THE PUBLIC HEALTH & SAFETY WORKING GROUP

CLIMATE CHANGE

In early 2010 the Pennsylvania Department of Environmental Protection (PADEP) created the Public Health & Safety Working Group (PHSWG) as one of four working groups to assist PADEP on its overall climate change initiative. The PHSWG consisted of two co-chairs (a representative of the Pennsylvania Department of Health (PADOH) and a faculty member of Temple University) as well representatives of other federal and state agencies and other interested groups. The PHSWG met four times during 2010 and was asked to develop a summary report for PADEP that would be part of PADEP's Final Adaptation Report on Climate Change. This report represents the PHSWG Final Report outlining those health and safety considerations related to climate change that are important to Pennsylvania.

According to the Interagency Working Group on Climate Change, global climate has become one of the most visible environmental concerns of the 21st century (1). This ad hoc group was formed by participating federal agencies and organizations at the invitation of the National Institute of Environmental Health Sciences, the National Oceanic and Atmospheric Administration (NOAA), the Centers for Disease Control and Prevention (CDC), and the Environmental Protection Agency (EPA) in 2009. The Group believes that climate change is currently affecting public health through numerous environmental consequences, including sea-level rise, changes in precipitation resulting in flooding and drought, heat waves, changes in intensity of hurricanes and storms, and degraded air quality, that are anticipated to continue into the foreseeable future. According to CDC, there is widespread scientific consensus that the world's climate is changing (2), leading to anticipated effects such as those just described. Each of these changes has the potential to have a negative impact on human health, resulting in excess numbers of deaths, injuries, and illnesses. Because many infectious diseases (e.g., West Nile virus and Lyme disease) are influenced by temperature, humidity, and other climate variables, climate change may affect the spread of these diseases or the intensity of disease outbreaks. Climate change may also lead to increased problems with allergies since a warmer climate can promote the growth of molds, weeds, and other irritants that cause allergic reactions in certain sensitive individuals. Although climate change is a global issue, it has the potential to significantly impact the health of citizens of Pennsylvania.

The PHSWG reviewed material available on public health issues associated with climate change, including the CDC website for Climate Change (2) and CDC's table describing possible weather events, health effects, and sensitive populations related to climate change. Based on this review, the PHSWG agreed to use the table as a template in its own considerations on vulnerabilities and risks due to climate change that are important to Pennsylvania. The PHSWG also prioritized potential issues and identified the following three high priority areas: 1) heat stress; 2) flooding; and 3) droughts. The PHSWG also developed relevant models (see attachments) that outline key issues on these three topics that pertain to the Commonwealth.

Heat Stress

Heat stress will be a significant climate change event for Pennsylvania since heat is already the leading cause of weather-related deaths each year in this country (3). In addition to death, heat stress can also lead to a variety of illnesses, including heat exhaustion, heat cramps, and heat stroke, and can exacerbate pre-existing chronic conditions, such as some respiratory, cerebral, and cardiovascular diseases. Counts of these deaths and illnesses are likely significantly underreported since criteria used in making these measurements vary and heat is rarely used as an official cause of death. Vulnerable populations include children, the elderly, low income individuals, and socially isolated people. Pennsylvania has two major metropolitan areas (Philadelphia and Pittsburgh) and the urban built environment specific to these two geographic areas of the state may exacerbate heat-related environmental conditions and associated heat-related health problems.

Although climate change is likely to increase the number of heat-related deaths and illnesses in Pennsylvania, many of these are preventable using appropriate precautions, such as increased air conditioning use and decreased time spent outdoors during a heat spell. From a public health perspective, proactive heat wave response plans (including heat wave early warning systems, heat advisories, availability of cooling stations, and other preventive measures) are an important and sustainable adaptation strategy.

A model public health early warning system for heat waves was established by the Philadelphia Department of Public Health following a major heat wave in the 1990s. An evaluation of the program has clearly demonstrated that the system saves lives and that the cost of running the system is low compared with the estimated value of a life lost (4).

The PHSWG has developed a model (Attachment 1) on heat stress delineating the important components in Pennsylvania for effectively dealing with this problem—
Health (susceptible populations; partners; data bases/sources) and the Environment (cooling stations; transportation; homeless shelters; hospitals/medical centers/outpatient care centers; developing a prototype for risk mitigation). The model also outlines a systems approach that can be used to understand the interaction of these various factors.

Flooding

A second example of an extreme weather event of particular concern to Pennsylvania and the public health community because of the frequency of these events is flooding. The potential adverse impact of flooding on the mortality and morbidity patterns in an affected community can be sizeable.

In January 1996, a winter blizzard followed by a flood on the Susquehanna River due to a warming spell resulted in an increase in morbidity and mortality directly related to this event (5-7). Residents experienced various health problems, including carbon monoxide poisoning due to use of space heaters in homes without proper ventilation. Drivers also experienced similar problems from exhaust systems in idling cars when blocked by the snow. Some residents had problems with flooded basements that affected their heating systems because of fuel leaks. The

Pennsylvania Department of Health (PADOH) provided technical advice for homeowners on unacceptable air levels of fuel oil in a home and steps that needed to be taken to address these problems, including having the air sampled and evacuating the home if levels exceeded certain guidelines. PADOH also requested technical assistance from CDC to study the pattern of mortality that resulted from the event (6).

Although the 1996 Susquehanna River flooding was not as extreme as the flooding caused by Hurricane Agnes in 1972 (8), the event demonstrated that flooding episodes in Pennsylvania can happen at various times of the year. The event also highlighted the fact that Pennsylvania historically is vulnerable to flooding. In fact, the worst flash flood in the nation's history happened in Johnstown in 1889 when the South Fork Dam broke killing 2,200 persons (9).

As with other extreme weather events, groups vulnerable to flooding include the elderly, the poor, infants and children, those with underlying chronic diseases, and those with disabilities. Those who live in areas that have experienced little or no flooding in the past can be at greater risk of adverse health effects since they are not as well prepared and are less experienced in dealing with floods. Understanding potential flood zones in Pennsylvania is important to preparedness for both homeowners who may be affected by flooding as well as potential responders (e.g. the Pennsylvania Emergency Management Agency) who will coordinate the appropriate response to an event.

The PHSWG has developed a model (Attachment 2) on flooding delineating the important components in Pennsylvania for effectively dealing with this problem—Health (health effects and susceptible populations; partners; data bases/sources) and the Environment (components of managing risk).

Drought

A third example of an extreme weather event of particular concern to Pennsylvania and the public health community is drought. Since public health experts operate today with only limited guidance on preparedness and response regarding this hazard, CDC developed a new guide (10) to aid public health professionals in this area. Important topics covered in the report include health issues, preparedness and response approaches, and future needs.

The PHSWG has developed a model (Attachment 3) on drought delineating the important components in Pennsylvania for effectively dealing with this problem—Health (health effects and susceptible populations; partners; data bases/sources) and the Environment (components of managing risk).

Environmental Public Health Tracking Program

In 2002, Congress provided CDC with funding to develop an Environmental Public Health Tracking (EPHT) Program and network that would build capacity to understand and respond to environmental health issues and explore links between environmental hazards and chronic disease. The Tracking Network is the first national resource providing standardized

environmental and public health data in one, searchable database. Currently, the Tracking Network's data and measures focus on:

- Health data that show the rates of certain non-infectious diseases or conditions like poisoning by carbon monoxide or lead, asthma, cancers, and birth defects
- Exposure data that tell us about the concentrations of certain chemicals inside people's bodies. For example, childhood blood lead levels will be available on the Network
- Hazard data that tell us about contaminants and pollutants that may be found in air and water

The Tracking Network offers states a unique opportunity to leverage existing public health information technology capabilities and data available through the network to incorporate climate change surveillance.

- The Tracking Network has already built a geospatial information technology (IT) platform for bringing together health and environmental data (e.g., air, water, asthma and vital statistics in time and space).
- Adding new data, tools, business processes and partners specific to climate change will maximize existing resources and prevent duplication of effort.
- Spatially enabled public and secure web interfaces (portals), which already exist, will facilitate quicker access to information that can be utilized to drive coordinated multi-agency public health action related to climate change.
- CDC has built a broad coalition of users, data providers, and champions with local, state, federal, and international public health and environmental agencies that can be leveraged to begin development of robust climate change tracking. A content work group (CWG) for climate change has been formed and meets regularly. A nationally consistent definition of heat waves is being formulated in collaboration with CDC, NOAA, and the National Weather Service.
- CDC and its state and local partners also collaborate with the Council of State and Territorial Epidemiologists in evaluating and pilot testing possible climate change indicators.

According to EPA, climate change will affect air quality leading to worsening regional ozone pollution, with associated risks of respiratory infections, aggravation of asthma, and premature death. CDC's National Asthma Control Program helps state health departments build asthma programs, bolster surveillance, implement interventions, and foster partnerships. A nationally consistent definition of "heat waves" is being formulated jointly by CDC, NOAA, and the National Weather Service. Increased frequency of higher temperature peaks, longer durations of these peaks and occurrence earlier in the season compared to other years are being considered in the final model and definition of heat waves.

Before 1998, cities and states did not collect asthma information uniformly. The National Asthma Control Program has helped state health departments standardize detailed data collection, which simplifies the comparison of disease rates across jurisdictions.

CDC-funded state asthma control programs now measure adult and child prevalence, indicators of asthma control, hospitalizations, and deaths. Some states also track asthma in the Medicaid

population, costs attributable to asthma, or asthma management indicators (e.g., asthma action plans, detailed medication use, school days or workdays missed due to asthma, or emergency department visits).

According to the most recent figures, in FY 2009 only 33 states and D.C. received CDC funding for state asthma control programs. Not all states that apply for funds receive grants because there are often insufficient funds appropriated for this program.

In FY 2009, only 22 states (including Pennsylvania with funding to PADOH) and New York City received CDC EPHT grants. Not all states that apply for funds receive grants because there are often insufficient funds appropriated for this program. Plans for the network include monitoring new environmental hazards (such as climate change), additional health outcomes, and additional state participation.

The PHSWG had numerous discussions about the relevance of climate change to the programs of CDC's national Environmental Public Health Tracking (EPHT) program to Pennsylvania. Since PADOH is funded by this program, the agency expects that future grant requirements will incorporate both environmental and health data sources that monitor trends in the state in this area over time. The health data sources could include mortality and morbidity measures for heat stress as well as adverse health outcomes associated with future flooding events.

Federal Funding Opportunities

In recent years, the federal government has allocated several billion dollars annually for projects to expand the understanding of climate change and to reduce carbon dioxide and other greenhouse-gas emissions. Most of that spending is done by the Department of Energy and by the National Aeronautics and Space Administration. The work is coordinated in the Executive Office of the President. Successive Administrations have tracked the funding of climate change programs and the cost of tax incentives related to climate change through what is sometimes called the "climate change budget." That budget typically has included federal efforts allocated in several categories:

- Technology programs that develop, demonstrate, and deploy new products or processes to reduce greenhouse-gas emissions
- Scientific research directed toward explaining the processes of climate change and monitoring the global climate
- Assistance to other countries as they work to reduce greenhouse-gas emissions
- Tax incentives that encourage businesses and households to adopt technologies that curtail the use of fossil fuels and reduce greenhouse-gas emissions

In addition to CDC offering federal funding for the EPHT program, other federal organizations offer funding for climate-sensitive health issues. According to the EPA, climate change will affect climate-sensitive diseases, including vector-borne diseases such as West Nile virus. Infectious disease surveillance systems, such as ArboNET, provide public health officials and health care providers with information about disease activity in their states. Having effective surveillance systems on the ground is essential as public health officials prepare for an increase in vector-borne diseases as a result of warming temperatures.

In FY 2008 CDC funded all states except Alaska to participate in "ArboNET." ArboNET is a web-based surveillance data network comprising 54 state and local public health departments and CDC developed in 2000. Arboviruses are transmitted by insects such as mosquitoes and ticks. States voluntarily submit data to ArboNET on West Nile virus, Colorado tick fever, dengue, Japanese encephalitis, yellow fever, and other domestic and imported arboviruses. In addition, states report results from environmental surveillance (e.g., testing mosquitoes, birds, and horses for evidence of arbovirus infection) based on activities conducted by local health departments and mosquito control agencies within the state. One of the major strengths of ArboNET is that it collects human, animal, and ecologic data, which provides users with a broad picture of arbovirus transmission activity by region. In addition, because it is internet-based, it offers the potential for real-time reporting (11).

EPA is supporting states to take significant action to curb greenhouse gases. In Region 9, California is leading a coalition of states in efforts to address climate change. EPA is working closely with state partners to provide funding and to help assess and reduce greenhouse gas emissions.

The U.S. Department of Agriculture has also made funding available for counties that qualify for drought assistance (e.g., a 30 percent drop in crop production or loss of livestock). After the Department declares a county drought emergency, counties qualify for low interest loans that become available through their farm service agencies.

Recommendations

1. Pennsylvania is one of 28 states that have developed a strategic climate change plan that does not include a public health response (11). The Pennsylvania strategic climate change plan should be revised to include a section that addresses the public health response. This report should be considered in the development of the revised plan.

2. Government agencies and other partners in Pennsylvania should implement appropriate measures to prevent adverse health effects caused by heat waves. In his narrative on "heat waves and hot environments," Kilbourne provides guidance on this topic by reviewing the timing of preventive measures, the content of prevention programs, and target groups (12). EPA developed a guidebook in 2006 to assist communities in preparing for and responding to excessive heat waves (13). The schematic on heat stress attached to this report also includes critical components of a model to help prevent heat-related adverse health conditions. The public health early warning system for heat waves established by the Philadelphia Department of Public Health can serve as a model in other parts of the state. An evaluation of the Philadelphia program has clearly demonstrated that the system saves lives during severe heat waves.

3. Government agencies and other partners in Pennsylvania should implement appropriate measures to prevent and control adverse health effects caused by flooding. In her narrative on "floods," Malilay provides guidance on this topic by reviewing issues on mitigation, warning and preparedness, needs assessment, surveillance, response and recovery, and health education (12). The schematic on flooding attached to this report

4. Government agencies and other partners in Pennsylvania should implement appropriate measures to prevent and control adverse health effects caused by drought conditions. The CDC report on this topic (10) can assist public health professionals on preparedness and response measures regarding this hazard. The Association of State and Territorial Health Officials also developed guidelines in 2008 (15) to help public health professionals deal with the threat of mosquito-borne diseases that may increase during drought conditions.

5. Should CDC expand the EPHT grant program to include activities related to the public health consequences of climate change, PADOH should take advantage of the availability of these federal resources. PADOH and other interested partners should also search out new areas for funding support in this area and continue to develop expertise in surveillance, health education, and other areas of public health that will contribute to the body of knowledge about how climate changes in Pennsylvania may be impacting the lives of residents.

6. A review of environmental health indicators for climate change in the United States released in 2009 shows that data exist for many environmental and health measures, but more research is needed to evaluate the sensitivity and usefulness of the measures (16). Government agencies and other partners in Pennsylvania should support efforts to increase data quality and availability and to develop new surveillance databases, especially for climate-sensitive morbidity.

7. The 2008 report by the National Academies on climate change recommends increasing interdisciplinary collaboration among medical and health professionals and other environmental and social scientists to better understand the linkage between climate change and disease (17). Government agencies and other partners in Pennsylvania should continue to support efforts such as this in the state in the future.

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ATTACHMENT 1

HEAT STRESS AND A MODEL FOR MITIGATING RISK TO ENVIRONMENTAL SUCCEPTIBILITIES

- **I. HEALTH**
  - **a. Susceptible Population**
    - **i. Elderly**
    - **ii. Very Young**
    - **iii. Disabled/Ill**
      1. **Respiratory Conditions**
      2. **Cardiovascular Conditions**
    - **iv. Athletes/Hot Weather Runners/Outdoor Games Participants**
    - **v. Outdoor Construction/Other Outdoor Workers**
    - **vi. Firefighters/Police**
    - **vii. Outdoor Campers/Counselors**
    - **viii. Animals**
      1. **Pets (e.g., at Risk in Homes and Vehicles)**
      2. **Farm Animals**
  - **b. Partners**
    - **i. Surrogate Care Givers**
      1. **Relatives**
      2. **Neighbors**
      3. **Friends**
      4. **Schools (e.g., for Athletes)**
      5. **Physicians**
      6. **Veterinarians (e.g., for Pets and Animals at Risk)**
      7. **Healthcare Providers**
      8. **Emergency Medical Services/Ambulance Drivers (e.g., Outdoor Workers)**

    - **ii. Service Organizations**
      1. **Police**
      2. **Fire Department**
      3. **Visiting Nurses**
      4. **911**
      5. **Meals on Wheels**
      6. **Town/City Planning Input**
      7. **Other (e.g., Utilities)**
      8. **Department of Aging (e.g., for Prescriptions and Meals)**

9. **Department of Public Welfare**
10. **Pennsylvania Department of Transportation**
11. **Office of Health Equity**
12. **United Way**
13. **American Lung Association (Asthma)**
14. **Senior Centers**
15. **Day Care Centers**
16. **Community Centers**
17. **Church Groups**

c. **Data Bases/ Sources**
   i. Real-time Outbreak and Disease Surveillance (RODS) system **(i.e., for Emergency Department Data)**
   ii. **Pennsylvania Health Care Cost Containment Council (PHC4) (i.e., for Inpatient Hospital Admissions Data)**
   iii. **National Weather Service**
   iv. **National Oceanic and Atmospheric Administration (NOAA)**
   v. **United States Geological Survey (USGS)**
   vi. **U.S. Census**
   vii. **Pennsylvania Vital Statistics (i.e., for Heat Related Deaths)**
   viii. **Pennsylvania Department of Environmental Protection (e.g., Forecasting, Monitoring, Ozone, and Heat Monitoring Throughout the State)**
   ix. **EPA**
      1. **National Emissions Inventory**
      2. **Air Quality System for Monitoring**
      3. **National Air Toxic Assessments (NATA)**

II. ENVIRONMENT

a. **Cooling Stations**
   i. **Options (e.g., Fans, Air-conditioning)**
b. **Transportation (e.g., Free Public Transportation on Ozone Action Days)**
c. **Homeless Shelters**
d. **Hospitals/Medical Centers/Outpatient Care Centers**
e. **Developing the Prototype for Risk Mitigation**
   i. **Use of the Internet**
   ii. **Fact Sheets**
   iii. **Support from PADEP**
   iv. **Information Technology Input**
   v. **Use of Data Bases**

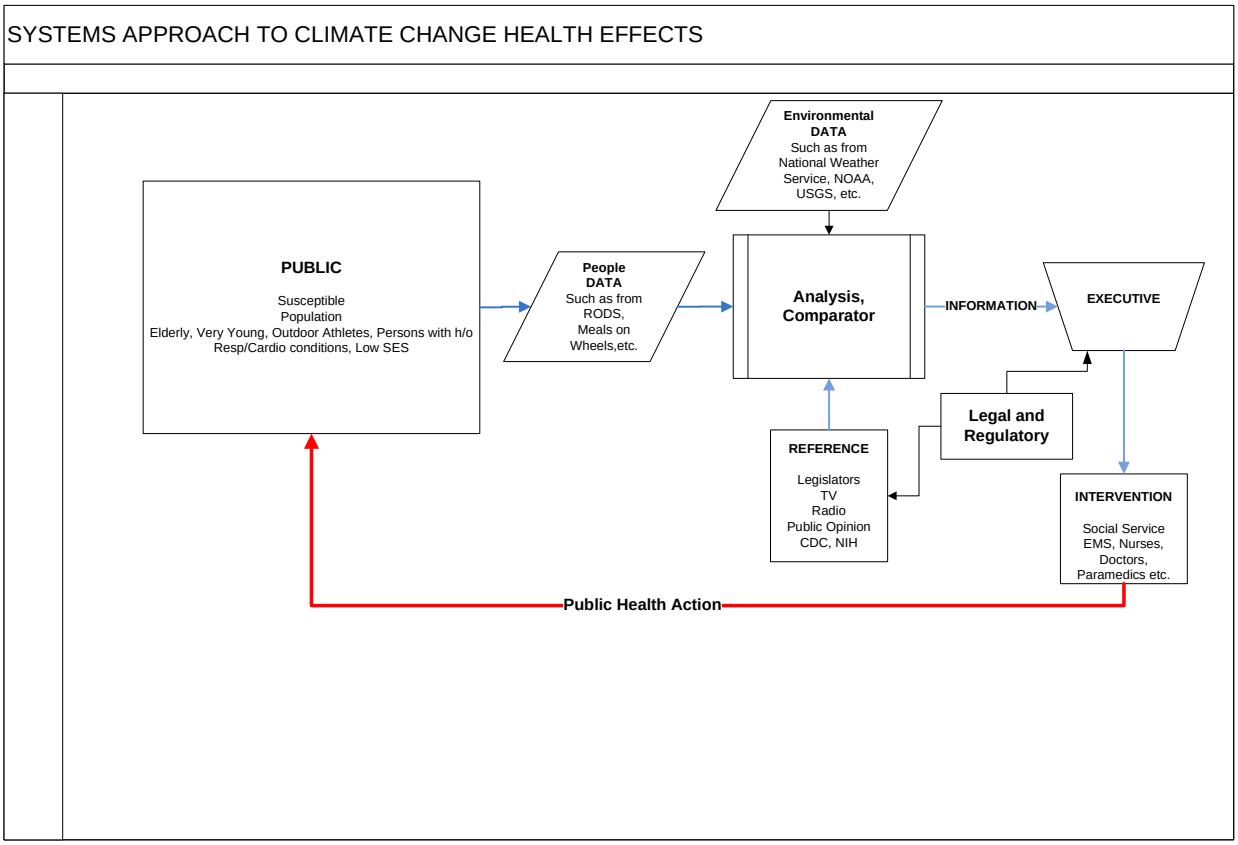
1. **Identification of those at Risk**
2. **Telephone/Addresses/Internet Connections**
3. **Privacy**

vi. **Funding Sources**

1. **Federal**
2. **State**
3. **Local (e.g., Discounts for the Elderly at Retail Stores for Air-conditioners)**

vii. **Promoting the Solution**

1. **Communications**
2. **Marketing**
3. **Public Relations**



ATTACHMENT 2

FLOODING HAZARDS AND MANAGING RISK

- **I. HEALTH**
  - **a. Health Effects**
    - **i. Drowning**
      1. **Susceptible Population**
         - **a. Residents Living in Floodway and Floodplain**
         - **b. Citizens Driving through Flooded Roadways**
         - **c. Emergency Medical Services Personnel**
           - **i. Volunteer Firemen**
         - **d. Emergency Management Personnel**

    - **ii. Infectious Diseases from Flood Waters**
      1. **Susceptible Population**
         - **a. Residents Living in Floodway and Floodplain**
         - **b. Emergency Medical Services Personnel**
           - **i. Volunteer Firemen**
         - **c. Emergency Management Personnel**
         - **d. Post Flood Assessment Personnel**
      2. **Increase in vector and water-borne diseases**
         - **a. Deceased livestock**
    - **iii. Molds and Fungi Exposures during Recovery Efforts**
      1. **Susceptible Population**
         - **a. Residents Living in Floodway and Floodplain**
         - **b. Construction Contractors**
    - **iv. Food supply shortages**
    - **v. Safety**
      1. **Susceptible Population**
         - **a. Exposure to downed power lines**
         - **b. Power outages (critical care facilities)**
         - **c. Improper use of emergency heating**
         - **d. Evacuation issues**
         - **e. Debris injuries**

  - **b. Partners**
    - **i. Pennsylvania Department of Environmental Protection**
    - **ii. Pennsylvania Emergency Management Agency**

iii. **Pennsylvania Department of Community and Economic Development**
iv. **Pennsylvania State Association of Township Supervisors**
v. **Pennsylvania State Association of Boroughs**
vi. **County Commissioners Association of Pennsylvania**
vii. **Pennsylvania Association of Floodplain Managers**
viii. **Susquehanna River Basin Commission**
ix. **Delaware River Basin Commission**
x. **Federal Emergency Management Agency**
xi. **National Oceanic and Atmospheric Administration National Weather Service (NWS)**
xii. **U.S. Geological Survey (USGS)**

c. **Databases/Sources**
   i. **Flood Insurance Policies**
   ii. **Digital Flood Insurance Rate Maps**
   iii. **NWS Advanced Hydrologic Prediction Service**
   iv. **Flood inundation Maps**
   v. **USGS National Water Information System**
   vi. **Dams and Levee databases**
      1. **State level**
      2. **Federal level**

II. ENVIRONMENT

a. **Infrastructure inundation**
   i. **Power generating facilities**
   ii. **Rail lines**
   iii. **Wastewater treatment facilities**
   iv. **Water treatment facilities**
b. **Managing Risk**
   i. **Floodplain Management**
      1. **Municipal Ordinances**
   ii. **National Flood Insurance Program**
   iii. **State and County Hazard Mitigation Plans**
   iv. **Dam and Levee inspections and certifications**
   v. **Bridge inspections**
   vi. **Promoting the Solution**
      1. **Public Outreach**
      2. **NWS Turn Around Don’t Drive Campaign**
      3. **Communications**
      4. **Marketing**

ATTACHMENT 3

DROUGHT HAZARDS AND MANAGING RISK

- **I. HEALTH**
  - **a. Health Effects**
    - **i. Hunger and famine**
      - **1. Susceptible Population**
        - **a. Very young**
        - **b. Elderly**
        - **c. Infirmed**
        - **d. Low-income urban and rural**
    - **ii. Ecosystem change affecting wildlife and fish**
      - **1. Susceptible Population**
        - **a. Subsistence hunting and fishing**
    - **iii. Disease from Lack of Available Clean Water**
      - **1. Susceptible Population**
        - **a. Residents with poor public water supplies**
        - **b. Residents with self-supplied water**
        - **c. Residents with poor public sanitation**
    - **iv. Wildfires**
      - **1. Susceptible Population**
        - **a. Commonwealth Residents**
    - **v. Particulate emissions**
      - **1. Susceptible Population**
        - **a. Residents along dirt and gravel roads**
    - **vi. Vector disease increase**
      - **1. Susceptible Population**
        - **a. Commonwealth Residents**

  - **b. Partners**
    - **i. Pennsylvania Department of Environmental Protection**
    - **ii. Pennsylvania Department of Health**
    - **iii. Pennsylvania Emergency Management Agency**
    - **iv. Pennsylvania Department of Agriculture**
    - **v. Pennsylvania Fish and Boat Commission**
    - **vi. Pennsylvania Game Commission**
    - **vii. County Commissioners Association of Pennsylvania**
    - **viii. Susquehanna River Basin Commission**
    - **ix. Delaware River Basin Commission**

x. **Federal Emergency Management Agency**
xi. **U.S. Environmental Protection Agency**
xii. **Centers for Disease Control and Protection**
xiii. **National Oceanic and Atmospheric Administration National Weather Service (NWS)**
xiv. **U.S. Geological Survey (USGS)**
xv. **U.S. Natural Resource Conservation Service (NRCS)**
xvi. **Pennsylvania Farm Bureau**
xvii. **USDA Farm Service Agency**
xviii. **Pennsylvania State Nurses Association**
xix. **Other health care providers**
xx. **Public/Municipal Water Suppliers**
xxi. **Private Water Companies**

c. **Databases/Sources**
   i. **National Integrated Drought information System**
   ii. **USGS Pennsylvania Drought Condition Monitoring website**
   iii. **http://www.cdc.gov/nceh/ehs/Docs/JEH/2009/July-Aug_09_Kalis_Miller.PDF**
   iv. **CDC's guidance document: When Every Drop Counts: Protecting Public Health During Drought Conditions—A Guide for Public Health Professionals**
   v. **NOAA's Climate Adaptation (From Kim Hoover)**

II. ENVIRONMENT

a. **Managing Risk**
   i. **State and County Emergency Operation Plans**
   ii. **Municipal Emergency Operation Plans**
   iii. **Water Supplier's Drought Contingency Plans**
   iv. **Water Conservation Programs**
   v. **Economic Cost/Benefit Assessments**
   vi. **Promoting the Solution**
      1. **Public Outreach**
      2. **Communications**
         a. **Pennsylvania Drought Task Force**
         b. **River Basin Commissions**
      3. **Marketing**