BSL3 Practices

Laboratory Biosecurity for BSL3 Laboratories
Nashville, TN
7 October 2007

www.biosecurity.sandia.gov

SAND No. 2006-3687C
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.

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BSL 3 Practices

- **Administrative**
  - Written SOPs
  - Material control & accountability
- **Access controls**
  - Training requirements
  - Personnel screening / reliability
  - Visitor controls / protocols
- **Standard & special lab practices**
- **Personnel protective equipment (PPE)**

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Biosecurity Practices

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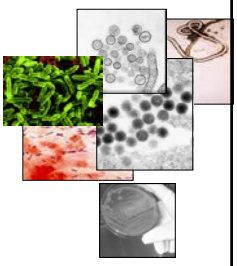
Administrative Procedures: Material control & accountability

- **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



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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

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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

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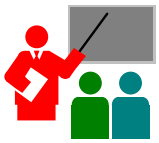
Access Controls: Training Requirements

- **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**

Biosafety Practices

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)

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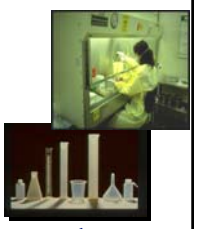
Standard and Special Laboratory Practices

- 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



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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

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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

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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

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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

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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**

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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 aerosol generating procedures present**
- **Surgical masks are not respirators**
  - Provide droplet protection, not aerosol protection
  - Provide patient protection
  - Keeps hands out of mouth

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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 face piece for seal and proper operation
  - Respirator maintenance

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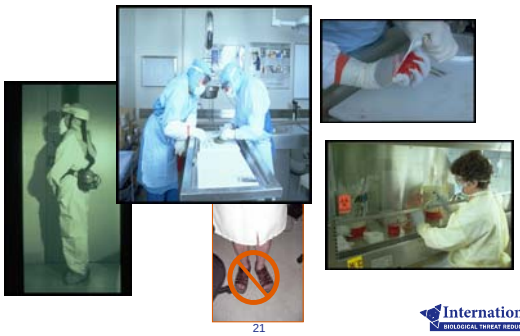
PPE Examples



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Removing Gloves

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