Year 2015 WNV Control Program Plan

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INTRODUCTION

**Background:** The mission of the Pennsylvania West Nile Virus (WNV) Control Program is to reduce expected morbidity and mortality, health care costs, and the financial impact that WNV disease outbreaks would have upon Commonwealth industries i.e., Agriculture, Fishing, Hunting, Tourism, etc.). The Department of Health (PA DOH), the Department of Environmental Protection (DEP) and the Department of Agriculture (PDA), have implemented a comprehensive strategy to prevent and control the seasonal impact of WNV.

1. Since 2000, PA DOH has led the multi-agency team tasked with reducing the impact of WNV in the state through a coordinated mosquito control program. The program involves county commissioners, health departments, conservation districts, emergency services and the Penn State Cooperative Extension Service.

2. There is a data collection and sharing using a WNV database maintained by DEP, as well as physical transfer of samples, among the organizations (Figure 1).

![Figure 1](Image)

**Figure 1**

- **Field**
  - Human Surveillance (PA DOH)
  - Mosquito Surveillance (PA DOH)
- **Veterinary Surveillance**
  - PA DOH Lab
  - PDA Lab
- **Internal Reporting**
  - Tabular
  - Maps on the internal web site
- **Secure Web**
  - GIS Database (ArcSDE, Oracle)
  - Data Exchange
- **Public Component**
  - Internal Analysis Component
- **DEP Lab, PA DOH**
  - Data analysis

**PA WNV System**

- **GIS Database (ArcSDE)**
  - CDC
  - PA
  - NWL
  - NVS

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Commonwealth of Pennsylvania

1 West Nile Control Program 2015
3. The 2015 WNV Plan continues an emphasis on mosquito control efforts, which rely on human, animal and mosquito surveillance; a streamlined system for testing collected samples; and a public education program. The mosquito control efforts focused on aggressive early season larviciding and appropriate adulticiding. Since WNV was extensively documented throughout the state in the past few years, early and forceful mosquito abatement activities are necessary to prevent the seasonal amplification and spread of the virus. With this plan in place, PA is ready for the mosquito season in 2015 when WNV reemerges.

4. All intervention strategies are planned and implemented in partnership with the counties in order to identify the most efficient method. The goal is to reduce expected morbidity and mortality, health care costs, and the financial impact that a WNV outbreak would have upon PA industry (i.e. Agriculture, Fishing, Health, Hunting, Tourism, etc.). The statewide mosquito surveillance plan will go operational on April 1, 2015 in the Southern Tier of Counties, and on May 1, 2015 in the Northern Tier of Counties. The Dead Bird surveillance plan will go operational on May 1, 2015. Human surveillance occurs year-round.

5. WNV was first isolated from a febrile adult woman in the West Nile District of Uganda in 1937. The virus became recognized as a cause of severe human meningoencephalitis (inflammation of the spinal cord and brain) in elderly patients during an outbreak in Israel in 1957. The virus was previously found only in Africa, Eastern Europe and West Asia until 1999 when it appeared in New York City.

6. WNV is spread to humans and animals by the bite of infected mosquitoes (primarily the _Culex_ species). A mosquito becomes infected by feeding on an infected bird. Although anyone can become infected with WNV, people older than 50 years of age have the highest risk of developing severe illness. The annual number of United States WNV cases and deaths are listed below in Table 1.

<table>
<thead>
<tr>
<th>Year</th>
<th>WNV Cases</th>
<th>WNV Deaths</th>
</tr>
</thead>
<tbody>
<tr>
<td>1999</td>
<td>62</td>
<td>7</td>
</tr>
<tr>
<td>2000</td>
<td>21</td>
<td>2</td>
</tr>
<tr>
<td>2001</td>
<td>66</td>
<td>10</td>
</tr>
<tr>
<td>2002</td>
<td>4,156</td>
<td>284</td>
</tr>
<tr>
<td>2003</td>
<td>9,862</td>
<td>264</td>
</tr>
<tr>
<td>2004</td>
<td>2,539</td>
<td>100</td>
</tr>
<tr>
<td>2005</td>
<td>3,000</td>
<td>119</td>
</tr>
<tr>
<td>2006</td>
<td>4,269</td>
<td>177</td>
</tr>
<tr>
<td>2007</td>
<td>3,630</td>
<td>124</td>
</tr>
<tr>
<td>2008</td>
<td>1,356</td>
<td>44</td>
</tr>
<tr>
<td>2009</td>
<td>720</td>
<td>32</td>
</tr>
<tr>
<td>2010</td>
<td>1,021</td>
<td>57</td>
</tr>
<tr>
<td>2011</td>
<td>712</td>
<td>43</td>
</tr>
<tr>
<td>2012</td>
<td>5,674</td>
<td>286</td>
</tr>
<tr>
<td>2013</td>
<td>2,469</td>
<td>119</td>
</tr>
<tr>
<td>2014</td>
<td>2,122</td>
<td>85</td>
</tr>
<tr>
<td>Total</td>
<td>41,679</td>
<td>1,753</td>
</tr>
</tbody>
</table>
7. Pennsylvania WNV human case data is displayed in the following table and graph:

### Table 2:

<table>
<thead>
<tr>
<th></th>
<th>Human Cases</th>
<th>Percentage</th>
<th>Mean Age</th>
<th>Deaths</th>
<th>First Case</th>
<th>Last Case</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total</td>
<td>Male</td>
<td>Female</td>
<td>Total</td>
<td>Male</td>
<td>Female</td>
</tr>
<tr>
<td>2001</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>66.7%</td>
<td>33.3%</td>
<td></td>
</tr>
<tr>
<td>2002</td>
<td>62</td>
<td>25</td>
<td>37</td>
<td>40.3%</td>
<td>59.7%</td>
<td></td>
</tr>
<tr>
<td>2003</td>
<td>237</td>
<td>115</td>
<td>122</td>
<td>48.5%</td>
<td>51.5%</td>
<td></td>
</tr>
<tr>
<td>2004</td>
<td>15</td>
<td>8</td>
<td>7</td>
<td>53.3%</td>
<td>46.7%</td>
<td></td>
</tr>
<tr>
<td>2005</td>
<td>25</td>
<td>11</td>
<td>14</td>
<td>44.0%</td>
<td>56.0%</td>
<td></td>
</tr>
<tr>
<td>2006</td>
<td>9</td>
<td>5</td>
<td>4</td>
<td>55.6%</td>
<td>44.4%</td>
<td></td>
</tr>
<tr>
<td>2007</td>
<td>10</td>
<td>5</td>
<td>5</td>
<td>50.0%</td>
<td>50.0%</td>
<td></td>
</tr>
<tr>
<td>2008</td>
<td>14</td>
<td>6</td>
<td>8</td>
<td>42.9%</td>
<td>57.1%</td>
<td></td>
</tr>
<tr>
<td>2009</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0.0%</td>
<td>0.0%</td>
<td></td>
</tr>
<tr>
<td>2010</td>
<td>28</td>
<td>15</td>
<td>13</td>
<td>54.0%</td>
<td>46.0%</td>
<td></td>
</tr>
<tr>
<td>2011</td>
<td>6</td>
<td>3</td>
<td>3</td>
<td>50.0%</td>
<td>50.0%</td>
<td></td>
</tr>
<tr>
<td>2012</td>
<td>60</td>
<td>34</td>
<td>26</td>
<td>56.7%</td>
<td>43.3%</td>
<td></td>
</tr>
<tr>
<td>2013</td>
<td>11</td>
<td>7</td>
<td>4</td>
<td>63.6%</td>
<td>36.4%</td>
<td></td>
</tr>
<tr>
<td>2014</td>
<td>13</td>
<td>9</td>
<td>4</td>
<td>69.2%</td>
<td>30.8%</td>
<td></td>
</tr>
</tbody>
</table>

### Graph 1:

**Annual West Nile Virus Disease Incidence Rates**

![Graph showing annual incidence rates](image)
8. In preparation for each mosquito season, multi-agency meetings are held to discuss planned surveillance and control activities. Using the information gained from the regional meetings, plus information and experiences of past seasons, PA DOH in collaboration with PDA, DEP, and other participating state agencies (PA Emergency Management Agency, Game Commission, Conservation and Natural Resources, Fish and Boat Commission, Aging, and Education) annually review and update the PA WNV Control Plan. Senior representatives from these government agencies serve on committees and meet as needed. Pennsylvania’s WNV Control Plan involves coordination between federal, state and local agencies, including the agencies mentioned earlier.
COMMUNICATION STRATEGY

Background: Communication and public awareness activities are designed to provide pertinent information both prior to and during the mosquito season. The goal is to educate Pennsylvanians on methods to reduce their risk of contracting WNV and to protect animal health. The theme of “Mosquito Control and Personal Protection” is the cornerstone for our prevention message. Getting this prevention message out and repeating it in as many formats as possible will help to reduce Pennsylvania’s risk of human and animal WNV cases.

Communications Objectives:

1. To make Pennsylvanians part of the control program by encouraging them to eliminate mosquito-breeding sites and report dead birds.

2. To educate the public, local government officials and media on WNV.

3. To inform target audiences of the potential risk for WNV infection in PA and improve their knowledge of how the virus is transmitted.

4. To encourage people to take action to protect themselves, their pets and their livestock from getting bitten by mosquitoes.

5. To improve knowledge among health care providers of the signs and symptoms of human encephalitis, appropriate treatments and testing options and encourage them to promptly report cases.

6. To improve knowledge among veterinarians and animal owners (particularly horse owners) of the signs and symptoms of WNV in animals and of reducing risk of infection in animals and encourage them to promptly report cases.

Message Management:

1. Targeted audiences will be given information on mosquito abatement activities. The primary message is to prevent mosquitoes from breeding and developing. Self-protection information will also be given.

2. When WNV is found in people, animals, birds or mosquitoes, a reinforcement message to this effect will be announced to the public. This message will advise people to protect themselves by:

   a. Seeking out and eliminating mosquito-breeding sites.

   b. Recognizing the signs and symptoms of WNV infection and seeking medical care.

3. Maintaining surveillance for dead birds, (especially crows and raptors) as this is a sign of WNV activity in an area. Be sure to report them to DEP by calling 717-346-8238 or
contacting the appropriate County WNV Coordinator found on the WNV website: 
www.westnile.pa.state.us.

4. PA DOH will act as a central clearinghouse for WNV information. In an effort to reduce duplication, PA DOH will coordinate information with other responding agencies and target audiences.

**Target Audiences:** Audiences include the general public, media, seniors, local governments, county/municipal health departments, veterinarians, animal owners and others as needed.

**Timeline:** The dissemination of information will begin in the early spring and will be designed to be maintained, enhanced and expanded, reaching different segments of the targeted audiences over the course of the mosquito breeding season (April through November).

**Outreach Efforts:** Communication will take place in many formats:

1. **Media:** All print, radio and TV outlets will receive information in April and May about the upcoming mosquito season and the risk of WNV. Media will be asked to assist with getting the prevention message out. This will be done through press releases and web notification. Information will be disseminated to news outlets as needed. PA DOH, DEP and PDA will coordinate all state media activities for the WNV notification and other press relations as needed.

2. **West Nile Website:** The West Nile website at www.westnile.state.pa.us will provide daily surveillance updates posted by 2 p.m. during the surveillance season (April-October). Updates will be posted weekly during the remainder of the year. It will contain information about WNV and what citizens can do to reduce their risk of becoming infected with WNV. A notification section will be used to send information to interested parties. Citizens will be able to report dead birds via the public website report form.

3. **Health Information Line:** We will promote the use of the 1-877-PAHEALTH information line for public use and instruct the public to call if they have health related questions. PA DOH staff will explain to the caller that only Corvid and Raptor species of birds will be tested (5 birds per county per week). The caller will be referred to the WNV County Coordinator if they want the bird tested or have mosquito related questions.

4. **Printed Materials:** Educational material (brochures, posters, standardized public presentations and other materials as needed) has been developed to disseminate to target audiences. Fact sheets for specific audiences have been developed as needed by departments based primarily on already approved material. This information will be made available to local officials, local health directors, key groups and the media as needed. Each Department will disseminate information to their constituents as needed.

**Surveillance and Control Communication:** Information will be shared between PA DOH, DEP and PDA through monthly WNV Operations Workgroup meetings. Information will be shared by these agencies with participating counties through electronic reports, the West Nile website
and conference calls if needed throughout the WNV season. Regular updates will be provided to all participants through electronic reports and the West Nile website.

1. PA DOH will be responsible for communications relating to human health, personal risk and protection issues.

2. PDA will be responsible for communications relating to agricultural issues.

3. DEP and county coordinators will coordinate and be responsible for communications relating to mosquito control.

4. Recommendations from the WNV Operations Workgroup will be presented at regular WNV Steering and multi-agency Committee Meetings.

5. The county controlling the treatment operations will be responsible for making the necessary notifications of affected persons on the PDA Hypersensitive Registry as needed, and other affected persons and agencies.

6. Additionally, DEP Regional Offices, County Commissioners, the Fish and Boat Commission, the Game Commission, PDA Regional Offices, and the appropriate State Legislators and State Senators will be notified of the treatment activities. Suitable press releases will be issued to provide appropriate notice to public citizens in the affected area.

**Communication Offices (PA DOH, DEP, PDA and others as needed):** The communications offices, after assessing the nature and scope of an event, and with approval from the Governor’s Office of Communication, will disseminate information to target audiences as needed:

1. Receive an event fact sheet from program staff for distribution and assign a member of the communications office to disseminate the facts of the event.

2. Disseminate information to media by the designated spokesperson from PA DOH, DEP or PDA with the most direct knowledge of the event.

3. Ensure that key constituents have been notified.

4. Reinforce the prevention message to media.

5. Remember that all information, including the name and address of the owner or guardian of a positive animal is confidential.

**Communications Team:** The Communication offices will meet as needed and will function on an ad-hoc basis to monitor and respond to the event until it is resolved.

**Post Event Evaluation:** The Communications offices will meet to discuss and review all communication actions taken as a result of the event to determine effectiveness and efficiency of operations and make any policy and procedures changes as needed.
**Release of Information:** Each Department laboratory that is responsible for testing specimens submitted for WNV testing will report positive specimens to the Arbovirus Program Manager for DEP, PA DOH and PDA every workday before 10:00 a.m. The positive results will be uploaded onto the West Nile public website by 2:00 p.m. on the same day. The DEP, PA DOH and PDA Arbovirus Program Manager/Coordinator will assess results and make appropriate notifications to designated individuals. This pertains to horses, birds, captive birds, other animals, and mosquitoes. Positive results related to human infection will be released after appropriate evaluation and consultation. When a horse, captive bird, or other animal is found positive for WNV, the Departments will only release the county of the affected sample. When a dead wild bird or mosquito sample is found positive for WNV, the Departments will only release the county/township of the affected sample. The submitter, owner and property name will not be released to the media or public. Information may be shared with the county control programs when needed as part of prevention and control activities. Public notification of a human case of WNV infection will be handled on a case-by-case basis. PA DOH is prohibited by law from releasing any information it obtains pursuant to its duties concerning disease prevention and control unless it determines that the release of the information would further the purposes of public health.
MOSQUITO CONTROL

Background:

1. During the 2000 season, WNV was detected in five states in the U.S., including PA. In 2001-2003, it rapidly spread across the U.S. and into Canada, Mexico and the Caribbean. By the end of 2004, WNV was present in all states except Alaska and Hawaii. During the past ten years, the virus has been detected in PA in mosquitoes, wild birds, sentinel chickens, horses, and/or humans in all 67 counties in the state.

2. Protecting the public from the mosquitoes that transmit the virus requires an integrated pest management program. In PA, the DEP is responsible for WNV mosquito surveillance and control...

   a. The WNV prevention and control program uses four fundamental approaches toward the management of disease vectors: education, larval habitat source reduction, larval mosquito control and adult mosquito control. This hierarchical approach from education to control provides the best integration of strategies to protect public health. The control and prevention program evolves as new scientific information becomes available.

   b. The DEP program includes monitoring of mosquito populations, control activities for mosquitoes that may carry the virus, determination of virus distribution, and examination of unknown vectors and reservoirs involved in the transmission of this virus. This program also involves the development and maintenance of a data sharing system, outreach, and a funding program to build a long-term infrastructure for county government. Coordinated communications play a key role in each phase of this effort.

   c. When DEP’s Mosquito Surveillance Program began on April 3, 2000, there were no counties actively conducting WNV surveillance. By November 2000, 59 counties were involved in the program, generating more than 10,000 samples. These samples produced 42 positive pools of mosquitoes from eight different species. In 2001, the program extended to 65 counties. This mosquito surveillance system collected and identified almost 35,000 samples. These samples produced 51 positive pools of mosquitoes from four different species, and adulticide and larvicide control activities were initiated as needed.
Table 3

<table>
<thead>
<tr>
<th>Year</th>
<th>Mosquito Samples Tested</th>
<th>Positive Samples</th>
<th>%</th>
<th>Dead Birds Tested</th>
<th>Positive Dead Birds</th>
<th>%</th>
<th>Positive Horses</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>2,274</td>
<td>46</td>
<td>2.0%</td>
<td>1346</td>
<td>37</td>
<td>2.7%</td>
<td>1</td>
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<tr>
<td>2001</td>
<td>5,951</td>
<td>43</td>
<td>0.7%</td>
<td>990</td>
<td>361</td>
<td>36.4%</td>
<td>7</td>
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<tr>
<td>2002</td>
<td>15,464</td>
<td>674</td>
<td>4.3%</td>
<td>2449</td>
<td>1437</td>
<td>58.7%</td>
<td>97</td>
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<tr>
<td>2003</td>
<td>14,138</td>
<td>954</td>
<td>6.7%</td>
<td>873</td>
<td>546</td>
<td>62.5%</td>
<td>546</td>
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<tr>
<td>2004</td>
<td>11,856</td>
<td>163</td>
<td>1.4%</td>
<td>174</td>
<td>46</td>
<td>26.4%</td>
<td>9 *</td>
</tr>
<tr>
<td>2005</td>
<td>13,258</td>
<td>276</td>
<td>2.1%</td>
<td>181</td>
<td>23</td>
<td>12.7%</td>
<td>0</td>
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<tr>
<td>2006</td>
<td>15,464</td>
<td>234</td>
<td>1.5%</td>
<td>626</td>
<td>55</td>
<td>8.7%</td>
<td>2</td>
</tr>
<tr>
<td>2007</td>
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<td>223</td>
<td>1.4%</td>
<td>97</td>
<td>10</td>
<td>10.3%</td>
<td>1</td>
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<tr>
<td>2008</td>
<td>15,881</td>
<td>518</td>
<td>3.2%</td>
<td>73</td>
<td>14</td>
<td>18.9%</td>
<td>2</td>
</tr>
<tr>
<td>2009</td>
<td>15,143</td>
<td>279</td>
<td>1.8%</td>
<td>58</td>
<td>10</td>
<td>17.2%</td>
<td>2</td>
</tr>
<tr>
<td>2010</td>
<td>15,188</td>
<td>1,057</td>
<td>6.9%</td>
<td>56</td>
<td>20</td>
<td>35.7%</td>
<td>7</td>
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<tr>
<td>2011</td>
<td>15,607</td>
<td>1,262</td>
<td>8.1%</td>
<td>108</td>
<td>49</td>
<td>45.4%</td>
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</tr>
<tr>
<td>2012</td>
<td>15,061</td>
<td>3,410</td>
<td>21.9%</td>
<td>260</td>
<td>135</td>
<td>51.9%</td>
<td>50</td>
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<tr>
<td>2013</td>
<td>13,416</td>
<td>1,213</td>
<td>9.0%</td>
<td>80</td>
<td>28</td>
<td>34.2%</td>
<td>2</td>
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<tr>
<td>2014</td>
<td>10,290</td>
<td>1,240</td>
<td>12.1%</td>
<td>74</td>
<td>17</td>
<td>23.0%</td>
<td>1</td>
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<tr>
<td></td>
<td>Totals</td>
<td>194,781</td>
<td>11,592</td>
<td>7,445</td>
<td>2,788</td>
<td>37.4%</td>
<td>739</td>
</tr>
</tbody>
</table>

*2004 was the first year equine WNV vaccine became available.

Objectives:

1. To determine the distribution and abundance of mosquitoes that may be carriers of WNV.
2. To determine the distribution and level of activity of the WNV in vectors and reservoirs in the Commonwealth.
3. To ensure effective and timely implementation of appropriate Arbovirus control strategies in potential and documented WNV situations.
4. To reduce potential mosquito production areas through source reduction programs across the Commonwealth that will assist both county and state government in responding to the potential for a WNV outbreak situation or other introduced vector-borne diseases.
5. To encourage, facilitate and financially support the development of county-based mosquito surveillance and control programs that promote source reduction through structural and educational efforts, application of larval controls using environmentally sound principles, while relying on adulticiding as a support tool in operational programs.
6. To maintain and refine an inter/intrastate agency shared data system to serve the joint efforts of DEP, PA DOH, PDA, county government and the Centers for Disease Control and Prevention (CDC) in WNV surveillance and control.

7. To ensure effective and timely communication between county, state, and federal government agencies, academia, health care providers, and the general public in matters pertaining to WNV.

8. To develop a statewide, long-term infrastructure that controls mosquitoes to reduce the risk to the public health from WNV and other vector-borne diseases that may be introduced into the Commonwealth.

WNV Program Authorizations:

1. All actions taken by DEP during the execution of this plan are authorized by and conducted in accordance with the following: Section 1917-A of the Act of April 9, 1929 (P.L. 177, No.175), as amended, known as the Administrative Code of 1929. 25 PA Code, Chapter 243.

2. The WNV Budget Authorization.

Roles and Responsibilities: PA DEP is the lead agency for WNV surveillance and control activities related to mosquitoes and other vectors, and as such will:

1. Conduct and/or support monitoring and investigations of WNV in arthropod, wild bird and animal populations to determine a baseline for its presence in PA and to develop intervention strategies to protect the public health.

2. Support county efforts to conduct education, surveillance, control, and source reduction for mosquitoes that may be carriers of WNV through technical support (i.e., mosquito identification, equipment and materials, technical training, etc.), funding grants, and data.

3. Develop and maintain a rapid response plan for mosquito surveillance and control of vectors where WNV has been detected or is suspected.

4. Conduct monitoring of mosquito populations for WNV in at risk nonparticipating counties.

5. Develop, implement, maintain and refine an interstate and intrastate agency shared data system to serve DEP, PA DOH and PDA, county government, and CDC in the joint efforts in WNV surveillance and control.

6. Coordinate communications related to mosquito surveillance and control with other local, state and federal agencies involved in WNV surveillance and control.
7. Communicate across the state to reach key audiences with basic information about mosquito prevention and control.

8. Obtain and enforce a Statewide NPDES Permit for the use of pesticides to control mosquitoes in Pennsylvania. The current permit # is PA0270741

**Education:** Education about mosquitoes, methods to control them (integrated pest management), and the DEP WNV Control Program are essential if the agency is to be successful in its vector management activities. Education will be conducted as two distinct tasks: Internal and Public Education. Each of these has a separate distinct objective. Internal education is defined as training and education of county coordinators, DEP staff, and other agency staff about mosquito surveillance and control. External education involves the provision of mosquito related information to the public.

1. Internal Education will focus on sharing information with partner agencies and providing them training. The specific objectives for this effort are:
   a. Maintain and refine an internal website to collect and share information.
   b. Provide training in general mosquito taxonomy, sampling protocols, and vector biology, as well as system data entry and retrieval for appropriate agency staff involved in the WNV effort.
   c. Provide training on integrated pest management.
   d. Provide training on larval and adult mosquito control practices in accordance with PDA and EPA guidelines.

2. The Public Education segment will focus on providing complete and accurate information and outreach communications to the general public. These activities will share general information and target key audiences with specific information. This education must be coordinated both within DEP and with other agencies involved in the WNV effort. The specific objectives for public education are:
   a. Improve public knowledge of the sources, reservoirs, and transmission of WNV.
   b. Encourage the elimination of mosquito breeding sites through source reduction by producing videos, fact sheets, and other educational materials, and by providing support to community relations coordinators on technical information relevant to WNV and mosquitoes.
   c. Develop and maintain web-based technologies to provide and share information and education outreach products (www.westnile.state.pa.us).
   d. Coordinate with partners to ensure the delivery of a unified message about mosquito production areas, source reduction, and other related activities (Appendix I).
e. DEP will continue to develop and maintain an inter/intrastate agency shared data system to serve DEP, PA DOH, PDA, county governments, neighboring states and CDC in joint efforts in WNV surveillance and control.
Surveillance:

1. Surveillance systems quantify the potential for disease and vector activity at a given time, predict the probable future course of the disease cycle, and indicate when control should be started to prevent epizootic or epidemic transmission. This requires that surveillance programs be long term, proactive projects, gathering and analyzing data in epidemic and non-epidemic years to provide a basis for setting thresholds and decision-making. No single technique can collect all of the data needed for a rational assessment of the risk of vector-borne disease. Because arbovirus cycles are complex and components of the cycle vary regionally, threshold levels and indicator parameters must be determined individually for each surveillance region. Current year data should be compared with historical data for the same region or locality, rather than looking for absolute index values. The appearance of human or animal cases is unlikely to be associated with a specific value of a single index (e.g. vector females per light trap night) over large geographic areas. However, such indices may prove locally useful.

2. Disease surveillance is a public health process for the identification of the presence of mosquito-borne disease agents, which allow for appropriate intervention using a variety of methods to mitigate further circulation of such disease agents in nature. The process relies on prompt collection of accurate, relevant infectious disease information; the quality and quantity of data analysis and report dissemination; and the rapid implementation of appropriate disease prevention and control programs. The program recognizes that more timely identification of infectious agents and implementation of disease prevention efforts have potential to significantly cut associated health-care costs and reduce infectious disease morbidity and mortality caused by the secondary spread of the infectious agent within the Commonwealth.

3. Mosquito surveillance and control is an essential part of this mosquito-borne disease control program. This will require commitment of regional and central office DEP staff, as well as significant support from county/local governments, citizen volunteers and other state agencies.

4. Considering Pennsylvania’s size, social and political complexities, and mosquito habitat diversity, the most effective way to control mosquitoes in the Commonwealth is through county and local programs.

5. The creation of the PA WNV Mosquito Surveillance & Control Program in 2000 was the first statewide mosquito surveillance program in PA since before 1985. Prior to 1985, the Department of Environmental Resources in some areas of the Commonwealth conducted limited mosquito surveillance. WNV is a relatively new arbovirus for the United States, and its yearly transmission cycle and impacts are constantly changing. The following guidelines are built around scientific and technical information that may change over time, and therefore the plan will require constant review and revision as new information becomes available.
6. DEP will continue a comprehensive mosquito surveillance program. The program’s emphasis will be mosquitoes and other arthropods that may carry WNV. Surveillance will be conducted across the Commonwealth in a manner that is recommended by CDC and health professionals in an effort to reduce at-risk human and horse populations.

7. DEP has developed standardized sampling to determine the distribution and activity level of WNV activity and now concentrates on counties with at-risk human and horse populations. This information assists in determining the potential for virus transmission and provides a baseline for possible mosquito vectors across the Commonwealth. Sampling and testing results will be maintained on the WNV data system.

8. DEP will maintain laboratory facilities to support county and Commonwealth vector management activities. This will include identification and counting of mosquitoes and potential vectors, developing pools for testing as well as testing pools using polymerase chain reaction (PCR) in the DEP lab. Pools will also be sent to PA DOH Bureau of Laboratories (BOL) for WNV testing to increase the program’s testing capacity.

9. Since PA currently has WNV present statewide, larval mosquito control will be conducted when significant populations of mosquito species implicated in WNV transmission are found. When WNV activity has been found in an area, surveillance and mosquito control will be increased. This increase in both surveillance and control activities will identify and decrease the likelihood of future WNV transmission to the human and animal population. Some activities associated with the identification of WNV in the Commonwealth are:

a. Adult and larval mosquito sampling and control will be conducted and expanded as needed to reduce the likelihood of transmission. Additional surveillance will be conducted to determine the levels of treatment effectiveness and to determine the need for additional treatments.

b. All information will be shared with the appropriate state agencies.

c. DEP will provide support and assistance in development of county resources to conduct this program.

d. This increased surveillance and control will continue based on mosquito populations and virus monitoring results until DEP, PA DOH, and PDA determine that the likelihood for transmission of WNV has been halted.

e. Surveillance will include conducting mosquito sampling to determine species composition, abundance, geographic distribution, and presence of WNV. This will include collection of mosquito larvae, pupae, and adults.

f. Properly collected adult mosquitoes will be tested for WNV and other arboviruses. The number of sites sampled and the frequency of the sampling will be based on
historic and current mosquito populations, citizen complaints, potential for disease transmission, WNV surveillance information, and other environmental factors.

**Source Reduction:** Source reduction is an important part of an integrated pest management program. Whenever possible, source reduction is the preferred solution to mosquito control, because it permanently eliminates the mosquito production site. Source reduction includes:

1. DEP will develop education/outreach tools to encourage individual awareness and responsibility for eliminating backyard mosquito sources through individual actions such as properly maintaining birdbaths and water gardens, proper container storage, etc.

2. DEP will target tire pile breeding areas. The program will work with the Bureau of Land Recycling and Waste Management to develop strategies for proper recycling of waste tires across the Commonwealth.

**Control:** Control efforts will be based on protecting public and animal health using a graded response and integrated pest management tools that will minimize environmental impacts.

1. County or local mosquito programs are encouraged to conduct prevention and control activities using integrated pest management practices. DEP will provide technical support for these activities.

2. The county will be encouraged to carry out prevention and control activities through both local and state funding, whether by using their existing staff or by contracting for services. DEP will work with the county to activate the control strategies to address the situation. DEP will provide technical assistance and reimburse eligible costs.

3. Counties deemed by DEP to have the highest risk for WNV transmission are eligible for grants for surveillance and control activities. The decision to participate and the level of participation are made at the county level. If the County cannot provide the required mosquito control, DEP will initiate intervention strategies to reduce the potential for transmission of the virus on a temporary basis in localized areas. An appropriate control method will be selected based on the location, habitat, and magnitude of mosquito populations, population at risk, and other factors. Applications relying on ground-based larviciding and/or ground-based-adulticiding may be used to reduce the potential for virus transmission. Mosquito control programs regularly use a variety of pesticides.

4. Control of mosquito pupae requires either monomolecular films or oils. These products will be used on a case-by-case basis.

5. All Contractor, County, and DEP staff that conducts mosquito control activities will maintain certification for application of pesticides for mosquito control. Adult mosquito control will be initiated based on mosquito populations and virus presence as defined in the surveillance program. All adulticiding for WNV must be done with prior State consultation and concurrence in order to receive grant funding. DEP will develop and
manage a contract for application of mosquito control materials that will be available to county government.

6. The specific control agents used will be determined based on the extent and nature of the outbreak. When WNV has been found in an area, or when there is a need for adult control to prevent significant virus amplification and transmission as determined by surveillance, adulticiding will be handled by one of the following methods:

a. County purchases adulticiding equipment and materials and conducts adulticiding with county staff. The costs of the equipment, materials and manpower to conduct the adulticiding would be grant eligible, and should be included on the grant application. DEP has also purchased adulticiding equipment and materials and conducts adulticiding events in counties that are not receiving DEP grants and also supports those counties that receive grants when additional help is requested.

b. The larvicides currently being used in The WNV Control Program’s larval control strategy includes the bacteria: *Bacillus thuringiensis israelensis* (Bti) and *Bacillus sphaericus* (Bsp), the growth regulator, methoprene, and spinosad. Both Bti and Bsp are naturally occurring bacteria found throughout the world. Both of these products have shown very low environmental impacts when used in mosquito control. Methoprene is a biorational control agent that interferes with the normal development of mosquito larvae. Spinosad is a natural substance made by a soil bacterium that is toxic to mosquito larvae. Hand application, truck-mounted, and/or aerial equipment may be used for larvicide applications.

c. The adulticides presently being used by DEP and county programs are all EPA and PDA registered products. The decision of which product to use will be determined on a case-by-case basis.

**Surveillance and Control Funding:** County grants are designed to develop the surveillance network being established across the Commonwealth for both the WNV and mosquitoes that may carry the WNV. The funds will also support mosquito control activities directed at mosquitoes that are implicated in WNV transmission.

1. DEP will provide financial and technical support, as well as, mosquito identification, virus testing, outreach training, and information exchange.

2. Grant funding will include surveillance costs, larviciding costs for mosquito species implicated in WNV transmission, and adulticiding costs for adult populations of mosquito species that are implicated in WNV amplification and transmission. Material, manpower, equipment, and training, especially for pesticide licenses and education/outreach are also eligible for funding.

3. Counties are eligible for grants for reimbursement of surveillance and larval control costs. The decision to participate and the level of participation are made at the county level. If a county decides not to participate, DEP staff will conduct limited surveillance
in the county as needed. Some counties will not be offered grants. DEP will determine if limited surveillance will occur in these counties. If DEP receives reports of WNV activity (human, wild dead birds, equine) in any of these non-granted counties, DEP will perform surveillance, and if needed, control to reduce the risk of WNV transmission to susceptible human or horse populations.

4. This funding is designed to develop a surveillance and control network across the Commonwealth for both the WNV and mosquitoes that may carry the WNV.

5. Participation is voluntary, and DEP will provide 100% funding for: salaries/benefits, administration, travel/training, equipment/supplies, contracted services, education/outreach, pesticide certification licenses, larviciding costs, and adulticiding costs when deemed appropriate by DEP.

6. When funding is approved, DEP will develop and execute an agreement with the county.

Special Study Funding: In addition to surveillance and control, when program funds allow, funding will be made available for special studies to support vector surveillance and suppression activities.

1. This special study funding will be used to develop an educational network that will provide support to deal with any vector-borne diseases that may be imported to PA in the future.

2. This will serve as a source for continuing education for both local and state governments.

3. These funding projects would include studies of specialized approaches focused on detailed mosquito studies or disease surveillance studies appropriate to PA.

4. These studies would be designed to determine baseline information for WNV in PA, other possible vectors, and possible control strategies.

5. These projects would be reviewed on a case-by-case basis, accepting only studies that would address needs or concerns specific to PA.
VETERINARY SURVEILLANCE

Sentinel Chicken Program: From 2003 to 2007, the Department of Agriculture’s sentinel chicken program was utilized with other surveillance to direct DEP mosquito control efforts. Sentinel site requirements included proximity to large human populations, proximity to previously identified pools of bird-biting mosquitoes, and sources of stagnant water. If positive chickens were identified, DEP was notified to increase local mosquito surveillance and control efforts. In general, four sentinel sites were placed strategically throughout the Commonwealth based on the positive results from the previous year. In 2008, the sentinel chicken program was discontinued because an analysis of the program’s cost/benefits ratio determined that the information provided by the sentinels no longer made the program cost effective.

Veterinary Diagnostic Samples:

1. The Pennsylvania Veterinary Laboratory in Harrisburg, (PVL) can test serum samples obtained from horses showing neurological symptoms consistent with WNV infection. The serum samples are tested using the IgM Capture Enzyme-Linked Immunoassay (ELISA).

2. Tissue samples collected from any diagnostic specimen (dead animal), submitted for necropsy, can be tested at PADLS Laboratories for WNV using Immunohistochemistry (IHC) and/or Real-time Polymerase Chain Reaction (RT-PCR) if the referring veterinarian requests the testing or if the case coordinator suspects WNV infection. Real time RT-PCR can be run for all species on formalin fixed tissues.

3. Serology samples for species, other than equine, are forwarded to the National Veterinary Services Laboratories (NVSL).

4. Samples from equine specimens submitted for rabies testing and found negative for rabies can be tested on request for WNV using IHC and/or PCR. Tissue samples from exotic birds are also tested at PVL.

5. When positive equine samples are identified at PVL, the notification protocol is used:
   a. The laboratory will send a fax with the test results to the referring veterinarians.
   b. WNV is a reportable disease in Pennsylvania and all laboratories with positive test results should notify PDA of those results.
   c. The WNV Coordinator at the Department of Agriculture Bureau of Animal Health and Diagnostic Services will provide owner contact information to DEP (information is to be kept confidential) so that DEP can conduct a risk analysis on their property.
   d. Samples from other species, including livestock and pets, will be referred to NVSL or Cornell diagnostic laboratories for testing.
e. Specimens submitted from exotic birds will continue to be treated as diagnostic specimens rather than part of the dead bird surveillance program, and may be submitted directly to PADLS for testing.
BIRD SURVEILLANCE

Background: The monitoring of dead birds is an integral component of the PA WNV surveillance program. There are two important aspects of the program, namely reporting of sick or dead birds by citizens and the testing of dead birds. Data suggests that Corvids and Raptors are the species most susceptible to serious illness from WNV infection. They suffer increased morbidity and mortality compared to other avian species. This characteristic makes dead or dying Corvids and Raptors the best surveillance measure for the existence of viral activity in a general geographic area potentially enabling public health and mosquito control units to respond quickly with preventive modalities to reduce the possibility of human and/or equine cases occurring. In 2015 DEP will be testing only Corvids and Raptor species of birds.

Dead Bird Surveillance:

1. In 2015, the DEP will receive and test dead Corvid and Raptor species that appear to have died from WNV infection. Samples for testing will be obtained utilizing oral swabbing for PCR testing, as recommended by CDC.

2. Effective partnering with the public and with other agencies is imperative for the dead bird surveillance program to be effective. WNV County Program will determine whether birds should be submitted for testing and WNV county personnel will either pick up the dead bird or inform the public where the dead bird can be dropped off. The WNV county personnel will swab and submit the sample to the Harrisburg DEP Laboratory for testing.

Bird Reporting and Submission Protocol:

1. In order to ensure a uniform level of surveillance and standard practices to measure the level of WNV in a county and the effectiveness of control, DEP has established a protocol for staff to both record reported sightings and to submit dead birds for testing.

2. DEP will alter criteria as needed based on future CDC Guidelines, circumstances, resources and laboratory capacity.

3. In an effort to be sure to detect WNV mortality in species other than Corvids and Raptors, if five or more dead wild birds (except pigeons) are found in one location (no limits per week or per jurisdiction), first contact the appropriate regional PGC office and then, if required, the PGC Wildlife Veterinarian Justin Brown DMV, PhD. This protocol was revised in July 2006. (Appendix III and Appendix V).

4. Dead bird surveillance and testing will continue in 2015 to reflect the focus of the program, which is to control the spread of WNV. Citizens will be encouraged to report all dead birds on the WNV website.

5. County and DEP staff will record all dead bird reports and then determine the dead birds that will be tested. Per the Dead Bird Protocol, counties will be limited to five (5)
submissions per week throughout the surveillance season (May 1, 2015 thru October 31, 2015). All birds will be submitted through DEP.
HUMAN SURVEILLANCE

Background: An essential component of an enhanced surveillance program for viral encephalitis includes the need to ensure rapid and complete laboratory diagnosis of all suspect cases. In addition, human surveillance is just one component of an effective Arbovirus surveillance program and should be coordinated with mosquito, avian and animal surveillance programs. Information from all of these programs should be used to determine the need for mosquito control efforts to prevent future outbreaks of WNV. Encephalitis and viral meningitis are two of 68 reportable diseases and conditions in PA. Physicians are required to report all suspected cases to BOE. However, physician reporting in general is not as reliable as laboratory-based reporting. Since most cases of encephalitis are diagnosed based on clinical criteria in the absence of laboratory testing, significant under-reporting of encephalitis is the norm. Therefore, to ensure detection of a human WNV disease outbreak, enhanced surveillance for viral encephalitis was implemented across PA when mosquito activity begins until several weeks after the first frost. Enhanced surveillance for WNV encephalitis includes periodic health notices and other educational pieces to health care providers and the public.

Goal: The goal of the WNV prevention and control program is to reduce expected morbidity and mortality, health care costs, and the financial impact that a WNV outbreak would have upon PA industry (i.e., Agriculture, Fishing, Health, Hunting, Tourism, etc.).

Human Surveillance Guidelines for WNV Encephalitis/Fever: Enhanced surveillance for human cases of viral encephalitis/Fever is recommended by CDC as the key system to detect WNV infection/activity in an area. Information regarding WNV/Arbovirus will be distributed to selected Commonwealth Health Care Providers. Health care personnel are to immediately report cases of viral encephalitis of unknown etiology and cases that test positive for antibodies to WNV or Saint Louis Encephalitis Virus (SLE). The following options for WNV surveillance are based on level of risk for an outbreak in 2015. BOL will implement enhanced surveillance for encephalitis/fever from the beginning of May to the end of October.

1. Enhanced Case Surveillance (Implemented in all counties): Enhanced surveillance for viral encephalitis/fever will be implemented during May - October. Human surveillance information will be mailed to hospitals and physicians regarding the importance of physician reporting, criteria for reporting and instructions for submission of appropriate laboratory specimens (CSF, acute and convalescent sera, brain tissue {from fatal cases}) for WNV testing (Appendix IV). Using the Health Alert Network an initial message summarizing the 2015 WNV season and outlining criteria for reporting and laboratory testing will be sent to all hospitals and selected physicians in PA.

2. Commercial Laboratory Surveillance: Laboratories are required to report patients with positive Arbovirus serologies (including SLE) to the PA NEDSS (Pennsylvania’s National Electronic Disease Surveillance System). BOL will provide the commercial laboratories with instructions on forwarding selected specimens to the state laboratory for confirmation.
3. **Surveillance Criteria for Human Encephalitis and Meningitis:** During the 1999 outbreak in New York City, two-thirds of the encephalitis cases were associated with severe muscle weakness. Documentation of muscle weakness was based on neurologic examination and/or EMG findings. Therefore, case ascertainment should include encephalitis with muscle weakness, which may be more likely to represent WNV than other viral causes of encephalitis. The background rate of viral meningitis is significantly higher than encephalitis and mostly due to enteroviruses during the summer and fall months. Therefore, the decision to include viral meningitis in the surveillance criteria needs to recognize that the increase in caseload may improve case detection but will generate significantly more testing requests. To lessen the laboratory burden of testing cases due to enteroviral meningitis, which is more common among young children, case criteria will restrict aseptic meningitis cases to children aged 2 years or older. Effective January 1, 2005 CDC recommended that all non-neuroinvasive diseases caused by Arboviruses be added to the National Notifiable Disease List (NNDL), especially the arboviral fevers caused by WNV, SLE, EEE, etc.

4. **CDC Case Definitions:**

   a. For full text of the arboviral disease case definition click [here](#).

   b. **Mild Infection (Non-neuroinvasive disease):** Most WNV infections (~80%) are clinically asymptomatic. Approximately 20% of those infected develop a mild illness (West Nile fever). The incubation period is thought to range from 2 to 15 days, following the bite of an infected mosquito. Symptoms generally last 2 to 7 days. Reports from earlier outbreaks describe the mild form of WNV infection as a febrile illness of sudden onset often accompanied by headache, arthralgia, myalgia, fatigue, maculopapular rash <20%, lymphadenopathy <20%. Although not observed in recent outbreaks, myocarditis, pancreatitis, and fulminant hepatitis have also been described.

   c. **Severe Infection (Neuroinvasive disease):** Approximately 1 in 150 infections will result in severe neurological disease. The most significant risk factor for developing severe neurological disease is advanced age. Encephalitis is more commonly reported than meningitis. In recent outbreaks, symptoms occurring among patients hospitalized with severe disease include fever, headache, aseptic meningitis, stiff neck, a change in mental status from confusion to coma, additional signs of brain dysfunction (e.g. paralysis, cranial nerve palsies, sensory deficits, abnormal reflexes, generalized convulsions, and abnormal movements. Some patients experienced severe muscle weakness and flaccid paralysis. Although not observed in recent outbreaks, myocarditis, pancreatitis, and fulminant hepatitis have also been described.

   d. **Clinical Suspicion:** Diagnosis of WNV infection is based on a high index of clinical suspicion and obtaining specific laboratory tests. WNV, or other arboviral diseases such as St. Louis encephalitis, should be strongly considered in adults ≥50 years who develop unexplained encephalitis or meningitis in summer or early fall. The local presence of WNV enzootic activity or other human cases should further raise suspicion. Obtaining a recent travel history is also important. Year-round
transmission is possible in some areas. Therefore, WNV should be considered in all persons with unexplained encephalitis and meningitis. Clinicians should have a high index of suspicion of WNV infection when a patient presents with unexplained neurological deficits. Note: Severe neurological disease due to WNV infection has occurred in patients of all ages.

System for Data Flow and Information Sharing for Human Surveillance:

1. The physician/hospital will complete an initial case report (ICR) form (Appendix IV) on a patient with viral meningoencephalitis. The ICR form with the clinical specimen(s) will be mailed to the BOL in Exton, PA for testing. If the test results are reported as positive, the physician will contact and fax the form to the BCHS District Office (DHO) or County/Municipal Health Department where the case-patient resides.

2. Data from the ICR form will be entered into a secure, confidential site separate from the WNV database by BOE. BCHS-DHO or County/Municipal Health Department will mail the ICR form to BOE for data entry on the database. BCHS-DHO or County/Municipal Health Department will be responsible for obtaining and updating essential missing information (e.g., dates of onset and specimen collection).

3. BOE will ensure that data on lab results are entered into the database. BOE will review the database regularly to look for errors, missing variables, duplications, etc. All new data on positive WNV human cases will be made available only to BOE and BCHS-DHO or County/Municipal Health Department involved, before sharing with other counties.

PA DOH Roles and Responsibilities:

1. All PA DOH District Offices in the Bureau of Community Health Systems and County/Municipal Health Departments should implement enhanced WNV surveillance in May and continue through October. Field staff are responsible for the following:

   a. To coordinate all case surveillance activities, including tracking suspect case reports, ensuring submission of appropriate laboratory specimens to BOL, and to obtain missing data (e.g., onset and collection dates, clinical syndrome) on the initial case report form and completing WNV case investigation forms for all positive cases.

   b. To develop the capacity to ensure that convalescent sera will be obtained on all clinically suspect encephalitis cases that do not test positive on acute specimens collected within eight days after illness onset in order to more definitively determine the presence or absence of WNV as the etiologic agent.

   c. To provide the name and telephone number of the County WNV Coordinator to the patient/family who tested positive for the WNV so that the family may voluntarily call the DEP Coordinator for any questions about mosquito abatement or control.
d. To provide medical outreach and consultation to physicians in their counties regarding WNV cases reporting and testing criteria.

2. Bureau of Epidemiology (BOE) staff are responsible for the following:

   a. To develop and maintain surveillance materials (including instructions for specimen collection, submission forms for requesting viral laboratory testing and case investigation forms) (Appendix IV).

   b. To send a Health Alert from the Secretary of Health describing the previous WNV season to all health care providers in PA by April 1. It will include the Surveillance criteria for diagnostic testing of suspect cases of WNV infections, instructions for collection and shipping of specimens and test result notification and the laboratory submission form.

   c. Provide timely summary data on human surveillance activities in PA.

3. Bureau of Laboratory (BOL) staff are responsible for the following:

   a. BOL will prioritize WNV serologic and virology testing on all suspect cases, especially during the mosquito season from May through October.

   b. Ensure timely sharing of laboratory test results for WNV on a secure site.

**Blood Donors:** WNV was first detected from organ transplants in 2002 through blood transfusion. Since July 2003, blood donors across the nation have been screened for the WNV. The American Red Cross performs the screening for WNV and if antibody positive, the blood is withdrawn from circulation. Confirmatory tests are performed by the American Red Cross, who then submits a report once a month to the state WNV coordinator giving the date of birth, gender and ZIP code of the donors who tested positive.
Table 4

<table>
<thead>
<tr>
<th>Positive Blood Donors</th>
<th>Pennsylvania</th>
</tr>
</thead>
<tbody>
<tr>
<td>2003</td>
<td>2</td>
</tr>
<tr>
<td>2004</td>
<td>1</td>
</tr>
<tr>
<td>2005</td>
<td>4</td>
</tr>
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</tr>
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</tr>
<tr>
<td>2014</td>
<td>4</td>
</tr>
<tr>
<td>Total</td>
<td>20</td>
</tr>
</tbody>
</table>
LABORATORY SURVEILLANCE

Overview: WNV is an Arbovirus, meaning an arthropod vector transmits it. Common Arboviruses include Eastern and Western Equine Encephalomyelitis viruses, Dengue, Yellow Fever and Powassan. Most of these are transmitted by mosquitoes, a few, such as Powassan are tick-borne. The range of clinical illness caused by Arboviruses varies greatly. However, most of the clinical illnesses caused by these viruses are encephalitic in nature.

1. WNV belongs to the Flaviviridae family of viruses. St. Louis Virus, Powassan and Dengue are other members of this family. Because these viruses share some degree of genetic relatedness to WNV, cross-reaction may occur in serologic tests.

2. This section outlines the protocols and procedures for WNV testing. It includes general safety and introductory as well as specific WNV testing protocols and procedures. These include Fluorescent Antibody and ELISA testing for human clinical specimens for IgG and IgM antibodies, viral isolation and PCR for selected clinical specimens, mosquito pools, avian and animal tissues. Many of the procedures and protocols are similar or identical to those used in the general immunology and virology area (Table 2).

Table 5
West Nile Virus Testing at the Bureau of Laboratories

<table>
<thead>
<tr>
<th>Test</th>
<th>Method</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>FA testing</td>
<td>4-quadrant slide using a fluorescein labeled conjugate</td>
<td>Panel of IgG and IgM tests obtained from Focus Laboratories and contains SLE, EEE, WEE and CE/LaCrosse (the California Encephalitis Group)</td>
</tr>
<tr>
<td>Mosquito pools and avian samples</td>
<td>All tested by TaqMan PCR;</td>
<td>CSF specimens accepted when recommended by Department of Epidemiology. Specimen should be from a patient with severe neurological deficit. If cell culture exhibits any CPE, then it is tested for WNV using TaqMan PCR. If this PCR is negative for WNV, then the culture is tested by FA for agents listed above. Animal samples accepted on a limited basis</td>
</tr>
<tr>
<td>Human and animal testing (Non-human mammals)</td>
<td>Tissues and selected CSF tested by TaqMan PCR and cell culture.</td>
<td></td>
</tr>
<tr>
<td>Human Testing</td>
<td>All CSF are tested for WNV IgM using ELISA</td>
<td>We are currently unable to test all specimens by PCR for SLE, LAC and EEE.</td>
</tr>
<tr>
<td>Misc. testing</td>
<td>TaqMan PCR is available for SLE, LAC and EEE upon special request.</td>
<td></td>
</tr>
</tbody>
</table>

Commonwealth of Pennsylvania 28 West Nile Control Program 2015
PRNT will be sent to CDC

<table>
<thead>
<tr>
<th>SLE – St. Louis Encephalitis</th>
<th>EEE = Eastern Equine Encephalitis</th>
</tr>
</thead>
<tbody>
<tr>
<td>WEE = Western Equine Encephalitis</td>
<td>LAC = LaCrosse Virus</td>
</tr>
<tr>
<td>WNV = West Nile Virus</td>
<td>FA = Fluorescent Antibody</td>
</tr>
<tr>
<td>PCR = Polymerase Chain Reaction</td>
<td>ELISA = Enzyme Linked Immunosorbent Assay</td>
</tr>
<tr>
<td>CPE = Cytopathic Effect</td>
<td>CSF = Cerebrospinal Fluid</td>
</tr>
<tr>
<td>PRNT = Plaque Reduction Neutralization Test</td>
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</tr>
</tbody>
</table>
BIOSAFETY

WNV is classified as Biosafety Level 3 (BL-3) agent by the Subcommittee on Arbovirus Laboratory Safety of the American Committee on Arthropod-Borne Viruses, and CDC. As such, all laboratory work that may result in exposure to WNV requires appropriate Biosafety Level Three containment.

1. The 11/8/1999 CDC Epidemic/Epizootic WNV Workshop recommended the following:
   a. Since WNV may be present in acute-phase serum and CSF specimens, any potentially contaminated specimen aliquots to be used for serology should be heat inactivated at 56°C for 30 minutes, if testing is to be performed in a BL-2 workspace.
   b. If only BSL-2 containment is available in a laboratory, all potentially contaminated clinical material should be processed in a Class 2 Biosafety Cabinet located in laboratory rooms with restricted access.
   c. Aerosol producing diagnostic procedures (e.g., ELISA plate rinsing) should be performed in a Class 2 Biosafety Cabinet located in laboratory rooms with restricted access.
   d. All potentially infected bird necropsies should be done in a Class 2 Biosafety Cabinet located in laboratory rooms with restricted access. Similar safety concerns also exist for any necropsy procedure on a potentially infected animal that may create an aerosol of WNV contaminated fluids.

2. Since WNV virus may be transmissible to humans via contact and aerosol:
   a. For increased protection from any exposure, it is recommended that an individual wear gloves or put a plastic bag over his/her hand before touching a dead animal or bird. Subsequently, we recommend double-bagging the dead bird or animal, and disposing of it in the garbage. Immediately after disposal the handler should wash his or her hands with soap and water.
   b. If a person needs to pick up a dead bird or local authorities tell you to simply dispose of it: Avoid barehanded contact with any dead birds/animals, and use gloves or an inverted plastic bag to place the bird carcass in a garbage bag.
   c. Since bird excreta can contain potentially infectious organisms, persons should be careful when cleaning and removing bird excrement. Birdbaths and feeders should be washed or disinfected regularly. A person should wash his or her hands with soap and water after touching the baths/feeders.
   d. There is currently no evidence indicating direct bird-to-human transmission via aerosols. However, protective measures recommended for those handling live wild
birds include wearing gloves and a facemask to prevent exposure to any organism that may be shed and aerosolized while the bird is being handled.

3. If Avian Influenza (H5N1) is reported in North America DEP will suspend dead bird pick-up. However, dead bird sightings will still be monitored on the WNV website.

**Reporting of Laboratory Testing for WNV:**

1. If a case meets the surveillance criteria, the hospital or physician will be provided information on how to submit appropriate diagnostic specimens for testing by the BCHS-DHO or the County/Municipal Health Department. BOL will perform viral testing for WNV, including PCR testing Enzyme-Linked Immunosorbent Assays (ELISA), and Fluorescent Antibody (FA). Plaque reduction neutralization tests (PRNT) will be sent to CDC on selected early season ELISA IgM positive cases.

2. BOE staff will encourage physicians and laboratories to complete all essential information on the laboratory submission forms, including clinical and risk factor data, and symptom onset and specimen collection dates.

3. If there is an insufficient quantity of CSF for both IgM capture ELISA, the ordering physician will determine testing priorities.

4. Patient information and laboratory data will be shared between BOE and BCHS-DHO or the County/Municipal Health Department in a secure manner to facilitate case surveillance, and timely reporting of laboratory results back to them.

5. In the event that acute specimens (obtained within eight days of illness onset) are negative by PCR or ELISA testing, laboratory diagnosis of WNV will require that a follow-up (convalescent) blood test be obtained at least 2 weeks after the acute specimen to evaluate for the presence of convalescent antibody to the virus. Since most patients will have been discharged from the hospital, BCHS-DHO or the County/Municipal Health Department may need to arrange for obtaining convalescent blood specimens on all suspect case-patients who have indeterminate or negative initial test results.

6. BOE staff will work with hospitals and physicians to encourage testing for those patients that meet criteria for meningoencephalitis or flaccid paralysis.
PLANNING

1. A Statewide conference call with DEP, PDA, PA DOH and the participating counties, County/Municipal Health Department’s staff will be scheduled as needed during the WNV season.

2. Education materials are also available on the WNV public website for the public, health care providers and other professionals.
INFORMATION SYSTEM

Background: The WNV Control Program utilizes a spatially driven information system for following and responding to WNV activity in PA. This system collects information on the presence of the virus in PA in any vector, host, or reservoir, identifies mosquito-breeding areas, and helps target control efforts. The system facilitates communication with the public, county governments, and State agencies.

Information System Description:

1. Web applications enable field data submittal from program personnel as well as data submittal from State laboratories and reporting to all participating organizations. Additionally, web site technology allows the sharing of information with the public and a forum for the public’s concerns and questions about WNV. The system maintains a centralized surveillance/control database updated and shared by participating agencies.

2. The key element in the database is the use of a Unified Sample Identification (USI) code across different agencies. The USI ensures that all information about a sample can be kept together in the database. The USI is encoded in a barcode that is affixed to samples as they are collected, and then remains with the sample throughout all analyses. Each agency that processes the sample creates a new barcode that includes the original number plus additional identifiers and affixes it to the sample as it moves to the next part of the process. The barcode increases the efficiency and accuracy of sample processing by replacing tedious hand entry of long numbers with an electronic scanner. It also allows each agency to see information already entered on a sample as it is received, thereby eliminating duplicate data entry for the same sample.

3. Each record in the database is spatially aware and available in real-time reporting. This improves the integrity of the data used in decision making for virus control as well as information presented to the public. It also improves the efficiency of data flow for quick and effective response and public reporting.

4. The system utilizes Internet technology, the World Wide Web, and Geographic Information Systems (GIS) for data exchange and analysis. DEP maintains a secure internal website that serves the multi-agency effort as well as the county partners. This website is password protected and allows each agency to see other agencies’ shared information in addition to their own information. DEP also maintains a public website to increase public knowledge of WNV and its activity across the Commonwealth.

System Architecture: The WNV information system is run from two separate servers.

1. One server houses the database that is the repository for all data collected as well as the data coming from the laboratories and field offices of DEP, PDA, and PA DOH.

2. The other server functions as the web server, displaying all the information on the internal web site to the users. This is the server that the users interact with directly.
There is a third server that supports the public website (this server also supports other Commonwealth public web pages).

**Data Analysis:** Data analysis is an important component of Pennsylvania’s ability to respond to WNV activity. The system enables analyses governing mosquito control activities to be completed by different agencies, in addition to allowing interagency decisions to be made quickly and efficiently. Different agencies’ management personnel are able to view pertinent information simultaneously and make decisions and recommendations concerning situations that need immediate attention.

1. **Field Collection Data:** Collection of field data is performed by State and county employees. Once they return to their office, staff can input their field information into the centralized database through the Internet using various data collection web forms that include a quality control process.

2. **Point Locator:** The Point Locator on the internal website allows users to utilize street addresses, zip codes, watersheds, and county/municipal maps to spatially locate their samples. This process determines the latitude and longitude coordinates of the location entered/chosen by the user, which is then recorded in the database along with the remainder of the sample information.

3. **DEP Laboratory Data Analysis:** In the DEP Laboratory, mosquito samples are counted and identified by DEP taxonomists. Samples are received at the lab by scanning the USI on the bar-coded label, and the lab staff can view the collection information about that sample. Samples that are suitable for testing are sorted into pools by species, given new bar-coded labels, some are sent to PA DOH for virus testing while the majority are tested in the DEP laboratory. Samples not suitable for testing are identified and counted. The results of species identification and counting are entered into the database at the DEP laboratory via a Web-enabled data entry form.

4. **PDA Laboratory Data Analysis:** PADLS laboratories report WNV testing results into the PDA Laboratory Information Management System (LIMS). PADLS laboratories and other laboratories required to provide PDA with positive WNV results. Positive results (by species) are entered into the database at PDA via a web-enabled data entry form.

5. **PA DOH Laboratory Data Analysis:** In the PA DOH BOL, surveillance samples from mosquito, veterinary (PCR testing) and human are tested for WNV. Samples are received at the lab by scanning the USI on the bar-coded label, and the lab staff can view the collection information about that sample. The results of analyses are entered directly into the database via a Web-enabled data entry form. The laboratory also has the capability of viewing background demographics and sample collection information about any sample they receive. The system is able to create real-time reports of testing results from different participating agencies.

**Management Reporting:** Management reporting serves two main purposes.
1. Its first purpose is to keep track of sample information. Most of these reports are provided automatically via the Web.

2. The second purpose is to provide information for analysis for the decision making process.

Public Reporting: DEP maintains the public Web site for the PA West Nile Program (www.westnile.state.pa.us). This site provides information about WNV, including a summary of surveillance results. These summary reports are updated daily from the database at the state and county level, and include maps. The human surveillance report will include the number of blood donors who tested positive for the whole State but no other details will be given.

PA WNV Secure system (Internal Web site): Only personnel from DEP, PA DOH, PDA, County and Municipal Health Departments who have access to the internal website will be able to see the date of onset of symptoms of human cases reported. This information will not be released to the general public, but the information will be utilized by DEP for timely mosquito abatement purposes. Blood donors who test positive for WNV will have their demographics posted, including age, gender and Zip code. This information will not be released to the general public.
ACRONYMS and ABREVIATIONS

BSL-3: Biosafety Level Three
CDC: Centers for Disease Control and Prevention
DEP: PA Dept. of Environmental Protection
PA DOH: PA Dept. of Health
BCHS-DHO: Bureau of Community Health Systems – District Health Office
BOE: Bureau of Epidemiology
BOL: Bureau of Laboratories
EEE: Eastern Equine Encephalomyelitis
ELISA: Enzyme-Linked Immunosorbent Assay
ICR: Initial Case Report
IgM and IgG: Short-term and Long-term Antibodies
IHC: Immunohistochemistry
NVSL: National Veterinary Services Laboratory
PCR: Polymerase Chain Reaction
PDA: PA Dept. of Agriculture
PGC: PA Game Commission
PRNT: Plaque Reduction Neutralization Test
PVL: PA Veterinary Laboratory
WNV: West Nile Virus

TERMS and DEFINITIONS

MOSQUITO SAMPLING:

Sample: All arthropods collected in one sampling effort
Pool: Subsamples of virus isolation samples tested together by species

ARTHROPOD STATUS:

Collected: All arthropod (larval or adult) samples collected in any sampling method
Submitted: Adult arthropod pools sent to PA DOH for virus isolation
Suitable sample for testing: All arthropod samples that arrive at the laboratory preserved to prevent degradation of virus
Not-suitable sample for testing: All arthropods samples that arrive at the lab that are not adequately preserved to prevent degradation of the virus
Tested: All arthropod pools whose testing results have been received

AVIAN SAMPLING:

Dead Birds: Five dead birds per week per county (Corvids and Raptors) during the season.

AVIAN STATUS:

Sighted: All dead birds observed with information provided to DEP, but not submitted for testing
Submitted: All dead birds received at a lab for testing
Suitable bird for testing: All dead birds that meet submission criteria
Not-suitable bird: All dead birds severely decomposed or do not meet submission criteria
Tested: All dead birds whose testing results have been received.
Appendix I

West Nile Virus Surveillance
County Coordinators
This table is now posted at: http://www.westnile.state.pa.us/contacts.htm

Appendix II

Dead Bird Reporting Flowchart

Initial Report

County WNV Staff Regional DEP Staff

Fewer than 5 birds submitted in the week AND Fresh (Corvids & Raptors dead < 48 hrs.)

YES

• Collect information
• Instruct on safe handling

Make arrangements for Pickup
• Staff pickup
• Citizen Drops off Bird

Enter Information Into PAWNVS Database

• Pack specimen for shipment
• Label & Attach to specimen bag

Ship sample through DEP courier

STOP

NO

• Thank citizen
• Explain limited testing
• Collect Information
• Instruct on safe handling and disposal

Appendix I
West Nile Virus Surveillance
County Coordinators
This table is now posted at: http://www.westnile.state.pa.us/contacts.htm
Appendix III

Dead Bird Reporting and Submission Protocol:

1. District office, state health centers and county/municipal staff will receive calls from residents regarding dead birds. District offices and health centers will direct calls to County WNV coordinators.

2. Upon receipt of the call, County WNV staff will determine if the bird(s) meets either of the following criteria:

   a. Fewer than 5 corvids or raptors have been collected that week and the bird/s is/are known to be dead 48 hours or less: (Relatively fresh specimens are required for testing. Carcasses which are decomposed or scavenged are usually of very limited diagnostic value).

   b. Five or more corvids or raptors have been collected that week or the birds are known to be dead more than 48 hours or if the time of death is unknown and the birds have been outside in hot weather showing signs of decomposition (visibly sunken dried eyes and/or infested with ants or maggots) are not suitable specimens for testing.

3. If the call falls into category 2.a. above, staff should:

   a. Birds will be swabbed in the field, the swabs placed in a collection vial, labeled and shipped during normal work-hours. Do not ship swabs on Friday or the day before a holiday. In such instances, the swab should be retained on dry ice until the next available shipping day.

   b. Each County WNV coordinator will be provided with specimen collection materials and barcoded labels for each specimen.

   c. Printed Barcode label will be attached to specimen bottle.

   d. Pack specimens in the containers provided with dry ice and ship it through the DEP laboratory courier system.

   e. .

4. If the call falls into category 2.b. above, staff should:

   a. Enter data into the WNV Website Secure Data Entry PAWNVS and mark it as sighted but not shipped.
b. Thank the caller for the information and explain that the carcass is not suitable for testing or that we are over testing capacity for the week. Inform the person on how to safely dispose of the unwanted specimen.

c. Bag it

d. Place the bag in the garbage

5. County WNV Staff should report to their respective DEP Coordinator when five or more dead birds are reported to have occurred at one location during the same period of time. DEP staff will contact the Regional Game Commission office and the PGC Wildlife Veterinarian Justin Brown DMV, PhD (Appendix VI) with reports of five or more dead birds in the same area indicting a possible poisoning or bird disease outbreak other than WNV.
Database Entry of dead birds:

1. Each bird must be assigned a unique identifier, from the pre-printed labels provided.

2. After you log in to the website (www.wnvcp.state.pa.us/pawnv/login/) go to the left hand column, under the heading “Data Input”:
   a. Click Dead Bird Entry on Menu.
   b. Click Submit a Bird button on your county’s row.
   c. Fill in the blanks on the form.
   d. Click Calendar.
   e. Fill in the other blanks.
   f. Click Locate.
   g. Click Address.
   h. Click Done.
   i. Click Submit.
   j. Verify Information.
   k. Click Save.
Appendix IV

PENNSYLVANIA DEPARTMENT OF HEALTH
Physician Initial Case and Laboratory Submission Report for Viral Encephalitis/Meningitis/Fever - WNV/EEE

CSF PCR and culture will only be performed with the approval of Epidemiology. Please call 717-787-3350 for instructions.

1. IDENTIFYING PATIENT INFORMATION

| Date of Report: | / / |

Date of onset of symptoms (must be completed): | / / |

| Last name | First Name | MI |

DOB | / | Sex: Male Female

| Street Address | Apt. |

| City: | State | Zip | County | Tel. H ( ) - |

2. REPORTED/SUBMITTED BY:

| Last name | First name |

| Work address | City | State | Zip Code |

| Telephone ( ) | - | Pager ( ) | - |

3. CLINICAL INFORMATION

Current diagnosis: Encephalitis Meningitis Other (Specify___________)

| Hospitalized? | Yes | No |

| Hospital Name | |

| Submitting Laboratory Name | |

| Address: | |

| Hospital Lab Phone # | Hospital Lab Fax # |

| Fever (>38C or 100F) | Yes | No | Unknown |

| Altered Mental Status | Yes | No | Unknown |

| Muscle Weakness | Yes | No | Unknown |

| Stiff neck/Meningeal signs | Yes | No | Unknown |

| Headache | Yes | No | Unknown |

| Seizures | Yes | No | Unknown |

| Rash | Yes | No | Unknown |

| Muscle Pain | Yes | No | Unknown |

| Joint Pain | Yes | No | Unknown |

| Other Neurological signs | Yes | No | Unknown |

Outcome: Recovered Still with symptoms/deficits Died (date of death / / ) Unknown

Discharge Diagnosis

Did patient travel outside PA in the 3 weeks before onset? Yes No If yes, where?

Did patient have a blood transfusion, organs or blood products in the last 3 months? Yes No

If yes, Facility Name When

Did patient donate blood in the previous 2 weeks? Yes No

4. SPECIMENS BEING SUBMITTED TO PA BOL FOR WEST NILE TESTING

CSF should be kept cold; sera 5-10 ml in red top tube should be kept cold; ship with ice packs; use overnight delivery service

| Specimen No. | Type: Specify CSF or Serum |

| DATE OF COLLECTION | *****Required***** |

| FOR BOL USE ONLY |

BOL Accession No.

Submit specimens directly to: PENNSYLVANIA DEPT. OF HEALTH, BUREAU OF LABORATORIES, 110 PICKERING WAY, EXTON, PA 19341. Call the Laboratory at 610-280-3464 if you have any questions about testing and shipping of specimens. Report cases of meningitis or encephalitis using PA NEDSS (National Electronic Disease Surveillance System) or call the DIVISION OF COMMUNICABLE DISEASE EPIDEMIOLOGY at 717-787-3350 if you have questions or for assistance.

Revised 9/05
Appendix V

PROTOCOL for AVIAN MORTALITY in PA

DEP Vector Management 717-346-8238  Regular Hours: 0700-1500

This following protocol was created by the PA Department of Health in concurrence with the PA Game Commission and the PA Department of Agriculture to address avian mortality with respect to Avian Influenza. Bird mortality events in Pennsylvania can be reported as follows:

**Wild birds:** If five (5) or more dead birds (except pigeons) are found in one location (no limits per week or per jurisdiction), first contact the appropriate Regional PGC office and then, if needed, contact the PGC Wildlife Veterinarian: Justin Brown DMV, PhD at 814-863-8370.

**Domestic/commercial birds:** If any number of dead domestic/commercial birds, call the PA Department of Agriculture (24/7) at 717-772-2852 (24/7).

### PA Game Commission (PGC) Regional Office Contact List

<table>
<thead>
<tr>
<th>NORTHWEST REGION</th>
<th>SOUTH CENTRAL REGION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Butler, Clarion, Crawford, Erie, Forest, Jefferson, Lawrence, Mercer, Venango, Warren</td>
<td>Adams, Bedford, Blair, Cumberland, Franklin, Fulton, Huntingdon, Juniata, Mifflin, Perry, Snyder</td>
</tr>
<tr>
<td>Phone: (814) 432-3187</td>
<td>Phone: (814) 643-1831</td>
</tr>
</tbody>
</table>

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<thead>
<tr>
<th>SOUTHWEST REGION</th>
<th>NORTHEAST REGION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phone: (724) 238-9523</td>
<td>Phone: (570) 675-1143</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>NORTHCENTRAL REGION</th>
<th>SOUTHEAST REGION</th>
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</thead>
<tbody>
<tr>
<td>Cameron, Centre, Clearfield, Clinton, Elk, Lycoming, McKean, Potter, Tioga, Union</td>
<td>Berks, Bucks, Chester, Dauphin, Delaware, Lancaster, Lebanon, Lehigh, Montgomery, Northampton, Philadelphia, Schuylkill, York</td>
</tr>
<tr>
<td>Phone: (570) 398-4744</td>
<td>Phone: (610) 926-3136</td>
</tr>
</tbody>
</table>