Design for Unknown Hazards

An integrated program for All Hazard Receipt Facilities and Unknowns Accessioning Laboratories

Mitsy Canto-Jacobs, AIA

HDR, Inc.

- Employee-owned Architecture, Engineering and Planning Firm
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- More than 7,800 Employees
- 185 Office Locations - Worldwide
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Outline

1. Goals
2. Definitions, Differences and Debates
3. Design Program Requirements
4. Design Examples
5. Sources
6. Recap
7. Questions?

1 Goals

We are now 10 years after 9/11
and are we better prepared?

NYTimes magazine article 10/31/2011

Goals

- Participants will be able to describe differences in requirements for All Hazards Receipt Facilities (AHRF) and Unknowns Accessioning Laboratories.
- Participants will be able to identify threat agent categories that are ruled out in risk assessments.
- Participants will be able to review workflow and program checklist requirements.

2 Definitions, Differences + Debate

Definitions

"All Hazards" AHRF

Where unknown materials are pre-screened for lethal risk agent categories (chemical, nuclear/ radiological; high explosives; and other threats) before the materials are admitted into the main laboratory facility (public health/ RBL).

"Unknowns Accessioning"

Where unknown materials admitted to public health laboratories can be divided into samples and packaged for internal distribution among departments.

Differences

"All Hazards" AHRF

- Isolated
- Mobile
- "Bunker" in field
- First Responders
- Pre-screening
- Rule out radioactive and explosive materials
- Limited or no screening for biological agents.

Unknowns Accessioning

- Within public health laboratory building
- Populated areas
- Public health scientists and technicians
- Radioactive and potentially explosive unknowns not admitted
- Bioterrorism and chemical terrorism labs test for biological gents.

Differences

"All Hazards" AHRF

- Staff do not conduct biological screening.
- No security clearance for select agent work.
- Screen samples for chemical, radiological, and explosive threats then send to Laboratory Response Network (LRN) lab.

Unknowns Accessioning

- Staff conduct biological screening after unknowns are pre-screened.
- BSL3+ trained staff
- Main laboratory for public health is part of the Laboratory Response Network.

Definitions

All Hazard Receipt Facilities are where chemical, nuclear or radiological, and other threats are ruled out before materials are sent on to where they may pose greater risks.

All hazards labs have focused procedures for pre-screening materials that are NOT typically received by recipient laboratory.

Debate

"All Hazards" AHRF

- US EPA DHS Research reviewing capabilities.
- Should AHRF staff use minimal biological screening methods (immunoassay or ATP bioluminescence)?

Unknowns Accessioning

- APHL supports training in AHRF protocols.
- Should public health and environmental staff use AHRF protocols to rule out biological, chemical, radiological and explosive hazards in unknown samples and packages?

Fundamental question

What is the Purpose of the All Hazards Receipt Facility?

Tentative Identification?

OR

Provide Data for Risk Assessments and Perform Limited Risk Mitigation?

ABSA 2005 Heyl

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3 Design Program Requirements

3. Design Program Requirements

- Accommodate the scope debate in planning space for unknown hazards labs
- Confirm project risk assessment + emergency preparedness drivers
- Refer to biosafety and EPA guidelines
- Provide roadmap through BMBL/ EPA/ DoD and other facility requirements
- Propose a worksheet checklist

Design Program Checklist

Steps	Workflow Requirements		AHRF	UAL	Sources
1	Sample receipt		Isolated, Setback	Within bldg BSL3; BSL4	EPA; BMBL
2	Area for 1st container (transport) inspection		Interviews; bleaching	PHL receiving	EPA and PHL procedures
3	Inspect 2nd container (sample) in Class III BSC		Glovebox	Glovebox	BMBL, EPA
4	Initial sample screening; rule-out tests in work chamber.		Glovebox	Glovebox	BMBL, EPA
5	Continued sample screening (agent-specific testing)		Glovebox	BT; CT labs	EPA, PHL SOP
6	Re-pack clean sample for further study		At LRN	CDC, RBL	EPA, CDC
	Sample enters study area via RTP or pass-through.		Interlocks	Interlocks	BMBL, EPA
	Facility isolation and containment: dedicated HVAC lab air systems and utilities. Biorisk eval (monitored)		ASZM-TEDA filters	HEPA filters	BMBL; US MIL-C-0013724D
	Isolation and Biocontainment Staff assemble at entry + exit rooms, don PPE/PAPRS Equipment decon area, double-door sterilizer		Interlocks	Interlocks	BMBL, EPA, DoD Navy 6055-aaM
	Staffing and stakeholders		Full-time	Not fulltime	EPA; & 2010 APHL survey

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3. Design Program Requirements

- AHRF Activities
  - *Isolate highest risk from community*
  - *Perform tests following AHRF protocol*
- AHRF program requirements
  - *Comply with EPA / BMBL + physical isolation*
  - *Receiving/Log-in; Change Rm; Ante-room; High Containment Lab; HVAC filtration room (672 GSF)*
  - *Area for interviews with delivery/ retrieval team*
  - *Containment of unknown threats: bio, chemical, dirty bomb*
  - *Biosafety cabinet and multi-chamber glovebox*
  - *Communications; double equipment;*

3. Design Program Requirements

AHRF workflow

Step 1 *Sample Receipt*

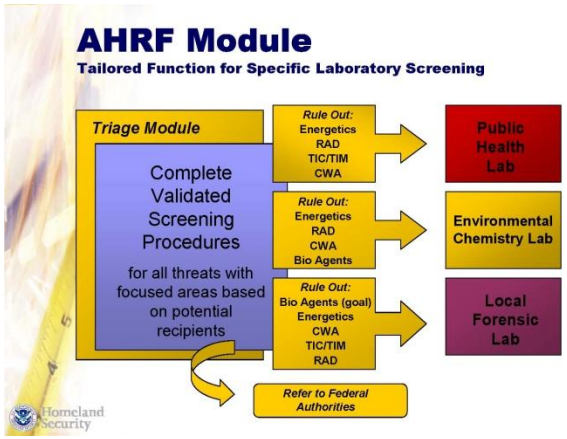
2 *Transport Container Screening*

3 *Primary Sample Container Screening*

4 *Initial Sample Screening*

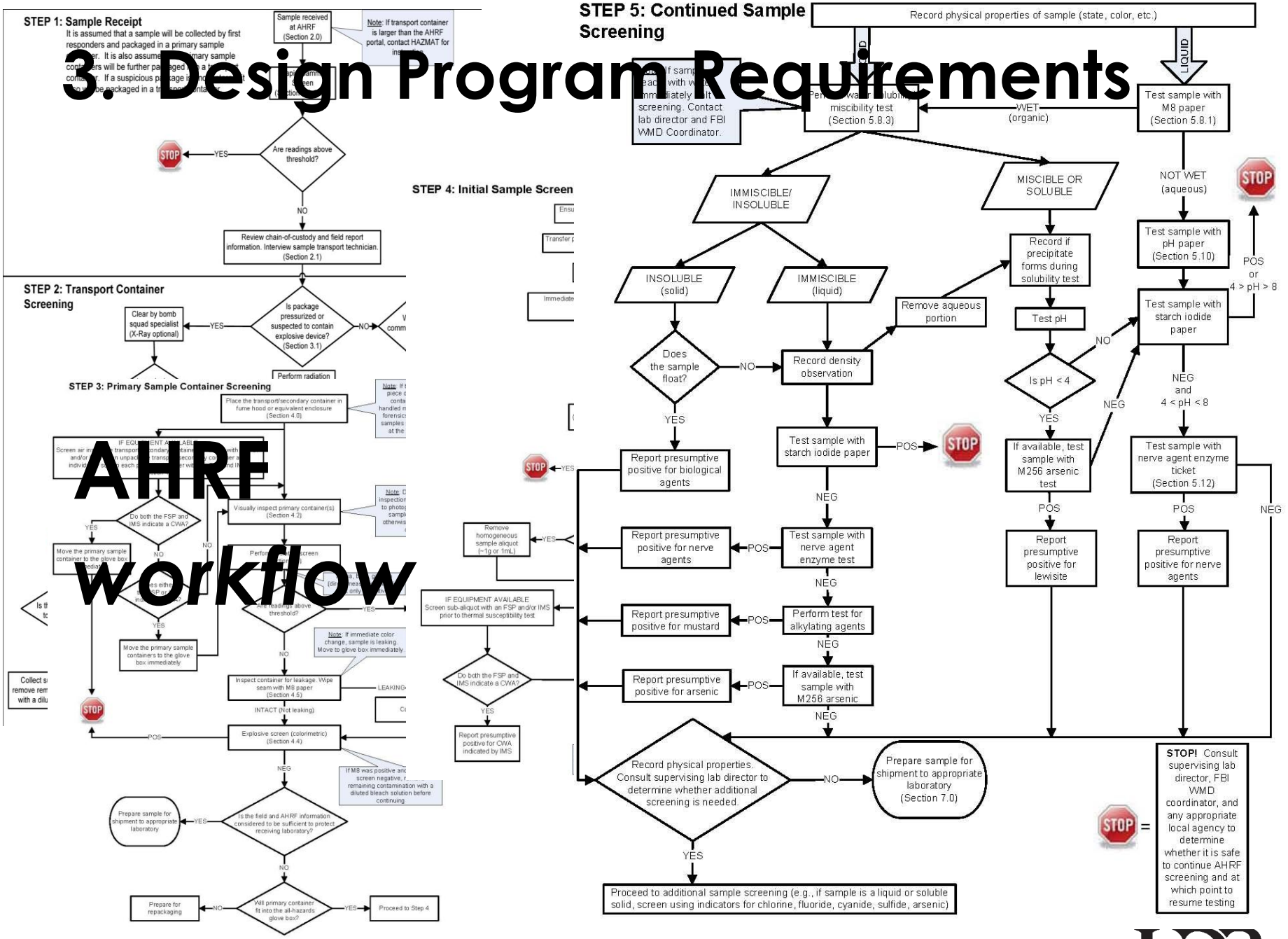
5 *Continued Sample Screening*

6 *Re-pack + send to lab network*



ABSA 2005 Heyl

3. Design Program Requirements



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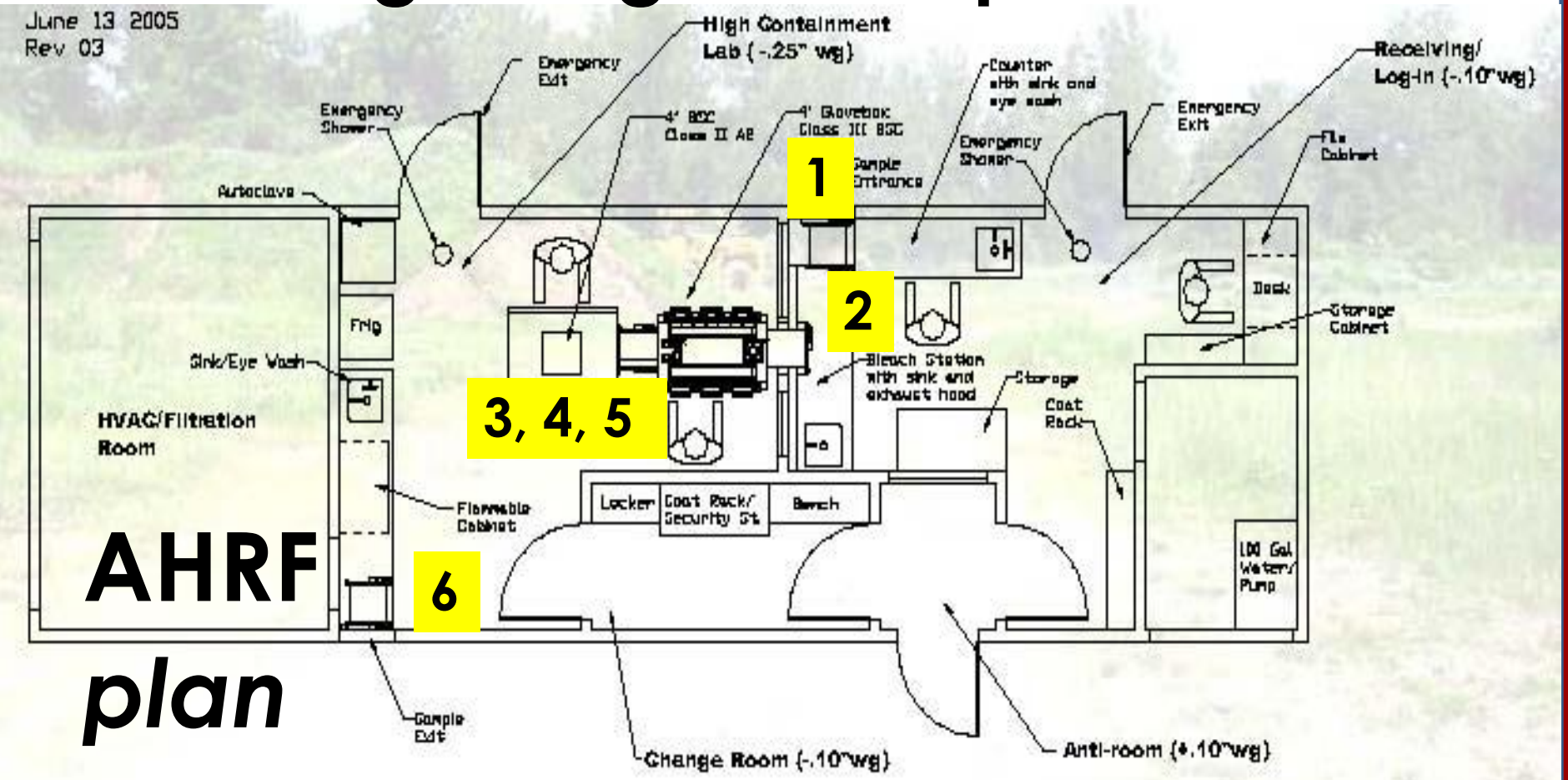
3. Design Program Requirements



AHRF ***plan***

Triage Facility 48' x14'

672 GSF

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3. Design Program Requirements

- Unknowns Accessioning (UAL) Activities
  - Admit and contain pre-screened suspected biological, chemical and environmental hazards
  - "Clean" container exteriors are admitted to IN to containment; "dirty" containers are decontaminated OUT
  - Aliquot; tag + fix slides + samples to BSL3, BSL2 labs
- UAL Facility requirements
  - Domestic BSL3 with enhancements within PHL and RBL
  - Receiving/Log-in at Loading Dock; Change Rm/ shower; Containment Lab; Glovebox; Sample archive; cart access to labs
  - International BSL3 with host nation cooperation; comply with World Health Organization guidelines.
  - HEPA supply air and HEPA/active carbon exhaust air on Class III biological safety cabinet

3. Design Program Requirements

UAL *workflow*

Step 1 *Sample Receipt*

2 *Transport Container Screening*

3 *Primary Sample Container Screening*

4 *Initial Sample Screening / Barcodes*

5 *Sample screening within facility*

6 *BT/CT/ENVIRON labs destroy (-) or re-ship to other facilities RBL, CDC*

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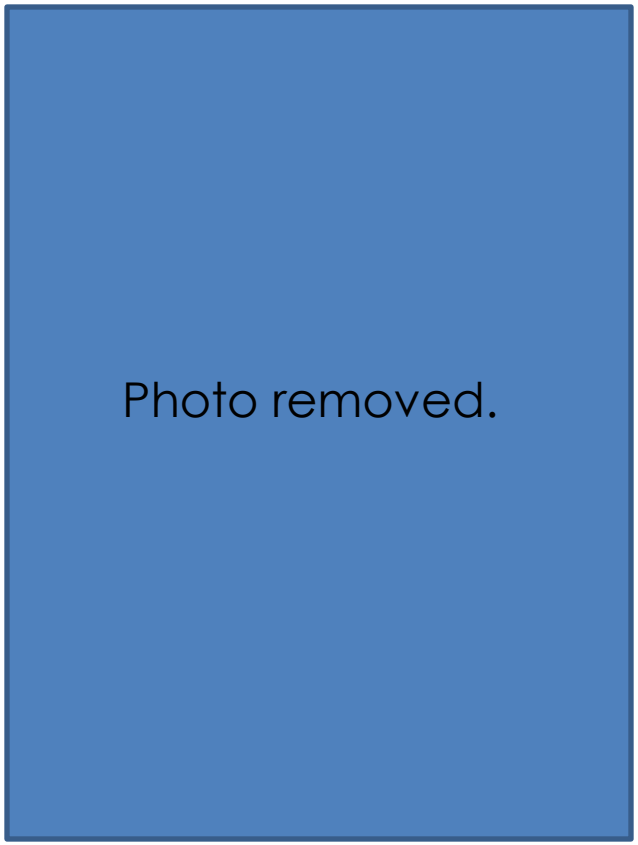
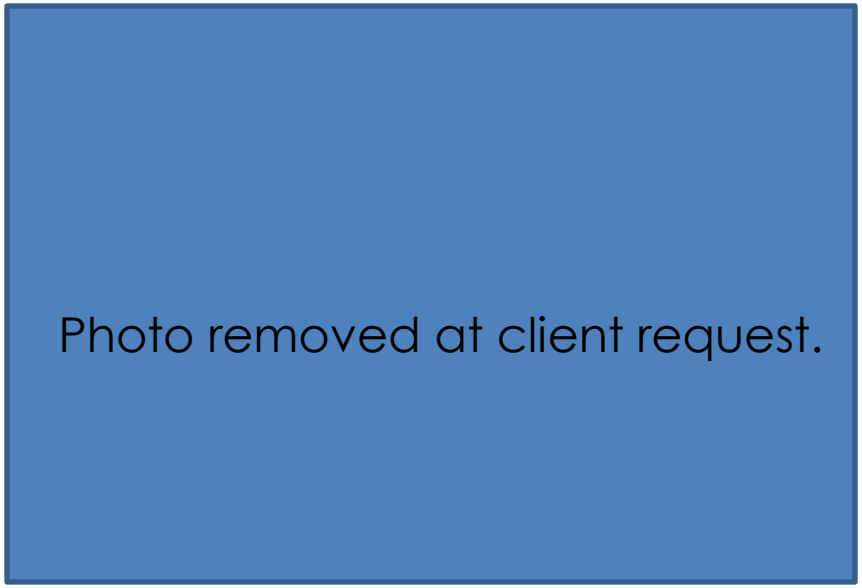
4 Design Examples

4. Design Examples

US Naval Medical
Research Unit No. 3
NAMRU3, Cairo, Egypt





Public Health Lab and
Medical Examiner's Office

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4. Design Examples

US Naval Medical Research Unit No. 3 NAMRU3
Cairo, Egypt

Site images removed.

4. Design Examples

US Naval Medical Research Unit No. 3 NAMRU3, Cairo, Egypt

- Site / security
  - Existing facility 7-level building to be renovated while operating.
  - Secure compound for human and animal health research
  - Training facility for regional public health scientists.
  - Egypt Ministry of Health; DTRA; Navy biocontainment +biosecurity.
- Unknowns Accessioning Lab

  Field service teams deployed for diagnostics in the field.

  Existing glovebox and chemical shower not operational.

  Future: reliable BSL3+ systems & gloveboxes with multiple chambers.

  Pre-screening will eliminate non-biological threat agents.

  Mission of NAMRU3 does not include all-hazards receipt facility.

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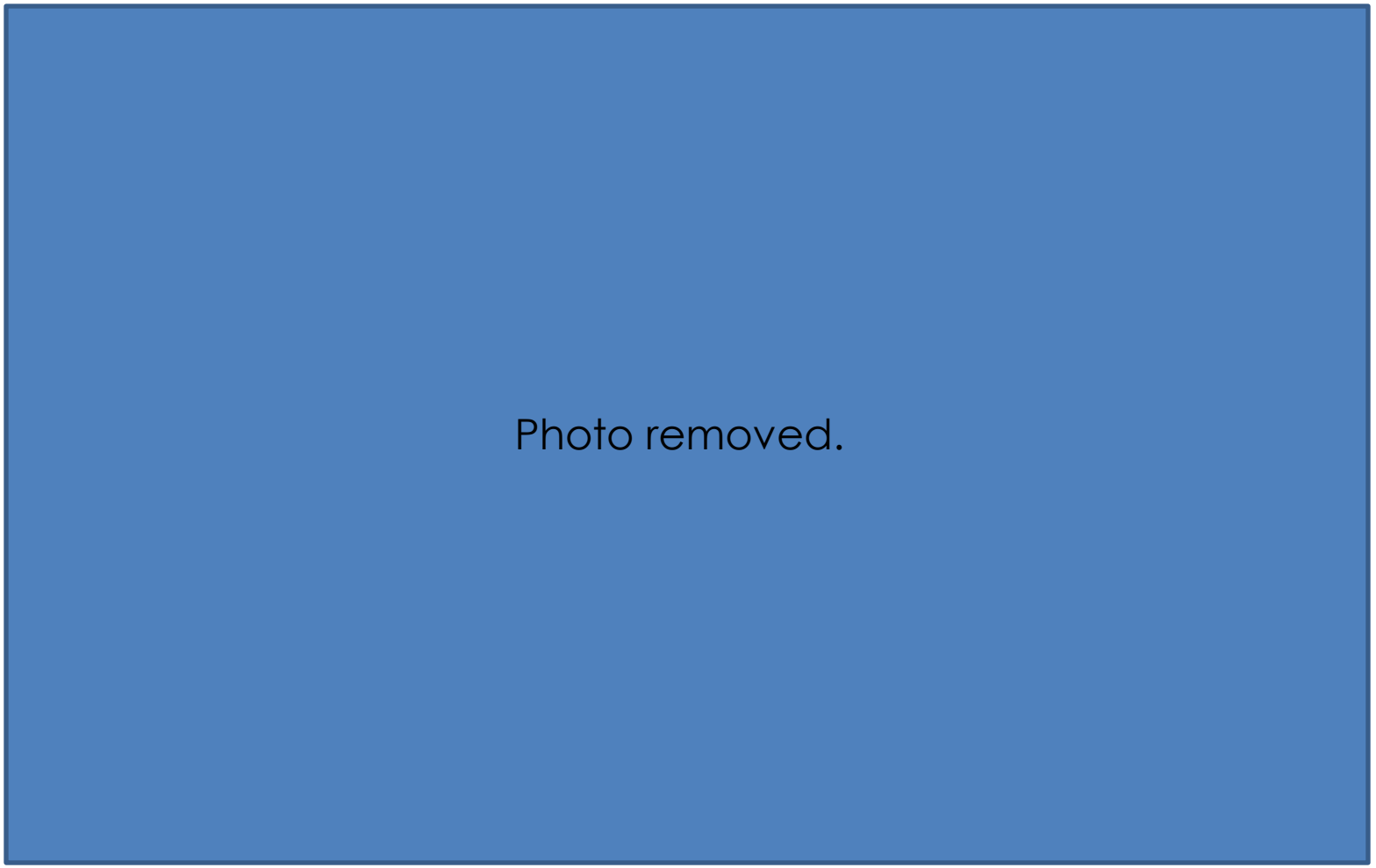
4. Design Examples

US Naval Medical Research Unit No. 3 NAMRU3
Cairo, Egypt



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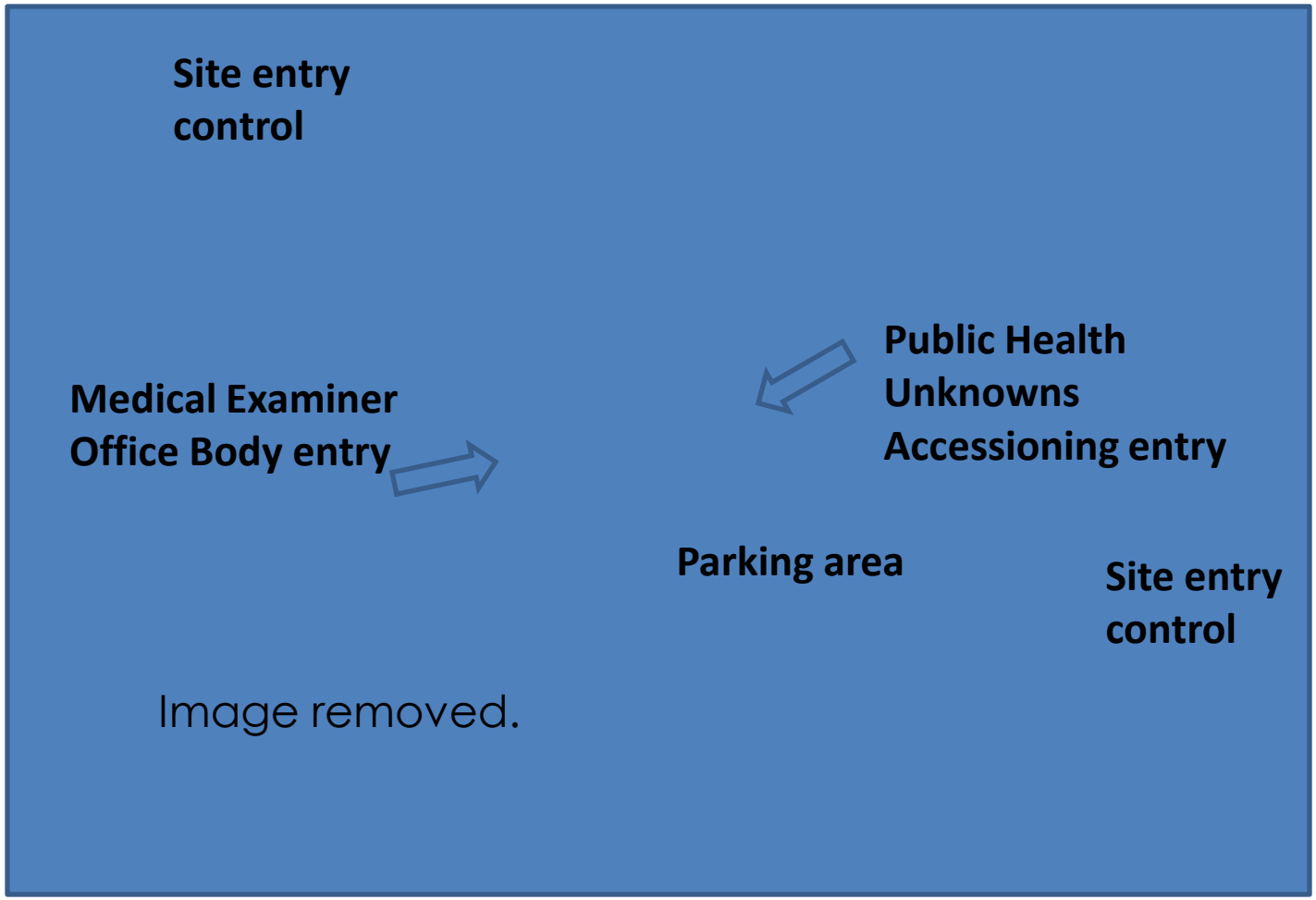
US Naval Medical Research Unit No. 3 NAMRU3
Cairo, Egypt

4. Design Examples

Public Health Lab and Medical Examiners Office



4. Design Examples

Public Health and Medical Examiner's Office

- Site/ security
  - New construction of 220,000 SF, to be occupied mid 2012
  - Secure site for public health wing monitoring and testing training and Medical Examiner Officer with BSL-3e areas.
  - IBC; BMBL; NIH BSL3 certification; NC State Codes
- Unknowns Accessioning (PH and MEO)
  - PH lab will receive pre-screened samples and glove box has in-line active carbon filters. UA space has 100% exhaust; room HEPA and TEDA filtered exhaust air.
  - Laboratories for Bioterrorism, Virology, Chemical Terrorism to perform sample testing.
  - Isolation autopsy suite to be certified "BSL-3 aut"

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4. Design Examples

GLOVEBOX REQUIREMENT 2009

CONSTRUCTION:
10ga TYPE 316 SS, #4 POLISH
VIEW SCREEN 3/8" POLYCARBONATE

CONTROL PANEL:
2x DIGIHELIC (PRIMARY PRESSURE GAUGE).
2x MINIHELIC (SECONDARY PRESSURE GAUGE).
1x MAIN POWER SWITCH (15AMP BREAKER).
1x OUTLET SWITCH (10AMP BREAKER).
2x LIGHT SWITCH (SINGLE 5AMP BREAKER).
2x AIR PRESSURE ALARM.
2x SILENCE BUTTON.

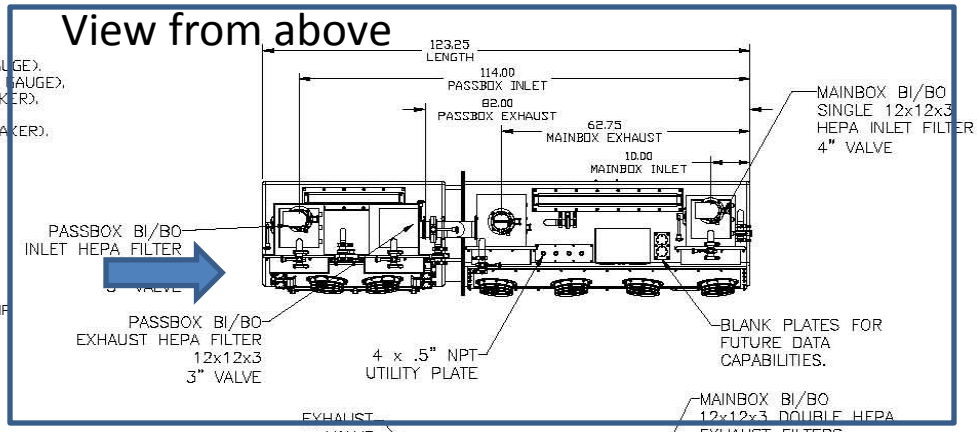
GASKET MATERIAL:
SILICONE

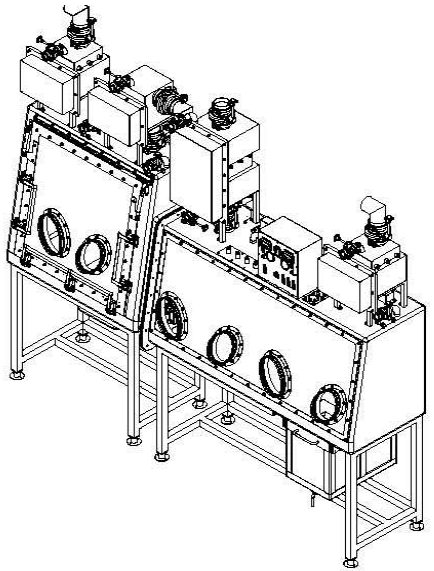
GLOVE MATERIAL:
BUTYL

POWER REQUIREMENTS:
120V 50-60 Hz SINGLE PHASE, 15-AMP
DEDICATED CIRCUIT.

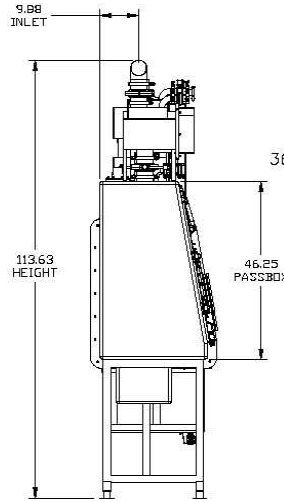
INTERIOR SHELVING:
QUANITY, HEIGHT, LOCATION AND
SIZE TBD BY CUSTOMER.

View from above

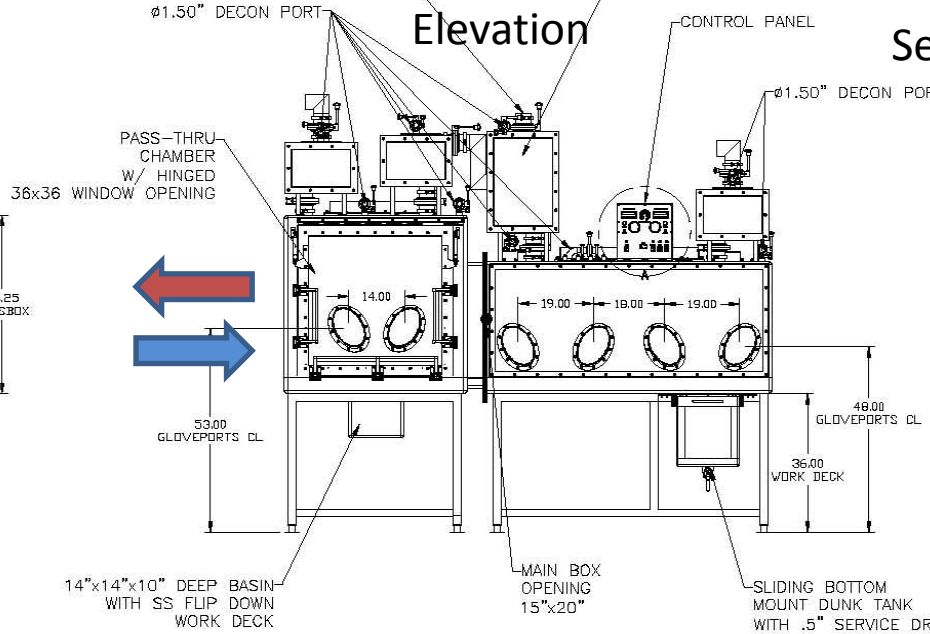




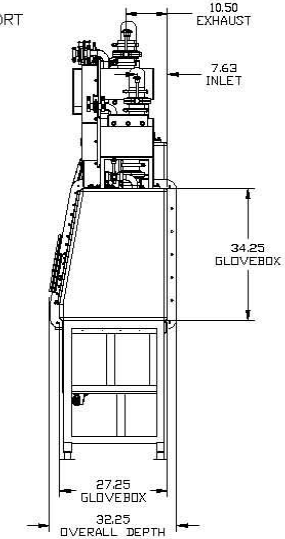
Section D-D

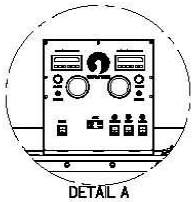


Elevation



Section B-B





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4. Design Examples

GLOVEBOX REQUIREMENT 2011

CONSTRUCTION:
10-16ga
ALL WETTED PARTS TYPE 316
ALL UN-WETTED PARTS TYPE 304 SS,
#4 POLISH
1/2" RADIUS CORNERS MIN. AT SS COMPARTMENTS
VIEW SCREEN 3/8" POLYCARBONATE

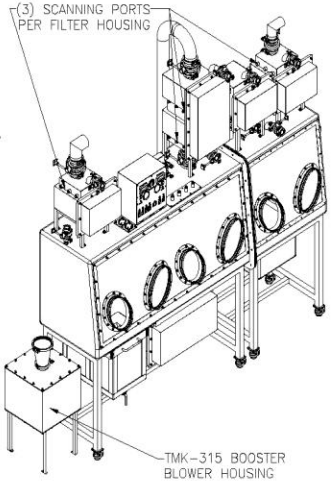
CONTROL PANEL:
2x DIGIHELIC (PRIMARY PRESSURE GAUGE).
2x MINIHELIC (SECONDARY PRESSURE GAUGE).
1x MAIN POWER SWITCH (15AMP BREAKER).
1x OUTLET SWITCH (10AMP BREAKER).
2x LIGHT SWITCH (SINGLE 5AMP BREAKER).
2x AIR PRESSURE ALARM (VISUAL AND AUDIBLE).
2x SILENCE BUTTON.

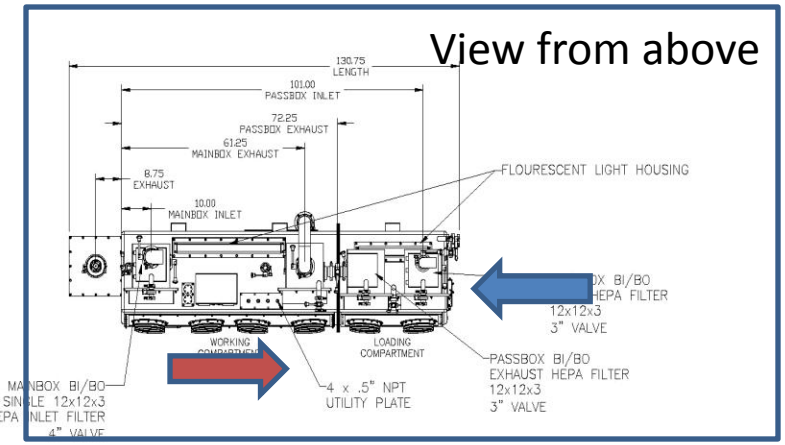
GASKET MATERIAL:
EPDM

GLOVE MATERIAL:
BUTYL

POWER REQUIREMENTS:
GLOVE BOX REQUIRES A DEDICATED 120V
50-60 Hz SINGLE PHASE, 15-AMP CIRCUIT.
BLOWER REQUIRES A DEDICATED 120V
60Hz SINGLE PHASE 30-AMP CIRCUIT

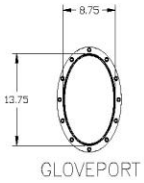
AIR REQUIREMENTS:
150cfm @ 2.5" STATIC

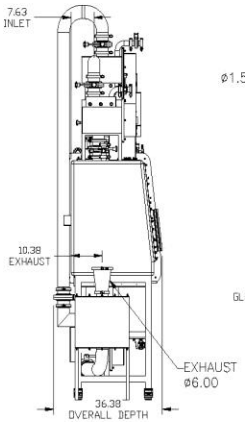




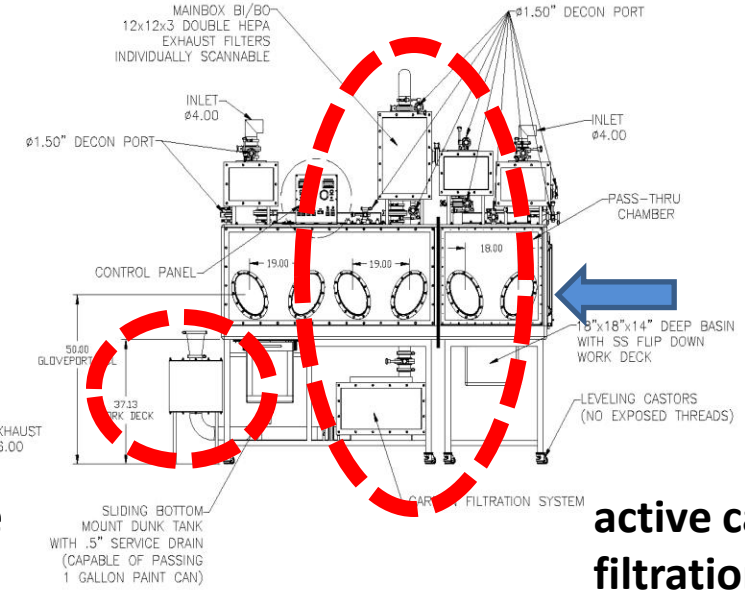
APPROVAL DRAWING

NO CHANGES
CUSTOMER SIGNATURE:
APPROVED WITH CHANGES
CUSTOMER SIGNATURE:
REJECTED WITH MARK-UPS
CUSTOMER SIGNATURE:

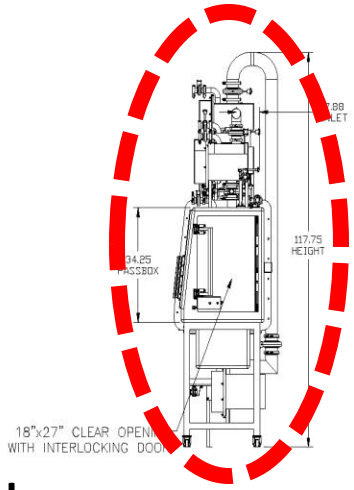




remote blower



active carbon filtration



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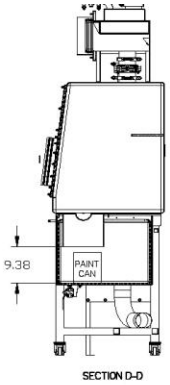
4. Design Examples



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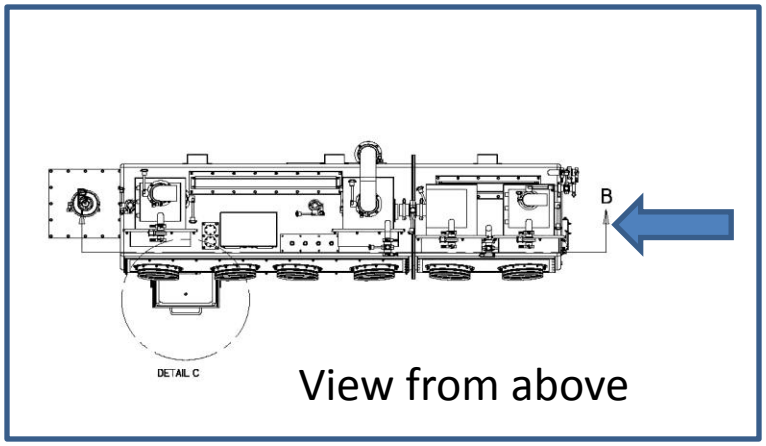
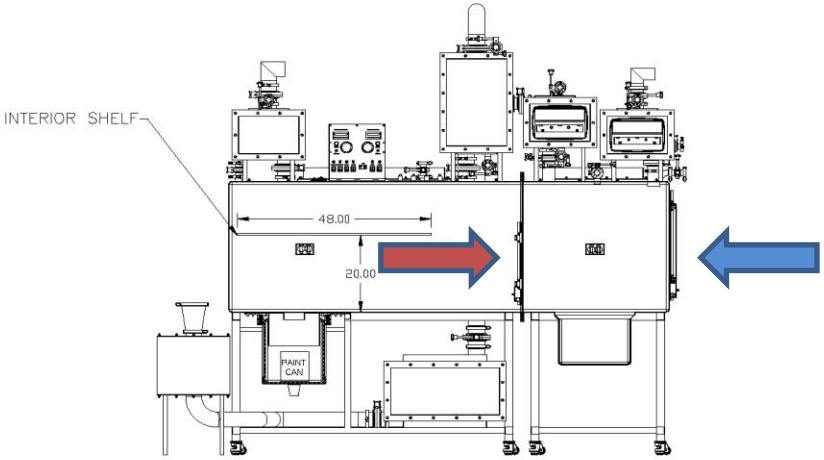


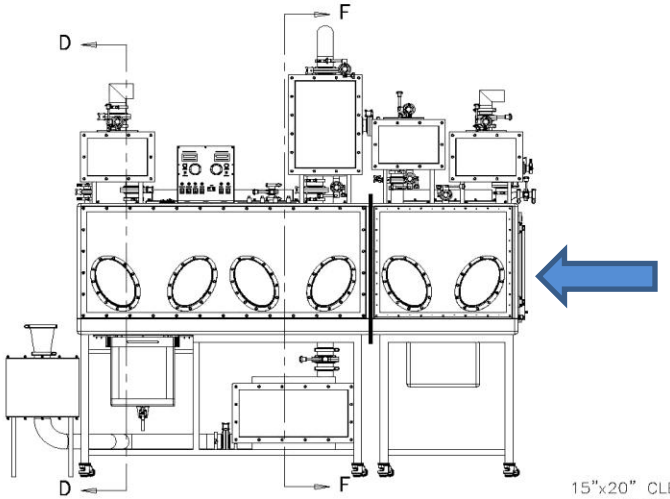
View from above

Section B-B



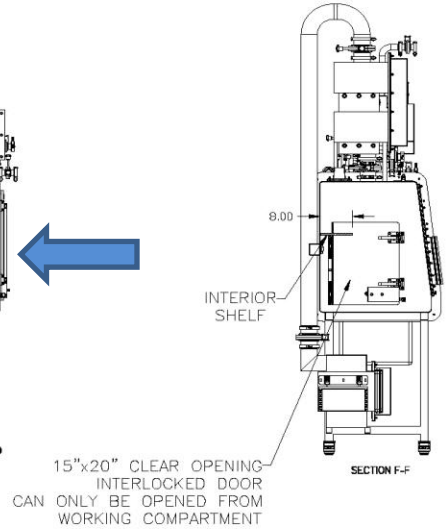
remote blower **active carbon filtration**

Elevation



remote blower **active carbon filtration**

Section F-F



Design for Unknown Hazards

5 Sources

Sources

- **Association of Public Health Laboratories (APHL)**
  - 2010 APHL Annual Meeting report "Public Health Laboratories: Diminishing Resources in an Era of Evolving Threats", based on data from the 2009 All-Hazards Laboratory Preparedness Survey Data (Aug 2008-2009). 51 responses from 50 states and DC (98% response rate)
  - 2011 APHL Annual Meeting report titled "Response by the Numbers: The Nation's Public Health Laboratories Protect the Country" based on data from 2010 APHL All-Hazards Laboratory Preparedness Survey Data (Aug 2009-2010)
- **US Dept of Health and Human Services, Centers for Disease Control**
  - 2009 Biosafety in Microbiological and Biomedical Laboratories (BMBL) 5th Edition.
  - 2011 Laboratory Response Network website http://www.bt.cdc.gov/lrn/
- **US Dept of Defense**
  - 2006 Joint Publication 3-41, "Chemical, Biological, Radiological, Nuclear, and High-Yield Explosives Consequence Management" (March)
  - 2010 Instruction 6200.03, Subject: Public Health Emergency Management Within the Department of Defense (March); also ABSA 2004 Chen, "
  - 2010 Manual 6055.aa-M, "Safety Standards for Microbiological and Biomedical Laboratories", May.
- **US Environmental Protection Agency and Dept of Homeland Security**
  - 2005-2009 US EPA and DHS developed project on All Hazards Receipt Facilities (AHRFs), and began developing standard procedures.
  - ABSA 2005 Heyl, "DEVELOPMENT of an ALL HAZARDS RECEIPT FACILITY (AHRF)".
  - 2010 Final Report — Assessment of All Hazards Receipt Facility (AHRF) Screening Protocol, Revision 1.0 (December).

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6 Recap

Recap

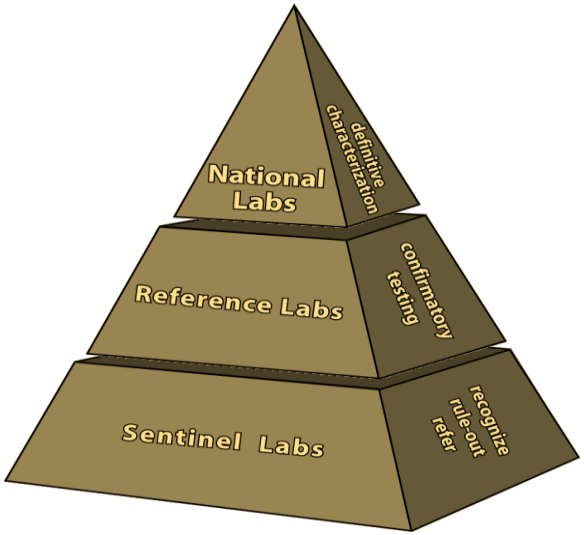
BLURRING MISSIONS 10 years after 9/11, there is pressure on AHRF and PHL to perform extended sample testing, despite decreased funding for staff positions, AHRF training and new equipment.

DESIGN PROGRAM CHALLENGE

- Checklist relates higher risk samples to facility design.
- Containment design and checklists will evolve.
- Whether or not AHRF (US EPA), LRN (US DHHS CDC), US DoD NMRC functions have resources and funding for missions will drive design for unknown hazards.

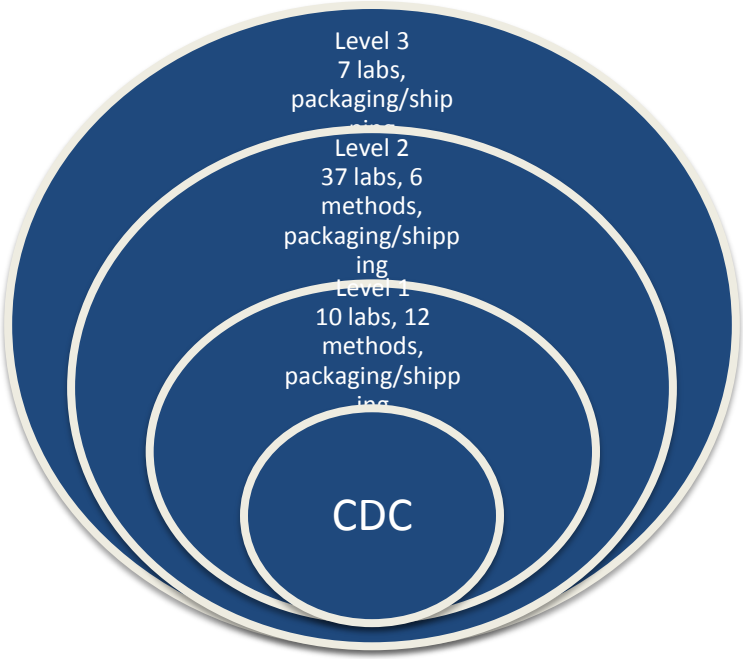
National and International Networks

- Laboratory Response Network (LRN)
  Founded by the CDC in1999 in collaboration with APHL & FBI
  - LRN-B (Biological) –
  - Currently 170 state and local public health, military, international, veterinary, agriculture, food and water testing laboratories



  - LRN-C (Chemical) –
  - Laboratory Response Network for Chemical Terrorism Preparedness Laboratories

- DoD Walter Reed Army Institute for Research (WRAIR) network, including NAMRU
  - US and international medical research units in collaboration with host countries the CDC and WHO.



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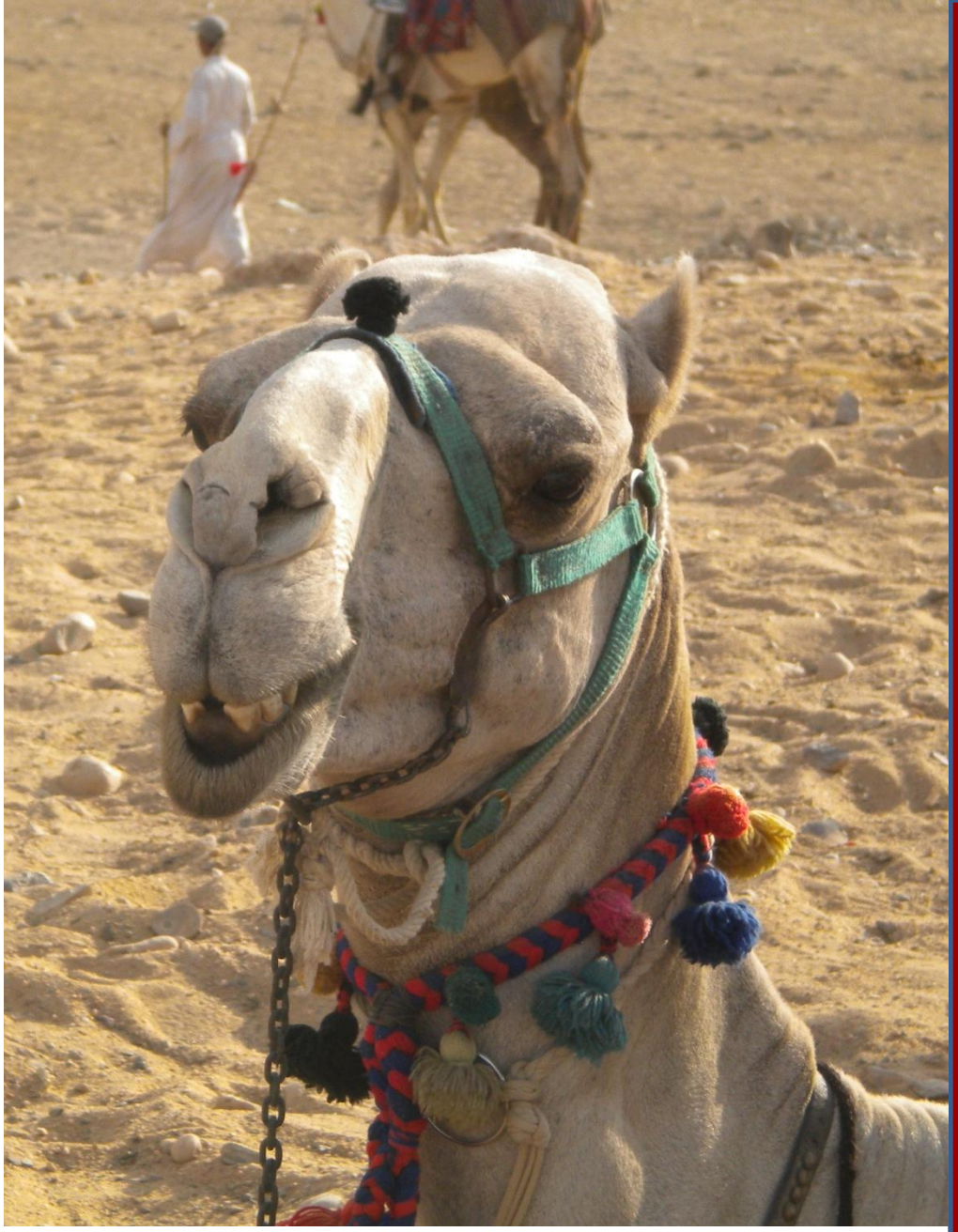
7 Questions?



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54th Annual Biological Safety Conference:
Oct. 27 - Nov. 2, 2011, Anaheim, CA