Exposure Response Plan for Laboratory Handling of *Yersinia pestis*

**Background Information:**

*Yersinia pestis* is a gram-negative bacterium of the Enterobacteriaceae family. It causes plague; a highly contagious and lethal disease that caused three human pandemics. Natural infections are generally the result of a bite from an infected flea but may also result from a bite or contact with an infected animal such as a rabbit or a cat.

This agent has been used as a bioweapon and has been classified by the Centers for Disease Control and Prevention (CDC) as a Select Agent. Attenuated strains are available for lab use. Confirmatory testing is used to validate genetic deletions.

**Signs and Symptoms of Infection:**

There are three forms of plague. Symptoms depend on how a person was exposed to *Y. pestis*. Diagnosis can be difficult. First symptoms, like sudden onset of high fever, resemble the flu. Other symptoms may include:

- Chills
- Feeling ill
- Muscle pain
- Headache – usually severe

Antibiotics have significantly reduced mortality. CDC cited an 11% mortality rate in the US between 1990-2010 with an average of 7 human cases reported each year. Natural cases in the US are most frequently seen in New Mexico, Arizona, Colorado, Nevada, California and Oregon.

- Bubonic – named for the tender and swollen lymph nodes called buboes; pain may occur in the area before swelling; usually the result of a flea bite; evident 2-6 days after infection
- Septicemic – may result from handling an infected animal; skin and other tissues may turn black and die; direct bacterial invasion of the bloodstream
- Pneumonic – may develop from inhaling infectious droplets; the most serious form of the disease can be spread from person-to-person; evident 1-6 days after infection

**Pre-exposure Health Screening:** Employees must be given a copy of this information at the initiation of work in laboratories in which *Yersinia pestis* is used. All people working with *Yersinia pestis* must be given the opportunity to be with Occupational Health.

There is no currently licensed vaccine available for general use in the US although countries in the former Soviet Union and China use a live vaccine. Significant adverse reactions after necessary boosters and lack of protection from the pneumonic form limit vaccine use. Recombinant subunit vaccines are in development. A Phase II trial is underway through DynPort Vaccine Company.

Workers with concerns about pre-existing medical conditions should make an appointment with Occupational Health to discuss concerns with a physician. Persons with hemochromatosis are especially susceptible to infections with *Yersinia* species. Hemochromatosis is a disorder of iron metabolism. Excess
iron accumulates in tissues and organs as the body has no mechanism for excess iron excretion. Diagnosis of this disease is often missed. The disease can have genetic or nongenetic causes. Men with genetic disease tend to become symptomatic in their 40’s and women about 15 years post menopause. A fatal lab acquired infection of \textit{Y. pestis} occurred in 2009. Route of transmission is unclear. The strain (KIM) was thought to be nonvirulent due to removal of the element related to iron absorption. It is believed that the undiagnosed man had such an iron overload that the strain overcame the deletion and acquired enough iron to become dangerous. As an insulin dependent diabetic he was also at increased risk. Screening for iron overload generally begins by measuring the protein that binds iron.

**Exposure Incident:** Any exposure of the agent to the eyes, nose, mouth or skin. Percutaneous exposure via needle stick, bite or scratch. Cutaneous exposure via damaged skin. Inhalation of aerosols.

In the event of a non-overt exposure but the individual develops sign and symptoms consistent with \textit{Y. pestis} infection, the individual must seek medical attention from the Tufts Occupational Medical Service provider or an emergency room. Inhaled aerosols or droplets can cause pneumonic disease which is fatal if not treated during the first day.

**Reporting Exposure Incidents:** All exposure incidents must be reported immediately to the supervisor, the Biosafety Officer and are reportable to the Massachusetts Department of Public Health.

**After an exposure incident occurs: immediate action by route of exposure**

- **Inhalation:** If contaminated materials are aerosolized outside of a biological safety cabinet and the cloud inhaled, rinse mouth twice expelling the rinsate. Do not swallow.

- **Ingestion of contaminated materials:** If contaminated material is ingested, rinse mouth out with clean water. No specific treatment available. Monitor for symptoms.

- **Needle stick, laceration, bite, and contact with non-intact skin:** Wash the area with soap and running water. Do not apply bleach, alcohol or other disinfectant to the skin.

- **Mucous membranes (eye, nose, mouth):** If contaminated material is ingested, rinse mouth out with clean water. If contaminated material is splashed or sprayed into the eyes, flush the eyes for 10-15 minutes.

- **Contact with intact skin and clothing:** Remove contaminated clothing using gloves and process as medical waste. Wash skin with soap and water.

Report all exposures to the Principal Investigator and seek prompt medical evaluation.

**After an exposure incident occurs: medical evaluation and follow-up:**

Following immediate actions, contact the Tufts Medical Center Employee Health Clinic (Boston), TCSVM Occupational Medical Clinic (Grafton) or the Mt. Auburn Occupational Health Services (Medford) and arrange for medical diagnosis and treatment.

During this medical evaluation, the employee will be instructed on the signs or symptoms of infection and instructed how to identify specific signs and symptoms.
If exposed individual develops signs and symptoms of suspect infection, s/he must be evaluated in the Clinic or referred to a Specialist as soon as possible and within 24 hours. Any infection will be assumed to be laboratory acquired until proved otherwise.

**Post-exposure pre-symptom prophylaxis:**

The decision to implement post exposure prophylaxis will depend on a risk assessment made by the physician based on the risk of infection as compared with the risk of antimicrobial drugs.