BSL3 Practices

Sandia National Laboratories

Laboratory Biosecurity and Biosafety

for BSL3 Laboratories

Bogor, Indonesia

20 June 2006

www.biosecurity.sandia.gov

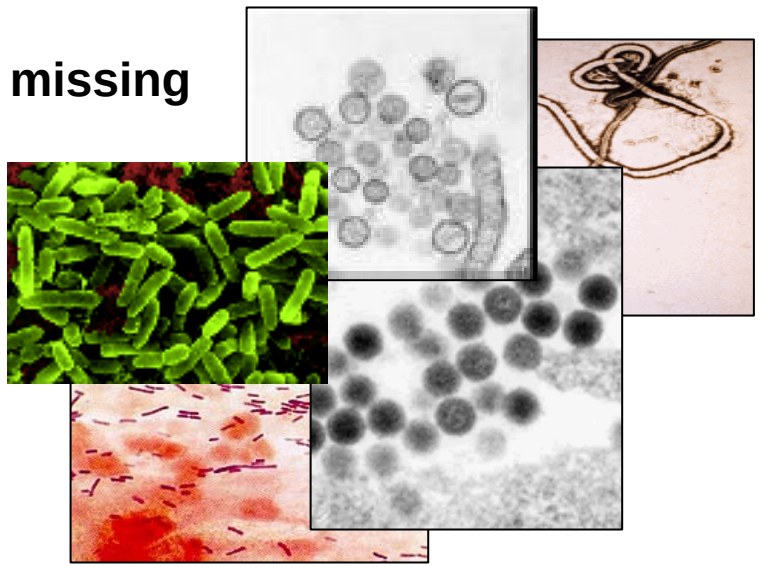
SAND No. 2006-3687C

BSL 3 Practices

- Administrative
  - Written SOPs – discussed in Program Management briefing
  - Material control & accountability
- Access controls
  - Training requirements
  - Personnel screening / reliability
  - Visitor controls / protocols
- Standard & special lab practices
- Personnel protective equipment (PPE)

Administrative Procedures: Material control & accountability

- **Ensure the complete and timely knowledge of:**
  - What materials exist
  - Where the materials are
  - Who is accountable for them
- **NOT: to detect whether something is missing**

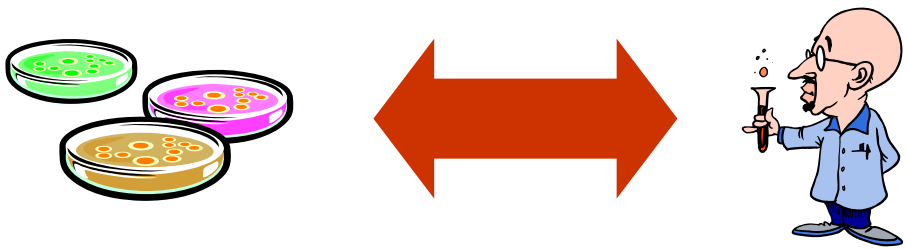


- What materials in what forms
- Agent
  - What agents are high risk?
  - Viable? Whole organism or DNA?
- Quantity
  - Any amount can be significant
  - A threshold amount for toxins
- Form
  - Repository stocks, working samples, in host, contamination
- Detail—what level is adequate for MC&A?
  - Material as *items*
  - Each vial as a separate inventory record?
- Capture—when does MC&A start & stop?
  - Naturally occurring; clinical samples; disposition

Administrative Procedures: Material control & accountability

- **All material should have an associated "accountable person"**
  - **The person best in a position to answer questions about the associated material**
  - **Not someone to blame!**
  - **Ensure that no material is "orphaned"**

- **Procedures should ensure accountability**
  - **Experimental work: laboratory procedures**
  - **Inventory: know what you have**
  - **Reporting: document routine MC&A practices**
  - **Audit/ assessment: is this working?**
    - Ensures effective *implementation* of MC&A
  - **Training: personnel understand requirements**



Access Controls: Establishing Restricted Areas

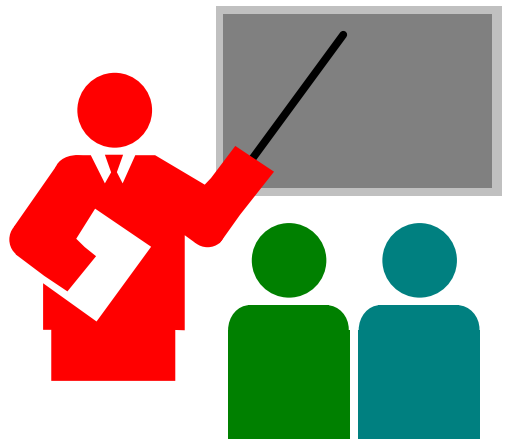
- **Access control ensures that only authorized individuals are allowed into certain areas**
  - **Increasingly strict controls as you move toward higher risk assets**
- **Limited Areas**
  - **Unique item**
  - **Controlled possession**
  - **Electronic or physical key**

- **Exclusion Areas**
  - **Unique item**
  - **Unique knowledge**
  - **Controlled possession**
  - **Electronic key card and keypad or biometric device**

  or
  - **Controlled key and second individual to verify identity**

Access Controls: Training Requirements

- Increased need for staff training as risk increases
- All lab and support personnel receive training on hazards, precautions, exposure procedures, escort responsibilities, biosecurity procedures
- All lab personnel must demonstrate proficiency in lab-specific procedures
- Training should be repeated every year and when procedures change
- All training is documented



Access Controls: Personnel Screening

- **Goal: Know that the individual is properly trained and can be trusted to work with the biological materials in the lab**

- **Before granting access:**
  - **Verify credentials**
  - **Verify completion of all pre-requisite training**
  - **Check references**
  - **Mentor and observe their lab skills**
  - **Ensure extensive experience at BSL 2 first**
  - **Medical surveillance**
  - **Assure supervision by competent scientist**
  - **Criminal history**
  - **In-depth background investigation**

Access Controls: Visitors

- **Types**
  - **Personal Visitors**
    - **Family members**
  - **Casual Visitors**
    - **Tours, seminars**
    - **Equipment repair technicians**
  - **Working Visitors**
    - **Visiting researchers**
    - **Facility maintenance personnel**

- **Controls**
  - **All visitors should have a host at the facility**
  - **Visitors should be escorted in restricted areas**

Access Controls: Badges

- **Badges should be issued to those individuals authorized to be in restricted areas**

- **Badge return**
  - **Upon employee termination**
  - **Daily or at the conclusion of a limited term for visitors**
- **Report lost or stolen badges**
- **Consider safety implications**

Exposure Routes

- Airborne (A)
- Skin contact (S)
- Mucous membrane contact (M)
- Ingestion (I)
- Percutaneous injection (P)

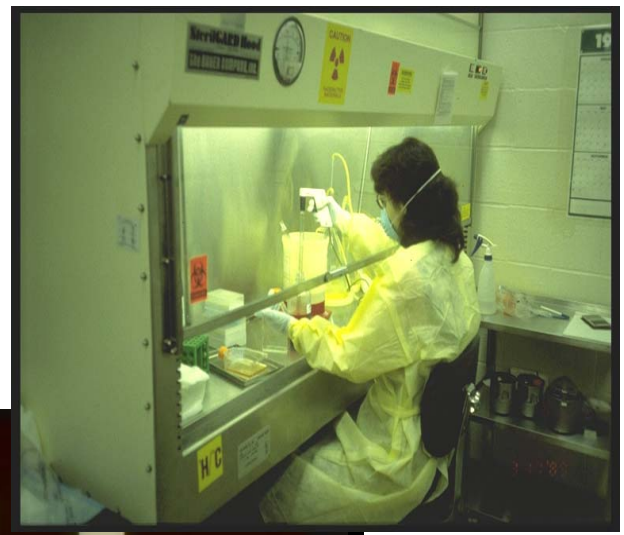
Standard and Special Lab Practices: Role in Preventing Exposure

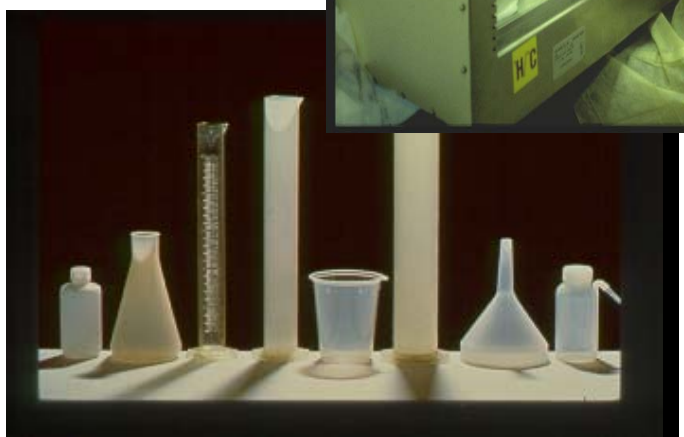
- No mouth pipetting: A, I, S
- Careful manipulation of fluids: A, S, M
- Care with sharps: P, S, A, M
- Use of PPE: S, M, A, I
- Frequent hand washing: S, M, I
- Decontamination of work surfaces: S, M, I
- No eating, drinking, etc in labs: S, I

Airborne (A)
Skin contact (S)
Mucous membrane contact (M)
Ingestion (I)
Percutaneous (P)

Standard and Special Laboratory Practices

- All procedures with live agent must be performed inside the biosafety cabinet
- No work with open vessels on open bench
- Use of paper covering on work surface assists clean-up
- Use of appropriate disinfectant in cabinet
- Substitute plastic for glass
- Careful pipetting techniques
- Wash hands often
- No mouth pipeting
- No eating or drinking in lab
- Minimize aerosol generation
- Decontaminate work surfaces
- Safe sharps handling
- Wear applicable PPE





Standard and Special Laboratory Practices: Minimizing Aerosols

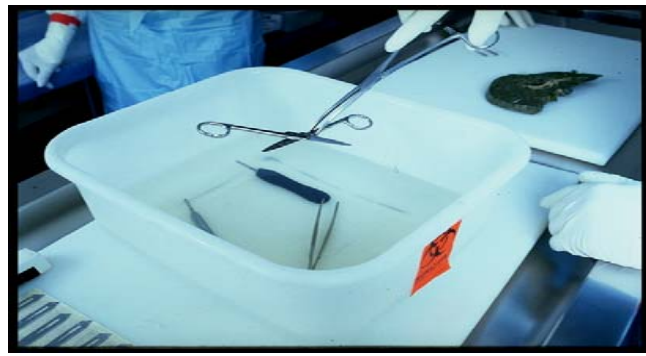
- Use careful pipetting practices
- Avoid drops onto hard surfaces
- Wipe up spills promptly with appropriate disinfectant
- Use capped tubes when mixing, blending, or vortexing
- Pour liquids carefully
- Avoid bubbles

Standard and Special Laboratory Practices: Careful Pipetting Techniques

- Never blow out last drop in pipette
- Use pipetting aids with filters
- Use horizontal pipette collection tubs
- Never mix by suction + expulsion
- Discharge liquid down side of container, using tip-to-wall contact
- Deliver as close as possible to contents
- Work over plastic-backed absorbent matting

Standard and Special Laboratory Practices: Safe Use of Sharps

- Sharps includes scalpels, blades and wires, anything that can cut or puncture
- Percutaneous exposure risk
  - Employ safe work practices
  - Only use sharps if absolutely required as part of a process
- Aerosol risk
  - Use biosafety cabinet for removal of air from needle
- Utilize safe sharp devices
- Keep hands away from needles
- Use mechanical methods for needle removal
- Never bend, recap or manipulate sharps by hand.
- Dispose of entire unit into sharps container
- Collect reusable sharps in labeled, leak-proof container



Personal Protective Equipment

- **Why:**
  - **Provides a barrier against skin, mucous membrane or respiratory exposure to infectious agents**
  - **To prevent spread of contamination**
- **Types:**
  - **Gloves**
  - **Gowns, lab coats, coveralls, scrubs**
  - **Goggles**
  - **Safety glasses with side shields**
  - **Face shield**
  - **Booties, head covers**
    - **Closed toe shoes (no sandals)**
  - **Respirators**
- **Limitations:**
  - **Does not eliminate the hazard**
  - **Integrity wanes with use (change gloves frequently)**
  - **Not all gloves created equal - select best glove for the task**

Personal Protective Equipment

- Personal protective equipment is NOT worn outside of the lab or taken home to be laundered!
- Reusable protective clothing should be autoclaved on-site
- For BSL 3
  - Back closing lab coat
    - Wrap around gowns with tight cuffs
  - Gloves
    - Single pair for entry
    - Double gloving for work in BSCs, transport, spill clean-up
  - Shoe coverings
  - Face protection
    - Safety glasses or goggles
  - Respiratory protection may be required (i.e. M.tb, SARS)
- Staff must be trained in aseptic removal procedures- gloves last

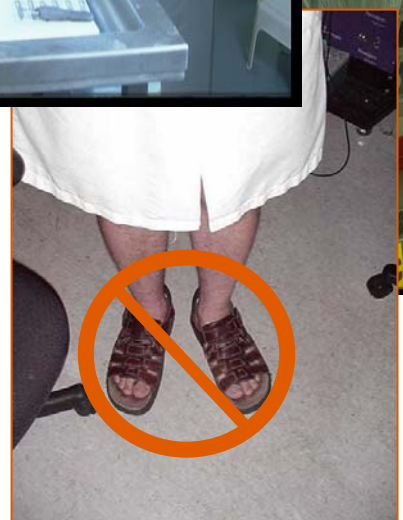
Personal Protective Equipment: Respirators

- Uses a filter medium to remove contaminant
  - Reduces aerosol exposure
- N95 Respirator
  - Disposable
  - Classified by:
    - Filter efficiency – 95% (N95), 99% (N99), 99.97% (N100)
    - Series – N (not oil resistant), R (oil resistant), P (oil proof)
- Powered Air Purifying Respirator (PAPR)
  - Disposable hood
  - Breathing tube
  - Motor/blower unit
  - Cartridges
  - Nickel Cadmium (NiCad) battery pack
  - Used when
    - Persons with facial hair or facial anomalies that interfere with the seal cannot wear an N95 respirator
    - High-risk aersol generating procedures present
- Surgical masks are not respirators
  - Provide droplet protection, not aerosol protection
  - Provide patient protection
  - Keeps hands out of mouth

Personal Protective Equipment: Respiratory Protection Program

- **Medical evaluation**
  - **Determine individual's fitness to use a respirator**
  - **Physician or other healthcare provider**
    - **Medical evaluation questionnaire**
    - **Physical exam at physician's discretion**
- **Fit test**
  - **Accepted/approved qualitative or quantitative protocol**
  - **When**
    - **Prior to initial use**
    - **Annually**
    - **Whenever different respirator is worn**
    - **Whenever a problem reported**
    - **Whenever a change (e.g. facial change, weight loss) is reported**
- **Training**
  - **Criteria for respirator selection**
  - **Limitations of respirator types**
  - **Proper method for donning**
  - **Checking facepiece for seal and proper operation**
  - **Respirator maintenance**

PPE Examples



Removing Gloves