How to Design a Decon Laundry

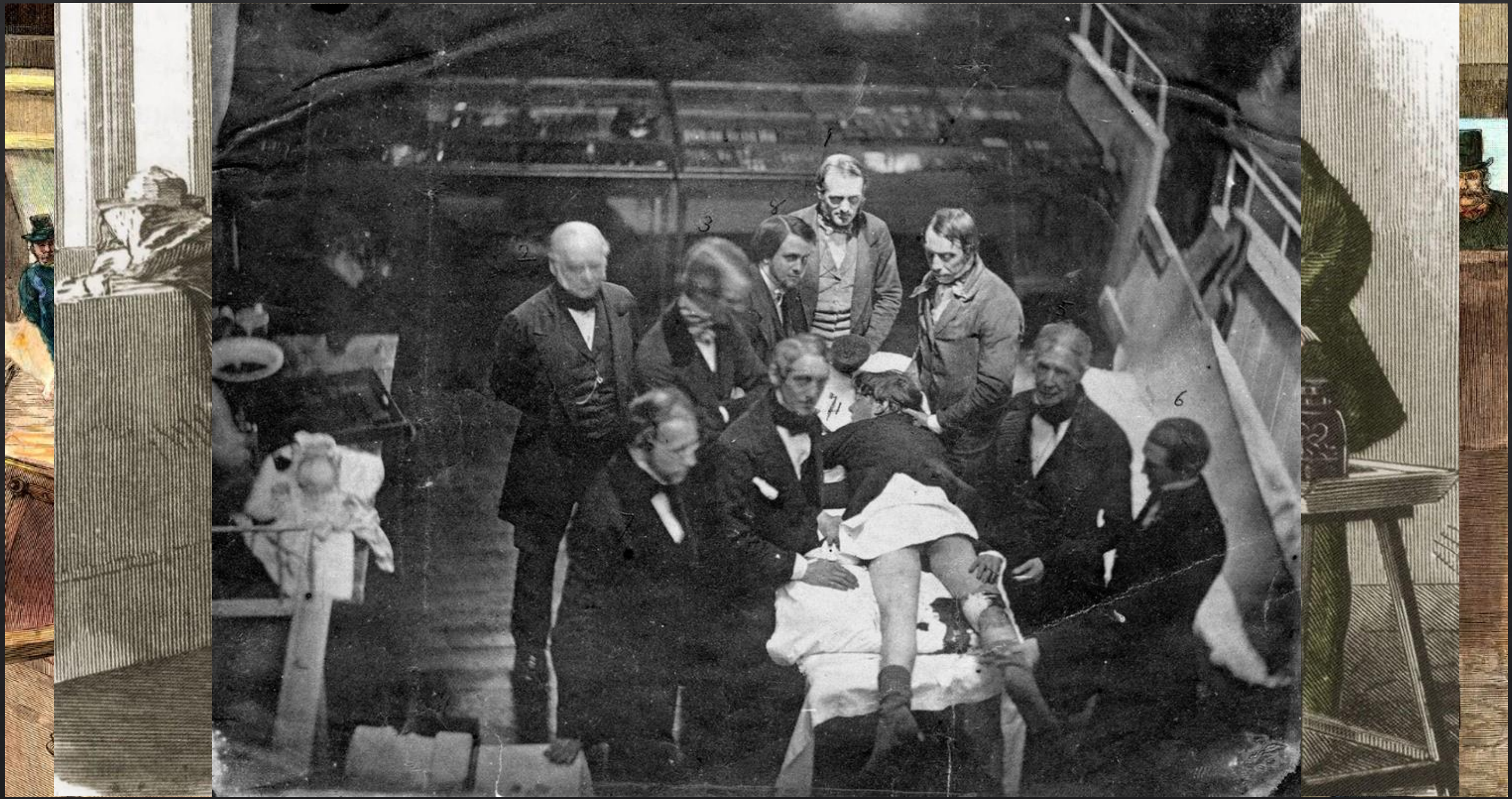
Robert Mitchell

Five Bugles Design™ + Mitchell Associates Architects

Wendel's award winning public safety design team

EMERGENCY SERVICES FACILITIES DESIGN

Progress

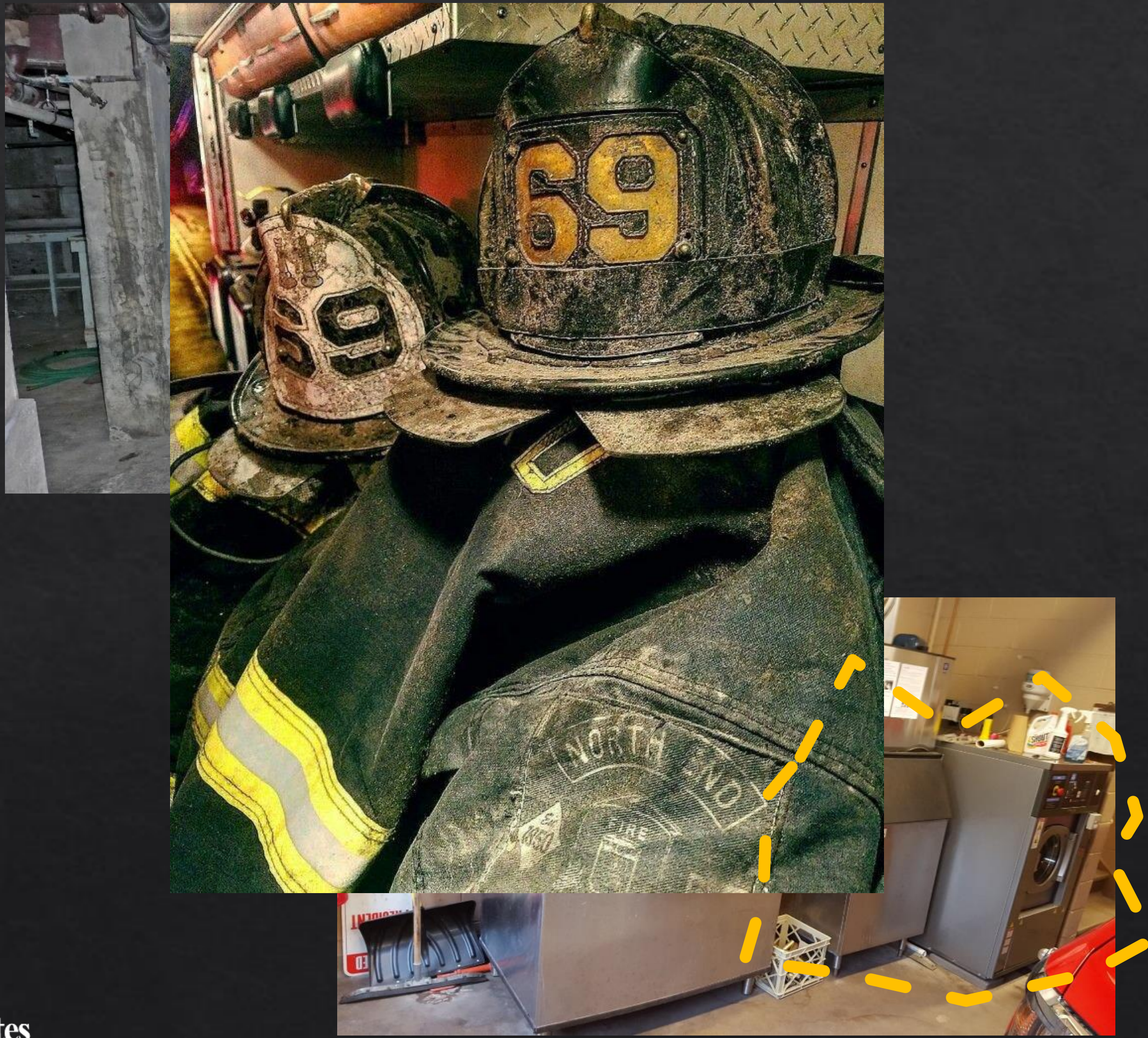


James Garfield 1881

Joseph Lister 1867

Progress

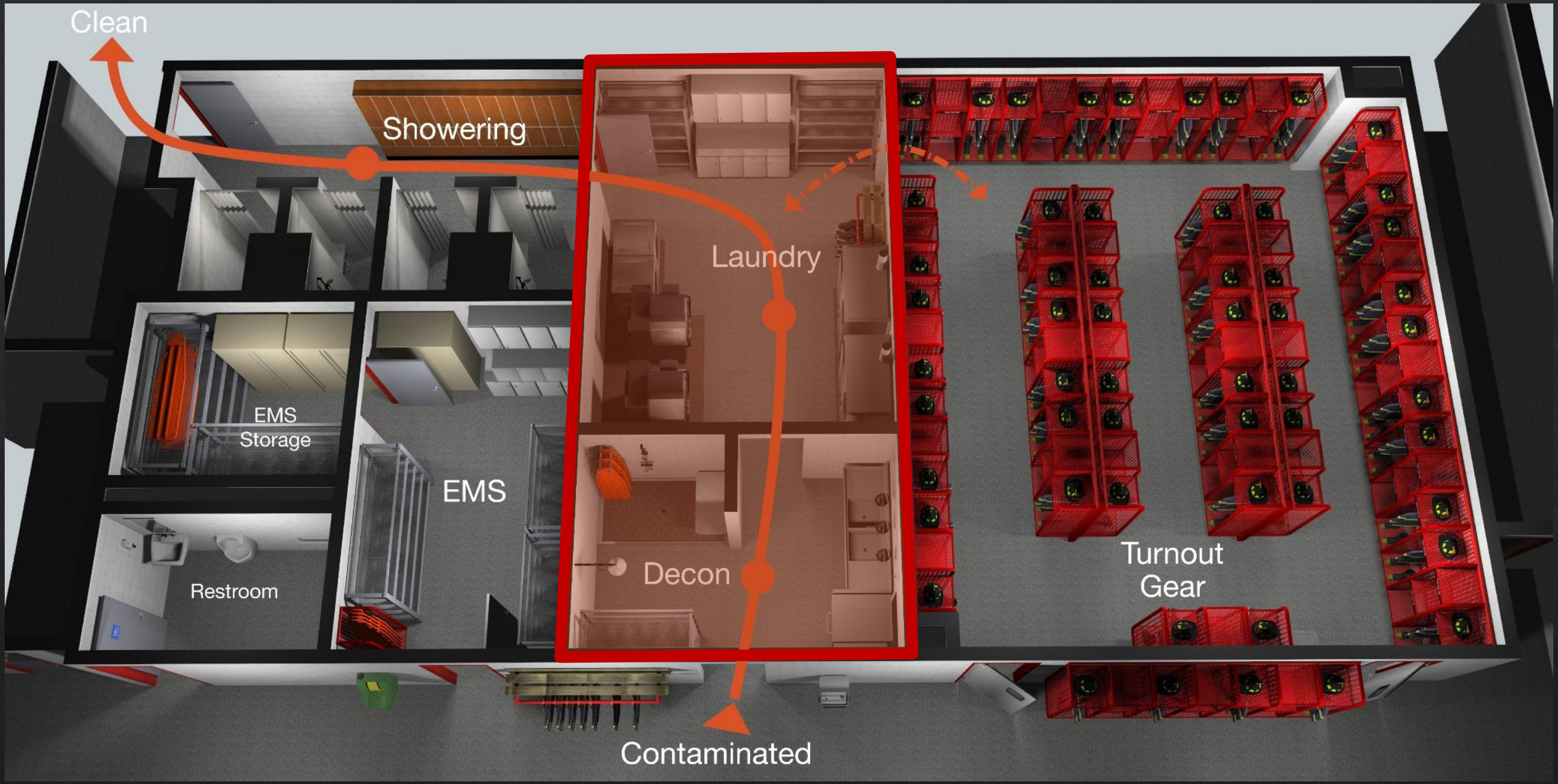
Changing Thinking



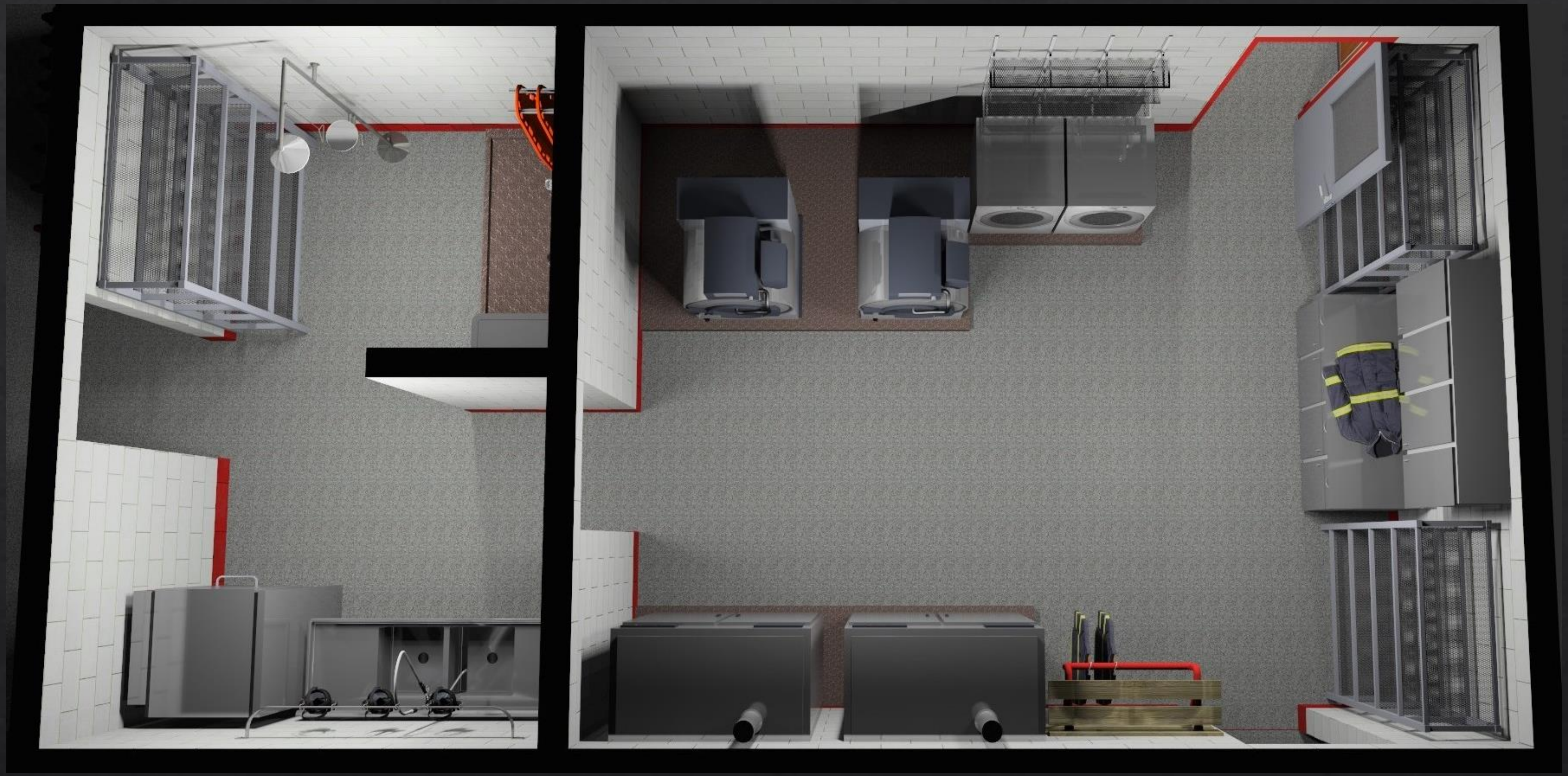
Just Put it Somewhere

How can these be repaired?

The Goal


Clean
Showering
Laundry
EMS
Storage
EMS
Restroom
Decon
Turnout
Gear
Contaminated

The Goal



Storing Dirty Gear

Door or No Door?

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F.I.E.R.O.

Pressure Differential

Pressure indication

Simple green status

Red indicates alarm

Gross Decontamination

Gross Decontamination

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F.I.E.R.O.

SCBA Decon

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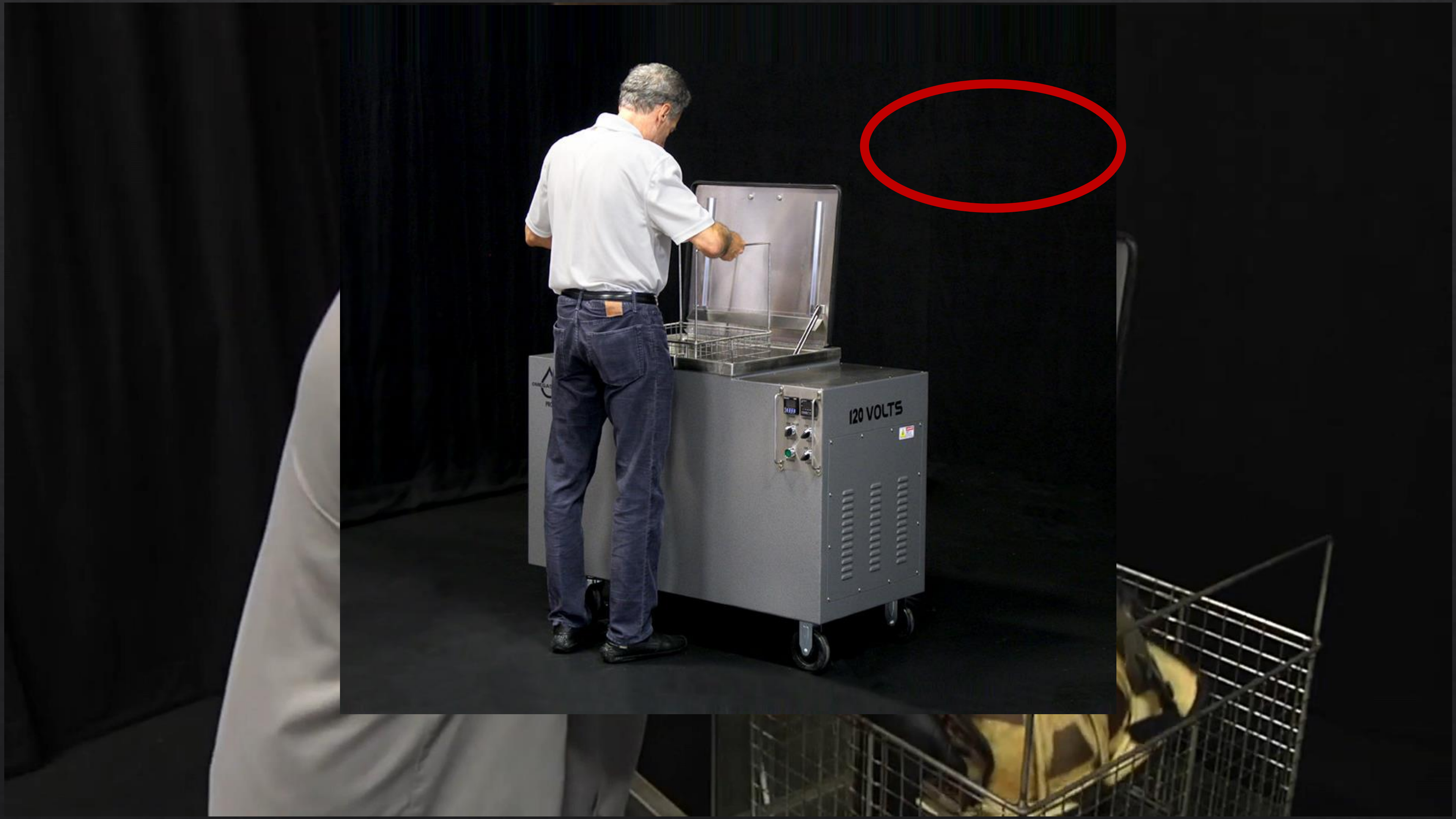
F.I.E.R.O.

SCBA Decon

Georgia Steel & Chemical Company

SCBA Decon – Ultrasonic Cleaning



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F.I.E.R.O.

Adequate Space to Work

Countertop should be 2’-8” deep

Installation Requirements for Washer/Extractor

Follow manufacturers' recommendations

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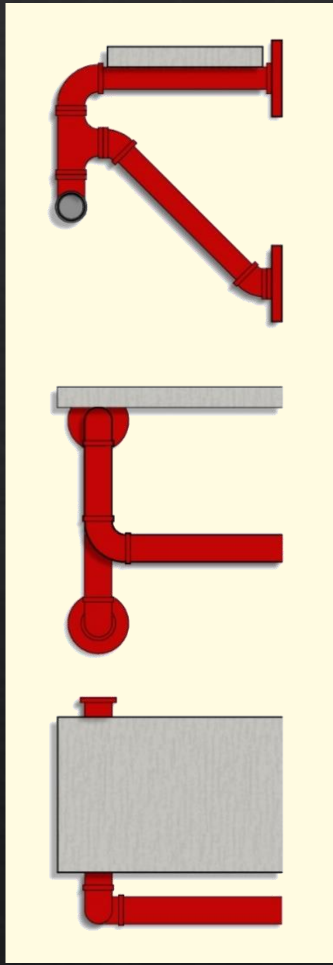
Gear Drying



Process Times:

- Extractor – 45 minutes
- Dryer – 3 hours

Do you dehydrate the room air?

Hot Zone Shower

Intradermal Microdialysis

Optimization of procedures for target analyte:

- Perfusion rate
- Perfusate
- Membrane molecular weight cutoff
- Physicochemical properties of target analyte
- Skin site and depth

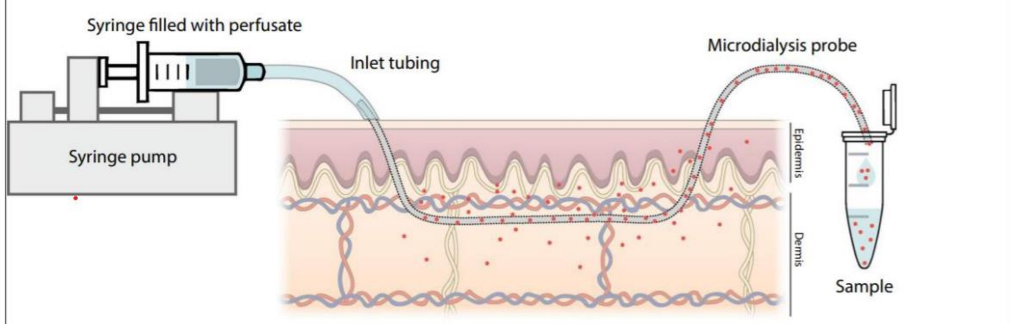
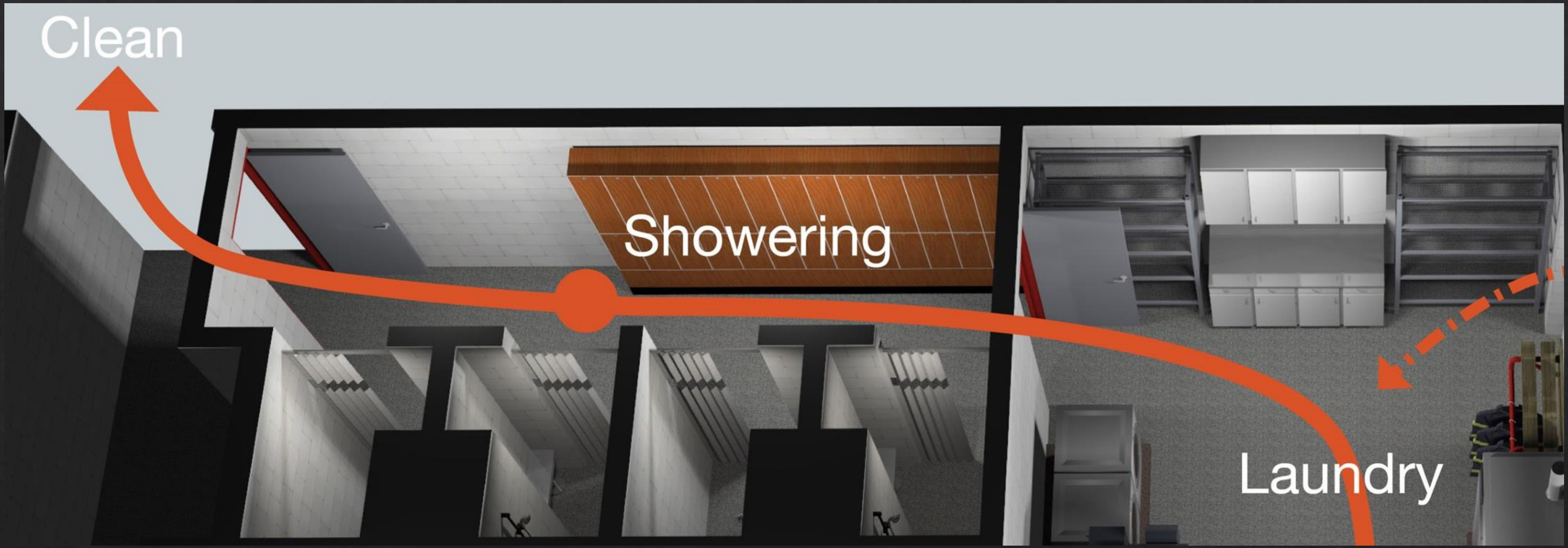


Fig. 1 Schematic representation of SMD (here with a linear microdialysis probe). The membrane is inserted into the tissue from which it allows recovery of soluble molecules (in red) when perfused using a microperfusion pump. © Niels Peter Hell Knudsen

Caroline J. Smith, PhD, FACSM
Appalachian State University

Hot Zone Shower



Hot Zone Shower

- Tepid shower within an hour
- Gender neutral privacy
- Travel path within the station

Understand the Space Before Building It

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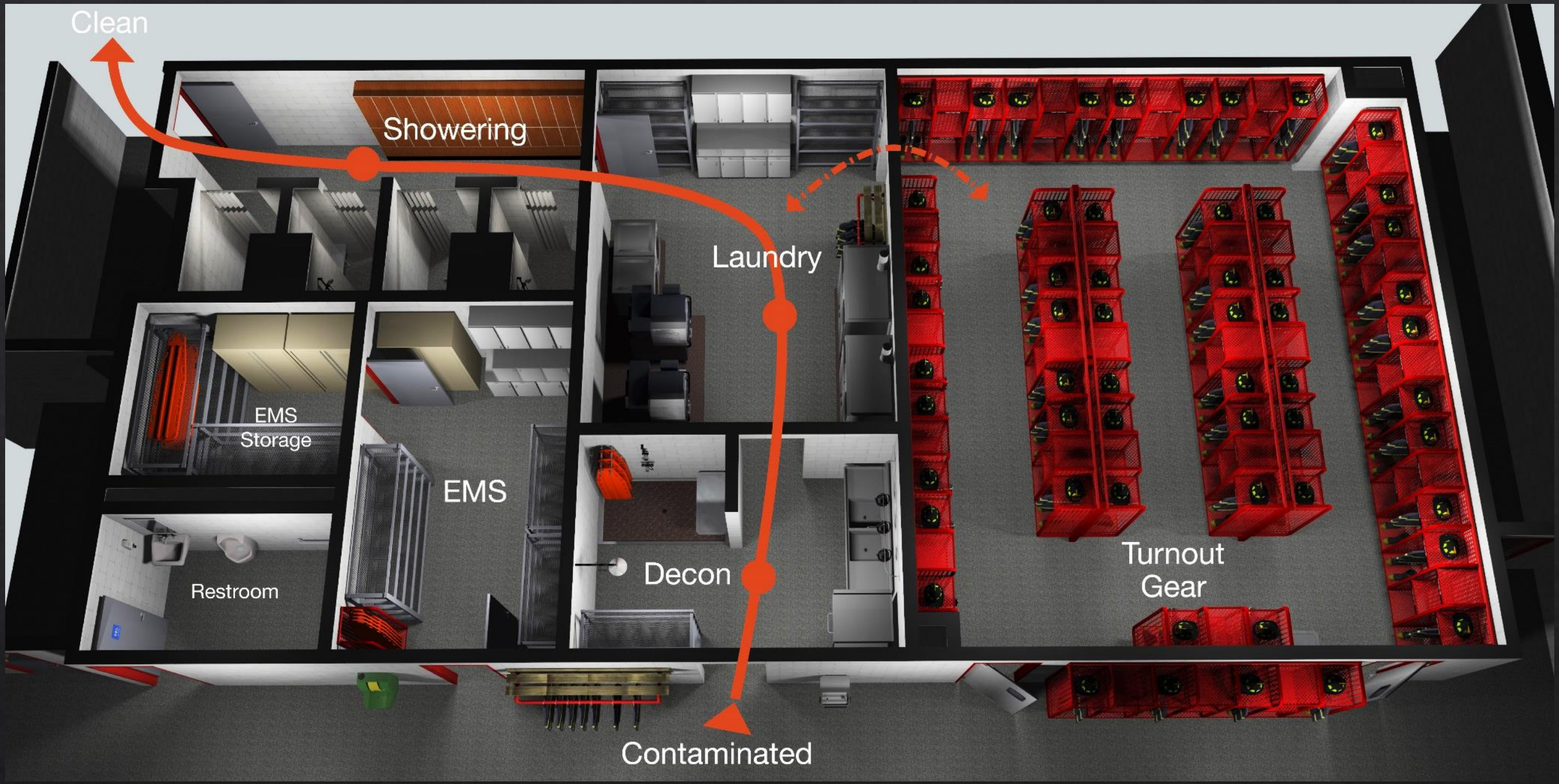
Scale For Your Operational Need

Decon, laundry & showers

778 sq ft net, w/o gear lockers



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F.I.E.R.O.

Career vs. Volunteer

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F.I.E.R.O.

Career vs. Volunteer

Decon, Laundry & showers

753 sq ft net

How to scale the facility for required size

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F.I.E.R.O.

Scaling For Building Size

Decon, laundry & showers

550 sq ft net

Scaling For Building Size

Decon, laundry & showers

430 sq ft net

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F.I.E.R.O.

Lessons Not Learned

Selecting Washer/Extractor Capacity

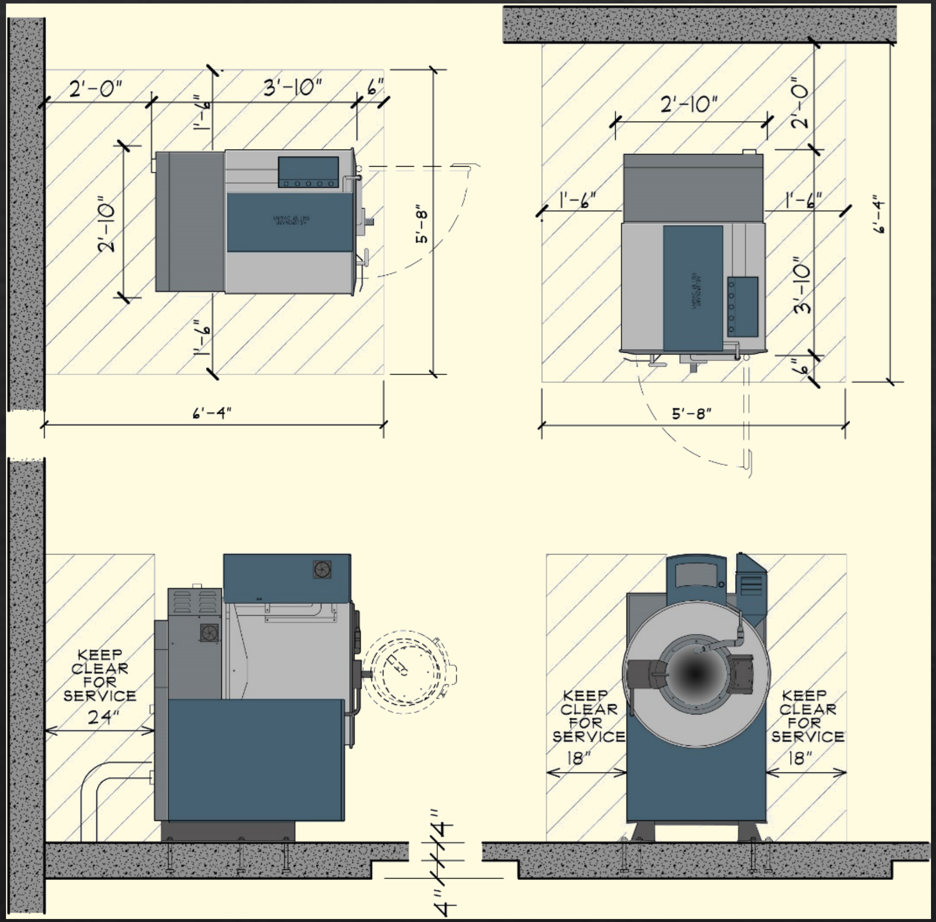
	25 lb. models	40 lb. models	60 lb. models	80 lb. models	100 lb. models	140 lb. models
No. of sets of gear *	1	2 to 3	4 to 5	6 to 7	8 to 9	11 to 13

**These figures are based on sample items. Weights and sizes of some brands differ, and therefore the figures should be used only as guidelines*

Not all manufacturers publish this data

Ask for it

Clearances

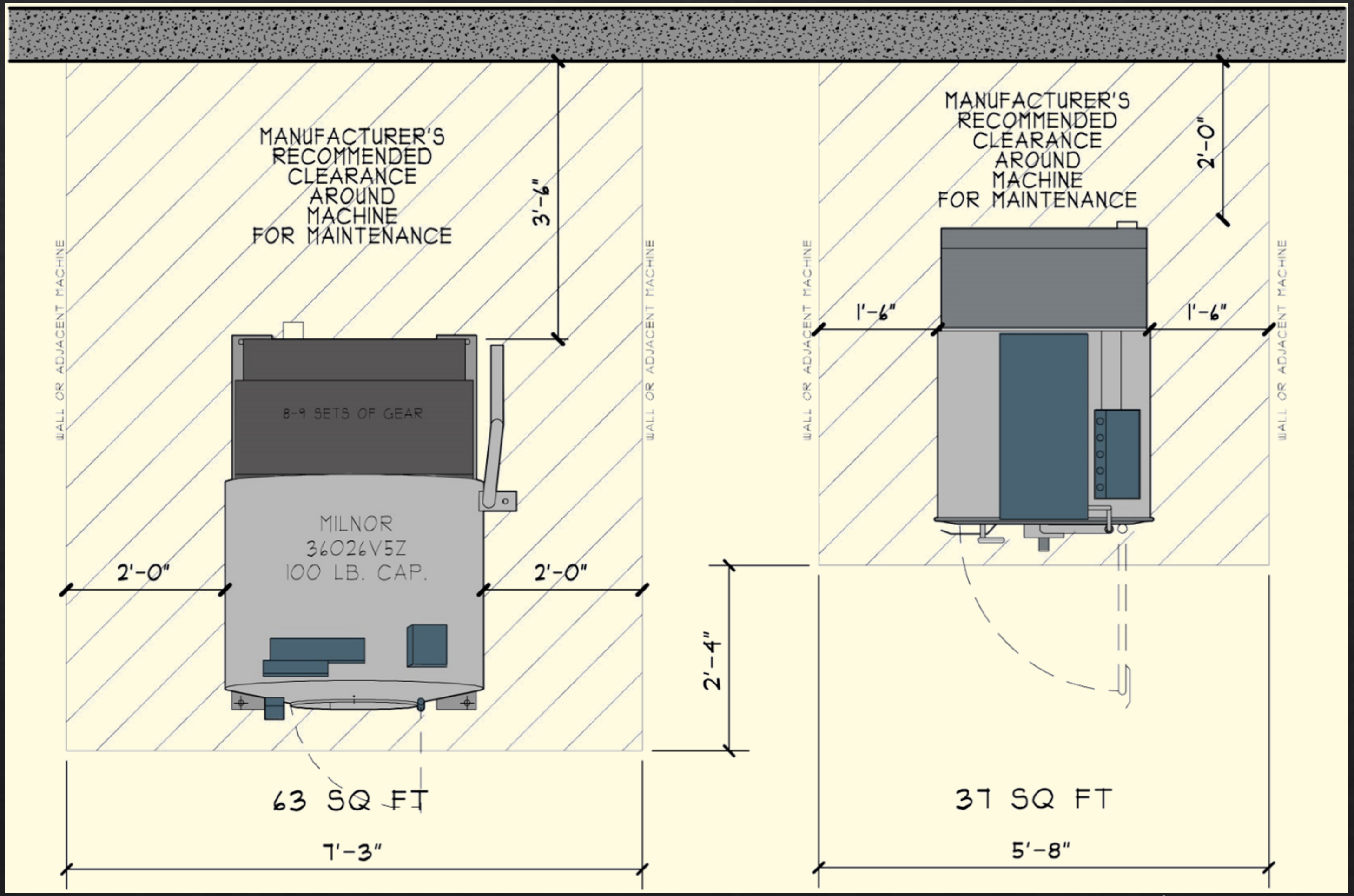


Clearances define space required for maintenance.

Machines are heavy & are bolted down

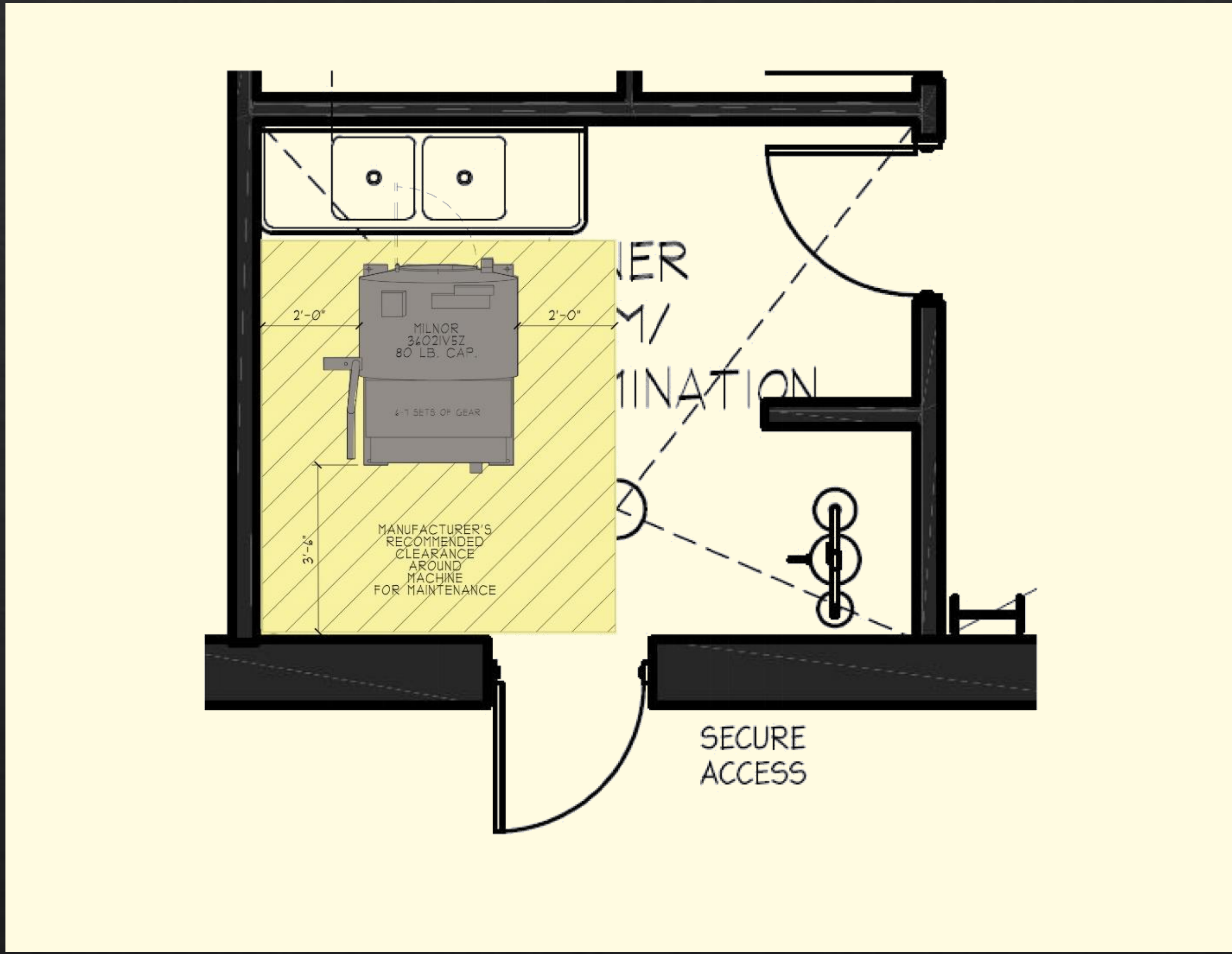
Clearances

Required space varies with manufacturer and capacity



Clearances

Know the requirements early in the design process



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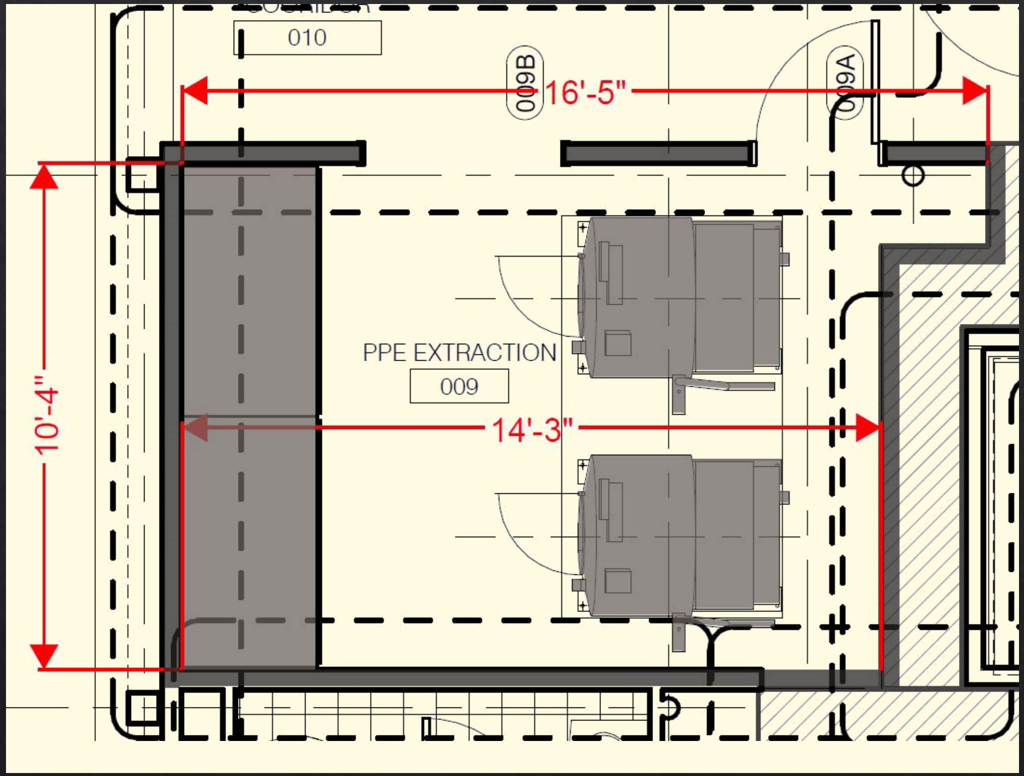
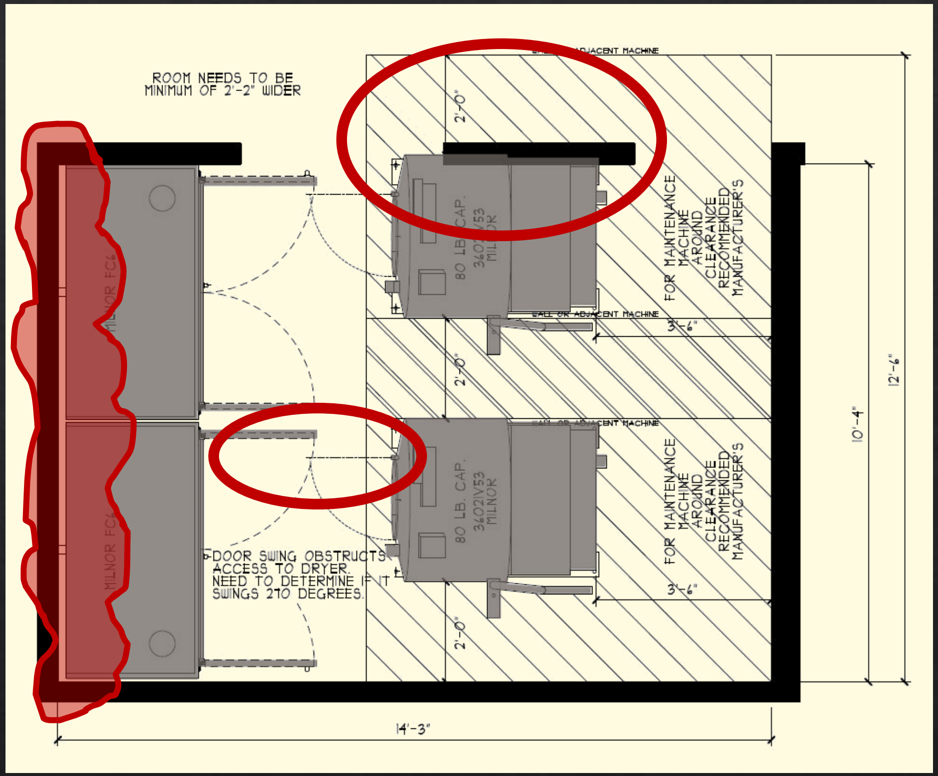
F.I.E.R.O.

Clearances



As Designed



Required Clearances

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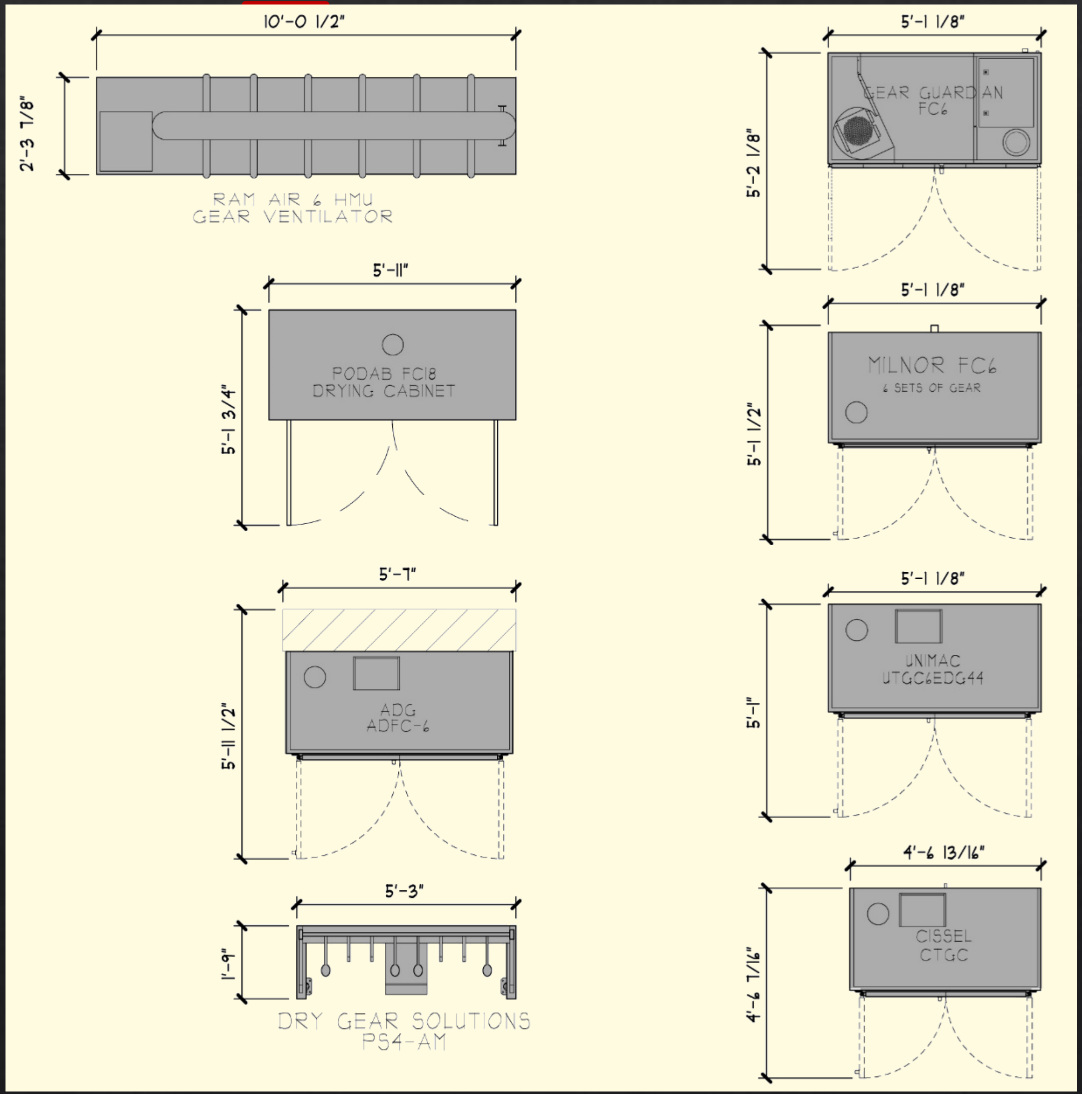
F.I.E.R.O.

Gear Dryers

- Consider the required space
- Do not ventilate internally



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F.I.E.R.O.

Soap

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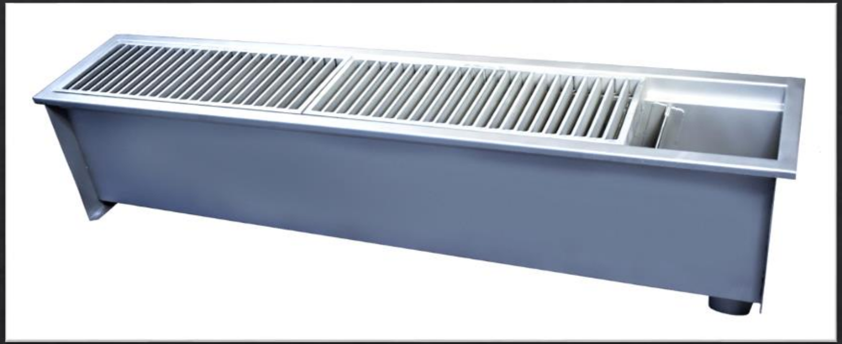
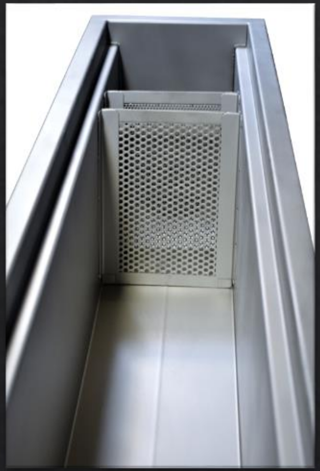
F.I.E.R.O.

Drainage

A 65 lb. capacity machine will discharge approximately 25 gallons in 20 to 30 seconds prior to extraction

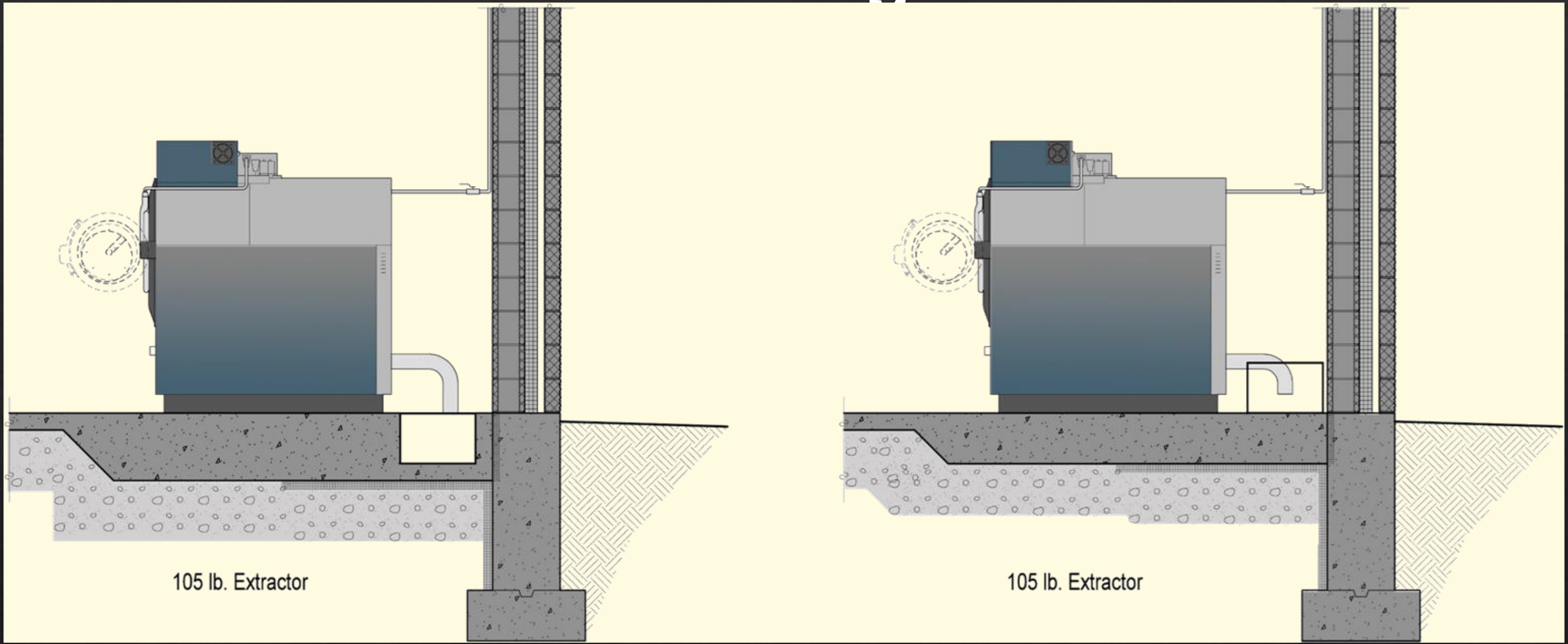
Drainage





Laundry equipment manufacturers prefer trench drains

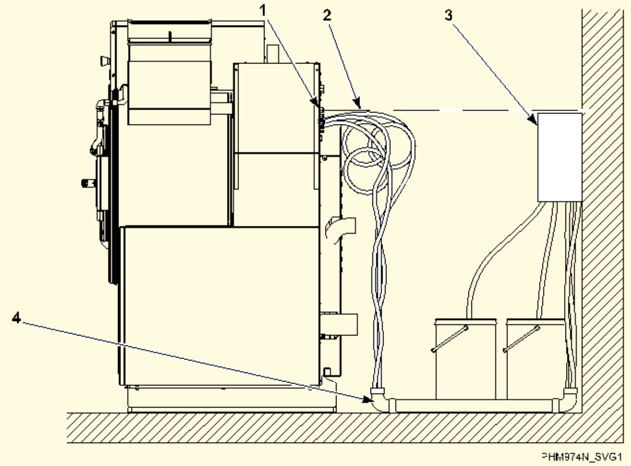
Drainage



25 Gallons requires
3 cu ft of storage

Follow Manufacturers’ Requirements

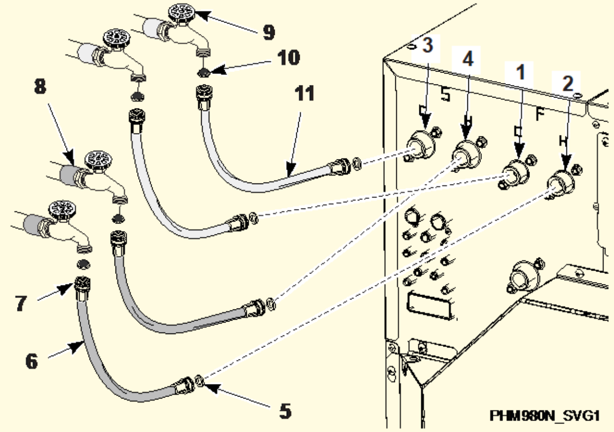
Chemical Supply Setup



* Use a check valve on the end of tubing

† Pumps must be mounted below the injection point

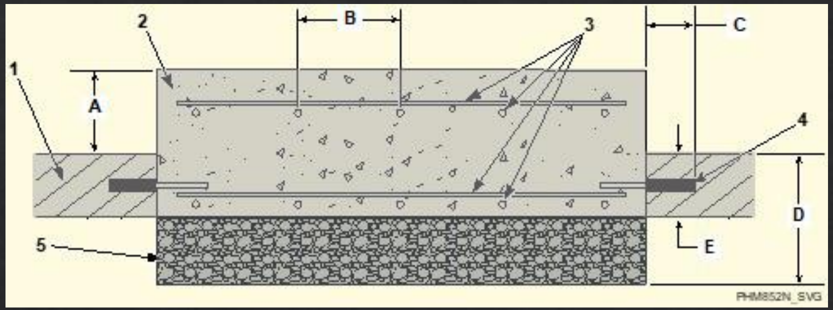
1. Injection Point*
2. Loops
3. Chemical Dispenser Pump Outlet †
4. PVC Pipe

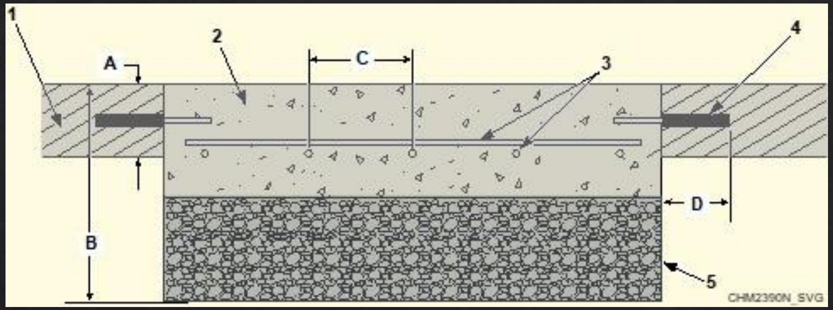


1. Cold Water Main Fill
2. Hot Water Main Fill
3. Cold Spray Valve Inlet
4. Hot Spray Valve Inlet
5. Rubber Washer (plain)
6. Fill Hose (hot)
7. Hose Coupling
8. Hot Water Supply Faucets
9. Cold Water Supply Faucets
10. Filter Screen (screen must be facing outward, toward water supply)
11. Fill Hose (cold)

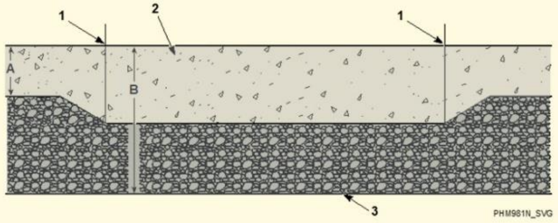
The manufacturers provide the information you need. Use it.

Slab Requirements





New Monolithic Floor (refer to *Table 14*)



1. Edge of Pad
2. 3500 PSI (minimum) Concrete
3. Compacted Fill (minimum 6 in. [152 mm] beneath machine)

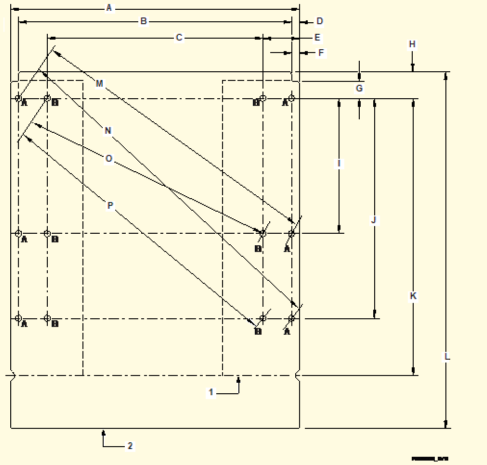
Figure 12

New Monolithic Floor, in. [mm]								
Description			L-speed / 45 (M-speed)	65 (M-speed)	45-65 (V-speed)	85-105	130-200
A	**Depth of Surrounding Floor**		6 [152]	6 [152]	6 [152]	6 [152]	6 [152]
B	**Total depth of foundation (concrete plus 6 in. [152 mm] fill) (minimum)**	Standard*	12 [305]	14 [356]	18 [457]	18 [457]	18 [457]
		Narrow*	14 [356]	16 [406]	20 [508]	20 [508]	20 [508] (Side-by-side) 24 [610] (Back-to-back)
		Ultra-narrow*	16 [406]	18 [457]	22 [559]	22 [559]	26 [660] (Side-by-side) 26 [660] (Back-to-back)

* Refer to *Floor Layout and Pad Dimensions.*

Mounting Bolt Hole Locations - 45 and 65 Pound Models

45 and 65 Pound [20.4 and 29.5 Kg] Models (refer to *Table 5*)



NOTE: For single machine installations or two machines installed back to back, use the outside bolt holes marked "A". For multiple machines installed side by side with minimum clearance, use the inside bolt holes marked "B".

1. Front of Mounting Bolt Template (45)
2. Front of Mounting Bolt Template (65)

Floor Load Data

Floor Load Data								
Specifications		45	65	85	105	130	160	200
Static load, lb [kN]		1280 [5.7]	1350 [6.0]	1990 [8.9]	2100 [9.3]	2540 [11.3]	2680 [11.9]	2920 [13.0]
Static pressure, lb/ft^2 [kN/m^2]		158 [7.6]	167 [8.0]	170 [8.1]	179 [8.6]	178 [8.5]	187 [9.0]	204 [9.8]
Maximum dynamic load, lb [kN]		2690 [12]	2690 [12]	3300 [14.5]	3300 [14.5]	4200 [18.7]	4200 [18.7]	4200 [18.7]
Maximum dynamic pressure, lb/ft^2 [kN/m^2]	L-Speed	483 [23.1]	493 [23.6]	N/A	N/A	N/A	N/A	N/A
	M-Speed	483 [23.1]	493 [23.6]	446 [21.4]	457 [21.9]	469 [22.5]	N/A	497 [23.8]
	V-Speed	491 [23.5]	499 [23.9]	450 [21.5]	459 [22.0]	471 [22.6]	480 [23.0]	N/A
Dynamic load frequency, Hz	L-Speed	8.0	8.0	N/A	N/A	N/A	N/A	N/A
	M-Speed	11.2	11.2	9.9	9.9	9.7	N/A	9.7
	V-Speed	15.9	15.9	12.8	12.8	11.8	11.8	N/A
[1]Maximum vertical load,		3870 [17.2]	3940 [17.5]	5140 [22.9]	5210 [23.2]	6500 [28.9]	6590 [29.3]	6760 [30.1]
Maximum base moment, lb-ft [kN-m]		8470 [11.5]	8470 [11.5]	10700 [14.5]	10700 [14.5]	15000 [20.3]	15000 [20.3]	15000 [20.3]

[1] Acting in the downward direction against the floor.

Keep referring to manufacturers' data

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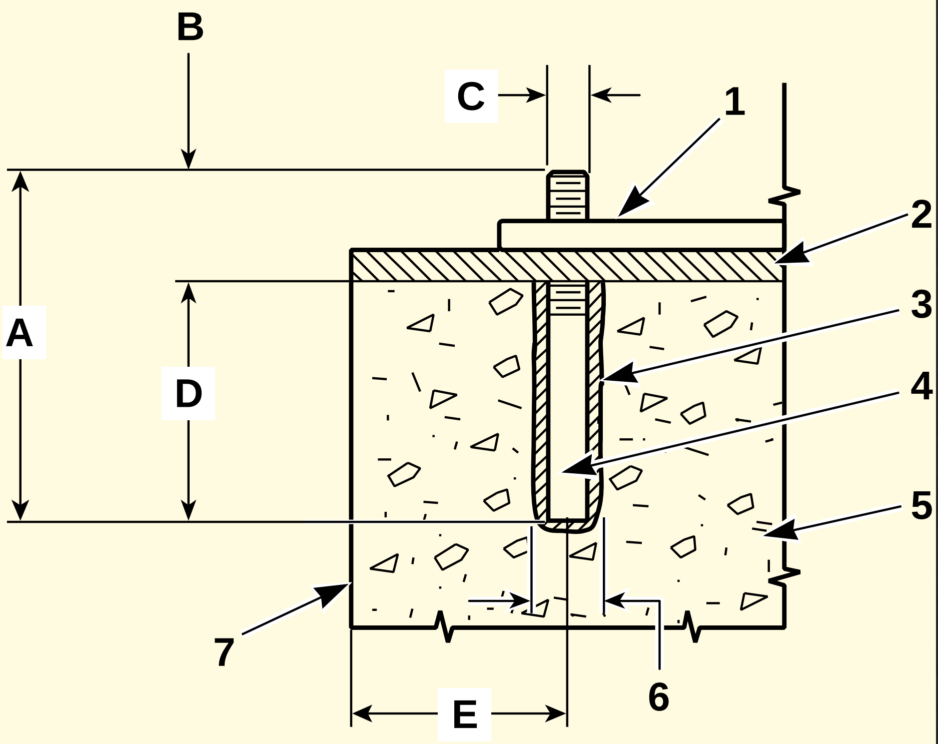
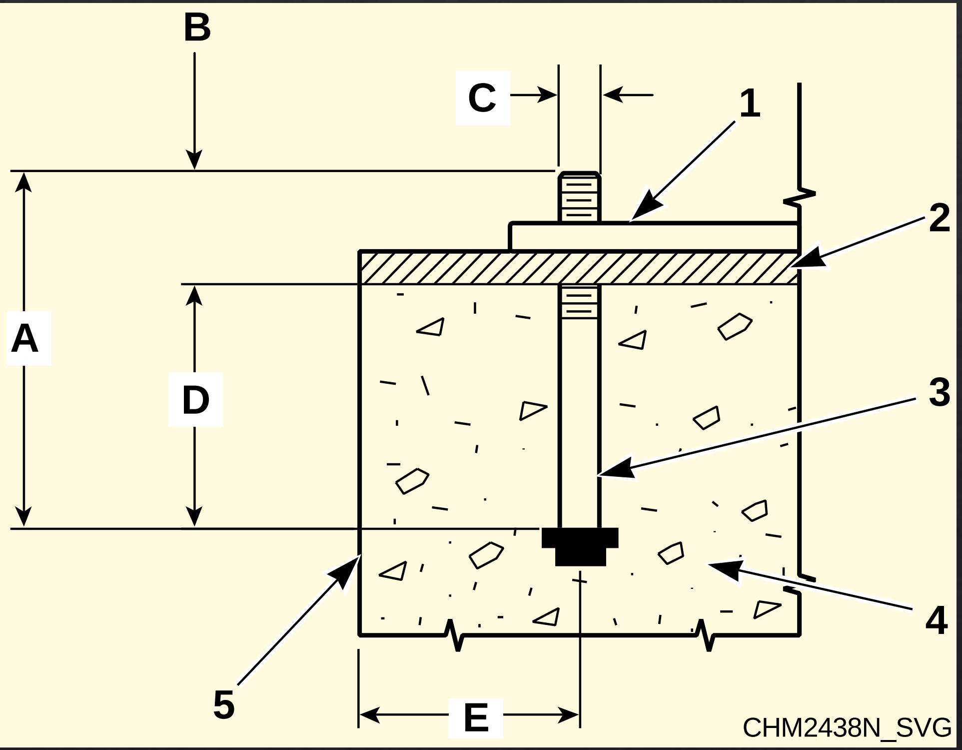
Slab Requirements





Anchoring is not a trivial consideration

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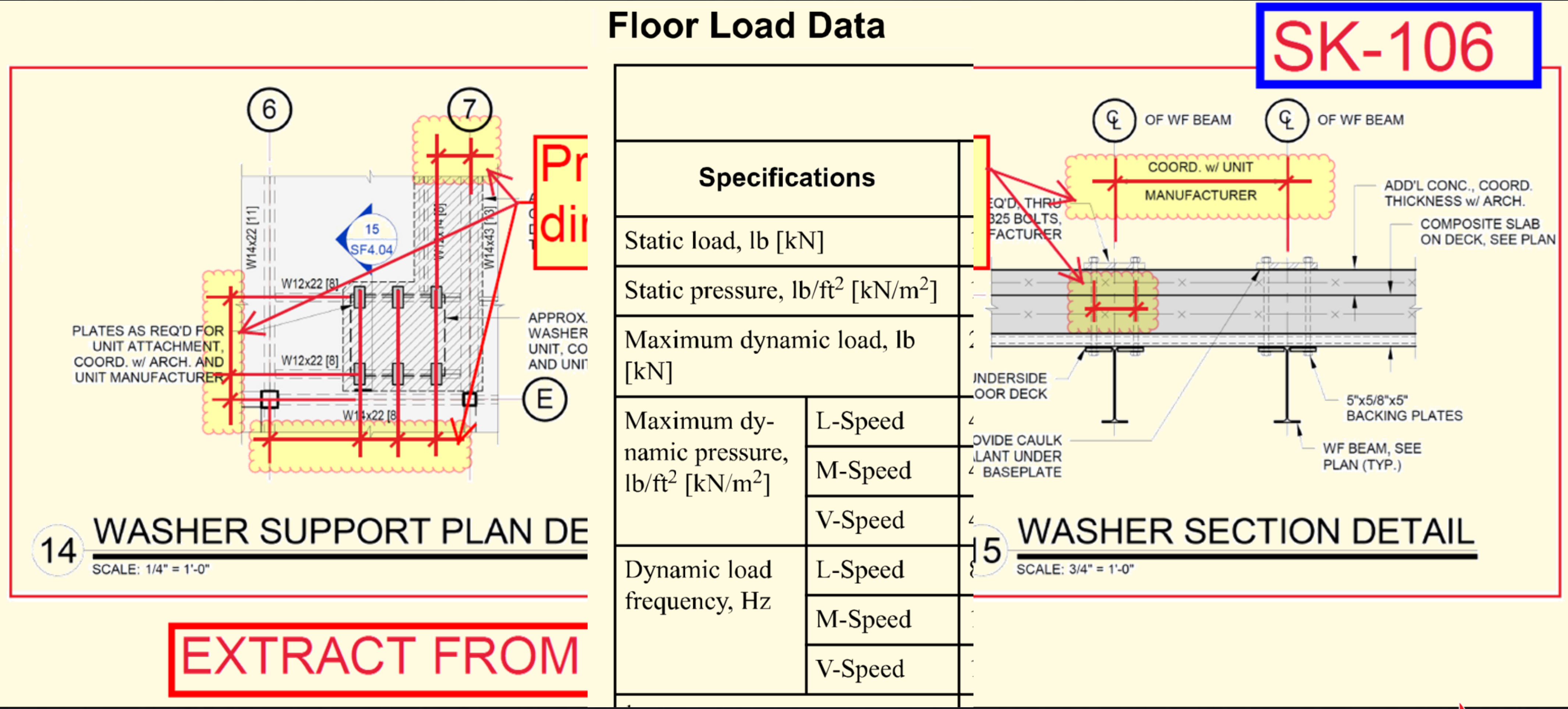
Elevated Slabs



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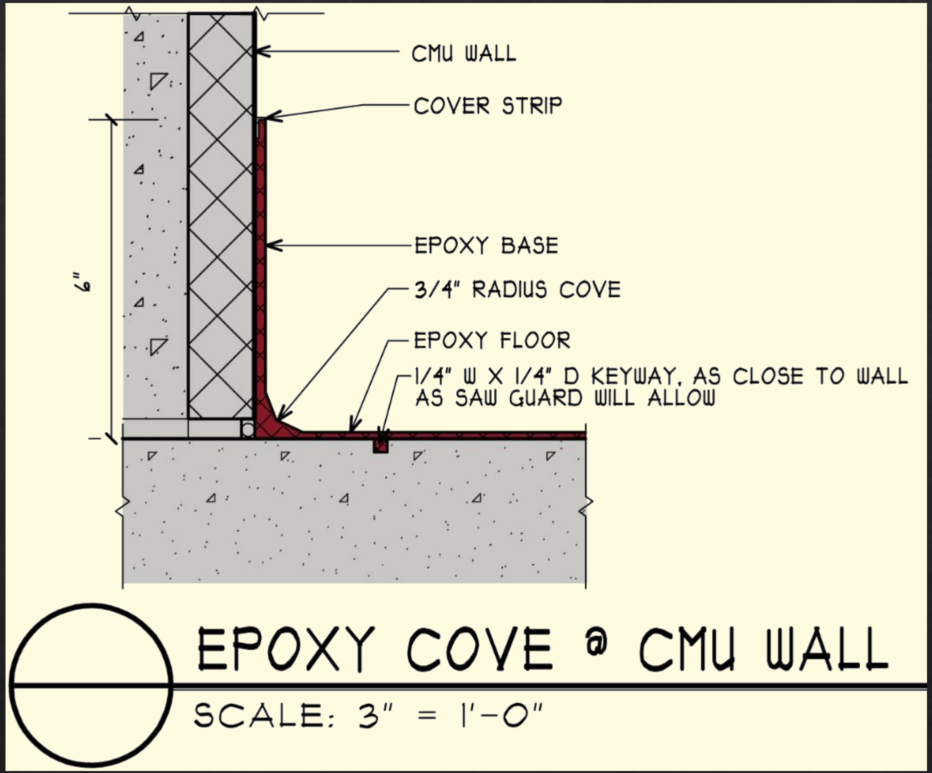
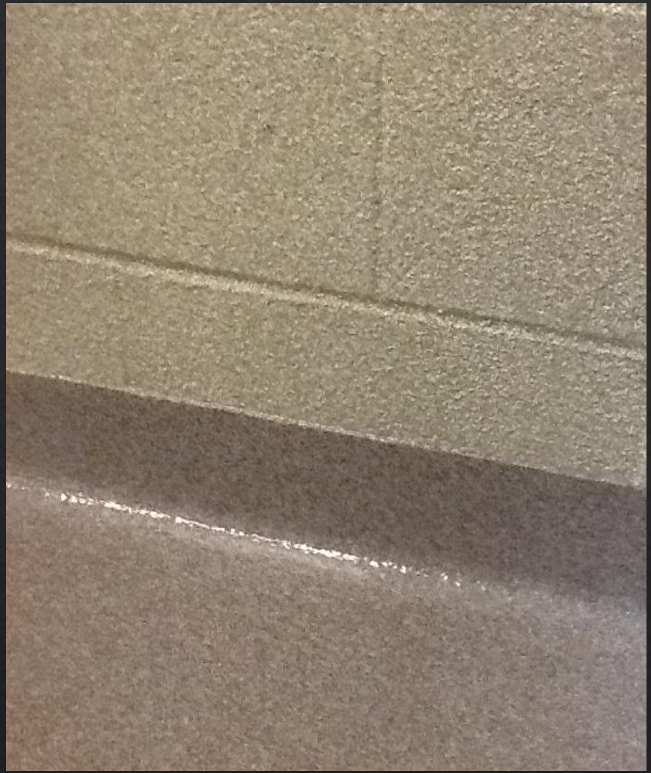
Elevated slab design is complex

F.I.E.R.O.

Surfaces

- Epoxy slab
- Wall finish
- Wall Smoothness
- Sanitary cove
- Flush ceiling
- Dirt gathering places
- Antibacterial finishes?





Surfaces

Nooks and crannies

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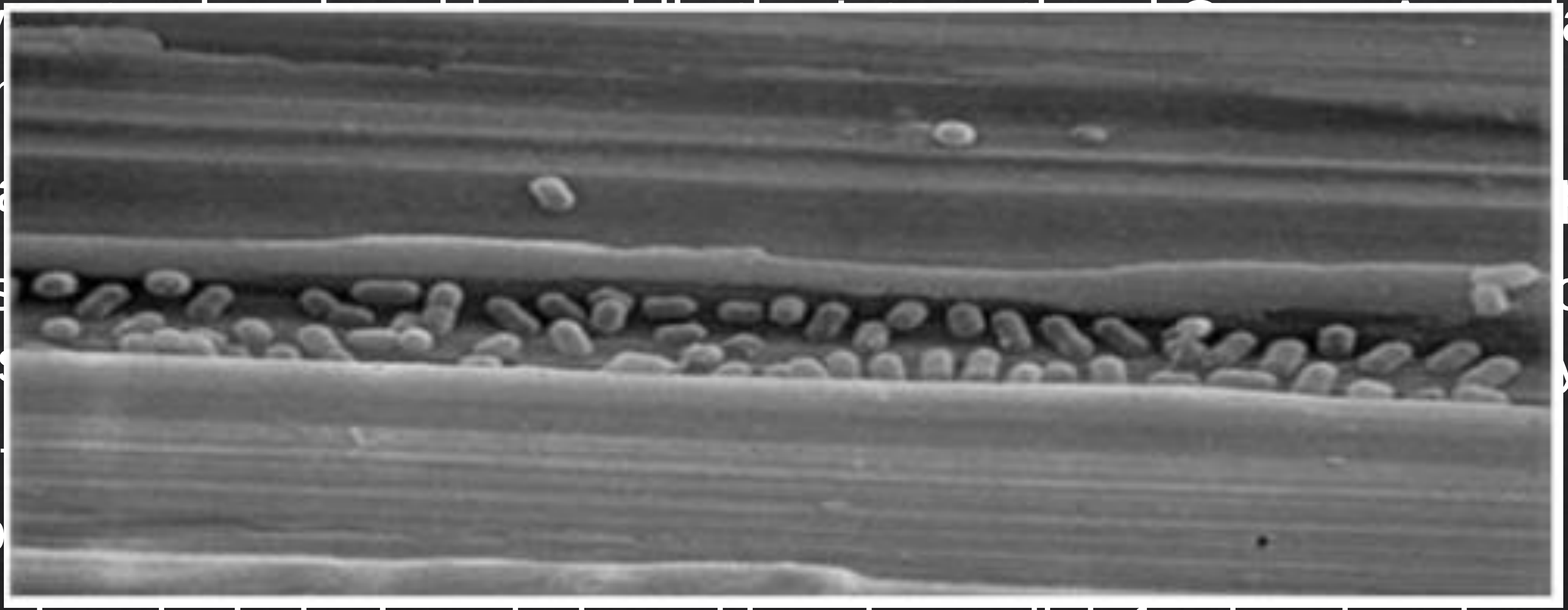
F.I.E.R.O.

Anti-Bacterial Surfaces

- CDC adv … ation
  asserts th …
- Kaiser Hea … program.
- Smooth s … ce;
  reservoir … y.
- Using an … with
  antimicro …



- Best practices include: laundering with a dryer, disinfecting, hand washing along with alcohol-based hand sanitizing.

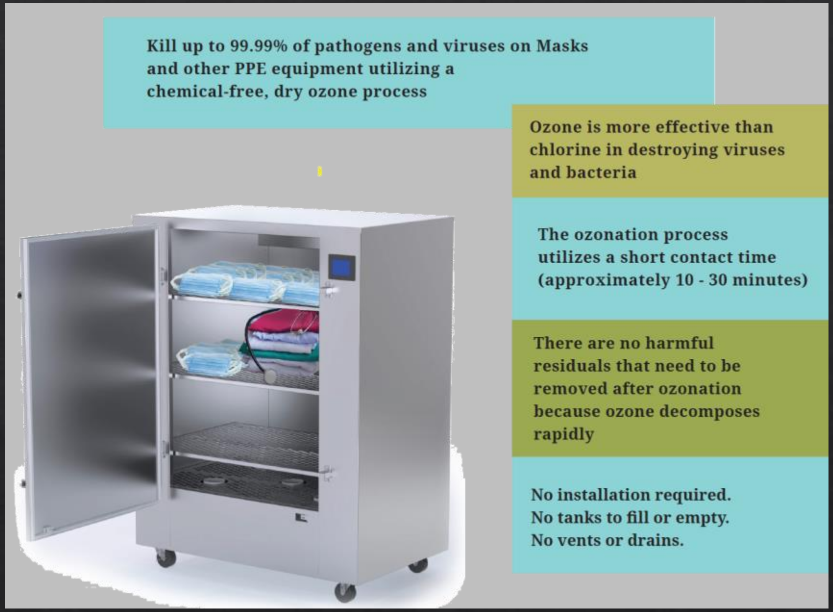
Other Agents

- CO^2 ?
- Ozone ?
- UV?
- High Temp Vapor

Other Agents – CO^2

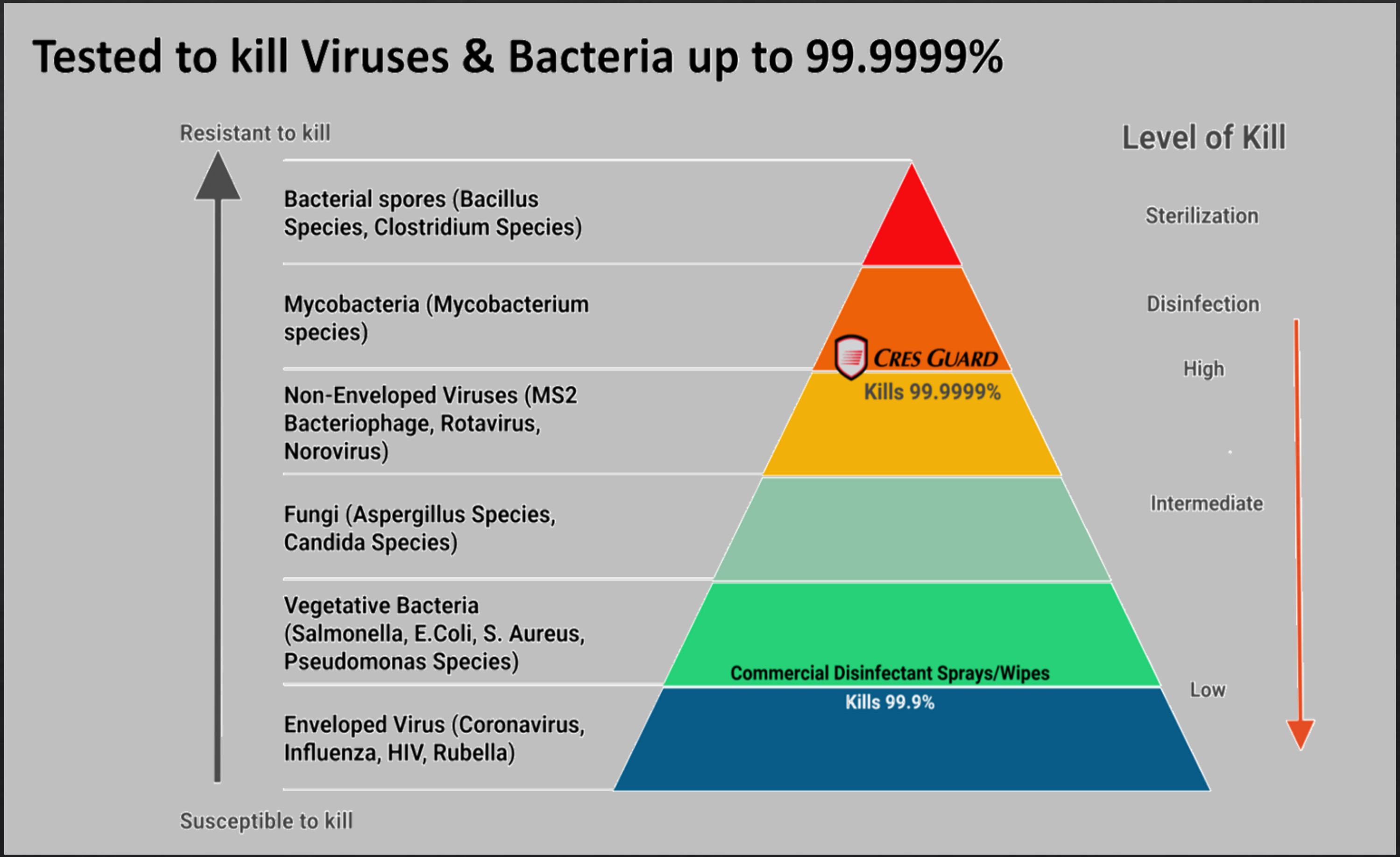
- Tersus' cleantech uses LCO^2
- They state that it removes 95%+ of the PAH according to a recent NC State Study.

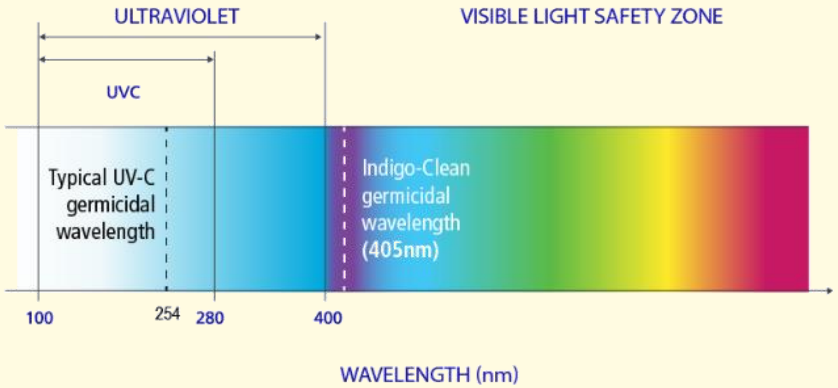
Other Agents - Ozone



- Is Ozone a viable treatment?

Other Agents – High Temp Vapor





405 nanometers: Peak germicidal activity via photoexcitation of porphryin molecules

vital vio

LESA
Lighting Enabled Systems & Applications

Indigo-Clean®
10200 55th Street,
Kenosha WI 53144
Phone: 1 (262) 891-9200
Email: indigo-clean@kenall.com

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Thinking outside the spectrum: Efficacy of a UV-A lighting system for passive disinfection of healthcare associated pathogens

Scott Livingston, BA[1,2]; Jennifer L. Cadnum, BS [1]; Michelle Nerandzic, BS[1]; & Curtis J. Donskey, MD[1,2]
[1] Research Service, Cleveland VA Medical Center, Cleveland, Ohio
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Follow The CLEan Team @CLE_Cleans
Contact: shl54@case.edu

Poster# 232

Case Western Reserve University — think beyond the possible
VA U.S. Department of Veterans Affairs — Northeast Ohio VA Healthcare System

Introduction

- Mobile UV-C light room decontamination devices are increasingly used as an adjunct to standard cleaning in patient rooms
- However, UV-C cannot be used when patients or personnel are present
- UV-A (315-400 nm) has been proposed as a safe method to provide continuous disinfection of surfaces that can occur while patients and staff are present

Methods

- In the laboratory, we evaluated the efficacy of UV-A for reduction of methicillin-resistant *Staphylococcus aureus* (MRSA), *Escherichia coli*, *Clostridium difficile* spores, *Candida auris*, and bacteriophages phi X147 and MS2 on steel disk carriers
- Recovery of organisms from carriers exposed to UV-A was compared to controls held under ambient light for the same duration of exposure

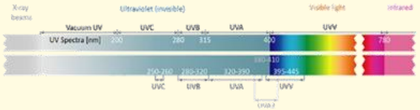


Figure 1. Reduction of organisms exposed to 3 W/m² of UV-A

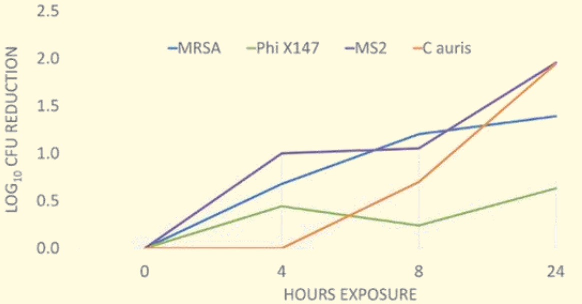
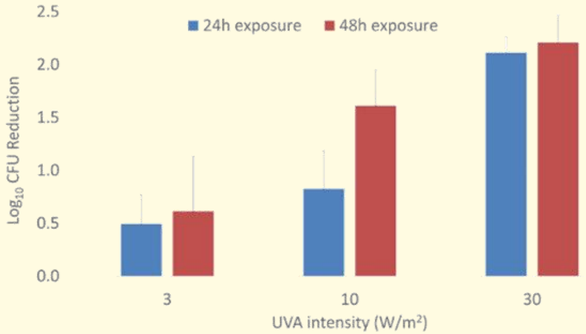


Figure 2. Reduction of *C. difficile* spores exposed to variable intensities of UV-A

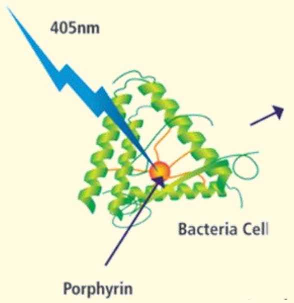


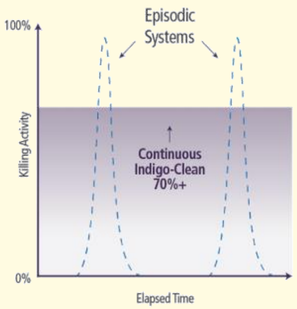
Results

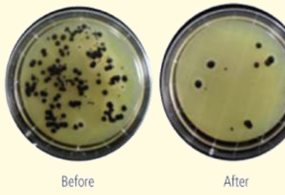
- At the intensity proposed for use in patient rooms (3 W/m²), we found that MRSA and *E. coli* were reduced by ≥1.2 $\log_{10}$ CFU after 8 hours of exposure (figure 1)
- Bacteriophage MS2 and Phi X147 were reduced by 1.1 $\log_{10}$ PFU and .3 $\log_{10}$ PFU respectively after 8 hours of exposure (figure 1)
- At 3 W/m², *C. difficile and Candida auris* were reduced by <0.5 log10 CFU at 8 hours
- At 24 and 48 hours of exposure at 30 W/m², *C. difficile* spores were reduced by 2.1 $\log_{10}$ CFU and 2.2 $\log_{10}$ CFU respectively (figure 2)

Conclusions and Acknowledgements

- We found that UV-A light was effective in reducing MRSA, *E. coli*, and bacteriophage MS2 at an intensity level proposed for use in patient rooms
- At higher intensities (10, 30 W/m²), UV-A was also effective against *C. difficile* spores
- UV-A may be useful as a supplement to standard cleaning by providing continuous low level disinfection of surfaces
- Current, Powered by GE provided the testing apparatus but had no role in the study design or outcome



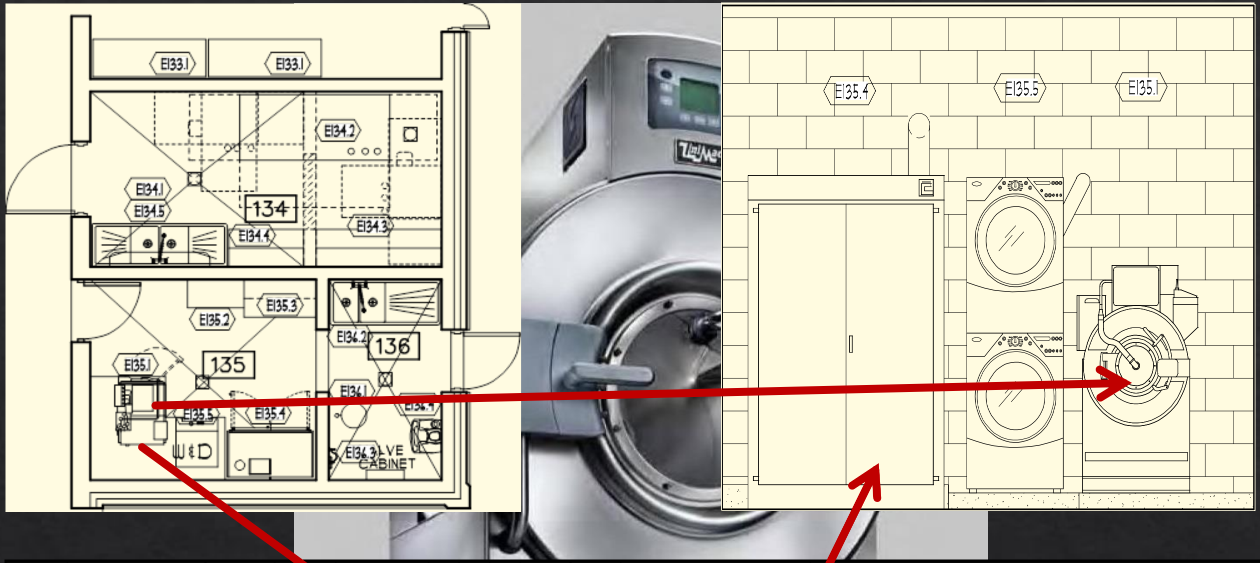




Environmental disinfection over a period of 8 hours

F.I.E.R.O.

Controlling Outcomes



Room No.	Room Name	Equip. No.	Provided by GC	Provided by PC	Provided by M[illegible]	Provided by EC	Supplied by Owner	Installed by GC	Installed by PC	Installed by EC	Installed by others, connections by PC	Installed by others, connections by EC	Mfgr. & Model No.	Description
134	SCBA	E134.1		X									UNIVERSAL 2N162[illegible]-2D24	2 Comp Sink With 2 Drain Boards
		E134.1		X									Advance Tabco K-116	Pre-Rinse Faucet
		E134.2					X	X				X	Owner's equipment	SCBA Compressor & Fill Station - get specs
		E134.3	X											Countertop, Wall & Base Cabinets - See A700
		E134.4	X											Countertop, Wall & Base Cabinets - See A700
		E134.5	X										Advance Tabco SW1-60	SS Single Bar Pot Rack - 60" LONG
135	LAUNDRY	E135.1					X	X			X	X	UniMac # UW60	Turnout Gear Washer Extractor
		E135.2					X						Global #T9A236632	Heavy Duty Shelving 36x18x96 With 5 Shelves
		E135.3	X											Countertop, Wall & Base Cabinets - See A700
		E135.4					X	X			X	X	Cissel ACG	Turnout Gear Drying Cabinet
		E135.5					X	X			X	X	Whirlpool WFW88HEAC	Residential Clothes Washer with steam sanitize
		E135.5					X	X				X	Whirlpool WED88HEAC	Residential Electric Clothes Dryer with steam cycle - stacking kit
136	DECON	E136.1		X									Advance Tabco 93-2-36-24 & Advance Tabco K-116.	2 bowl Pot Sink w/Hand Held, foot control. Sink Bowl 24" x 24" - 14" deep with 8" high backsplash & wall mounted spray arm.
		E136.2		X									Guardian G-1662	Drench Shower with test kit
		E136.3		X									Moen 8346	Heavy duty hand held shower
		E136.4	X										Global TPA-237005	Portable Eye Wash Station

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F.I.E.R.O.

Control The Design & Construction Process

Beware of Value Engineering

Control The Design & Construction Process

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F.I.E.R.O.

What About Retrofits?

Retrofit

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Test 9 of 65 stations

F.I.E.R.O.

Test Cases

Engine 01 Ladder 05
711 South Broad St.

Engine 05 Ladder 06
4221-29 Market St .

Engine 09 Ladder 21
6900 Germantown Ave.

Engine 12 Ladder 25
4445-54 Main St.

Engine 50 Ladder 12
1325 W. Cambria St.

Engine 51/Ladder 29
5931 Old York Rd.

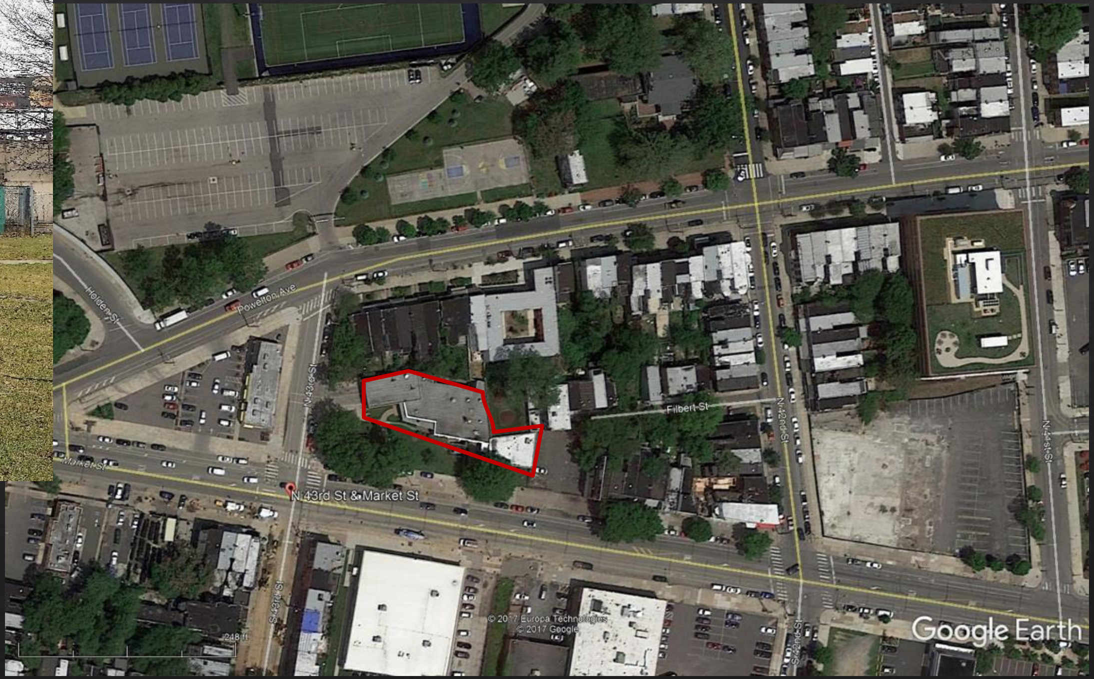
PD 35

Engine 56
830 Rhawn St.

Engine 68 Ladder 13
5198 Willows Ave..

Engine 71 Ladder 28
1900 Cottman Ave.

Philadelphia Engine 5



Space available for expansion

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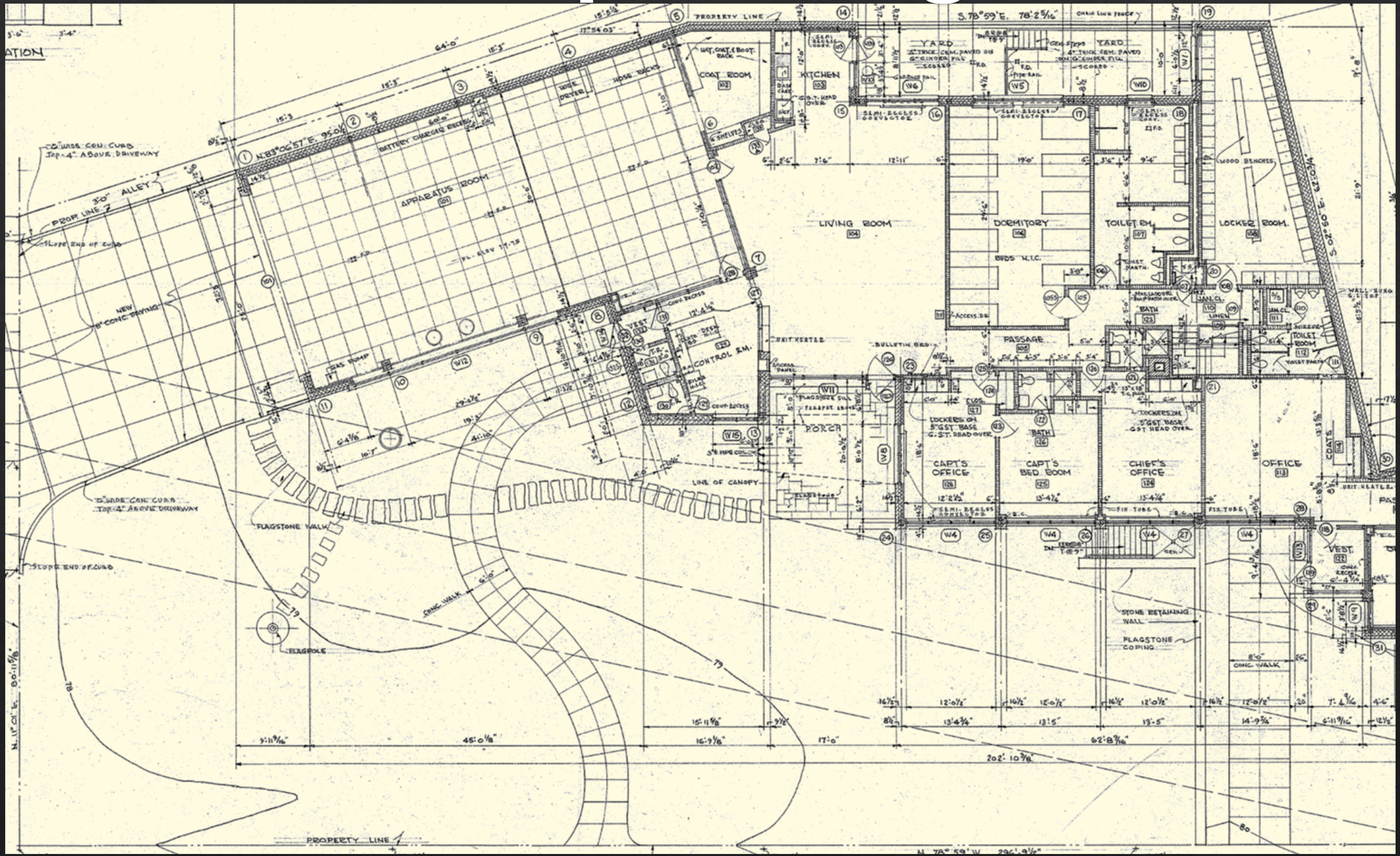
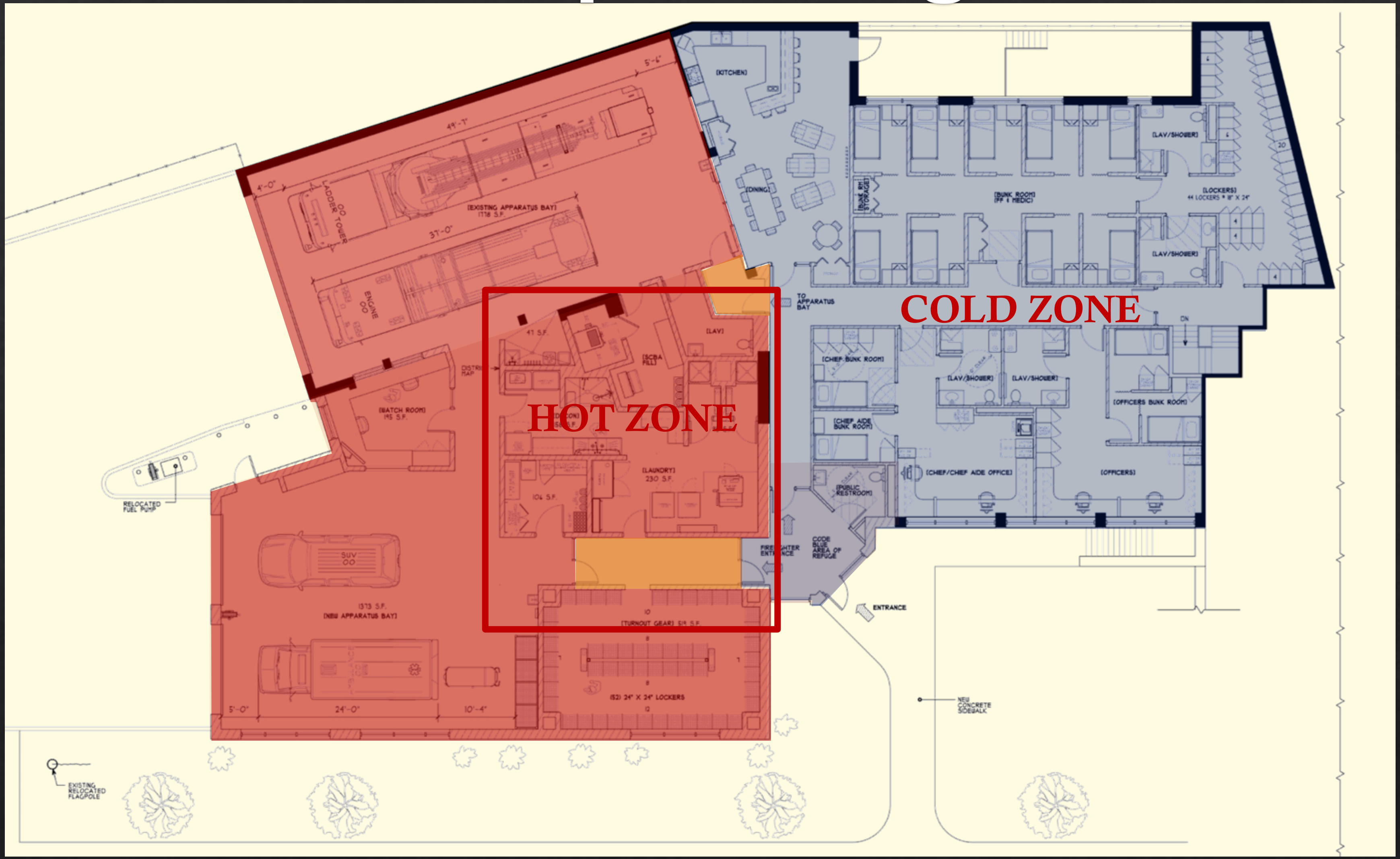
F.I.E.R.O.

Philadelphia Engine 5



Philadelphia Engine 5



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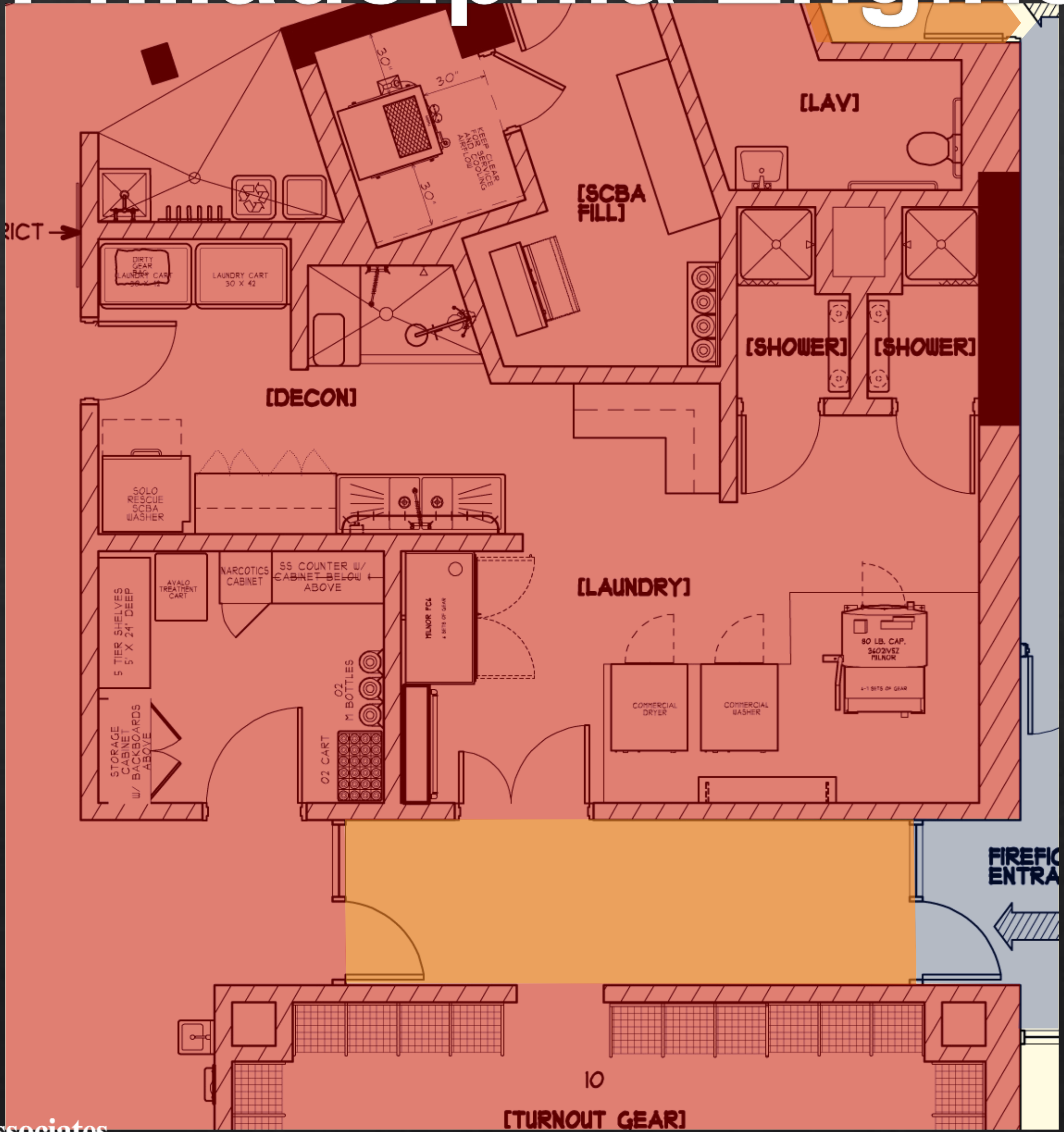
F.I.E.R.O.

Philadelphia Engine 5



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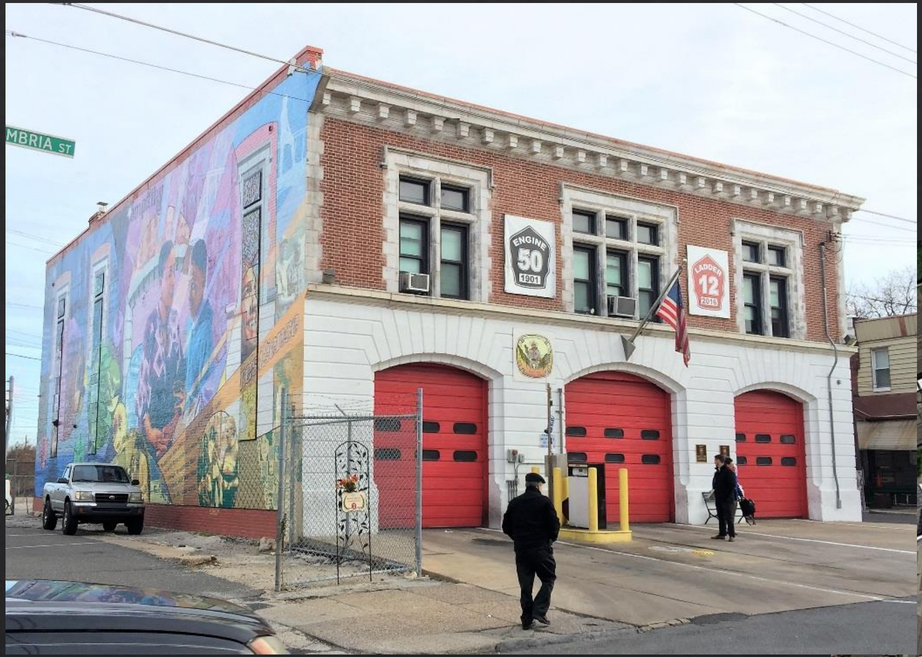
F.I.E.R.O.

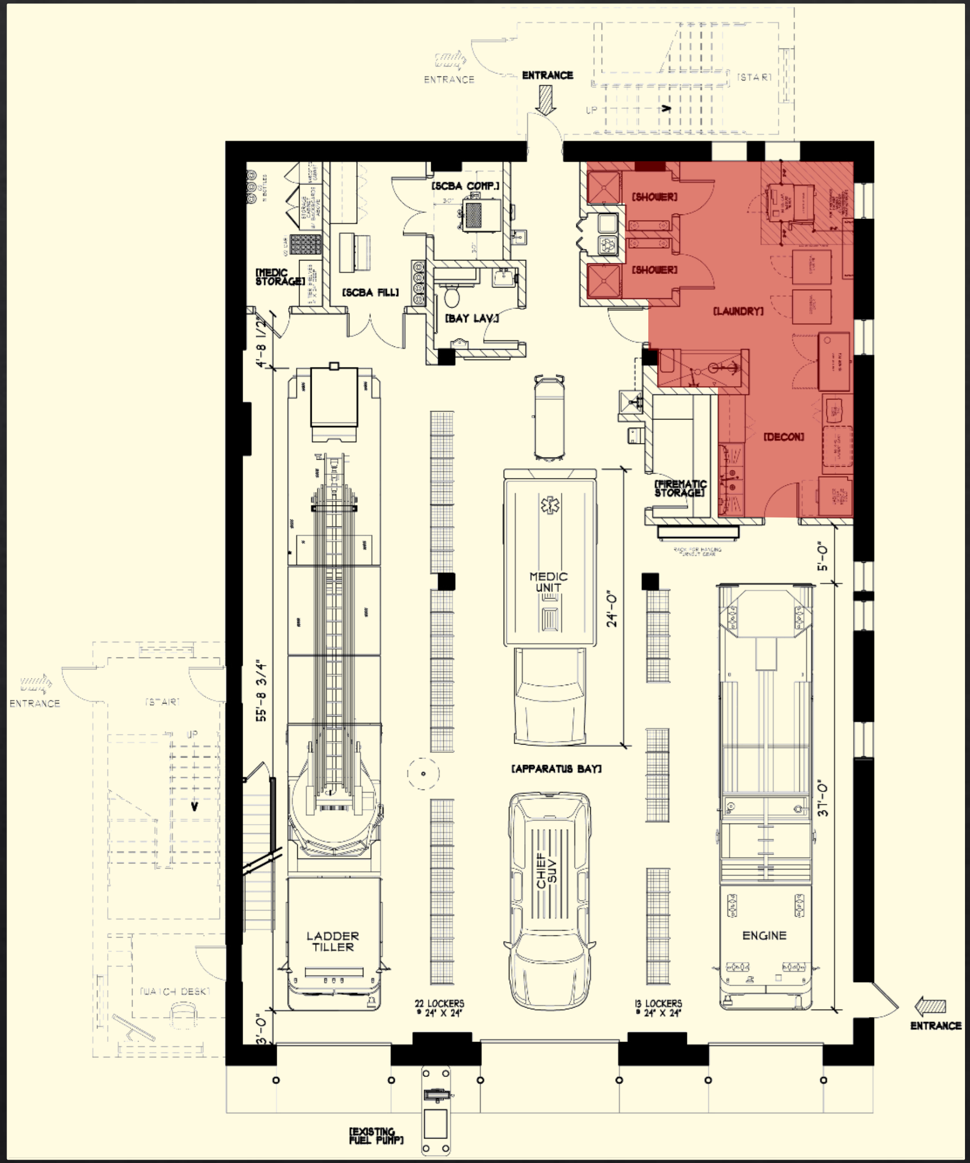
Philadelphia Engine 5



No space available for expansion

Philadelphia Engine 50

No space available for expansion



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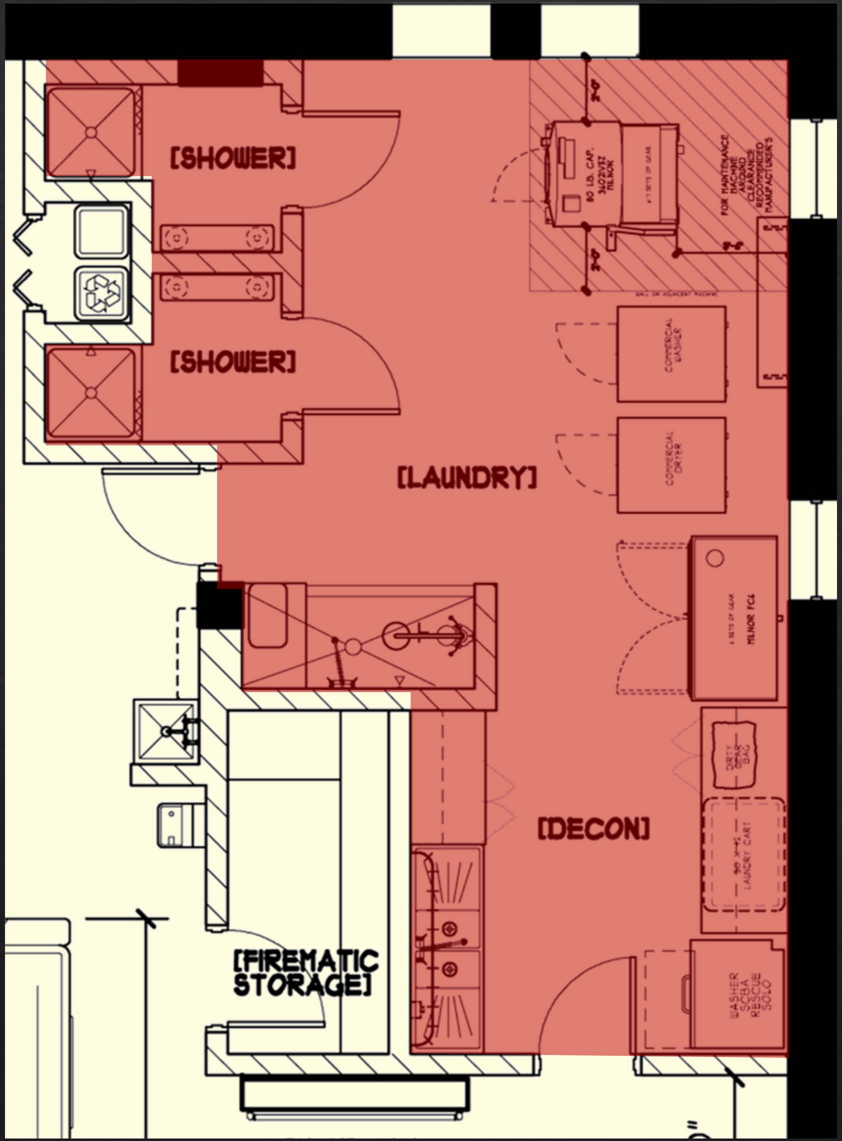
F.I.E.R.O.

Philadelphia Engine 50



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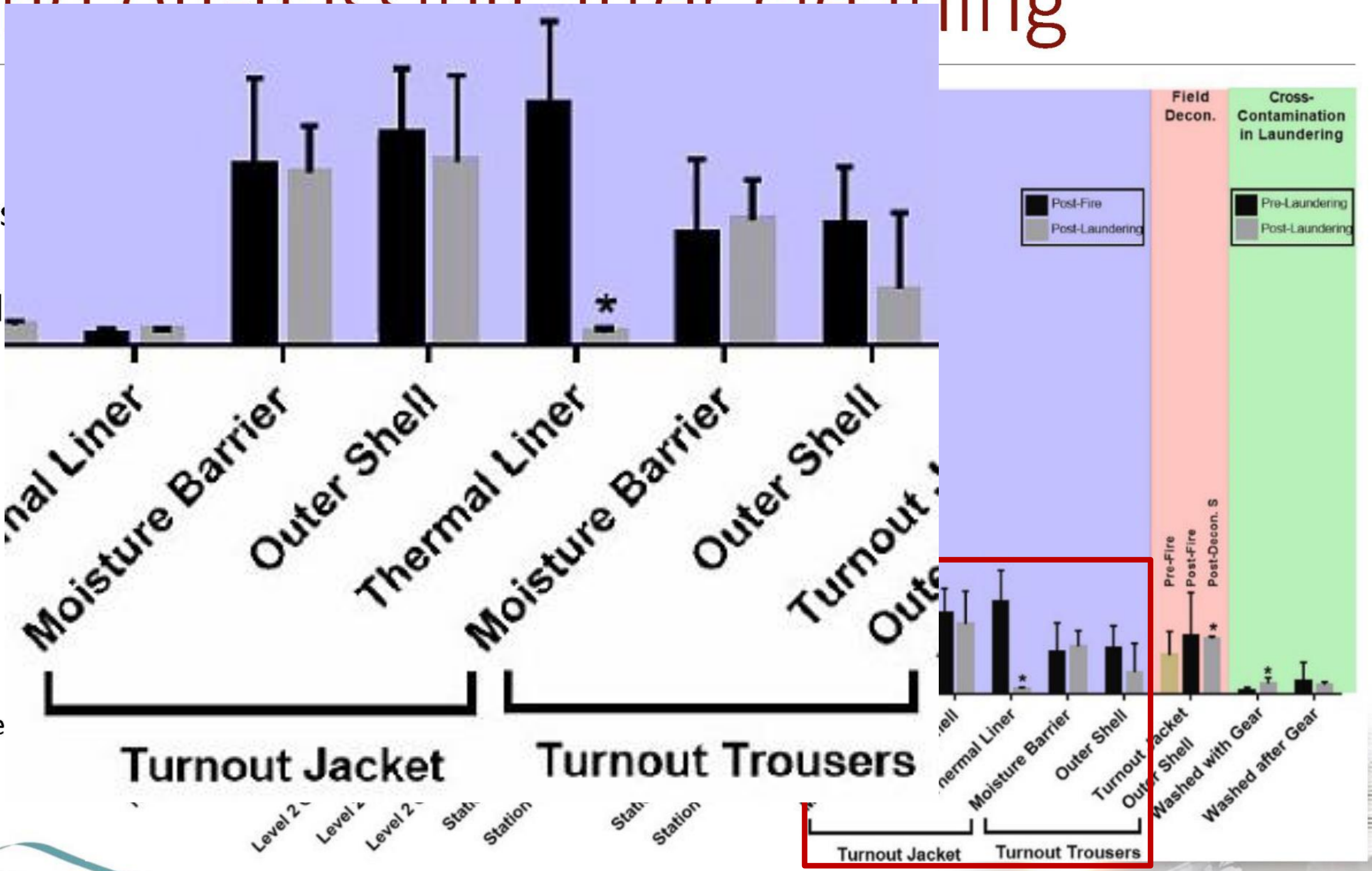
F.I.E.R.O.

Residual and off-gassing after cleaning

- Residual from layers of laundered jacket and gloves
- Off-gassing from outer shell laundered uniform

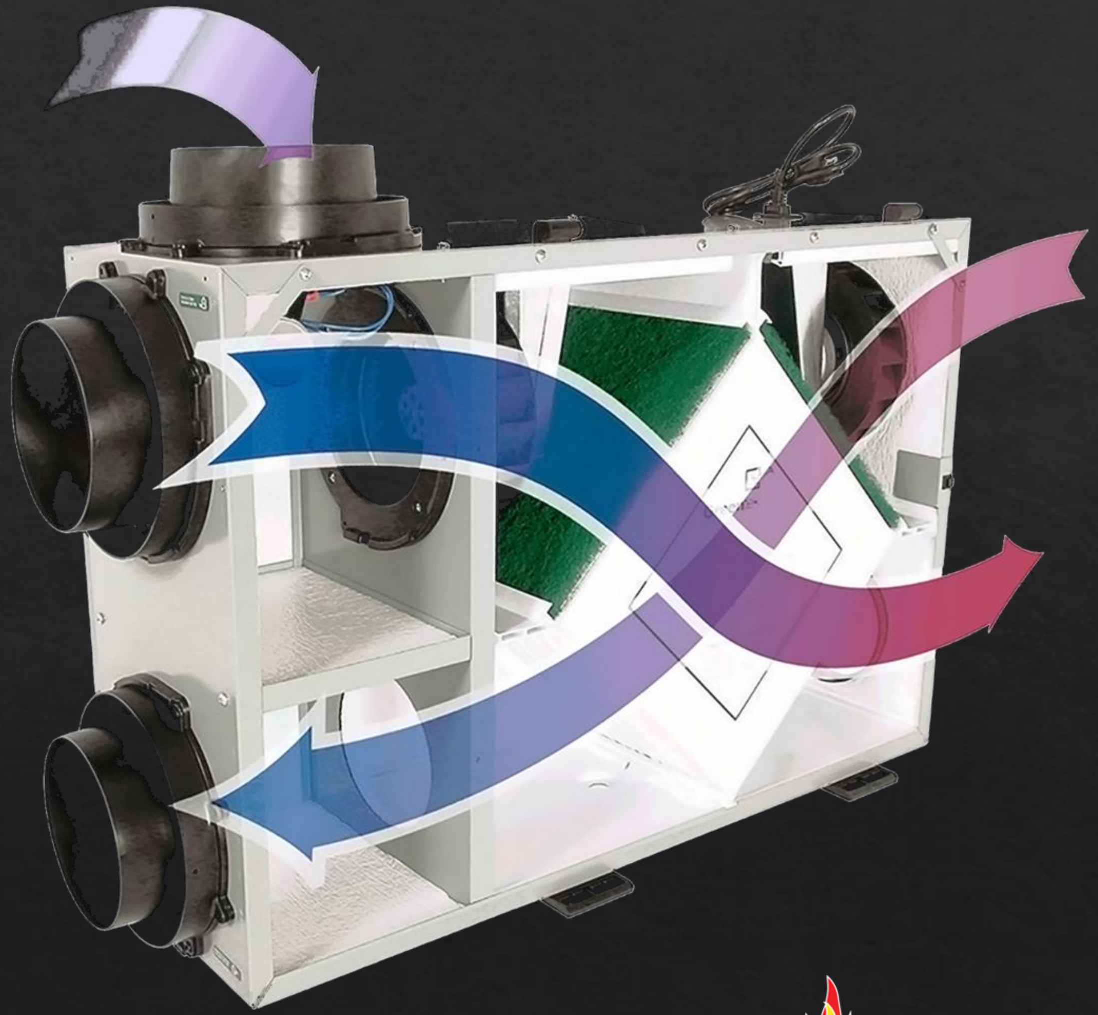


Source: QAEHS, Queensland Alliance Environmental Health Sciences

Ventilation

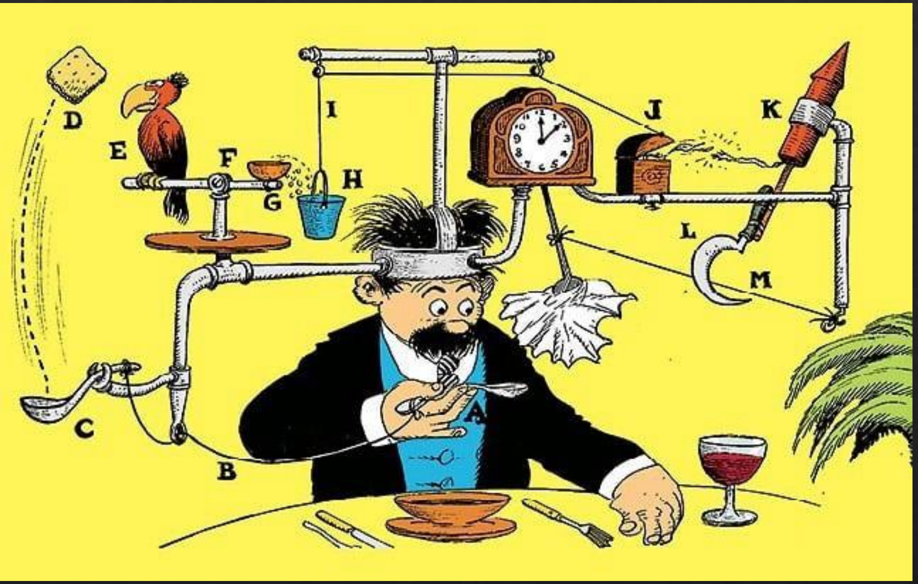
- Ventilation rate – Labs use 6 AC/hr
- Where does the exhaust go
- Recover the exhaust energy

Not enthalpy recovery!!!!!



Key Messages

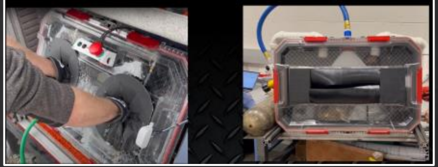
- Determine your protocol & design to it
- Evaluate the required throughput rate & number of people in the space
- Allow for ergonomics of the tasks
- Consider proposed & future equipment
- Understand manufacturers' requirements



F.I.E.R.O. PPE Conference

Conducting Wear Trials; Lessons Learned

On-site Deployment Decon Apparatus



Impact of Exposures on Particulate Hoods

Integration of Carbon Nanotube Hybrid Textile System in Personal Protective Equipment for the Ohio Fire Service

Enhanced Cleaning Procedures for Turnout Gear

Effectiveness of Exposure Mitigation Strategies for Fire Investigators

Do We Have A Solution to Address Contamination?

Impact of SCBA Weight on the Firefighter

Field Evaluations of First Responder PPE Opportunities & Limitations Best Practices for Obtaining Reliable Data

Environmental and Occupational Exposures Effects on Firefighters

Effects of Turnout Construction and Use Conditions on Heat Loss through Turnouts Suits and the Impact on Firefighter Heat Stress

Update on NFPA PPE & NFPA 1971

Dermal Carcinogen Absorption in Firefighters: Updates & Future Directions

Outfitting Female Firefighters: Why Female Specific PPE is Important for the Fire Service

A State of the Art Review of PPE Cleaning Effectiveness

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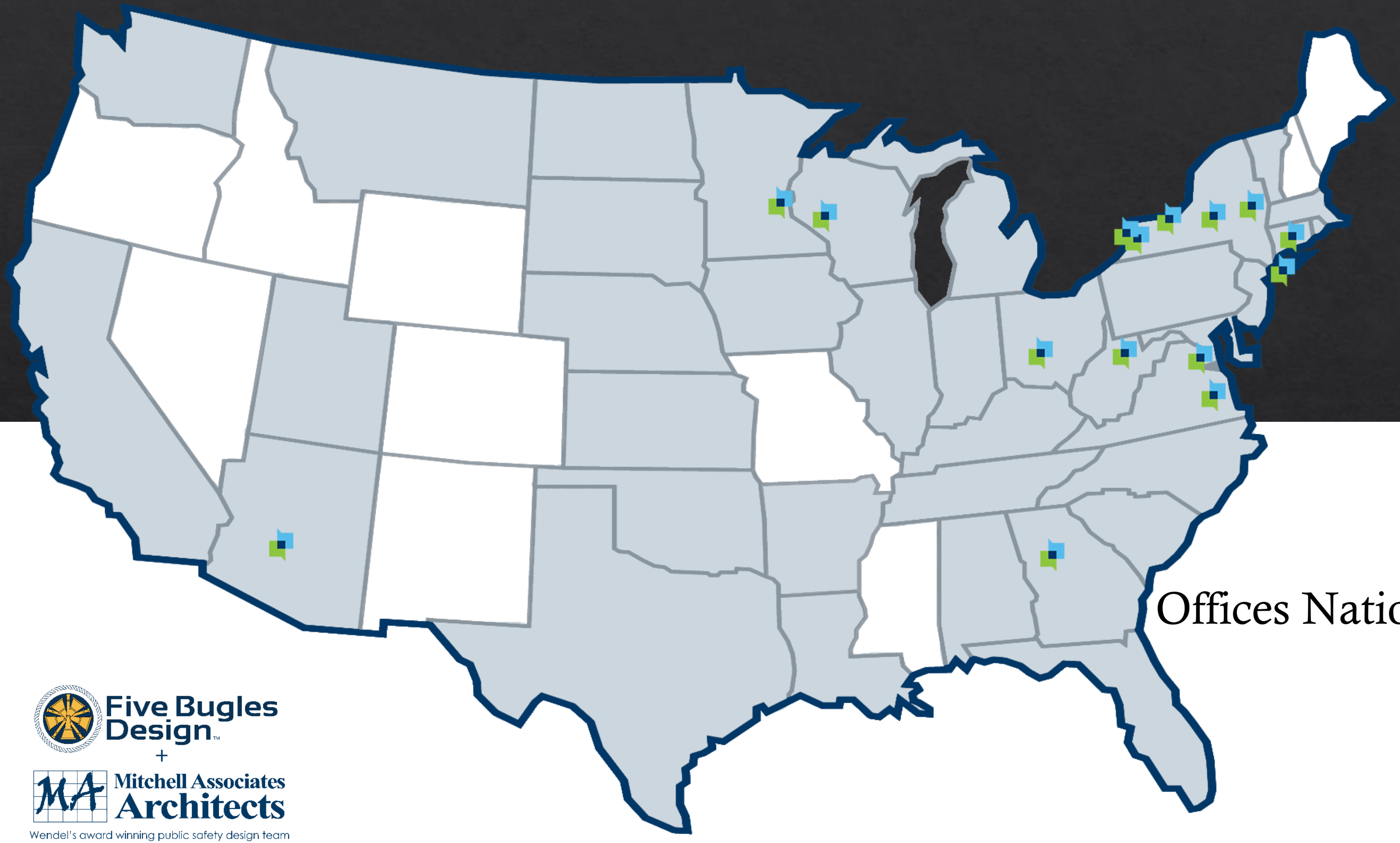
F.I.E.R.O.



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