

Hospital Renovation
Andrew Streifel, University of Minnesota
A Webber Training Teleclass

Hospital Renovation

Infection Control Best Practice
Training & Experience



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Hosted by Dr. Lynne Schulster

www.webbertraining.com

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Objectives for Infection Control during Construction in Healthcare Facilities

- Respectful of patients
- Control aerosols
- Maintain a clean environment
- Prevent water damage
- Respond to emergencies
- Provide documentation
- Be trained & communicate

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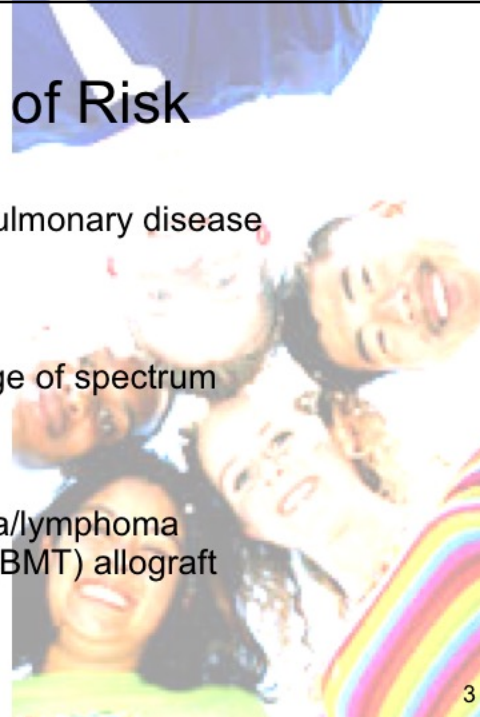
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Levels of Risk

Healthy person

- Chronic obstructive pulmonary disease
- Diabetes
- Steroids
- Cancer - solid tumor
- HIV infection-end stage of spectrum
- Organ transplant
 - Kidney/heart
 - Lung/liver
- Malignancy - leukemia/lymphoma
- Bone marrow transplant (BMT) allograft



What and Where Risk During Construction

AIR & WATER

- Patients
 - Immune suppressed
 - Convalescent areas
- Departments
 - Surgery
 - Radiation
 - Catheterization
 - Equipment cleaning
- Procedures
 - Bedside or specified areas
- Issues for Environmental Infection Control
 - Utility planning emergent and routine outages
 - Ventilation management during projects
 - Water quality assurance (opportunistic pathogens)

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Internal Construction

- Dust containment, removal and moisture control
 - Educate construction workers and staff
 - Prepare the site
 - Notify staff, visitors, patients re: precautions
 - Relocating patients and moving staff as needed
 - Monitoring for adherence to infection control
 - HVAC system maintenance; water system
 - Daily clean-up and removal of debris

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Barrier management

- solid versus plastic barriers
- short and long term (3 days)
- framed or taped barriers
- ceilings and door barriers
- smoke control barriers
- pressure differential management

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Barrier containment variation

Expectations:

- contains aerosol
- controls airflow clean to dirty

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The Joint Commission

Pre-Construction Risk Assessment

From The Joint Commission's Environment of Care Standards:

EC.02.06.05

2. When planning for demolition, construction or renovation, the hospital conducts a preconstruction risk assessment for air quality requirements, infection control, utility requirements, noise, vibration, and other hazards that affect care, treatment, and services.

Interim Life Safety

When the fire alarm system is impaired (i.e. construction zones), fire watch assignments will be made during working hours. Project Managers will verify availability of fire extinguishers in the work zone. These inspections are required to be documented daily.

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• **INFECTION CONTROL GENERAL OUTLINE NOTES**

- ALL BALANCING REPORTS WILL BE MADE AVAILABLE TO UMMC INFECTION CONTROL PERSONNEL ON REQUEST. SUBMIT THESE REPORTS DIRECTLY AFTER BEING REVIEWED BY THE ENGINEER OF RECORD.
- ALL CONTRACTORS AND SUBCONTRACTORS SHALL FOLLOW THE FUMC INFECTION CONTROL RISK ASSESSMENT (IRCA) AND AIA GUIDELINES THROUGHOUT THE CONSTRUCTION PROCESS. ALL CONTRACTED WORKERS MUST RECEIVE INFORMATION/TRAINING ON INFECTION CONTROL RISKS AND PRACTICES PRIOR TO STARTING ANY ON SITE WORK.
- ALL WORK OUTSIDE THE PROTECTED PROJECT BOUNDARIES ABOVE EXISTING CEILING SHALL BE COMPLETED WITH CEILING REPLACED IN THE SAME DAY UNLESS FULLY COORDINATED THROUGH INFECTION CONTROL.
- CEILING TILES WITH VISIBLE WATER DAMAGE SHALL BE SPRAYED TO DISINFECT AND ENCAPSULATE POTENTIAL MOLD PRIOR TO REMOVAL.
- CONTRACTOR TO INSTALL TEMPORARY BARRIERS FOR EACH PROJECT PHASE AND/OR AREA. THESE BARRIERS SHALL BE FULLY COORDINATED WITH UMMC AND IN MOST CASES CONTAIN SOME FORM OF AIRLOCK VESTIBULE PRIOR TO ENTERING THE CONSTRUCTION AREA.
- FLUTTER STRIPS OR AIR PRESSURE GAUGES SHALL BE PROVIDED AT THE ENTRANCES TO EACH CONSTRUCTION AREA. ALL CONTRACTED WORKERS SHALL BE TRAINED TO VISUALLY MONITOR THESE DEVICES FOR ADEQUATE NEGATIVE PRESSURIZATION AS THEY ENTER/EXIT THE CONSTRUCTION AREA. DAILY LOGS SHALL BE KEPT BY THE MECHANICAL CONTRACTOR TO INSURE CONSTANT PRESSURIZATION HAS BEEN MAINTAINED.
- PORTABLE HEPA FILTER UNIT SHALL BE UTILIZED WITHIN EACH CONSTRUCTION AREA. THESE UNITS WILL BE PROVIDED BY FAIRVIEW UNIVERSITY AND MAINTAINED BY THE MECHANICAL CONTRACTOR.
- NEGATIVE PRESSURIZATION SHALL BE MAINTAINED IN EACH CONSTRUCTION AREA. IF LOCATED ON AN EXTERIOR WALL, FANS SHOULD BE UTILIZED TO EXHAUST AIR DIRECTLY OUT A NEARBY WINDOW, TAKING PRECAUTIONS TO NOT INTERFERE WITH EXISTING BUILDING AIR INTAKES, PUBLIC AREAS, ETC. IF NO EXTERIOR WALL IS AVAILABLE THEN NEGATIVE AIR MACHINES WITH INTERNAL FILTRATION SHALL BE PROVIDED AND CONNECTION TO THE NEAREST EXHAUST OR RETURN DUCT AVAILABLE (CONTACT ENGINEER TO VERIFY EXISTING DUCTWORK CAPACITY PRIOR TO CONNECTION).
- COORDINATE DEBRIS REMOVAL WITH UMMC. IF AN ACCEPTABLE EXIT PATH IS NOT AVAILABLE FROM THE PROJECT SITE THEN AFTER HOURS REMOVAL OF DEMOLISHED MATERIAL WILL BE PERFORMED. COVER ALL CARTS WITH SEALED COVERS TO MAINTAIN DUST CONTROL.

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Construction Contractor Safety Orientation

1. Confidentiality and the Right to Privacy
2. Security
3. Fire Safety
4. Employee Right-to-Know: Radiation Safety
5. Safety on MRI Unit
6. Infection Control -- Part 1: Contractor's Role in Preventing Infections
 - a) Follow good personal health practices.
 - b) Within the past three weeks, have you been exposed to any of these diseases.
 - c) Do you currently have any of the following illnesses.
7. Infection Control -- Part 2: Preventing Infections During Construction
 - a) Immune Compromised Patients
 - b) Barrier Systems
 - c) Demolition
 - d) Ventilation
 - e) Traffic Control
 - f) Work Site Clothing
 - g) All Water Damage must be Dried Immediately

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Infection Control—Part 1: Your Personal Role in Preventing Infections

Practice to prevent the spread of infectious organisms (germs) is important for everyone. Germs are everywhere. Understanding how germs are spread and cause disease or infection is an essential part of infection control. This is best done using a concept called the **Chain of Infection**. If you think of disease transmission as a circle of chain links, it is easy to visualize how a germ travels from one link to the next. Breaking a link (stopping a germ) at any point in the chain prevents an infection.

Follow good personal health practices.

Cover your cough – Use a tissue or your arm to cover coughs and sneezes. Help stop the spread of infection.

••Wash your hands

All illnesses are hazardous to patients that have weakened immune systems

Your health could be important to our patients as well.

Within the past three weeks, have you had or been exposed to any of the following?

Chickenpox/Shingles, Measles, Mumps, Rubella / (German measles)

Whooping Cough / (Pertussis)

•Yes to any of the above disqualifies you from working in a patient care unit/area.

Do you currently have any of the following?

Cold or coughing, Sore throat, Fever, Rash or any abnormal itching body and/or scalp, skin sores, Pink eye, Strep throat, Herpes simplex/cold sores

•Yes to any of the above may limit your access to areas in the hospital.

Contact your Project Manager with questions.

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Infection Control—Part 2: Preventing Infections During Construction

Our patients are our primary concern. It is our expectation that no patient will become infected due to construction or renovation. We need your support in meeting this goal.

Most patients will not be at great risk of infection.

Those that are at risk include:

Patients who are in Intensive Care Units (ICUs)

Patients that have a poor to no immune system to fight infection such as cancer, organ transplant, bone marrow transplant

Patients on steroids or underweight like neonate infants are "at risk".

"At Risk" patients are located throughout the hospital, rehabilitation and clinic areas.

Almost all University patients meet the "at risk" definition

Many go to Riverside campus for additional care or therapy.

Dust and debris can carry fungus and molds into the air. It is not a big risk to the rest of us, however, these infections can be serious to life threatening for our "at risk" patients.

the "at risk" patient could breathe this in it could land on skin surfaces and enter through openings of the skin, like from surgery or burns.

Barrier Systems. Follow *Infection Control Risk Assessment (ICRA) developed for the project*. Solid wall barriers are required in areas where patients are located/traveling. Check barriers for leaks. Temporary barrier use: Must be approved by Infection Control: See: *ICRA*. Approved short term temporary barriers must be framed.

Controlled dust = controlled fungus and mold.

Ventilation. Must be maintained at all times from clean to dirty workspace (negative), this must be monitored. **A constant visual indicator must be present. Contractors will monitor at least daily.**

HEPA filtration When entering the ceiling in any patient care area for any reason, a HEPA filtration unit must be in place within 10-15 feet of the opening.

Traffic Control. Plan your exits and entrances. Keep carts covered, place walk-off mats where they are actually walked on, change daily or more often if they become loaded with soil. If exit is in patient/family elevators, plan to do during quiet hours. Look clean, be clean!

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HEPA filters

Whenever a ceiling tile is to be removed, in any area of the hospital, a HEPA filter will be used.

Number of HEPA filters

One HEPA filter can cover 20 square feet (about 4 large ceiling tiles). If two openings are needed at each end of the hallway, two HEPAs may be required.

Replace all ceiling tiles properly into the ceiling grid when work is completed.

ICRA (Infection Control Risk Assessment)

Areas in the hospital are grouped by risk category. We also evaluate the type of work you are doing and how it can impact our patients.

An ICRA is completed by the Infection Control Department following notification from a Fairview Facilities project manager. An ICRA is a careful evaluation of the project that takes into consideration the types of patients who could be potentially impacted or harmed. The UMMC Facilities Project Manager is required to distribute the ICRA to all vendors and UMMC partners working on the project. The ICRA is posted either at the construction entrance or in the immediate area. **Read the ICRA for your area to verify you are in compliance.**

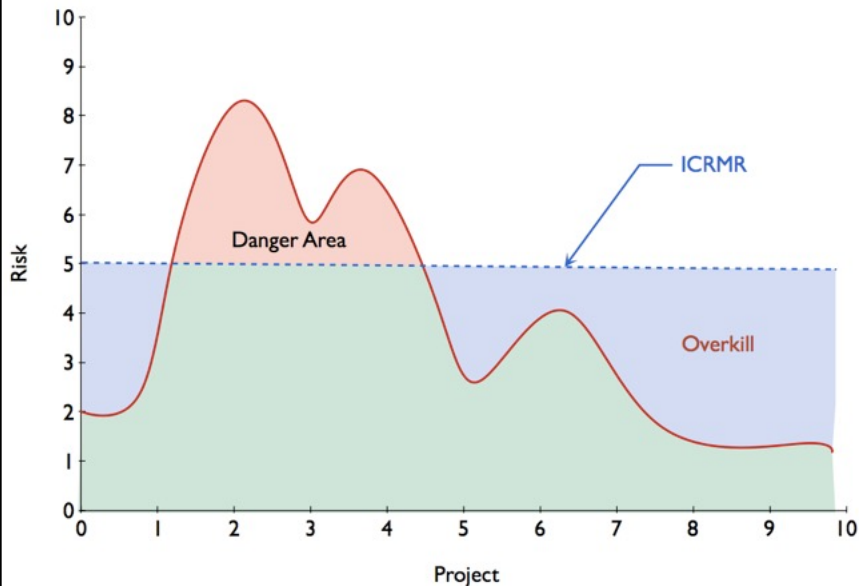
A safer environment is created when everyone is aware of recommendations and risks.

	Group 1 low risk: office area	Group 2 Medium risk, most patient care areas	Group 3 Medium-High Risk: Radiology, Birthplace, Peds, Kitchen, Labs	Group 4 High risk Transplant, OR, BMT, Oncology, cardiac, pharmacy
level 1 visual inspection, minor work	Be careful moving ceiling tiles and don't bring dust into occupied space	Be careful moving ceiling tiles and don't bring dust into occupied space	Be careful moving ceiling tiles and don't bring dust into occupied space	Be careful not to generate dust, use portable HEPA filter
level 2 small scale, short duration activities that generate minimal dust	Be careful moving ceiling tiles and don't bring dust into occupied space	Be careful not to generate dust, use portable HEPA filter	Be careful not to generate dust, use portable HEPA filter	Be careful not to generate dust, use portable HEPA filter
level 3 moderate scale, generates dust, often includes demolition	Complete ICRA, likely will require barriers and negative air pressure	Complete ICRA, likely will require barriers and negative air pressure	Complete ICRA, likely will require barriers and negative air pressure	Complete ICRA, likely will require barriers and negative air pressure
level 4 major projects	Complete ICRA, likely will require barriers and negative air pressure	Complete ICRA, likely will require barriers and negative air pressure	Complete ICRA, likely will require barriers and negative air pressure	Complete ICRA, likely will require barriers and negative air pressure

All Level 3 and 4 projects require an ICRA. All Group 3 and 4 Projects require an ICRA
Some Level 1 and 2 projects- in high-risk areas may require an ICRA, the project manager should be discussed with Infection Control. (e.g. – surgery, laboratory, NICU, BMT, CPC)

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Does Risk Vary during a Project



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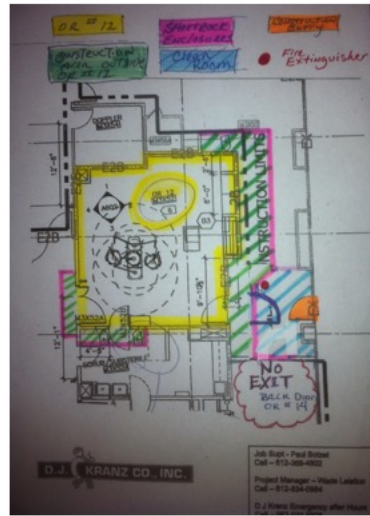
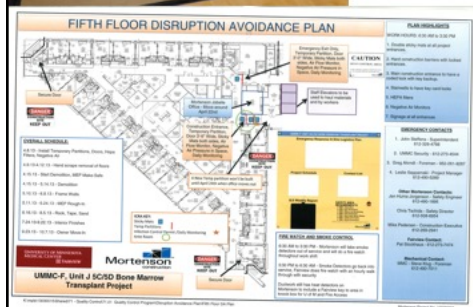
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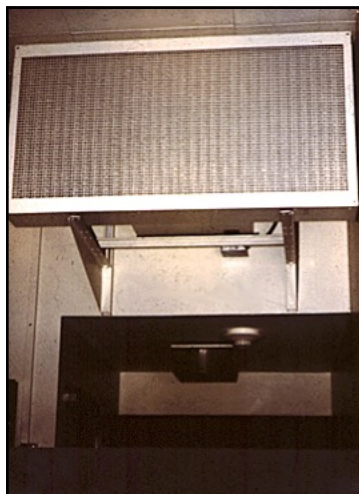


Disruption Avoidance through ICRA Mitigation Planning

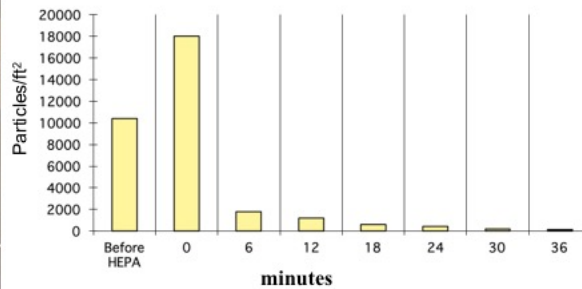
Knowing what to expect is key
 Example: repairing water damage begets mold
 Plan: be ready with mold training



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Portable HEPA Filter Particle Removal in 1200 ft³ Patient Room (600 cfm airflow with recirculation)



Portable HEPA filter
 -dilution ventilation
 -directional airflow
 -high volume (800cfm)
 -low velocity

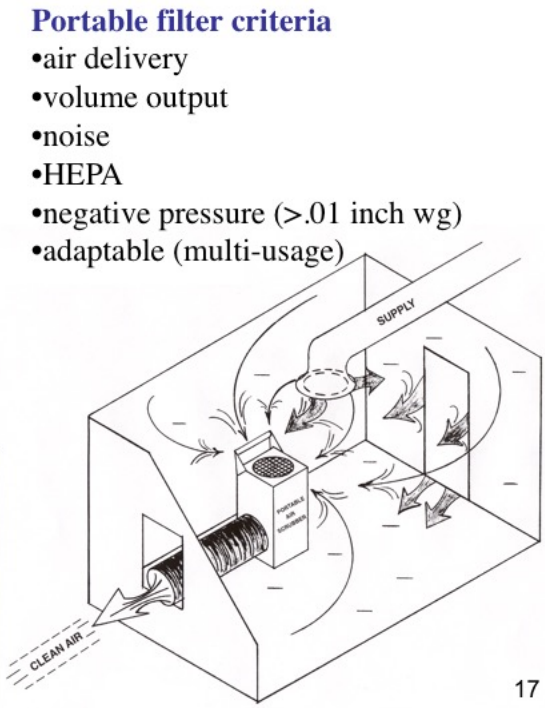
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Portable filter criteria

- air delivery
- volume output
- noise
- HEPA
- negative pressure (>.01 inch wg)
- adaptable (multi-usage)

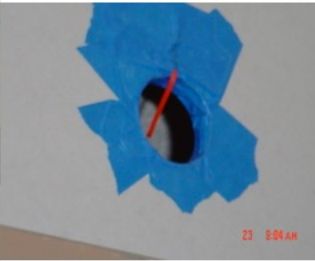


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Filter in barrier

- dilution vent
- depressurization



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Negative pressure machine

A good idea may not work if the window is not sealed.



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Barriers CM1- 101



GLOVE BOXES & FILTERED VACUUM



CONTAINMENT METHODS

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Environmental Management Training



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Training to mitigate hazards during construction in healthcare.



Training provides IC know how with methods to minimize exposure to construction aerosols. Consistent training for hospital staff and contractor rank and file workers essential.

Training needs constant updating to be relevant with the variation found in Healthcare construction.

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What do you do when you discover mold?



Hidden behind object that are not moved very often on the PCU

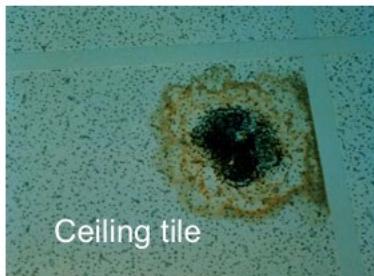


Dialysis cabinet in ICU



Pump with copper 8 quinolinolate 23

Mold Sources are Abundant!!



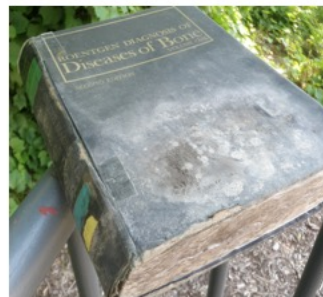
Ceiling tile



Sink removal in ICU



MRI table support



Moldy books after Radiology flood 24

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Simple airflow monitor device



Demonstrates correct & incorrect airflow.



Chart recorder

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Portable containment
on BMT unit




Portable side wall & Ante room unit

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Some small maintenance jobs can be a risk?



How do you do repairs on a drinking fountain?

Can you see accumulated dust?

Easy to set up barriers work.

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PORTABLE FILTERS CAN BE FUN?!?!

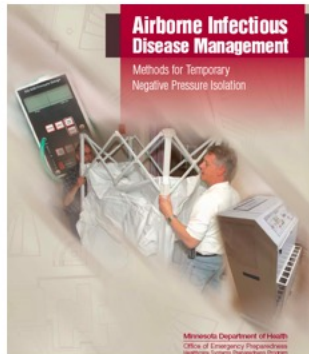


But they must be used properly and for the right reasons.

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Contaminated air must be removed from the building



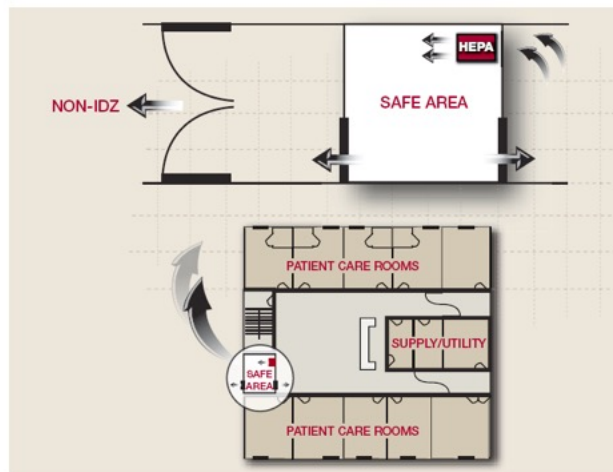
Specified areas within the healthcare facility can create an isolation zone if the contaminated air is relieved to the outside. This requires sophistication in the controls that will allow for other priorities to be maintained: fire mgmt, fresh air make-up, etc. But this process can be improvised to expedite the need for ventilation control

Airborne Infectious Disease Management
www.health.state.mn.us/communities/ep/surge/infectious/airbornenegative.pdf

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ISOLATION OF A SUITE OF ROOMS FOR AIRBORNE ISOLATION

Parts of hospitals are set aside for construction or infectious patients when needed.



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Criteria for Portable Filter Certification

- Policies and Procedures for usage
 - discharge of air modes
 - outside, inside adjacent & recirculate in room
- portable filters should be routinely evaluated
 - volume output should be determined
 - $Q=VA$
 - leak check for filter
 - 16 locations over output area
 - criteria for filter change
 - pressure differential or volume of filter output
 - maintenance
 - storage, pre filter change & cleaning



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Miniforce II HEPA Air Filtration System

Inspection, Cleaning, and Maintenance Procedure for the UMCHF Project

The Miniforce II HEPA Air Filtration System is a unit dedicated to hospital working environments only. The care, inspection, cleaning, and maintenance is integral to the function of this equipment.
**Please refer to the following pages for the manufacturer's owner's manual.

Inspection:

A visual inspection of the negative air machine (NAM) will be conducted prior to each use and prior to transportation entering and exiting the hospital environment.

Visual inspection will verify:

- Appearance/external cleanliness of NAM is appropriate to enter and exit the hospital environment.
- Primary filter is clean, in order to limit dust exposure to the hospital environment.
- All other external components are clean, in order to limit dust exposure to the hospital environment.

Cleaning:

The NAM will be cleaned prior to transportation entering and exiting the hospital environment. All external components will be cleaned prior to transportation.

Cleaning within the hospital environment:

- NAMs will only be cleaned within the temporary enclosure.
- NAMs and filters will be cleaned with HEPA Vacuums.
- NAMs will be cleaned with a non-bleach disinfectant agent (UMCHF encourages us to use their disinfectants).

Maintenance:

NAM maintenance will occur outside the hospital environment, within a temporary enclosure of the hospital environment, or a designated maintenance area approved by the hospital.

Filter Replacement:

- When filters are clean, the pressure gauge will indicate about 1" WC of vacuum. When the vacuum gauge reaches about 1.5" WC with a clean pre filter, the HEPA filter will need to be replaced.
- Due to differing work environments, the need to clean and/or change the pre filter and HEPA filter will be determined by the foreman and/or employees involved with the operation.

Filter Disposal:

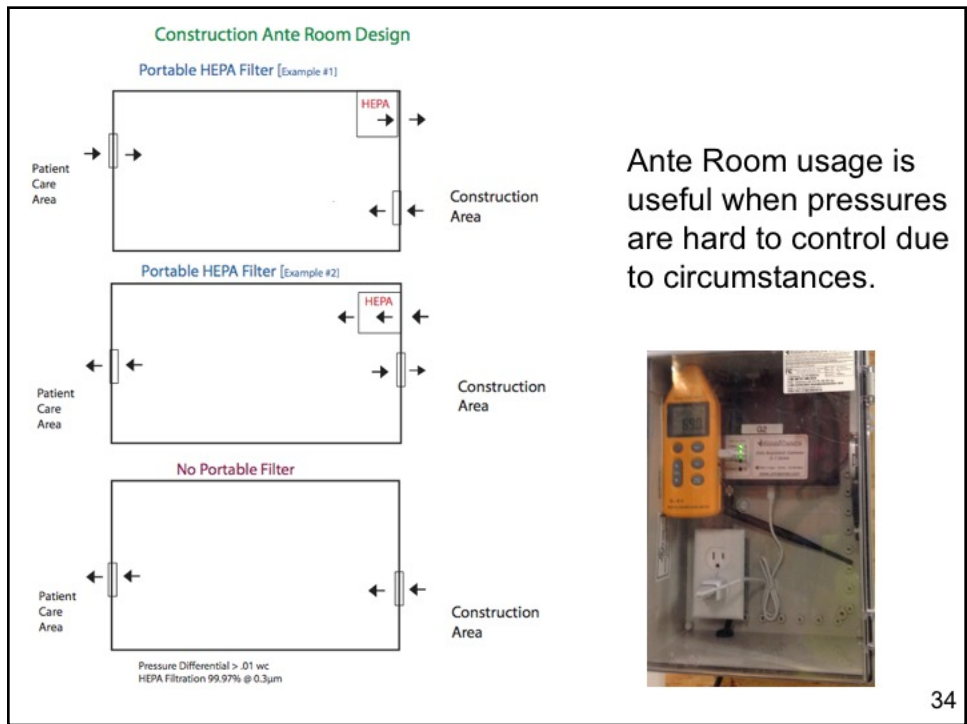
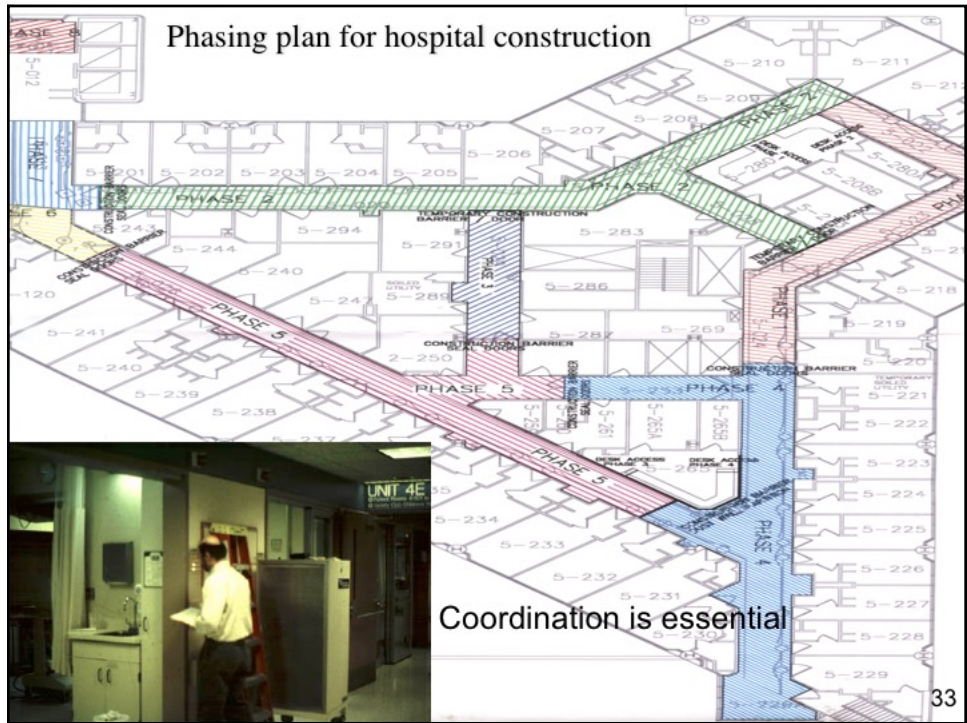
- All used filters will be contained in a sealed bag and removed from the hospital facility.

This procedure is paid for by as part of the project for the mechanical contractor to properly maintain the portable filters during the interface of a tie in project.

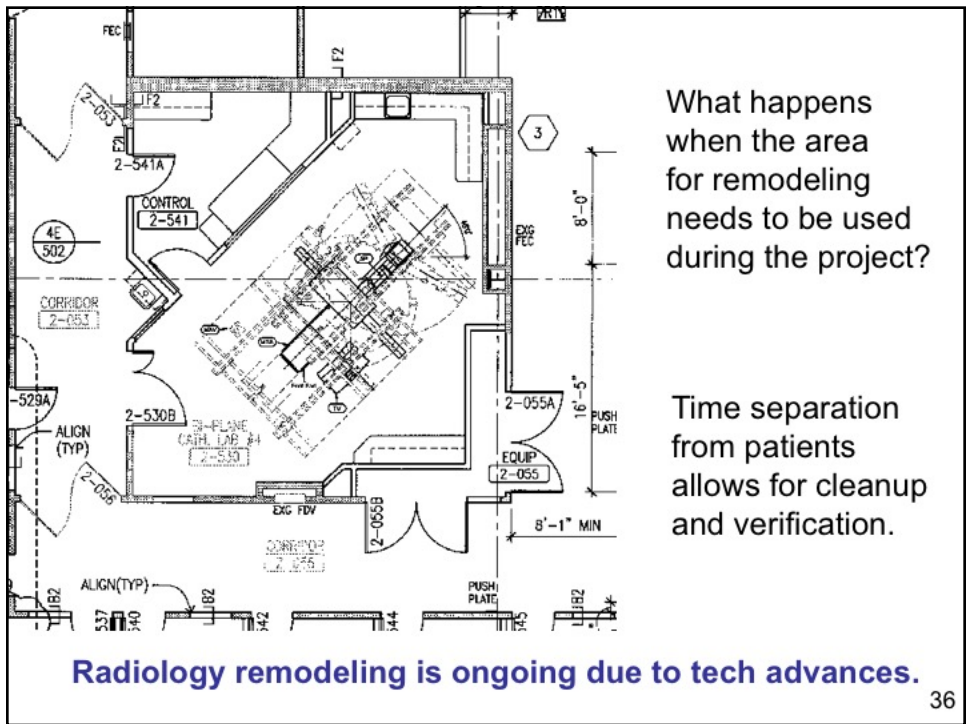


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NRC SAYS WE CANNOT MOVE TREATMENT

AIR QUALITY VERIFICATION

PORTABLE FILTERS WORK

Construction & Patient care
 -when the situation is difficult you need to find a solution
 -the risk assessment must determine the risk based on the situation
 -such problems can be solved

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What method is best for exhausting air from a construction zone.

The ducted exhaust advantages
 *control

The direct exhaust advantages
 *no duct loses

Disadvantages
 No one is paying attention!

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Exhaust systems need to reinforce flex duct to avoid pressure issues



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Have you seen this before?

- air handler door propped open
- what does this do to the air supply?
- what might this indicate as a problem?

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At this stage of construction it is not a good time to
Start seeing fungal infections in patients!

Preconstruction risk assessment

- identify high risk areas
- determine existing conditions
 - window seal
 - filtration efficacy
 - air exchange rate
 - pressure relationships
- entrance to hospital
- building pressure
- pedestrian pathways
- ID architectural structure leaks
- road cleaning protocol
- emergency response



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Building tie-ins can
be problematic

- noise & vibration
- relocate patients
- air infiltration
- barrier management

Solutions for issues

- fan outage during penetration
- worker access control
- airflow control
- communication



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Storage of Debris and Building Material a Challenge



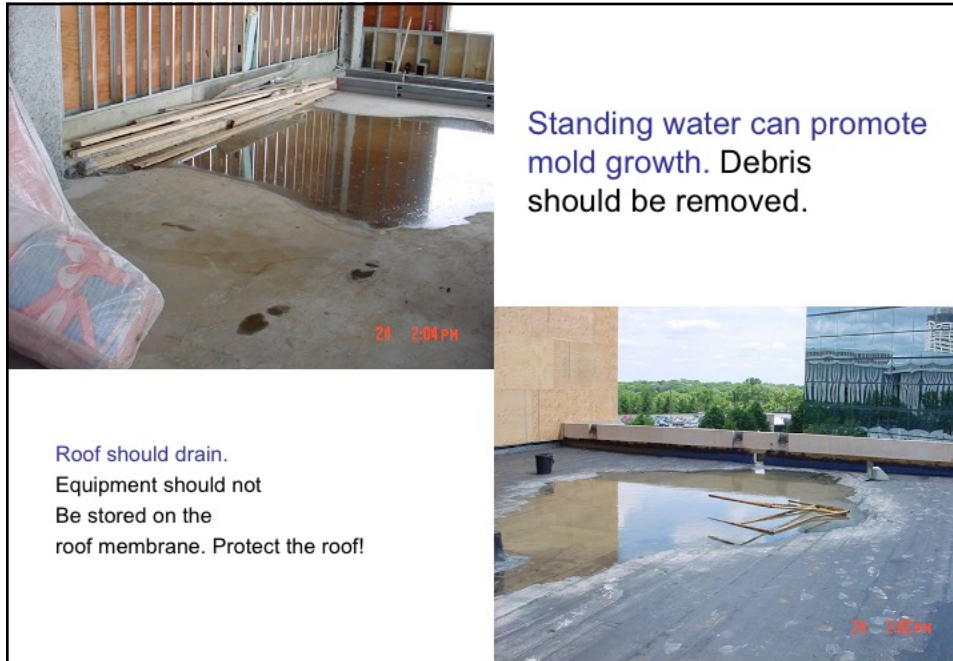
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- Sensitive areas**
- above BMT unit
 - beside OR
 - noise and vibration
 - communication

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Standing water can promote mold growth. Debris should be removed.

Roof should drain.
Equipment should not be stored on the roof membrane. Protect the roof!

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Control Airborne-Projects

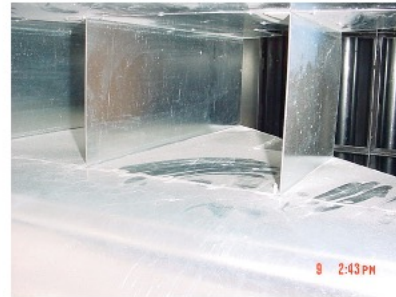
- Pressure management
 - Barrier airflow control
 - > 0.01"WC(>2.5 Pascals)
 - Ideal 0.02-0.03"WC (btwn 5 - 8 Pascals)
- Transport
 - Personnel and materials
 - Track dirt
- Water damage protocols
 - Water resistant materials
 - Early detection
- Training
 - Supervisors and workers
 - Area tenants



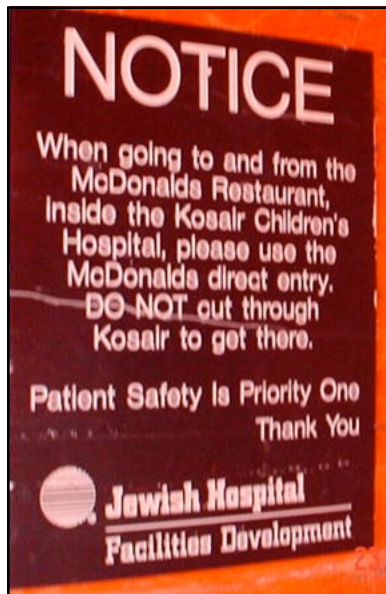
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Specify Duct Cleanliness

- Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)
 - *Duct Cleanliness for New Construction Guidelines* (2000) www.smacna.org
 - A. Basic Level
 - B. Intermediate Level
 - C. Advanced Level
- Specify in contract



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SIGNAGE IS ESSENTIAL

- inform construction workers
- inform building occupants
 - utility outages
 - noise
 - other
- location
 - public spaces
 - email blast
 - elevators
- sign boards for info sharing



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Best practice includes

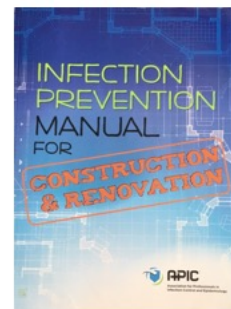
- cleaning site
- protecting critical equip
- well trained supervisors
- exhaust reliability



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Value Engineering During Construction

- What process do you have for VE
 - Who approves the decision
 - Is infection control involved where appropriate
- What VE proposals are not acceptable and must be discussed
 - Water proofing
 - Warranty issues
 - Ventilation compromise
 - Surfaces
- Regular Safety Meeting Attendance
 - Place holder for Infection Control in the Notification section
- IP involvement from project concept forward
- Training for the role of the IP during construction
 - Familiarity with FGI Guidelines planning design and construction



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Healthcare Construction: Case Studies in Medical Facilities

Ventilation Outage Planning

- Planned maintenance outages
 - critical areas - time limits
 - combining tasks for efficiency
 - patient protection
- Emergency Outages
 - backup motors, fan belts, bearings, etc.
 - redundant systems in critical areas
 - portable filtration contingencies

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Floods happen for many reasons.



Broken pipe in CSP



Expansion joint leak



Building junction

Floods with water damage require immediate or measured response.



Or you may get this!!



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Being Prepared for Floods in Prudent Best Practice



Tools assembled for quick response



Transport gurney plus vacuum
And extension cords in waiting

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**What happens when a sprinkler fails at midnight
one week before occupancy?**



Serious flooding is a problem
So can we prepare for the potential?



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IC CONSIDERATION EXAMPLES

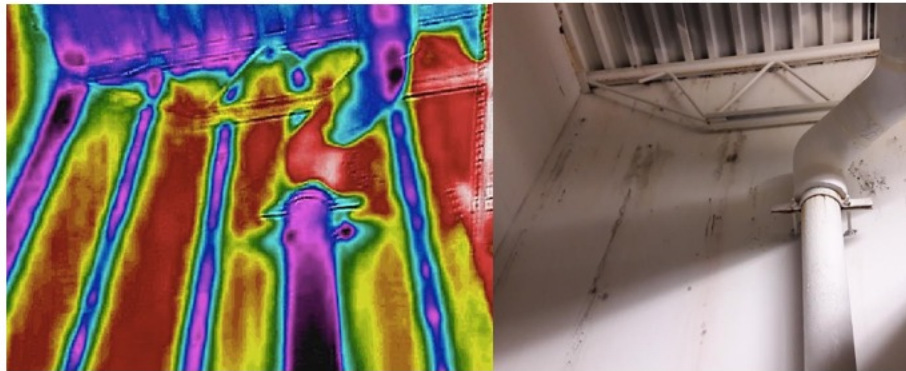
Moisture detectors are useful decision makers for water detection & drying

Keep moisture content <20% & <90%RH
Maintain air movement
Remove moisture physically
or by evaporation



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Infrared camera reveals source of mold



Evaporative cooling shows up on colored display.

Real time analysis shows the extent of water damage

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Mold Concerns



Leaky sink

MOLD SOURCES ARE
COMMON

Aerosol management
during mitigation is necessary



Leaks plastic laminate lack of caulk



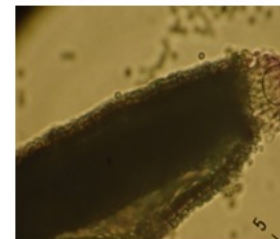
Pressure release valve stuck open with rust 59

Common Air Sample Method



Sticky slide impaction

Real time analysis of spore
Morphology. Genus only ID



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Air sample interpretation (problem)

- Indoor/Outdoor ratio >1 (Precipitation not present)
- Indoor problem area different from indoor control
- Indoor organisms are not similar to outdoor organisms
- Aggressive samples have higher counts than passive samples.

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Surface sampling strategy

- Indoor problem
- Indoor control
- Plate control

Looking for:

- Suspected poor maintenance
- Area with previous water damage

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Surface sampling methods

- Rodac contact plate (viable)
- Swab plate (viable)
- Tease tape (non-viable)
- Vacuum method (viable)

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Objectives for Infection Control during Construction in Healthcare Facilities

- Respectful of patients
- Control aerosols
- Maintain a clean environment
- Prevent water damage
- Respond to emergencies
- Provide documentation
- Be trained & communicate

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Andrew Streifel, University of Minnesota
A Webber Training Teleclass

Construction ... Never Ending Process



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May 3, 2019	<p><i>(FREE ... WHO Teleclass - Europe ... Special Lecture for 5 May)</i> <u>CLEAN CARE FOR ALL - IT'S IN YOUR HANDS</u> Speaker: Prof. Didier Pittet and Prof. Benedetta Allegranzi, World Health Organization, Geneva Sponsored by the World Health Organization Infection Control Global Unit</p>
May 16, 2019	<p><u>IMMIGRANT AND REFUGEE POPULATIONS: A PUBLIC HEALTH AND POLICY PERSPECTIVE ON A CONTINUING GLOBAL CRISIS</u> Speaker: Prof. Sotirios Tsiodras, National and Kapodistrian University of Athens, Greece</p>
May 27, 2019	<p><i>(FREE Teleclass – Broadcast live from the IPAC Canada conference)</i> <u>To be announced</u> Speaker: To be confirmed</p>
May 29, 2019	<p><i>(FREE Teleclass – Broadcast live from the IPAC Canada conference)</i> <u>ONE HEALTH: THE RISKS AND REWARDS OF LOVING ANIMALS</u> Speaker: Prof. Jason Stull, Ohio State University Broadcast sponsored by GOJO Canada</p>
	<p><i>(South Pacific Teleclass)</i></p>

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