

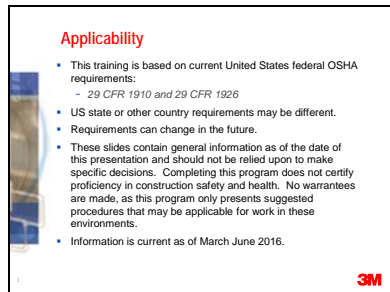
Slide 1



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Health Care - 2014

- The health care situation:
 - Long-term continued shift to outpatient care
 - Aging of the population
- Affordable Care Act uncertainty:
 - Less mega projects, more upgrades and additions
 - New projects slow to start but renovations appear less affected by ACA
- Projected 6% increase in health care facility construction in 2014 to \$44 billion

*Source:
• FTM Forecast for 2014 in the Q3-2013 Construction Outlook Report Online
• Cooper, D. "Market Reset: Construction projects, no longer afraid of Obamacare implementation." Health Facilities Management 30(2) 14-20 (2013)
• Construction Issues in Health Care - A. Stahl/AFCA 2004



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Renovations in Health Care Facilities


- Bid preparations
- Pre-work preparations
- Work suggestions
- Post-work suggestions



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Bid Preparation

- Medical centers have high community profile. They typically will look for:
 - Management commitment to safety
 - Proof of insurance – WC, GL, Fleet
 - OSHA 300
 - Competent, trained safety staff
- Safety programs:
 - Lockout/Tagout
 - PRCS
 - Hot Work
 - Haz Com
 - Fall Protection
 - Bloodborne Pathogens




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Bid Preparation

- Sophisticated facilities may check that bid has the money to do what you say you'll do (e.g. 100% tie off at 6')
- Infection control - one estimate:
 - 0.5% of project cost
 - \$10 mil project = \$50,000
- Realize some tasks may take significantly longer due to infection control procedures

Source: 3M




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Pre-Work Preparation

- Confirm that **facility** has decommissioned area and its safe to enter:
 - Chemicals – removed
 - Radioactive materials – confirm with RSO
 - Sharps - removed
 - ACM, PCB, lead – ask for any audit reports
 - Ventilation – off and sealed from occupied areas
 - Gas lines - shut off – fuel and medical

Source: Corbett et al. Medical Facility Renovations— Safety and Health Considerations for Construction Safety Professionals. Professional Safety June 2001




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Pre-Work Preparation

Examples of Chemicals:

- Central Supply
 - ETO
 - Mercury
 - Gluteraldehyde
- Labs:
 - Xylene
 - Toluene
 - Formaldehyde
 - Acrylamide
- Pharmacy – drugs



Source: OSHA Hospital #108
https://www.osha.gov/OS-TC/controls/health/safety/health/safety/health.html



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Pre-Work Preparation

- Power sources:
 - De-energized
 - Consider electrically isolating work
- Communications – radios, cell phones
- Waste pipes – locate and mark




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Life Safety Code Compliance

- NFPA 101 compliance critical to the facility:
 - Feds require it for Medicare payment
 - The Joint Commission requires it for accreditation
 - Health care maybe second only to nuclear plants in oversight
 - Requirements for egress, fire protection, sprinkler systems, alarms, emergency lighting, smoke barriers, and special hazard protection
- Develop interim plan with facility




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Pre-Work Preparation

- Increased hazard surveillance
- No smoking policy
- Housekeeping and storage
- Safety education – staff and workers




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Pre-Work Preparation

- Infection Control Committee – suggested members:
 - Start at design phase and go to commissioning
 - Nursing Staff
 - Environmental
 - Physicians
 - Physical Plant
 - Infection Control
 - Architect
 - Contractor – PM; Safety


Source: Garvey et al. "Medical Facility Renovation – Safety and Health Considerations for Construction Safety Professionals" Professional Safety June 2001



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Pre-Work Preparation


- Infection Committee should consider:
 - Extent/duration of the project
 - Location of project
 - Impact on mechanical systems
 - Areas still in use
 - Chemical and physical contamination
 - Vertical as well as horizontal locations
 - Communications – staff, patients, visitors
 - Exterior dirt work – keep facility (+) pressure to outside
 - End of project – commissioning requirements
- Patient population
- Microbial contamination



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High Risk Patients



- Because of increased outpatient treatment – those hospitalized tend to be more serious cases:
 - Immunosuppressed (AIDS, cancer, transplant)
 - Age (neonatal and infirm)
 - Dialysis – renal failure
 - Mechanical ventilation
 - Heart failure
 - Surgery
 - Burns



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Infectious Agents



- Fungi:
 - Most common source of infection
 - Aspergillus is predominant
- Bacteria:
 - Legionella
 - Mycobacterium



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Aspergillus



- Common in soil, water, vegetation
- Early signs of Aspergillosis are nonspecific:
 - Cough
 - Ill feeling
 - Fever
- Can be fatal to immunosuppressed patient
- Prevention is critical



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Legionella

- Found in cooling towers, water heaters, showers, hot water lines
- Contamination of water system when:
 - Repressurization of water line
 - Contaminated soil in lines
 - Soil/dust contaminates cooling towers
- Prevention is the key




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Pre-Work Preparation

- Non-patient - Critical – sterile - equipment and supplies
- Protect from construction dust. Don't transport through construction zone


Source: Construction Related Infection Control: Hospital as a Patient in Health Care Facilities, Health Canada 2011



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Pre-Work Preparation


- Environmental monitoring – discuss this in advance:
 - Possible options:
 - Air: Aspergillus
 - Water: Legionella
 - Surrogates –total particulate
 - Pressure gauges
 - Moisture meters
 - Pre, during, and post construction samples
 - Define in advance what is acceptable
- Guidelines for Environmental Infection Control in Health Care Facilities – DHHS (CDC) for air monitoring recommendations.
www.cdc.gov/nceh/ehp/infection/guide.htm



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Pre-Work Preparation



- Mechanical systems:
 - HVAC – air flows, filters in place, pressure differential
 - Plumbing - shutoffs, re-pressure
 - Electrical – isolation
 - Elevator service
- Shrink wrap HVAC ductwork, med gas lines, plumbing lines or delay delivery until ready for use
- Do your subs, subs, sub contractors know what they are doing?



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Pre-Work Preparation



- Traffic routes – Avoid patient areas
- "Remote" construction locations:
 - Plumbing valves or electrical junction boxes
 - Above ceiling work permit? (e.g. Dangling wires, fire protection, no leaving candy wrappers up there)
 - Mini-enclosures with HEPA
- Worker facilities – smoking, washroom, lunch
- Open windows, air vents, doors, electrical, gas, lighting, and plumbing penetrations must be sealed
- Debris removal – night? Covered containers or debris chutes



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Pre-Work Preparation



- Scheduling of "problem" activities:
 - Noise
 - Dust
 - Vibration – neonates may be particularly sensitive
 - Odor
- Forewarn facility staff:
 - Temporary ventilation – portable HEPA units, exhaust to exterior
 - Patients restrictions or removal for work in occupied areas
 - Safety Data Sheets
 - When will it come and when will it go
 - Communication is critical



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Pre-Work Preparations

- Action plans for:
 - "mystery" chemicals or fluids
 - Fire
 - Radiation
 - Reporting accidents
 - Emergency assistance
 - Water damage
- Who has authority to shut project down if safety is compromised?
- Who has authority to re-start project?




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Infection Control Risk Assessment (ICRA)

Extent of work

- **Type A** - Inspection and non-invasive activities
 - No dust generation - remove ceiling tile, trim work
- **Type B** - Small scale
 - Minimal dust; 1-2 rooms for 30 mins
 - Cut hole in wall, repair services
- **Type C** - Moderate activity
 - High levels of dust; Demolition several rooms, over 1 shift
 - Remove floor, new wall construction, sanding
- **Type D** - Major demolition activity – this includes buildings adjacent to occupied areas

Source: Construction Related Nosocomial Infections in Patients in Health Care Facilities, Health Canada 2001
American Society for Health Care Engineering
http://www.asha.org/ashacpe/engr/assessment/ICRAassessment_1019.pdf




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Infection Control Risk Assessment (ICRA)

Location of work

- **Group 1** - Low risk – office, public areas
- **Group 2** - Medium – Admissions, most out patient
- **Group 3** - Medium/High – ER, Labor, Labs, Peds, Minor surgery
- **Group 4** - Highest – ICU, OR, Dialysis, Transplant, Oncology


Source: Construction Related Nosocomial Infections in Patients in Health Care Facilities, Health Canada 2001
American Society for Health Care Engineering
http://www.asha.org/ashacpe/engr/assessment/ICRAassessment_1019.pdf



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During Work


- **Construction worker qualifications:**
 - Communicable diseases
 - Worker education – including infection control
 - Vaccinations
 - Tetanus – yes
 - Others consult with physician on need
 - Baseline testing – TB?
- **Site Security:**
 - Staff awareness of work zones
 - Access routes - identify and secure - positive barriers
 - Unauthorized entry reporting procedures
 - Patient signalers



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During work – HVAC and Plenums


- Entry into inactive plenum may be more risk to patient than workers:
 - Air pressure differentials - new flow patterns may endanger patients
 - Co-ordinate with Infection Control Committee and Facility Engineering
 - Vents/dampers closed and sealed
 - Proper pressurization of patient area and work area
 - HEPA filters maintained if needed
- Entry into active plenums – avoid:
 - Chemical, biological, PRCS
 - Ask facility about any past experience entering plenums



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During Work - Plumbing


- Schedule interruptions during low activity
- Flush lines prior to reuse - possible superheating or hyperchlorination
- Temperature standards established
- Look for discolored water, water leaks, mold



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During work - Dust



- Seal off all portals for dust:
 - Windows
 - Doors
 - Vents
 - Plumbing penetrations
 - Electrical outlets
 - Gas portals
 - Lighting/ceiling penetrations



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During work - Dust



- Dust barriers:
 - 6 mil poly or drywall
 - Must go slab to slab
 - Not removed until area is clean and inspected
 - Walk off mats or shoe covers
 - Misting may be necessary
- Co-ordinate with Environmental for extra cleaning of adjacent areas



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During work - Dust



- Near high risk areas:
 - Worker coveralls left in work area or HEPA vac.
 - Shoe covers left in work area
 - Negative air pressure in work area
 - High risk patients removed from area
 - Portable HEPA units in patient areas
 - Flutter strips to show air flow. Easy to see, easy to interpret



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During work – Pipes and Water Damage


- Demolishing walls and floors:
 - Undocumented pipes and drains
 - Mold (fungal) infestation – kitchens, showers, roofs. STOP and get ICC involved



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During work - Sharps


- Exposure to sharps - May be the most common hazard.
- Proper decommissioning should minimize risk.
- Check where they may accumulate:
 - Elevator shafts
 - Dumb waiters
 - Floor openings



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During Work – Exterior Work


- Air filters in place and tight
- May need to shut down air intakes temporarily
- Windows closed and sealed (plastic and duct tape)



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Post Construction Work


- Cleaning and disinfecting prior to occupancy:
 - Allow dust to settle prior to cleaning
 - Regular areas – TSP
 - High risk areas – copper-8-quinolinolate – discuss with facility how they want to do it
 - HEPA vacuum
 - Flush water lines and disinfect
- Infection Control Committee inspects prior to admitting patients.



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Post Construction Work


- HVAC system test and balance:
 - Cleaning and commissioning criteria – ANSI/ASHRAE 111- Measurement, Testing, Adjusting, and Balancing of Building HVAC Systems
 - Air filters efficiency – MERV 14 is typical.
 - Third party certification?



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Other Sources of Information

- American Institute of Architects – Guidelines for Design and Construction of Hospital Health Care Facilities
- Association for Professionals in Infection Control – State of the Art Report... The Role of Infection Control During Construction in Health Care Facilities
- OSHA – Framework for a Comprehensive Health and Safety Program in the Hospital Environment
- NFPA 241 – Standard for Safe Guarding Construction, Alteration and Demolition Operations
- Health Canada - Construction Related Nosocomial Infections in Patients in Health Care Facilities
- National Air Duct Cleaners Association - ACR, The NADCA Standard for Assessment, Cleaning & Restoration of HVAC Systems
- CDC - Guidelines for Environmental Infection Control in Health Care Facilities




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Magnitude of the Problem

- Approximately 20,000 U.S. WWTPs handle roughly 50 trillion gals. of raw sewage daily
- Sewage collection and treatment facilities average age 33 years, with some parts over 100 years
- Between 3 and 9 billion gals. of raw sewage into waterways annually
- Without substantial increase in investment by 2025 US waterways will have sewage load as high as 1968

Source: US EPA Report to Congress Impact and Control of CSO and SSO – 2004
http://ocw. epl.gov/epaleader/quality_report0304.dlm




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State of Minnesota

- More than 1200 projects and \$4.5 billion will be needed to improve public wastewater systems in next 20 years.


Source: Drinking Water and Wastewater Infrastructure Needs in MN
U of MN Water Resource Center - 2011



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Focus on Biohazards


- Most contractors aware of obvious hazards:
 - Combustible gas
 - Oxygen deficiency
 - Hydrogen sulfide
- Be aware of other potential chemical exposures:
 - Ozone – gas to disinfect water prior to release
 - Chlorine – gas to disinfect water prior to release
 - Chlorine dioxide
 - Ultra violet light
 - Heavy metals – in sludge
 - Upstream facilities discharge



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Wastewater Biology

- Composition will vary with:
 - Geographic location
 - Time (weekly and seasonal)
 - Location within the WWTP
- Typically:
 - Fresh – Grey, Septic - Black
 - Fresh – “earthy” smell. Septic - Rotten eggs
 - 10-20° C (50-70° F)
 - pH between 6 and 9




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Wastewater Biology

- Ingestion - Hand to mouth is primary route of exposure:
 - Eating Drinking
 - Smoking Wiping face
- Inhalation - less common.
 - Highest where water is agitated
 - Incoming water inlets
 - Sludge treatment areas
- Skin – unlikely unless previously damaged (e.g. burns, cuts, punctures). Eyes and nose may be portals.

Source: Sanchez-Monedero et al., "Effect of Aerosolized Suspensions on the Levels of Bacteria Microorganisms Generated in WWTP", Water Research 42 (2008)




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Disease Studies

- Studies did *not* show a higher *infection* rate (i.e. diagnosed disease)
- Studies did show increased risk of *symptoms* associated with infection (e.g. headache, G.I. tract upset, dizziness)
- Studies show subclinical infection indicators (elevated antibody titers)
- Many workers experiencing symptoms were new on the job

Source: McCurney, R.J. "Health Effects of Work at Waste Water Treatment Plants: A Review of the Literature", American Journal of Industrial Medicine 9 (1986)

Abbottson, M.A. et al. "Work Related Health Effects Among WWTP Workers", International J. of Occ. and Environmental Health 2 (2015)




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Disease Studies

- Study of 500 WWTP workers:
 - New employees (less than 2 years experience) – higher rate of G.I. symptoms
 - Symptoms mild and transitory
- Study of 150 WWTP - no reported cases of:
 - Polio Salmonellosis
 - Leptospirosis Shigellosis
 - Typhoid fever Hepatitis A
 - Giardiasis Amoebiasis

Source: McCurney, R.J. "Health Effects of Work at Waste Water Treatment Plants: A Review of the Literature", American Journal of Industrial Medicine 9 (1986)


Source: Khuder, et al. "Prevalence of Infectious Diseases and Associated Symptoms in Wastewater Treatment Facilities", American Journal of Industrial Medicine 33 (1998)



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HBV, HCV and HIV

- No cases linked to sewage exposure:
 - Would be diluted in sewage
 - Not transmitted by oral-fecal route or inhalation
 - Blood to blood contact
- Risk of contracting either disease from wastewater appears to be small




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HAV, HEV and *Helicobacter pylori*

- HAV:
 - Stable at room temperature for up to 3 months
 - Studies indicate no increased risk or slight increased risk of HAV
 - (+) Anti-HAV associated with shellfish consumption and age
- HEV and *Helicobacter*:
 - No clear increase in risk to workers
 - Unlikely to be cause of GI symptoms

Source:
• Giam C, et al. "Hepatitis A in Wastewater: Evidence for Sewage as a Potential Source". *Env. Health Perspect* 58 (2001)
• Havelaar A, et al. "Prevalence of Hepatitis A Virus in Shellfish from Sewage Polluted Areas in Georgia". *American Journal of Industrial Medicine* 2002
• Montaut P, et al. "Wastewater Workers and Anti-HAV". *Occupational and Environmental Medicine* 59 (2002)




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Methicillin-Resistant *Staphylococcus aureus* (MRSA)

- Water samples from 4 WWTP in Midwest and Mid-Atlantic:
 - 50% of incoming samples had MRSA
 - Declined as treatment progressed
 - 8% after full treatment
 - 0% after chlorination


Source: Rasmberg-Gibson et al. "MRSA Detected by Four US WWTP". *Environmental Perspectives* 2010



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Suggested Precautions


- Assume all surfaces are contaminated
- Disinfect surfaces where practical
- Avoid direct contact with sewage (remote viewing?)
- Avoid aerosolizing sewage:
 - Ensure any ventilation system is active
 - Minimize time around sedimentation basin inflow, sludge treatment



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Suggested Precautions


- Wash hands and face prior to eating, drinking, smoking and at end of shift:
 - This may be the most important safeguard to take
 - 15-20 seconds for washing – soap and warm water
- Keep hands out of eyes, nose, mouth
- Keep finger nails short
- Shower daily
- Food consumption only in designated areas
- Adequate first aid supplies – treat and report all cuts/punctures immediately



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Suggested Precautions

- Worker training:
 - Diseases
 - Entry routes into body
 - High risk areas
 - Personal hygiene
 - Need for immediate medical attention for cuts/punctures
 - Proper use of PPE per manufacturers user instructions




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PPE

- Use liquid proof gloves, boots, eye/face protection in direct contact areas:
 - One study showed relationship between facemask use and decreases presence of HAV antibody*
- Wash PPE with soap and hot (160° F) water
- Puncture proof gloves in cut prone areas
- Gloves especially if hands are chapped or cut

*Source: Blotnik et al. "Prevalence of Antibody to Hepatitis A Virus in Drinking Water Workers and Wastewater Workers in Texas From 1988 to 1992" Journal of Occupational Medicine 2002

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PPE - Respirators

- Respirators usually not necessary:
 - Dusty sludge or heavy aerosol areas
 - Always follow manufacturers user instructions
- Respirator particle filters effective against microbes. Filter does not distinguish between alive or dead particles
- Implementation of a respirator program per 29 CFR 1910.134 and following manufacturer user instructions is critical for effective use of respirators

Source: Centers for Disease Control "Prevention of Hepatitis A Through Active or Passive Immunization" 2006

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Vaccinations

- Currently no US federal OSHA vaccination requirements for construction workers.
- CDC recommendations:
 - Recommended – Tetanus-diphtheria
 - HBV, HAV – not recommended at this time but no reason not to.
- Foreign-born workers – don't assume same vaccination history as native-born citizen.

Source: Centers for Disease Control "Prevention of Hepatitis A Through Active or Passive Immunization" 2006


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Infection Investigation

- Is suspect microbe present or likely to be present in wastewater environment in significant amounts?
 - Wastewater is aggressive environment
 - Most bacteria are gram negative – positive would be odd
 - pH, temperature, competition from other organisms
- Has microbe actually been identified in person? What tests were used? Were symptoms consistent with microbe?
- Was there an exposure opportunity?
- Was there an opportunity for the microbe to enter the body (e.g. puncture wound)?



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Finally

A good public speaker:

- Stands up to be seen
- Speaks up to be heard
- Shuts up to be appreciated
