



# CONSTRUCTION DESIGN GUIDELINES FOR WORKING WITHIN AND/OR NEAR OCCUPIED BUILDINGS

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## I. GENERAL PRINCIPLES

### A. BACKGROUND

Campus construction projects impact many people in diverse ways. The people affected include students, visitors, faculty and staff, nearby community neighbors, the City and the State of North Carolina. Once a construction project is underway, Environment, Health and Safety is primarily concerned with potential soil and water contamination in and around the site and the health and safety risks for personnel outside the construction zone. The health and safety activities and practices within the construction area are the sole responsibility of the contractor until they affect personnel outside.

The architects are responsible for anticipating and planning for the EHS aspects of the construction project. They incorporate these controls as part of the construction documents with special notes and specification requirements. However, not every contingency has been anticipated and addressed. Consequently, any unspecified activities, which could result in environment, health or safety impacts outside the construction area, must be communicated to and through the Construction Manager. The EHS Department is available for consultation on these issues.

Any imminent threats or occurrences that impact the environment (spills, leaks, releases to the soil, stream, storm system, or sewer) or the health or safety of personnel outside of the construction area must be communicated immediately to EHS (962-5507). If someone is not available, a phone message directs the caller to an alternate number, 24 hours per day. It is expected that the Contractor will take quick action to address the problem. However, the EHS Office needs to be notified quickly when these situations arise to ensure University resources are brought to bear when appropriate.

In summary: In an emergency, take prudent action immediately and call EHS (962-5507).

#### *1. General Requirements for Contractors on all construction projects (critical issue recap):*

- a) Establish a list of building representative contacts for buildings that will be impacted by the construction project
- b) Keep the fire lanes, hydrants and fire department connections clear at all times. (Should be specified on the drawings)
- c) Provide and maintain directional signs around construction fences, barricades and at blocked exits.
- d) Maintain pedestrian walkway protection near the project.(From overhead falling objects, projectiles and construction material which may protrude through the fence)
- e) Maintain erosion control devices. Dust, mud and silt are not to escape from the site during a rainstorm. The Contractor must inspect the run-off at the beginning and during a storm event to ensure compliance. Corrective action must be put in place immediately when a deficiency is discovered.
- f) Provide covered chemical secondary containment and spill response equipment.
- g) Protect streams, storm drains, sanitary sewer-no chemicals, dirt or construction chemicals or debris.
- h) Exposures to:

##### *i. Noise:*

equipment placement, mufflers, other noise control techniques such as constructing enclosures

##### *ii. Dust:*

ensure dust control techniques are used routinely including wet drilling/cutting of masonry materials, wet cleaning methods

##### *iii. Fumes:*



locate welding/cutting, heated tar pots etc. away from building air intakes

- iv. *Engine exhausts- Turn off vehicles, or equipment when not in use. Idling creates a great deal of pollution. Keep IC engines away from air intakes.*
- v. *Lay down areas must occur in designated areas only to prevent pedestrian slips, trips and falls and to keep fire lanes open.*
- vi. *Maintain MSD sheets on site for rapid access in the event of an emergency.*
- vii. *Repair vehicle and equipment leaks immediately to prevent fuel, coolants, and oils (hydraulics and gear box) spills.*
- viii. *"Maintain access and clearance for service vehicles, including trash and recycling collection vehicles."*

## 2. *Protecting Adjacent Building*

Protect building air intakes from vehicle and construction equipment exhaust. Consider feasibility of the following:

- a) Blocking potentially contaminated intakes and provide building makeup air from other clean air intakes (may not be possible to maintain any building balance.)
- b) Filter intake air for dust and exhaust
- c) Provide physical barriers to restrict traffic and deflect exhaust
- d) Use low emission equipment-electrically powered in most circumstances
- e) Position portable IC generators/compressors away from building intakes.
- f) Locate hot tar units away from windows, doors air intakes
- g) (7) Keep road and drive accesses clear at all times as per the construction drawings. Fire lanes must never be blocked.
- h) (8) Disruption of utility services must be coordinated in advance with building representatives with contingencies provided for fire alarms, security and critical equipment operations.

## 3. *Protection in Occupied Building under Construction*

Wherever possible, occupants will be moved out of the buildings during renovation projects. Construction in an occupied building requires more planning and the development of contingency plans to deal with construction inconveniences as well as health and safety risks. When buildings must be occupied during construction, the architect is responsible for incorporating the occupancy mitigation features into the design specifications for the construction project. After construction begins, unforeseen, issues must be resolved between the architect, construction manager and the general contractor. These issues and their resolution are to be added to the construction logbook. It is expected that occupant concerns will be addressed rapidly (within 24 hours preferably but no longer than 1 week).

### a) Communication

#### i. *Issue:*

Once construction begins, occupants feel that they their work environment is out of their control. They are subject to risks and inconveniences that occur often without warning for an undetermined amount of time. Preplanned weekly meetings should forewarn occupants of what to expect as well as allow them to provide feedback and suggestions on how to improve their work environment.

#### ii. *Controls:*

- 1. Identify the primary and secondary building contact person for contractors and occupants
- 2. Weekly meetings with the building occupants lead by the building liaison with the construction manager in attendance.
- 3. Record minutes for the meeting



4. Minutes should indicate what the construction plans are for the coming week and any changes to building access and services.
5. Minutes should reflect employee concerns and resolution completed
6. Copies of the minutes should be sent to EHS for review. (vii) Any unresolved issues after 1 week need to be raised to Ed Willis

b) Life/Fire Safety

i. *Issue:*

During construction, exits may be blocked for days or months at a time. Nevertheless, in an emergency, occupants must have access to emergency evacuation routes so they can safely leave the building in the event of a fire or other emergency. Also, when electrical systems are shut off, the fire alarm systems may be lost. Similarly, when plumbing lines are disconnected, the sprinkler system may be disabled as well. If the fire alarm system requires re-programming to accommodate extensive renovations to an occupied facility or major additions to an occupied facility, that constitutes a 10% or greater change to the system database, the fire alarm vendor and/or contractor will assume all and full responsibility and liability of the entire system. Upon completion of the project a 100% inspection by the Owner will be scheduled and performed. Assumption of responsibility and liability for the system will return to the Owner after the system inspection items have been satisfactorily addressed.

ii. *Controls:*

1. Maintaining life safety features
2. Means of egress
3. Alternate means of egress
4. Clear directional signs to alternate exits
5. Sprinklers/Fire alarm systems/fire watch provisions
6. Additional fire extinguishers where required (vii) Emergency communication method

c) Interior Building Separation of Construction Traffic/Work Areas:

Construction traffic carrying demolition debris and new construction materials (pipes, studs, wire etc.) could injure the occupants of a building due to lack of protective equipment or lack of awareness of construction hazards.

i. *Controls: Physical Barriers*

1. Each project phase shall have designated on the drawings
2. Temporary wall locations and sound insulation requirements- sealed air tight
3. Locations to seal off wall and floor penetrations to be dust tight
4. Designated construction worker travel paths in the building separate from occupants
5. Designated building occupant paths with barriers at the construction zone.
6. Areas around floor and walls to be penetrated to be blocked with barricades to keep occupants out when the penetrations are made.
7. All floor penetrations to be covered with steel plate, fixed in place to prevent objects from falling through to the floors below.
8. Which occupied areas must be secured and vacated before wiring, pipes and conduit are run overhead through walls or ceilings.
9. Which occupied areas are below unprotected openings in the ceiling which must be vacated and barricaded to prevent falling objects from the construction area hitting occupants. Physical barriers are to be inspected and repaired and repaired at least daily.

d) Warning and Directional Signs



Warning and directional signs shall be specified in the construction documents to indicate the paths of safe egress through the building. The architects will specify the appropriate number and location of these exit paths for the entire construction project according to building code requirements. Signs must comply with OSHA standards. The contractor must maintain these signs at all times throughout the project.

e) Indoor Air Quality

i. *Issues:*

1. Every construction project generates dust and odors at various points throughout the project that may include:
2. Masonry dust (cutting, jack hammering, blasting)
3. Sheet rock and spackle dust – sanding
4. Solvents- adhesives, caulks, finishes, sealants, resins
5. Metal fumes/dust (welding and cutting)
6. Fungi (mold and mildew) (vii) Asphalt fumes

ii. *Controls:*

1. Block and seal off any ductwork shared with occupied areas.
2. Protect all active building air intakes from external contaminants (dust, exhaust, chemicals etc.)
3. Maintain a continuous negative air pressure in the construction zone
4. Use of exhaust fans (include filters for dust)
5. Pressurize the occupied areas with excess clean outside air
6. Demonstrate negative pressure in the construction zone with smoke tests at low and high openings (watch for thermal gradients) or through the use of a pressure differential meter.
7. Use wet methods for masonry cutting
8. Use wet methods or HEPA vacuum for cleaning (no compressed air or dry sweeping)
9. Stop work if exposures exceed specified limits outside of the construction area (see the monitoring section).
10. Use low or no VOC content in paints, adhesives and finishes
11. Avoid the use of isocyanates and urea formaldehyde resin containing materials.
12. Perform certain tasks when the building is unoccupied including extremely loud activity, overhead crane work etc.
13. Use covered chutes to drop materials from upper levels to the ground
14. Use of propane heaters or IC engine powered equipment shall not be used in the building without multiple CO monitors within and outside of the construction zone.
15. Facilities services must check HVAC filters more frequently to avoid plugging with dust and debris.

f) Noise

i. *Issue:*

Noise levels within an office environment directly affect one's ability to use the telephone. The average sound levels for the speech frequencies (500, 1000, 2000 and 4000 Hz) constitute the speech interference level (SIL). SILs greater 80 make telephone use impossible. SILs down to 60 make phone conversation difficult. Below 60, telephone conversation is acceptable.

ii. *Controls:*

1. Restrict high noise operations to unoccupied periods.
2. Provide suitable mufflers for air operated tools and engine powered equipment
3. Provide acoustical enclosures for noisy fixed equipment
4. Prefab building components outside or offsite.



5. Incorporate sound insulation in construction barriers

g) Maintenance of Building Mechanical Systems

*i. Issues:*

The building occupants need access to restroom facilities, and the regular utilities. Disruption of these services can be a hardship particularly for individuals with significant personal health issues or disabilities.

*ii. Controls:*

The architect will provide alternate plans in the specifications to address scheduled disruptions in the following services:

1. HVAC
2. Plumbing
3. Electrical/lighting
4. Telephone
5. Data lines

h) Inclement Weather

*i. Issues:*

Roof work and the creation of openings in the building envelope can result in water intrusion into the occupied areas resulting in water damage to the building and equipment. In addition, slip hazards and electrical shock hazards could be introduced.

*ii. Controls:*

Provide barriers and water diverters to control water in the building. These devices must be checked carefully at the beginning and periodically throughout a rain event to ensure they function properly.

i) Housekeeping

*i. Issues:*

Areas in and around construction sites are often characterized by the accumulation of dust and dirt, trash and debris.

*ii. Controls:*

The Contractor is responsible for keeping his work area clean. If the dust barriers and negative air units are performing properly, little dust will migrate outside the construction zone. Even so, the University is responsible for keeping the occupied areas clean as well. Contractors should be working and traveling only within the confines of the construction zone. Restricting contract employee access to owner occupied areas should reduce the amount of trash and debris accumulating outside the construction zone. Wet cleaning and/or HEPA vacuuming should be used within and outside of the construction zone. Contractors are responsible for their work areas. University housekeeping maintains the occupied areas. Compressed air must not be used for cleaning purposes.

j) Exposure Monitoring



i. *Issue:*

Building occupants tend to have a low tolerance for exposures to dust and chemicals because they do not control the exposures and often do not know what the exposures are.

ii. *Control:*

The Contractor is responsible for monitoring exposures outside the construction zone. He/she must have a trained and qualified individual on site at all time with the capability to monitor for noise, dust and vapor emissions escaping from the project. The Contractor will ensure that the instrumentation is properly calibrated and zeroed in a clean air environment prior to use, using the manufacturer's instructions. Calibration procedures must be documented in an equipment logbook.

At least weekly, the Contractor shall select random times to monitor these exposures for a minimum of 4 hours using direct reading instrumentation. Average and peak readings, sample times, locations and instrumentation shall be recorded in the construction logbook. When a building occupant registers an exposure complaint with the University Construction Manager, all the exposure parameters will be checked at the complainant's workstation and documented in the construction logbook. The University Construction Manager will notify the EHS Office of this concern whether the exposures register above the specified limits or not. If exposures exceed the limits, work must stop until the source of the problem is found and fixed. The following list contains the exposure guidelines for building occupants outside of the construction zone:

1. Total dust: 1 mg/M<sup>3</sup>
2. Carbon monoxide: 10 PPM
3. Noise: < 60 dB averaging the speech frequencies (500, 1000, 2000, 4000 Hz) and < 80 dB using the A weighted scale
4. Total Hydrocarbon: 10 PPM
5. 25% of the TLV for other specific compounds. These levels are more stringent than industrial standards in order to provide a greater safety margin for the general public. If these levels are exceeded over a 4- hour averaging period, work must stop and corrective action must be taken. Sampling frequencies must be increased if the exposure limits are exceeded based upon consultation with the EHS Department.
6. The EHS Department will review the construction logbook data and will perform additional assessments as needed.

*(END OF SECTION)*