

## Pandemics Risk Assessment

*This plan is an update of the 2004 City of Redmond Hazard Mitigation Plan (HMP). Although it is an update, this document has been redesigned so that it looks, feels, and reads differently than the original. This is due to several factors: new hazard information has become available that drives new definitions of risk, the City has matured and new capabilities are now available, and the new format will allow readers to more easily understand the content. In addition, the 2004 HMP included several action items that have been completed, creating an opportunity for developing new mitigation strategies.*

### 9.1 Identify Pandemic Hazards

Pandemics are characterized by the emergence of a new infectious disease that causes serious illness and spreads easily among humans. Since pandemics involve new diseases, there are often no vaccines and little natural immunity to thwart the spread of the epidemic.

Pandemics spread quickly through communities, nationally or even globally. Generally, the elderly, young children, and people with pre-existing illnesses are most vulnerable to a pandemic. However, some pandemics such as the H1N1 Influenza outbreak of 2009 and the Influenza Outbreak of 1918-1919 have defied this pattern by primarily affecting otherwise healthy individuals<sup>91</sup>.

Many types of diseases can result in a pandemic. In the 14<sup>th</sup> century, the Bubonic Plague pandemic in Europe killed around 75 million people in a four-year period.<sup>92</sup> More recently, the Influenza pandemic of 1918-1919 was responsible for millions of deaths worldwide.<sup>93</sup> New, emerging diseases such as Severe Acute Respiratory Syndrome (SARS) or the H1N1 Flu (Swine Flu) are causes for concern. The World Health Organization (WHO) has created a pandemic alert system for influenza-like viruses; shown in **Table 16**.

91 Tara Smith, "Swine flu and deaths in healthy adults--cytokine storm?" Aetiology April 26, 2009, [http://scienceblogs.com/aetiology/2009/04/swine\\_flu\\_and\\_deaths\\_in\\_health.php](http://scienceblogs.com/aetiology/2009/04/swine_flu_and_deaths_in_health.php).

92 Will Dunham, "Black death 'discriminated' between victims," ABC Science, January 29, 2008, <http://www.abc.net.au/science/articles/2008/01/29/2149185.htm>.

93 Jeffery Taubenberger and David Morens, "1918 Influenza: the Mother of All Pandemics," Emerging Infectious Diseases 12 no. 3 (2006), <http://www.cdc.gov/ncidod/eid/vol12no01/05-0979.htm>.

World Health Organization Pandemic Alert System Phases	
<b>Phase 1</b>	No viruses circulating among animals have been reported to cause infections in humans.
<b>Phase 2</b>	An animal influenza virus circulating among domesticated or wild animals is known to have caused infection in humans, and is therefore considered a potential pandemic threat.
<b>Phase 3</b>	An animal or human-animal influenza virus has caused sporadic cases or small clusters of disease in people, but has not resulted in human-to-human transmission sufficient to sustain community-level outbreaks.
<b>Phase 4</b>	Verified human-to-human transmission of an animal or human-animal influenza virus able to cause “community-level outbreaks.” The ability to cause sustained disease outbreaks in a community marks a significant upwards shift in the risk for a pandemic.
<b>Phase 5</b>	Human-to-human spread of the virus into at least two countries in one WHO region. While most countries will not be affected at this stage, the declaration of Phase 5 is a strong signal that a pandemic is imminent and that the time to finalize the organization, communication, and implementation of the planned mitigation measures is short.
<b>Phase 6</b>	This Pandemic phase is characterized by community level outbreaks in at least one other country in a different WHO region in addition to the criteria defined in Phase 5. Designation of this phase will indicate that a global pandemic is under way.
<b>Post-Peak Period</b>	Pandemic disease levels in most countries with adequate surveillance will have dropped below peak observed levels. The post-peak period signifies that pandemic activity appears to be decreasing; however, it is uncertain if additional waves will occur and countries will need to be prepared for a second wave.
<b>Post-Pandemic Period</b>	Influenza disease activity will have returned to levels normally seen for seasonal influenza. It is expected that the pandemic virus will behave as a seasonal Influenza A virus.

Table 16: World Health Organization Pandemic Alert System Phases

Source: World Health Organization, “Current WHO Phase of Pandemic Alert,” [https://www.who.int/csr/disease/avian\\_influenza/phase/en/](https://www.who.int/csr/disease/avian_influenza/phase/en/).

The primary concern when a pandemic occurs is severe illness and potential loss of life. However, it may have cascading effects on the economy and burden strained existing resources.

A pandemic may cause disruptions in the local economy. Schools and businesses may close either to stop the spread of the disease or due to employee absence. The financial losses due to business closure may be significant. The economic implication of a pandemic is more thoroughly explained in Section 9.3.2.C, Profiling the Vulnerabilities, Systems.

A pandemic will overburden existing services. This will increase emergency response times and demand for health care facilities. In a severe pandemic, public transportation may shut down in order to prevent the spread of diseases. Grocery stores and other service providers may be similarly impacted.

In the event of a pandemic, the WHO and the U.S. Center for Disease Control and

Prevention (CDC) direct response efforts. Depending on the severity of the outbreak, local or national public health agencies may also respond.

## 9.2 Profiling Pandemic Events

### A. Location

All of Redmond is vulnerable during a pandemic. The disease agents (bacteria, viruses, parasites) responsible for a pandemic are more likely to be transmitted in areas with a high human-to-human or human-to-animal contact. Despite Redmond's relatively low residential population density; the large business centers, schools, and retirement homes concentrate large numbers of people. These public gathering places are locations where disease can spread rapidly.

Locations in Redmond that involve large numbers of domestic and international travel, such as hotels or business centers, should be noted as possible locations for the spread of diseases. During the SARS outbreak of 2003, an outbreak of the disease in a hotel was found to be the source of its spread across the globe.<sup>94</sup> Large businesses in Redmond often require extensive business travel outside the region, increasing Redmond's risk of exposure to new diseases.

### B. Timing and Duration

Pandemics do not have a predictable time component. The duration of a pandemic may be much longer than many other hazards. The Washington State Department of Health warns, "An Influenza pandemic will most likely not be a short, sharp event leading immediately to commencement of a recovery phase, as would be the case in an earthquake. A pandemic may last several months, as was the case of the 1918 influenza pandemic, and may contain peaks followed by periods of reduced illness."<sup>95</sup>

The ability of local, regional and national medical organizations to prepare for, and respond to, an outbreak will affect the duration of the pandemic. Additionally, the type of disease, number of people infected, and the means by which the disease is transmitted will determine the rate at which the disease will spread. For example, a microorganism that only has the ability to spread via blood contact will spread less quickly than one that has the ability to be transmitted through the air or by contact with contaminated objects.

### C. Severity

The severity of a pandemic depends on the disease itself and the method of transmission. A disease that is air-borne and spreads human-to-human could be catastrophic. Once such a disease develops, it has the potential to spread rapidly causing outbreaks around the world, causing many deaths. The CDC predicts that as much as 25% to 30% of the United States' population can be affected by a pandemic

<sup>94</sup> World Health Organization, "Communicable Disease Surveillance and Response: Severe Acute Respiratory Syndrome (SARS)," [http://www.who.int/csr/media/sars\\_wha.pdf](http://www.who.int/csr/media/sars_wha.pdf).

<sup>95</sup> Washington State Department of Health, "Pandemic Influenza Planning Guide for State Agencies," <http://www.doh.wa.gov/panflu/pdf/StateAgencyPanFluGuide.pdf>, 5.

outbreak. In King County that prediction translates to about 540,000 infected people and 11,500 deaths. **Table 17, Selected Diseases, Severity and Method of Transmission**, provides details about previous outbreaks.

Selected diseases, severity and method of transmission						
Disease	Estimated Mortality Rate	Transmission Methods				Notes
		Airborne	Contaminated surfaces	Blood or direct body fluid contact	Animal to Human	
SARS	10%	Maybe	Yes	Yes	Yes	SARS is still considered a rare disease with the last case reported on July 11, 2003.
H1N1 Influenza	0.46%**	Yes	Yes	Yes	Yes	In the past the disease spread to humans mainly via contact with infected pigs. In April 2009, a mutated form that spreads between humans was identified in Mexico. The exact severity of this disease is still under speculation.
Avian Influenza	60%	No	No	Yes	Yes	Frequency of the disease has been low and limited to a few regions around the world due to limited human to human transmission.
Food-borne illness	minimal	No	No	No	via contaminated food	While food poisoning illness can be severe, outbreaks are limited to people who consumed the infected food source.
Ebola	69%	No	No	Yes	Yes	The spread of Ebola has so far been limited but the virulent nature of this disease is a cause for concern. The virus causes fatal hemorrhaging disease in humans and can be spread via close bodily contact. Some strains of the virus have been demonstrated to be spread airborne between monkeys. A mutation of the disease in the human population could trigger a major worldwide pandemic.
West Nile Virus	3%	No	No	No	Yes	West Nile Virus can only be transmitted to humans via mosquito bites. Frequency of human infection depends on the prevalence of infected mosquitoes. The disease first appeared in North America in 1999, resulting in thousands of flu-like infections throughout the US. It has manifest as fatal encephalitis in certain people.

Table 17: Selected Diseases, Severity and Method of Transmission  
 Source: Centers for Disease Control and Prevention – Diseases and Conditions <http://www.cdc.gov/DiseasesConditions/>

\*\* As of June 6, 2009. Calculated from total confirmed cases and deaths. Figure subject to change.

## D. Frequency

### *Previous Occurrences*

There are no recent cases of pandemics affecting Redmond directly, but the U.S. has experienced four influenza pandemics in the 20th century. The pandemic of 1918-19 was the most severe pandemic on record, killing 650,000 Americans, and 50 million or more worldwide. The most recent occurrence of influenza pandemic is the 2009 outbreak of H1N1 Influenza (Swine Flu). As of July 6, 2009, 136 countries had officially reported over 94,000 confirmed cases of the influenza infection and 429 deaths.<sup>96</sup>

### *Probability of future events*

King County Health Services Communicable Disease Center warns that in the presence of a growing population, there are more opportunities for infectious diseases to occur and spread. From 2000-2007 Redmond's population increased roughly 10%.<sup>97</sup> The increases in population, paired with increases in international travel, suggest that Redmond is more likely to be affected by a pandemic in the future.

Climate change is another factor that will increase the probability of future pandemics. Rising temperatures enable carriers of disease, such as insects and rodents, to expand their geographic range and thus the ability to infect people.<sup>98</sup> Additionally, milder winters and longer summers increase the ability of warm-climate diseases to survive in previously colder climates. When diseases migrate, the local population will have little immunity to new diseases. Local healthcare providers may have limited knowledge or familiarity with these diseases, and thus be unprepared to diagnose and treat them.<sup>99</sup> These changing variables make it difficult to establish a definite probability for pandemic events.

## 9.3 Assessing Pandemic Vulnerability

### 9.3.1 Overview

While a pandemic will not affect man-made structures or the environment, large numbers of fatalities and economic loss may occur. Redmond is home to many large multinational businesses that involve both international and domestic travel, increasing the chances that new infectious diseases may appear there. Redmond contains large numbers of vulnerable populations who may be adversely affected by a pandemic disease outbreak.

<sup>96</sup> World Health Organization, "Influenza A(H1N1) - Update 58," [http://www.who.int/csr/don/2009\\_07\\_06/en/index.html](http://www.who.int/csr/don/2009_07_06/en/index.html).

<sup>97</sup> American FactFinder, "2007 Population estimates," U.S. Census Bureau, [http://factfinder.census.gov/servlet/GCTTable?\\_ds\\_name=PEP\\_2007\\_EST&-mt\\_name=PEP\\_2007\\_EST\\_GCTT1R\\_ST9S&-geo\\_id=04000US53&-format=ST-9&-tree\\_id=806&-context=gct](http://factfinder.census.gov/servlet/GCTTable?_ds_name=PEP_2007_EST&-mt_name=PEP_2007_EST_GCTT1R_ST9S&-geo_id=04000US53&-format=ST-9&-tree_id=806&-context=gct).

<sup>98</sup> Rick Smith, "Is Climate Change Aiding Spread of Disease?" International Herald Tribune, September, 2002, [http://news.nationalgeographic.com/news/2002/09/0920\\_020910\\_climatedisease.html](http://news.nationalgeographic.com/news/2002/09/0920_020910_climatedisease.html).

<sup>99</sup> Richard Bissel, Andrew Bumbak, Matthew Levy and Patrick Echebi, "The Threat of Infectious Disease in a Global Community," *Journal of Emergency Management* 7 (2009): 19-35.

### 9.3.2 Profiling the Vulnerabilities

#### A. Man-made

The man-made environment, including built structures and infrastructure, is not vulnerable in the event of a pandemic.

#### B. Natural

While some wildlife may suffer from zoonotic diseases that are transferred between humans and animals, the natural environment is unlikely to be affected as a result of a pandemic.

#### C. Systems

In the event of a catastrophic pandemic, community systems in Redmond will be severely strained. There are no hospitals within the City limits to treat ill residents; therefore, neighboring jurisdictions are likely to be overwhelmed with patients from Redmond. An increase in deaths resulting from a pandemic may overflow morgues. Medical staff may become ill, resulting in staff shortages. The CDC estimates 540,000 infections in King County during a pandemic flu outbreak. This prediction includes 270,000 in need of outpatient care and nearly 60,000 in need of hospitalization. These levels would overwhelm existing regional medical and emergency services.<sup>100</sup>

The economy of Redmond may be severely impacted by loss of productivity, resulting from business closures and isolation. During peaks of a significant pandemic, staff absences could be as high as 50%.<sup>101</sup> Measures to control the spread of diseases could include closing businesses, schools, and public transportation.<sup>102</sup> Even without closures, people with the illness or those in fear of contracting the disease may keep residents away from public areas. Redmond's food supply may be in danger of running short as workers in the food industries fall victim to the disease, impeding delivery of food supplies and depriving people of vital nourishment when their immune systems may be in greatest need of it.<sup>103</sup>

The 2003 SARS outbreak was an example of how a new disease outbreak impacts the economy of the infected countries. Originating in China, the previously unknown disease quickly spread internationally to other Asian countries and North America. International air travel was identified as contributing to its spread.<sup>104</sup> Air travel to SARS-infected areas immediately plummeted due to travel advisories. Tourism and other businesses related to international travel were also affected; a decrease in customers visiting local businesses hurt revenue streams. Special isolation hospitals were dedicated in Hong Kong and Singapore to contain SARS patients. SARS was transmitted within hospitals, making isolation necessary.

100 Public Health- Seattle and King County, "General Questions About Pandemic Flu," <http://www.kingcounty.gov/healthservices/health/preparedness/pandemicflu/questions.aspx>.

101 Washington State Department of Health, "Pandemic Influenza Planning Guide for State Agencies," <http://www.doh.wa.gov/panflu/pdf/StateAgencyPanFluGuide.pdf>, 5.

102 U.S. Department of Health and Human Services, "Pandemic Influenza Planning: A Guide for Individuals and Families," (2006). <http://www.pandemicflu.gov/plan/pdf/guide.pdf>.

103 Berks County Pandemic Advisory Council, "How will the next pandemic affect you?" <http://www.co.berks.pa.us/pac/cwp/view.asp?a=3&q=494721&pacNav=%7C34106%7C34108%7C>.

104 World Health Organization, "Communicable Disease Surveillance and Response: Severe Acute Respiratory Syndrome (SARS)," [http://www.who.int/csr/media/sars\\_wha.pdf](http://www.who.int/csr/media/sars_wha.pdf).

**D. Populations**

The H1N1 Influenza outbreak of 2009 in Mexico has seen many more fatalities in adults between the ages of 15-50.<sup>105</sup> Although all populations are vulnerable to an outbreak, populations that have increased exposure to viruses or have compromised immune systems are more likely to be infected.

*Hazard Specific*

People that are exposed to the infected will be particularly vulnerable. Travelers may be more vulnerable to a disease that suddenly appears internationally. Healthcare providers who are treating the infected will have increased contact with the disease and thus will have heightened exposure.

*Isolated Populations*

If quarantine measures are taken and transit services are reduced in an effort to prevent or slow down the spread of a disease, some people may have difficulty obtaining or accessing goods and services.

*Children*

Young children, under the age of five, have delicate immune systems that may make them more vulnerable to contract and survive a disease.<sup>106</sup> School children may be more vulnerable due to increased exposure to large populations and inadequate hand washing. Twenty-five percent of Redmond's population consists of children over the age of three that are attending school.<sup>107</sup>

*Elderly*

People over the age of 65 experience increased risk.<sup>108</sup> Those with existing medical conditions and compromised immune systems are more vulnerable to infection and death. The H1N1 Influenza outbreak of 2009 is an example of a disease that produces only mild symptoms in the majority of people, but may be fatal for those who have asthma, diabetes, or heart disease, illnesses which are common in the elderly.<sup>109</sup> Additionally, like hospitals and schools, the concentration of people in a retirement home increases exposure.

*Limited English Language*

People who have limited English language skills may have increased difficulty communicating with healthcare providers. This may lead to a delay in diagnosis and treatment. Without prompt identification, the risk of transmission increases and the lack of prompt treatment may cause the case to be more severe. Evidence has shown that current anti-viral drugs may be effective in a pandemic influenza outbreak, but those drugs must be given at the first signs of the illness.<sup>110</sup>

105 Tara Smith, "Swine flu and deaths in healthy adults--cytokine storm?" Aetiology April 26, 2009, [http://scienceblogs.com/aetiology/2009/04/swine\\_flu\\_and\\_deaths\\_in\\_health.php](http://scienceblogs.com/aetiology/2009/04/swine_flu_and_deaths_in_health.php).

106 Sam Lister, "Young and Elderly in Danger of Infection," The Times, September 8, 2005, <http://www.timesonline.co.uk/tol/news/world/article564087.ece>.

107 Census, 2000

108 Sam Lister, "Young and Elderly in Danger of Infection," The Times, September 8, 2005, <http://www.timesonline.co.uk/tol/news/world/article564087.ece>.

109 <http://www.nytimes.com/2009/05/09/health/09flu.html>

110 <http://www.nytimes.com/2009/05/09/health/09flu.html>

*Low-Income Residents*

Uninsured and underinsured people often delay seeking care until symptoms become severe. Delayed diagnosis can increase transmission and decrease treatment effectiveness.

**9.3.3 Analyzing Development Trends**

Population growth will increase the number of residents who could potentially be exposed to a pandemic disease. An increase in population density may increase the frequency of contact between infected individuals, thus hastening the spread of disease.