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ORGANIC AND CHEMICAL CONTAMINATION IN ADVANCED LABORATORIES

Michael R. Somin, AIA
Earl Walls Associates

BUILDINGS for ADVANCED TECHNOLOGY WORKSHOP

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FACILITIES TYPE COMPARISON

- Nano Cleanrooms
- Biocontainment BSL3 and BSL4



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CONTAMINATION DIFFERENCES

- Cleanroom to protect the PRODUCT
 - Suited Up and Dusted Off
- Bio Facility to protect the USER
 - Suited Up and Protected



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SIMILAR SPACE ORGANIZATION

- Number of Locations
 - Cleanroom Type – MANY
 - BSL-3 - Many
 - BSL 4 – Less than 6 in the United States
- Interstitial Space
 - Supply and filtering system
 - Bio – Solid Floors
- Lower Levels
 - Support Facilities
 - Waste Handling – BSL4, BSL3 AG



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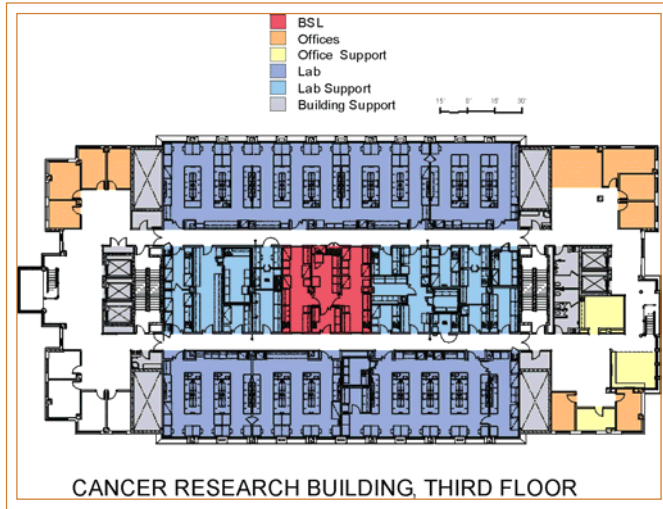
SIMILAR CONSTRUCTION

- Gown-Up Areas
- Filtered Supply Air
- Hard Surfaces
- Sealed Environment
- Contaminated Material Removal
 - Bio - Autoclave and Filtration

SPACE ISSUES - INFRASTRUCTURE

- **Redundant Systems**
- **Emergency Power System**
- **Waste Systems**
- **Maintenance Staff Outside Barrier**
- **Flexibility**
- **Reliability**
- **Decontamination Agents**

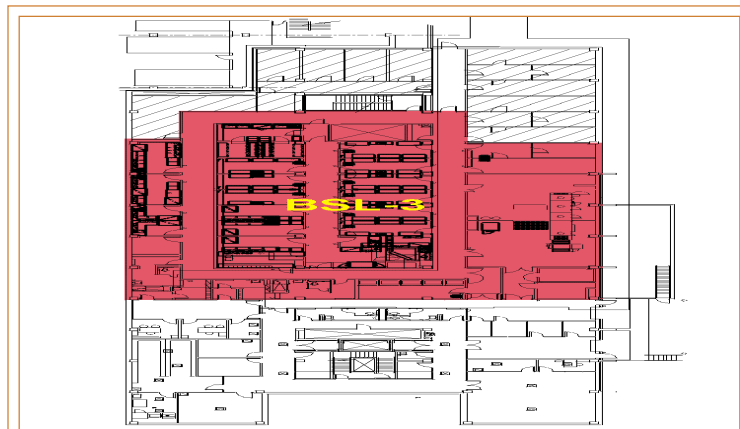
SMALL SUITE



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LARGE SUITE

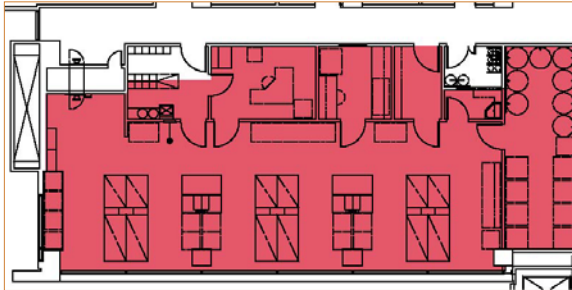


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MAXIMIZE USE

- **Multiple Work Stations**
- **Shared Facilities**
- **Single Entrance and Autoclave**
- **Equipment Locations**

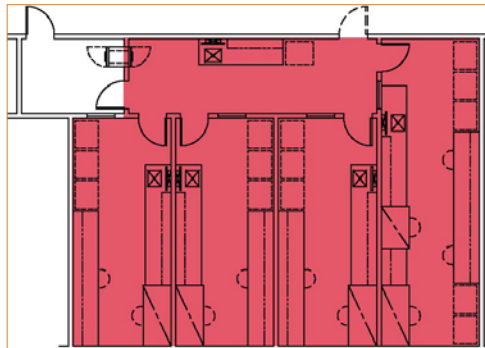


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MULTIPLE AGENT SUITES

- **Shared**
 - Entrance
 - Autoclave
 - Support
- **Each Cell**
 - Sink
 - BSC
 - Incubators
 - Microscopes



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VENTILATION DIFFERENCES

- **NANO Cleanroom**
 - Supply – Highly Filtered
 - Positive Pressure Facility
 - High Rate of Filtered Recirculated Air
 - Ducted Hoods and Equipment
 - Exhaust
- **Bio Facility**
 - Supply – Filtered
 - Negative Pressure Facility
 - Once Through Air Pass
 - Ducted Hoods and Equipment
 - Exhaust

SPACE OUTFITTING

- **NANO Cleanrooms –
Tools and Hoods**
- **Bio facilities – Tools and
Hoods**
 - Contamination Control
 - **Biological Safety
Cabinets**
 - Lab Apparatus
 - **Refrigerators and
Ultra Cold Freezers**
 - **Incubators**
 - **Centrifuges**



PROGRAMMATIC CONSIDERATIONS

▪ ELF Requirements

- Increase in space needs
- ADA
- Large instrumentation
- HEPA filtration
- Specimen storage



DIVERGENT DIRECTIONS - BIO

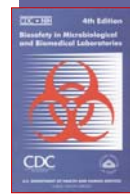
▪ Types of Studies

- Contagious Diseases
- Plant and Insect Pests
- New Drugs
- Animal Diseases
- Bioterrorism
- All Produce Organic & Chemical Contamination



SOURCES FOR BIOSAFETY GUIDELINES

- NIH - CDC Biosafety in Microbiological and Biomedical Laboratories
- USDA – APHIS Quarantine and Containment Guidelines
- World Health Organization Biosafety Guidelines

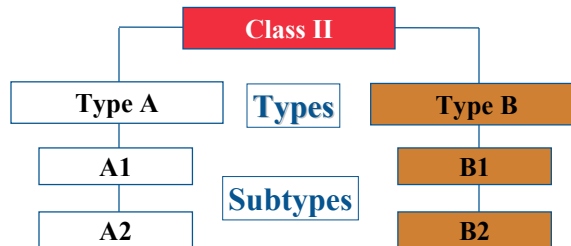



 Health Canada / Santé Canada Laboratory Biosafety Guidelines



BIOLOGICAL SAFETY CABINETS

- Primary Barrier
- New cabinet classifications from NSF



Described by NSF Standard No. 49

Type A or Type B - Which to Choose?

Type A

For routine microbiological work. Type A2 may be used with volatile toxic gasses and fumes if canopy connected.

Type B

Offers containment and direct removal of volatile toxic gasses and fumes used in conjunction with biological research.

The critical factor in choosing Type A or B is not biological containment, but whether or not and how much the user works with volatile toxic chemicals.

TYPES of BIOLOGICAL SAFETY CABINETS

- What type of BSC to use



BIOLOGICAL SAFETY CABINETS



- **Glove boxes**
- **Ducted**
- **Primarily BSL4**

CONTAINMENT – BSL3

- **Primary Barrier**
 - Clothing
 - BSCs
- **Secondary Barrier**
 - Architecture
 - Construction
 - Engineering
 - Pressurization



FURNISHINGS and FINISHES

▪ Interior Finishes

- Flooring
- Walls
- Ceilings
- Doors



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FURNISHINGS and FINISHES

▪ Casework Choices

- Adaptability
- C-Frame
- Movable cabinets
- Easily Cleanable



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CONSTRUCTION ISSUES

- **Interstitial Space**

- Ease of Maintenance
- Adequate Space for Equipment
- Flexibility
- Solid Ceiling



CONSTRUCTION ISSUES

- **Interstitial Space**
- **Maintenance Personnel in Work Clothes**



CONSTRUCTION ISSUES

▪ Light Fixtures – Solid Ceiling

- Sealed
- Access Top
- Access bottom



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FINE DETAILS

▪ Seal, caulk, gasket

- Conduits
- Penetrations
- Doors
- Cracks
- Pressure testing

▪ HEPA filtration

- Supply air (single)
- Exhaust air (double)
- Lab waste vent
- HC has over 1600 HEPA's!!

▪ Magnehelic gauges

- Digital
- Analog

▪ BSC's

- II A2
- II B2

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HEPA FILTERS



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HEPA FILTERS

- HEPA Filtration



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MORE HEPA FILTERS



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MORE FINE DETAILS

- **HVAC system**
- **Door seals**
 - Inflatable gaskets
 - Compression gaskets
- **Autoclaves**
- **Breathing air**
 - Very dry- dehydrates workers

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ENTRY DOORS



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SUIT LABS – BSL4



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SUIT LABS - BSL4



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METHODS of DECONTAMINATION

- Autoclaves
- Incineration



- Transfer
- Compartments Rendering

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DISPOSAL METHODS - Lab Liquid Waste



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RECOMMENDATIONS

- Separate Functions
- Evaluate the need for Biocontainment in NANO facilities
- Plan material and people flow from the beginning
- Plan for separate entrances – Bio/Nano

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