identify Essential Personnel	Operators for treatment plant
	Mechanics for repair of pumps
5. COOP Component	Emergency Generator Plan
	Alternate Disinfectant Plan
	Pandemic Influenza Plan
Major Considerations: Sufficient staff, supplies, energy, and chemicals.	

Best practices for water system continuity of operations planning for pandemic influenza were established through a review of literature and from critical areas identified by the USEPA and the American Water Works Association. A summary of planning, description, and action elements that incorporate best practices is listed in Table 5. Sources of best practices are listed in appendix F.

**Table 5 – Best Practices For Pandemic Influenza COOP For Water Systems**

<b>Essential Elements of Pandemic Influenza Preparedness Plans for Water Systems</b>		
<b>Planning</b>	<b>Description</b>	<b>Action</b>
Identify pandemic coordinator and team	Identify all planning processes and define roles and responsibilities.	Designate Pandemic coordinator. Assign members to team.
Define essential services and products.		List essential services.
Identify essential resources	Energy, chemicals, supplies.	Develop alternate energy, supplier and disinfection plans.
Identify and prioritize essential services, products and personnel.	Conduct thorough review of all processes.	List primary, secondary and non-essential functions and services in plan.
Delegate authorities and lines of succession.	Use existing succession plans or develop succession plans and lines of succession.	Identify authorities and lines of succession in plan.
Determine essential positions for maintaining essential services.	Conduct review of all positions.	Identify essential employees and backups.
Determine current status of pandemic influenza in region on daily basis. Forecast worker absences. Track employees who have influenza and employees that have recovered.	Monitor public health information or establish public health contact. Monitor absences during pandemic. Keep records that track employees that have recovered from influenza.	Meet with public health officials. Monitor federal, state, and local pandemic information sites. Develop forms for tracking employees that have recovered from influenza.
Plan for sustaining essential functions, supplies, material, and equipment.	Identify and propose actions to protect and sustain essential functions, supplies, materials, equipment, and systems support.	Cross train employees. Retrain recently retired employees. Establish mutual aid agreements. Establish contracts for temporary workers. Determine trigger points for prioritizing and ensuring essential services.

		<p>Propose cost effective and efficient preparedness actions to stockpile essential supplies, material, and equipment.</p> <p>Propose cost effective and effective actions to sustain essential functions.</p>
Emergency communications.		<p>Establish or update emergency communication procedures and maintain equipment.</p>
Sustain essential workers.	<p>Assess needs and requirements to protect and sustain all employees.</p>	<p>Ensure medical resources for employees.</p> <p>Encourage annual influenza vaccinations for employees.</p> <p>Establish telecommuting and flexible work hour policies.</p> <p>Ensure IT is adequate for telecommuting.</p> <p>Establish hygiene control procedures and train employees.</p> <p>Screen employee health.</p> <p>Establish travel restriction and teleconferencing policies.</p> <p>Establish policies for sequestering critical staff.</p> <p>Store emergency kits at key locations.</p> <p>Practice social distancing (limit contacts with the public by ending tours, delay meter reading, etc.)</p>
Identify and assess worker's family care requirements.	<p>While respecting privacy protections, identify and assess issues for supporting worker family care.</p>	<p>Develop pandemic education information for worker families and disseminate.</p> <p>Assess the number of workers with school-age children or other dependents at home.</p> <p>Identify other special needs for family support.</p>

Identify sick leave and pay issues.	Employees may violate sick leave policy caring for family members, etc. Paychecks may be delayed. Shifts worked may exceed union or employer rules.	Develop human resource policies to address pandemic influenza issues: excessive sick leave, overtime, work rules, etc.
Identify, document, coordinate, and test “trigger points” and actions.	Assess and identify “triggering events” for each action, such as changes in WHO or U.S. government alert matrix.	Assess what triggers a change in the Federal, State, and local pandemic alert status. Establish authorities, triggers, and procedures for activating and terminating response and recovery plans. Keep records of actions & expenditures.
Assess and develop exercise and training programs.	Involve internal and external partners in training.	Conduct training at least annually. Provide ICS training for employees.
Finalize, implement, and review pandemic plan periodically.	Finalize and implement the pandemic plan in a practical and timely manner to ensure that the water system is fully prepared to respond and recover from a potentially severe pandemic.	Implement initial appropriate actions for the pandemic phase and external trigger point. Continuously monitor and assess implementation actions to ensure staying on target. Adjust plans as necessary. Review plans periodically, at least every 90 days initially and more frequently as the pandemic evolves.
Identify potential costs associated with pandemic influenza.	Evaluate budget impact of pandemic influenza.	Develop funding policies and budget for pandemic influenza planning and response.
Mutual aid.	Discuss mutual aid with neighboring utilities, American Water Works Association and regulators.	Develop mutual aid agreements.

## **Pandemic Influenza Continuity of Operations Plan for Water Systems Template**

A Pandemic Influenza Continuity of Operations Plan template for water systems is included in appendix D. The template was developed for this project based on existing plans and checklists from public health agencies, private industry, professional associations, government and water systems. The template was designed so that action items related to stages of pandemic influenza are in the beginning sections of the plan for efficient access. Background information such as preparedness, hygiene, communication, and educational materials, is in later sections or appendices.

The template can be used to develop a “stand alone” plan or it can be incorporated as an appendix in an existing “all hazards” emergency plan. Because water systems are unique and vary in size, the template is scalable and can be easily modified to fit local circumstances. The checklist for pandemic influenza planning in appendix E can be used to ensure that a system’s plan considers essential elements of preparedness, response, and recovery. This checklist includes essential information from various regulatory, water agency, and critical infrastructure documents.

## **VII. CONCLUSION**

Many of the larger water systems in Ohio that serve populations greater than 20,000 are preparing for the potential of an influenza pandemic. Twenty six percent of the Ohio water systems responding to the project survey indicated that they have developed a pandemic influenza preparedness plan. Eighty-eight percent of the surveyed water systems either have a plan, are working on a plan or intend to develop a plan.

A majority of the surveyed water systems (86%) were interested in obtaining training related to pandemic influenza preparedness and response. This training could be arranged by professional organizations such as the American Water Works Association in partnership with the Ohio or U.S. Environmental Protection Agencies. Training is essential to ensure proper response to man-made and natural disasters that could result in a significant disruption of service.

An informed public responds better in emergencies and is less likely to create social disruption. Water systems should ensure that the customers in their community receive emergency preparation information, especially regarding stockpiling water, food, and emergency supplies. This information could be delivered as a water bill insert or in the annual Consumer Confidence Report.

Ensuring that enough employees are available to perform essential services is seen as the most significant factor for maintaining continuity of operations. Cross training for essential positions, sequestering critical employees, vaccination and other personal protection measures can help maintain an adequate level of staffing. These measures represent multiple barriers to influenza caused disruptions which reflects the multi-barrier concept that water systems use to ensure safe drinking water.

Pandemic influenza plans for water systems could prove to be extremely valuable tools for ensuring that water systems are able to continue treating and pumping safe water in a sufficient quantity for drinking, sanitation, fire fighting, and commercial use during a pandemic. In the event of a pandemic, communities will struggle with maintaining healthcare systems, infrastructure, transportation systems, businesses, and the provision of services. A disruption in the supply of drinking water would be extremely disastrous for public health in a community already overwhelmed by pandemic influenza.

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## APPENDIX A: Wright State University Institutional Review Board Approval

### RESEARCH INVOLVING HUMAN SUBJECTS

SC# 3462

ACTION OF THE WRIGHT STATE UNIVERSITY  
SCREENING COMMITTEE  
Assurance Number: FWA00002427

Title: 'Pandemic Flu Response Planning for Water Utilities'

Principal Investigator: Philip Van Atta, PI, Student  
2445 Ravenwood Avenue  
Sara Paton, Ph.D., Faculty Advisor

The Institutional Review Board Screening Committee Coordinator has approved an exemption with regard to the use of human subjects on this proposed project.

REMINDER: Federal regulations require prompt reporting to the IRB of any changes in research activity [changes in approved research during the approval period may not be initiated without IRB review (submission of an amendment), except where necessary to eliminate apparent immediate hazards to subjects] and prompt reporting of any serious or on-going problems, including unanticipated adverse reactions to biologicals, drugs, radioisotope labeled drugs or medical devices.

NOTE: This approval has been assigned an "SC" number in our system, which means the WSU Screening Committee concurs that this protocol is exempt under federal regulations.

B. Levent Erol, Ph.D.  
Signed Chair, WSU-IRB  
Approval Date: August 13, 2007  
IRB Mtg. Date: September 17, 2007

## **APPENDIX B: Survey Cover Letter and Questionnaire**

September 28, 2007

Subject's Title  
Subjects Organization

Dear Sir or Madam:

My name is Phil Van Atta. I am conducting research to determine best practices for response and continuity of operations for water systems in the event of an influenza pandemic. I work for the City of Dayton Water Department and I am a student in the Master of Public Health (MPH) program at Wright State University.

A pandemic flu epidemic could cause widespread illness and fatalities, and create major disruptions to the global economy and the operations of critical infrastructure, including drinking water systems. I am conducting a survey of medium and large Ohio water utilities to determine the status of preparations for a potential influenza pandemic. This information will be used for background information for a MPH degree project.

You are invited to participate in this study. The questionnaire is expected to take less than one minute to complete. Your participation in this study is strictly voluntary and you may choose not to participate at any time without prejudice. There are no risks anticipated from participating in this study. Your participation in this study implies consent. Any information given will be reported in general terms related to the size of population served. The source of information provided will remain anonymous. Your water system will not be identified in the study.

It is requested that surveys be returned by October 19, 2007 in the postage paid envelope. You may request a copy of the findings by submitting a request to me at the address located below. It is anticipated that the report will be available after November 15, 2007.

If you have any general questions about giving consent or your rights as a research participant, in this research study, you can call the Wright State University Institutional Review Board at 775-4462. Thank you for your time and cooperation.

With regards,

Philip Van Atta  
Principal Investigator  
Wright State University - MPH  
3235 Southern Blvd.  
Kettering, Ohio 45429  
(937) 775- 5555

Sara Paton, Ph.D.  
Faculty Advisor  
Wright State University  
3235 Southern Blvd.  
Kettering, Ohio 45429  
(937) 775- 5555

### Water Utility Preparation for Pandemic Influenza Survey

I am conducting a survey of Ohio water utilities as part of a Master of Public Health degree project. This project will include a paper that describes research of "best practices" for water utility response, including continuity of operations, in the event flu pandemic. **This survey will take less than five minutes to complete.** Your participation in this survey is greatly appreciated. Please respond by October 19, 2007.

**The identity of survey respondents will remain confidential.**

#### Survey Questions

1. How many water customers are served by your utility?

≥200,000 \_\_\_\_\_

100,000 – 199,999 \_\_\_\_\_

50,000 – 99,999 \_\_\_\_\_

20,000 – 49,999 \_\_\_\_\_

2. Is your water utility:

Publicly owned and operated? \_\_\_\_\_

Publicly owned and privately operated? \_\_\_\_\_

Privately owned and operated? \_\_\_\_\_

Other (please describe) \_\_\_\_\_

3. Number of employees in your water utility? \_\_\_\_\_

4. Does your utility have a Pandemic Influenza Plan? Yes  No

5. What is the status of your utility's preparation for Pandemic Influenza?

A Pandemic Flu Plan has been completed \_\_\_\_\_

Currently working on a Pandemic Flu Plan \_\_\_\_\_

Intend to develop a Pandemic Flu Plan \_\_\_\_\_

Pandemic Flu planning is part of the utility's Emergency Response Plan \_\_\_\_\_

Other (please describe) \_\_\_\_\_

6. Have your employees participated in training that is related to Pandemic Flu planning and response?

Yes \_\_\_\_\_  No \_\_\_\_\_

7. Would you or your employees be interested in participating in training that is related to Pandemic Flu planning and response?

Yes \_\_\_\_\_  No \_\_\_\_\_

8. Comments (optional):

## APPENDIX C: Public Health Competencies Achieved During Project

(Source: Competencies Project, Council on Linkages, April, 2001)

<b>Domain 1: Analytic Assessment</b>	
Specific Competencies	Description of Completion
1. Defines a problem	<b>Water systems don't have a template to facilitate development of pandemic influenza plan.</b>
2. Identifies relevant and appropriate data and information sources.	<b>Literature search included recognized authorities for pandemic preparedness; WHO, CDC, FEMA, U.S. Dept. of Homeland Security, state and local health agencies. Also researched and spoke to recognized experts for water system preparedness; EPA, AWWA, AMWA, and emergency preparedness coordinators.</b>
3. Identify gaps in data sources.	<b>Discovered that public health agencies have scant information about disruptions to water or other utilities in their emergency plans.</b>
4. Apply ethical principles to the collection, etc. of data and information.	<b>Confidentiality was maintained for all sources of survey data.</b>
5. Obtains and interprets information regarding risks and benefits to the community.	<b>Project discussed how pandemic influenza planning and preparedness by water systems would benefit communities.</b>

<b>Domain 2: Policy Development/Program Planning Skills</b>	
Specific Competencies	Description of Completion
6. Collects, summarizes, and interprets information relevant to an issue.	<b>A survey was used to collect information from Ohio water systems to determine the status of preparedness for pandemic influenza.</b>
7. Prepares and implements emergency response plans.	<b>This project resulted in a template pandemic influenza plan and a plan for the City of Dayton Water Department.</b>
8. Develops mechanisms to monitor and evaluate programs for their effectiveness and quality.	<b>Best practices were developed to allow evaluations of pandemic influenza planning for water systems.</b>
9. Solicits input from individuals and organizations.	<b>Phone discussions and email communications were conducted with emergency preparedness coordinators, public health officials, regulators, water associations, and water system managers for this project.</b>

<b>Domain 3: Communication</b>	
Specific Competencies	Description of Completion
10. Presents information accurately	<b>Sources of pandemic influenza information were the World Health Organization and the Centers for Disease Control and Prevention.</b>
<b>Domain 5: Community Dimensions</b>	
Specific Competencies	Description of Completion
11. Establishes and maintains linkages with key stakeholders.	<b>Initiated partnership with local public health and regulatory officials for pandemic preparedness.</b>
<b>Domain 6: Basic Public Health Sciences</b>	
Specific Competencies	Description of Completion
12. Applies basic environmental health principals	<b>Describes the relationship between drinking water, sanitation, and community health.</b>
13. Identifies and retrieves current relevant scientific evidence.	<b>Retrieved current scientific papers describing pandemic influenza viruses and control of pandemics. Also, retrieved papers discussing the risk of influenza viruses to drinking water sources.</b>
<b>Domain 8: Leadership and Systems Thinking</b>	
Specific Competencies	Description of Completion
14. Identifies internal and external issues that may impact delivery of essential public health services.	<b>Notes that disruptions of water systems caused by pandemics could affect community health and overwhelm public health services. Also, notes that loss of water in public health facilities would impact delivery of public health services.</b>
15. Facilitates collaboration of internal and external groups to ensure participation of key stakeholders.	<b>Project initiated contacts with local public health and regulatory officials for participation in future training and continued communication between stakeholders.</b>
16. Promotes team and organizational learning.	<b>Manuscript and template plan describe the importance of team training and ongoing education for water system employees.</b>
17. Contributes to development, implementation, and monitoring of organizational performance standards.	<b>Best practices and a checklist were developed to monitor progress towards pandemic influenza preparedness.</b>

## **APPENDIX D: Water System Pandemic Influenza COOP Plan Template**

The following template provides a structure for formulating a Pandemic Influenza Continuity of Operations (COOP) Plan based on guidelines from the Federal Emergency Management Agency and information from other sources. Sources of pandemic influenza information include the Centers for Disease Control and Prevention (CDC), U.S. government pandemic influenza planning documents, including the [pandemicflu.gov](http://pandemicflu.gov) website, and the World Health Organization.

The template can be used to develop a “stand alone” plan or it can be incorporated as an appendix in an existing “all hazards” emergency plan. Some existing water system plans can be used as sources of information for the pandemic influenza plan, e.g. “Strike Plans” could be used to prepare for employee shortages. Water utilities can modify the pandemic influenza template to meet their own needs and requirements. Divisions, bureaus, laboratories, etc. within water utilities should develop specific actions relevant to their unique activities. These action plans could be attached as annexes to an overall Pandemic Influenza COOP.

# INFLUENZA PANDEMIC CONTINUITY OF OPERATIONS PLAN

*Template*

(Date)

City of \_\_\_\_\_ Water Department

(LOGO HERE)

**FOR OFFICIAL USE ONLY**

**CONFIDENTIAL**

***DO NOT DUPLICATE***

The City of \_\_\_\_\_ uses “For Official Use Only” for sensitive information.

## **FOREWORD**

The City of \_\_\_\_\_ Water Department has operations that must be performed, or rapidly and efficiently resumed, in an emergency. While the impact of an emergency cannot be predicted, planning for operations under such conditions can mitigate the impact of the emergency on our people, our facilities and our mission.

This continuity of operations plan (COOP) is designed to ensure that essential operations can be performed during an influenza pandemic. These operations are the foundation upon which the COOP is built. Continuity of Operations Plans for man-made or natural disasters are important resources in providing essential services to our customers during an emergency. Utilities can develop continuity of operations plans for all-hazards or for specific situations, e.g. "Strike Plans".

This template provides a structure for formulating a Pandemic Influenza Continuity of Operations (COOP) Plan based on guidelines from the Federal Emergency Management Agency and information from other sources. Sources of pandemic influenza information include the Centers for Disease Control and Prevention (CDC), U.S. government pandemic influenza planning documents, including the pandemicflu.gov website, and the World Health Organization.

Water utilities are encouraged to modify this template to meet their own needs and requirements. Divisions, bureaus, laboratories, etc. within water utilities should develop specific actions relevant to their unique activities. These action plans could be attached as annexes to the overall Pandemic Influenza COOP.

**Necessary actions to take during different stages of pandemic influenza are located in Section 3.0 of the plan. Later sections of the plan provide details and background information.**

This plan will be updated periodically as required to incorporate new directives/strategies, new information technology, legislative changes, and procedural changes based on lessons learned and best practices identified during exercises and actual events. A full review, update, and approval of the plan will be conducted annually. Revised plans will be distributed to the appropriate individuals.

**Instructions and a template for developing general continuity of operations plans can be downloaded at the Federal Emergency Management Agency (FEMA) website at: <http://www.fema.gov/government/coop/index.shtm>**

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Appendix A	Pandemic Influenza Planning Checklist
Appendix B	Essential Functions and Resources
Appendix C	Essential Personnel List & Qualifications
Appendix D	Inventory of supplies
Appendix E	Training plan
Appendix F	Educational materials

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## 1.0 INTRODUCTION

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Flu pandemics occurred in 1918, 1957 and 1968. Public health and medical experts at the World Health Organization (WHO) and elsewhere believe that another pandemic could occur at any time. Pandemics occur when an influenza virus with severe health effects undergoes genetic shift and human to human transmission occurs readily. There is concern among public health officials that the avian influenza virus H5N1 could undergo genetic changes and cause a pandemic.

Avian influenza viruses can spread between wild birds and domestic birds. Migratory waterfowl can infect other birds directly or through fecal contamination of water used by domestic birds. Currently, human avian influenza H5N1 cases are associated with close contact with contaminated chickens and other poultry. There is some evidence indicating that limited, non-sustained human-human transmission of H5N1 may have occurred. If H5N1 undergoes genetic shift and becomes easily transmissible between humans, pandemic influenza could spread rapidly. Because of increased global commerce and international travel, diseases can now spread rapidly throughout the world which would likely make a pandemic in the 21<sup>st</sup> century much more deadly than in the past.

Avian Influenza virus H5N1 has a high mortality rate. High mortality rates and rapid human to human transmission differentiate pandemic influenza from “normal” seasonal influenza. As of January 3, 2008 there were 348 human cases of H5N1 influenza world wide with a death rate of 62%. These cases were mostly confined to Asia with other cases in the Middle East and Africa. Public health officials track these H5N1 cases in addition to tracking of “normal” seasonal influenza cases.

A Center for Disease Control and Prevention (CDC) study of disease rates for a new pandemic estimated that in the United States, 40 – 100 million people could be sickened. The CDC study provided a “most likely estimate” death toll of 89,000 – 300,000, with “best case” to “worst case” death toll range of 75,000 – 422,000.

It is considered unlikely that properly treated drinking water can serve as a mode of transmission for the H5N1 virus. However, a pandemic caused by an influenza virus could cause serious disruptions to the operations of drinking water systems. These disruptions could be caused by staffing shortages, power disruptions, and shortages of chemicals and other supplies. Protecting employee health is vital for continuing operations, especially if another emergency, e.g. flooding, occurs during an influenza pandemic. Ensuring continuity of operations for drinking water systems is crucial to protect public health and safety, and to the economy of all communities.

Plans for maintaining essential functions and services in a pandemic influenza must emphasize and implement procedures such as social distancing techniques, infection control and personal hygiene, cross-training, and telecommuting. Protecting the health and safety of employees must be a major focus of planning in order to ensure the continuity of essential functions. Vaccines and antiviral medications will be important tools for reducing the impact of influenza pandemics. However, a virus specific vaccine might not be available in sufficient supply until more than 6 months after a pandemic begins.

## 1.1 Definitions (from [www.pandemicflu.gov](http://www.pandemicflu.gov))

**Avian (or bird) flu** is caused by influenza viruses that occur naturally among wild birds. The H5N1 avian flu virus is deadly to domestic fowl and can be transmitted from birds to humans. There is no human immunity and no vaccine is available.

**Pandemic influenza** is virulent human flu that causes a global outbreak, or pandemic, of serious illness. Because there is little natural immunity, the disease can spread easily from person to person. **Currently, there is no pandemic flu.**

**Seasonal (or common) flu** is a respiratory illness that can be transmitted from person to person. Most people have some immunity, and a vaccine is available.

**Social Distancing** are measures to increase the space between people and decrease the frequency of contact among people.

**Teleworking (or Telecommuting)** is working from home or an alternate site and avoiding commuting to the workplace through telecommunication (computer access).

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## 2.0 PURPOSE

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The purpose of this plan is to provide information and action steps for preparation, response, and recovery in the event of pandemic influenza. This plan should be used in conjunction with existing emergency plans.

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## 3.0 PANDEMIC ALERT LEVELS AND ACTIONS

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### 3.1 Pandemic Phases, Stages, and Water System Alert Levels

The (insert utility name) will implement its Pandemic Influenza COOP in response to changes or “triggers” in the Federal Government (U.S.) Response Stages. Preparation and actions are listed in Section 3.2 of this plan. Notification of various stages and actions will follow the normal chain of command. Managers and supervisors will be responsible for implementation following the normal chain of command. Details of preparations and response actions are listed in later sections of this plan.

As of January 3, 2008 the World Health Organization list the current global pandemic status as Phase 3 which corresponds with “No or very limited human-to-human transmission”. The U.S. government classifies the current pandemic status as Stage 0 which relates to “New domestic animal outbreak in at risk country”. It is currently believed that limited human to human transmission of H5N1 influenza may have occurred in Asia. Table 1 shows the relationship between Federal Government Stages, World Health Organization Phases, and suggested alert levels for water systems.

**Table 1 – Relation between Water System “Alert Levels” and Pandemic Stages/Phases**

WHO Phase 1 or 2: Inter-Pandemic Period	WHO Phase 3 Pandemic Alert Period	WHO Phase 4 or 5 Pandemic Alert Period	WHO Phase 6 Pandemic Period			
U.S. Stage 0	U.S. Stage 1	U.S. Stage 2	U.S. Stage 3	U.S. Stage 4	U.S. Stage 5	U.S. Stage 6
New Domestic Animal Outbreak in At-Risk Country	Suspected Human Outbreak Overseas	Confirmed Human Outbreak Overseas	Widespread Human Outbreaks in Multiple Locations Overseas	First Human Case in North America	Spread throughout United States	Recovery and Preparation for Subsequent Pandemic Waves
Water System Planning Stage	Water System Pre-Pandemic Alert Level A		Water System Pandemic Alert Level B		Water System Pandemic Alert Level C	Water System Preparation for Next Pandemic Wave Alert Level D

Note: The relationship between WHO Phases 1 - 3 and U.S. Stages 0 - 2 is approximate. WHO Phase 3 begins while U.S. Stage 0, “New domestic animal outbreaks in at-risk country” is still in effect.

### 3.2 Pandemic Planning

Table 2, “Pandemic Planning and Preparation”, indicates suggested actions for water systems to undertake in preparation for pandemic influenza. Tables 3, 4, 5 and 6 in section 3.3 list actions for water systems to undertake in response to various pandemic stages.

Table 2 – Pandemic Planning and Preparation

Pandemic Planning and Preparation (New domestic animal outbreak in at-risk country)		
Responsible Person or Team	Water System Action	Completed
	Identify critical functions that must be kept in operation.	
	Identify critical supplies, e.g. chlorine, necessary to maintain safe water.	
	Identify essential personnel.	
	Identify cross training needs and conduct cross training.	
	Develop pandemic influenza plan.	
	Participate in pandemic influenza planning and exercises with local public health and regulatory officials.	
	Consider developing mutual aid agreements.	
	Update Standard Operating Procedures for plant operations and other essential functions.	
	Define roles and responsibilities for all personnel during a pandemic.	
	Educate all employees regarding pandemic policy (changes in work rules, etc.), infection control measures (hygiene measures, use of N-95 masks, etc) and flu symptoms.	
	Plan for supply disruptions: Develop alternate treatment chemicals, supplies, and power.	
	Acquire supplies for sanitizing and personal protection: sanitizing stations, sanitizing agents, latex/vinyl gloves, and N-95 masks.	
	Develop emergency supply kits (food, water, PPE) to critical facilities.	
	Ensure IT system is capable for telecommuting and provide secure access to appropriate employees.	
	Establish necessary pandemic policies: Emergency communications, travel, social distancing, telecommuting, sequestering critical staff on-site, screening employees for influenza, sick leave (for sending employees home that have exceeded sick leave limits or have no accrued sick leave).	
	Encourage employees to receive annual influenza vaccinations and to stay home when they have influenza.	
	Set up pandemic influenza surveillance notification system with local public health officials.	
	Reserve funds for emergency purchases at increased costs.	
	Encourage employees and public to develop home emergency kits (food, water, etc.) and plans.	

### 3.3 TRIGGERS – Water System Actions in Response to Pandemic Stages

Table 3 – Alert Level A – Pre-Pandemic Actions

Alert Level A – Pre-Pandemic Preparation (Suspected human outbreaks overseas – Confirmed human outbreaks overseas)		
Responsible Person or Team	Actions	Completed
	Remind employees regarding pandemic policy (changes in work rules, etc.) and infection control measures (hygiene measures, use of N-95 masks, etc) and flu symptoms.	
	Review preparations for supply disruptions and staffing shortages (cross training and alternate treatment chemicals, suppliers, and backup power systems.	
	Set up sanitizing stations and provide work areas with sanitizing agents, latex/vinyl gloves, and N-95 masks.	
	Distribute emergency supply kits (food, water, personal protection equipment) to critical facilities.	
	Establish or finalize necessary pandemic policies: Emergency communications, travel, social distancing, telecommuting, sequestering critical staff on-site, screening employees for influenza, sick leave (for sending employees home that have exceeded sick leave limits or have no accrued sick leave).	
	Encourage employees to receive annual influenza vaccinations and to stay home when they have influenza.	
	Monitor pandemic status through pandemicflu.gov and local public health.	
	Maintain contact with critical supply vendors, e.g. chlorine, electric, gas, to determine their ability to deliver supplies.	
	Suspend travel outside state when human outbreaks are confirmed.	

Table 4 – Alert Level B – Pandemic Actions

<p style="text-align: center;"><b>Alert Level B – Pandemic</b>  <b>(Widespread human outbreaks in multiple locations overseas</b>  <b>– First human cases in North America)</b></p>		
Responsible Person or Team	Actions	Completed
	Communicate pandemic status, and provide infection control and symptoms of flu refresher training to all employees.	
	Remind all employees to stay home when they have influenza.	
	Implement influenza screening (based on symptoms) of employees.	
	Suspend all travel.	
	Focus on conducting essential functions only.	
	Prepare to implement necessary pandemic policies for social distancing, telecommuting, sequestering critical staff on-site, screening employees for influenza, sick leave (for sending employees home that have exceeded sick leave limits or have no accrued sick leave).	
	Maintain contact with critical supply vendors, e.g. chlorine, electric, gas, to determine their ability to deliver supplies.	
	Prevent access to facilities by non-employees unless necessary.	
	Prepare for use of cross trained employees.	
	Review line of succession plans and update as necessary.	
	Continue to monitor pandemic status through pandemicflu.gov and local public health.	
	Provide supplies at facilities for sequestering essential staff.	
	Document actions and additional expenses.	

Table 5 – Alert Level C – Pandemic Actions

Alert Level C – Pandemic (Spread throughout North America)		
Responsible Person or Team	Actions	Completed
	Communicate pandemic status to all employees.	
	Focus on conducting essential functions only.	
	Remind all employees to stay home when they have influenza.	
	Continue influenza screening (based on symptoms) of employees.	
	Consider modifications of treatment to conserve chemicals and energy.	
	Reassign staff to insufficiently staffed facilities.	
	Consider sequestering essential personnel at facilities.	
	Provide daily absentee reports to Manager.	
	Suspend all travel.	
	Eliminate all non-essential face to face meetings.	
	Provide transportation to employees as necessary.	
	Maintain contact with critical supply vendors, e.g. chlorine, electric, gas, to determine their ability to deliver supplies.	
	Continue to monitor pandemic status through pandemicflu.gov and local public health.	
	Document actions and additional expenses.	
	Keep records of employees that have recovered from influenza. They will be vital for maintaining operations because of their acquired immunity.	

Table 6 – Alert Level D – Pandemic Recovery and Preparation Actions

Alert Level D – Pandemic Recovery and Preparation (Preparation for Subsequent Pandemic Waves)		
Responsible Person or Team	Actions	Completed
	Continue essential functions and evaluate reinstating non-essential activities.	
	Communicate pandemic status to all employees.	
	Stockpile essential supplies.	
	Allow necessary travel on a case by case basis.	
	Maintain contact with critical supply vendors, e.g. chlorine, electric, gas, to determine their ability to deliver supplies.	
	Restock supplies at facilities for sequestering essential staff.	
	Evaluate response and update plans.	
	Continue to monitor pandemic status through pandemicflu.gov and local public health.	
	Document actions and additional expenses.	
	Remind all employees to stay home when they have influenza.	
	Keep records of employees that have recovered from influenza. They will be vital for maintaining operations because of their acquired immunity.	

---

## 4.0 PANDEMIC PLANNING ASSUMPTIONS

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These assumptions are adopted from the National Strategy for Pandemic Influenza Implementation Plan and Business Continuity Planning Assumptions for Influenza Pandemics from the North American Electric Reliability Council.

### 4.1 GENERAL ASSUMPTIONS

1. An influenza pandemic will occur in the future but timing of the outbreak is uncertain.
2. Susceptibility to the pandemic influenza virus will be universal.
3. Efficient and sustained person-to-person transmission signals an imminent pandemic.
4. The clinical disease attack rate will likely be 30 percent or higher in the overall population during the pandemic. Illness rates will be highest among school-aged children (about 40 percent) and decline with age. Among working adults, an average of 20 percent will become ill during a community outbreak. Some persons will become infected but not develop clinically significant symptoms. Asymptomatic or minimally symptomatic individuals can transmit infection and develop immunity to subsequent infection.
5. Of those who become ill with influenza, 50 percent will seek outpatient medical care. With the availability of effective antiviral drugs for treatment, this proportion may be higher in the next pandemic.
6. The number of hospitalizations and deaths will depend on the virulence of the pandemic virus. Estimates differ about 10-fold between more and less severe scenarios. Two scenarios are presented based on extrapolation of past pandemic experience (Table 7). Planning should include the more severe scenario. Risk groups for severe and fatal infection cannot be predicted with certainty but are likely to include infants, the elderly, pregnant women, and persons with chronic medical conditions.

7. Rates of absenteeism will depend on the severity of the pandemic. In a severe pandemic, absenteeism attributable to illness, the need to care for ill family members, and fear of infection may reach 40 percent during the peak weeks of a community outbreak, with lower rates of absenteeism during the weeks before and after the peak. Certain public health measures (closing schools, quarantining household contacts of infected individuals, “snow days”) are likely to increase rates of absenteeism.
8. The typical incubation period (interval between infection and onset of symptoms) for influenza is approximately two days.
9. Persons who become ill may shed virus and can transmit infection for up to one day before the onset of symptoms. Viral shedding and the risk of transmission will be greatest during the first two days of illness. Children usually shed the greatest amount of virus and therefore are likely to pose the greatest risk for transmission.
10. On average, infected persons will transmit infection to approximately two other people.
11. A pandemic outbreak in any given community will last about six to eight weeks for each wave of the pandemic.
12. Multiple waves (periods during which community outbreaks occur across the country) of illness could occur with each wave lasting two-three months. Historically, the largest waves have occurred in the fall and winter, but the seasonality of a pandemic cannot be predicted with certainty.
13. The stages of the pandemic should occur sequentially, though they may overlap or occur so rapidly as to appear to be occurring simultaneously or being skipped. For example, the pandemic could spread so rapidly that Federal Government Response Stages 3 and 4 may be activated simultaneously or the status could change directly from Stage 3 to 5.

Table 7: Number of Episodes of Illness, Healthcare Utilization, and Death Associated with Moderate and Severe Pandemic Influenza Scenarios in the United States\*

Characteristic	Moderate Pandemic (similar to 1957, 1968)	Severe Pandemic (similar to 1918)
<b>Illness</b>	90 million (30%)	90 million (30%)
<b>Outpatient Medical Care</b>	45 million (50%)	45 million (50%)
<b>Hospitalization</b>	865,000	9,900,000
<b>ICU Care</b>	128,750	1,485,000
<b>Mechanical Ventilation</b>	64,875	745,500
<b>Deaths</b>	209,000	1,903,000

\*Estimates based on extrapolation from past pandemics in the United States. Note that these estimates do not include the potential impact of interventions not available during the 20th century pandemics.

#### 4.2 (Insert Water Utility Name) ASSUMPTIONS

(Sample text)

1. Source water pumping, complete water treatment, treated water pumping and (other critical functions) will remain operational during a pandemic influenza outbreak.
2. Alternate facilities may be activated for use during a pandemic to separate staff, i.e. implement social distancing protocols. A pandemic influenza event does not necessarily require the use of alternate facilities.
3. Essential functions, operations and support requirements will continue to be people-dependent. Social distancing, hygiene, health screening and other measures may need to be implemented to protect the utility's work force.
4. Disruptions of power and supplies, transportation restrictions, and staffing reductions could affect the performance of essential functions.
5. Water utilities must be prepared to rely on their own resources. The widespread effects of pandemic influenza would impact mutual aid from other utilities.

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#### 5.0 PANDEMIC RESPONSE TEAM AND COORDINATOR

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**(Water utility name)** has designated **(insert name or position)** as the Pandemic Coordinator. The **(insert utility name and position)** shall serve as the Alternate Pandemic Coordinator. **(Insert name or position)** will establish a Pandemic Response Team (PRT) to anticipate the impacts of a pandemic on **(utility name)** and to assist with developing strategies to manage the effects of a pandemic outbreak. Each Division (or bureau or other category) shall establish and designate a representative to the PRT.

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## 6.0 ESSENTIAL OPERATIONS

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### 6.1 Essential Functions

Table 8 is an example list of essential functions with associated employees. In order to minimize the effects of a pandemic on staff and essential functions, (insert utility name) will emphasize and implement procedures such as social distancing techniques, infection control and personal hygiene, and cross-training. (Primary employees (currently perform these functions) and backup employees (cross trained, recently retired, etc.) should be determined as part of pandemic planning.)

Table 8: Example - Essential Functions and Supporting Information

Priority	Essential Function	Primary Employees	Backup Employees
1	Water Treatment		
2	Pumping		
2	Water Treatment and Pumping Equipment Repair		
3	Distribution System Water Testing		
4	Equipment Maintenance		

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## 7.0 CRITICAL POSITIONS AND MINIMUM STAFFING LEVELS

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### 7.1 Identification of Essential Positions and Skills

The (insert utility name) shall identify positions, skills, and personnel needed to continue essential functions and services. Back-up personnel will also be identified and cross-trained. (The utility may decide to attach “Essential Personnel” stickers on the back of ID badges for security and screening of non-essential personnel.)

Annex (insert if applicable) of the (insert utility name) COOP Plan identifies those personnel needed to support continuity of operations in all-hazards scenarios.

Table 9: Example - Employees with Essential Positions and Skills

Position (Back-up position)	Employee	Skills	Certifications/ Qualifications
Water Plant Operator (Maintenance)		Water Treatment Laboratory Plumbing	Water Operator III Water Analyst I Pump Repair License
Laboratory Analyst (Water Plant Operator)		Can repair anything	Water Operator III Water Analyst III

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## 8.0 CROSS TRAINING AND ALTERNATE WORK ARRANGEMENTS

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### 8.1 Cross Training

Employees will be cross-trained in advance of pandemics so that back-up workers are available for essential functions. Employees in non-essential and essential positions will be trained to perform essential tasks that are not part of their job description. Discussions should be held with unions and human resource departments to prepare for these situations. Table 9 provides a list of primary and backup employees.

### 8.2 Alternate Work Schedules

Regular work schedules may be modified in the event of a pandemic. Departments should review normal work schedules and determine how they can be modified to promote social distancing and continuity of operations. During pandemics, overtime is probable but meal and rest periods will still be required. Notification periods in collective bargaining agreements may be suspended.

### 8.3 Telework Policy

Telework, aka Telecommuting can be an integral part of plans and procedures to maintain essential functions and services in an influenza pandemic. **(insert utility name)** shall analyze its current IT capability for teleworking and identify which personnel can perform essential functions by teleworking during a pandemic. **(insert name or position)** shall develop and evaluate telework plans, procedures, and capabilities through reviews, testing, post-incident reports, lessons learned, performance evaluations, and exercises. Procedures shall be established to ensure that corrective action is taken on any deficiency identified in the evaluation process.

(List pre-identified tasks and/or jobs) can be done remotely during a pandemic. **(If applicable state, “Employees in these positions and their alternates have been enabled with the appropriate security to access electronic networks and work from home.”) (If applicable, insert, attach or reference Telework Plan here.)**

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## 9.0 EMPLOYEE HEALTH PROTECTION

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### 9.1 Vaccinations and Antiviral Medications

Employees should be encouraged to receive annual seasonal vaccinations. These vaccinations could protect the health of their work force before a pandemic. Establishing a relationship in advance with local public health officials could facilitate the distribution of anti-virals and vaccines to water system personnel. Prioritization of vaccination and antivirals distribution follows guidance from the U.S. Department of Health and Human Services Pandemic Influenza Plan. In accordance with guidance from the Public utility personnel are in Tier 2, subtier B for vaccinations and Tier 8 for antivirals distribution

Antivirals must be taken within 48 hours of symptoms to be effective (CDC). The current potential pandemic virus, H5N1 is resistant to amantadine and rimantadine, but oseltamavir and zanamavir would probably be effective (pandemicflu.gov).

## 9.2 Personal Protective Equipment and Supplies to Stockpile

Advance training and “just-in-time” training should be provided to employees regarding infection control measures. The following infection control supplies should be provided or made available at all times to employees:

- Soap and paper towels within washrooms
- Soap and paper towels within kitchen areas
- Hand sanitizer stations at various work areas
- Tissues
- Disinfectant spray for surfaces
- Extra trash cans and garbage bags for tissue disposal
- Personal Protective Equipment: Vinyl/latex gloves, N95 masks

## 9.3 Basic Hygiene

Employees shall be educated and reminded of hygiene measures to prevent the spread of disease:

- Cover coughs and sneeze with a tissue (or into shirt sleeve if necessary).
- During pandemics: Avoid hand shaking (use alternatives like nodding, elbow bumping, etc.).
- Keep work area and home clean and disinfected.
- Stay home when ill.
- Wash hands often, especially before eating (or touching near mouth, nose or eyes).
- Wash hands before and after smoking.
- Hand sanitizers are only effective if hands are not soiled.

## 9.4 Disinfection

During a pandemic workplace cleaning measures will be required on a daily basis to minimize transmission of influenza virus through hard surfaces (counters, door knobs, etc.). Thorough cleaning should be performed before disinfection, especially for the work areas of an ill employee. Disinfectants that can inactivate viruses should be used. Influenza viruses may live up to two days on surfaces. Employees should wear a mask and gloves when cleaning and disinfecting. The gloves and masks should be discarded afterwards. Hands must be washed and sanitized after the procedure.

## 9.5 Travel Restrictions and Social Distancing

**Social Distancing** are measures to increase the space between people and decrease the frequency of contact among people. Travel will be restricted or eliminated according to plans for alert levels A, B, and C.

Alert Level A (confirmed human cases overseas) – **Travel is restricted to in-state only.**

Alert Level B and C (widespread human outbreaks in multiple locations overseas - first human cases in North America) – **All travel is suspended.**

Alert Level D (preparation for next pandemic wave) – **Necessary travel evaluated on case by case basis.**

## 9.6 Employee Influenza Screening

Supervisors may rely on observations of employee symptoms to determine if an employee has influenza. These symptoms include:

- Fever
- Cough
- Sore throat
- Muscle aches
- Eye infections (conjunctivitis)
- Pneumonia
- Acute respiratory distress

## 9.7 Ill Employees

Employees with influenza symptoms should be isolated and sent home as soon as possible to prevent the spread of influenza. When the employee's condition improves to the point where the employee no longer poses a health hazard to fellow employees, the employee shall contact his or her supervisor and arrange for the employee's return to work.

Treatment of employees with influenza will be problematic because the health care system will be overwhelmed by a pandemic. Records should be kept of employees who have recovered from pandemic influenza. These employees will be vital for operations because of their acquired immunity.

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## 10.0 CHAIN OF SUPPLY

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### 10.1 Essential Contract and Support Services and Other Interdependencies

#### To prepare for pandemic influenza:

Existing inventory will be supplemented to keep essential services functioning for 7 days or more. Vendors of critical products and services shall be identified. Discussions with vendors shall include vendor plans for ongoing services and/or shipments in the event of absences, shortages, or disruptions in transportation systems. (insert utility name) shall initiate pre-solicited, signed and standing agreements with contractors and other third parties to ensure fulfillment of supply and service requirements.

(Insert utility name) shall develop relationships with more than one supplier should a primary contractor be unable to provide the required service. Table 10 is a sample chart used to depict the Contractual Staff and other interdependencies necessary to perform essential functions.

Table 10: Example - Essential Contractual Arrangement and Interdependencies

<b>Essential Supply or Service</b>	<b>Primary Contractor And Contact Info.</b>	<b>Back-up Contractor And Contact Info.</b>
Chlorine		
Water Main Repair		

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## 11.0 HUMAN RESOURCES & UNION CONTRACT ISSUES

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Discussions should be held with unions and human resource departments to prepare for alternate work arrangements that may be implemented during pandemics.

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## 12.0 COMMUNICATION PLAN

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### Communications Plan

(insert utility name) shall develop a Communications Plan and mechanisms to provide relevant information to internal and external stakeholders, including but not limited to instructions for determining the status of agency operations and possible changes in working conditions and operational hours.

(Insert plan or refer to location of existing Communications Plan)

According to the National Strategy for Pandemic Influenza Implementation Guidance, workplace risk can be minimized through implementation of systems and technologies that facilitate communication without person-to-person contact.

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## 13.0 DELEGATION OF AUTHORITY & NIMS

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At the height of a pandemic wave, absenteeism may reach a peak of 40 percent. As such, delegations of authority are critical. **(insert utility name)** shall plan for delegations of authority that are at least three deep per responsibility to help assure continuity of operations over an extended time period, i.e., 30-60-90 days.

All employees should receive National Incident Management System training. Supervisors and managers should be certified at IC 300 and 400 levels.

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## 14.0 INDIVIDUAL AND FAMILY PANDEMIC PREPARATION

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Essential personnel should have family care succession plans in place to ensure that they can report to work if schools are closed, family members are ill, etc. All employees should receive educational materials that describe pandemic influenza protection measures for families. These materials are in Appendix F of this plan.

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## 15.0 PANDEMIC PREPARATION TRAINING

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### 15.1 Testing, Training, Exercises

Testing, training, and exercising are essential to assessing, demonstrating, and improving the ability of organizations to maintain their essential functions and services.

### 15.2 Social Distancing

**(insert utility name)** shall conduct annual tests, training, and exercises to ensure sustainable social distancing techniques, including telecommuting capabilities, and to assess the impacts of reduced staff on the performance of essential functions.

### 15.3 Tabletop, Functional, and Full-Scale Exercises

**(insert utility name)** shall conduct annual pandemic exercises (tabletop, functional, or full scale) to examine the impacts of pandemic influenza on essential functions, to familiarize personnel with their responsibilities, and to validate the effectiveness of pandemic influenza COOP planning by senior leadership.

(Attach Testing, Training and Exercise Plan in appendix.)

### 15.4 Annual Awareness Training

**(insert utility name)** shall conduct annual awareness briefings specific to pandemic influenza.

### 15.5 Cross-Training Successors and Back-up Personnel

**(insert utility name)** shall identify and train back-up personnel, by position, needed to perform essential functions.

## APPENDICES

(Note: Utilities can use manuscript Appendix E for the “Template Appendix A”. Spreadsheets or tables with utility specific information should be developed and used for Appendices B, C, D, and E. Materials for “Template Appendix F can be obtained from public health agencies or public health web sites.)

***Template APPENDIX A - Water Utility Pandemic Influenza Planning Checklist***  
(In Appendix E of manuscript.)

***Template APPENDIX B – Essential Functions and Resources*** (Personnel, equipment, supplies, power, and other requirements, e.g. Supervisory Control and Data Acquisition Systems.)

***Template APPENDIX C – Essential Personnel List*** (With qualifications, skills, certifications, etc.)

***Template APPENDIX D – Inventory of Supplies*** (Utility specific information)

***Template APPENDIX E – Testing, Training, and Exercise Plan*** (Utility specific information)

***Template APPENDIX F – Educational Materials*** (Obtain from Local Public Health Agency)

Frequently asked questions about pandemic influenza  
Employee and family pandemic influenza protection measures.

## APPENDIX E: Pandemic Influenza Planning Checklist

### Water Utility Pandemic Influenza Planning Checklist

The following checklist is a modified version of a pandemic flu checklists developed by the United States Department of Health and Human Services and Centers for Disease Control and Prevention. It identifies specific activities that water utilities can take to prepare for a pandemic flu event. This checklist can be modified to cover unique circumstances relating to your utility. Some items on the checklist may be covered by existing all-hazards, emergency response plans.

Pandemic Response Coordinator: \_\_\_\_\_ Date: \_\_\_\_\_

<b>1.1 Plan for the impact of a pandemic on your water utility:</b>			
<b>Completed</b>	<b>In Progress</b>	<b>Not Started</b>	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Identify a pandemic coordinator and/or team with defined roles and responsibilities for preparedness and response planning. Include input from all management levels and staff that are involved in day-to-day operations.
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Identify critical functions that must be maintained, e.g. disinfection.
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Identify essential personnel functions and critical inputs needed to maintain operations, including locations where they may be needed during a pandemic. Ensure there is redundancy in terms of personnel (cross-training), materials (chemical suppliers, equipment suppliers, etc.), communication (phones, radios, etc.), information technology, and power (electric, gas). Establish contingency agreements with other utilities (gas, electric) where feasible.
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Identify key customers and customers with special needs, such as hospitals and nursing homes, and ensure services can be provided.
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Cross train employees to provide backups for critical positions. Train and prepare an ancillary workforce (e.g. contractors and retirees). Develop mutual aid contacts through with other utilities through a Water Agency Response Network (WARN) or other means.
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Develop and plan for scenarios likely to result in an increase or decrease in demand on your facilities during a pandemic (Loss of tourism, consumers at home instead of work, etc.)
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Determine the potential impact of a pandemic on utility-related travel (e.g. quarantines, border closures that limit availability of chemicals), including suppliers who make deliveries. Encourage suppliers to develop their own pandemic influenza continuity of operations plans.
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Find up-to-date, reliable pandemic information from the local public health agency and other sources. Make this information available to all personnel.

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Establish an emergency communications plan and revise it periodically. The plan should include identification of key contacts (with back-ups), chain of communications (including suppliers and key customers), and processes for tracking and communicating utility operational status and status of employees. Ensure public notification procedures are in place for potential scenarios.
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Implement an exercise/drill to test your plan, and revise it periodically. Ensure that exercises include the participation or cooperation of local health agencies, emergency planning officials and the Environmental Protection Agency.

**NOTES:**

**1.2 Plan for the impact of a pandemic on your employees and customers:**

Completed	In Progress	Not Started	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Forecast and allow for employee absences during a pandemic due to factors such as personal illness, family member illness, community containment measures and quarantines, school and/or business closures, and public transportation closures.
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Implement guidelines to limit the frequency and type of face-to-face contact (e.g. hand-shaking, meetings, office layout, shared workstations) among employees and between employees and customers. Take into consideration delivery personnel who would interact with employees. (See CDC recommendations.)
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Encourage and track annual influenza vaccination for employees. Consult local public health pandemic coordinators regarding pandemic vaccination and distribution of antiviral medications.
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Evaluate employee access to and availability of healthcare services during a pandemic, and improve services as needed.
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Evaluate employee access to and availability of mental health and social services during a pandemic, including corporate, community, and faith-based resources, and improve services as needed.
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Identify employees and key customers with special needs, and incorporate the requirements of such persons into your preparedness plan.

**NOTES:**

**1.3 Establish policies to be implemented during a pandemic:**

Completed	In Progress	Not Started	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Establish policies for employee attendance, sick-leave absences and compensation unique to a pandemic (e.g. non-punitive, liberal leave), including policies on when a previously ill person is no longer infectious and can return to work after illness.
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Establish policies for flexible worksite (e.g. telecommuting) and flexible work hours (e.g. staggered shifts). Take into account that longer shifts and onsite sleeping accommodations may reduce potential exposure to key workers. Consider needs and conditions (food, sleeping accommodations, family arrangements, etc.) for sequestering on-site critical staff.

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Establish policies for preventing influenza spread at the worksite (e.g. promoting respiratory hygiene/cough etiquette, sanitizer stations, disinfecting work areas and break rooms, and prompt exclusion of people with influenza symptoms).
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Establish policies for employees who have been exposed to pandemic influenza, are suspected to be ill, or become ill at the worksite (e.g. infection control response, immediate mandatory sick leave).
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Establish policies for teleconferencing and videoconferencing to limit face to face contact.
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Establish policies for travel to affected geographic areas and guidance for employees returning from affected areas (refer to CDC travel recommendations).
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Set up authorities, triggers, and procedures for activating and terminating the utility's response plan.

#### **1.4 Allocate resources to protect your employees and customers during a pandemic:**

Completed	In Progress	Not Started	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Provide sufficient and accessible infection control supplies (e.g. alcohol sanitizer stations, tissues, N-95 facial masks and receptacles for their disposal) at all work-related locations.
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Enhance communications and information technology infrastructures as needed to support employee telecommuting and remote customer access.
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Ensure availability of medical consultation and advice for emergency response.

#### **NOTES:**

#### **1.5 Communicate to and educate your employees:**

Completed	In Progress	Not Started	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Develop and disseminate programs and materials covering pandemic fundamentals (e.g. signs and symptoms of influenza, modes of transmission), personal and family protection and response strategies (e.g. hand hygiene, use of N-95 masks, coughing/sneezing etiquette, contingency plans).
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Anticipate employee fear and anxiety, rumors and misinformation and plan communications accordingly.
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Ensure that communications are culturally and linguistically appropriate.
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Disseminate information to employees about your pandemic preparedness and response plan.
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Provide information for the at-home care of ill employees and family members.
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Develop platforms (e.g. hotlines, dedicated websites) for communicating pandemic status and actions to employees, vendors, suppliers, and customers inside and outside the worksite in a consistent and timely way, including redundancies in the emergency contact system.
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Identify community sources for timely and accurate pandemic information (domestic and international) and resources for obtaining counter-measures (e.g. vaccines and antivirals).

#### **NOTES:**

**1.6 Coordinate with external organizations and help your community:**

Completed	In Progress	Not Started	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Collaborate with insurers, health plans, and major local healthcare facilities to share your pandemic plans and understand their capabilities and plans.
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Collaborate with local public health officials, Environmental Protection Agency officials and/or emergency responders; participate in their planning and training, share your pandemic plans, and understand their capabilities (e.g. surveillance) and plans.
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Communicate with local and/or state public health agencies and/or emergency responders about the assets and/or services your utility may be able to contribute to the community.
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Share pandemic continuity of operations best practices with other utilities and professional associations to improve community response efforts.

**NOTES:**

## **APPENDIX F: Sources of Best Practices for Pandemic Influenza Continuity of Operations Plans for Critical Infrastructure**

*Business Continuity for Water and Wastewater Utilities: How to Keep Your Utility in Business and Operating in Times of Crisis seminar, August 15 – 16, 2007, Alexandria, Virginia.* American Water Works Association.

*Business Continuity for Pandemic, Natural Disaster, and Terrorism webcast* (2006). American Water Works Association.

*Business Continuity Guideline: A Practical Approach for Emergency Preparedness, Crisis Management, and Disaster Recovery* (2005). ASIS International.  
<http://www.asisonline.org>.

*Business Continuity Planning in the Event of an Influenza Pandemic: A Reference Guide* (2007). Association of Metropolitan Water Agency. <http://www.amwa.net/>.

*Business Pandemic Influenza Planning Checklist, version 3.5* (2005). U.S. Department of Health and Human Services. <http://www.pandemicflu.gov/index.html>.

*Continuity of Operations/Continuity of Government and Pandemic Influenza Planning* (2007). State of California, Office of Emergency Services.  
[http://www.oes.ca.gov/Operational/OESHome.nsf/PDF/COOPCOG%20Document%20Downloads/\\$file/DP%20Pan%20Influenza%20.pdf](http://www.oes.ca.gov/Operational/OESHome.nsf/PDF/COOPCOG%20Document%20Downloads/$file/DP%20Pan%20Influenza%20.pdf)

*Continuity of Operations Planning for Pandemic Influenza Guidance* (2006). U.S. Department of Homeland Security. <http://www.fema.gov/government/coop/index.shtml>

*Drinking Water Supply Emergency Plan* (2003). Ohio Environmental Protection Agency. <http://www.epa.state.oh.us/ddagw/pwswebpg.htm#vol1>.

Disaster Response and Recovery Planning for Water Systems: A Kit of Tools, Project 2929 (2006). American Water Works Association Research Foundation.

Exemplary Practices in Public Health Preparedness (2005). Rand Corporation.  
[www.rand.org/](http://www.rand.org/)

*Electric Sector Influenza Pandemic Planning, Preparation, and Response Reference Guide* (2006). North American Electric Reliability Council.  
<http://esisac.com/publicdocs/Influenza%20Pandemic%20Reference%20Guide.pdf>.

*Introduction to Continuity of Operations (COOP)* on-line course (2007). U.S. Department of Homeland Security.  
<http://www.training.fema.gov/EMIweb/IS/IS5471st.asp>.

*National Strategy for Pandemic Influenza Implementation Plan (May 2006).* U.S. Homeland Security Council.

*Pandemic Influenza Continuity of Operations Guide & Template for San Francisco City and County Agencies* (June 2006). San Francisco Department of Public Health.

*Pandemic Influenza - A Guide for Water and Wastewater Plant Owners and Operators.* Ohio Environmental Protection Agency (2007).

<http://www.epa.state.oh.us/ddagw/pwswebpg.htm/>.

*Pandemic Influenza Preparedness, Response, and Recovery Guide for Critical Infrastructure and Key Resources* (Sept. 2006). U.S. Department of Homeland Security.

*Pandemic Influenza Best Practices and Model Protocols* (April 2007). U.S. Department of Homeland Security.

*Pandemic Preparedness Planning Checklist for Utilities and Other Businesses* (2007). Public Service Commission of West Virginia.

<http://www.psc.state.wv.us/PanInfo/PSCChecklist200701.pdf>.

*Project Approach for Disaster Response, Recovery and Business Continuity Planning for Drinking Water Utilities* (2004). Westby, K. & Saldanha, D. Coalfire Systems Inc.

## APPENDIX G: Pandemic Influenza Plans Reviewed For This Project

Alameda County (CA) Public Health Department – *Pandemic Influenza Continuity of Operations Guide and Template*, 2006.

Alaska Division of Public Health – *Pandemic Influenza Response Plan*, 2007.

Boston Public Health Commission – *Pandemic Influenza Plan*, 2007.

Combined Health District of Montgomery County - *Public Health Pandemic Influenza Preparedness and Response Plan for Montgomery County, Ohio*, 2006.

Greene County Combined Health District – *Influenza Pandemic Response Plan*, 2006.

Indiana State Department of Health – *Pandemic Influenza Plan*, 2006.

Indian Health Service, U.S. Department of Health and Human Services – *Pandemic Influenza Workbook*, 2006.

King County (WA) Health Department – *Pandemic Influenza Emergency Response Manual*, 2006.

Maine- *Pandemic Influenza Plan*, 2005.

Massachusetts – *Influenza Pandemic Preparedness Plan*, 2006.

Minnesota Department of Public Health (2006). *Pandemic Influenza Plan (Supplement) Technical Section K: Environmental Public Health*, version 2.5, April 2006, p. 233.

Montana Department of Health and Human Services – *Pandemic Influenza Preparedness and Response Plan*.

Monterey County (CA) Health Department – *Pandemic Influenza Response Plan*, 2005.

Nashville/Davidson County Metro Public Health Department – *Pandemic Influenza Response Plan*, 2006.

Ohio Department of Health – *Pandemic Influenza Preparedness and Response Plan (PIPRP)*, 2006.

Ohio Department of Health – *Pandemic Influenza Tool Kit For Ohio Schools*, 2007.

Preble County General Health District – *Pandemic Influenza Preparedness and Response Plan*, 2006.

San Francisco City and County – *Pandemic Influenza Continuity of Operations Guide and Template*, 2006.

Santa Clara County Public Health Department - *Your Guide to Preparing for Pandemic Flu*, 2007.

Security and Prosperity Partnership of North America. - *North American Plan for Avian and Pandemic Influenza*, 2007.

South Carolina – *Pandemic Influenza Plan*, 2006.

Toronto (Canada) – *Pandemic Influenza Plan*, 2006.

University of California, Davis Health System – *Influenza Pandemic Emergency Response and Business Continuity Plan*, 2006.

U.S. Homeland Security Council – *National Strategy for Pandemic Influenza*, 2005.

U.S. Homeland Security Council -*National Strategy for Pandemic Influenza Implementation Plan*, 2006.

World Health Organization – *Global Influenza Preparedness Plan*, 2005.