**Basic agent information**

**Section I - Infectious Agent**

**Risk Group:**
- RG3

**Synonym or Cross reference:**
- Plague, Peste, Bubonic plague

**Characteristics:**
- Gram negative rod-ovoid 0.5-0.8 um in width and 1-3 um in length, bipolar staining (safety pin appearance), facultative intracellular, non-motile

**Section II - Dissemination**

**Reservoir:**
- Wild rodents (rats) are the natural reservoir; lagomorphs (rabbits, hares) and carnivores may be a source of infection to humans

**Zoonosis:**
- Yes - bites of fleas from an infected animal; contact or being bitten by an infected animal

**Vectors:**
- Wild rodent fleas, especially the oriental rat fleas (*Xenopsylla cheopis*); occasionally by human fleas (*Pulex irritans*)

**Research use considerations**

**Section III - Laboratory Hazards**

**Laboratory-Acquired Infections:**
- 10 reported laboratory-acquired infections with 4 deaths

**Sources/Specimens:**
- Bubo fluid, blood, sputum, CSF, feces, urine

**Primary hazards:**
- Direct contact with cultures and infectious materials from humans or rodents; infectious aerosols or droplets generated during manipulation of cultures and infected tissues and in the necropsy of rodents; accidental auto-inoculation; ingestion

**Special Hazards:**
- Bites by infected fleas collected from rodents
Section IV- Stability and Viability

Susceptibility to Disinfectants:
- Susceptible to many disinfectants - Clidox, 5% bleach, 70% ethanol, 2% glutaraldehyde, iodines, phenolics, formaldehyde

Physical Inactivation:
- Sensitive to moist heat (121°C for at least 15 min) and dry heat (160-170°C for at least 1 hour)

Survival Outside Host:
- Blood - 100 days; human bodies - up to 270 days

Section V- Recommended Precautions

Containment Requirements:
- Biosafety level 3 practices, containment equipment and facilities for all activities involving the handling of potentially infectious clinical materials and cultures

Protective Clothing:
- Gloves should be worn when handling field-collected or infected laboratory rodents and when there is the likelihood of direct skin contact with infectious materials; gown with tight cuffs and ties in back should be worn when manipulating cultures and specimens; a mask should be worn when there is a risk of contact with aerosols

Other Precautions:
- Special care should be taken to avoid the generation of aerosols during the necropsy of animals; necropsy should be conducted in a biological safety cabinet; insecticide treatment when collecting animals (living or dead) for testing

Health and Medical

Section VI- Health Hazard

Pathogenicity:
- Zoonotic disease; bubonic plague with lymphadenitis in nodes receiving drainage from site of flea bite, occurring in lymph nodes and inguinal areas, fever, 50% case fatality if untreated
- May progress to septicemic plague with dissemination by blood to meninges
- Secondary pneumonic plague with pneumonia, mediastinitis, and pleural effusion
- Untreated pneumonic and septicemic are fatal

Epidemiology:
- Wild rodent plague in North America, South America, Africa, Near and Middle East, Central and Southeast Asia, Indonesia; plague foci in former USSR; urban plague controlled in most areas; human plague occurred recently in Africa; endemic in Burma and Vietnam; sporadic cases in North and South America following exposure to wild rodents or their fleas (no human-to-human transmission in USA since 1925)

Host Range:
- Humans, > 200 mammalian species
**Infectious Dose:**
- Unknown; depends upon route of infection

**Natural Mode of Transmission:**
- Result of human intrusion into zoonotic (sylvatic) cycle or by entry of rodents or infected fleas into human's habitat and bite of infected fleas; domestic pets can carry plague-infected fleas; contact of commensal rodents and their fleas with sylvatic rodents may result in epizootic and epidemic plague; handling of infected tissues; airborne droplets from humans or pets with plague pneumonitis; careless manipulation of laboratory cultures; person-to-person transmission by human fleas; percutaneous injection via contaminated SHARPs

**Incubation Period:**
- From 2 to 6 days; may be a few days longer in vaccinated individuals; for primary plague pneumonia, 1 to 6 days, usually short

**Communicability:**
- Fleas may remain infective for months; bubonic plague not usually transmitted directly from person-to-person; pneumonic plague may be highly communicable under appropriate climatic conditions (overcrowding facilitates transmission)

**Section VII- Medical Surveillance:**
- There is no standard, ongoing recommended surveillance for this organism

**Immunization:**
- Although field trials have not been conducted to determine the efficacy of licensed vaccines, experience has been favorable; immunization is recommended for personnel working regularly with culture of *Y. pestis* or infected rodents, boosters are required every 6 months if high risk continues; protection against pneumonic form is limited

**Drug Susceptibility:**
- Sensitive to streptomycin, tetracycline, chloramphenicol (for cases of plague meningitis), kanamycin (for neonates)

**Prophylaxis:**
- All patients will receive empiric therapy for any febrile illness until the diagnostic evaluation reveals an alternative diagnosis and/or symptoms resolve. Fever should be used as a sign that someone might be infected, as should a suppurative lymphadenitis, or a febrile respiratory illness. Admission is not necessary for patients with fever alone. Tetracycline or doxycycline for 10 days is adequate

**Clinical Monitoring, including fever watch:**
- Fever watch, clinical evaluation for other symptoms
- Any person working with *Y. pestis*, the agent of bubonic and pneumonic plague, regardless of vaccination status, who develops a fever with or without other complaints, should report to UCOM or the ER. The most common presentation of plague is acute febrile lymphadenitis, or bubonic plague. Involved lymph nodes are usually tender
- Patients may also present with respiratory symptoms with cough, hemoptysis, and chest pain, in addition to fever. This is the presentation of pneumonic plague. This is usually a rapidly progressive disease that mimics other fulminant pneumonias. Less frequently, patients may present with septicemia or meningitis
- The Employee should declare that he/she works with Yersinia pestis in a research lab. A focused history and physical will be performed. If there is a fever of $< 101.5$ F, antibiotic therapy will be initiated pending results of the diagnostic work up
- If the fever is $> 101.5$ F, antibiotic therapy will be initiated immediately
- Initial therapy should be empiric, as delayed therapy can have serious consequences
- Diagnostic testing for all patients will include:
  1. CBC and diff
  2. Blood culture x 2
  3. Chest X-ray
  4. If infiltrate on CXR, sputum Gram stain and culture
  5. Patients with a fluctuant lymph node should have an aspiration with material sent for Gram stain and culture
  6. All patients will have a nasopharyngeal wash for viral isolation and rapid viral diagnostics (EIA for RSV, if -, DFA for RSV; DFA for influenza A and B, DFA for parainfluenza) (lab has agreed to do rapid tests for viruses year round for lab workers)
- The Microbiology Lab should be notified that the worker is being evaluated for plague
- Admission is not necessary for patients presenting with fever alone. Patients would be admitted if they have nausea/vomiting and are unable to take oral meds, if they have other signs of sepsis, or pulmonary symptoms with radiographic findings, as they will require respiratory isolation

**Treatment:**
- All patients will receive empiric therapy for any febrile illness until the diagnostic evaluation reveals an alternative diagnosis and/or symptoms resolve
- For patients who are seriously ill requiring hospitalization or are unable to take oral medication, therapy will be IM streptomycin 15 mg/kg q 12 hours for 10 days or until another diagnosis is made. Although SM is usually given IM, IV is a safe alternative. Although SM is considered the most active aminoglycoside, gentamicin is also effective and is more frequently given as an IV agent
- For patients who are allergic to streptomycin, have other relative contraindications, or for whom an oral medication is strongly preferred, tetracycline (500 mg PO qid) or doxycycline (100 mg PO bid) can be given as an alternative
- In the rare patient with meningitis, the initial regimen should include chloramphenicol (1 g IV q 6 hours). Other drugs with in vitro activity include fluoroquinolones and trimethoprim/sulfamethoxazole.
- Post-exposure Prophylaxis, Asymptomatic Patient
If a lab worker has an inoculation injury or a significant splash exposure, doxycycline 100 mg PO bid should be administered for 10 days. If there is an allergy to tetracyclines, cipro 500 mg PO bid can be given.
- Isolation Procedures
Patients with respiratory symptoms and possible pneumonic plague should be considered highly contagious. They should be put in respiratory isolation for at least 72 hours, longer if there is a lack of clinical improvement with therapy

**Date approved: December 21, 2014**