Biological Agents and Blood borne Pathogens

1

Regulations

- OSHA 29CFR1910.1030 (1989—2004)
  - Exposure to blood and blood products and other potentially infectious material (OPIM)
  - Definition of OPIM-human body fluids: semen, vaginal secretions, cerebrospinal fluid, lung fluid, heart fluid, abdominal fluid, amniotic fluid, saliva in dental procedures, any other body fluid that is visibly contaminated with blood such as saliva or vomit
  - Body fluids in situations where it is difficult or impossible to differentiate between body fluids such as emergency response;

2

Applicability

- Human Pathogens-blood borne only!
  - Ex: HIV (Human Immunodeficiency), HBV (Hepatitis B) and HCV (Hepatitis C)
- Types of Business
  - Biotech/Drug companies-Research labs
  - Emergency Response personnel
  - Hospitals/Doctors/Dentists/

3

Bloodborne Pathogens

- Hepatitis B
  - Vaccine available
  - Can be fatal to infected person
- Hepatitis C
  - No vaccine
  - Only 15 % who become infected recover
  - Lifelong illness – generally ending in death after 25-30 years
- HIV – Human Immunodeficiency Virus
  - No vaccine
  - Therapy available, effective for only a short time?

The philosophy of Universal Precautions

Assume all persons, tissues, bodily fluids and other potentially infectious material (OPIM) carry all diseases at all times.

4

Exposure Prevention Plan

Written Plan
- Reviewed and Updated yearly
- Biological Safety Officer (BSO) designation

- Determination of who is affected
  - Job classification vs occupational exposure
- Engineering Controls
  - Needle less systems
  - Biosafety hoods

5

Written Plan (continued)

- Sharps Injury Log
- Incident Report on Exposures
  - Who, what and where
- Universal Precautions
  - Hand Washing
  - PPE
  - Prohibited practices-capping of needles
  - No food or drinks, etc in affected areas
  - Minimize aerosols-spraying etc.

6

Exposure Prevention Plan continued

- Disposal of waste
  - Sharps container-not liquids/leak proof/labeled
  - Liquid waste needs to be in labeled containers
  - Offsite disposal-manifests/licensed
  - Onsite treatment-autoclaves/chemical disinfectant
- PPE
  - Provided free
  - Includes not limited to gloves, lab coat, surgical clothes, safety glasses/face shield
  - Employer determines appropriate PPE-Employee input
  - Comfortable, laundry provided, repaired and replaced

7

Exposure Prevention Plan continued

- Post –Exposure-what to do in an emergency
  - Access to medical care
  - Prophylaxis treatment
  - Counseling
  - Testing
  - Determination of exposure
  - Medical record-keeping required

8

Exposure Prevention Plan continued

- Hepatitis B Vaccination
  - Declination
- Signage
  - Outside of Labs stating type of infectious agent
  - Requirements for entering area-PPE
  - Responsible people and telephone numbers
- Biosafety Cabinets
  - Annual certification

9

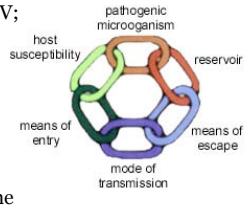
Training Requirements

- Training
  - Potential for contamination
  - Symptoms and Route of contamination
  - HIV, HBV and HCV
  - Hep B vaccination/declination
  - Labels and signs
  - Engineering controls and PPE
  - Provide copy of regs and exposure plan
  - Proper Microbiological techniques
  - Should include non-bloodborne if working with them

10

Training Example

- The infectious disease process typically consists of three routes of entry:
- **PENETRATION** into the bloodstream, exemplified by Hepatitis B Virus and HIV/HCV;
- **INHALATION** of airborne organisms, such as Mycobacterium (TB); and
- **INGESTION** of organisms, demonstrated by salmonella.
- **The Infectious Disease Process (**For an infectious disease to occur, each link in the chain must be connected



11

Types of Infectious Agents

- Bloodborne Pathogens
- Herpes B Virus
- Research Agents
- Select Agents

12

Research Agents

Laboratory Biosafety Levels

- BL-1 E. coli K-12
- BL-2 Human Tissue
- BL-3 M. tuberculosis
- BL-4 Ebola

13

Select Agents

USA PATRIOT ACT

- Center for Disease Control (CDC)
- Select Agents (42 CFR Part 72)
  - 13 Viruses
  - 7 Bacteria
  - 3 Rickettsiae
  - 1 Fungi
  - 12 Toxins
- Must Register with CDC/institution
- Security measures must be taken

14

Select Agents: Viruses

- Crimean-Congo haemorrhagic fever
- Eastern Equine Encephalitis
- Ebola
- Equine Morbillivirus
- Lassa Fever
- Rift Valley Fever
- Tick-borne Encephalitis Complex
- Variola Major (Small Pox)
- Venezuelan Equine Encephalitis
- Yellow Fever
- Viruses causing Hantavirus Pulmonary Syndrome
- South American Haemorrhagic Fever

15

Select Agents

TOXINS

Arbin
Aflatoxins
Botulinum
Clostridium Perfringens Epsilon
Conotoxin
Diacetoxysirpenol
Ricin
Saxitonxin
Shigatoxin
Straphylococcal Enterotoxins
Tetrodotoxin
T-2 toxin

BACTERIA/FUNGI

Bacillus anthracis
Brucella abortus, B. melitensis, B. suis
Burkholderia (Pseudomonas) mellei
Burkholderia (Pseudomonas) pseudomallei
Clostridium botulinum
Francisella tularensis
Yersinia pestis
RICKETTSIAE
Coxiella burnetii
Rickettsia prowazekii
Rickettsia rickettsii
FUNGI
Coccidioides immitis

16

Biological Hazards

- **Working definitions for agent classification:**
  - **Class 1: Minimal hazard**
  - **Class 2: Oral or inoculation hazard**
  - **Class 3: Aerosol transmission hazard**
  - **Class 4: No cure available**

17

Biological Hazards

- **Biosafety levels are combinations of facilities and practices:**
  - **Level 1:** basic lab, good lab practices
  - **Level 2:** limited lab access, specific training and practices
  - **Level 3:** containment (biosafety cabinet), specific training and practices
  - **Level 4:** full containment, specific facility, training and practices

18

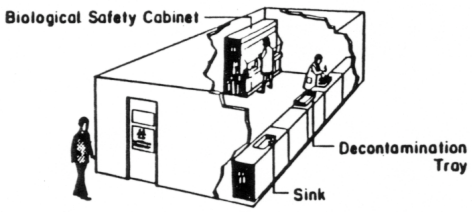
Biological Hazards
Biosafety levels (BL's)

- **BL 1**

19

Biological Hazards
Biosafety levels (BL's)

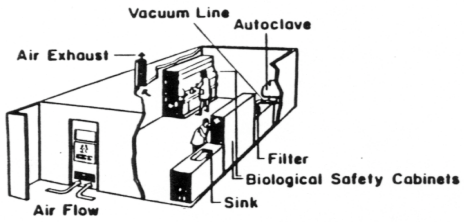
- **BL 2**



20

Biological Hazards
Biosafety levels (BL's)

- **BL 3**



21

Biological Hazards
Biosafety levels (BL's)

- **BL4** - microorganisms that cause lethal disease, with no known treatment or vaccine
  - Ebola virus, Marburg virus
  - Maximum containment lab; positive pressure ventilated suits (moon suits)

22

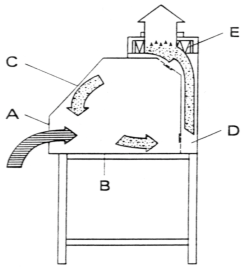
Biological Hazards
Biosafety cabinets

- **Class I:** Modified chemical hood with HEPA filtered exhaust; no product protection
- **Class II:** Recirculating cabinet with HEPA filtered exhaust: provides product and personnel protection
- **Class III:** Fully contained glove box

23

Biological Hazards
Biosafety cabinets

- **Class I Biosafety cabinet**



24

Biological Hazards
Biosafety cabinets

- **Class II Biosafety cabinet**

25

Biosafety Cabinets

26

Use of Biosafety Cabinet

- Turn on fan 15 min before starting
- Don't block grille
- Disinfect work surface w/ 70% etoh
- Discard pipets inside cabinet
- Minimize movement of hands
- Avoid use of flame unless necessary
- Have cabinet certified annually

27

Clean Bench

- This is not a BSC
- Air flows from back of cabinet, across work surface, and onto user.
- This does not provide worker protection.

28

Biological Hazards Universal Precautions

- **Safe work practices**
  - **Treat all body fluid samples as though they are infectious**
  - **Handwashing**
  - **Decontamination and workplace cleaning**
  - **Prevention of aerosols**
  - **Do not recap needles**

29

Biological Hazards Universal Precautions

- **Engineering controls**
  - **Shields and barriers**
  - **Sharps containers and coverings**
  - **Biological safety cabinets**

30

Biological Hazards Universal Precautions

- **Protective equipment**
  - **Lab coats**
  - **Goggles**
  - **Eye wash**
  - **Showers**
  - **Containers for disposal**
  - **Vaccinations, if possible and available**

31

Biological Hazards Universal Precautions

- **Housekeeping**
  - **Keep workplace clean and sanitary**
  - **Proper waste disposal**
  - **Proper handling of laundry**

32

Physical Hazards
Universal Precautions

- **Fall prevention**
- **Cuts, punctures, burns, etc.**
- **Ergonomics: lifting, bending, reaching, etc.**
- **Electrical**
- **Compressed gases**
- **Fire**

33

Physical Hazards
Fire Safety

- **Minimize flammable and combustible material**
- **Store flammable and combustible materials away from ignition sources**
- **Segregate incompatible chemicals**
- **There should be no oxygen tanks or oxidizer chemicals anywhere near any flames**

34

Related Regulations/Guidelines

- CDC 42 CFR 73-Select Agents
- CDC/NIH Biosafety in Microbiological and Biomedical Laboratories
- NIH Guidelines for Research Involving Recombinant DNA Molecules, 2002

35

Selected References

- CDC/NIH Biosafety in Microbiological and Biomedical Laboratories
- NIH Guidelines for Research Involving Recombinant DNA Molecules
- Laboratory Safety-Principles and Practices-Diane Fleming, et. Al.
- CRC Handbook of Laboratory Safety-A. Furr
- CDC 42 CFR 73 (Select Agent Program)
- CAL-OSHA Title 8, Section 5193

36

Additional material
Websites

- http://www.cdc.gov/od/sap/
- http://www.cdc.gov/od/ohs/biosfty/bmbl4/bmbl4toc.htm
  CDC's Biosafety Manual
- http://www.osha.gov/pls/oshaweb/owasrch.search_form?p_doc_type=STANDARDS&p_toc_level=0&p_keyvalue=1910_1030.html
- http://www.hc-sc.gc.ca/pphb-dgspsp/msds-ftss/index.html
  Canada's Safety site-MSDSs for infectious organisms
- http://www2.umdnj.edu/eohssweb/aiha/technical/biosafety.htm AIHA website
- http://www4.od.nih.gov/oba/rdna.htm
- http://www.dir.ca.gov/Title8/sb7g16a109.html Cal-OSHA

37

The End!

38