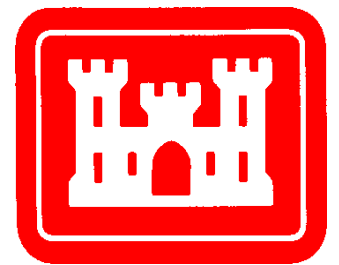


Unified Facility Criteria (UFC)

Security Engineering: Procedures for Designing Airborne Chemical, Biological and Radiological Protection for Buildings

**Ken Christenson, P.E.
Protective Design Center
Omaha District**



**US Army Corps
of Engineers**

UFC's Under Development

- **UFC 4-020-01 Security Engineering Planning Manual**
- **UFC 4-024-01 Security Engineering: Procedures for Designing Airborne Chemical, Biological and Radiological Protection for Buildings**
- **UFC 4-024-01 Security Engineering: Design Examples of Airborne Chemical, Biological and Radiological Collective Protection Systems for Buildings**



UFC 4-020-01

- **UFC 4-020-01 Security Engineering Planning Manual**
 - *Draft June 2005*
- **Provides procedures for establishing basic criteria for CBR protection.**
 - *Design Basis Threat*
 - *Level of Protection*
 - *Overpressure Classification*

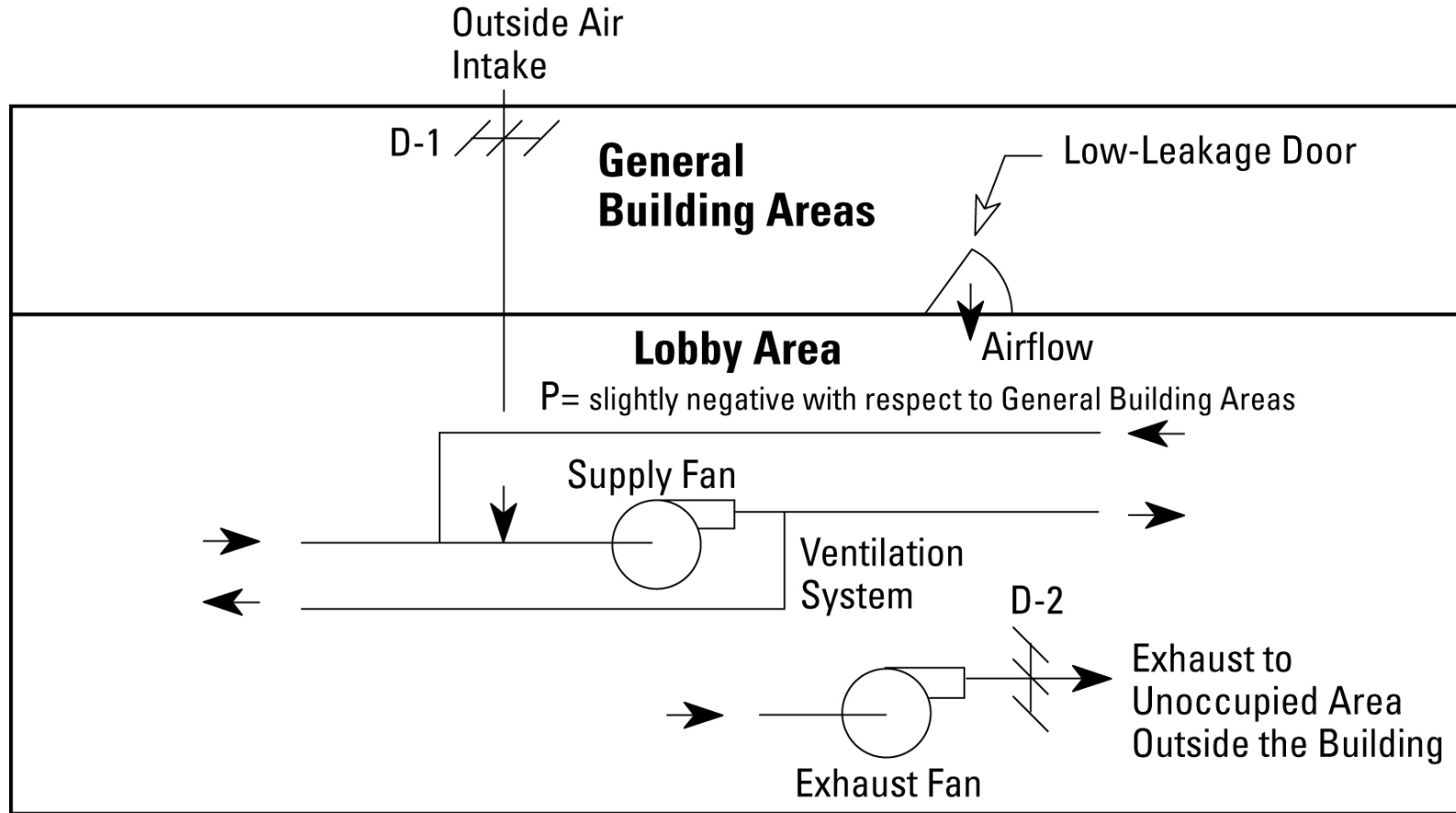


Internal Release Protection Strategy

- **Integrated Approach**
- **Access control and security screening to prevent the introduction of agents into the building.**
- **Ventilation System Isolation**
 - *Isolate High Risk Areas*
 - *Mailroom*
 - *Lobby*
 - *Security Screening Areas*
 - *Loading Dock*
- **Central AHU Filtration**



Typical High Risk Area



Damper or Equipment	Normal Mode	Release Outside	Release Inside
D-1	Open	Closed	Closed
D-2	Open	Closed	Open
Supply Fan	On	Off	Off
Return Fan	On	Off	On



External Release Protection Strategy

- **Shelter in place**
 - ***Close all openings such as windows and doors. Turn off ventilation systems and close outside air, relief air and exhaust ducts.***
 - ***Must have advance warning to implement***
 - ***Protection diminishes overtime***
- **CP Filtration system**
 - ***Design system to meet the level of protection***



Very Low and Low Levels of Protection

- **Very Low – (No Filtration - Shelter-In-Place)**
 - *External release – Short term diminishing protection*
 - *Internal release – Limited containment*
- **Low (HEPA Filtration at Central AHU)**
 - *External release – Filters biological/radiological particulates*
 - *Internal release – Limits distribution of bio/rad particulates*

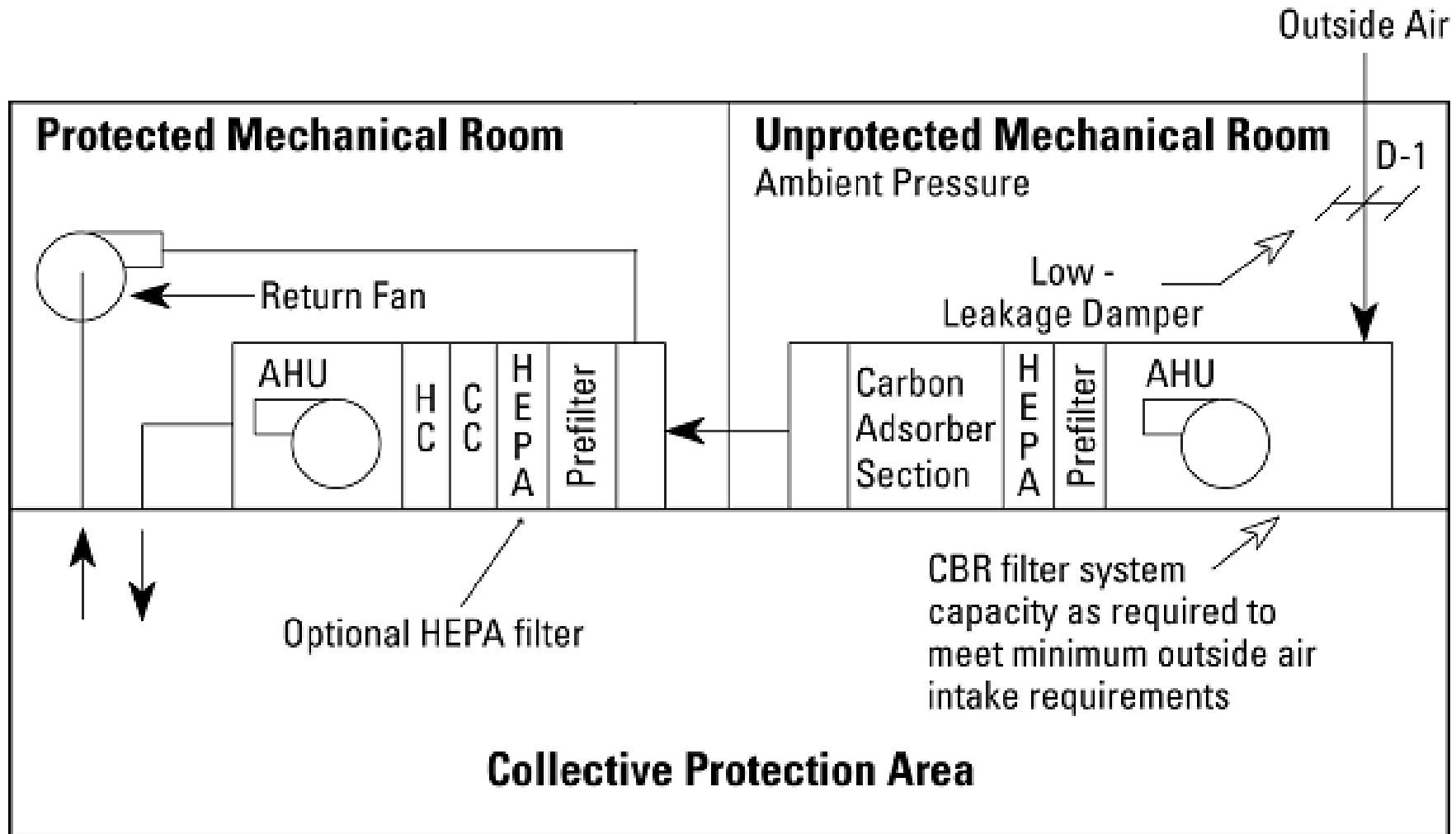


Medium and High Levels of Protection

- **Medium (Chemical and HEPA Filtration of OA)**
 - *External release – Full CBR protection*
 - *Internal release – No Filtration*
- **High (CBR Filtration of OA and RA)**
 - *External release – Full CBR protection*
 - *Internal release – Limits distribution of CBR particulates and vapor*



Medium LOP



Overpressure Classes

Overpressure Class	Event Duration	Protection Components
I Filtration with Pressurization	Hours to Days	<ul style="list-style-type: none">• Filtration System• 0.3 iwg Overpressure• 25 – 30 mph wind• Airlocks for ingress and egress
II Filtration with Little Pressurization	Hours	<ul style="list-style-type: none">• Filtration System• Slight Overpressure (0.02 to 0.05 iwg)• 5 - 7 mph wind
III Passive Protection	Hours	<ul style="list-style-type: none">• Toxic free area with diminishing protection



Facility CP System Design

- ***Air Leakage Testing***
- ***Sealing the Protected Area Envelope***
- ***Sizing the CP System***
- ***CP System Configuration***
- ***Equipment***
- ***Supplemental Heating and Cooling***
- ***Ductwork***
- ***Controls***



Filters

- **Particulate Filters**
 - *M98 radial flow HEPA filters*
 - *Commercial 24" by 24" HEPA filters*
- **Gas Filters**
 - *Military M98 radial flow adsorber*
 - *Military M49 adsorber*
 - *Commercial V-Beds*
 - *Commercial Type II Trays*



Filters and Carbon Adsorbers



M98 Radial Flow
Filter Set

24 by 24 inch HEPA



Filter Housings

- **Military Filter Housings**
 - *Fan-Filter Assemblies (FFA)*
 - *Navy Standard CBR Filter Housing Assesmbly*
- **Commercial Housings**
 - *Conform to applicable sections of ASME AG-1 and ASME N509*



Military Filter Housings



Navy Standard Filter
Housing Assembly



Fan-Filter Assemblies
(FFAs)



Commercial Filter Housings

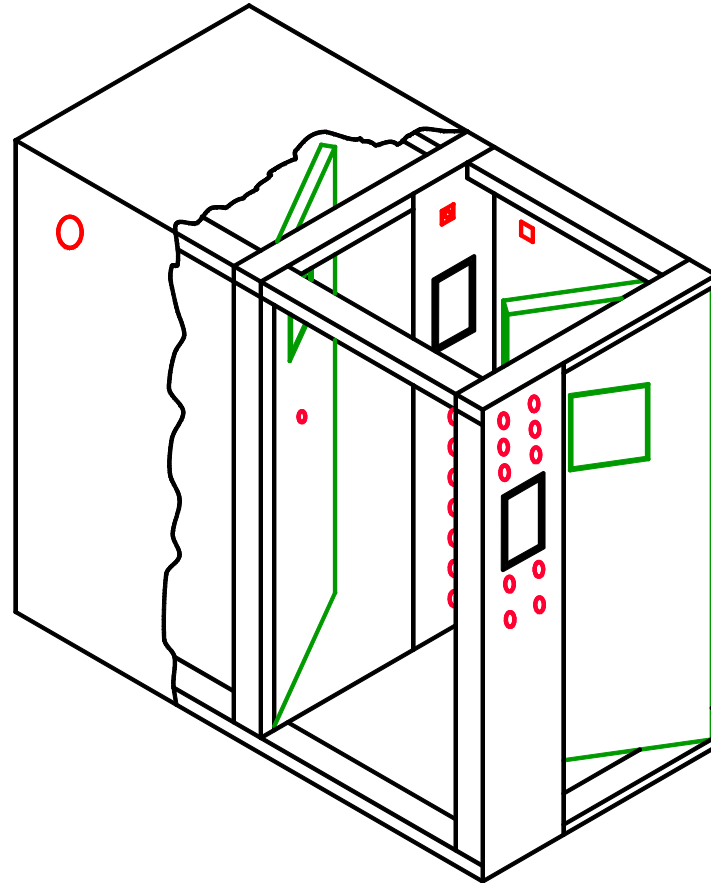


Multi Cell Radial Flow Filter
Housing



Airlocks

- **Single-stage and two-stage airlocks**
 - ***Size***
 - ***Capacity***
 - ***Purge time***
 - ***Airflow rates***
 - ***Signage***
 - ***Test ports***
 - ***Windows***



Testing

- **Filter Housing Factory Tests**
 - *Pressure test*
 - *Air flow distribution test*
 - *Leakage test*
- **In place HEPA filter and carbon adsorber testing**
 - *HEPA filter bypass test with Emory 3004*
 - *Adsorber bypass test with decaflouropentane (HFC 43-10)*



Commissioning & Maintenance

- **Integrated HVAC and CBR system commissioning and certification**
 - *Verify entire system operates properly, including all airflows, pressures, temperatures.*
- **Adsorber replacement**
 - *Remove adsorber and submit for adsorbant life testing*
- **Periodic In-place HEPA and adsorber bypass testing**



UFC 4-024-02 Design Examples

- **Two Examples**
- **2-story, 40,000 square foot, Command Center**
 - ***Medium LOP***
 - ***Class II Overpressure (0.02 to 0.05 iwg)***
- **900 square foot Crisis Management Center located on 1st floor of a multistory building.**
 - ***High LOP***
 - ***Class II Overpressure***



Design Examples

- **Examples include:**
 - ***Blower door testing***
 - ***Building air leakage using ASHRAE method***
 - ***Airflow calculations***
 - ***Equipment selection***
 - ***Equipment placement/configuration***
 - ***Supplemental heating and cooling***



For More Information

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