Exposure Response Plan for the Laboratory Handling of Pertussis toxin

Background Information

*Bordetella pertussis* (the causative agent of whooping cough) secretes a biological toxin; pertussis toxin. During a bacterial infection secreted toxin paralyzes respiratory cilia causing inflammation of the respiratory tract and inhibiting the clearance of respiratory secretions. The toxin produces systemic effects and allows the bacteria to evade host defenses. In research labs the toxin is used as a tool to study binding proteins during signal transduction. Toxin crosses the blood-brain barrier and has been used in the treatment of central nervous system autoimmune disease such as multiple sclerosis.

The lethal dose (LD50) for humans is estimated to be 10ug/kg i.p. or 700ug if you weigh 155 pounds. When using toxin alone, risk of laboratory exposure is due to the presence of the toxin and not due to a potential infection from the organisms that produce the toxin.

*Exposure Incident:* Typical laboratory exposure routes to pertussis toxin are through inhalation, mucous membranes contact, sharps injuries with contaminated materials, and ingestions of trace amounts if hands are not washed prior to eating or other hand to face contact.

*Reporting Exposure Incidents:* All exposure incidents must be reported immediately to the Principal Investigator, Supervisor, and the Biosafety Officer.

**Pre-exposure Health Screening**

It is thought that vaccination with pertussis vaccine is protective and will limit long-term side effects if parenteral exposure occurs; thus for workers in laboratories in which large amounts of toxin is typically used (over 100 ug), or in which toxin is routinely used with sharps, pre-work discussion with Occupational Health should be offered. That discussion typically includes whether an acellular vaccine is indicated.

**Before an Exposure Incident Occurs**

A combined vaccine is available. Allergies and other contraindications should be discussed with a Health Care professional.

**After an Exposure Incident Occurs: Immediate Action by Route of Exposure**
**Inhalation:** If toxin is aerosolized outside of primary containment and potentially inhaled, rinse mouth twice expelling the rinsate, do not swallow. Do not induce vomiting. Fresh air and rescue breathing may be necessary as inhaled toxin can be fatal.

**Needle stick:** Wash the area with soap and running water. Avoid rubbing of skin.

**Mucous membranes (eye, nose, mouth):** If contaminated material is splashed or sprayed into the face contaminating the eyes, nose or mouth: flush the eyes for 10-15 minutes, rinse mouth out with clean water and be sure not to swallow, and wash down face being sure that the nasal cavities have been rinsed as much as possible.

**Contact with intact skin and clothing:** Remove contaminated clothing using gloves either discard as biological or medical waste or autoclave prior to laundering and re-use. Wash contaminated skin with soap and water.

**After an Exposure Incident Occurs: Medical Evaluation and Follow-up:**

**Post-Exposure Treatment:**

If any individual working with or around pertussis toxin develops signs or symptoms suggestive of exposure to the toxin, they must inform their Principal Investigator and Biosafety Officer immediately. The individual must notify the TCSVM Occupational Medical Clinic or Emergency Response Call Center-ERCC 866-360-8100 (Grafton), Tufts MC Employee Health (Boston), or Mt. Auburn Hospital Occupational Health Group (Medford).

If the exposed individual requires immediate medical attention (especially after inhalation and injection of toxin) call Tufts Police 6-6911.

**Signs and Symptoms**

Pertussis toxin affects immune response and disrupts signaling pathways. It is able to cross the blood-brain barrier and can cause severe neurological complications. Report exposures prior to any signs and symptoms developing so that the use of hyperimmune globulin can be considered.

Symptoms may include:

- Low blood sugar (shakiness, sweating, hunger, irritability)
- Difficulty breathing
- Impaired mental state (confusion, inability to complete routine tasks)

Massachusetts Department of Public Health-MDPH regulations (105 CMR 300.000) stipulate that pertussis is reportable to the Local Board of Health –LBOH.