

BEYOND THE ICRA

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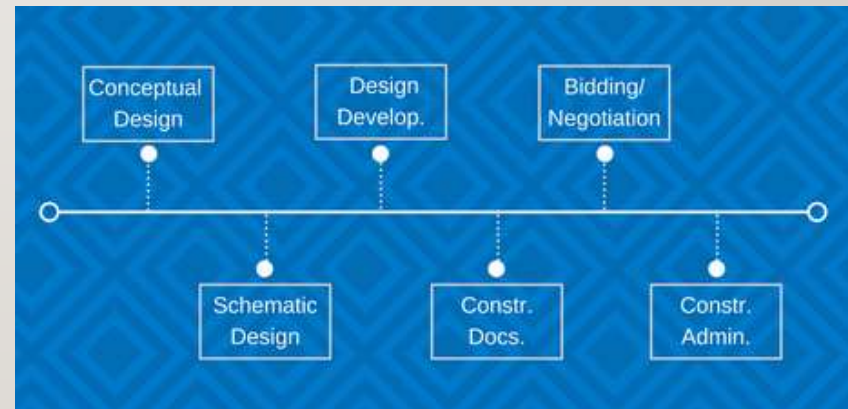
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OBJECTIVES

- Demonstrate basic understanding of a construction or renovation project from a planning perspective
- Distinguish key opportunities to be involved in the construction or renovation project beyond barriers
- Formulate an effective and safe turnover sequence to maintain a safe environment for staff and patients

CONSTRUCTION BASICS – PHASES OF THE BUILDING PROJECT

- Pre-design
- Schematic Design
- Design Development
- Construction Documents
- Construction
- Commissioning



CONSTRUCTION BASICS – PHASES OF THE BUILDING PROJECT

Pre-design

- Wish List for a specific project
- Conduct a needs analysis from each department and service

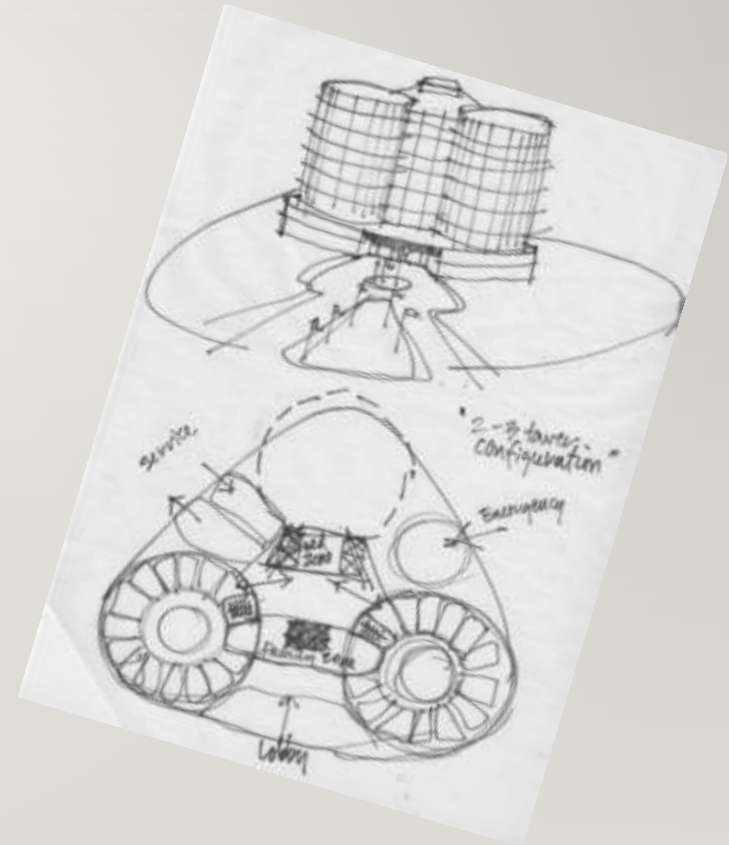


Key Team: C-suite, Physicians, Nursing, IP, Facilities, Finance, Planning & Construction

CONSTRUCTION BASICS – PHASES OF THE BUILDING PROJECT

Schematic design (SD)

- Rough outline of preliminary layout
- Structure and scope of project
 - Create design concept
 - Create preliminary construction schedule
 - Create preliminary construction budget



CONSTRUCTION BASICS – PHASES OF THE BUILDING PROJECT

Design Development (DD)

- Add details to all elements of the SD
- Space Planning
- Interior Design
- Mechanical Equipment



CONSTRUCTION BASICS – PHASES OF THE BUILDING PROJECT

Construction Documents

- Construction Drawings
 - Illustrate the location, configuration, assembly and size of all construction components
- Construction Specifications
 - Detailed written data on structure's materials, products, and systems used to construct the building
 - Used to prepare the contractor's bid
- Contract Conditions
 - Legal agreements between the organization and contractor

CONSTRUCTION BASICS – PHASES OF THE BUILDING PROJECT

Construction

- Before construction begins, finalize plans for:
 - Contractor access/badging/immunizations
 - Storage of building materials
 - Relocation of patients / furniture / equipment
 - Above ceiling access in occupied spaces (separate ICRA)
- Barrier construction and placement / exhaust discharge
- Clean Duct Protocols
- IP involvement during turnover
- Contractor travel path
- Contractor parking
- Contractor education of relevant hospital policies

CONSTRUCTION BASICS – PHASES OF THE BUILDING PROJECT

Construction

- Contractor education
 - Interim life safety measures (ILSM)
 - Infection control risks and their practices to reduce the risk
 - Security
 - Fire alarm activation
 - Parking and building access
 - Patient privacy
 - Cell phone use
 - Use of cafeteria



CONSTRUCTION BASICS – PHASES OF THE BUILDING PROJECT

Commissioning

- Occurs before the organization takes ownership of the building/renovation
- Purpose:
 - To ensure all systems, components, equipment are fully operational
 - To ensure adequate air quality and water quality

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FACILITY GUIDELINES INSTITUTE (FGI)

GUIDELINES FOR DESIGN AND CONSTRUCTION

- Roadmap for the design of any new or renovated space in a healthcare facility – A to Z
- Published every 4 years
- 2018 is now broken out into Hospital and Outpatient Facilities
- Additionally there are specialty focus areas such as
 - Hybrid OR's
 - Emergency Departments of the Future
 - Low Acuity Treatment Rooms
- ANSI/ASHRAE/ASHE Standard 170: *Ventilation of Health Care Facilities* has been incorporated into the 2018 FGI

FGI COMPLIANCE

- “Where renovation or replacement work is done in an existing facility, all new work or additions or both shall comply with applicable sections of the *Guidelines* and local, state, and federal codes.”
 - New buildings
 - Major renovations
 - Complete buildings or areas for a new use or occupancy
 - Conversions of occupancy type
- Multidisciplinary Team
 - “administrators, clinicians, infection preventionists, architects and other design professionals, facility managers, safety officers, security managers, users of equipment, and support staff relevant to the areas affected by the project”

FGI EXCEPTIONS AND WAIVERS

- **Exceptions- do not reduce the level of health and safety in an existing building**
 - Routine repairs and maintenance to buildings, systems, or equipment
 - Replacement of building furnishings and movable or fixed equipment
 - Minor changes to the configuration of an existing space or cosmetic changes and upgrades
 - Improvements to a building system or a space that cannot reasonably meet the requirements of this document should be permitted, provided the improvement does not impair other systems or functions of the building.
 - Existing systems that are not in strict compliance with the provisions of this document should be permitted to continue in use, unless the AHJ has determined that such use constitutes a distinct hazard to life.
 - Replacement of mechanical, electrical, plumbing, and fire protection equipment and infrastructure for maintenance purposes due to the failure or degraded performance of the components being replaced should be permitted, provided the health and safety in the facility is maintained at existing levels.
- **Waivers**
 - Patient care and safety cannot be jeopardized

FUNCTIONAL PROGRAM

- Design team submits plans on behalf of the owner to CDPHE for Review
- CDPHE approval of all designs and functional program
- FGI - Infection Control Risk Assessment (ICRA)
 - Identify and plan safe design elements, including consideration of long-range infection prevention.
 - Identify and plan for internal and external building areas and sites that will be affected during construction/renovation.
 - Identify potential risk of transmission of airborne and waterborne biological contaminants during construction and/or renovation and commissioning.
 - Develop infection control risk mitigation recommendations (ICRMRs) to be considered.

FGI Infection Control Risk Assessment Design Considerations

Design Element	Facility/Patient Care Unit Type	Guidelines Section or Other Reference
HVAC Systems		
HVAC systems	Hospital	Part 3 (ASHRAE 170)
Water/Plumbing Systems		
Potable water supply systems	Hospital	2.1-8.4.2.3
Heated potable water distribution systems	Hospital	2.1-8.4.2.5, Table 2.1-3
Hemodialysis/hemoperfusion	Hospital	2.1-8.4.2.2, 2.2-3.10.8.17
Drainage systems/ condensate/floor drains	Hospital	2.1-4.3.3.3, 2.1-8.4.2.2, 2.1-8.4.2.6, 2.1-8.4.2.7, 2.2-3.1.3.6 (8), 2.2-3.10.8
Emergency eyewash and emergency shower stations	Hospital	2.1-5.1.2.2, 2.1-5.7.2.2, 2.1-8.4.3.8, 2.2-3.4.8.22, 2.2-3.10.9.2, 2.2-3.11.4.2
Hand-washing stations (plumbed sinks) and hand sanitation dispensers	Hospital	2.1-2.3.4, 2.1-2.4.2.2, 2.1-2.4.2.3, 2.1-2.8.7, 2.1-
	Patient care units	2.1-2.2.5, 2.2-2.2.2.5, 2.2-2.6.2.5, 2.2-2.9.3.5,
	Diagnostic and treatment areas	2.1-3.2.2.2, 2.1-3.2.3.3, 2.1-3.3.2.2,
	NICU/nursery	2.2-2.8.2.5, 2.2-2.10.2.4
	Cancer treatment/infusion therapy	2.2-3.12.2.5
	Imaging	2.2-3.4.2.3, 2.2-3.4.3.1, 2.2-3.4.4.2,
Mobile/transportable medical units	2.8-3.1.2	2.8-3.1.2
Hand scrub facilities (scrub sinks)	Hospital	2.1-2.8.6, 2.1-8.3.5.1, 2.1-8.4.3.2,
Hydrotherapy facilities	Hospital	2.1-8.4.3.9
Ice making equipment	Hospital	2.1-2.8.10, 2.1-8.4.3.4
Sinks – clinical	Hospital	2.1-8.4.3.5
Showers/bathing facilities	Hospital	2.1-2.3.6, 2.1-8.4.3.3
Surfaces and Furnishings		
Surfaces	Hospital	2.1-7.2.3
Furnishings	Hospital	2.1-7.2.4

ADDITIONAL DESIGN ELEMENTS

- **Finishes**
 - Get EVS involved early
 - Cleaning IFU's
- **Structure**
 - Look beyond the department boundaries
- **Workflow**
 - How will cleaning happen
 - Who will do it
- **Equipment**
 - IFU's
 - Storage
 - Training



ANSI/ASHRAE/ASHE STANDARD 170-2017; *VENTILATION OF HEALTH CARE FACILITIES*

- Details space ventilation for:
 - Hospital spaces
 - Outpatient spaces
 - Nursing Home spaces

Ventilation defined:

The movement of clean and thermally conditioned air into a space to provide environmental control for comfort, asepsis, and odor in health care facilities.

- Chemical contaminants
- Physical contaminants
- Biological contaminants

ANSI/ASHRAE/ASHE STANDARD 170-2017; VENTILATION OF HEALTH CARE FACILITIES

Table 6.4 Minimum Filter Efficiencies

Space Designation (According to Function)	Filter Bank No. 1 (MERV) ^a	Filter Bank No. 2 (MERV) ^a
Operating rooms (ORs); inpatient and ambulatory diagnostic and therapeutic radiology; inpatient delivery and recovery spaces	7	14
Inpatient care, treatment, and diagnosis, and those spaces providing direct service or clean supplies and clean processing (except as noted below); All (rooms)	7	14
Protective environment (PE) rooms	7	HEPA ^{c,d}
Laboratory work areas, procedure rooms, and associated semirestricted spaces	13 ^b	NR
Administrative; bulk storage; soiled holding spaces; food preparation spaces; and laundries	7	NR
All other outpatient spaces	7	NR
Nursing facilities	13	NR
Psychiatric hospitals	7	NR
Resident care, treatment, and support areas in inpatient hospice facilities	13	NR
Resident care, treatment, and support areas in assisted living facilities	7	NR

NR = not required

a. **Informative Note:** The minimum efficiency reporting value (MERV) is based on the method of testing described in ANSI/ASHRAE Standard 52.2 (ASHRAE [2017a]).

b. Additional prefilters may be used to reduce maintenance for filters with efficiencies higher than MERV 7.

c. As an alternative, MERV-14 rated filters may be used in Filter Bank No. 2 if a tertiary terminal HEPA filter is provided for these spaces.

d. **Informative Note:** High-efficiency particulate air (HEPA) filters are those filters that remove at least 99.97% of 0.3 micron-sized particles at the rated flow in accordance with the testing methods of IEST RP-CC001.6 (IEST [2016]).

ANSI/ASHRAE/ASHE STANDARD 170-2017; VENTILATION OF HEALTH CARE FACILITIES

Table 7.1 Design Parameters—Hospital Spaces

Function of Space	Pressure Relationship to Adjacent Areas (n)	Minimum Outdoor ach	Minimum Total ach	All Room Air Exhausted Directly to Outdoors (j)	Air Recirculated by Means of Room Units (a)	Design Relative Humidity (k), %	Design Temperature (l), °F/°C
SURGERY AND CRITICAL CARE							
Critical and intensive care	NR	2	6	NR	No	30–60	70–75/21–24
Delivery room (Caesarean) (m), (o)	Positive	4	20	NR	No	20–60	68–75/20–24
Emergency department decontamination	Negative	2	12	Yes	No	NR	NR
Emergency department exam/treatment room (p)	NR	2	6	NR	NR	Max 60	70–75/21–24
Emergency department public waiting area	Negative	2	12	Yes (q)	NR	Max 65	70–75/21–24
Intermediate care (s)	NR	2	6	NR	NR	Max 60	70–75/21–24
Laser eye room	Positive	3	15	NR	No	20–60	70–75/21–24
Medical/anesthesia gas storage (r)	Negative	NR	8	Yes	NR	NR	NR
Newborn intensive care	Positive	2	6	NR	No	30–60	72–78/22–26
Operating room (m), (o)	Positive	4	20	NR	No	20–60	68–75/20–24

ANSI/ASHRAE/ASHE STANDARD 170-2017; *VENTILATION OF HEALTH CARE FACILITIES*

What does Positive mean?

- To the design engineer, positive means supply air cfm > return air cfm by about 100 cfm
- The difference between SA and RA is called an offset

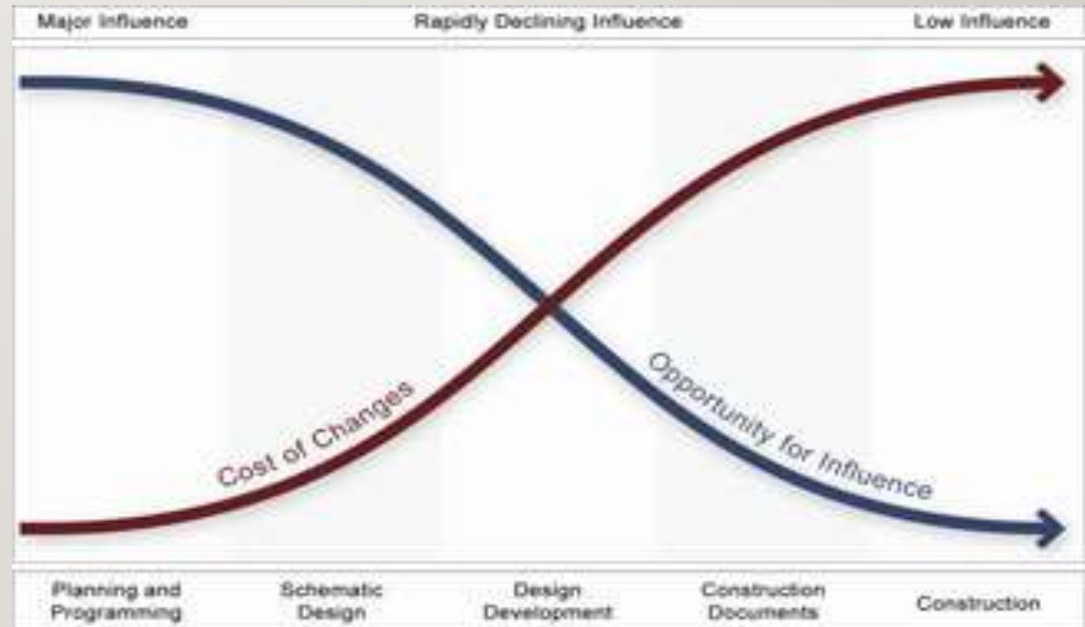
$$\text{SA cfm} - \text{RA cfm} = 100 \text{ cfm}$$

100 cfm is the offset

- The engineer determines the offset value that will create a pressurized OR
- Only after TAB, will the actual differential air pressure be known (i.e. measured)

WHY CAN'T WE MOVE THE SINK TO THE OTHER SIDE OF THE ROOM?

- Changes beyond DD's
- RFI
- Change Order's
- Time
- Budget



PHASES OF CONSTRUCTION

- Permitting
- PCRA (pre-construction risk assessment)
- ICRA
- Pre-construction (“Enabling”)
- Construction
- Turn-over
- Occupancy

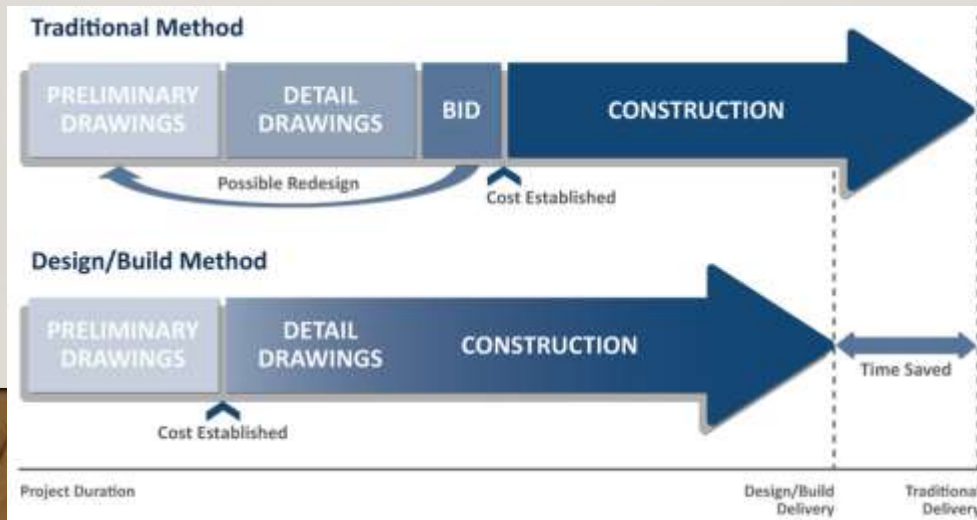
WHO IS MY TEAM

- Planning and Design

- Architect
- Engineers
 - Mechanical, Electrical, Plumbing, HVAC

- General Contractor (GC) – Design Build

- Overlapping based on schedule
- Core and Shell vs Tenant Improvements



WHO IS MY TEAM

- Construction

- Architect

- May be the same design team as the pre-planning or a different team for the actual construction phase
 - Change requests
 - Punch

- Owner Project Manager

- Responsible for the owners side of the project, planning , schedule and budget

- GC

- Senior Project Manager/Project Manager/Construction Manager

- Oversees the project from start to finish

- Superintendent

- Supervises the field construction, including organization, planning and scheduling
 - They will be the primary contact for day to day work and will be the key player in ICRA development and schedule

WHO IS MY TEAM

- **Foreman**
 - Responsible for the workers onsite
 - Task completion on schedule
- **MEP Coordinator**
 - Works with Engineers and subcontractors on all MEP issues
 - Key player for utility shut-downs
- **Safety**
 - Manages the onsite safety of all workers
 - Safety class
 - Onsite evaluations for policy compliance
 - Your resource along with Superintendent if you see breaches
- **Estimator**
 - Responsible for estimating the costs, materials and labor needed to complete the project
 - ICRA plays a significant role in this depending on class of risk and requirements for barriers

WHO IS MY TEAM

- Sub-contractors
 - MEP
 - Key players in the HVAC and Plumbing of a project
 - Follows similar structure as a GC; Super and Foreman
 - TAB
 - Finishes
 - 3rd Party Commissioning Agents
 - Your partner in the validation and testing of MEP equipment and BAS
 - Inspectors
 - AHJ
 - Local and State sign offs
 - Need to understand the testing process implications on HVAC systems

MEETING STRUCTURES

- Selection Meetings
- Design Meetings
 - Conceptual Design
 - Design Development
 - Lean or PI Events
 - Workflow Reviews
 - Sign off



MEETING STRUCTURES

- Owner/Architect/Contractor
– “OAC”
 - Typically weekly are larger projects
 - Set structure
 - Schedule Reviews
 - RFI/Change Requests
- MEP
 - Commissioning
 - AHJ
 - MOP
 - Equipment Planning/IT
 - Building Readiness
 - Operational Planning

WHERE TO FOCUS MY LIMITED TIME

- Document reviews
- Virtual reality walks
- Mock-ups
 - Wall space for hand sanitizers, sharps, gloves, waste cans, linen
 - Bathrooms and shower slopes
 - Pre-fabrications
- Box and track walks
 - Coordination between IP and GC
 - Documentation
 - Take pictures
 - Set expectations
 - PPE
 - Come prepared to be in a construction zone



BREAK



PRE-TEST: PLACE IN THE PROPER ORDER TURNOVER SEQUENCE FOR MEDIUM/LOW RISK AREAS STEP-BY-STEP PROCEDURE

Step	Description	Action By
	Daily water flush	GC
	Perform and complete a detailed construction clean – remove dust and debris from ALL surfaces	GC
	Infection Prevention inspection	IP
	Barriers are removed, negative air machines off, plastic over supply and return grills is removed.	GC
	All supply and return air grills are securely covered. HEPA filtered negative air is still depressurizing the work area.	GC
	Testing, adjusting and balancing can occur. ICRA needed for access above the ceiling.	MEP
	EVS performs a triple terminal clean	EVS
	EVS performs terminal clean.	EVS
	TAB and Commissioning complete	GC
	Plumbing tie-ins complete; plumbing disinfection performed	MEP
	Infection prevention inspection	IP
	TCO awarded	GC
	Daily water flush to the date of first patient occupancy	EVS
	EVS performs daily terminal clean each day to the date of first patient occupancy	EVS

INFECTION CONTROL RISK ASSESSMENT (ICRA)

- Determines level of risk to patients and defines controls to reduce risk
- 3 step method
 - Identify type of construction
 - Identify patient or staff risk group
 - Determine the level of infection control classification
 - Defines the controls that are needed to reduce or eliminate risk to patients

INFECTION CONTROLS INTERRUPT CONTAMINANT TRANSMISSION

SOURCE

- Air flow
- Construction area



PATHWAY

- Traffic patterns
- Equipment
- People



PATIENT

- Rooms
- Transportation



SOURCE CONTROLS: CONTAINMENT BARRIERS – 3 MAIN TYPES



Environmental containment unit (ECU)

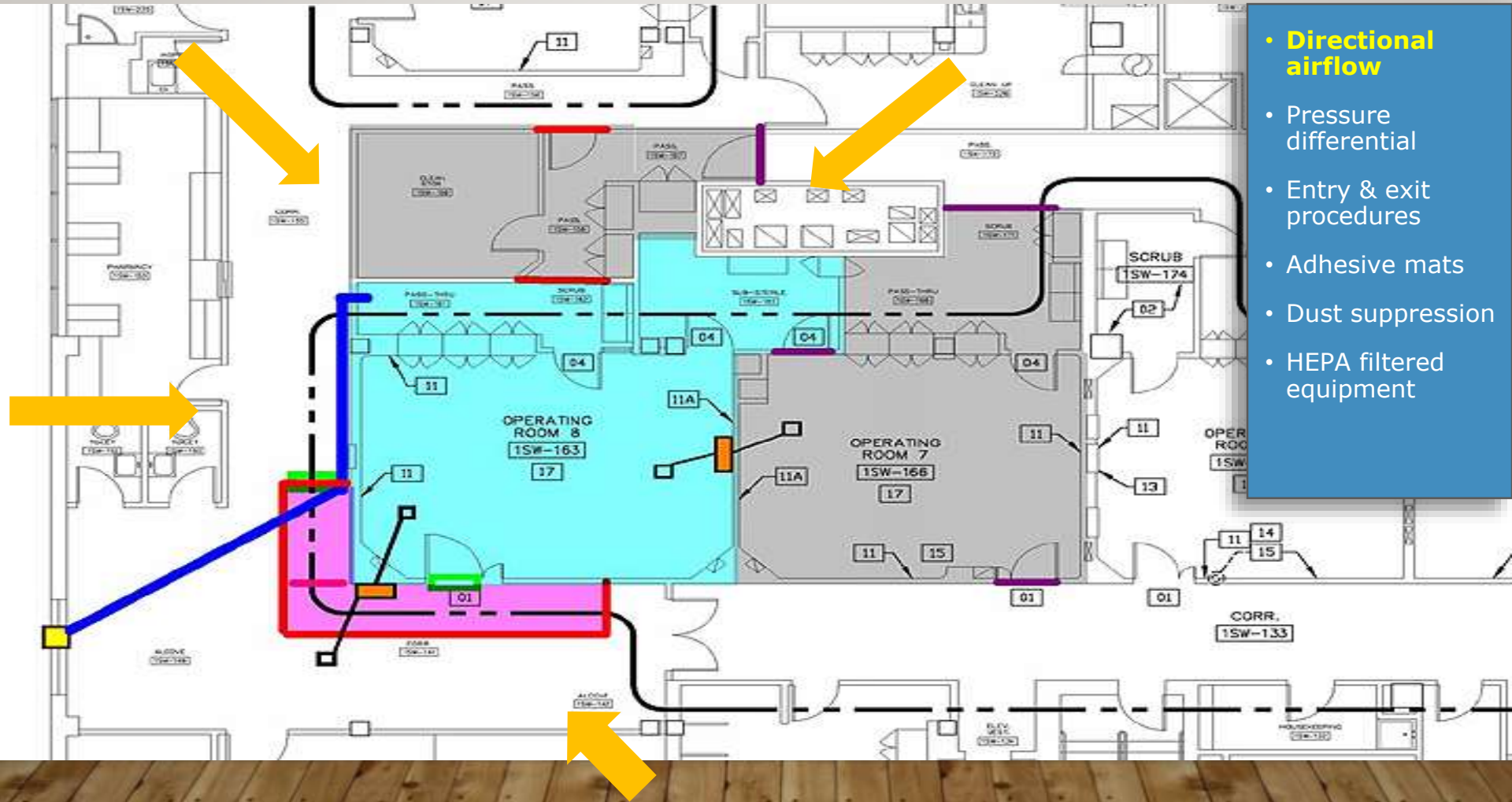


Non-rigid containment barrier



Rigid containment barrier

CONTAINMENT LAYOUT



CONTAINMENT ENTRY & EXIT PROCEDURES

- Vacuum work clothing
- Wear appropriate clean clothing
- Clean equipment
- Cover equipment
- Walk over tacky mats



- Directional airflow
- Pressure differential
- **Entry & exit procedures**
- Adhesive mats
- Dust suppression
- HEPA filtered equipment

CONTROL TRANSMISSION ALONG THE TRAFFIC ROUTE

DEMOLITION



BUNNY SUIT ENSEMBLE



Take off bunny suit in work area – Step into anteroom – Vacuum clothing – Exit anteroom

CONTROL TRANSMISSION ALONG THE TRAFFIC ROUTE

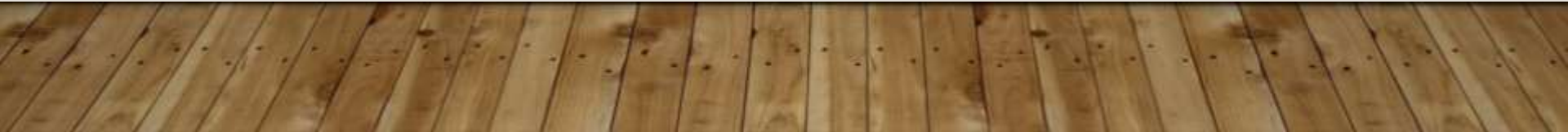
WIPE CLEAN



COVERED AND WIPE WHEELS



MOVING EQUIPMENT ACROSS THE RED LINE



CONTROL TRANSMISSION ALONG THE TRAFFIC ROUTE

WASTE FROM
DEMOLITION ZONE



MOVE CONTAINER TO
PRE-CLEAN STATION



CONTROL TRANSMISSION ALONG THE TRAFFIC ROUTE

CLEAN WASTE CART
PRIOR TO ENTRY INTO
ANTEROOM



CLEAN PERSONNEL
CLOTHING/SHOES IN
ANTEROOM



CONTROL TRANSMISSION ALONG THE TRAFFIC ROUTE

CLEAN CART MOVES THROUGH HOSPITAL



CART CLEANED AGAIN AFTER DUMPSTER



CONTROL TRANSMISSION ALONG THE TRAFFIC ROUTE

MOVING LARGE MATERIALS



TACKY MATS ALONG THE ROUTE



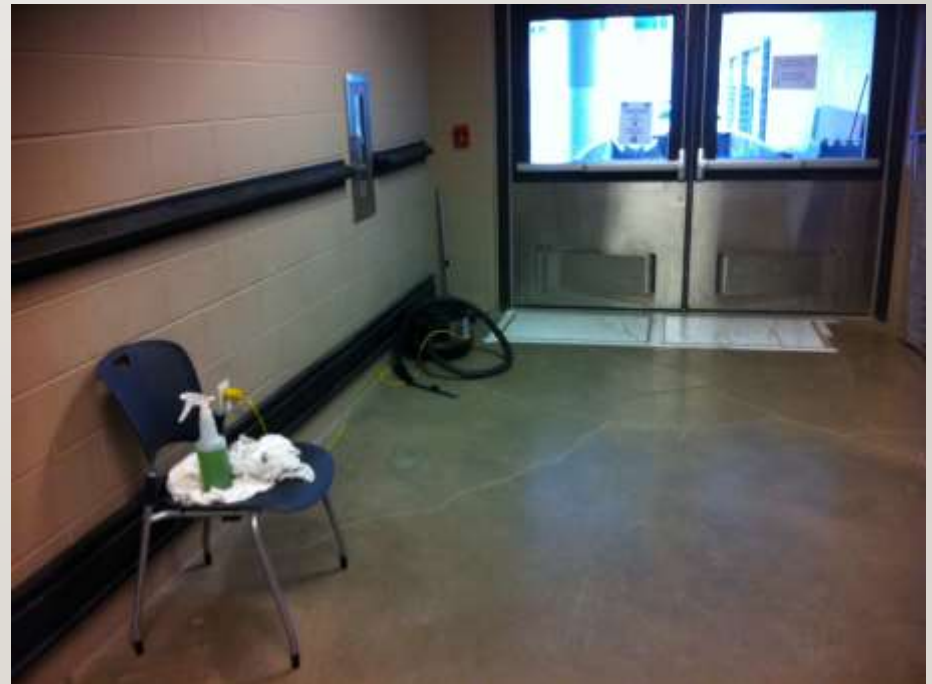
ALSO Frequent mopping or vacuuming traffic route

CLEANING STATIONS

IN THE ANTEROOM



AT THE ENTRANCE INTO
HOSPITAL AT LOADING DOCK



PATIENT CONTROL SYSTEMS

- Patient relocation
- Unit closures
- Work Hours
 - Day-time or night-time
- Workers do not ride in elevators with patients



Separate patients and construction area by

- Distance
- Time

THE ICRA PERMIT

Patient Risk Group	Construction Project Type			
	A	B	C	D
LOW Risk Group	I	II	II	III / IV
MEDIUM Risk Group	I	II	III	IV
HIGH Risk Group	I	II	III / IV	IV
HIGHEST Risk Group	II/III	III / IV	III / IV	IV

VUMC Infection Control Construction Permit

Project Location:	Date Permit Completed:
Supervisor's Name:	Dates of work:
Contractor performing work:	Amended dates of work:
Brief Project Description:	

YES	NO	Construction Activity	YES	NO	Infection Control Risk Group
		TYPE A: Inspection, minor non-dust producing activities			Low Risk –Office workers
		TYPE B: Small scale activities less than 24 hours which create minimal dust			Medium Risk – All inpatient and outpatient areas not in the High Risk group
		TYPE C: Activity generates moderate to high levels of dust, requires demolition or removal of any fixed building components and is in the confines of a suite or office			High Risk
		TYPE D: Major demolition and construction projects not within the confines of a suite or office.			HIGH RISK areas: INPATIENT AREAS: Pediatric and Adult: Operating/Delivery Rooms, Cath labs, Myelo suppression units, ICUs), dialysis, nurseries. CLINIC AREAS: Any clinic associated with Hematology, Oncology, Pediatric Infectious Diseases, or Transplant services. SERVICE AREAS: Central Processing, Sterile processing, Food Prep & Service area, Pharmacies.

Use Matrix to determine Infection Control Class required for this job:		Infection Control Risk Group	Type A	Type B	Type C	Type D
			Low	Medium	High	I
CLASS I						
<i>Initial:</i>	<ul style="list-style-type: none"> Notify area manager before work begins. Use work methods that minimize generation of dust. Clean up work upon completion of task. 					<ul style="list-style-type: none"> Immediately replace ceiling tile displaced for visual inspection.
CLASS II						
<i>Initial:</i>	<ul style="list-style-type: none"> Complete all activities noted under Class I. Provide active means to prevent airborne dust from dispersing into atmosphere. Water mist work surfaces to control dust while cutting Seal unused doors with blue painter's tape. Block off and seal air vents. Method of capping ducts shall be dust tight and withstand airflow. Place dust mat at entrance or exit of work areas. 					<ul style="list-style-type: none"> Remove or isolate HVAC system in areas where work is being performed. Clean up by wiping work area with disinfectant. Contain construction waste before transport in tightly covered containers. Containers are wiped down before leaving jobsite. Wet mop and/or vacuum jobsite with HEPA vacuum before leaving work area.
CLASS III						
<i>Initial:</i>	<ul style="list-style-type: none"> Complete all activities noted under Class I and II Submit Infection Control Permit for approval by VEHS and Infection Control 72 hours before project begins. Complete all critical barriers to seal area from non-work area or implement control cube method before construction begins. Airtight plastic or drywall barriers extend from floor to ceiling. If plastic is used as a barrier, use 4 mil grade, opaque plastic sheeting. Entrances are draped with plastic that overlaps at least 24 inches. Seal all penetrations to ensure an existing air-tight barrier. Maintain negative air pressure within work site utilizing HEPA equipped air filtration units. 					<ul style="list-style-type: none"> Cover return vents with appropriate filter media. Verify negative pressure using a manometer at the project entrance as recommended by VEHS/ICP Vacuum area thoroughly using HEPA filtered vacuum at least daily. Wipe work surfaces with hospital approved disinfectant during routine clean up and when work is completed each day. Immediately clean any dust tracked outside of construction barrier Remove dust barriers carefully to minimize spreading of dust associated with construction. Temporary dust protection may be required before removal of barriers.
CLASS IV						
<i>Initial:</i>	<ul style="list-style-type: none"> Complete all activities noted under Class I, II, and III All personnel entering the work site are required to wear shoe covers. Shoe covers are changed each time the worker exits the work area. 					<ul style="list-style-type: none"> Construct anteroom and require all personnel to pass through this room so their clothing is vacuumed before leaving the worksite with a HEPA vacuum or they can wear coveralls that are removed each time they leave the work site.

Notes/Comments:

Interim Life Safety Measures Required: Y N Square ft. of construction area: _____ No. HEPA's required: _____	Signatures: Infection Control: _____ PIT Svcs/SFP: _____ VEHS: _____ Project Supervisor: _____ Area Representative: _____	Amended Date(s) X _____ X _____ X _____ X _____ X _____
Fixed Distribution: (Fax nos. listed): Infection Control: 6-0727 Plant Services: 3-9956 VEHS: 6-2950 Space and Facilities: 3-8388		

REVISED ICRA PERMIT

Preparation for work – Select Controls applicable for Construction Project (√)

- All work personnel shall have clean clothing and shoes at all times when in the facility. Hard hats and high visibility clothing shall also be clean.
- All equipment, materials, waste carts and transfer carts shall be wiped clean prior to entry into the hospital and shall be clean at all times when moving throughout the hospital.
- Clean interior and exterior surfaces of HEPA filtered vacuum. Conduct detailed inspection of the vacuum to ensure clean, intact filters and proper seating of the HEPA filter on the filter gasket.
- Conduct detailed inspection of the HEPA filtered negative air machine to ensure clean, intact filters and proper seating of the HEPA filter on the filter gasket.
- Have available a HEPA filtered vacuum for the purposes of vacuuming dust and debris from equipment, materials, carts and personnel clothing
- Have available clean cloths and spray disinfectant or wipes for the purposes of wiping clean all equipment, materials and carts
- No tool belts, gloves, or rags shall be hanging from contractor belts or pockets. All small equipment (tool belts, tape measure, hammer, drywall saw, etc.) shall be placed inside cleanable portable containers.
- Have bunny suit ensemble (bunny suit, booties, hair bonnets) available
- Have booties available

Infection Controls – Select all that apply (√)

- Immediately replace a ceiling tile displaced for visual inspection
- Place HEPA filtered portable air scrubber in area with open ceiling tile.
- Immediately upon replacement of ceiling tile, vacuum personnel clothing, equipment, ladder and floor to remove dust and debris generated by removing and replacing the ceiling tile.
- Close door to work area – the room will serve as containment.
- Remove all equipment and materials from room prior to beginning work.
- Place tape and plastic over cabinets and shelving within room.
- Place HEPA filtered portable air scrubber outside of work area (in adjacent occupied spaces).
- Seal unused doors with tape.
- Coordinate with the Control Room a shut-down of the Terminal Box or Variable Air Volume Box serving the work area prior to covering the supply air diffuser.
- Securely seal and block off supply air diffusers.
- Securely seal and block off return air grills
- Place MERV 11 filters over return air grills
- Securely seal and block off exhaust air grills
- Place MERV 8 filters over exhaust air grills
- Place tacky mat at corridor entrance into the work area. Change tacky mat as needed so it remains effective at capturing dust and debris.
- Place tacky mat within work area at the exit to the adjacent corridor. Change tacky mat as needed so it remains effective at capturing dust and debris.
- Capture dust during drilling by placing the nozzle of a HEPA filtered vacuum at the drill point.
- Capture dust during cutting by placing the nozzle of a HEPA filtered vacuum at the cut point.
- Maintain a clean work area by vacuuming all affected surfaces with HEPA-filtered vacuums.
- Contain construction waste before transport in tightly covered containers. All trash carts shall be wiped clean (on all surfaces and wheels) prior to exiting the work area and again prior to re-entry into the hospital after dumping at the loading dock. This may necessitate placement of cleaning materials at the loading dock entrance.
- Cover transport receptacles or carts; tape covering down unless solid lid. All covers shall be clean and not stored on the floor when not in use; the covers shall be stored in a clean container or bag.
- Install all critical barriers, (i.e., sheetrock, plywood, plastic), to seal area from non-work area per attached infection control schematic.
- Install hard-wall barriers without anteroom.
- Install hard-wall barriers with anteroom.
- Install plastic wall barriers without anteroom.
- Install plastic wall barriers with anteroom.
- Install plastic sheeting above the ceiling up to the ceiling deck.
- Seal holes, pipes, conduits, and all other penetrations through containment barrier.
- Maintain negative air pressure within work site utilizing HEPA-equipped air filtration units.
- Discharge negative air to: _____ (write in discharge location)
- Place manometers with data logging or printing capabilities in each anteroom. Measure pressure differential between work areas identified in the infection control schematic. Program alarm set point at -0.01/-0.02/-0.03 inches water gage (circle selection).
- Do not begin construction work until barriers and other infection controls are inspected by the Infection Preventionist and an infection control permit is issued.
- When bunny suits, booties and hair bonnet/hat cover are required, all clothing should be stored off the floor inside the anteroom
- Bunny suits shall be worn by all subcontractors within work area while dusty tasks are being performed. These tasks include demolition and installation/sanding drywall.
- Anteroom shall be clean at all times.
- Workers are required to vacuum their clothes with a HEPA vacuum while in the anteroom and before exiting the work site
- Workers are to wear bunny suits, booties and hair bonnets/hat covers when exiting the work area.
- All personnel entering work site are required to wear shoe covers (booties). Shoe covers must be changed each time the worker exits the work area.
- Install new HVAC ductwork using clean duct protocols - cover all open ducts at the end of each shift.

When work is above ceiling and requires the use of an Environmental Containment Unit – Select all controls that apply (√)

- Access above ceiling using a containment cube that has been cleaned on all interior and exterior surfaces
- Depressurize the containment cube using a HEPA filtered negative air machine
- Prior to exiting the cube, thoroughly clean (vacuum and wipe with disinfectant) the cube interior and all materials and equipment within the cube
- All work personnel shall thoroughly vacuum clothing and shoes prior to exiting the containment cube. Hard hats and high visibility clothing shall also be clean.
- Workers are to wear bunny suits, booties and hat covers when exiting the containment cube
- Contain construction waste in tightly covered cleanable containers.

At the end of all construction select the appropriate activities that must be completed prior to patient/resident and staff occupancy (√)

- Coordinate construction turnover sequence with Epidemiology/Infection Preventionist/Industrial Hygienist
- Perform a construction area clean by wiping all work surfaces with disinfectant.
- Perform a construction area clean by wet mopping.
- Perform a construction area clean by vacuuming the floor, walls and other affected surfaces at the completion of work using a HEPA filtered vacuum.
- Coordinate an Environmental Services EVS terminal clean at the completion of the work.
- Coordinate an EVS triple-terminal clean at the completion of the work.
- Remove isolation of HVAC system in areas where work was performed.
- Perform test, balance and adjustment of the HVAC system as required by Facilities Management.
- Do not remove barriers from work area until completed project is inspected by the Infection Preventionist.
- Remove barrier materials carefully to minimize spreading of dirt and debris associated with construction.

INFECTION CONTROL DURING THE CONSTRUCTION PHASE - RENOVATION

- Prepare an ICRA and infection controls for the renovation area
- Prepare additional ICRA's and infection controls for construction activities outside of the renovation area
 - Above ceiling
 - Core drilling
 - Plumbing disruptions
 - HVAC disruptions

WHEN SHOULD AN ICRA PERMIT BE ISSUED FOR NEW CONSTRUCTION?

- Technically the organization does not “own” the building until the Temporary Certificate of Occupancy (TCO) is issued
- But the TCO is issued after the HVAC system is on and commissioning is nearly complete
- The IP should imbed themselves into *the progress towards TCO* long before TCO is issued!

INFECTION CONTROL FOR NEW CONSTRUCTION



Cleanliness of the HVAC system must be maintained

Clean Duct Protocols cannot be compromised

Walls, floors, ceilings, and equipment can be terminally cleaned

HVAC System – Heating, Ventilation, and Air-Conditioning system

AIR HANDLING UNIT AND HVAC START-UP SEQUENCE

Event	Notes
Heating Water System TAB ongoing or complete	
Construction clean the AHU/RTU – Preparation for Bump Start	Bump start – energizing motors to make sure motors and fan operating properly. All access doors are open – no air is pushed through the supply and return ducts.
Restricted/monitored access to AHU/RTU through Contractor key sign out process begins	For the purposes of controlling access to the RTU/AHU to better manage equipment damage, cleanliness and filter damage
Install low efficiency filter fabric on outside air intake louvers, Stage 1 MERV 7 filters in AHU/RTU and Stage 2 MERV 14 filters	These are temporary filters and will be replaced prior to final TAB
Install MERV 8 or 9 media filters at all Supply Air diffusers and ensure Mighty Blue securely attached to return air grills	
Final construction clean. Begin daily construction clean until begin EVS cleaning.	Major punch list complete. Minor non-dust producing punch items on-going following clean construction protocols.
Startup of unit to run in Supply Air only, 100% outside air, and 0% return	Required Space conditions: Walls: primer and 1 st coat paint applied. Floors: Floor preparation, sanding and installation complete. Ceiling: Above ceiling inspections and related repairs complete. Grid installed, nearly all ceiling tiles installed. All hard lid ceilings installed. Millwork: Installed. If conditions are not met, consult with Infection Preventionist/Industrial Hygienist for infection controls and approval to turn on supply air.
AHU/RTU Controls set-up/checkout; VAV (terminal box) programming	
In-duct humidifiers set-up/checkout	
Construction punch complete	
EVS post-construction (single) terminal clean of the area– BEGIN daily terminal clean in ORs and daily clean in remaining areas	Cleaning Frequency negotiable
Install AHU/RTU turnover filters stage 1 and 2	
Turn on Return Air at Unit	Space Conditions: Construction is complete. Ceiling tiles installed. Major punch list complete. Minor non-dust producing punch items on-going following clean construction protocols.
Return Air Controls Checkout	
Return Air TAB/Pressurization. Finalize Supply Air TAB/Pressurization.	
INSERT OR VENDOR ACTIVITIES	These vendors must follow clean construction protocols if occur after SA and RA air is on
INSERT OFOI ACTIVITIES	These vendors must follow clean construction protocols if occur after SA and RA air is on
EVS triple terminal clean in ORs	
Begin Redline Protocols in ORs	
Visual inspection by Infection Preventionist/Industrial Hygienist	
Air Quality Sampling	
Commissioning Process	

CLEAN CONSTRUCTION PROTOCOLS (CCP)

- Applicable to all locations where supply air, return air and exhaust air are turned on
- Purpose:
 - To maintain cleanliness of the ventilation system as per Clean Duct Protocols
- How?
 - Prepare infection controls that will protect the HVAC system
 - Present controls in a Clean Construction Protocol format

CLEAN DUCT PROTOCOLS - SMACNA

Ductwork leaving the premises of the manufacturer will include some or all of the following:

- internal and/or external self-adhesive labels or marking for part(s) identification
- exposed mastic sealant
- light zinc oxide coating on the metal surface
- a light coating of oil on machine formed ductwork
- minor protrusions into the airway of rivets screws, bolts and other jointing devices
- internal insulation and associated fasteners
- discoloration marks from plasma cutting process
- to maintain cleanliness during transportation, all ductwork shall be sealed either by blanking or capping duct ends, bagging small fittings, surface wrapping or shrink wrapping.

Site Storage

- A clean and dry environment where the ductwork is protected from dust, must be provided for the storage of ductwork prior to installation
- All ducts and HVAC components shall be stored off the floor
- All sealed ends shall be visually examined and if damaged resealed with an appropriate material

Installation

- The working area shall be clean, dry and the ductwork protected from dust.
- Protective coverings shall only be removed immediately before installation and inspected to determine if additional wipe down is necessary
- The internal surfaces of the uninsulated ductwork shall be wiped to remove excess dust immediately prior to installation
- Open ends on completed ductwork and overnight work-in-progress shall be sealed

CLEAN DUCT PROTOCOLS

SITE STORAGE



INSTALLATION



INFECTION CONTROL COMMISSIONING

Verification that newly renovated or constructed patient care areas meet infection prevention design criteria

- ✓ Visual inspections for surface cleanliness
- ✓ Air Exchange Rates (ACH)
- ✓ Pressure differential measurements
- ✓ Air quality monitoring
- ✓ Water quality monitoring

INFECTION CONTROL COMMISSIONING

- Rooms meet ACH design criteria
- Space meets design pressure relationships
- AHU and/or point of use filtration
 - Air-tight installation and no damage to filter media
- EVS Terminal cleaning efficiency
- Acceptable Water Quality and Air Quality

HUMIDIFICATION STEAM TUBES AT AHU

What is wrong?



THE CORRECTION

Cleaning

Install plates for proper slope and draining



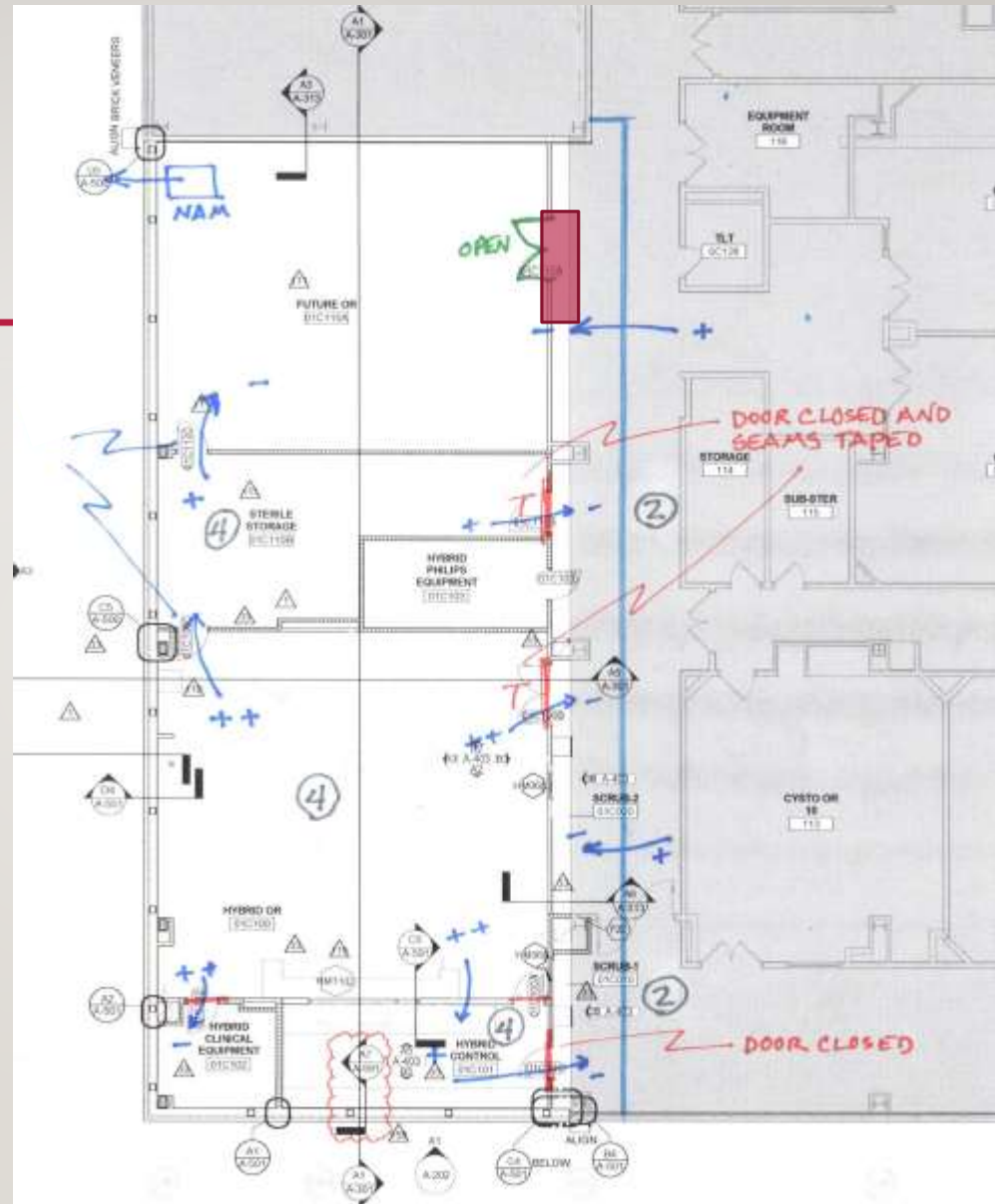
AIR SAMPLING – DECISIONS TO BE MADE BEFORE SAMPLE COLLECTION

- What is baseline? What is acceptance criteria?
- What is the sampling methodology?
- Where to sample?
- How many samples to collect?
- When to sample?
- How to interpret sample results
 - Compare to baseline?
 - Compare to another standard?



Air sampling strategy

- Determine acceptance criteria
- Prepare pressure relationships upon which samples will be collected
- Determine number of viable samples to collect
- Determine sample locations
- Determine when to collect samples



HOW TO ADDRESS SAMPLE RESULTS

ACCEPTABLE

- Communication
- Written documentation

UNACCEPTABLE

- Communication
 - Who
- Patient safety
- Investigation
- Corrective actions
- Repeat air sampling

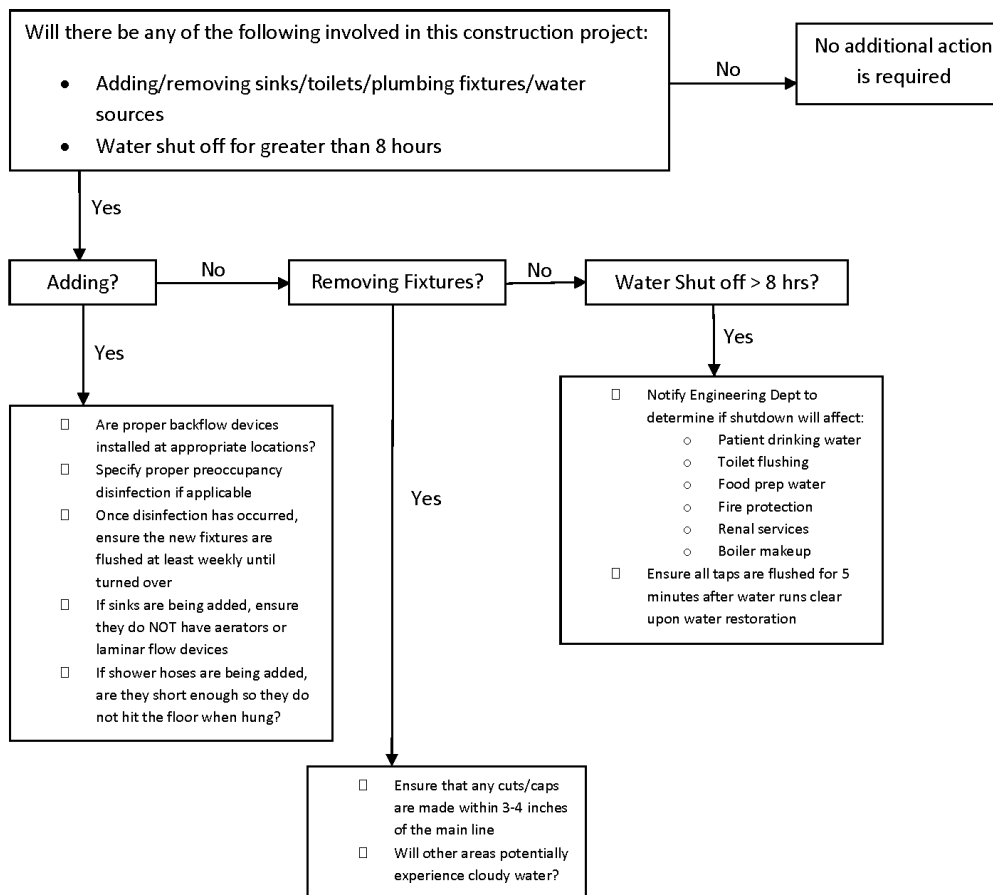
WATER SYSTEMS: NEW OR BACK ON-LINE AFTER RENOVATION

- Flush-Disinfect-Flush
 - Thermal eradication
 - Hyperchlorination
 - Copper-silver ionization
 - Point-of-use filters
 - Chlorine dioxide
- Water Sampling Analyses
 - Legionella
 - Heterotrophic plate count (HPC)
 - Fecal coliform / *E. coli*
- When to sample
- What sinks to sample

The need for water quality testing should be determined in the planning phase.

Timing of disinfection and water flushing must be discussed!

WATER INFECTION CONTROL RISK ASSESSMENT (WICRA)



Courtesy of Laura Riley, PhD,
CIH

LUNCH - SPOT IT



SPOT IT



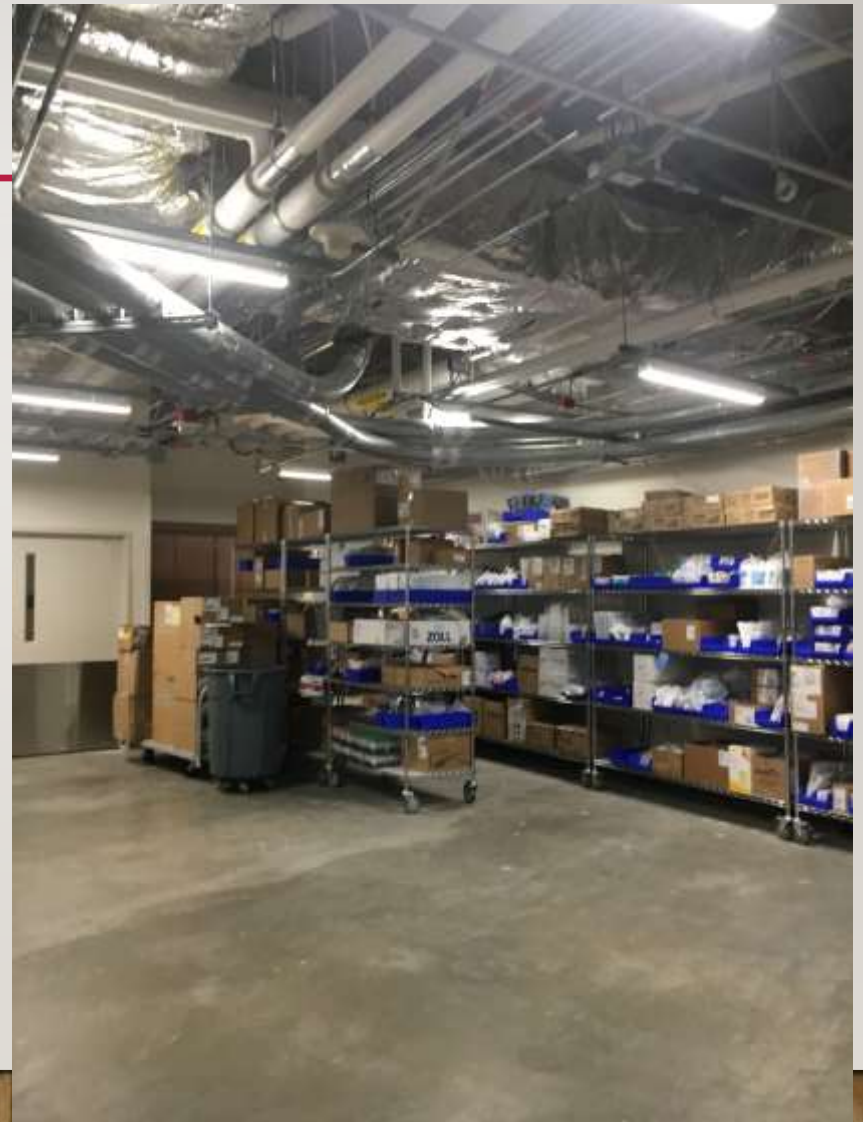
SPOT IT



SPOT IT



SPOT IT



TURN-OVER & OUTFITTING

- Construction Clean
 - Removal of all dust and debris from all surfaces
- Hospital Clean
 - Patient rooms meet discharge clean status
 - Support rooms, corridors, nurse stations, and public areas meet daily clean status
- Terminal Clean
 - OR suite, SPD, and critical care areas meet terminal clean status

HOW TO MAKE A RED-LINE AREA A REALITY

- Red-Line: a critical care area treated as if a patient is present
- Conditions:
 - Daily terminal clean
 - Clothing/PPE requirements implemented
 - Equipment entering space cleaned/disinfected
 - HVAC system operating per design specifications
 - Construction activities performed following ICRA controls
- Air sampling performed – deemed acceptable

RED-LINE AIR QUALITY

- Air quality is dependent on:
 - Air handling system design and filtration
 - Air handling system performance

As long as minor construction activities that happen after air sampling and redline status do not impact the HVAC system and those activities were performed following effective ICRA controls, then the air sampling results should represent air quality after completion of minor construction

TURNOVER – BUILDING READINESS

- Equipment and Building Readiness –
 - Filters (air and water)
 - Temperature monitors
 - Test, Adjust and Balance (TAB)
 - Building Automated Systems
 - Clinical Engineering
 - Security



OUTFITTING THE SPACE



How and when to stock the new space

- Supply management systems
 - Pyxis
 - Stocking and wrapping in warehouse
 - Nurse servers
 - Sensitive Equipment – MRI, CT, Linac
 - Cardboard – staging, unboxing, floor protection and HVAC protection

OUTFITTING THE SPACE



BREAK



POST-TEST: PLACE IN THE PROPER ORDER TURNOVER SEQUENCE FOR MEDIUM/LOW RISK AREAS STEP-BY-STEP PROCEDURE

Step	Description	Action By
	Daily water flush	GC
	Perform and complete a detailed construction clean – remove dust and debris from ALL surfaces	GC
	Infection Prevention inspection	IP
	Barriers are removed, negative air machines off, plastic over supply and return grills is removed.	GC
	All supply and return air grills are securely covered. HEPA filtered negative air is still depressurizing the work area.	GC
	Testing, adjusting and balancing can occur. ICRA needed for access above the ceiling.	MEP
	EVS performs a triple terminal clean	EVS
	EVS performs terminal clean.	EVS
	TAB and Commissioning complete	GC
	Plumbing tie-ins complete; plumbing disinfection performed	MEP
	Infection prevention inspection	IP
	TCO awarded	GC
	Daily water flush to the date of first patient occupancy	EVS
	EVS performs daily terminal clean each day to the date of first patient occupancy	EVS

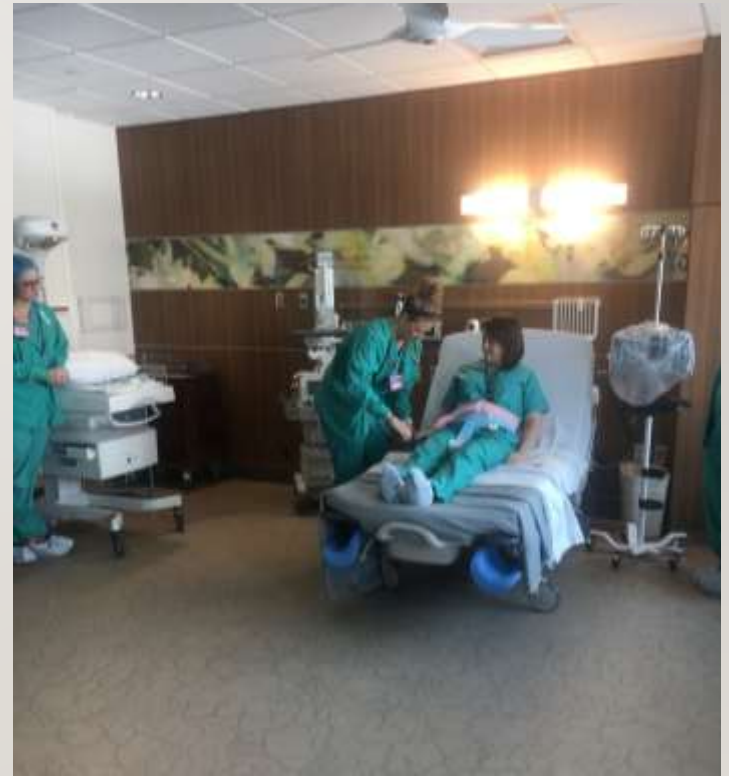
ANSWER KEY

TURNOVER SEQUENCE FOR MEDIUM/LOW RISK AREAS STEP-BY-STEP PROCEDURE

Step	Description	Action By
1	Plumbing tie-ins complete; plumbing disinfection performed	MEP
2	Daily water flush	GC
3	All supply and return air grills are securely covered. HEPA filtered negative air is still depressurizing the work area.	GC
4	Perform and complete a detailed construction clean – remove dust and debris from ALL surfaces	GC
5	Infection Prevention inspection	IP
6	EVS performs a triple terminal clean	EVS
7	Infection prevention inspection	IP
8	Barriers are removed, negative air machines off, plastic over supply and return grills is removed.	GC
9	EVS performs terminal clean.	EVS
10	Testing, adjusting and balancing can occur. ICRA needed for access above the ceiling.	MEP
11	EVS performs daily terminal clean each day to the date of first patient occupancy	EVS
12	TAB and Commissioning complete	GC
13	TCO awarded	GC
14	Daily water flush to the date of first patient occupancy	EVS

OWNERSHIP TIMELINE

- When do we take over?
 - Temporary Certificate of Occupancy- “TCO”
 - Punch Correction
 - Substantial Complete
 - Facility staff training and taking over building
 - BAS
 - Certificate of Occupancy- “CO”
 - Insurance
 - builders risk vs hospital claims
 - Warranty
 - Change Request



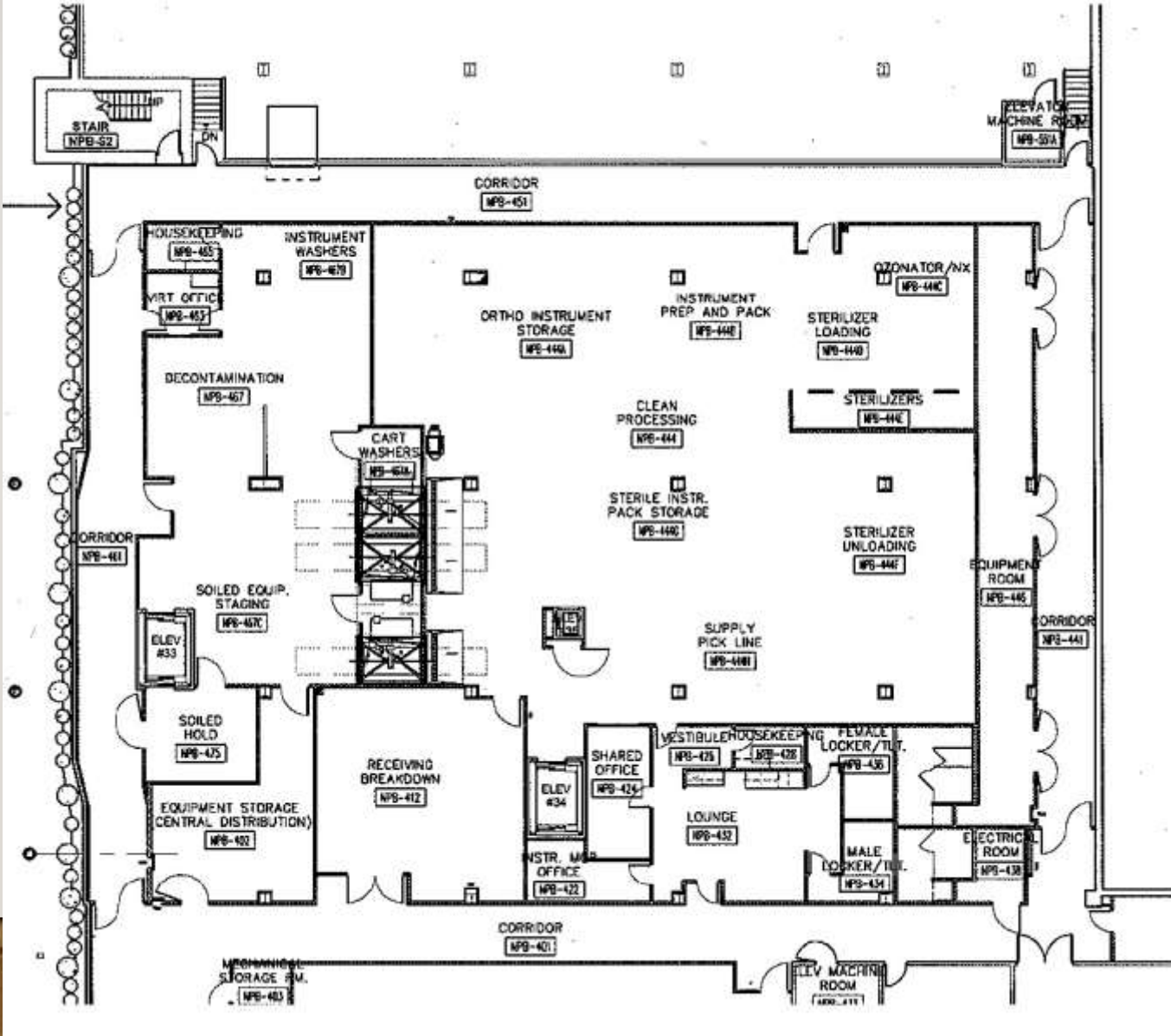
EVENTS HAPPEN.....

"The only
mistake in life
is the lesson
not learned"

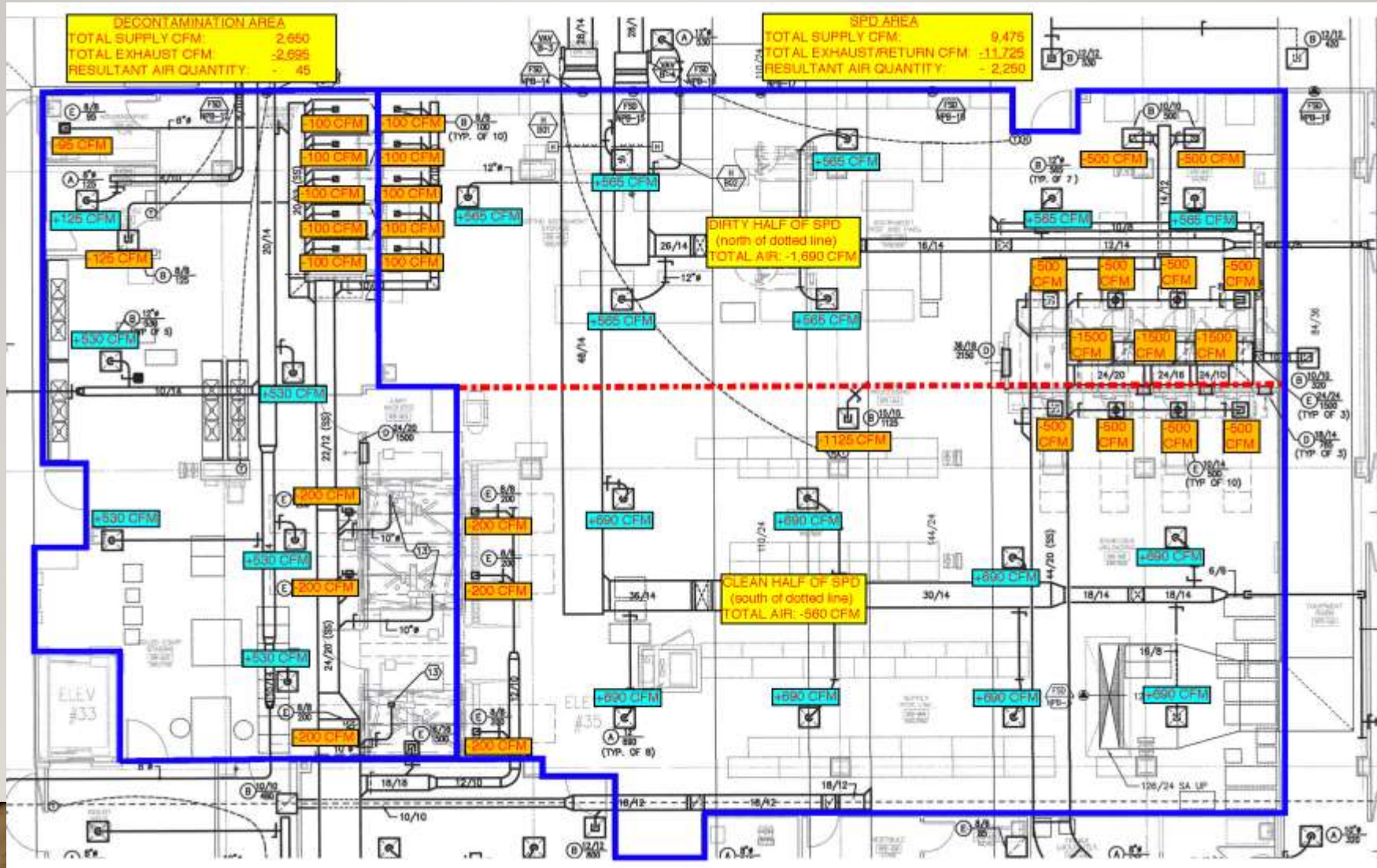


Albert Einstein

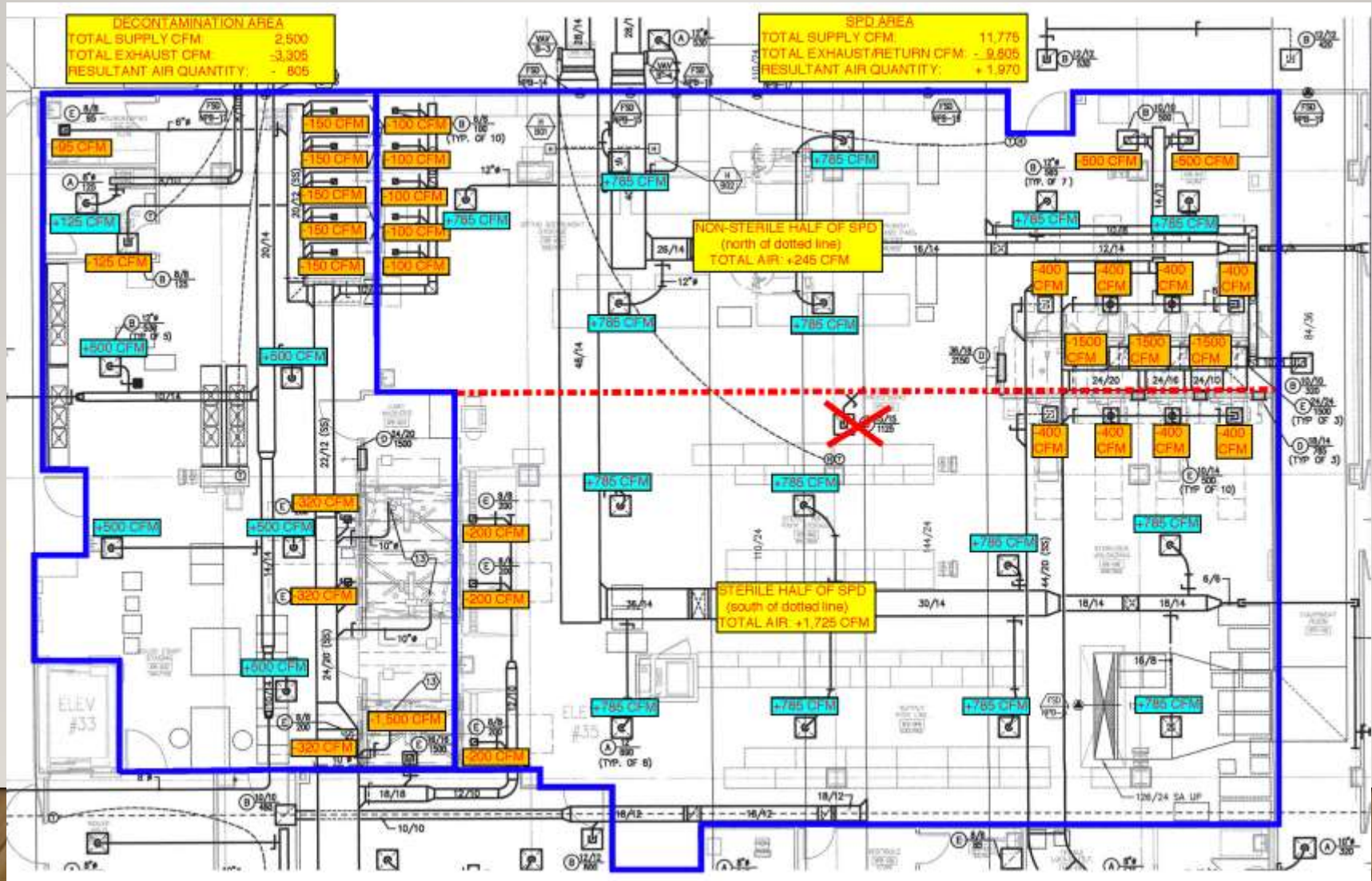
Infection Control Commissioning Discovers Engineering Design Error



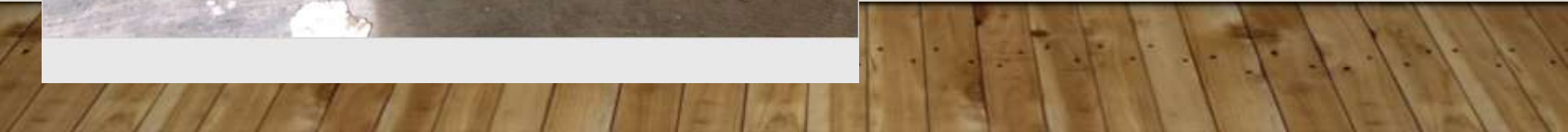
Installation per engineering design



Removal of exhaust from room corrected pressure issue



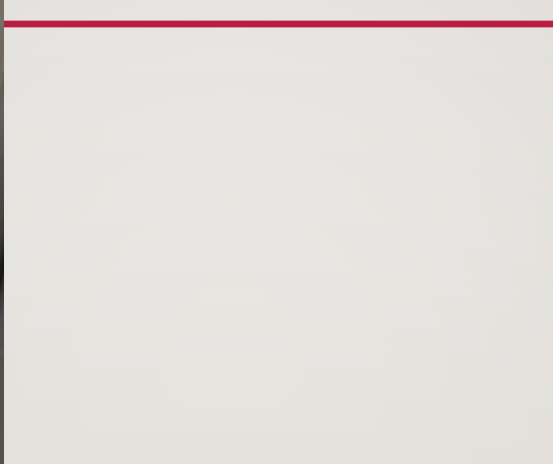
MOLD



WATER EVENT



USP 797/800 TESTING FAILURES



QUESTIONS?

