

# EPIDEMIOLOGICAL SURVEILLANCE AND INVESTIGATION

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## **Capability Definition**

The Epidemiological Surveillance and Investigation capability is the capacity to rapidly conduct epidemiological investigations. It includes exposure and disease (both deliberate release and naturally occurring) detection, rapid implementation of active surveillance, maintenance of ongoing surveillance activities, epidemiological investigation, analysis, and communicating with the public and providers about case definitions, disease risk and mitigation, and recommendation for the implementation of control measures.

## **Outcome**

Potential exposure and disease is identified rapidly (determine exposure, mode of transmission and agent, and interrupt transmission to contain the spread of the event and reduce number of cases). Confirmed cases are reported immediately to all relevant public health, food regulatory, environmental regulatory and law enforcement agencies. Suspected cases are investigated promptly, reported to relevant public health authorities, and accurately confirmed to ensure appropriate preventive or curative countermeasures are implemented. An outbreak is defined and characterized; new suspect cases are identified and characterized based on case definitions on an ongoing basis; relevant clinical specimens are obtained and transported for confirmatory laboratory testing; the source of exposure is tracked; methods of transmission identified; and effective mitigation measures are communicated to the public, providers and relevant agencies are recommended, as appropriate.

## **Relationship to National Response Plan Emergency Support Function (ESF)/Annex**

This capability supports the following Emergency Support Function (ESF)/Annexes:

ESF#8: Public Health and Medical Services

Biological Incident Annex

Terrorism Incident Law Enforcement and Investigation Annex

## **Preparedness Tasks and Measures/Metrics**

Activity: Develop and Maintain Plans, Procedures, Programs and Systems	
Critical Tasks	
Pro.B1a 1.1.4	Develop and maintain efficient surveillance systems supported by information systems that comply with PHIN functional requirements for <i>Early Event Detection, Outbreak Management and Countermeasure and Response Administration</i> to facilitate early detection, mitigation and evaluation of expected and unexpected public health conditions
Pro.B1a 1.1.5	Distinguish on the State list of notifiable conditions between select conditions that require immediate reporting to the public health agency (at a minimum, Cat A agents), and conditions

Activity: Develop and Maintain Plans, Procedures, Programs and Systems	
	for which a delay in reporting is acceptable
Pro.B1a 1.2.1.1	Describe time frames for notification for conditions where a delay in reporting is acceptable,
Preparedness Measures	Metrics
Epidemiological and laboratory emergency plans in place	Yes/No
Epidemiological emergency response plans delineate the epidemiological investigation steps and include:	
Surveillance – ongoing and event-specific collection of health data	Yes/No
Compare cases to the baseline and confirm diagnosis	Yes/No
Case finding – actively search for cases	Yes/No
Conduct contact tracing	Yes/No
Identify/develop information systems to support the epidemiological investigation that comply with PHIN functional requirements for <i>Outbreak Management</i> and <i>Countermeasure and Response Administration</i> including a protocol for management/flow of data	Yes/No
Develop description of cases through interviews, medical record review and other mechanisms (person, place and time)	Yes/No
Generate possible associations of transmission, exposure and source	Yes/No
Identify population at risk	Yes/No
Coordinate with environmental investigation	Yes/No
Perform and analyze definitive studies	Yes/No
Report appropriate information to partners	Yes/No
Evaluate therapeutic outcome	Yes/No
Monitor adverse reactions to public health interventions	Yes/No
Chain of evidence and chain of custody protocols are followed according to SOP – zero loss of evidence or specimens	Yes/No
State notifiable conditions list distinguishes between select conditions that require immediate reporting to the public health agency (at a minimum, Cat A agents), and conditions for which a delay in reporting is acceptable	Yes/No

### **Performance Tasks and Measures/Metrics**

Activity: Direct Epidemiological Surveillance and Investigation Operations	
Definition: Coordinate, maintain, enhance, analyze, and provide efficient surveillance and information systems to facilitate early detection and mitigation of disease.	
Critical Tasks	
Pro.B1a 3.3.2	Identify applicable laws, policies, and implementation procedures for public health reporting and notification
Pro.B1a 3.3.1	Maintain public health communication channels supported by information systems that comply with the PHIN functional requirements for <i>Partner Communications and Alerting</i>
Pro.B1a 3.3.3	Provide Public Health information to emergency public information for release
Pro.B1a 3.2.3	Coordinate resources needed to respond to public health concern

Pro.B1a 3.1	Lead public health investigations to determine source of disease in collaboration with law enforcement	
Pro.B1a 3.2.2	Identify all stakeholders and agency representatives or liaisons for public health response	
Pro.B1a 4.5.1	Report instances of disease that raise the index of suspicion of terrorist or criminal involvement to FBI Headquarters (National Response Plan)	
Pro.B1a 3.3.4	Make public health recommendations for prophylaxis and other interventions	
Pro.B1a 3.2.4	Coordinate examination of deceased suspect patients with the medical examiner and/or coroner	
Performance Measures		Metric
Time for State to notify local or local to notify State of receipt of notice of a case with a high index of suspicion of an immediately notifiable condition		Within 1 hour of receipt
Time to issue information to the public that acknowledges the event, provides status, and commits to continued communication once a response plan is activated		Within 60 minutes of implementing response plan
Time from case definition to dissemination of case finding and public health instruction to all hospitals in jurisdiction through the Health Alert Network (HAN) whose supporting information systems comply with the PHIN functional requirements for <i>Partner Communications and Alerting</i> .		Within 12 hours of case definition
Percent of public health epidemiological staff with sufficient equipment (e.g., PPE, IT, communication, clinical sampling equipment, specimen collection material) to conduct investigation		100%
Time to have a knowledgeable public health professional answer a call of urgent public health consequence 24/7/365		15 minutes or less
Time to obtain message approval and authorization for distribution of public health and medical information to clinicians and other responders once message has been finalized		Within 60 minutes

<b>Activity: <i>Surveillance and Detection</i></b>		
<b>Definition: Collect ongoing and event-specific health data to recognize events of public health significance.</b>		
Critical Tasks		
Pro.B1a 4.5.4	Facilitate reporting consistent with disease reporting laws or regulations	
Pro.B1a 4.3	Compile surveillance data	
Pro.B1a 4.4	Analyze surveillance data	
Pro.B1a 4.2.1	Detect suspected outbreak through pattern recognition	
Pro.B1a 4.3.3	Maintain chain of custody	
Pro.B1a 4.3.2	Have or have access to PHIN compliant information systems to support detecting events of public health significance and tracking of chain of custody	
Performance Measures		Metric
Ability exists to receive, review, and analyze data warranting public health attention		Yes/No

**Activity: Conduct Epidemiological Investigation**

**Definition:** Investigate a disease and its determinants in a population; characterize and classify a case; identify the source of the public health event; and define the population at risk.

**Critical Tasks**

Pro.B1a 5	Conduct epidemiological investigations
Pro.B1a 5.3	Confirm the outbreak using lab data and disease tracking data
Pro.B1a 5.2.1	Define case characteristics
Pro.B1a 5.3.1	Search actively for cases (case finding)
Pro.B1a 5.3.2	Create registries of ill, exposed, and potentially exposed persons
Pro.B1a 5.4	Conduct contact tracing
Pro.B1a 5.4.1	Analyze and interpret epidemiological investigation data in coordination with data from law enforcement investigation
Pro.B1a 5.4.2	Analyze and confirm origin of outbreak
Pro.B1a 5.5.1	Recommend control measures for outbreak
Pro.B1a 5.6	Draft and disseminate initial report of epidemiological investigation
Pro.B1a 5.6.1	Have or have access to information systems to support investigating, describing and understanding events of public health significance that comply with the PHIN Functional Area <i>Outbreak Management</i>

**Performance Measures****Metric**

Time from initial notification to public health epidemiologist to initiate initial investigation	Within 3 hours of initial notification
Time from first identification of agent to first recommendation for public health intervention	Within 6 hours of identification of agent
Time to identify suspect case and send to key Federal, State, and local public health partners (e.g., CDC, FBI, law enforcement, State, and local)	Within 3 hours
Time from laboratory confirmation of index case(s)/agent to creation of case definitions	Within 12 hours of confirmation of index case
Time for a health alert that describes the initial report of an indexed case along with known cases, possible risk factors, and initial public health interventions to be distributed via Epi-X, Health Alert Network (HAN), fax, and e-mail	Within 12 hours of initiation of case investigation
Time for active case findings in all affected States to be initiated	Within 24 hours of established working case definition.
Time from initial laboratory confirmation of high priority diseases or events with suspicion of terrorism to notification of law enforcement	Within one hour of confirmation.
Time from epidemiologist acquisition of clinical diagnostic specimens/samples to receipt at the laboratory response network (LRN)	Within 6 hours of acquisition
Time for 75 percent of known suspected cases (or proxies) to be contacted/interviewed for more detailed epidemiologic follow-up	Within 48 hours of identification of the index case

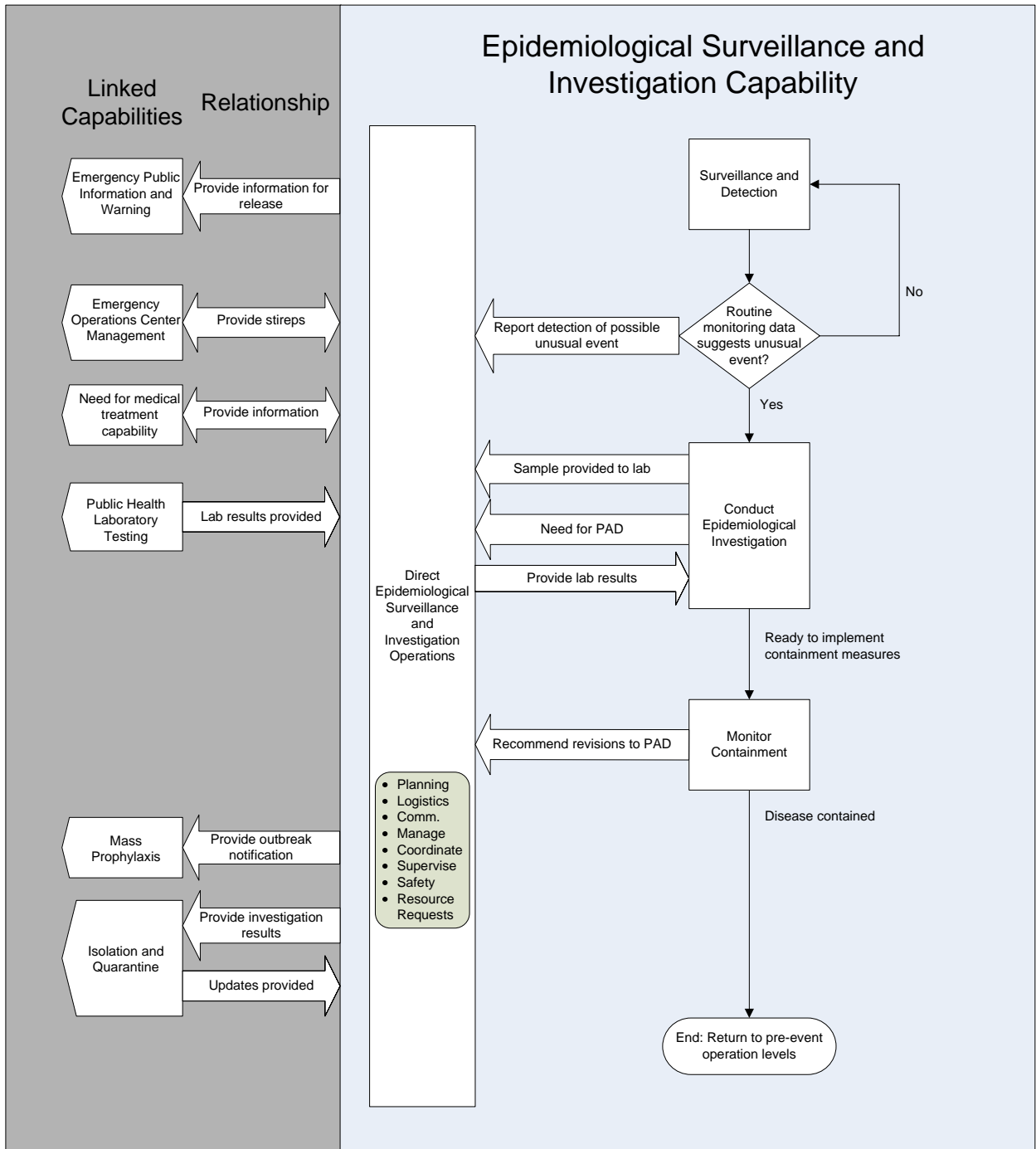
Time for an initial report to be produced describing all suspected cases by person, place, and time	Within 60 hours of identification of the index case
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<b>Activity: <i>Monitor Containment</i></b>	
<b>Definition: Based upon the extent of the population at risk and recommendations for outbreak control, assess the effectiveness of disease containment measures.</b>	
<b>Critical Tasks</b>	
Pro.B1a 6.1.1	Monitor the course and population characteristics of a recognized outbreak
Pro.B1a 6.2	Have or have access to information systems that support administration of outbreak control and that comply with the PHIN functional requirements for <i>Countermeasure and Response Administration</i> .
Pro.B1a 6.1	Monitor effectiveness of mitigation steps
Pro.B1a 6.4	Conduct an after action debriefing (hotwash) to identify deficiencies that require corrective actions in areas such as personnel, training, equipment, and organizational structure
Pro.B1a 6.3.2	Conduct special studies of critical public health issues.
<b>Performance Measures</b>	<b>Metric</b>
Percentage of known cases and exposed successfully tracked from identification through disposition to enable follow-up	100%

### ***Linked Capabilities***

<b>Linked Capability</b>	<b>Relationship</b>
Emergency Public Information and Warning	Epidemiological Surveillance and Investigation provides information for release to Emergency Public Information and Warning.
Emergency Operations Center Management	Epidemiological Surveillance and Investigation and Emergency Operations Center Management both contribute to situation reports.
Public Health Laboratory Testing	Epidemiological Surveillance and Investigation receives lab results from Public Health Laboratory Testing.
Mass Prophylaxis	Epidemiological Surveillance and Investigation provides outbreak notification to Mass Prophylaxis.
Isolation and Quarantine	Epidemiological Surveillance and Investigation provides investigation results to Isolation and Quarantine, while Isolation and Quarantine provides containment updates to Epidemiological Surveillance and Investigation.

# Capability Activity Process Flow



## Capability Element Description Details

Capability Elements	Components and Description
Local Health Department-based Surveillance Team (staff may be drawn from local, State or Federal resources)	Team to track suspect case reports within their jurisdiction; personnel (per 12-hour shift) consists of 1 supervisor (MD, DVM, or PhD level), 2 epidemiologists, 1 IT staff , and 1 statistician
Investigation Personnel/Team	Epidemiologist (or public health nurse or public health advisor) to interview cases and perform investigation
Active Surveillance/Case Finding Team	Epidemiologist (or public health nurse or public health advisor) to find cases in hospitals and the community
Special Studies Team	Team to undertake focused scientific investigations of interest; personnel consist of 1 epidemiology supervisor (MD, DVM, or PhD), 5 epidemiologists or scientists, 1 public health advisor, 1 subject matter expert, 1 interviewer per 10 persons, and 1 statistician
CDC Department Emergency Operations Center (DEOC)	Team to coordinate CDC response to an incident ; personnel consists of 1 senior epidemiology supervisor, 1 Federal-State liaison epidemiologist per affected State, 5 support epidemiologists, 1 public health advisor (PHA), 1 data entry manager, 10 data entry staff
State/Local EOC	Personnel consists of 1 epidemiology incident commander, 1 BT coordinator per State, 1 senior epidemiology supervisor per 12 hour shift, 5 support epidemiologists per 12 hour shift, 1 PHA per 12 hour shift, 1 Database manager, 1 programmer, 2 analysts, 2 transport teams (each with 1 driver), 1 clerical staff member, 1 IT person
Equipment	Laptops, Blackberry/cell phone, portable printers, PPE, and appropriate equipment cache per person

## Planning Assumptions

### Scenario-Specific

- Although applicable to several of the 15 National Planning Scenarios, the capability planning factors were developed from an in-depth analysis of the Anthrax and Pandemic Influenza scenarios. Other scenarios were reviewed to identify required adjustments or additions to the planning factors and national targets.
- Estimates are made of the needs for communities to respond to this emergency once identified and for baseline resources needed for timely initial detection
- *B. anthracis* spores added directly to product without aerosolization
- Ground beef was sent to San Diego, Seattle, and Phoenix
- Orange juice was sent to Albuquerque, Las Vegas, and Palm Springs
- Patient presentations involved gastrointestinal, oropharyngeal, and cutaneous forms of anthrax.
- Clinical and laboratory confirmation (LRN) occurred between days 2 and 5 after index case presentation
- Production facilities and distribution system mechanisms will be contaminated until formally decontaminated

- Cases will continue sporadically following public health intervention due to consumers and retailers failing to discard/return/destroy contaminated product
- No simultaneous disasters are occurring during the same time
- There will be an unprecedented level of public concern, anxiety, and fear as a result of this incident
- Assume field investigation will last 10 days at full personnel strength and then another 20 days at 50 percent personnel strength.
- Assume a concurrent law enforcement investigation
- Assume health departments and Emergency Operation Centers (EOC) will require 100 percent surge staffing for 30 days in 10 cities (6 affected cities and 4 neighboring areas that have high levels of anxiety/concern) and at CDC.
- Staff requirements, detailed in this worksheet, represent existing local, State, and Federal resources that are devoted to routine (baseline) public health activities.
- Assume that staff at the local level may include Federal or State employees; assume that staff at the State level may include Federal employees.
- Assume that for every case interviewed, 10 ill persons with diseases other than anthrax will need to be interviewed in a more abbreviated manner. Assume these “non-case” interviews will take half the time of a case interview. Given that 2,300 cases are indicated in the scenario, this means that 25,300 total interviews will need to be conducted.
- Assume 100 percent of cases and 50 percent of non cases will be interviewed during first 10 days. The remaining 50 percent of non-cases will be interviewed during the next 20 days.
- Assume there will be 100 facilities (hospital emergency departments) requiring active surveillance in 10 locations.
- Assume 10 special studies will be conducted. Each study will require 50 interviews.
- The food contamination scenario explored would be considered a national response that involves local, State and Federal resources.
- To provide 24 hour coverage for the first 10 days, the national response described in this scenario would require a staff of 110 epidemiology supervisors, 451 epidemiologists, 60 data entry staff, 40 IT staff, 30 statisticians, 60 public health advisors, 10 occupational/environmental epidemiologists, 50 non-epidemiologist interviewers, 10 subject matter experts and 10 State bioterrorism coordinators.
- Over the next 20 days of the investigation, staffing could be reduced to 70 epidemiology supervisors, 270 epidemiologists, 31 data entry staff, 30 IT staff, 30 statisticians, 40 public health advisors, 10 occupational/environmental epidemiologists, 50 non-epidemiologist interviewers, 10 subject matter experts and 10 State BT coordinators.
- The percent of staff contributions to the investigation from the State and local levels is dependent on baseline availability of resources. It should be noted that the Council of State and Territorial Epidemiologists (CSTE) *2004 National Assessment of Epidemiology Capacity: Findings and Recommendations* sites a 40 percent deficiency of trained public health epidemiologists nationally.
- Due to potentially unforeseen delays in the identification of a non-naturally occurring epidemiological event, detection of disease outbreaks may not occur until large numbers of victims are affected, particularly when the agent has a long incubation period.

**Planning Factors from an In-Depth Analysis of a Scenario with Significant Demand for the Capability (Anthrax and Pandemic Influenza)**

Resource Organization	Estimated Capacity	Scenario Requirement Values	Quantity of Resources Needed
Local Health Department-based Surveillance Team (staff may be drawn from local, State or Federal resources)	Track all reportable diseases within the defined area	Per 12 hour shift 1 supervisor (MD, DVM, or PhD level) and 2 epidemiologists. 1 IT staff 1 statistician	Assume 100% staff needs for 30 days at 10 locations. All 30 days: 20 supervisors 40 epidemiologists 20 IT staff 20 statisticians
Active Surveillance/Case Finding Team	Find cases in local hospitals and emergency departments	One epidemiologist (or public health nurse or public health advisor) per 12 hour shift per facility (e.g. hospital ER in affected region).	Assume 100% staff needs for first 10 days, and 50% staffing for next 20 days at 100 facilities in 10 cities <u>First 10 days:</u> 200 epidemiologists per day <u>Next 20 days:</u> 100 epidemiologists per day
Special Studies Team	Undertake focused scientific investigations of interest	Personnel per study: 1 epidemiology supervisor (MD, DVM, or PhD) 5 epidemiologists or scientists 1 public health advisor 1 subject matter expert 1 interviewer per 10 persons 1 statistician	Assume 10 studies conducted, 500 interviews All 30 days: 10 epidemiology supervisors 50 epidemiologists or scientists 10 public health advisors 10 subject matter experts 50 interviewers 10 statisticians

Resource Organization	Estimated Capacity	Scenario Requirement Values	Quantity of Resources Needed
CDC Department Emergency Operations Center (DEOC)	Coordinate CDC response to incident	Personnel per 12 hour shift: 1 senior epidemiology supervisor 1 Federal-State liaison epidemiologist per affected State 5 support epidemiologists 1 public health advisor (PHA) 1 data entry manager 10 data entry staff	Assume 100% staff needs for first 10 days, and 50% staffing for next 20 days <u>First 10 days (per day):</u> 20 epidemiology incident commanders 20 senior epidemiology supervisors 20 Federal State-liaison epidemiologists 10 support epidemiologists 20 public health advisors (PHA) 20 data entry staff <u>Next 20 Days:</u> 10 senior epidemiology supervisors per day 10 Federal State-liaison epidemiologists per day 5 support epidemiologists per day 10 public health advisors (PHAs) per day 10 data entry staff per day

Resource Organization	Estimated Capacity	Scenario Requirement Values	Quantity of Resources Needed
State/Local EOC	Coordinate State response to incident	1 epidemiology incident commander; 1 BT coordinator per State; 1 senior epidemiology supervisor per 12 hour shift; 5 support epidemiologists per 12 hour shift; 1 PHA per 12 hour shift. 1 database manager 1 programmer 2 analysts 2 transport teams: each with 1 driver 1 clerical staff member 1 IT person	Assume 100% staff needs for first 10 days, and 50% staffing for next 20 days. Assume 10 affected States (6 with cases + 4 additional) <u>First 10 Days (per day):</u> 10 epidemiology incident commanders per day 10 BT coordinators 20 senior epidemiology supervisors 50 support epidemiologists 20 PHAs <u>Next 20 Days:</u> 10 epidemiology incident commanders 10 BT coordinators 10 senior epidemiology supervisors per day 25 support epidemiologists per day 10 PHAs per day
Equipment		Laptops – 1 per 2 persons deployed; Blackberry/cell phone – 1 per person deployed; portable printers – 1 per 10 laptops; PPE and appropriate equipment cache per person	<u>First 10 Days:</u> 256 laptops, 511 Blackberry/cell phones, 26 portable printers, 511 PPE, 511 appropriate equipment cache <u>Next 20 Days:</u> 171 laptops, 341 Blackberry/cell phones, 17 portable printers, 341 PPE, 341

Resource Organization	Estimated Capacity	Scenario Requirement Values	Quantity of Resources Needed
			appropriate equipment cache

### ***Approaches for Large-Scale Events***

Pandemic Flu – For all teams, the work force will be diminished by one-third. The need for epidemiologic investigation will be far reduced relative to surveillance needs. Resource needs for pandemic flu are orders of magnitude greater.

### ***National Targets and Assigned Levels***

Responsible	Element Resource Unit	Type of Element	Number of Units	Unit Measure (number per x)	Capability Activity supported by Element
Federal/ State/ Local	Local Health Department-based Surveillance Team	Personnel	1	Per affected county	Monitor Containment Surveillance and Detection
County	Investigation Team	Personnel	1	Per affected county	Conduct Epidemiological Investigation
County	Active Case Finding/ Surveillance Team	Personnel	1	Per affected county	Conduct Epidemiological Investigation Monitor Containment Surveillance and Detection
Federal/ State/ Local	Special Studies Team	Personnel	As needed	Per incident	Conduct Epidemiological Investigation Monitor Containment Surveillance and Detection
CDC	CDC Department Emergency Operations Center (DEOC)	Federal Resource Organization	1	Nationally	Direct Epidemiological Surveillance and Investigation Operations

State	State/Local EOC	Resource Organization	1	Per state	Direct Epidemiological Surveillance and Investigation Operations
Federal/ State/ Local	Equipment cache	Equipment	1	Per person	All Activities

## References

1. Homeland Security Presidential Directive/HSPD-8, "National Preparedness". December 2003. <http://www.whitehouse.gov/news/releases/2003/12/20031217-6.html>
2. National Response Plan (NRP) Department of Homeland Security. December 2004.
3. National Incident Management System (NIMS). Department of Homeland Security. March 2004. <http://www.dhs.gov/interweb/assetlibrary/NIMS-90-web.pdf>
4. Bravata, D, McDonald, K, Owens, D et al. Bioterrorism Preparedness and Response: Use of Information Technologies and Decision Support Systems. Evidence Report/Technology Assessment No 59, HRQ Publications No. 02-E028. Agency for Healthcare Research and Quality. June 2002. <http://www.ahrq.gov/clinic/epcsums/bioitsum.pdf>
5. Syndrome and Outbreak Detection Using Chief-Complaint Data: Experience of the Real-Time Outbreak and Disease Surveillance Project. Morbidity and Mortality Weekly Report. September 2004. <http://www.cdc.gov/mmwr/preview/mmwrhtml/su5301a7.html>
6. Epidemic Intelligence Service. Center for Disease Control. 2004. <http://www.cdc.gov/eis>
7. State Public Health Preparedness and Response Capacity Inventory; Version 1.1. Centers for Disease Control and Prevention. December 2002. [http://www.phppo.cdc.gov/od/inventory/docs/State%20Inventory%20version%201\\_1\\_FINAL.pdf](http://www.phppo.cdc.gov/od/inventory/docs/State%20Inventory%20version%201_1_FINAL.pdf)
8. Bioterrorism and Public Health Emergency Preparedness and Response: A National Collaborative Training Plan. Centers for Disease Control and Prevention. February 2002. <http://www.phppo.cdc.gov/owpp/docs/library/2002/BioTerrorism%20National%20Training%20Plan%20Exec%20Sum.pdf>
9. National Bioterrorism Hospital Preparedness Program, Continuation Guidance. Department of Health and Human Services, Health Resources and Services Administration. 2005. <http://www.hrsa.gov/grants/preview/guidancespecial/hrsa05001.htm>
10. FY05 CDC Public Health Preparedness and Response Cooperative Agreement. 2005. <http://www.bt.cdc.gov/planning/guidance05/index.asp>
11. U.S. Department of Health and Human Services Strategic Plan to Combat Bioterrorism and Other Public Health Threats and Emergencies. October 2003. <http://www.hhs.gov/emergency/index.shtml#bioterrorism>
12. Ready or Not...Chemical Terrorism Project. Association of Public Health Laboratories (APHL). July 2003. [www.aphl.org](http://www.aphl.org)
13. DHS, Office for Domestic Preparedness, Metropolitan Medical Response System (MMRS) Program, <http://mmrs.fema.gov>.