International
BIOLOGICAL THREAT REDUCTION

SAND2007-3547C

Biohazards of HIV, JEE, and *B. anthracis*

India

June 2007

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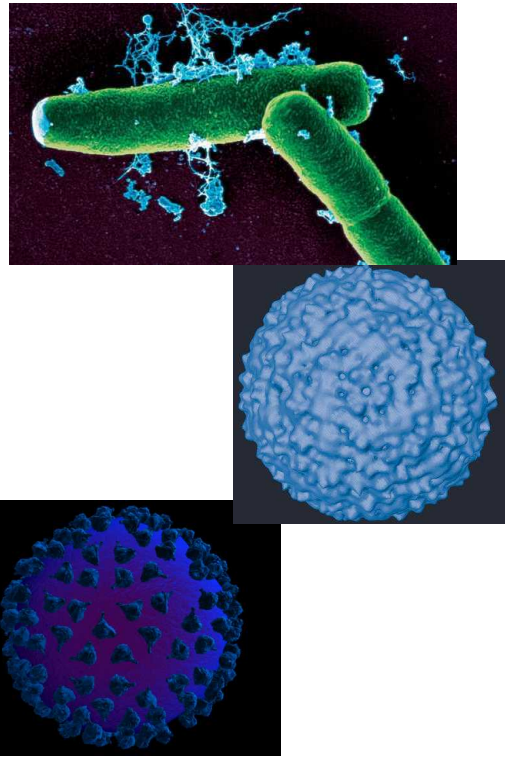
SAND No. #########
Sandia is a multiprogram laboratory operated by Sandia Corporation, a Lockheed Martin Company, for the United States Department of Energy's National Nuclear Security Administration under contract DE-AC04-94AL85000.

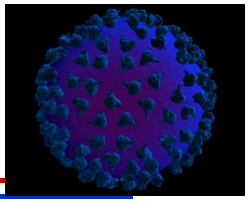
Sandia National Laboratories

Outline

- History of Laboratory Acquired Infections
- Health Hazards
- Viability
- Laboratory Hazards
- Recommended precautions/practices
  - Containment
  - PPE
  - Decontamination
  - Inactivation
  - Incident response
- Medical surveillance

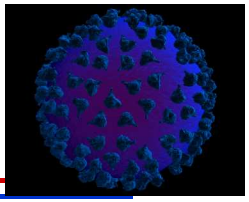


Human immunodeficiency virus (HIV)



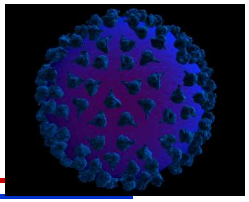
- **History of Laboratory Acquired Infections**
  - Splashing of infected materials
  - Apparent skin exposure
  - Puncture wounds
- **Health Hazards**
  - Transmitted from person to person through direct exposure to infected body fluids (blood, semen) sexual contact, sharing unclean needles etc
  - Epidemiologic evidence suggests that duration from exposure to onset of symptoms has a minimum range from 6 months to more than 7 years
- **Viability**
  - Drying in environment causes rapid (within several hours) 90-99% reduction in HIV concentration
  - Infected serum samples in liquid form showed a loss of concentration within a few days; at one month there was no detectible virus (the samples were still in liquid form at one month)
- **Laboratory Hazards**
  - Direct contact with skin and mucous membranes
  - Accidental parenteral inoculation
  - Ingestion
  - Hazard of aerosols exposure unknown

Human immunodeficiency virus (HIV)



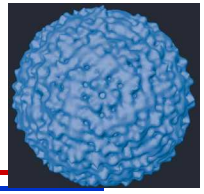
- Recommended precautions/practices based upon the Risk Assessment
  - Containment
    - Biosafety level 2 practices, containment equipment and facilities for activities involving clinical specimens and non-cultured procedures and for activities involving non-human primates and any animals experimentally infected or inoculated with HIV
    - Biosafety level 3 practices, containment equipment and facilities for all work culturing HIV
  - PPE
    - Gloves should be worn when handling potentially infectious specimens, cultures or tissues
    - Laboratory coats, gowns or suitable protective clothing should be worn
    - Goggles or face masks should be worn in areas of high potential for splash
  - Decontamination
    - Surface Decontamination
      - 1% sodium hypochlorite
      - 2% glutaraldehyde, formaldehyde, or ethanol
    - Waste Decontamination
      - Steam sterilization
      - Incineration
      - Chemical disinfection

Human immunodeficiency virus (HIV)



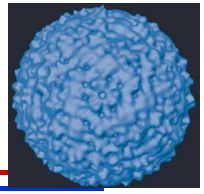
- **Inactivation**
  - 30 min at 56°C reduces residual infectivity to below detectable levels
  - All inactivation should be validated
- **Incident response**
  - Spill response
    - Allow aerosols to settle
    - Wearing protective clothing, gently cover spill with paper towels and apply 1% sodium hypochlorite, starting at perimeter and working towards the centre
    - Allow sufficient contact time before clean up
    - Decontaminate before disposal
- **Medical surveillance**
  - Serological monitoring for evidence of HIV infection
  - Post Exposure treatment and follow up
    - Specific measures for the opportunistic diseases that result from AIDS
    - "Cocktail" multidrug treatment for HIV
    - Experimental prophylaxis with AZT/DDI or other appropriate drug

Japanese Encephalitis (JEE)



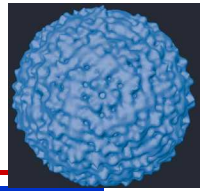
- **History of Laboratory Acquired Infections**
  - 22 cases reported up to 1980 and no fatalities in Canada
  - Reported causes accidental puncture and vector transmission
- **Health Hazards**
  - Transmitted by the bite of infective mosquitoes
  - Incubation perious 5-15 days
  - Not directly transmitted from person-to-person
  - Virus is not usually demonstrable in the blood of human after onset of disease, but can be isolated from the CSF in 1/3 of acute cases
- **Viability**
  - Survives for long periods in mosquito eggs (virus can be maintained over winter in eggs)
  - The virus is not viable in dead mosquitoes after 24 hours (RNA can still be extracted 14 days after death)
  - Stability of JEE in dried or stored CSF unknown, but other arboviruses like VEE are infectious when in dried CSF or blood
- **Laboratory Hazards**
  - Direct contact with broken skin or mucous membranes
  - Accidental parenteral inoculation
  - Exposure of infectious aerosols
  - Bites or scratches from experimental animals, including arthropods (mosquitoes)

Japanese Encephalitis (JEE)



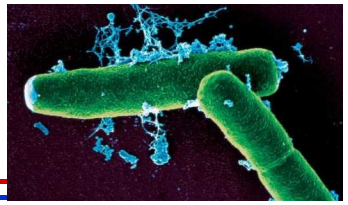
- **Recommended precautions/practices based upon the Risk Assessment**
  - **Containment**
    - **Biosafety level 3 practices, containment equipment, and facilities are recommended for all activities involving potentially infectious materials and infected tissue cultures, animals, or arthropods**
  - **PPE**
    - **Laboratory coat**
    - **Gloves and gown (tie in back and tight wrists) must be worn when working with infectious materials**
    - **Vaccination of personnel working directly and regularly with the JE**
  - **Proper sharps handling and disposal**
  - **Decontamination**
    - **Surface Decontamination**
      - **70% ethanol**
      - **2% glutaraldehyde**
      - **3-8 % formaldehyde**
      - **1% sodium hypochlorite, iodine, phenol iodophors and organic solvents/detergents**
    - **Waste Decontamination**
      - **Steam sterilization**
      - **Incineration**
      - **Chemical disinfection**

Japanese Encephalitis (JEE)



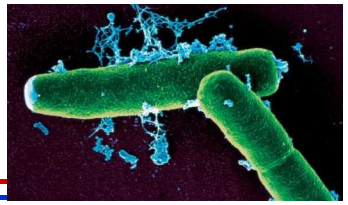
- **Inactivation**
  - Inactivated by heat
    - 50% reduction in 10 min at 50° C
    - Complete inactivation in 30 min at 56° C
    - Sensitive to UV and gamma irradiation
  - All inactivation should be validated
- **Incident response**
    - Spill Response
      - Allow aerosols to settle
      - Wearing protective clothing, the spillage must be covered promptly with a paper towel and disinfectant poured gently on towel, working from the outside to inwards
    - Accidental Exposure
      - Passively protect accidentally exposed laboratory workers by human or animal immune serum
- **Medical surveillance**
  - Monitor for symptoms
  - Serological studies
  - Isolation of virus from blood, CSF or other body fluid
  - IMMUNIZATION: Formalin inactivated vaccine (JE-VAX)

B. Anthracis



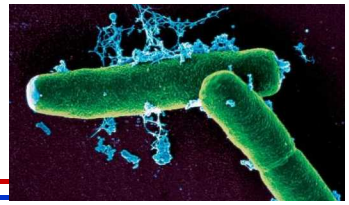
- **History of Laboratory Acquired Infections (from US armed force laboratories)**
  - 45 cases with 5 deaths occurring primarily in facilities conducting anthrax research
  - 25 reported cases of cutaneous anthrax among armed forces personnel
- **Health Hazards**
  - Infection of skin by contact with infected animal tissues and possible by biting flies feeding on such animals, or by contaminated hair, wool, hides or products made from them
  - inhalation anthrax results from inhalation of spores in contaminated soil areas, dried or processed skins and hides of infected animals
  - intestinal anthrax from ingestion of contaminated undercooked meat
  - Incubation period within 7 days of exposure, usually 2 to 5
  - Infectious dose: 8,000 to 50,000 organisms by inhalation
- **Viability**
  - Spores remain viable in soil, skins and hides of infected animals and contaminated air and wool for decades
  - Survival in milk - 10 years;
  - Dried on filter paper - 41 years
  - Dried on silk threads - up to 71 years
  - Pond water - 2 years
- **Laboratory Hazards**
  - Direct and indirect contact of skin with cultures and contaminated laboratory surfaces
  - Accidental parenteral inoculation
  - Exposure to infectious aerosols

B. Anthracis



- **Recommended precautions/practices based upon the Risk Assessment**
  - **Containment**
    - **US Recommends: Biosafety level 2 practices and facilities for clinical material and diagnostic quantities.**
    - **Biosafety level 3 practice and facilities for production quantities, high concentration of cultures, unknown but suspected samples or a high potential for aerosolization**
  - **PPE**
    - **Gloves, gowns with tight wrists and ties in back**
    - **Frequent hand washing**
    - **Care of skin abrasions and proper handling of potentially contaminated articles**
  - **Decontamination**
    - **Surface Decontamination**
      - **2% glutaraldehyde or formaldehyde**
      - **5% formalin (overnight soak preferable)**
    - **Waste Disposal**
      - **Incineration**
      - **Steam sterilization of cultures and infected materials**
      - **Animals that have died from anthrax should be incinerated**

B. Anthracis



- **Inactivation**
  - Spores are highly resistant to drying, heat, and sunlight
  - Adequate sterilization requires direct exposure to 121°C for at least 30 min
  - All inactivation should be validated
- **Incident response**
  - Spill Response
    - Allow aerosols to settle
    - Wearing protective clothing, gently cover spill with paper towels and apply suitable disinfectant (glutaraldehyde, formalin), starting at the perimeter and working towards the centre
    - Allow sufficient contact time before clean up
  - Accidental Exposure
    - Prompt treatment with high-dose antibiotics
- **Medical surveillance**
  - Monitor for suspicious skin lesions and other symptoms
  - Laboratory confirmation through direct microscopy, culture, immunological techniques
  - IMMUNIZATION: Vaccine is recommended for those workers with frequent exposure to clinical specimens and cultures
  - Vaccination of cattle or other livestock may be justified in anthrax-endemic areas

General safety precautions

- Blood and Bodily Fluid Precautions should be taken when working with samples regardless of transmission and infectious route of suspected agent
  - Samples may contain other infectious agents like Hepatitis
- General PPE
  - Gloves should be worn when handling potentially infectious specimens, cultures or tissues
  - Laboratory coats, gowns or suitable protective clothing should be worn
  - Goggles or face masks should be worn in areas of high potential for splash
- Proper sharps handling
- Proper spill response
- Proper waste management

References

- Health Canada Material Safety Data Sheets
- US Centers for Disease Control Biosafety in Microbiological and Biomedical Laboratories (BMBL) 5th Edition:
  - http://www.cdc.gov/od/ohs/biosfty/bmbl5/bmbl5toc.htm