CHAPTER IV:
SUPPLEMENTAL GUIDELINES

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I. SUPPLEMENTAL GUIDELINES

A. SECTION A - GENERAL GUIDELINES

1. NEW CONSTRUCTION ERGONOMIC DESIGN GUIDELINES

a) Housekeeping closet size

Size: Typically, each floor will have housekeeping closet. The closet should have room to store the wastebasket (24"X36" or larger), mop, wringer and supplies without lifting items to store them in the sink. Housekeeping sinks should be of the built into the floor type, with a low wall surrounding a drain to reduce lifting. Location/Additional Size Consideration: Buildings with tile/carpet will have floor buffers, brooms and vacuum cleaners in housekeeping closets. There should either be room for these in each housekeeping closet without putting things in the sink OR, in buildings where every closet will not have space for buffer/vacuum/etc equipment, closets that do have space for this equipment should be close to the building elevator.

b) Receptionist workstation

Height: As per ADA (28-34) though closer to 28 is better. (ADA height is from North Carolina State Building Code Volume 1-C, Accessibility Code, 1999 Edition, Chapter 21 (Fixed or built- in seating & tables), Section 1.3 (clearances and height of tables, counters, etc.) Articles 21.3.1 and 21.3.2.) illumination: 200-500 lx. equipment: The receptionist will interact with the public while using a computer. The receptionist should be able to see the monitor and customers without looking to the side or upwards.

c) Laboratory

Laboratory Benches: Laboratory benches should not have a lip on the front

2. UNC LABORATORY DESIGN GUIDELINES

a) INTRODUCTION

Purpose: UNC-Chapel Hill has a continuing need to modernize and upgrade its facilities. The resulting construction projects often have significant health and safety requirements due to regulatory oversight. Since these requirements can impact the design of a project, Environment, Health and Safety (EHS) prepared this EHS Laboratory Design Guide to aid the campus community with planning and design issues. EHS believes that the Guide, in conjunction with EHS's plan review and consultation, improves design efficiency and minimizes changes. The main number for the UNC-EHS Office is (919) 962-5507.

Application: The Guide is a resource document for use by faculty, staff, and design professionals for use during the planning and early design phases of a project. The Guide applies to construction projects for all UNC-Chapel Hill facilities, including leased properties.

Format of Guide: The Guide is formatted to address laboratory design issues pertinent to General Laboratories (e.g.: chemical laboratories) in Section 1, with additional requirements for Radioactive Materials Laboratories and Biosafety Level 2 Laboratories presented in Sections 2 and 3 respectively. Within the sections, specific design criteria are provided. Comments are included under the specific design criterion to give the user the rational behind the design feature.

References: Please note that if any Design Guidelines are less stringent than the current NC Building Code, Mechanical Code, Fire Prevention Code etc., it should be brought to the attention of the EHS Department for discussion and revision as necessary. The Design Guidelines are not intended to preempt NC Code without State approval of Alternate Methods and Materials, where these Guidelines are found to be less stringent.

b) Design criteria are designated in the following ways:

(1) Shall: Criterion is typically mandated by applicable regulation(s). The user of the Guide is required to include the design feature.
(2) Must: Criterion is based on well-established consensus standards//guidelines. "Must" is used to reflect a UNC requirement, although not required by a regulation. The user of the Guide is required to include the design feature.
(3) Should: Criterion is advisory in nature, based on good engineering and safety practices. It is the discretion of the user of the Guide to include the design feature.

c) Limitations of the Guide: The EHS Laboratory Design Guide is not "all inclusive." It does not cover all regulatory issues nor does it cover all design situations. It is important to note that use practices must be considered during the design process, as they can directly influence how the laboratory will be designed (e.g.. how hazardous materials are used impacts how they are stored, which is a design issue). In all cases, EHS should be consulted on questions regarding health, safety, and the environment.

d) General Requirements for UNC-Chapel Hill Laboratories

(1) Codes, Standards, and References

(a) Regulations:

(i) Federal Code of Regulations ("CFR"), Title 29, Labor
(ii) NC Building Code
(iii) NC Fire Prevention Code

(iv) NC Mechanical Code
(v) CDC Select Agents, Title 42, Chapter I, Part 72 – Interstate Shipment of Etiologic Agents
(vi) National Fire Protection Association ("NFPA") Handbook 70
(vii) National Electric Code
(viii) NC Radiation Control Regulations

(b) Consensus Standards and References:

(i) American National Standard for Laboratory Ventilation (ANSI/AIHA Z9.5-)
(ii) American National Standard for Thermal Environmental Conditions for Human Occupancy (ANSI/ASHRAE 55-1992)
(iii) NC Radiation Protection Section
(iv) "Safe Handling of Radioactive Materials", National Council on Radiation Protection (NBS 92) Handbook
(v) "Safe Handling of Radionuclides", International Atomic Energy Agency, Safety Series No. 1, (1973 ed. is still current as of 1999) (IAEA)
(vi) CDC-NIH Biosafety in Microbiological and Biomedical Laboratories, 4th (or latest) Edition
(vii) Guidelines for Research Involving Recombinant DNA Molecules (NIH Guidelines), April 2002 (or latest)
(viii) Reducing the Risks of Nonstructural Earthquake Damage: A Practical Guide, Federal Emergency Management Agency: FEMA-74, 1994

(2) Scope

The primary objective in laboratory design is to provide a safe environment for laboratory personnel to conduct their work. Therefore, all health and safety hazards must be identified and carefully evaluated so that protective measures can be incorporated into the design. The basic laboratory design features listed in this section illustrate some of the basic health and safety elements to include in all new and remodeled laboratories at UNC. The subsections of Section 2.1 provide specific guidance on additional critical features of a general laboratory (e.g., fume hoods, hazardous materials storage, and compressed gases.) (Keep in mind, however, that no matter how well designed a laboratory is, improper usage of its facilities will always defeat the engineered safety features.)

(3) Architectural Considerations

(a) Walls/Doors/Security

The laboratory must be completely separated from outside areas (i.e., must be bound by four walls).

The laboratory shall have means of securing hazardous and radioactive materials (i.e., lockable doors)

(b) CDC Select Agents

Having secured hazardous materials storage will keep unauthorized personnel from gaining access to them. These regulations apply specifically to laboratories containing radioactive materials and CDC Select Agents; however, UNC-Chapel Hill EHS interprets this to include all laboratories (e.g., general chemistry and electronics).

Laboratories which may use select agents should have wires (power/control/ data) pulled to the doors leading to these work areas for additional security control. (Discuss with UNC-EHS)

Doors in H-occupancy laboratories shall have doors which swing in the direction of egress. Doors serving B-occupancy shall swing in the direction of egress if the occupant load is 50 or more. Where possible, all B-occupancy lab doors should swing out with hardware satisfying ADA requirements.

On the hallway wall next to each door entry into a laboratory space must have a standardized clear frame with the room number permanently affixed with space for an 8.5x11 inch hazard warning sheet insert (landscape orientation).

Each door into a laboratory room must have a view panel.

Inside the laboratory, on the wall adjacent to the door latch, provide 2 feet of clear space for light switches, telephone, thermostat and fire extinguisher.

Vents are prohibited in laboratory doors which open to egress/access corridors.

Laboratories which use hoods or other larger equipment should be equipped with doorways that have 48 inch openings. Each opening should accommodate a 36 active door leaf and a 12 inch inactive leaf.

(c) Windows

If the laboratory has windows that open they must be fitted with insect screens.

(d) Flooring

The floor must be a one piece non-pervious and with covings to the wall. This can be achieved by use of glue, heat welded vinyl flooring, epoxy coated concrete slab, etc.

Floors should be coved up walls and cabinets to ensure spills cannot penetrate underneath floors/cabinets. Tiles and wooden planks are not appropriate because liquids can seep through the small gaps between them. These references apply specifically to laboratories containing biological and radioactive materials; however, UNC-Chapel Hill EHS interprets this to include all laboratories (e.g., general chemistry, electronics, etc.).

Floors in storage areas for corrosive liquids shall be of liquid tight construction.

(e) Sinks

Each laboratory must contain a sink for hand washing. Elbow or electronic sensing faucet controls are recommended particularly for biological agents and/or highly toxic chemicals.

Sink faucets and hose bibs that are intended for use with attached hoses must be equipped with back siphon prevention devices.

Laboratory sinks shall have lips that protect sink drains from spills.

Sink lips or berms should be >= 0.25 inches and designed to completely separate the lab bench or fume hood work area from the sink drain.

(f) Chemical/Waste Storage

Chemical storage shelves shall not be placed above laboratory sinks.

Chemical storage shelves shall be flush to a back wall and shall have a ½ inch lip along the front edge.

Sufficient space or facilities (e.g., storage cabinets with partitions) shall be provided so that incompatible chemicals can be physically separated. This will be based on the chemical inventory and use projection provided by the Principal Investigator to the project and EHS. If the project scope cannot provide sufficient storage the user must develop a written management control plan to include as part of their local Chemical Hygiene Plan.

Materials, which in combination with other substances may cause a fire or explosion, or may liberate a flammable or poisonous gas, must be kept separate. Recommend that solvent storage not be located under the laboratory fume hood, as this is a location where fires are most likely to occur in laboratories.

Adequate space must be provided for the collection of waste materials.

Good Practice per UNC-Chapel Hill EHS

All labs should be designed to conveniently and safely accommodate the temporary storage of biological, radiological, and chemical wastes based on laboratory use projections. Wastes are generally stored in the lab in which they are generated, not in centralized accumulation areas. Contact EHS if waste storage and space become design challenges.

(g) Furniture Design and Location/Exit Paths

All furniture must be sturdy. All work surfaces (e.g., bench tops and counters) must be impervious to the chemicals used. (See Appendix to this section for suggested materials) For example, many microbiological manipulations involve concurrent use of chemical solvents such as formaldehyde, phenol, and ethanol as well as corrosives. The lab bench must be resistant to the chemical actions of these substances and disinfectants. Wooden bench tops are not appropriate because an unfinished wood surface can absorb liquids. Also, wood burns rapidly in the event of a fire. Fiberglass is inappropriate since it can degrade when strong disinfectants are applied. Fiberglass also releases toxic smoke when

burned. These references apply specifically to laboratories containing biological and radioactive materials; however, UNC-Chapel Hill EHS interprets this to include all laboratories (e.g., general chemistry and electronics).

The lab shall have a minimum aisle clearance of at least 24 inches. Main aisles used for emergency egress must have a clearance width of at least 36 inches.

Lab benches and other furniture must be placed a minimum of 36 inches from an exit.

Lab desks should be located near exit ways and in the path of fresh make up air.

(h) Cleanability

The laboratory must be designed so that it can be easily cleaned. Walls should be painted with washable, hard non-porous paints.

Spaces between benches, cabinets, and equipment must be accessible for cleaning.

Laboratory furniture must have smooth, non-porous surfaces so as to resist the absorption of liquids and the harsh effects of disinfectants. Furniture must not be positioned in such a manner that makes it difficult to clean spilled liquids or conduct routine maintenance. For example, positioning a Class II biosafety cabinet in a limited concave space might not allow the biosafety cabinet certifier to remove panels of the cabinet when recertifying the unit. These references apply specifically to laboratories containing biological and radioactive materials; however, UNC-Chapel Hill EHS interprets this to include all laboratories (e.g., general chemistry and electronics).

(i) Breakrooms

The design of the laboratory building must incorporate adequate additional facilities for food storage/consumption and personal hygiene tasks outside of the rooms where chemical and biological materials are handled.

Break rooms should be sized based upon floor occupancy and must be dedicated as a break area and not serve other functions such as a copy center or equipment storage.

A minimum of 1 break room is required per floor unless separate desk space is provided for each occupant in office areas which are walled off and separately ventilated from the laboratory space.

(j) General Ventilation Considerations (see also Section 2.2 for fume hood considerations)

Laboratory room supply should discharge through a perforated ceiling/plenum at velocities not exceeding 50 fpm. Supply terminal velocity at the face of the hood must not exceed 25 fpm or 30 per cent of the minimum face velocity (whichever is less).

The building DDC system should have spare capacity for building gas and vapor sensor inputs.

Sensor technology should be considered for emergency detection and alarm for highly hazardous gases or vapors.

Winter: 69-76 °F (at 35% RH); Summer: 73-79 °F (at 60% RH)

Consider providing chilled water line services to laboratories with significant heat loads.

Certain equipment may be specified to incorporate centrally produced chilled water and reduce water use and conditioned air.

Chilled water lines may be connected to portable fan coil units for spot cooling in rooms with high general heat loads.

Cabinetry or other structures or equipment must not block or reduce effectiveness of supply or exhaust air.

Good Practice per UNC-Chapel Hill EHS

Many supply diffusers and room exhaust room openings are located along laboratory walls. Storage of boxes near these openings may obstruct the circulation of air and supply or exhaust air functioning.

General laboratories must have a minimum of 6-air changes/hour.

OSHA requires a minimum of 6 AC/HR in chemical storage rooms. Since most laboratories store some quantities of chemicals, this regulation applies. OSHA has cited university chemical storerooms for inadequate ventilation under this regulation.

Laboratories should be equipped with an emergency exhaust button with reset capability located next to the exit door to provide up to 12 air exchanges per hour in the event of a chemical emergency (gas leak, volatile liquid spill, smoke, etc.)

Laboratories must be maintained under negative pressure in relation to the corridor or other less hazardous areas. High containment laboratories (P3) require air lock vestibules with door closing mechanisms so both doors are not open at the same time. Pressure differential detection systems (including magnehelic gages) must be installed with readouts/alarms located in a central panel. Consult with UNC EHS for special designs.

Clean rooms requiring positive pressure should have entry vestibules (anterooms) provided with door-closing mechanisms so that both doors are not open at the same time. Consult with UNC EHS for design details.

Air exhausted from the general laboratory space (as distinguished from exhaust hoods) must not be recirculated unless one of the criteria listed in ANSI/AIHA Z9.5 are met. Exhaust air from hoods is never recirculated.

General laboratory and Hood exhaust systems which pass conditioned building air through heat recovery systems require maintenance at the filtration/heat exchange units. These units should be maintainable without physical entry into the exhaust system.

If bodily entry is required into the ventilation system, isolation valves/dampers must be provided for each section being entered. Also, grade D air must be plumbed to the units to allow the use of supplied air respirator hoods or masks while working inside the ventilation system.

(k) Casework and counter top recommendations

(i) Casework:

Type: Standard, floor mounted, closed-base type (may have access doors), should be used in all laboratories.

Materials: Metal or Hardwood (such as oak or other approved equivalent) - should be used in:

(a) General research and teaching laboratories where humidity and temperature will be normal (standard for occupied rooms), where casework maintenance is not a compelling factor, and where flammable, corrosive, or toxic substances will not be absorbed into the surface.
(b) Plastic Laminate - Should be used in:

(i) Miscellaneous storage and workrooms requiring base or wall storage facilities, and where the infusion of appropriate colors may be architecturally desirable.
(ii) Only non-combustible and non-reactive laminates may be used where flammable or corrosive chemicals are to be stored or used.

(c) Millwork - Should not be considered for new construction. Variances may be considered on renovation projects on a case-by-case basis.
(d) Counter Tops:

Chemical Reaction and Abuse Resistance - for chemical resistance work surfaces, either of the following should be used:

(iii) Type 1 - Composition Stone -- with a chemical resistant resin finish.
(iv) Type 2 - Natural Quarry Stone -- with a chemical resistant finish.
(v) Type 3 - Solid Resin -- for chemical resistant surfaces and in the bottom of general purpose fume hoods.

General Purpose - Areas where neither chemical nor physical abuse is expected and where no liquid services are to be used, such as 30" high desk and writing surfaces, instrument support surfaces, or storage areas may use either of the following:

(i) Type 4 - Wood Core -- A wood fiber or wood particleboard core with chemical resistant finish on all exposed surfaces.
(ii) Type 5 - Plastic Laminate -- Plastic Laminate surface with a wood particle core; may be self-edged or post-formed.
(iii) Radiation and Other Special Uses -- areas where radioactive materials or other special uses are approved should use the following:
(iv) Type 6 - Stainless Steel -- Type 316 polished stainless steel counter top surfaces may be approved on a case-by-case basis.

Physical Abuse Resistance - areas where abrasive physical abuse is expected; Physics, Earth Sciences, Geology, or Paleontology laboratories shall use:

(i) Type 3 - Solid Resin -- with a chemical resistant surface, or
(ii) Type 7 - Composition Stone -- with a low gloss vinyl sealer.

Fume Hood Work Surfaces -- should be selected as follows:

(i) General Purpose Hoods - Type 3, Solid Resin (chemical resistant)
(ii) Radiation Hoods - Type 6 - (Type 316 Stainless Steel).
(iii) Perchloric Acid Hoods - Type 6 - (Type 316 Stainless Steel).
(iv) Special Purpose Hoods - Type 3, Solid Resin (chemical resistant)

Where these casework guidelines are not deemed suitable, alternates of equal or better quality and durability shall be discussed with the UNC Chapel Hill EHS Office.

Good practice per UNC-Chapel Hill EHS

(4) Engineering Considerations

(a) Electrical

Shall provide GFI protection to electrical receptacles above counter tops and within 6 feet of sinks. Receptacles that are not readily accessible or receptacles for appliances occupying dedicated space, which are cord-and-plug connected in accordance with NEC Section 400-7A (6-8), are exempted.

Circuit breakers should be located outside the lab. All breakers must be clearly labeled as to equipment, lighting and outlets served.

Good Practice per UNC-Chapel Hill EHS

In the event of an emergency, the laboratory may be unsafe to enter. Hence, the circuit breakers for key electrical appliances should be located outside the lab.

(b) Plumbing

Valves for building gas supply lines should be located outside the lab.

The flexible connections should be used for connecting gas and other plumbed utilities to any freestanding device including, but not limited to; biosafety cabinets, incubators, and liquid nitrogen freezers. Flexible connections should be appropriate for the pressure requirements and should be constructed of material compatible with the transport gas. A shutoff valve should be located within sight of the connection and clearly marked.

Sink drains traps must be transparent (e.g., made of glass) and easy to inspect or have drain plugs to facilitate mercury spill control.

Lab waste water lines shall be separate from domestic sewage and sampling points shall be installed in an easily accessible location outside the building.

The sampling point shall be installed at a location where all building lab wastes are discharged, before the lab waste line connects to the domestic waste line. The sampling point shall be designed so that it is perpendicular to the lab waste line, has a minimum 4 inch diameter, has a cleanout screw on cap and is protected by a Christie Box. The sampling point should not be located in an area where water from irrigation or flow from stormwater runoff can accumulate.

All gas and utility supply lines shall be clearly marked along their entire length through the building. One suggested marking scheme is outlined in SEFA 7, 1994 as follows:

Number	Service	Color	Code	Color of Letter
1	Cold Water	Dark Green	CW	White
2	Hot Water	Red	HW	White
3	Steam	Black	STM	White
4	Air	Orange	Air	Black
5	Gas	Dark Blue	Gas	White
6	Vacuum	Yellow	Vac	Black
7	Distilled Water	White	DW	Black
8	Oxygen	Light Green	OXY	White
9	Hydrogen	Pink	H	Black
10	Nitrogen	Gray	N	Black
11	All Other Rare Gases	Light Blue	Chemical Symbol	Black

e) Fume Hoods

The requirements of this Guide apply to all UNC laboratory buildings, laboratory units, and laboratory work areas in which hazardous materials are used, handled, or stored.

(1) Fume Hood Location

Fume hoods should be located away from activities or facilities, which produce air currents or turbulence. Locate away from high traffic areas, air supply diffusers, doors, and operable windows.

Fume hoods should not be located adjacent to a single means of access to an exit. Recommend that hoods be located more than 10 feet from any door or doorway.

Fume hoods must not have large equipment located in front.

Hoods should not be located in room corners, near windows or near very cold equipment.

Fume hood openings should not be located opposite workstations where personnel will spend much of their working day, such as desks or microscope benches.

Fume hoods should not face each other across narrow aisles.

An emergency eyewash/shower station shall be within 10 seconds of each fume hood.

Per 8 CCR 5162, the requirement for an eyewash/shower is triggered when an employee may be exposed to substances, which are “corrosive or severely irritating to the skin or which are toxic by skin absorption” during normal operations or foreseeable emergencies. Fume hoods are assumed to contain such substances; hence, UNC interprets this regulation to mean that emergency eyewash/shower station shall be within 10 seconds of fume hoods.

An ADA emergency eyewash/shower shall be within 10 seconds of an ADA fume hood (minimally one ADA hood per laboratory floor).

The location of at least one ADA hood per floor will enable disabled individuals to conduct their research without having to transport chemicals, etc. in elevators.

(2) Approved Equipment

All fume hoods shall meet the requirements of NFPA 45, Standard on Fire Protection For Laboratories Using Chemicals, and ANSI/AIHA Z9.5.

(3) Selection/Types

(a) General: Consider the following factors when selecting fume hood:

(i) Room size (length x width x height)
(ii) Number of room air changes
(iii) Lab heat load
(iv) Types of materials used
(v) Linear feet of hood needed based on
(vi) number of users/hood
(vii) frequency of use
(viii) % of time working at hood
(ix) size of apparatus to be used in hood, etc.

(b) Constant Volume Hoods: These hoods are recommended.

Good Practice per UNC-Chapel Hill EHS

These hoods permit a stable air balance between the ventilation supply and exhaust by incorporating a bypass feature. A restricted bypass is recommended to reduce the opportunity for hood leakage through the bypass caused by convection currents established when a heat source is used in a hood.

(c) Variable Air Volume (VAV) fume hoods: These hoods are an option.

Good Practice per UNC-Chapel Hill EHS

These hoods maintain constant face velocities by varying exhaust volumes in response to changes in sash position. Because only the amount of air needed to maintain the specified face velocity is pulled from the room, energy savings are possible when the sash is closed. However, these hoods cost more up front and the potential energy savings may not be realized at UNC, because users do not exercise good sash management (e.g., pull sash closed when not using hood). EHS's concerns with this technology are not related to the VAV hoods ability to protect the worker. To be viable, any design should show significant energy savings without having to rely on the end user. Also, system maintenance of the supply and exhaust systems is more technically demanding. Sufficient additional resources for system maintenance must be budgeted. Otherwise, failing exhaust hoods and laboratories may need to be shut down for the safety of the building occupants.

(d) Supply or auxiliary air hoods: These hoods are not permitted for new construction.

Good Practice per UNC-Chapel Hill EHS

It is very difficult to keep the air supply and exhaust of supply hoods properly balanced. In addition, the supply air is intemperate, causing discomfort for those working in the hot or cold air stream. As a result, the supply vent is often either shut or blocked off, which eliminates any potential benefit of this type of hood. Finally, the presence and movement of the user's body in the stream of supply air creates turbulence that degrades the performance of the hood.

(e) Ductless Fume Hoods: Portable, non-ducted fume hoods are generally not permitted; however, a portable hood may be used for limited applications (e.g., used inside of an existing hood for a special application, such as odor control or to enclose a microbalance). Such applications must be reviewed and approved by EHS on a case-by-case basis.
(f) Perchloric Acid Hoods: Heated perchloric acid shall only be used in a laboratory hood specifically designed for its use and identified as "For Perchloric Acid Operations." (Exception: Hoods not specifically designed for use with perchloric acid shall be permitted to be used where the vapors are trapped and scrubbed before they are released into the hood.)

Perchloric acid hoods and exhaust duct work shall be constructed of materials that are acid resistant, non-reactive, and impervious to perchloric acid.

The exhaust fan should be acid resistant and spark-resistant. The exhaust fan motor should not be located within the duct work. Drive belts should not be located within the duct work.

Ductwork for perchloric acid hoods and exhaust systems shall take the shortest and straightest path to the outside of the building and shall not be manifold with other exhaust systems. Horizontal runs shall be as short as possible, with no sharp turns or bends. The ductwork shall provide a positive drainage slope back into the hood. Duct shall consist of sealed sections. Flexible connectors shall not be used.

Sealants, gaskets, and lubricants used with perchloric acid hoods, duct work, and exhaust systems shall be acid resistant and non-reactive with perchloric acid.

A water spray system shall be provided for washing down the hood interior behind the baffle and the entire exhaust system. The hood work surface shall be watertight with a minimum depression of 13 mm (½ inch) at the front and sides. An integral trough shall be provided at the rear of the hood to collect wash-down water.

The hood surface should have an all-welded construction and have accessible rounded corners for cleaning ease.

The hood baffle shall be removable for inspection and cleaning.

Each perchloric acid hood must have an individually designated duct and exhaust system.

(g) Radioactive Material Use

(i) Laboratory hoods in which radioactive materials are handled shall be identified with the radiation hazard symbol.
(ii) Fume hoods intended for use with radioactive isotopes must be constructed of stainless steel or other materials that will not be corroded by the chemicals used in the hood.
(iii) The interior of all radioisotope hoods must have coved corners to facilitate decontamination.
(iv) The hood exhaust may require filtration by HEPA or Charcoal/HEPA filters. Where such is the likelihood, the hood must have a bag-out plenum for mounting such filters and fan capacity for proper operation of the hood with the filter installed. The most appropriate location for the plenum is near the exhaust port of the fume hood (i.e., proximal to the hood).
(v) Hoods used for radioactivity should have sashes with horizontal sliding glass
(vi) The cabinet on which the hood is installed shall be adequate to support shielding for the radioactive materials to be used therein.
(vii) In general, glove boxes with HEPA filtered exhausts shall be provided for operations involving unsealed radioactive material that emit alpha particles. Consult with the Radiation Safety Office for specific requirements.

(h) American with Disabilities Act (ADA) Hoods: Must consult with UNC-Chapel Hill's ADA Compliance Office regarding the number lab hoods to install in facilities, which are accessible to and usable by individuals with disabilities – recommend minimally one ADA hood per laboratory floor. These hoods must provide appropriate work surface heights, knee clearances, reach to controls, etc. to individuals in wheelchairs.

The location of at least one ADA hood per floor will enable disabled individuals to conduct their research without having to transport chemicals, etc. in elevators.

(i) Glove Boxes: Glove boxes (positive and negative) must meet the type, design and construction of requirements ANSI/AIHA Z9.5
(j) Floor mounted (walk-in) Fume Hoods: These hoods must meet the type, design and construction requirements of ANSI/AIHA Z9.5
(k) Special Purpose Hoods: These hoods include enclosures for operations for which other types of hoods are not suitable (e.g., enclosures for analytical balances, histology processing machines, special mixing stations, evaporation racks). These hoods must be designed per ANSI Z9.5 and the Industrial Ventilation manual.

(4) Labeling

Laboratory hoods and special local exhaust ventilation systems (SLEV) shall be labeled to indicate intended use (e.g., "Perchloric Acid Hood").

A label must be affixed to each hood containing at least the following information from the last inspection:

(a) certification date due
(b) average face velocity
(c) inspector's initials

See the Campus Laboratory Hood and Ventilation Policy

(5) Construction, Installation & Performance

New hoods can be mounted above a chemical storage cabinet provided that the cabinet meets the International Fire Code requirements for construction.

Type 316 stainless steel should be used for all parts of the fume hood system ventilation duct as long as compatibility is maintained.

Fume hood interior surfaces shall be constructed of corrosion resistant, non-porous, non-combustible materials such as type 316 stainless steel. These materials shall have a flame spread index of 25 or less when tested in accordance with NFPA method 255, Standard Method of Test of Surface Burning Characteristics of Building Materials. New hoods must not contain asbestos materials. Hoods used for perchloric acid digestion shall have interiors constructed of stainless steel and be equipped with perforated spray pipes behind the top of the baffles for periodic wash downs.

Hood inserts are only permitted for radioactive iodination procedures specifically approved by the UNC Radiation Safety Officer.

Laboratory hoods shall be provided with a means of containing minor spills.

The means of containing minor spills might consist of a 6.4-mm (¼ in.) recess in the work surface, use of pans or trays, or creation of a recess by installing a curb across the front of the hood and sealing the joints between the work surface and the sides, back, and curb of the hood.

There must be a horizontal bottom airfoil inlet at the front of the hood.

Adjustable baffles with horizontal slots must be present in the fume hood interior at the back and top.

Before a new fume hood is put into operation, an adequate supply of make up air must be provided to the lab.

(6) Face Velocity:

Average air velocity at the hood face must be between 100-120 linear feet per minute (LFM) with a minimum of 90 LFM at any measured point at a minimum vertical sash opening of 18 inches. For combination sashes, the face velocity with the vertical sash down and two panels open must be 100 fpm and must pass the ASHRAE 110 tests at constant volume when the sash is raised to the full open (setup) position.

(7) Certification:

The criteria for new fume hood installations at UNC-Chapel Hill are:

The average face velocity of the fume hood is between 100-120 fpm at an 18-in sash height or, for the combination sash, 100-120 fpm with the vertical sash closed and two horizontal sashes open.

All single-point velocity measurements are 90 fpm or greater at the specified minimum openings.

Fume hood containment is shown using the ASHRAE 110 smoke test and tracer gas tests in 3 test conditions:

(a) Two horizontal sashes open (vertical sash lowered)
(b) Vertical sash at 18 inches
(c) The sash fully open.

Fume hoods with a vertical sash only must pass the ASHRAE 110 testing for the 18 inch and full open sash positions.

Where the required velocity can be obtained by partly closing the sash, the sash and/or jamb shall be marked to show the maximum opening at which the hood face velocity will meet the face velocity requirements.

An airflow indicator and alarm shall be provided and located so that it is visible from the front of the fume hood. In addition, a magnehelic gauge mounted on the front of the hood and connected to the hood throat shall be installed to monitor hood suction.

Hood alarms will sound locally and should be annunciated at the central Energy Management system computer through the DDC system.

Baffles shall be constructed so that they may not be adjusted to restrict the volume of air exhausted through the laboratory hood. Manual dampers shall be locked in position as soon as the system is balanced.

Fans should run continuously without local control from hood locations and independently of any time clocks unless specifically exempted by the UNC EHS Department.

For new installations or modifications of existing installations, controls for laboratory hood services (e.g., gas, air, and water) should be located external to the hood and within easy reach.

Shutoff valves for services, including gas, air, vacuum, and electricity shall be outside of the hood enclosure in a location where they will be readily accessible in the event of fire in the hood. The location of such a shut-off shall be legibly lettered in a related location on the exterior of the hood.

Each exhaust hood shall be permanently labeled with the unique identification number and the fan ID to which it is attached. Each fan on the roof shall be permanently labeled

with its unique ID and a permanent listing of all room numbers, hoods and or general exhausts to which it is attached.

(8) Power and Electrical

Chemical fume hood exhaust fans shall be connected to an emergency power system in the event of a power failure.

Emergency power circuits should be available for fan service so that fans will automatically restart in proper sequence upon restoration after a power outage.

Fume hood ventilating controls should be arranged so that shutting off the ventilation of one fume hood will not reduce the exhaust capacity or create an imbalance between exhaust and supply for any other hood connected to the same system.

In installations where services and controls are within the hood, additional electrical disconnects shall be located within 15m (50ft) of the hood and shall be accessible and clearly marked. (Exception: If electrical receptacles are located external to the hood, no additional electrical disconnect shall be required).

Hood lighting shall be provided by UL-listed fixtures external to the hood or, if located within the hood interior, the fixtures shall meet the requirements of NFPA 70, (National Electrical Code) and NFPA 45.

The light fixtures must be of the fluorescent type and replaceable from outside the hood. Light fixtures must be displaced or covered by a transparent impact resistant vapor tight shield to prevent vapor contact.

(9) Sashes

Sashes may be horizontal, vertical, or a combination, and must have the capability to close off the hood face substantially.

Sash panels (horizontal sliding) must be 12 to 14 inches in width.

Sashes shall be made of safety glass.

Use laminated safety glass when internal temperature is anticipated to be less than 160 □F.

Use tempered safety glass when high internal temperatures are anticipated that will result in sash surface temperatures greater than 160 F.

(10) Ducting

Hood exhausts should be manifold together except for:

(a) Perchloric acid hoods
(b) Hoods with wash down equipment
(c) Hoods that could deposit highly hazardous residues on the ductwork
(d) Hoods requiring HEPA filtration or other special air cleaning

(e) Situations where the mixing of exhausted materials may result in a fire, explosion, or chemical reaction hazard in the duct system

Manifold fume hood exhaust ducts shall be joined inside a fire rated shaft or mechanical room, or outside of the building at the roofline.

Horizontal ducts must slope at least 1 inch per 10 feet downward in direction of airflow to a suitable drain or sump.

Ducts exhausting air from fume hoods should be constructed entirely of noncombustible material. Gaskets should be resistant to degradation by the chemicals involved and fire resistant.

Automatic fire dampers shall not be used in laboratory hood exhaust systems. Fire detection and alarm systems shall not be interlocked to automatically shut down laboratory hood exhaust fans.

Duct linings shall have a flame spread index of 25 or less when tested in accordance with NFPA 255, Standard Method of Test of Surface Burning Characteristics of Building Materials. Test specimens shall be of the minimum thickness used in the construction of the duct or duct lining.

Duct linings are not recommended. If they are installed then they must meet the above requirement.

Air exhausted from laboratory work areas shall not pass unducted through other areas.

(11) Exhaust

New exhaust fans should be oriented in an up-blast orientation.

Hood exhaust stacks shall extend at least 10 feet above the roof. Discharge shall be directed vertically upward.

If parapet walls are present, EHS recommends that stacks extend at least 2 feet above the top of a parapet wall or at least 10 feet above the roof, whichever is greater.

Note: The University Architect/Planning Office must be contacted if any building features, such as exhaust stacks, extend above the roofline.

Hood exhausts shall be located on the roof as far away from air intakes as possible to preclude re-circulation of laboratory hood emissions within a building. For toxic gas applications, the separation distance shall be at least 75 feet from any intake.

As future gas necessities are difficult to predict, EHS recommends at least 75 feet for all applications.

All building exhaust and air intakes must be modeled to demonstrate that the exhaust air (including generator exhaust) will not be recirculated within the building being constructed nor in nearby buildings. At a minimum, computer modeling must be used

while wind tunnel modeling may be more appropriate for complex building and terrain interactions.

Discharge from exhaust stacks must have a velocity of at least 3,000 fpm. Achieving this velocity should not be done by the installation of a cone type reducer. The duct may be reduced, but the duct beyond the reduction should be of sufficient length to allow the air movement to return to a linear pattern.

Rain caps that divert the exhaust toward the roof are prohibited.

Fume hood exhaust is not required to be treated (e.g., filtered or scrubbed) except when one of the following substances is used with content greater than the percent specified by weight or volume:

(a) Chemical CAS Reg # (Percent)
(b) 2-Acetylaminofluorene 53963 (1.0)
(c) 4-Aminodiphenyl 92671 (0.1)
(d) Benzedrine (and its salts) 92875 (0.1)
(e) 3, 3'-Dichlorobenzidine 91941 1.0
(f) 4-Dimethylaminoazobenzene 60117 (1.0)
(g) alpha-Naphthylamine 134327 (1.0)
(h) beta-Naphthylamine 91598 (0.1)
(i) 4-Nitrobiphenyl 92933 (0.1)
(j) N-Nitrosodimethylamine 62759 (1.0)
(k) beta-Propiolactone 57578 (1.0)
(l) bis-Chloromethyl ether 542881 (0.1)
(m) Methyl chloromethyl ether 107302 (0.1)
(n) Ethyleneimine 151564 (1.0)
(o) 1, 2-Dibromo-3-Chloropropane
(p) Asbestos
(q) Vinyl Chloride
(r) Acrylonitrile
(s) Inorganic Arsenic
(t) Ethylene Dibromide
(u) Ethylene Oxide
(v) Methylene Chloride

when used for radioisotope work. In this instance, the fume hood exhaust treatment system must be approved by the UNC Radiation Safety Officer prior to installation and use.

Air exhausted from laboratory hoods and other special local exhaust systems shall not be recirculated.

Exhaust fans shall be located outside the building housing the laboratory or in a separate room that is maintained at negative pressure to the rest of the building and provides direct access to outside for fan discharge ducts.

The minimum penthouse exhaust flow rate is 1 air change per hour.

(12) Noise

System design must provide for control of exhaust system noise (combination of fan generated noise and air-generated noise) in the laboratory. Systems must be designed to achieve an acceptable Sound Pressure Level (SPL) frequency spectrum (room criterion) as described in the 1991 HVAC Applications Handbook.

The preferred method of exhaust noise control is with low static loss air valves and reduced exhaust fan speeds.

Noise attenuators may be used as a last resort if constructed of 304 stainless steel and no packing material is used.

(13) Testing

Proper operation of fume hoods must be demonstrated by the contractor installing the fume hood prior to project closeout. The recommended containment performance test is ANSI/ASHRAE 110 with the acceptable criteria as specified in ANSI/AIHA Z9.5.ANSI/AIHA Z9.5, 5.6

f) Emergency Eyewash and Safety Shower Equipment

(1) Regulations, Consensus Standards, and References

Consensus Standards and References:

(a) American National Standards Institute (ANSI), Z358.1
(b) Emergency Eyewash and Shower Equipment
(c) National Fire Protection Association
(d) Health Care Facilities, Handbook 99, Chapter 10-6, Emergency Shower

(2) Scope

This Guide presents the minimum performance requirements for eyewash and shower equipment or the emergency treatment of the eyes or body of a person exposed to injurious materials. It covers the following types of equipment: emergency showers, eyewash equipment, and combination shower and eyewash or eye/face wash.

A plumbed eyewash shall be provided for all work areas where, during normal operations or foreseeable emergencies, the eyes of an employee may come into contact with a substance, which can cause corrosion, severe irritation, or is toxic by skin absorption. Drench hoses, sink faucets, or showers are not acceptable eyewash facilities. Plumbed eyewash shall be provided at all work areas where formaldehyde solutions in concentrations greater than or equal to 0.1% are handled.

NFPA 99 Chapter 10-6

An eyewash safety station should be installed within all acid washing areas. An eyewash safety station should be installed in N2 dispensing stations and film processing areas using chemical developers and fixers.

An emergency shower shall be provided for all work areas where, during normal operations or foreseeable emergencies, areas of the body may come into contact with a substance which is corrosive, severely irritating to the skin or is toxic by skin absorption.

A deluge shower shall be provided at all work areas where formaldehyde solutions in concentrations greater than or equal to 1% are handled.

NFPA 99 Chapter 10-6

A deluge shower should be installed within all acid washing areas. A deluge shower should be installed in N2 dispensing stations and film processing areas using chemical developers and fixers.

(3) General Location

(a) Where to Install

Emergency eyewash facilities and deluge showers shall be in unobstructed and accessible locations that require no more than 10 seconds for the injured person to reach along an unobstructed pathway (i.e., no doors without panic bars or which don't swing open when pushed). If both eyewash and shower are needed, they shall be located so that both can be used at the same time by one person.

ANSI Z358.1, 4.6.1 and 5.4.4

NFPA 99, Chapter 10-6

American with Disabilities Act (ADA) Emergency Eyewash/Showers: Install an emergency eyewash/shower so that a disabled person can access it within 10 seconds of an ADA fume hood (minimally one ADA hood per laboratory floor). These emergency eyewash/showers must provide appropriate accessibility (e.g., activation of controls and height of eyecups) to individuals in wheelchairs.

The location of at least one ADA hood per floor will enable disabled individuals to conduct their research without having to transport chemicals, etc. in elevators. Fume hoods are assumed to contain substances which are "corrosive or severely irritating to the skin or are toxic by skin absorption," hence the need for emergency eyewash/shower stations.

(b) Signage

Emergency eyewash and shower locations shall be identified with a highly visible sign. The areas around the eyewash or shower shall be well lighted and highly visible.

ANSI Z358.1, 4.6

ANSI Z358.1, 5.4.5

(c) Prohibitions around Equipment

No obstructions, protrusions, or sharp objects shall be located within 16 inches rom the center of the spray pattern of the emergency shower facility.

ANSI Z358.1, 4.6.5

Electrical apparatus, telephones, thermostats, or power outlets should not be located within 18 inches of either side of the emergency shower or emergency eyewash facility (i.e., a 36-inch clearance zone).

Good Practice per UNC-Chapel Hill EHS

Prevent potential electrical hazards posed when the water generated by the activated emergency eyewash/safety shower is in proximity to live electrical equipment.

(4) Eyewash Requirements

(a) Flushing Rates

A means shall be provided to ensure that a controlled flow of flushing fluid is provided to both eyes simultaneously.

ANSI Z358.1, 5.1.1

Eyewash equipment shall be capable of delivering to the eyes not less than 0.4 gallons per minute of flushing fluid for 15 minutes.

(b) Eyewash Positioning

The eyewash unit shall be positioned with the water nozzles 33-45 inches from the floor and 6 inches minimum from the wall or nearest obstruction. The unit must be located at an operable sink.

ANSI Z358.1, 5.4.1

(c) Equipment Activation

The valve shall be designed so that the flushing fluid remains on without requiring the use of the operator's hands. The valve shall be designed to remain activated until intentionally shut off.

ANSI Z358.1, 5.2 (a)

ANSI Z358.1, 5.1.5

(d) Eyewash Equipment Protection

Nozzles shall be protected from airborne contaminants. The removal of the nozzle protection shall not require a separate motion by the operator when activating the unit.

ANSI Z358.1, 5.1.3

(e) Deluge Shower Requirements

(i) Deluge Shower Positioning

The emergency shower location must have a level surface beneath the shower head.

Good Practice per UNC-Chapel Hill EHS

Having a level surface will prevent the users from tripping while trying to access and use the emergency shower.

Emergency shower heads shall be designed so that a flushing fluid column is provided that is not less than 82 inches and not more than 96 inches in height from the surface on which the user stands.

ANSI Z358.1, 4.1

The shower head should not be mounted flush or recessed within any constructed surfaces or partitions and the center of the spray pattern shall be located at least 16 inches from any obstruction.

Good Practice per UNC-Chapel Hill EHS

ANSI Z358.1, 4.1

Recessing the shower head may limit access and/ or affect spray pattern.

The spray pattern shall have a minimum diameter of 20 inches at 60 inches above the surface on which the user stands

ANSI Z358.1, 4.1

(ii) Flushing Rates

Emergency shower heads shall be capable of delivering a minimum of 75.7 liters per minute (20 GPM) of flushing fluid.

ANSI Z358.1, 4.1

The shower should be attached to a flushing fluid supply from a 1-inch minimum iron pipe size (IPS).

Good Practice (based on ANSI manufacturer's test procedures)

(f) Equipment Activation

The valve shall be designed so that the flushing fluid remains on without requiring the use of the operator's hands. The valve shall be designed to remain activated until intentionally shut off.

ANSI Z358.1, 4.2

The manual actuator, triangle pull, shall be located not more than 69 inches above the surface on which the user stands. The manual actuator shall be free from obstruction for 18 to 24 inches in all directions. The actuator shall not be mounted flush or recessed within any constructed surfaces or partitions.

ANSI Z358.1, 4.3

(g) Design for Maintenance/Use

The water supply to showers and/or shower/eyewash combination units should be controlled by a shutoff valve which is visible and accessible to shower testing personnel in the event of leaking or failed shower head valves.

Good Practice per UNC-Chapel Hill EHS

This design will make maintenance easier.

When floor drains are used, a means shall be provided to control odors from dry traps.

If floor drains are not provided, controls shall be provided to prevent or minimize flooding.

(h) Testing

Proper operation of the equipment must be demonstrated by the contractor installing the emergency eyewash or shower equipment prior to project closeout and facility occupation.

Good Practice per UNC-Chapel Hill

By testing the equipment, UNC can be assured that it is working properly before the users begin their research.

(i) Approved Equipment

All emergency showers and eyewash facilities shall meet the requirements of NFPA 99 Chapter 10, and ANSI Z358.1 and shall be installed in accordance with ANSI Z358.1.

NFPA 99, Chapter 10

ANSI Z358.1

g) Compressed Gas Cylinders

(1) Codes, Standards, and References

(a) NFPA 45, Chapter 8
(b) NFPA 99, Chapter 4
(c) NFPA 704, Chapter 2

(2) Scope

The Guide applies to all UNC-Chapel Hill facilities, including leased properties. It covers the design of storage for compressed gas cylinders. Note that there are numerous regulations governing the proper use of compressed gas cylinders; use is not addressed by the Guide, as it is a work practices issue, rather than design feature.

(3) Storage of Compressed Gas Cylinders – General Location

Laboratory design shall include a storage area for cylinders of compressed gases where:

(a) they are protected from external heat sources such as flame impingement, intense radiant heat, electric arc, or high temperature steam lines.
(b) they are in a well protected, well ventilated, dry location, at least 20 feet from highly combustible materials.

NFPA 99, 4-3.1.1.2

Design features which are prohibited: Unventilated enclosures such as lockers and cupboards.

Work practice issues: Oxygen cylinders shall not be stored near highly combustible materials, especially oil or grease, or near any other substance likely to cause or accelerate fire

(4) Restraint Systems

Laboratory design shall include restraints for the storage of cylinders greater than 26 inches tall; the restraint system shall include at least 2 restraints (made of noncombustible materials), which are located at one-third and two-thirds the height of the cylinder.

NFPA 45, 8-1.5

NFPA 99, 4-3.1.1.2.3

A restraint system of chains, metal straps, or storage racks provides a reliable method of securing gas cylinders. Chains or a metal strap at the bottom and top one third of each cylinder provides protection against tipping and falling. [Work Practice Note: When compressed gas cylinders in service, they shall be adequately secured by chains, metal straps, or other approved materials, to prevent cylinders from falling or being knocked over.]

The purchase and installation of compressed gas cylinder securing systems must be subject to review and approval of EHS.

Good Practice per UNC EHS. EHS can assist in identifying good quality securing systems.

Gas cylinder securing systems should be anchored to a permanent building member or fixture.

Good practice

Provisions shall be made for securing cylinders that are delivered to locations outside of the laboratory.

h) Storage of Compressed Gas Cylinders - Toxic and Highly Toxic Gases

Laboratory design shall incorporate storage capabilities of compressed gas cylinders of toxic and highly toxic gases per the following table. The number of lecture bottle cylinders [approximately 5 cm x 33 cm (2 in. x 13 in.)] shall be limited to 25. See Table 6-1. Also, review the International building and fire codes for other limitations.

Flammable or Oxidizing Gases Liquefied Flammable Gases with Health Hazard Rating of 3

Table 6-1

	Flammable or Oxidizing Gases		Liquefied Flammable Gases		Gases with Health Hazard Rating of 3 or 4
	Sprinklered Space	Nonsprinklered Space	Sprinklered Space	Nonsprinklered Space	Nonsprinklered or Sprinklered Space
Max. no. of cylinders per 46.5m^2 (500 ft^2) or less	6	3	3	2	3

NFPA 45, Table 8-1

(1) Storage Systems

Laboratory design shall include one of the following storage systems for toxic and highly toxic compressed gas cylinders:

(a) ventilated gas cabinets/exhausted enclosures/ laboratory fume hoods; or
(b) separate ventilated gas storage rooms without other occupancy or use, which has explosion control.

When gas cabinets or exhausted enclosures are provided they shall (be):

(a) located in a room or area which has independent exhaust ventilation;
(c) operate at negative pressure in relation to the surrounding area;
(d) have self-closing limited access parts or noncombustible windows to provide access to equipment controls, with an average face velocity of at least 200 fpm and with a minimum of 150 fpm at any part of the access port or window;
(e) connected to an exhaust system;
(f) have self-closing doors and is constructed of at least 0.097 inch (12 gauge) steel;
(g) internally sprinklered;
(h) anchored;

(i) contain not more than 3 cylinders per gas cabinet, except where cylinder contents are 1 pound net or less, in which case gas cabinets may contain up to 100 cylinders.

When separate gas storage rooms are provided they shall:

(a) Operate at a negative pressure in relation to the surrounding area;
(j) Direct the exhaust ventilation to an exhaust system.

(2) Treatment

Treatment systems for the exhaust of toxic and highly toxic gases must be reviewed and approved by EHS.

EHS reviews treatment systems to ensure they are compliant and are consistent.

(3) Emergency Power

Emergency power shall be provided for exhaust ventilation, gas-detection systems, emergency alarm systems, and temperature control systems.

(4) Detection System

A continuous gas detection system shall be provided to detect the presence of gas at or below the permissible exposure limit or ceiling limit. The detection system shall initiate a local alarm and transmit a signal to a constantly attended location. Activation of the monitoring system shall automatically close the shut-off valve on toxic and highly toxic gas supply lines to the system being monitored.

An approved supervised smoke detection system shall be provided in rooms or areas where highly toxic compressed gases are stored indoors.

(5) Security

Storage areas shall be secured against unauthorized entry.

(6) Storage of Compressed Gas Cylinders - Medical Gases

Enclosures such as 1-hour interior and exterior rooms (detailed below) must be provided for supply systems cylinder storage or manifold locations for oxidizing agents such as oxygen and nitrous oxide. Such enclosures must be constructed of an assembly of building materials with a fire-resistive rating of at least 1 hour and must not communicate directly with anesthetizing locations.

NFPA 99, Sections 4-3.1.1.2(a).2

Other nonflammable (inert) medical gases may be stored in the enclosure. Flammable gases shall not be stored with oxidizing agents. Storage of full or empty cylinders is permitted. Such enclosures shall serve no other purpose.

A 1-hour exterior room shall be a room or enclosure separated form the rest of the building by not less than 1-hour-rated fire-resistive construction. Openings between the room or enclosure and interior spaces shall be smoke-and draft-control assemblies having no less than a 1-hour fire-protection rating. Rooms shall have at least one exterior wall provided with at least two vents. Each vent shall not be less than 36 square inches in area. One vent shall be within 6 inches of the floor and one shall be within 6 inches of the ceiling. Containers of medical gases shall be provided with at least one fire sprinkler to provide container cooling in case of fire.

When an exterior wall cannot be provided for the room, automatic sprinklers shall be installed within the room. The room shall be exhausted through a duct to the exterior. Makeup air to the room shall be taken from the exterior. Both separate air streams shall be enclosed in a 1-hour-rated shaft enclosure from the room to the exterior. Approved mechanical ventilation shall be in accordance with the California Mechanical Code and provided at a minimum rate of 1 cubic foot per minute per square foot of the room area.

Medical gas system cabinets shall be in accordance with the following:

(a) Operated at a negative pressure in relation to surrounding area,
(b) Provided with self-closing, limited-access ports or noncombustible windows to give access to equipment controls. The average velocity of ventilation at the face of access ports or windows shall not be less than 200 feet per minute, with a minimum of 150 feet per minute at any point of the access port or window,
(c) Connected to an exhaust system,
(d) Provided with a self-closing door,
(e) Constructed of not less than 0.097-inch (12 gage) steel, and
(f) Internally sprinklered.

(7) Flammable Liquid Storage Cabinets

(a) Codes, Standards, and References

(i) NC Fire Prevention Code Section
(ii) NFPA 30 Chapter 4

(b) Scope

Flammable liquid storage cabinets are intended for the storage of flammable and combustible liquids. This Guide applies to all UNC-Chapel Hill facilities, including leased properties. It covers the design, construction, and installation of Flammable Liquid Storage Cabinets; the Guide does not address the proper use of Flammable Liquid Storage Cabinets.

(c) Design

(i) Approval/Submittal

Flammable Liquid Storage Cabinets must be UL listed and must meet NC Fire Prevention Code requirements.

Good Practice

UL listing and EHS approval assures a minimum level of quality consistent with code requirements and good practice.

(ii) Cabinet Capability

Where flammable liquid storage cabinets are required, they shall be designed such that they do not exceed 120 gallons for the combined total quantity of all liquids (i.e., Classes 1, 2, and 3).

NFPA 30, Chapter 4-3.1

NFPA 30 Chapter 4-3.1 still contains the limit (Check most recent NC Fire Protection Code)

One or more Flammable Liquid Storage Cabinets are required for laboratories which store, use, or handle more than 10 gallons of flammable or combustible liquids.

(iii) Labeling

Flammable Liquid Storage Cabinets shall be conspicuously labeled in red letters on contrasting background "FLAMMABLE - KEEP FIRE AWAY."

NFPA 30, Chapter 4-3.5

When flammable or combustible liquids present multiple hazards, the laboratory design shall address the storage requirements for each hazard.

For example, acetic acid is a corrosive and flammable material. Therefore, if stored in a flammable cabinet with other flammable materials, it must be segregated through the use of separate barriers (e.g., secondary containment). Incompatible material shall not be stored within the same cabinet.

(d) Construction

(i) Materials (NFPA 30, Section 4-3.3(b))

New Flammable Liquid Storage Cabinets must be constructed of steel.

Good Practice per UNC-Chapel Hill EHS

Wood cabinets are not UL listed or EHS approved.

Flammable Liquid Storage Cabinets shall be constructed as follows:

(a) Minimum wall thickness of 0.044 inches (18 gauge).

(b) Double walled construction with a minimum air gap of 1-1/2-inches between the walls including the door, top, bottom, and sides.
(c) Tight-fitting joints welded or riveted.
(d) Liquid-tight bottom with a door sill of at least 2 inches.
(e) Three-point latch on doors.

(ii) Doors

Cabinet doors shall be self-closing and self-latching.

(iii) Venting (NFPA 30, Chapter 4-3.4 and NFPA 99, Chapter 10-7.2.3)

Flammable Liquid Storage Cabinets are not required to be vented except for odor control of malodorous materials. Vent openings shall be sealed with the bungs supplied with the cabinet or with bungs specified by the manufacturer of the cabinet. If vented, cabinet should be vented from the bottom with make-up air supplied to the top. It shall be vented outdoors to an approved location or through a flame arrester to a fume hood exhaust system. Construction of the venting duct should be equal to the rating of the cabinet.

(iv) Location

Flammable Liquid Storage Cabinets shall NOT be located near exit doorways, stairways, or in a location that would impede egress. Flammable Liquid Storage Cabinets must NOT be wall mounted.

Good Practice per UNC-Chapel Hill EHS

Wall mounted cabinets are not UL Listed or Fire Marshal Approved.

(v) Laboratory design must ensure that Flammable Liquid Storage Cabinets are NOT located near an open flame or other ignition source.
(vi) Good Practice per UNC-Chapel Hill EHS
(vii) An open flame or other ignition source could start a fire or cause an explosion if an accident or natural disaster brought the ignition source and flammable liquids or vapors together.

(8) Hazardous Materials Storage and Handling

(a) Standards

NC Building Mechanical and Fire Prevention Codes

(b) Scope

This design guide applies to the storage of hazardous materials. As noted in the introduction, the use of hazardous materials has direct bearing on the design of the laboratory; hence the research operations should be well understood in the planning phases when designing the laboratory's hazardous materials storage.

(c) Requirements

Laboratory design shall include spill control and secondary containment for the storage of hazardous materials liquids in accordance with the requirements of the NC Building Code, NC Fire Prevention Code and NFPA 45.

Notes: Design must allow for substances which, when mixed, react violently, or evolve toxic vapors or gasses, or which in combination become hazardous by reason of toxicity, oxidizing power, flammability, explosibility, or other properties, to be separated from each other in storage by distance, by partition, or otherwise, so as to preclude accidental contact between them.

Explosion control shall be provided for storage of non-exempt quantities of the following materials:

(i) Highly toxic flammable or toxic flammable gases when not stored in gas cabinets, exhausted enclosures or gas rooms.
(ii) Combustible dusts.
(iii) Class 4 oxidizers.
(iv) Unclassified detonable and Class 1 organic peroxides.
(v) Pyrophoric gases.
(vi) Class 3 and 4 unstable (reactive) materials.
(vii) Class 2 and 3 water-reactive solids and liquids.

When the hazardous materials stored in a control area are not in excess of the amounts specified in the International Building and Fire codes, such storage shall conform to the Building Code requirements for Group B Occupancy. (See Building and Fire Codes)

When the hazardous materials stored in a control area exceed the amounts specified such storage shall conform to the Building Code requirements for Group H, Occupancy.

When the hazardous materials stored in laboratories and similar areas used for scientific experimentation or research are not in excess of the table below and are not otherwise classified as Group B Occupancies, shall conform to the Building Code requirements for Group H,

(d) Procedures

Permitting and reporting procedures

(i) NC Building Code Chemical Inventory Report Procedure

As noted in this and other sections, the quantity of hazardous chemicals planned for use and storage within a project area has a direct impact on how the project is designed. The project architect is responsible for ensuring the necessary data is collected from the future building occupants and is assessed by a qualified individual (firm) before the Design Development Drawings are submitted to the State Department of Insurance (DOI). This review must be completed using standard Microsoft software (or other approved by the EHS Department). The

end result of the procedure is a summarized report showing the quantities of hazard classes planned for designated control areas as compared to the NC Building Limits. For unassigned spaces, the assumptions made for these areas must be specified. A copy of the final report and all supporting information must be provided to the EHS Office on a Read Only optical disk as a permanent record of this analysis.

(ii) Hazardous Waste Generator "permit" for "off campus" facilities

Projects within five campus sites are covered by the University's existing Hazardous Waste Generator permits (Horace Williams Airport, Cogen, HMF, Main Campus and Marine Sciences). Projects that are outside of these 5 areas must contact the Environmental Section of the UNC-Chapel Hill EHS Department for guidance and assistance.

(iii) City Water Quality Control

All projects must be reviewed by the UNC Facilities Department if a new connection is made to the sanitary sewer. The University holds a comprehensive permit for the main campus. Sewer connections cannot be made until the building permit documentation has been submitted to the UNC Facilities Department.

(iv) Decommissioning of Existing Facilities

Prior to completion of construction documents, contact the UNC-EHS Environmental Office to coordinate the preparation of a decommissioning plan.

Chemical removal and cleaning of surfaces must be completed before demolition can begin. Decontamination of concealed areas such as pipes, and under cabinets etc. must be coordinated with demolition activity.

All chemical waste and contaminated debris must be assessed by the UNC-EHS for hazard determination.

The Environmental Office will assist in identifying appropriate waste handling methods.

Hazardous waste must be managed according to all State and Federal regulations. All hazardous waste manifests must be signed by the Hazardous Waste Manager and shipped to UNC approved waste facilities.

(9) Additional Requirements for Laboratories using Radioactive Materials, Radiation Producing Machines, or Lasers

(a) Codes, Standards, and References

(i) Regulations:

(a) NC Radiation Control Regulations (15A NCAC 11)
(b) NC Radioactive Material License,
(c) Code of Federal Regulation (CFR) 10, Parts 20 and 35
(d) UNC-Chapel Hill Radiation Safety Manual (STIPULATED IN LICENSE)

(ii) University Policies:

Policies of the Administrative Panel on Radiological Safety

(iii) Recommendations:

NC Radiation Protection Section

"Safe Handling of Radioactive Materials," National Council on Radiation Protection (NBS Handbook 92)

"Safe Handling of Radionuclides," International Atomic Energy Agency (IAEA), Safety Series No. 1, (1973 ed. is still current as of 1999)

"Structural Shielding and Evaluation for Medical Use of X-rays and Gamma Rays of Energies up to 10 Me", National Council on Radiation Protection, Report No. 49

"Radiation Protection Design Guidelines for0.1-100MeV Particle Accelerators," National Council on Radiation Protection, Report No. 51, (NCRP51)

Guide for the Preparation of Application for Medical Use Programs, (Proposed Revision2 to Regulatory Guide 10.8, USNRC (NRC 10.8)

Guide for the Preparation of Applications for Type A Licenses of Broad Scope, 2nd Proposed

Revision 2 to Regulatory Guide 10.5, Revision 2, USNRC (NRC10.5)

"CRC Handbook of Laboratory Safety, 4th Ed." CRC Press 1995, (CRCLAB)

"Recommendations for the Safe Use Of LASERS," American National Standards Institute. (ANSI Z136.1)

(b) Scope

All radioactive materials used at UNC-Chapel Hill are governed by the terms and conditions of the UNC-Chapel Hill Radioactive Materials Licenses, issued by the Department of Environment and Natural Resources, Division of Environmental Health, Radiation Protection Section. All radiation producing devices are registered with the State of NC, Radiation Protection Section.

(c) Decommissioning of Existing Facilities Prior to Demolition or Renovation

Contact the Radiation Safety Office as early as possible (at least 120 days) before the planned initiation of construction. A plan for decommissioning must be prepared following the UNC EHS Guidelines for decommissioning. The laboratory must be cleared of all radioactive sources/contamination before demolition, renovation or construction can begin.

(d) Design Features for Radiological Labs

(i) Approval Process

Proposals for new facilities must be submitted to the Radiation Safety Office for review. New facilities may require the multiple approvals prior to construction.

NC Radioactive Material License

UNC-Chapel Hill Radiation Safety Manual

Shared facilities for the use of radioactive materials should not be included in plans for new buildings. If such facilities are deemed absolutely necessary, the facility must be under the direction, control and authority of a single principal investigator, who shall be accountable for maintaining the facility in a safe and orderly manner.

(ii) Architectural Considerations

Benches in laboratories must be capable of supporting weight of necessary shielding for gamma rays.

NBS Handbook 92

IAEA, Safe Handling of Radionuclides

When work involves gamma emitters (especially gamma irradiators) the floors and coatings must be able to support the gamma shielding.

NBS Handbook 92

IAEA, Safe Handling of Radionuclides

When applicable, lead shielding must be incorporated in the structure. Based on the proposed type and quantities of radioactive materials, the Radiation Safety Program will determine the need for the shielding.

Note that for x-ray producing machines, shielding calculations will be performed by the Radiation Safety Office. Shielding design is to be in accordance with all applicable State Regulations and NCRP and ANSI standards. Designs must be submitted to the State through the Radiation Safety Office. During construction the shielding must be

inspected by the Radiation Safety Office while walls are open. After completion, the effectiveness of the installed shielding and protective design features shall be evaluated by the Radiation Safety Office and required reports submitted to and accepted by the State prior to operation of the radiation producing machine.

NC Radiation Control Regulations

National Council on Radiation Protection, Report No. 49

NC Radioactive Material License

(iii) Security

Areas where radioactive materials or other radiation sources are used or stored shall be provided with adequate security (e.g., locks) to prevent removal or use by unauthorized personnel.

NC Radiation Control Regulations

UNC-Chapel Hill Radiation Safety Manual

High radiation areas or very high radiation areas (as defined in 10 CFR 20.1602-2) shall be equipped with means to prevent inadvertent access and restrict access to only authorized personnel. Means to reduce exposure levels in the area may be required via an interlock device. In some applications, means to monitor the radiation levels in the areas shall be provided.

NC Radiation Control Regulations

10 CFR 20.1601-2

High radiation areas or very high radiation areas (as defined in 10 CFR 20.1602-2) shall be equipped with a control device that energizes a conspicuous visible or audible signal so that an individual entering the area and the operator of the device are made aware of the entry.

NC Radiation Control Regulations

10 CFR 20.1601-2

(iv) Waste Storage

Adequate space must be available for radioactive wastes generated by projects within the lab. Most radioisotope projects will need about 10 sq. ft. of floor space for containers and shields within a lockable area. Radioactive wastes must be properly segregated by half-life categories.

UNC-Chapel Hill Radiation Safety Manual

(e) Ventilation Considerations

(i) Ventilation requirements for the laboratories utilizing radioactive materials are dependent upon the types of materials used. Facilities that use radioactive gases shall be equipped with ventilation to adequately maintain concentrations to below allowable occupational exposure levels and to not permit escape of the gas to adjacent non-use areas such that concentrations exceed those allowed for uncontrolled areas. These range from no special requirements to those requiring separate exhaust systems equipped with "panic button" shut down switches. The Radiation Safety Program will review the proposed uses and make specific recommendations appropriate for each facility.

10 CFR 20: Appendix B

UNC-Chapel Hill Radiation Safety Manual

Depending on the type and quantities of radioactive materials or the location of the facility, fume hoods used with volatile radioactive materials have specific design requirements. These are detailed in the Fume Hoods Section of this Design Guide.

(f) Laser Radiation Items

Class IIIb and IV Laser facilities must be equipped with adequate shielding (e.g. thermal curtains using materials approved by the University's Fire Marshall, window glass that does not transmit direct laser radiation or the specula or diffuse reflections of the laser radiation (shutters or filters)). Portals and viewing windows must be designed to prevent any exposure above the permissible threshold limit value.

ANSI Z136.1

CRC Handbook of Laboratory Safety, 4th Ed.

Class IIIb and Class IV laser facilities must in rooms secured by locks. Class IV laser installations must be provided with interlocked warnings that indicate the status of the laser prior to entering the facility.

ANSI Z136.1

Electrical outlets need to be positioned is such a manner that leakage of water coolant will not lead to risks of electrocution.

ANSI Z136.1

(g) Laser Ventilation Considerations

Appropriate ventilation to remove laser generated airborne contaminants must be provided for Class IIIb and IV lasers.

ANSI Z136.1

Gas cabinets and adequate ventilation must be provided to mitigate the hazards associated with excimer laser gases or other lasers using toxic gases.

ANSI Z136.1

(10) Biosafety Level 2 Laboratories

(a) Codes, Standards, and References

OSHA Blood borne Pathogens Standard

Biosafety in Microbiological and Biomedical Laboratories, 4th ed., pub #93-8395, CDC

National Fire Protection Association (NFPA) Standard 45, Fire Protection for Laboratories

The Centers for Disease Control and Prevention (CDC) and the National Institutes of Health (NIH),

Primary Containment for Biohazards: Selection, Installation and Use of Biological Safety Cabinets The Centers for Disease Control and Prevention (CDC) and the National Institutes of Health (NIH),

Guidelines for Research Involving Recombinant DNA Molecules, October 31, 1997, Federal Register, Vol. 62, No 211.

National Sanitation Foundation (NSF) International Standard 49

(b) Scope

All of the biological research conducted at UNC-Chapel Hill involves low to moderate risk

etiological agents as defined by the NIH. Section 1 of this Guide, General Requirements for UNC Laboratories, covers all design requirements for Biosafety Level 1 laboratory work areas. This section focuses primarily on the biosafety considerations for a Biosafety Level 2 laboratory. Proposed Biosafety Level 3 labs will be reviewed on a case by case basis depending on what biohazard material the principal investigator plans to use.

(i) Ventilation Considerations for Biosafety Level 2 Laboratories

Air pressure in laboratories and animal care rooms should be negative in relation to the corridor or adjacent non-laboratory areas. Rooms housing immunocompromised animals should be at a positive pressure with respect to adjoining areas. Consult with UNC EHS Office for design details.

CDC-NIH Biosafety in Microbiological and Biomedical Laboratories (ABSL 2, D.5)

Good Practice per UNC EHS

Potentially harmful aerosols can escape from the containment of the laboratory room unless the room air pressure is negative to adjacent non-laboratory areas. As a general rule, air should flow from low hazard to high hazard areas.

Dedicated sterile tissue culture rooms should be balanced neutral or slightly positive with respect to adjoining areas. Tissue culture rooms that involve the use of biohazardous agents shall be negative as stated in C-1 above.

Good Practice per UNC-Chapel Hill EHS

This will minimize the potential for possible contamination of experiments within these rooms.

An autoclave should be provided with a canopy hood with slotted exhaust or other suitable means of local exhaust. In addition, autoclave rooms should have a minimum of 10 air changes per hour.

Good Practice per UNC-Chapel Hill EHS

Unpleasant heat and odors will linger in the room unless provided with effective local exhaust and adequate frequency of air changes.

(c) Biological Safety Cabinets and Other Containment Considerations

(i) Approval/Type

All cabinets must be NSF listed, UL approved, and installed in accordance with the manufacturer's requirements.

Good Practice per UNC-Chapel Hill

Cabinets, which when used and installed properly, will provide both product and personnel protection. However, if the cabinet is not installed properly (e.g., not ducting a Class II, B2 cabinet), then it will not be serviceable. Installing a cabinet, which deviate from the listed NSF requirements, will void the NSF Standard 49 approved listing.

For Biosafety Level 2 applications involving toxic chemicals or radionuclides, a Class II- B type cabinet must be installed.

Good Practice per UNC-Chapel Hill EHS

Class II-B cabinets do not allow in-room venting of exhaust air and are thus appropriate for such uses. For Biosafety Level 2 applications,

fume hoods are not appropriate; a fume hood is not designed for the usage of biological materials. An appropriate biosafety cabinet must be used. The exact type of BSC should be specified early in the design process.

(ii) Location

Biological safety cabinets (BSCs) must be located away from doors and other high traffic areas.

NSF Standard 49, Annex E, I.A.1

Good Practice per UNC-Chapel Hill EHS

Currents of air can disrupt and degrade the protective capability of the cabinet. All attempts should be made to neutralize any interference.

A biosafety cabinet should not be installed directly opposite of another biosafety cabinet if spatial considerations allow otherwise.

NSF Standard 49, Appendix A

Good Practice per UNC-Chapel Hill EHS

Laminar airflow is greatly hindered by the operation of a biosafety cabinet located directly opposite of another biosafety cabinet or autoclave.

(iii) Restraints

When initially installed or reinstalled, biosafety cabinets must be provided with an appropriate means of seismic stabilization.

Good Practice per UNC-Chapel Hill EHS

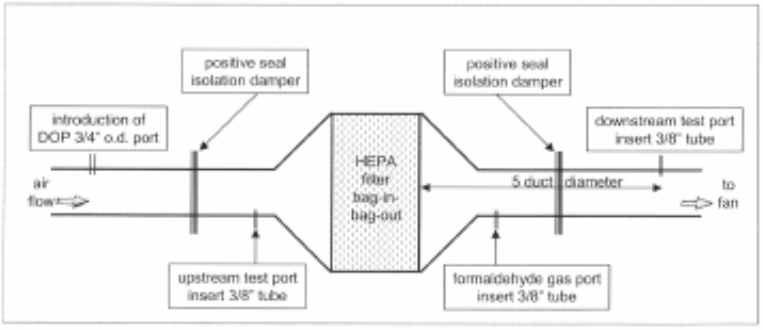
(Note: The manufacturer should always be consulted to avoid possible damage to the pressurized cabinet volumes.)

(iv) Testing

Biological safety cabinets are to be certified as part of the building contract.

Remote HEPA Filtration Units in ductwork

Remote HEPA filters must have provisions for testing and decontamination, with test ports before and after the HEPA, isolation dampers, and decontamination ports according to the drawing.



(v) Autoclaves

Laboratory designs must include an autoclave for sterilizing media, lab instruments, and medical waste as necessary.

CDC-NIH Biosafety in Microbiological and Biomedical Laboratories (BSL 2, D.6)

Guidelines for Research Involving Recombinant DNA Molecules (NIH Guidelines) App. G-II-B-4-f

An autoclave is required since heat and pressure can kill potentially infectious spores that resist other disinfectants. The autoclave need not be in the actual lab room, however should be available on the floor. The investigator policies must be to transport medical waste in leak proof containers (in a sealed approved autoclave bag) if the autoclave is not in the room. The potential microbiological culture waste must be disposed in a manner consistent with the UNC Biosafety Manual section on biohazardous waste.

(d) Additional Considerations for HIV/HBV Research Laboratories

HIV/HBV research laboratories shall have vacuum lines which are protected with liquid disinfectant traps and high efficiency particulate air (HEPA) filters or filters of equivalent or superior efficiency. (Note: Filters must be maintained and routinely replaced, as necessary).

Liquid disinfectant traps and HEPA filtered vacuum lines prevent inadvertent contamination resulting from a release or backflow of liquid HIV/HBV contamination through a laboratory vacuum line.

HIV/HBV research laboratories shall contain a facility for hand washing and an eyewash facility which is readily available within the work area.

Containment equipment such as a sink and eyewash will expedite personnel decontamination in the event of a splash or spill on the body. For information on the appropriate eyewashes that meet EHS approval, review Section 1.2, Emergency Eyewash and Safety Showers in this Guide.

(e) Glossary

(i) Biohazardous Materials: Infectious agents, the products of infectious agents, or the components of infectious agents presenting a risk of injury or illness.
(ii) Biosafety Level: Biosafety levels consist of laboratory practices and techniques, safety equipment, and a laboratory facility appropriate for the operations performed and the hazard posed by the particular biohazard material. The Centers for Disease Control (CDC) and the National Institute of Health (NIH) define the four biosafety levels in the publication, Biosafety in Microbiological and Biomedical Laboratories, 1988 and revisions, and recommend biosafety levels for particular pathogenic microorganisms.
(iii) Biosafety Cabinet1: A ventilated cabinet which serves as a primary containment device for operations involving biohazard materials. The three classes of biosafety cabinets are described below:
(iv) Class I Biosafety Cabinet: The Class I biosafety cabinet is an open-fronted negatively pressured ventilated cabinet with a minimum inward average face velocity at the work opening of at least 75 feet per minute. The exhaust air from the cabinet is filtered by a HEPA filter and discharged without recirculation.
(v) Class II Biosafety Cabinet: The Class II biosafety cabinet is an open-fronted, ventilated cabinet. Exhaust air is filtered with a high efficiency particulate air filter (HEPA). This cabinet provides HEPA-filtered downward airflow within the workspace. Class II Cabinets are further classified as type A1, A2, B1, and B2.

    (a) Class II, type A1 biosafety cabinets may have positive pressure contaminated internal ducts and may exhaust HEPA-filtered air back into the laboratory. The cabinet shall provide a minimum inward average face velocity of 75 feet per minute at the work opening.
    (b) Class II type A2 cabinets have all biologically contaminated internal ducts or plenums under negative pressure or surrounded by negative pressure ducts or plenums, exhaust HEPA filtered air through external ducts to space outside the laboratory, and have HEPA filtered down flow air that is a portion of the mixed down flow and inflow air from a common exhaust plenum.
    (c) Class II type B1 cabinets have all biologically contaminated internal ducts or plenums under negative pressure or surrounded by negative pressure ducts or plenums, exhaust HEPA filtered air through external ducts to space outside the laboratory, and have HEPA filtered down flow air composed largely of unrecirculated inflow air. Class II type B2 cabinets (also know as "total exhaust" cabinets) have all biologically contaminated internal ducts or plenums under negative pressure or surrounded by negative pressure ducts or plenums, exhaust HEPA filtered air through external ducts to space outside the laboratory, and have HEPA filtered down flow air drawn from the laboratory or outside air.

(vi) Class III Biosafety Cabinet: The Class III biosafety cabinet is a totally enclosed, negative pressure, ventilated cabinet of gas-tight construction. Operations within the Class III cabinet are conducted through protective gloves. Supply air is drawn into the cabinet

through high-efficiency particulate air filters. Exhaust air is filtered by two high efficiency particulate air filters placed in series or by high efficiency particulate air filtration and incineration, and discharged to the outdoor environment without recirculation.

(vii) Boiling Point: The temperature at which the vapor pressure of a liquid equals the surrounding atmospheric pressure. For purposes of defining the boiling point, atmospheric pressure shall be considered to be 14.7 PSIA (760 mm Hg). California Fire Code Section 203, 204

(viii) Carcinogen: A substance is considered to be a carcinogen if:

(a) It has been evaluated by the International Agency for Research on Cancer (IARC) Monographs and found to be a carcinogen or potential carcinogen; or
(b) It is listed as a carcinogen or potential carcinogen in the Sixth Annual Report on Carcinogens published by the National Toxicology Program (NTP) or,
(c) It is regulated by Fed/0OSHA or Cal/OSHA as a carcinogen

(ix) Combustible Liquid: A combustible liquid shall be defined as any liquid that has a closed-cup flash point at or above 100°F (37.8°C).

(a) Class II Liquid. Any liquid that has a flash point at or above 100°F (37.8°C) and below 140°F (60°C).
(b) Class IIIA Liquid. Any liquid that has a flash point at or above 140°F (60°C) but below 200°F (93°C).
(c) Class IIIB Liquid. Any liquid that has a flash point at or above 200°F (93°C).

(x) Compressed Gas:

(a) A gas or mixture of gases having a pressure exceeding 40 PSIA at 70□F in a container, or
(b) A gas or mixture of gases having a pressure exceeding 104 PSIA in a container at 130□F, regardless of the pressure at 70□F, or
(c) A liquid or mixture of liquids having a vapor pressure exceeding 40 PSIA at 100□F as EHS Design Guide Glossary

Revised: 10/02/00, Page3, determined by UFC Standard No. 9-5.

(xi) Containment: The combination of personal practices, procedures, safety equipment, laboratory design, and engineering features to minimize the exposure of workers to hazardous or potentially hazardous agents.

(xii) Control Area: A building or portion of a building within which the exempted amounts of hazardous materials are allowed to be stored, dispensed, used or handled.

(xiii) Corrosive: A substance that causes visible destruction of, or irreversible alterations in, living tissue by chemical action at the site of contact. For example, a substance is considered to be corrosive if, when tested on the intact skin of albino rabbits by the

method described by the U.S. Department of Transportation in Appendix A to 49 CFR Part 173, it destroys or changes irreversibly the structure of the tissue in 4 hours. This term does not refer to action on inanimate surfaces.

(xiv) Decontamination: Removal or destruction of infectious agents; removal or neutralization of toxic agents.

(xv) Emergency shower: A unit that enables a user to have flushing fluid cascading over the entire body.

(xvi) Explosive: A substance that causes a sudden, almost instantaneous release of pressure, gas, and heat when subjected to sudden shock, pressure, or high temperature.

(xvii) Eyewash: A device used to irrigate and flush the eyes.

(xviii) Flammable Anesthetic Gas: A compressed gas which is flammable and administered as an anesthetic including cyclopropane, divinyl ether, ethyl chloride, ethyl ether and ethylene.

(xix) Flammable Liquid: Any liquid that has a closed-cup flash point below 100°F (37.8°C).

(xx) Class I Liquid. Any liquid that has a closed-cup flash point below 100°F (37.8°C) and a Reid vapor pressure not exceeding 40 PSIA at 100°F (37.8°C).

(a) Class IA liquids shall include those liquids that have flash points below 73°F (22.8°C) and boiling points below 100°F (37.8°C).
(b) Class IB liquids shall include those liquids that have flash points below 73°F (22.8°C) and boiling points at or above 100°F (37.8°C).
(c) Class IC liquids shall include those liquids that have flash points at or above 73°F (22.8°C), but below 100°F (37.8°C).
(d) California Fire Code Section 207

(xxi) Flash Point: The minimum temperature of a liquid at which sufficient vapor is given off to form an ignitable mixture with air, near the surface of the liquid or within the vessel used.

(xxii) Fume Hood: A device enclosed on three sides, as well as the top and bottom, with an adjustable sash or fixed partial enclosure on the remaining side. They are designed, constructed and maintained so as to draw air inward by means of mechanical ventilation, and so that any operation involving hazardous materials within the enclosure does not require the insertion of any portion of a person's body other than the hands and arms into the work area. (Note: Laboratory fume hoods prevent toxic, flammable, or noxious vapors from entering the laboratory, present a physical barrier from chemical reactions, and serve to contain accidental spills.)

(xxiii) Hazardous Material: A material for which there is statistically significant evidence based on at least one study conducted in accordance with established scientific principles that acute or chronic health effects may occur in exposed employees. The term “health hazard” includes materials which are carcinogens, toxic or highly toxic agents, reproductive toxins, irritants, corrosives, sensitizers, hepatoxins, nephrotoxins, neurotoxins, agents that act on the hematopoietic systems, and agents which damage the lungs,

skin, eyes, or mucous membranes. The term "physical hazard" includes materials for which there is scientifically valid evidence that it is a combustible liquid, a compressed gas, cryogenic, explosive, flammable, an organic peroxide, an oxidizer, pyrophoric, unstable (reactive), or water-reactive.

(xxiv) Hazard Warning: Any words, pictures, symbols, or combination thereof appearing on a label or other appropriate form of warning that convey the health and physical hazards of the substance(s) present.

(xxv) Highly Toxic: A substance is considered to be highly toxic if:

(a) A substance that has a median lethal dose (LD50) of 50 milligrams or less per kilogram of body weight when administered orally to albino rats weighing between 200 and 300 grams each.
(b) A substance that has a median lethal dose (LD50) of 200 milligrams or less per kilogram of body weight when administered by continuous contact for 24 hours (or less if death occurs within 24 hours) with the bare skin of albino rabbits weighing between 2 and 3 kilograms each.
(c) A substance that has a median lethal dose (LD50) in air of 200 parts per million by volume or less of gas or vapor, or 2 milligrams per liter or less of mist, fume, or dust, when administered by continuous inhalation for 1 hour (or less if death occurs within 1 hour) to albino rats weighing between 200 and 300 grams each.

(xxvi) HIV/HBV Research Facility: A laboratory producing or using research laboratory scale amounts of HIV or HBV. Research laboratories may produce high concentrations of HIV or HBV but not in the volume found in production facilities.

(xxvii) Irritant: A substance, which is not corrosive, but which causes a reversible inflammatory effect on living tissue by chemical action at the site of contact. A substance is a skin irritant if, when tested on the intact skin of albino rabbits by the methods of 16 CFR 1500.41 for 24 hours exposure or by other appropriate techniques, it results in an empirical score of 5 or more. substance is an eye irritant if so determined under the procedure listed in 16 CFR 1500.42 or other appropriate techniques.

(xxviii) NIH: National Institute of Health

(xxix) Nonflammable Medical Gas: A compressed gas, such as oxygen or nitrous oxide, which is nonflammable and used for therapeutic purposes.

(xxx) Organic Peroxide: An organic compound that contains the bivalent -O-O- structure and which may be considered to be a structural derivative of hydrogen peroxide where one or both of the hydrogen atoms has been replaced by an organic radical.

(xxxi) Oxidizer: A substance, other than a blasting agent or explosive, that initiates or promotes combustion in other materials, thereby causing fire either of itself or through the release of oxygen or other gases.

(xxxii) Pyrophoric: A substance that will ignite spontaneously in air at a temperature of 1300 F (54.40 C) or below.

(xxxiii) Risk Levels:

(a) LOW RISK: risk level of agents and/or operations having minimal effect on personnel, other animal or plants under ordinary use. This classification is restricted to all etiologic agents designated as Biosafety Level 1 by the CDC.
(b) MODERATE RISK: risk level of agents/or operations requiring special conditions for control or containment because of (a) known pathogenicity to personnel, other animals or plants; (b) concentration; or (c) genetic alteration (synergistic effect) with other materials. This classification includes all etiologic agents designated as Class 2 or 3 by the CDC (Biosafety level 2 or 3) and oncogenic viruses specified as moderate risk by the National Cancer Institute (NCI).
(c) HIGH RISK: risk level of agents and/or operations requiring additional control measures beyond those for moderate risk. This classification includes all etiologic agents designated Class 4 or 5 by the CDC and oncogenic viruses classified as high risk by the NCI.

(xxxiv) Sensitizer: A substance that causes a substantial proportion of exposed people or animals to develop an allergic reaction in normal tissue after repeated exposure to the substance.

(xxxv) Toxic: A substance is considered to be toxic if:

(a) A substance that has a median lethal dose (LD50) of more than 50 milligrams per kilogram but not more than 500 milligrams per kilogram of body weight when administered orally to albino rats weighing between 200 and 300 grams each.
(b) A substance that has a median lethal dose (LD50) of more than 200 milligrams per kilogram but not more than 1000 milligrams per kilogram of body weight when administered by continuous contact for 24 hours (or less if death occurs within 24 hours) with the bare skin of albino rabbits weighing between two and three kilograms each.
(c) A substance that has a median lethal dose (LD50) in air of more than 200 parts per million but not more than 2000 parts per million by volume of gas or vapor, or more than 2 milligrams per liter but not more than 20 milligrams per liter of mist, fume, or dust, when administered by continuous inhalation for one hour (or less if death occurs within one hour) to albino rats weighing between 200 and 300 grams each. CCR, Title 24, Part 9, Section 221-T

(xxxvi) Unstable (reactive): A substance which in the pure state, or as produced or transported, will vigorously polymerize, decompose, condense, or will become self-reactive under conditions or shocks, pressure or temperature.

(xxxvii) Vapor Pressure: The pressure, measured in PSIA, exerted by a liquid. California Fire Code Section 223

(xxxviii) Water-reactive: A substance that reacts with water to release a gas that is either flammable or presents a health hazard.

(f) Codes, Standards, and References

OSHA Blood borne Pathogens Standard, 29 CFR 1910.1030

Biosafety in Microbiological and Biomedical Laboratories, 4th ed., pub #93-8395, CDC

National Fire Protection Association (NFPA) Standard 45, Fire Protection for Laboratories

The Centers for Disease Control and Prevention (CDC) and the National Institutes of Health (NIH),

Primary Containment for Biohazards: Selection, Installation and Use of Biological Safety Cabinets The Centers for Disease Control and Prevention (CDC) and the National Institutes of Health (NIH),

Guidelines for Research Involving Recombinant DNA Molecules (NIH Guidelines, April 2002,

National Sanitation Foundation (NSF)/ANSI International Standard 49, 2002

(g) Scope

Section 1 of this Guide, General Requirements for UNC Laboratories, covers all design requirements for Biosafety Level 1 laboratory work areas. This section focuses primarily on the biosafety considerations for a Biosafety Level 2 laboratory.

(i) Ventilation Considerations for Biosafety Level 2 Laboratories

Air pressure in laboratories and animal care rooms should be negative in relation to the corridor or adjacent non-laboratory areas. Rooms housing immunocompromised animals should be at a positive pressure with respect to adjoining areas. Consult with UNC EHS Office for design details.

CDC-NIH Biosafety in Microbiological and Biomedical Laboratories (ABSL 2, D.5)

Good Practice per UNC EHS

Potentially harmful aerosols can escape from the containment of the laboratory room unless the room air pressure is negative to adjacent non-laboratory areas. As a general rule, air should flow from low hazard to high hazard areas.

Dedicated sterile tissue culture rooms should be balanced neutral or slightly positive with respect to adjoining areas. Tissue culture rooms that involve the use of biohazardous agents shall be negative as stated above.

Good Practice per UNC-Chapel Hill EHS

This will minimize the potential for possible contamination of experiments within these rooms.

An autoclave should be provided with a canopy hood with slotted exhaust or other suitable means of local exhaust. In addition, autoclave rooms should have a minimum of 10 air changes per hour.

Good Practice per UNC-Chapel Hill EHS

Unpleasant heat and odors will linger in the room unless provided with effective local exhaust and adequate frequency of air changes.

(h) Biological Safety Cabinets and Other Containment Considerations

(i) Approval/Type

All cabinets must be NSF listed, UL approved, and installed and certified in accordance with the manufacturer's requirements and NSF/ANSI 49.

All cabinets must have a magnehelic gauge to indicate pressure drop across the HEPA filter.

Good Practice per UNC-Chapel Hill

Cabinets, which when used and installed properly, will provide both product, personnel and environmental protection. However, if the cabinet is not installed properly (e.g., not ducting a Class II, B2 cabinet), then it will not be serviceable. Installing a cabinet, which deviates from the listed NSF requirements, will void the NSF Standard 49 approved listing.

For Biosafety Level 2 applications involving minute quantities of volatile toxic chemicals or radionuclides, a Class II- B1 or B2 type cabinet must be installed.

For Biosafety Level 2 applications involving small quantities of volatile toxic chemicals or radionuclides, a Class II- B2 type cabinet must be installed.

Good Practice per UNC-Chapel Hill EHS

Class II-B cabinets do not allow in-room venting of exhaust air and are thus appropriate for such uses. For Biosafety Level 2 applications, fume hoods are not appropriate; a fume hood is not designed for the usage of biological materials. An appropriate biosafety cabinet must be used. The exact type of BSC should be specified early in the design process.

Type B cabinets must have audible and visible alarms that indicate a 20% loss of exhaust volume within 15 seconds. The internal cabinet fan must be interlocked to shut off at the same time the alarm activates.

NSF/ANSI Standard 49

Class II Type A cabinets shall not be ducted unless approved by EHS.

(ii) Location

Biological safety cabinets (BSCs) must be located away from doors, windows that open and other high traffic areas.

NSF Standard 49, Annex E, I.A.1

Good Practice per UNC-Chapel Hill EHS

Currents of air can disrupt and degrade the protective capability of the cabinet. All attempts should be made to neutralize any interference (i.e. room air supply diffusers, steam from autoclaves and dishwashers).

A biosafety cabinet should not be installed directly opposite of another biosafety cabinet or chemical fume hood if spatial considerations allow otherwise.

NSF Standard 49, Appendix A

Good Practice per UNC-Chapel Hill EHS

Laminar airflow is greatly hindered by the operation of a biosafety cabinet located directly opposite of another biosafety cabinet, chemical fume hood or autoclave.

Restraints

When initially installed or reinstalled, biosafety cabinets must be provided with an appropriate means of seismic stabilization.

Good Practice per UNC-Chapel Hill EHS

(Note: The manufacturer should always be consulted to avoid possible damage to the pressurized cabinet volumes.)

Testing

Biological safety cabinets are to be certified as part of the building contract.

Remote HEPA Filtration Units in ductwork

Remote HEPA filters must have provisions for testing and decontamination, with test ports before and after the HEPA, isolation dampers, and decontamination ports according to the drawing.

(iii) Autoclaves

Laboratory designs must include an autoclave for sterilizing media, lab instruments, and medical waste as necessary. The autoclave must have temperature and pressure readouts and a chart recorder.

CDC-NIH Biosafety in Microbiological and Biomedical Laboratories (BSL 2, D.6)

Guidelines for Research Involving Recombinant DNA Molecules (NIH Guidelines) App. G-II-B-4-f

NC Medical Waste Management Rules, Section .1200

An autoclave is required since heat and pressure can kill potentially infectious spores that resist other disinfectants. The autoclave need not be in the actual lab room, however should be available on the floor. The investigator policies must be to transport medical waste in leak proof containers (in a sealed approved autoclave bag) if the autoclave is not in the room. The potential microbiological culture waste must be disposed in a manner consistent with the UNC Biosafety Manual section on biohazardous waste.

BSL2 laboratories shall have vacuum lines which are protected with liquid disinfectant traps and high efficiency particulate air (HEPA) filters or filters of equivalent or superior efficiency. (Note: Filters must be maintained and routinely replaced, as necessary).

Liquid disinfectant traps and HEPA filtered vacuum lines prevent inadvertent contamination resulting from a release or backflow of liquid contamination through a laboratory vacuum line.

BSL2 laboratories shall contain a facility for hand washing and an eyewash facility which is readily available within the work area.

Containment equipment such as a sink and eyewash will expedite personnel decontamination in the event of a splash or spill on the body. For information on the appropriate eyewashes that meet EHS approval, review Section 1.2, Emergency Eyewash and Safety Showers in this Guide.

3. DESIGN GUIDELINES FOR FIRE SAFETY

Fire Lanes shall not be less than twenty feet wide.

Fire Lanes vertical clearance shall not be less than thirteen feet and six inches

Dead-end Fire Lanes in excess of 150 feet shall be provided with an approved area for turning around Fire Apparatus

The required turning radius for the Fire Trucks is 55 feet.

Markings and signs shall be provided for Fire Lanes

Fire lanes must be able to support the weight of the largest fire truck (86,000 pounds)

Fire alarm panels should not be put in closets that have other uses such as House Keepers and communication.

If the building has a sprinkler system or standpipe a PIV must provided

The purchase and installation of fire extinguishers shall be included as part of the cost of each project.

4. EROSION AND SOIL CONTROL (ESC) DESIGN GUIDELINES

a) Clearing Limits

(1) Clearing Limits: Contractors must establish clearing limits is to prevent disturbance of those areas of the project site that are not designated for clearing or grading. This is important because limiting site disturbance is the single most effective method for reducing erosion. Clearing limits may also be used to control construction traffic, thus reducing the disturbance of soil and limiting the amount of sediment tracked off site.
(2) When to Install: Clearing limits shall be installed by the contractor prior to clearing and/or grading of the site.
(3) Measures to Use: Clearing limits should be delineated with chain link fences. Fencing may be required at UNC-CH's discretion to control construction traffic or at any location where greater protection is warranted.
(4) Conditions of Use

(a) To establish clearing limits, a six foot-high (minimum) chain link fence must be used:
(b) At the boundary of sensitive areas, their buffers, and other areas required to be left unclear
(c) As necessary to control vehicle access to and on the site

(5) Design and Installation Specifications

(a) The fence shall be designed and installed according to manufacturer's specifications.
(b) The fence shall be at least six feet high with top rail and filter fabric screening.
(c) The fence shall not be wired or stapled to trees.

(6) Maintenance Requirements

If the fence has been damaged or visibility reduced, it shall be repaired or replaced immediately and visibility restored.

Disturbance of a sensitive area, sensitive area buffer or any other area required to be left undisturbed shall be reported to UNC-CH for resolution.

(7) Site Restoration

Fence holes in parking lots and sidewalks must be restored (filled) to their original condition.

b) Cover Measures

Temporary and permanent cover measures shall be provided by the contractor to protect disturbed areas. Temporary cover shall be installed if an area is to remain unworked for more than seven days. UNC-CH may reduce this time limit if site conditions warrant greater protection (e.g., adjacent to aquatic resources or highly erosive soils) or if a significant precipitation event (rainfall greater or equal to 0.5 inches) is expected. Any area to remain unworked for more than 30 days shall be seeded or sodded. Slopes and stockpiles 3H: 1V or steeper and with more than ten feet of vertical relief shall be covered if they are to remain unworked for more than 3 days. The material

necessary to cover all disturbed areas as required in this section must be stockpiled on site. The intent of these cover requirements is to have as much area as possible covered during any period of precipitation.

(1) When to install: Any exposed soils that will remain unworked for more than the time limit set in Cover Limits Requirement shall be covered by the contractor by the end of the working day. If the exposed area is to remain unworked for more than 30 days, the area shall be seeded with a seed mix that will provide rapid protection. If the disturbed area is to remain unworked for a year or more or the area has reached final grade, permanent seed mix shall be applied. The contractor shall install permanent cover within 7 days of reaching final grade.
(2) Measures to Use: Cover methods include the use of mulch, erosion control nets and blankets, plastic covering, seeding, and sodding. Mulch and plastic sheeting are primarily intended to protect disturbed areas for a short period of time, typically days to a few months. Seeding and sodding are measures for areas that are to remain unworked for months. Erosion nets and blankets are to be used in conjunction with seeding steep slopes. The choice of measures is left to the designer; however, there are restrictions on the use of these methods, which are listed in the "Conditions of Use" and the "Design and Installation Specifications" sections for each measure.

The methods listed are by no means exhaustive. Variations on the standards presented here are encouraged if other cost-effective products or methods provide substantially equivalent or superior performance. Also, the details of installation can, and should, vary with the site conditions.

(1) Mulching

(a) Purpose

The purpose of mulching soils is to provide immediate temporary protection from erosion. Mulch also enhances plant establishment by conserving moisture, holding fertilizer, seed, and topsoil in place, and moderating soil temperatures. There are an enormous variety of mulches that can be used. Only the most common types are discussed in this section.

(b) Conditions of Use

(i) As a temporary cover measure, mulch should be used:
(ii) On disturbed areas that require cover measures for less than 30 days
(iii) As a cover for seed during rainy periods and during the hot summer months
(iv) On slopes steeper than 3H: 1V with more than 10 feet of vertical relief.

(c) Design and Installation Specifications

For mulch materials, application rates and specifications see Table B.1. Note: Thicknesses may be increased for disturbed areas in or near sensitive areas for other areas highly susceptible to erosion.

Table B.1. Mulch Standards and Guidelines		
Mulch Material	Quality Standards	Application Rates
Straw	Air dried; free from undesirable seed and coarse material	2"-3" thick; 2-3 bales per 1000 SF or 2-3 tons per acre
Wood Fiber Cellulose	No growth inhibiting factors	Approx. 25-30 lbs per 1000 SF or 1000-1500 lbs per acre
Chipped Site Vegetation	Average size shall be several inches	2" minimum thickness

(d) Maintenance Standards

The thickness of the cover must be maintained.

Any areas that experience erosion shall be remulched and/or protected with a net or a blanket. If the erosion problem is drainage related, then the problem shall be fixed and the eroded area remulched.

(3) Nets and Blankets

(a) Purpose

Erosion control nets and blankets are intended to prevent erosion and hold seed and mulch in place on steep slopes and in channels so that vegetation can become well established. In addition, some nets and blankets can be used to permanently reinforce turf to protect drainage ways during high flows. Nets are strands of material woven into an open, but high-tensile strength net (for example, jute matting). Blankets are strands of material that are not tightly woven, but instead form a layer of interlocking fibers, typically held together by a biodegradable or photodegradable netting (for example, excelsior or straw blankets). They generally have lower tensile strength than nets, but cover the ground more completely. Coir (coconut fiber) fabric comes as both nets and blankets.

(b) Conditions of Use

Erosion control nets and blankets should be used

For permanent stabilization of slopes 2H: 1V or greater with more than 10 feet of vertical relief.

In conjunction with seed for final stabilization of a slope, not for temporary cover. However, they can be used for temporary applications as long as the product is not damaged by repeated handling. In fact, this method of slope protection is superior to plastic sheeting, which generates high-velocity runoff.

For drainage ditches and swales (highly recommended). The application of appropriate netting or blanket to drainage ditches and swales can protect bare soil from channelized runoff while vegetation is established. Nets and blankets also can capture a great deal of sediment due to their open, porous structure. Synthetic nets and blankets can be used to permanently stabilize channels and may provide a cost-effective, environmentally preferable alternative to riprap.

(c) Design and Installation Specifications

With the variety of products available, it is impossible to cover all the details of appropriate use and installation. Therefore, it is critical that the design engineer thoroughly consults the manufacturer's information and that a site visit takes place in order to insure that the product specified is appropriate. See Figures B.1 and B.2 for typical orientation and installation detail of nettings and blankets. Good ground contact must be achieved, or runoff can concentrate under the material, resulting in significant erosion.

Purely synthetic blankets are allowed but shall only be used for long-term stabilization of waterways. Organic blankets are better for slope protection and short-term waterway protection because they retain moisture and provide organic matter to the soil, substantially improving the speed and success of revegetation.

(d) Maintenance Standards

Good contact with the ground must be maintained, and there must not be erosion beneath the net or blanket.

Any areas of the net or blanket that is damaged or not in close contact with the ground shall be repaired or stapled.

If erosion occurs due to poorly controlled drainage, the problem shall be fixed and the eroded area protected.

Figure B.1 Waterway Installation

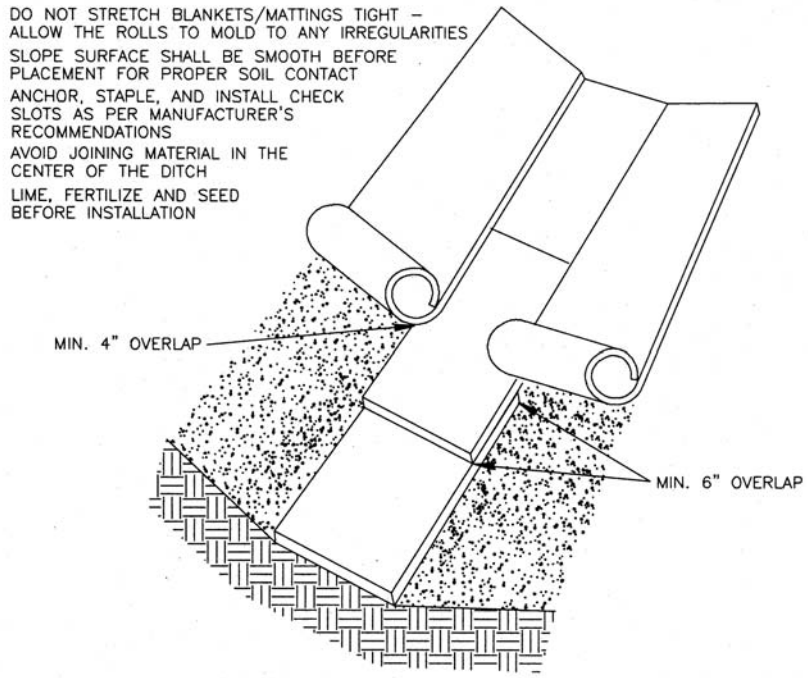
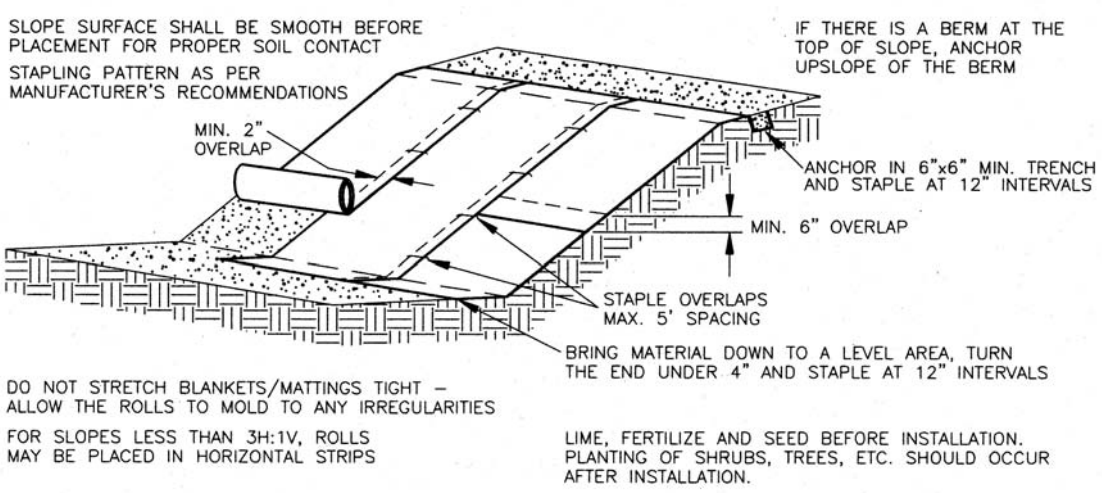


Figure B.2 Slope Installation



(4) Plastic Covering

(a) Purpose

Plastic covering provides immediate, short-term erosion protection to slopes and disturbed areas.

(b) Conditions of Use

Plastic covering may be used on disturbed areas that require cover measures for less than 30 days.

Plastic is particularly useful for protecting cut and fill slopes and stockpiles. Note: The relatively rapid breakdown of most polyethylene sheeting makes it unsuitable for long-term applications.

Due to rapid runoff caused by plastic sheeting, this method shall not be used upslope of areas that might be adversely impacted by concentrated runoff. Such areas include steep and/or unstable slopes.

Note: There have been many problems with plastic, usually attributable to poor installation and maintenance. However, the material itself can cause problems, even when correctly installed and maintained, because it generates high-velocity runoff and breaks down quickly due to ultraviolet radiation. In addition, if the plastic is not completely removed, it can clog drainage system inlets and outlets. It is highly recommended that alternatives to plastic sheeting be used whenever possible and that its use be limited

(c) Design and Installation Specifications (See Figure B.3 for details).

Plastic sheeting shall have a minimum thickness of 0.06 millimeters.

If erosion at the toe of a slope is likely, a gravel berm, riprap, or other suitable protection shall be installed at the toe of the slope in order to reduce the velocity of runoff.

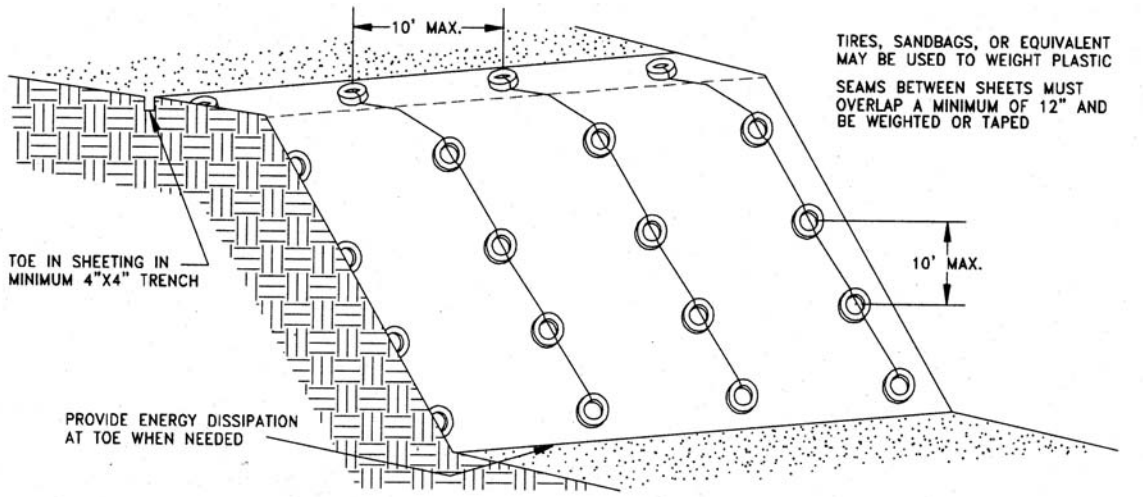
(d) Maintenance Standards for Plastic Covering

Torn sheets must be replaced and open seams repaired.

If the plastic begins to deteriorate due to ultraviolet radiation, it must be completely removed and replaced.

When the plastic is no longer needed, it shall be completely removed.

Figure B.3 Plastic Covering



(5) Temporary and Permanent Seeding

(a) Purpose

Seeding is intended to reduce erosion by stabilizing exposed soils. A well-established vegetative cover is on of the most effective methods of reducing erosion.

(b) Conditions of Use

Seeding shall be used throughout the project on disturbed areas that have reached final grade or that will remain unworked for more than 30 days.

Vegetation-lined channels shall be seeded.

Retention/detention ponds shall be seeded.

Mulching with seeding is required, because the mulch protects seeds from heat, moisture loss, and transport due to runoff.

(c) Design and Installation Specifications

During dry periods, irrigation may be required in order to grow adequate cover.

To prevent seed from being washed away, confirm that all required surface water control measures have been installed.

The seedbed should be firm but not compacted because soils that are well-compacted will not vegetate as quickly or thoroughly. Slopes steeper than 3H: 1V shall be surfaced roughened. Roughening can be accomplished in a variety

of ways, but the typical method is track walking, or driving a crawling tractor up and down the slope, leaving cleat imprints parallel to the slope contours.

In general, 10-20-20 N-P-K (nitrogen-phosphorus-potassium) fertilizer can be used at a rate of 90 pounds per acre. Slow release fertilizers are preferred because they are more efficient and have fewer environmental impacts. Disturbed areas within 200 feet of water bodies, streams, and wetlands must use slow-release low-phosphorus fertilizer (typical proportions 3-1-2 N-P-K).

Mulch is always required for seeding. Mulch can be applied on top of the seed or simultaneously by hydroseeding.

Hydroseeding is allowed as long as tackifier is included.

(d) Maintenance Standards for Temporary and Permanent Seeding

Any seeded areas that fail to establish at least 80 percent cover within one month shall be reseeded. If reseeding is ineffective, an alternate method, such as sodding or nets/blankets, shall be used.

After adequate cover is achieved, any areas that experience erosion shall be reseeded and protected by mulch. If the erosion problem is drainage related, the problem shall be fixed and eroded area reseeded and protected by mulch.

Seeded areas shall be supplied with adequate moisture, but not watered to the extent that it causes runoff.

(6) Sodding

(a) Purpose

The purpose of sodding is to establish permanent turf for immediate erosion protection and to stabilize drainage ways where concentrated overland flow will occur.

(b) Conditions of Use

Sodding may be used in the following areas:

(i) Disturbed areas that require short-term or long term cover
(ii) Disturbed areas that require immediate vegetative cover

All waterways that require vegetative lining (except biofiltration swales – the seed mix used in most sod is not appropriate for biofiltration swales). Waterways may also be seeded rather than sodded, and protected with a net or blanket.

(c) Design and Installation Specifications

Sod shall be free of weeds, of uniform thickness and shall have a dense root mat for mechanical strength.

The following steps are recommended for sod installation:

Shape and smooth the surface to final grade in accordance with the approved grading plan.

Amend two inches (minimum) of well-rotted compost into the top six inches of the soil if the organic content of the soil is less than ten percent. The compost should be high quality compost.

Fertilize according to the supplier's recommendations. Disturbed areas within 200 feet of water bodies, streams, and wetlands must use slow release low-phosphorus fertilizer.

Work lime and fertilizer 1 to 2 inches into the soil, and smooth the surface.

Lay strips of sod beginning at the lowest area to be sodded and perpendicular to the direction of water flow. Wedge strips securely into place. Square the ends of each strip to provide for a close, tight fit. Stagger joints at lease 12 inches. Staple on slopes steeper than 3H:1V.

Roll the sodded area and irrigate.

When sodding is carried out in alternating strips or patterns, seed the areas between the sods immediately after sodding.

(d) Maintenance Standards

If the grass is unhealthy, the cause shall be determined and appropriate action taken to reestablish a healthy groundcover. If it is impossible to establish a healthy groundcover due to frequent saturation, instability, or some other cause, the sod shall be removed, the area seeded with an appropriate mix, and protected with a net or blanket.

(i) Perimeter Protection: Perimeter protection to filter sediment from sheet wash shall be located down slope of all disturbed areas and shall be installed prior to upslope grading. Perimeter protection includes the use of vegetated strips as well as more conventional, constructed measures, such as silt fences. 50 linear feet of silt fence (and the necessary stakes) per acre of disturbed area must be stockpiled on site.
(ii) When to Install: Perimeter protection is to be installed by the contractor prior to any upslope clearing and grading.
(iii) Measures to Use: There are three perimeter protection measures in this section that can be used to satisfy perimeter protection requirements: silt fence, brush barriers, and vegetated strips. These measures can be used interchangeably. If surface water is collected by an interceptor dike or swale and routed to a sediment pond or trap, there is no need for the perimeter protection measures specified in this section.
(iv) Criteria for Use as Primary Treatment: At the boundary of a site, perimeter protection may be used as the sole form of treatment when the flow path meets the criteria below. If these criteria or not

met, perimeter protection shall only be used as a backup to a sediment trap or pond.

Average Slope	Slope Percent	Flow path Length
1.5H:1V or less	67% or less	100 feet
2H:1V or less	50% or less	115 feet
4H:1V or less	25% or less	150 feet
6H:1V or less	16.7% or less	200 feet
10H:1V or less	10% or less	250 feet

(7) Silt Fence

(a) Purpose

Use of a silt fence reduces the transport of coarse sediment from a construction site by providing a temporary physical barrier to sediment and reducing the runoff velocities of overland flow.

(b) Conditions of Use

Silt fence may be used down slope of all disturbed areas.

Silt fence is not intended to treat concentrated flows, nor is it intended to treat substantial amounts of overland flow. Any concentrated flows must be conveyed through the drainage system to a sediment trap or pond. The only circumstance, in which overland flow can be treated solely by a silt fence, rather than a sediment trap or pond, is when the area draining to the fence is small.

(c) Design and Installation Specifications

See Figure C.1 for details.

The geotextile used must meet the standards listed below. A copy of the manufacturer's fabric specifications must be available on site.

AOS (ASTM D4751)	30-100 sieve size (0.60-0.15 mm for slit film 50-100 sieve size (0.30-0.15 mm) for other fabrics
Water Permittivity (ASTM D4491)	0.02 sec-1 minimum
Grab Tensile Strength (ASTM D4632)	180 lbs. min. for extra strength fabric 100 lbs. min. for standard strength fabric
Grab Tensile Strength (ASTM D4632)	30% max
Ultraviolet Resistance (ASTM D4355)	70% min.

Standard strength fabric requires wire backing to increase the strength of the fence. Wire backing or closer post spacing may be required for extra strength if field performance warrants a stronger fence.

Where the fence is installed, the slope shall be no steeper than 2H:1V.

(d) Maintenance Standards

Any damage shall be repaired immediately.

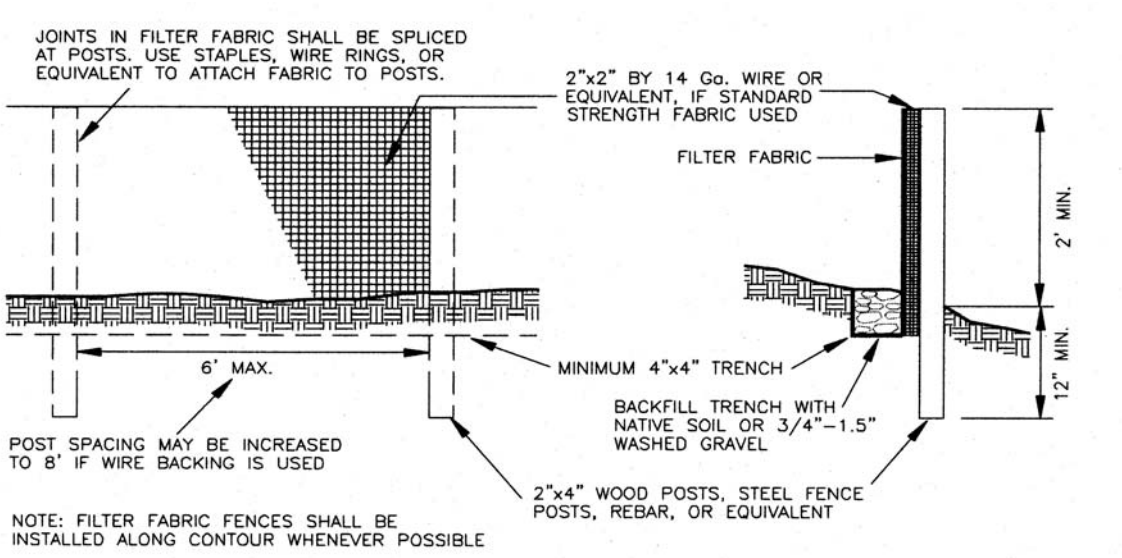
If concentrated flows are evident uphill of the fence, they must be intercepted and conveyed to a sediment trap or pond.

It is important to check the uphill side of the fence for signs of fence clogging and acting as a barrier to flow and the causing channelization of flows parallel to the fence. If this occurs, replace the fence or remove the trapped sediment.

Sediment must be removed when the sediment is 6 inches high.

If the filter fabric (geotextile) has deteriorated due to ultraviolet breakdown, it shall be replaced.

Figure C.1 Silt Fence



(8) Brush Barrier Purpose

The purpose of brush barriers is to reduce the transport of coarse sediment from a construction site by providing a temporary physical barrier to sediment and reducing the runoff velocities of overland flow.

(a) Conditions of Use

Brush barriers may be used down slope of all disturbed area.

Brush barriers are not intended to treat concentrated flows, nor are they intended to treat substantial amounts of overland flow. Any concentrated flows must be

conveyed through a drainage system to a sediment trap or pond. The only circumstance, in which overland flow can be treated solely by a barrier, rather than a sediment trap or pond, is when the area draining to the barrier is small (see "Criteria for Use as a Primary Treatment" in Section C).

(b) Design and Installation Specifications

See Figure C.2 for details.

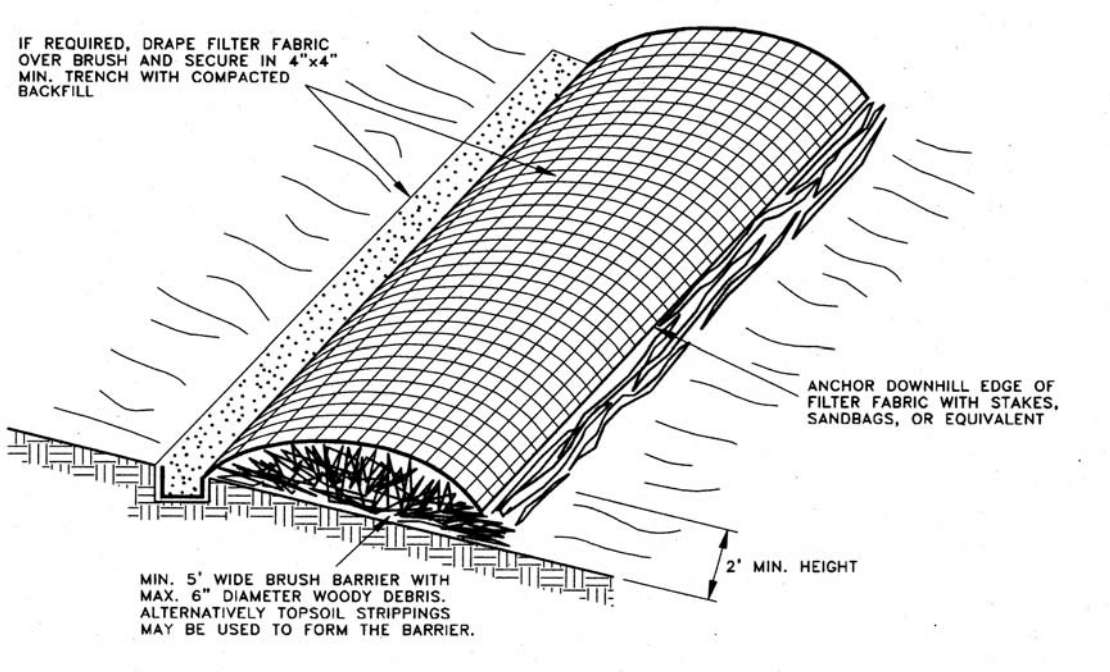
UNC-CH may require filter fabric (geotextile) anchored over the brush berm to enhance the filtration ability of the barrier.

(c) Maintenance Standards

There shall be no signs of erosion or concentrated runoff under or around the barrier. If concentrated flows are bypassing the barrier, it must be expanded or augmented by toed-in filter fabric.

The dimensions of the barrier must be maintained.

Figure C.2 Brush Barrier



(9) Vegetated Strip

(a) Purpose

Vegetated strips reduce the transport of coarse sediment from a construction site by providing a temporary physical barrier to sediment and reducing the runoff velocities of overland flow.

(b) Conditions of Use

Vegetated strips may be used down slope of all disturbed areas.

Vegetated strips are not intended to treat concentrated flows, nor are they intended to treat substantial amounts of overland flow. Any concentrated flows must be conveyed through a drainage system to a sediment trap or pond. The only circumstance, in which overland flow can be treated solely by a strip, rather than a sediment trap or pond, is when the area draining to the barrier is small (see "Criteria for Use as a Primary Treatment" in Section C).

(c) Designation and Installation Specifications

The vegetated strip shall consist of a 25-foot wide continuous strip of dense vegetation with permeable topsoil. Grass-covered, landscaped areas are generally not adequate because the volume of sediment overwhelms the grass. Ideally, vegetated strips shall consist of undisturbed native growth with a well developed soil that allows for infiltration of runoff.

The slope within the strip shall not exceed 4H:1V.

The uphill boundary of the vegetated strip shall be delineated with clearing limits as specified in Section A.

(d) Maintenance Standards

Any areas damaged by erosion or construction activity shall be seeded immediately and protected by mulch.

If more than 5 feet of the original vegetated strip width has had vegetation removed or is being eroded, sod must be installed.

If there are indications that concentrated flows are traveling across the buffer, surface water controls must be installed to reduce the flows entering the buffer, or additional perimeter protection must be installed.

c) Traffic Area Stabilization

Traffic Area Stabilization: Unsurfaced entrances, roads, and parking areas used by construction traffic shall be stabilized to minimize erosion and tracking of sediment off site. Roads and parking areas shall be stabilized immediately after initial grading.

When to Install: The construction entrance is to be installed by the contractor as the first step in clearing and grading. Construction road stabilization shall occur immediately after initial grading of the construction roads and parking areas.

Measures to Use: There are two types of traffic area stabilization: (1) a stabilized construction entrance and (2) construction road/parking area stabilization. Both measures must be used as specified under "Conditions of Use" for each measure.

(1) Stabilized Construction Entrance

(a) Purpose

Construction entrances are stabilized to reduce the amount of sediment transported onto paved roads by vehicles or runoff by constructing a stabilized pad of quarry spalls at entrances to construction site.

(b) Conditions of Use

Construction entrances shall be stabilized wherever traffic will be leaving a construction site and traveling on paved roads.

(c) Design and Installation Specifications

See Figure D.1 for details. Logging mats may also be used for stabilization. Also refer to Chapter III, Section A.10. "Tree Protection Guidelines".

A separation geotextile shall be placed under the spalls to prevent fine sediment from pumping up into the rock pad. The geotextile shall meet the following standards:

Grab Tensile Strength (ASTM D4751)	200 PSI min.
Grab Tensile Elongation (ASTM D4632)	30% max.
Mullen Burst Strength (ASTM D3786-80a)	400 PSI min.
AOS (ASTM D4751)	20-45 (U.S. standard sieve size)

Hog fuel wood mulch may be substituted for or combined with quarry spalls in areas that will not be used for permanent roads. The effectiveness of hog fuel is highly variable, but it has been used successfully on many sites. It generally requires more maintenance than quarry spalls. The inspector may at any time require the use of quarry spalls if the hog fuel is not preventing sediment from being tracked onto pavement or if the hog fuel is being carried onto pavement. Hog fuel is prohibited in permanent roadbeds because organics in the subgrade soils cause difficulties with compaction.

Fencing (see Section A) shall be installed as necessary to restrict traffic to construction entrance.

Whenever possible, the entrance shall be constructed on a firm, compacted subgrade. This can substantially increase the effectiveness of the pad and reduce the need for maintenance.

(d) Maintenance Standards

Quarry spalls (or hog fuel) shall be added if the pad is no longer in accordance with specifications.

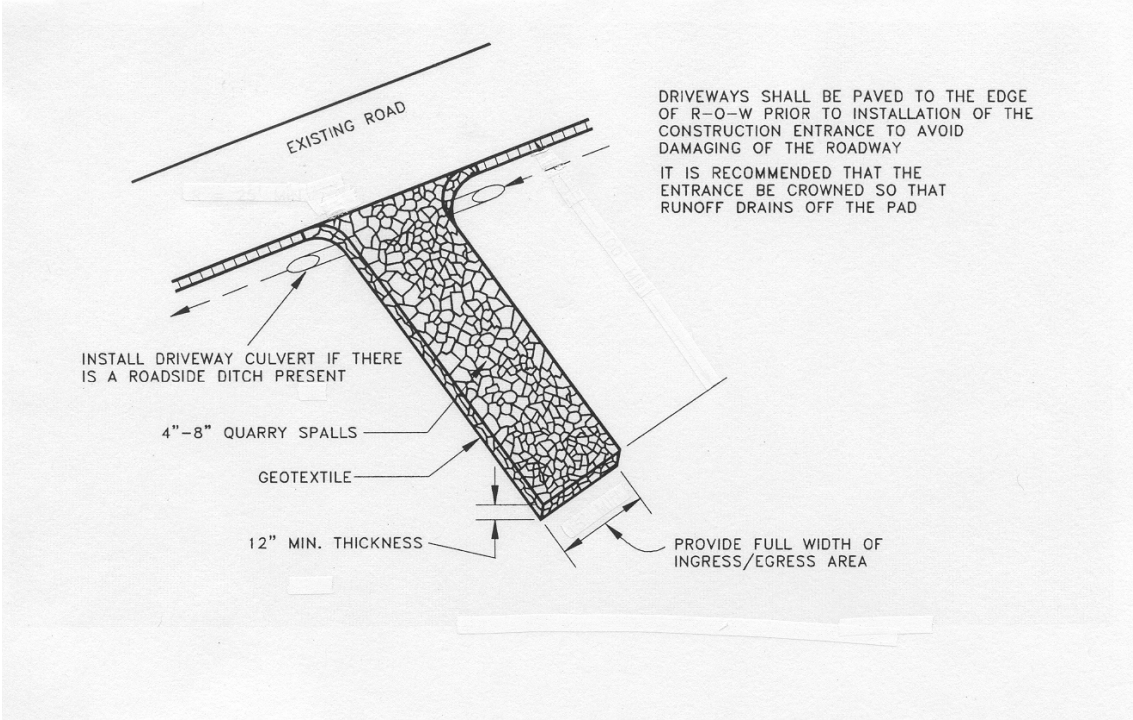
If the entrance is not preventing sediment from being tracked onto pavement, than alternative measures to keep the streets free of sediment shall be used. This may include street sweeping, an increase in the dimensions of the entrance, or the installation of a wheel wash. If washing is used, it shall be done on an area covered with crushed rock, and wash water shall drain to a sediment trap or pond.

Any sediment that is tracked onto pavement shall be removed immediately by sweeping. The sediment collected by sweeping shall be removed or stabilized on site. The pavement shall not be cleaned by washing down the street, except when sweeping is ineffective and there is no threat to public safety. If it is necessary to wash the streets, the construction of a small sump shall be constructed. The sediment can then be washed into the sump. Water from the sump can then be pumped to a sediment trap or pond.

Any quarry spalls that are loosened from the pad and end up on the roadway shall be removed immediately.

If vehicles are entering or exiting the site at points other than the construction entrances(s), fencing (see Section A) shall be installed to control traffic.

Figure D.1 Stabilized Construction Entrance



(2) Construction Road/Parking Area Stabilization

(a) Purpose

Stabilizing roads, parking areas, and other onsite vehicle transportation routes immediately after grading reduces erosion caused by construction traffic or runoff.

(b) Conditions of Use

Roads or parking areas shall be stabilized wherever they are constructed, whether permanent or temporary, for use by construction traffic.

Fencing (see Appendix A) shall be installed, if necessary, to limit the access of vehicles to only those roads and parking areas that are stabilized.

(c) Design and Installation Specifications

A 6-inch depth of 2- to 4-inch crushed rock, gravel base, or crushed surfacing base course shall be applied immediately after grading or utility installation. A 4-inch course of asphalt treated base (ATB) may also be used, or the road/parking area may be paved. If the area will not be used for permanent roads, parking areas, or structures, a 6-inch depth of hog fuel wood mulch may also be used, but this is likely to require more maintenance. Whenever possible, construction roads and parking areas shall be placed on a firm, compacted subgrade.

Temporary road gradients shall not exceed 15 percent. Roadways shall be carefully graded to drain transversely. Drainage ditches shall be provided on each side of the roadway in the case of a crowned section, or on one side in the case of a super-elevated section. Drainage ditches shall be designed in accordance with the standards given in Appendix F and directed to a sediment pond or trap.

In order to control construction traffic, UNC-CH can require that signs be erected on site informing construction personnel that vehicles, other than those performing clearing and grading, are restricted to stabilized areas.

(d) Maintenance Standards
(e) Crushed rock, gravel base, hog fuel, etc. shall be added as required to maintain a stable driving surface and to stabilize any areas that have eroded.

d) Sediment Retention

Surface water collected from disturbed areas of the site shall be routed through a sediment pond or trap prior to release from the site. An exception is for areas at the perimeter of the site with drainage areas small enough to be treated solely with perimeter protection (see Appendix C). Protection of catch basins is required for inlets that are likely to be impacted by sediment generated by the project and that does not drain to an onsite sediment pond or trap. Sediment retention facilities shall be installed by the contractor prior to grading of any contributing area.

Purpose: The purpose of sediment retention facilities is to remove sediment from runoff generated from disturbed areas.

When to Install: The facilities shall be constructed as the first step in the clearing and grading of the site. The surface water conveyances can then be connected to the facilities as site development proceeds.

Measures to Use: All runoff from disturbed areas must be routed through a trap or pond except for very small areas as specified in Appendix C. Catch basin protection is only to be used in limited circumstances and is not a primary sediment treatment facility. It is only intended as a backup in the event of failure of other onsite systems.

Selection of the Design Storm: Sediment ponds shall be designed and constructed such that the pond will have a settling efficiency of at least 70% for the 40 micron (0.04 mm) size soil particle transported into the basin by the runoff of the 2-year storm which produces the maximum peak rate of runoff. The peak rate of runoff shall be calculated according to procedures in the USDA's National Engineering Field Manual for Conservation Practices or according to procedures adopted by any other agency of the State of North Carolina or the United States or any generally recognized organization or association.

(1) Sediment Trap

(a) Purpose

Sediment traps remove sediment from runoff originating from disturbed areas of the site. Sediment traps are typically designed to only remove sediment as small as medium silt (0.04 mm), as a consequence, they usually only result in a small reduction in turbidity.

(b) Conditions of Use

A sediment trap shall be used where the contributing drainage area is 3 acres or less.

(c) Design and Installation Specifications

See Figure E.1 for details.

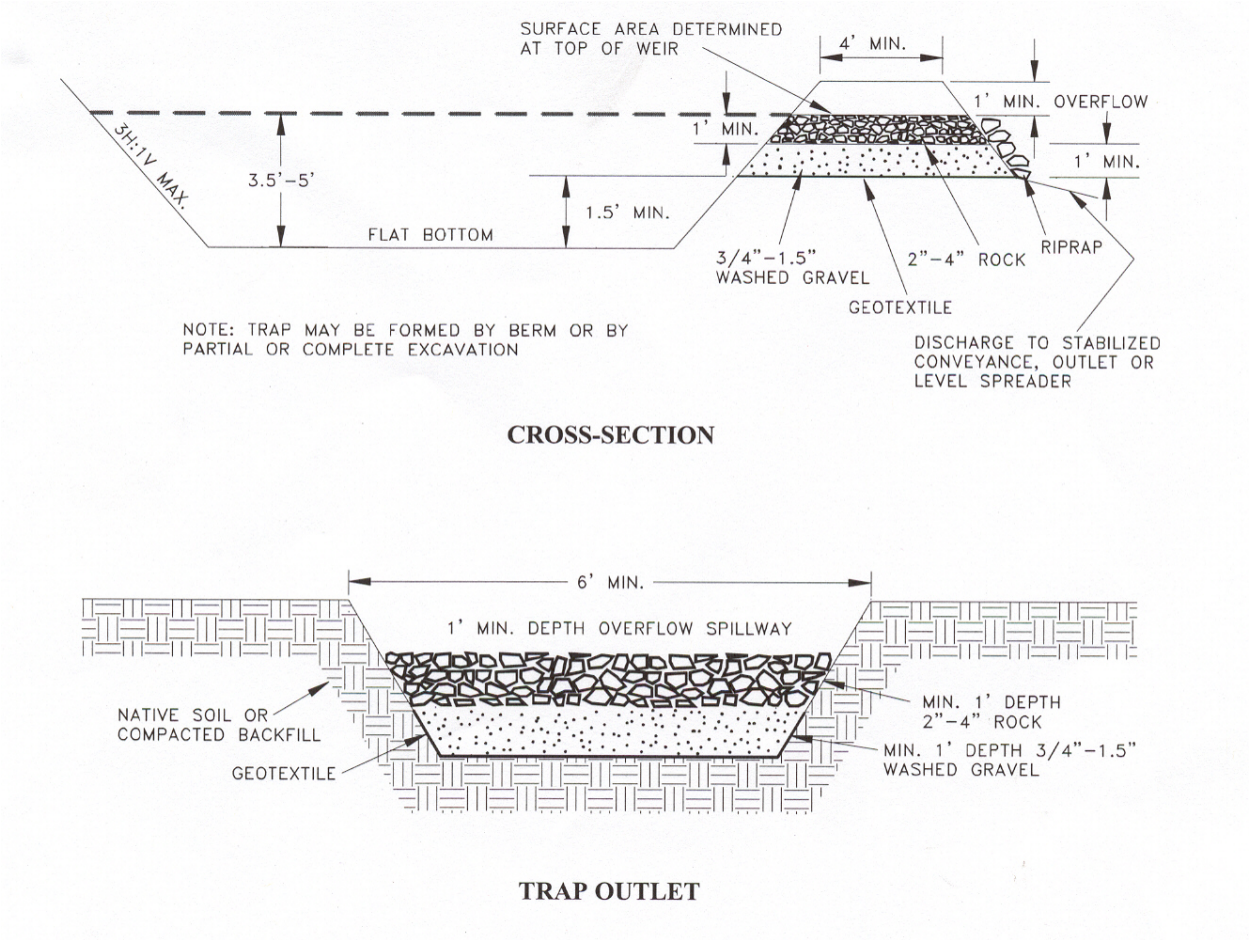
To aid in determining sediment depth, all traps shall have a staff gage with a prominent mark one foot above the bottom of the trap.

(d) Maintenance Standards

Sediment shall be removed from the trap when it reaches 1 foot in depth.

Any damage to the trap embankments or slopes shall be repaired.

Figure E.1 Sediment Trap



(2) Sediment Pond

(a) Purpose

Sediment ponds remove sediment from runoff originating from disturbed areas of the site. Sediment ponds are typically designed to only remove sediment as small as medium silt (0.04 mm). As a consequence, they usually reduce turbidity only slightly.

(b) Conditions of Use

A sediment pond shall be used where the contributing drainage area is 3 acres or more.

(c) Design and Installation Specifications

See Figures E.2, E.3, and E.4 for details.

Depth shall be a minimum of 3.5-foot from top of riser to bottom of pond.

Slopes shall not exceed a maximum 3:1 interior side slopes and maximum 2:1 exterior slopes. The interior slopes can be increased to a maximum of 2:1 if fencing is provided at or above the maximum water surface.

The pond shall have one foot of freeboard between the top of the riser and the crest of the emergency spillway and the spillway shall be a minimum of one foot deep.

Length-to-width ratio of the pond shall be between 3:1 and 6:1.

The vertical, perforated tubing connected to the dewatering orifice must be at least 2 inches larger in diameter than the orifice to improve flow characteristics. The size and number of perforations in the tubing should be large enough so that the tubing does not restrict flow. The flow rate should be controlled by the orifice.

The pond shall be divided into two roughly equal volume cells by a permeable divider that will reduce turbulence while allowing movement of water between cells. The divider shall be at least one-half the height of the riser and a minimum of one foot below the top of the riser. Wire-backed, 2- to 3-foot high, extra strength filter fabric (see Section 4.3.1) supported by treated 4x4s can be used as a divider. Alternatively, staked straw bales wrapped with filter fabric (geotextile) may be used.

If the pond is more than 6 feet deep, a different mechanism must be proposed. A riprap embankment is one acceptable method of separation for deeper ponds. Other designs that satisfy the intent of this provision are allowed as long as the divider is permeable, structurally sound, and designed to prevent erosion under or around the barrier.

To aid in determining sediment depth, one-foot intervals shall be prominently marked on the riser.

(d) Maintenance Standards

Sediment shall be removed from the pond when it reaches 1 foot in depth.

Any damage to the pond embankments or slopes shall be repaired.

Figure E.3 Sediment Pond Cross Section

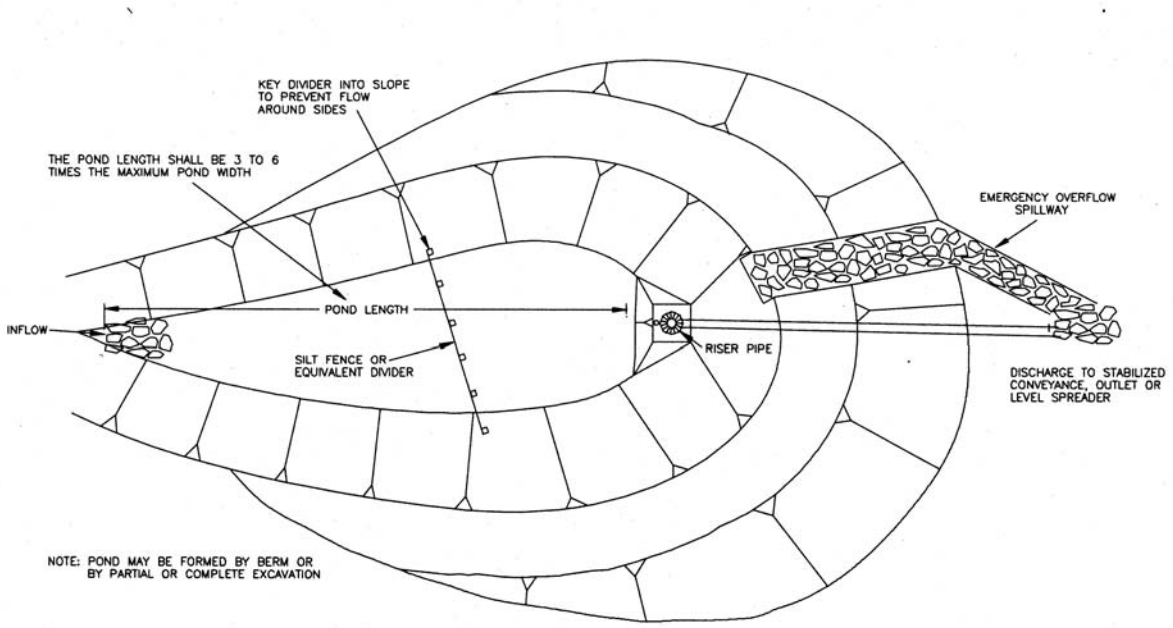


Figure E.3 Sediment Pond Cross Section

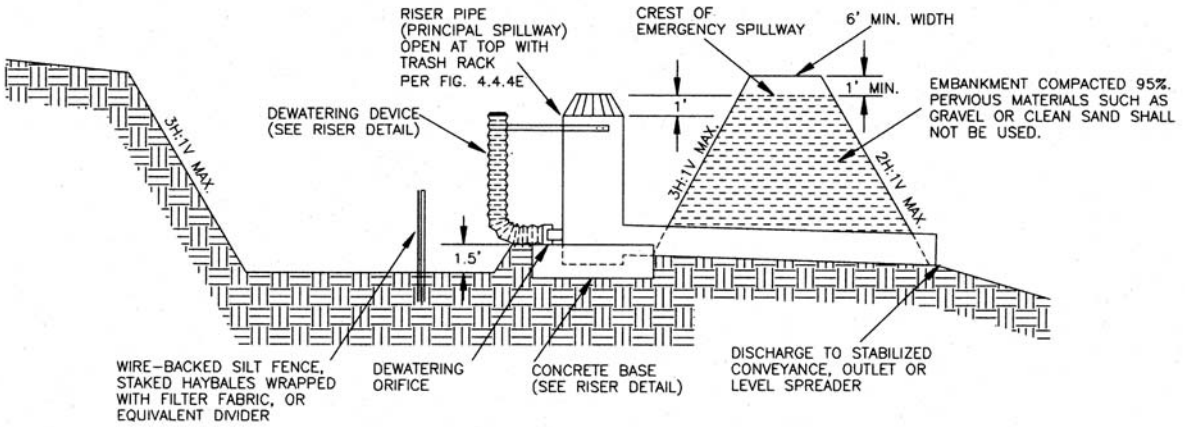
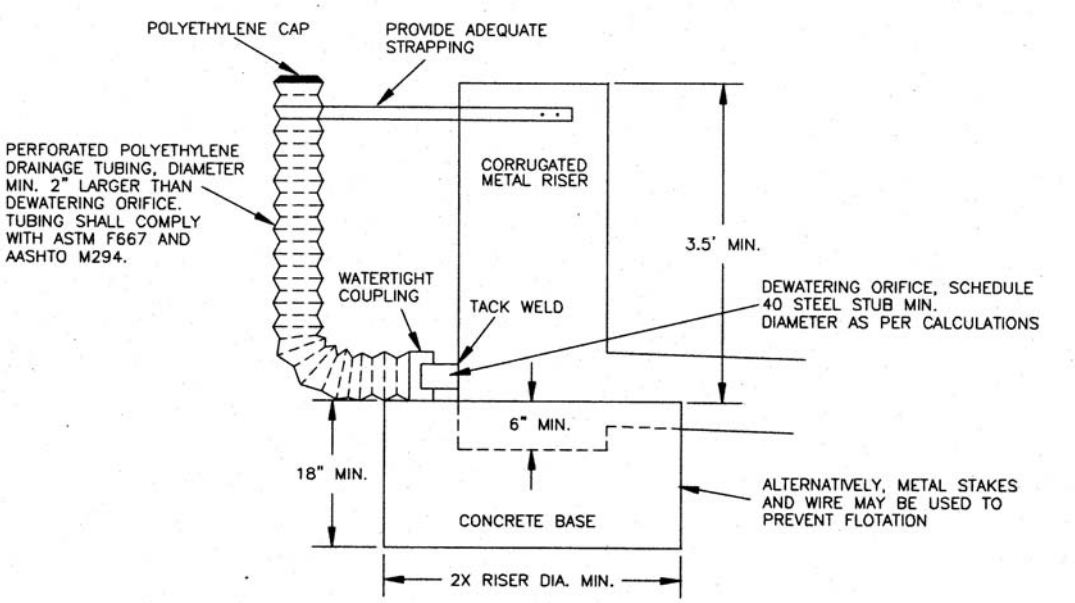


Figure E.4 Sediment Pond Riser Detail



(3) Storm Drain Inlet Protection

(a) Purpose

Storm drain inlets are protected to prevent coarse sediment from entering storm drainage systems.

(b) Conditions of Use

Protection shall be provided for all storm drain inlets down slope and within 500 feet of a disturbed or construction area, unless the runoff that enters the catch basin will be conveyed to a sediment pond or trap.

Inlet protection may be used anywhere at the designer's discretion to protect the drainage system. This will, however, require more maintenance, and it is highly likely that the drainage system will still require some cleaning.

(c) Design and Installation Specifications

There are two options for protecting storm drain inlets: filter fabric protection and catch basin inserts. Filter fabric protection (see Figure E.5) is filter fabric (geotextile) placed over the grate. Catch basin inserts (see Figure E.6) are manufactured devices that nest inside a catch basin. Both options are much simpler to maintain than many other methods of storm drain inlet protection and are not a hazard to traffic. Both options provide adequate protection, but filter fabric is likely to result in ponding of water above the catch basin, while the insert will not. Thus, filter fabric is only allowed where ponding will not be a traffic concern and where slope erosion will not result if the curb is overtopped by ponded water.

Trapping sediment in the catch basins is unlikely to improve the water quality of runoff if it is treated in a pond or trap because the coarse particles that are trapped at the catch basin settle out very quickly in the pond or trap. Catch basin protection normally only improves water quality where there is no treatment facility downstream. In these circumstances, catch basin protection is an important last line of defense. It is not, however, a substitute for preventing erosion.

The traditional method of catch basin protection has been placement of filter fabric under the grate of the catch basin. This method is very difficult to maintain, leads to ponding, and can cause substantial erosion because curbs can be overtopped, and concentrated runoff then erodes slopes. The placement of filter fabric under grates is therefore prohibited and the use of filter fabric over grates is strictly limited and discouraged.

It is sometimes possible to construct a small sump around the catch basin before final surfacing of the road. This is allowed because it can be a very effective method of sediment control.

(d) Maintenance Standards

Any accumulated sediment on or around the filter fabric protection shall be removed immediately. Sediment shall not be removed with water, and all sediment must be disposed of as fill on site or hauled off site.

Any sediment in the catch basin insert shall be removed when the sediment has filled one-third of the available storage. The filter media for the insert shall be cleaned or replaced at least monthly.

Regular maintenance is critical for both forms of catch basin protection. Unlike many forms of protection that fail gradually, catch basin protection will fail suddenly and completely if not maintained properly.

Figure E.5 Filter Fabric Protection

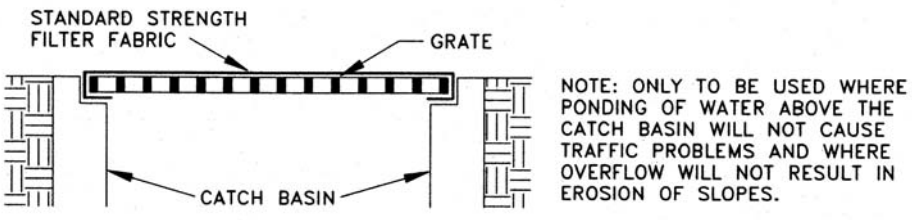
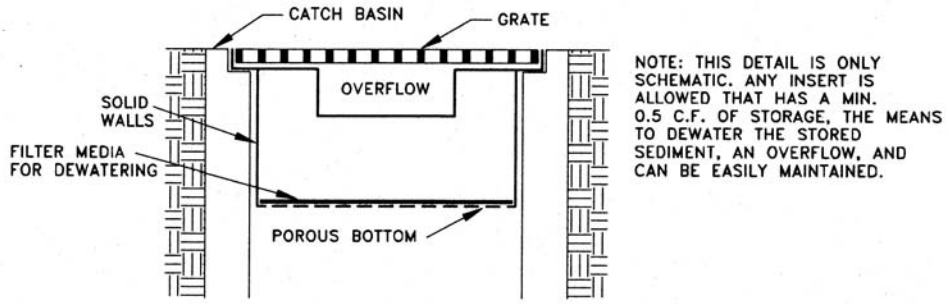


Figure E.6 Catch Basin Insert

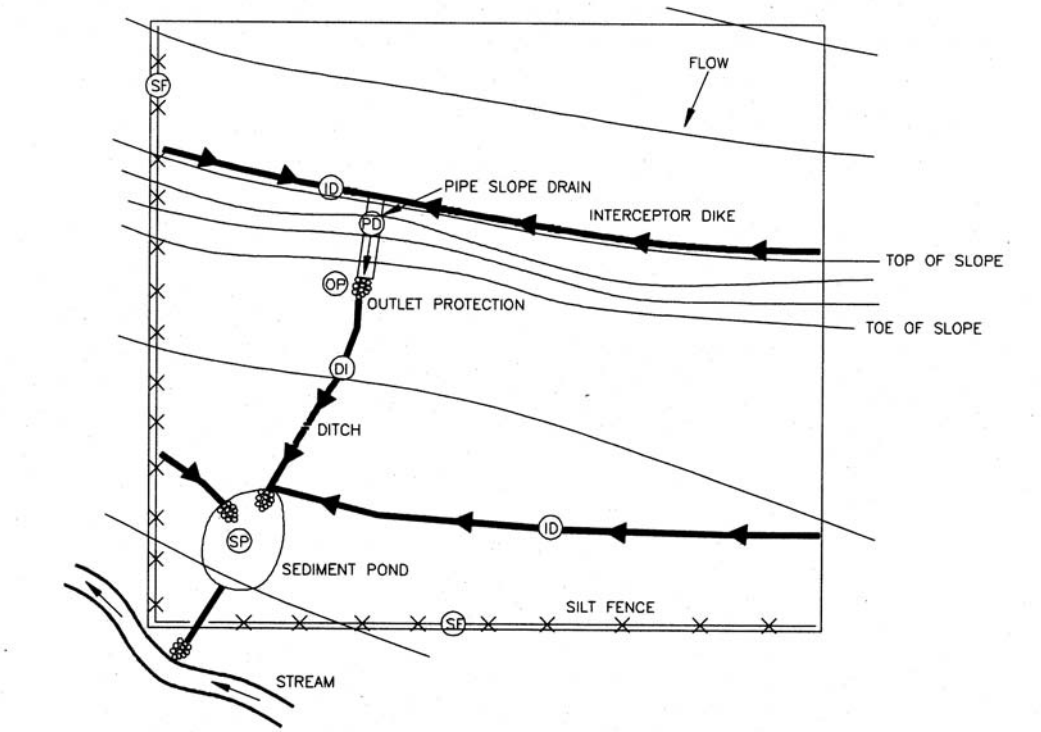


(4) Surface Water Control

All surface water from disturbed areas shall be intercepted, conveyed to a sediment pond or trap, and discharged down slope of any disturbed areas. An exception is for areas at the perimeter of the site with drainage areas small enough to be treated solely with perimeter protection (see Appendix C). Also, if the soils and topography are such that no offsite discharge of surface water is anticipated up to and including the developed 2-year runoff event, surface water controls are not required. Significant sources of upslope surface water that drain onto disturbed areas shall be intercepted and conveyed to a stabilized discharge point down slope of the disturbed areas. Surface water controls shall be installed concurrently with rough grading.

(a) When to Install: Surface water controls shall be constructed by the contractor during the initial grading of an area and must be in place before there is any opportunity for storm runoff to cause erosion.
(b) Measures to Install: Interceptor dikes/swales intercept runoff, ditches and pipe slope drains convey the runoff, and riprap or level spreaders help release the runoff in a non-erosive manner. Each measure is to be used under different circumstances so there is very little overlap. However, the two options for releasing water in a non-erosive manner, outlet protection and level spreaders, can be somewhat interchangeable. See Figure F.1 for a schematic drawing demonstrating the use of these measures.

Figure F.1 Sketch Plan of Surface Water Controls



(5) Interceptor Dike or Swale

(a) Purpose

Interceptor dikes and swales intercept storm runoff from drainage areas on or above disturbed slopes and convey it to a sediment pond or trap. They can also be used to intercept runoff from undisturbed areas and convey the runoff to a point below any exposed soils. Interception of surface water reduces the possibility of slope erosion. Interceptor dikes and swales differ from ditches in that they are intended to convey smaller flows along low-gradient drainage ways to larger conveyance systems such as ditches or pipe slope drains.

(b) Conditions of Use

Interceptor dikes and swales are required in the following situations:

At the top of all slopes in excess of 3H: 1V and with more than 20 feet of vertical relief.

At intervals on any slope that exceeds the dimensions specified in this section for the horizontal spacing of dikes and swales.

(c) Design and Installation Specifications

See Figure F.2 for details of an interceptor dike and Figure F.3 for an interceptor swale.

Interceptor dikes and swales shall be spaced horizontally as follows:

Average Slope	Slope Percent	Flow path Length
20H:1V or less	3-5%	300 feet
(10 to 20)H:1V	5-10%	200 feet
(4 to 10)H:1V	10-25%	100 feet
(2 to 4)H:1V	25-50%	50 feet

For slopes steeper than 2H: 1V with more than 10 feet of vertical relief, benches may be constructed or closer spaced interceptor dikes or swales can be used. Whichever measure is chosen, the spacing and capacity of the measures must be designed by the engineer and the design must include provisions for effectively intercepting the high velocity runoff associated with steep slopes.

If the dike or swale intercepts runoff from disturbed areas, it shall discharge to a stable conveyance system that routes the runoff to a sediment pond or trap (see Appendix E). If the dike or swale intercepts runoff that originates from undisturbed areas, it shall discharge to a stable conveyance system that routes the runoff down slope of any disturbed areas and releases the water at a stabilized outlet.

Construction traffic over temporary dikes and swales shall be minimized.

(d) Maintenance Standards

Damage resulting from runoff or construction activity shall be repaired immediately.

If the facilities do not regularly retain storm runoff, the capacity and/or frequency of the dikes/swales shall be increased.

Figure F.2 Interceptor Dike

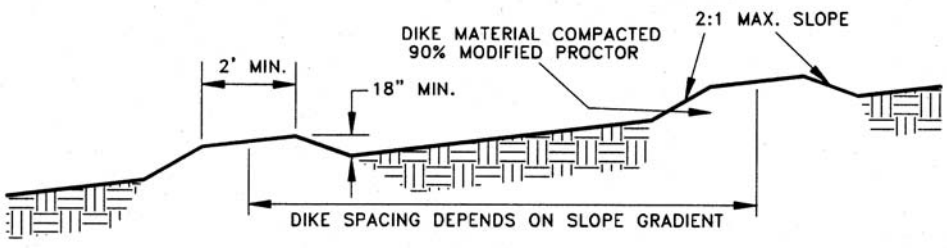
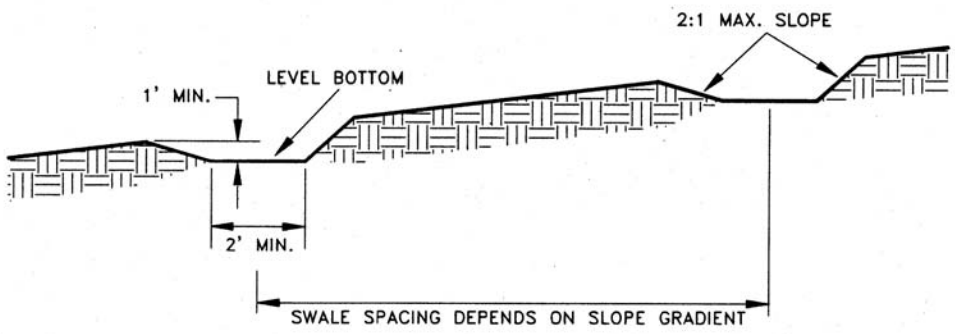


Figure F.3 Interceptor Swale



(6) Pipe Slope Drain

(a) Purpose

Pipe slope drains are designed to carry concentrated runoff down steep slopes without causing erosion, or saturation of slide-prone soils.

(b) Conditions of Use

Pipe slope drains may be used on any slope with a gradient of 2H: 1 V or greater and with at least 10 feet of vertical relief.

Rock-lined ditches or other permanent, non-erosive conveyances may also be used to convey runoff down steep slopes that are not steep slope hazard areas.

(c) Design and Installation Specifications

See Figure F.4 for details.

The capacity for temporary drains shall be sufficient to handle the peak flow from a developed 10-year runoff event.

The maximum drainage area allowed for any sized pipe is 10 acres. For larger areas, more than one pipe shall be used or a rock-lined channel shall be installed

The soil around and under the pipe and entrance section shall be thoroughly compacted.

The flared inlet section shall be securely connected to the slope drain and be fused or welded, or have flange-bolted mechanical joints to ensure a watertight seal.

Slope drains shall be continuously fused, welded, or flange-bolted mechanical joint pipe systems with proper anchoring to the soil.

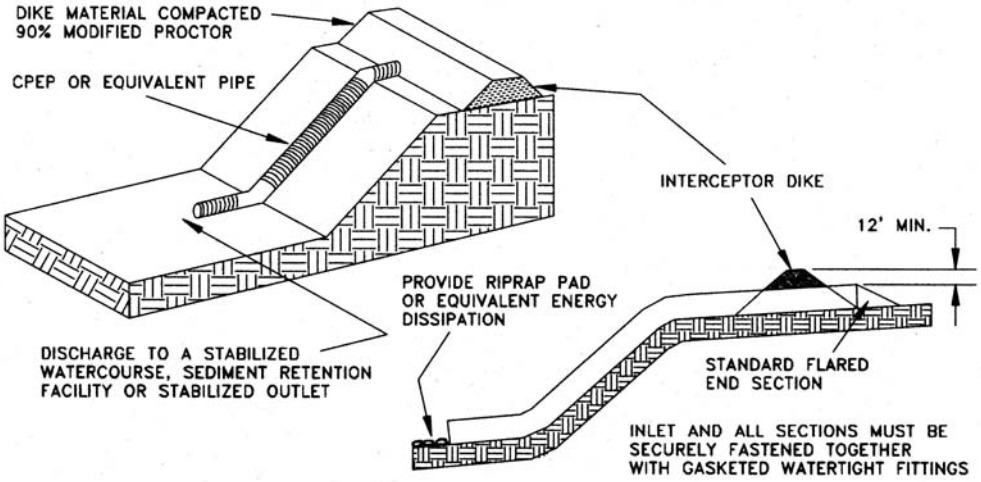
If the pipe slope drain will convey sediment-laden runoff, the runoff must be directed to a sediment retention facility (see Appendix E). If the runoff is not from a disturbed area or is conveyed from a sediment trap or pond, it must be conveyed to a stabilized discharge point.

(d) Maintenance Standards

The inlet shall not be undercut or bypassed by water. If there are problems, the head wall shall be appropriately reinforced.

No erosion shall occur at the outlet point. If erosion occurs, additional protection shall be added.

Figure F.4 Pipe Slope Drain



(7) Ditches

(a) Purpose

Ditches convey intercepted runoff from disturbed areas to and from sediment ponds or traps. They also convey runoff intercepted from undisturbed areas around the site to a non-erosive discharge point.

(b) Conditions of Use

Ditches may be used anywhere that concentrated runoff is to be conveyed on or around the construction site. Temporary pipe systems can also be used to convey runoff

(c) Design and Installation Specifications

Channels and ditches shall be sized to accommodate the peak flow from the developed 10-year runoff event with 0.5 feet of freeboard.

Check dams may be used, rather than grass linings, for channels in which the design flow velocity does not exceed 5 fps (see Figure F.5).

(d) Maintenance Standards

Any sediment deposition of more than 0.5 feet shall be removed so that the channel is restored to its design capacity.

If the channel capacity is insufficient for the design flow, it must be determined whether the problem is local (e.g., a constriction or bend) or the channel is under-designed. If the problem is local, the channel capacity must be increased through construction of a berm(s) or by excavation. If the problem is under-design, the design engineer shall be notified and the channel redesigned to a more conservative standard to be approved by UNC-CH.

The channel shall be examined for signs of scouring and erosion of the bed and banks. If scouring or erosion has occurred, affected areas shall be protected by riprap or an erosion control blanket or net.

(8) Outlet Protection

(a) Purpose

Outlet protection prevents scour at conveyance outlets.

(b) Conditions of Use

Outlet protection is required at the outlets of all ponds, pipes, ditches, or other approved conveyances, and where runoff is conveyed to a natural or manmade drainage feature such as a stream, wetland, lake, or ditch.

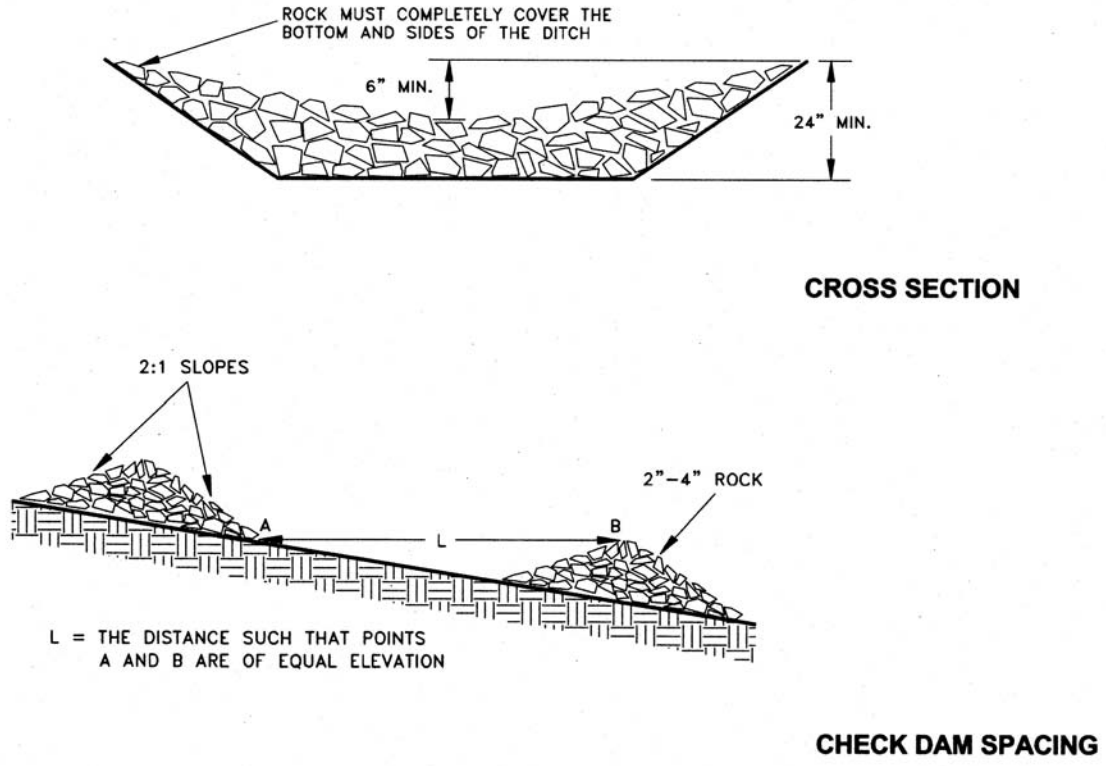
(c) Design and Installation Specifications

For the standard pipe slope drains and other smaller conveyance systems, the standard rock pad (6 feet by 8 feet) made of 1-foot thick quarry spall is adequate.

(d) Maintenance Standards for Outlet Protection

If there is scour at the outlet, the eroded area shall be protected with more conservative measures proposed by the design engineer and approved by UNC-CH.

Figure F.5 Check Dams



(9) Level Spreader

(a) Purpose

Level spreaders convert concentrated runoff to sheet flow and release it onto areas stabilized by existing vegetation.

(b) Conditions of Use

Level spreaders may be used where runoff from undisturbed areas or sediment retention facilities is discharged. This practice applies only where the spreader can be constructed on undisturbed soil and the area below the level lip is vegetated and low gradient (see below).

Note: Level spreaders are conceptually an ideal way to release stormwater since the vegetation and soil allow for the removal of fines from runoff that cannot be removed by settling or filtration. Unfortunately, the performance record of spreaders in the field is dismal. They are frequently under-designed and, despite the best installations, are rarely perfectly level, which results in the release of stormwater at a particular point. This concentrated runoff can result in catastrophic erosion down slope. Given such design failures, the use of spreaders is not encouraged. However, where slopes are gentle and the water

volume is relatively low, spreaders may still be the best method. When proposing their use, the designer shall carefully evaluate the site for possible concerns.

(c) Design and Installation Specifications

See Figure F.6 for detail. Other designs may be used subject to UNC-CH approval.

If runoff velocity as it enters the level spreader is more than 4 fps for the developed 10-year peak flow, a riprap apron must be provided to dissipate energy before the runoff enters the spreader.

The total spreader length shall be at least the square root of the catchment area. The maximum length for an individual spreader is 50 feet, limiting the catchment area that a single spreader may serve to 2500 square feet. Although this is very small, four 50-foot level spreaders next to one another could serve nearly an acre (40,000 square feet). Multiple spreaders shall not be placed uphill or downhill from one another in a configuration that would allow water released from one spreader to enter a down slope spreader.

The area below the spreader for a horizontal distance of 100 feet shall not exceed 20 percent and shall be completely vegetated with no areas of instability or erosion. The topography for a horizontal distance of 50 feet below the spreader shall be uniform so that runoff is not funneled into a swale or channel immediately after its release.

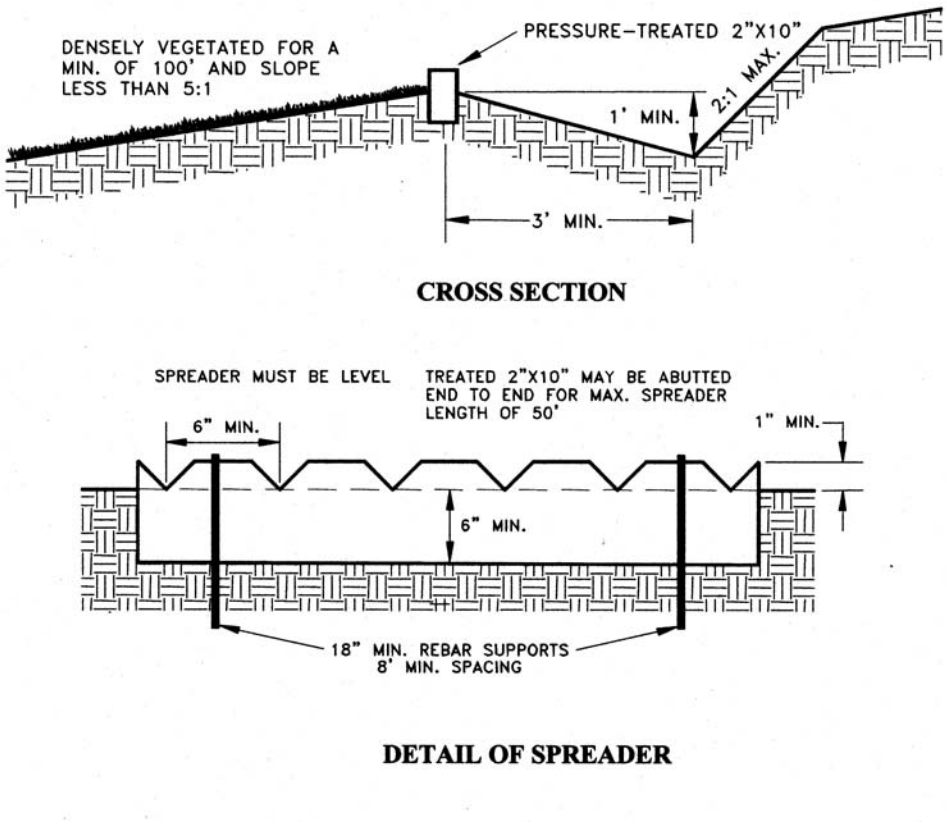
The level spreader shall be seeded and mulched in accordance with page Appendix B.

(d) Maintenance Standards

Any damage to the spreader shall be immediately repaired.

The down slope area shall be checked for signs of erosion and to verify that the spreader is not functioning as a point discharge. Any eroded areas shall be immediately stabilized, and the cause determined and eliminated if possible. If the erosion is recurrent and the design, even when properly installed and maintained, is not adequate to prevent erosion, a new method of releasing runoff shall be installed in accordance with the standards of this appendix. Any new design must be approved by UNC-CH.

Figure F.6 Level Spreader



e) Dust Control

(1) Dust Control: Preventative measures to minimize the wind transport of soil shall be taken when a traffic hazard may be created or when sediment transported by wind is likely to be deposited in water resources or adjacent properties.
(2) When to Install: Dust control shall be implemented by the contractor when exposed soils are dry to the point that wind transport is possible and roadways, drainage ways, or surface waters are likely to be impacted.
(3) Measures to Install: Water is the most common dust control used in the area. When using water for dust control, the exposed soils shall be sprayed until wet, but runoff shall not be generated by spraying. Exposed areas shall be resprayed as needed. Oil shall not be used for dust control.
(4) Road and Utility Projects

f) Road and utility projects often pose difficult erosion control challenges because they frequently cross surface waters and because narrow right-of-way constrains areas available to store and treat sediment-laden water. In most cases, the standards of this document can be applied to such linear projects without modification. For instance, the ability to use perimeter control rather than a sediment retention facility for small drainage areas (see Appendix C) will apply to many of these projects.

However, there may be some projects that cannot reasonably meet the standards of this document. In these cases, other measures may be proposed that will provide reasonable protection. An adjustment is not required for such projects, unless UNC-CH determines that measures proposed by the designer fail to meet the intent of this document, and that significant adverse impacts to surface water may result. Examples of other measures that may be taken in lieu of the standards of this document are:

Phasing the project so that the site is worked progressively from end to end, rather than clearing and grubbing the entire length of the project. This results in smaller exposed areas for shorter durations, thus reducing the erosion risk.

Mulching and vegetating cut and fill slopes as soon as they are graded. Frequently, this is done at the end of construction when paving or utility installation is complete. Vegetating these areas at the start of the project stabilizes those areas most susceptible to erosion.

Protecting all catch basin inlets with catch basin inserts when these do not drain to ponds or traps. This will not provide the same level of protection as a sediment pond or trap, but can remove most of the sand-sized material entrained in the runoff.

Using flocculants such as chitosan to reduce the turbidity of water released from sediment ponds.

Hiring a private consultant with expertise in ESC to review and monitor the site.

g) Standard ESC Plan Notes

The standard ESC plan notes must be included by the designer on all ESC plans. At the designer's discretion, notes that in no way apply to the project may be omitted; however, the remaining notes must not be renumbered. For example, if ESC Note #3 were omitted, the remaining notes should be numbered 1, 2, 4, 5, 6, etc.

Approval of this erosion and sedimentation control (ESC) plan does not constitute an approval of permanent road or drainage design (e.g., size and location of roads, pipes, restrictors, channels, retention facilities, utilities, etc.).

The implementation of these ESC plans and the construction, maintenance, replacement, and upgrading of these ESC facilities is the responsibility of the contractor and ESC supervisor until all construction is approved.

The boundaries of the clearing limits shown on this plan shall be clearly flagged by fencing prior to construction. During the construction period, no disturbance beyond the clearing limits shall be permitted. The clearing limits shall be maintained by the ESC supervisor for the duration of construction.

The ESC facilities shown on this plan must be constructed prior to or in conjunction with all clearing and grading so as to ensure that the transport of sediment to surface waters, drainage systems, and adjacent properties is minimized.

The ESC facilities shown on this plan are the minimum requirements for anticipated site conditions. During the construction period, these ESC facilities shall be upgraded as needed for unexpected storm events and modified to account for changing site conditions (e.g., additional sump pumps, relocation of ditches and silt fences, etc.).

The ESC facilities shall be inspected daily by the ESC supervisor and maintained to ensure continued proper functioning. Written records shall be kept of two-week reviews and post-storm reviews of the ESC facilities.

Any areas of exposed soils, including roadway embankments that will not be disturbed for seven days shall be immediately stabilized with the approved ESC methods (e.g., seeding, mulching, plastic covering, etc.).

Any area needing ESC measures that do not require immediate attention shall be addressed within fifteen (15) days.

Catch basins collecting stormwater that discharge into the permanent infrastructure shall be continuously maintained by the contractor. At no time will the contractor allow sediment to accumulate in catch basins. All catch basins and conveyance lines shall be cleaned prior to paving. The cleaning operation shall not flush sediment-laden water into the downstream system.

Stabilized construction entrances and roads shall be installed at the beginning of construction and maintained for the duration of the project. Additional measures, such as wash pads, may be required to ensure that all paved areas are kept clean for the duration of the project.

Where straw mulch for temporary erosion control is required, it shall be applied at a minimum thickness of 2 to 3 inches.

h) ESC Maintenance Report

Performed By: _____

Date: _____

Project Name: _____

Clearing Limits

Damage	OK ___	Problem_____
Visible	OK ___	Problem_____
Intrusions	OK ___	Problem_____
Other	OK ___	Problem_____

Mulch

Rills/Gullies	OK ___	Problem_____
Thickness	OK ___	Problem_____
Other	OK ___	Problem_____

Nets/Blankets

Rills/Gullies	OK ___	Problem_____
Ground Contact	OK ___	Problem_____
Other	OK ___	Problem_____

Plastic

Tears/Gaps	OK ___	Problem_____
Other	OK ___	Problem_____

Seeding

Percent Cover	OK ___	Problem_____
Rills/Gullies	OK ___	Problem_____
Mulch	OK ___	Problem_____
Other	OK ___	Problem_____

Sodding

Grass Health	OK ___	Problem_____
Rills/Gullies	OK ___	Problem_____
Other	OK ___	Problem_____

Silt Fence

Damage	OK ___	Problem_____
Sediment Build-up	OK ___	Problem_____
Concentrated Flow	OK ___	Problem_____
Other	OK ___	Problem_____

Brush Barrier

Damage	OK ___	Problem_____

Sediment Build-up	OK ___	Problem_____
Concentrated Flow	OK ___	Problem_____
Other	OK ___	Problem_____
Vegetated Strip		
Damage	OK ___	Problem_____
Sediment Build-up	OK ___	Problem_____
Concentrated Flow	OK ___	Problem_____
Other	OK ___	Problem_____
Construction Entrance		
Dimensions	OK ___	Problem_____
Sediment Tracking	OK ___	Problem_____
Vehicle Avoidance	OK ___	Problem_____
Other	OK ___	Problem_____
Construction Road		
Stable Driving Surface	OK ___	Problem_____
Other	OK ___	Problem_____
Sediment Trap/Pond		
Sed. Accumulation	OK ___	Problem_____
Overtopping	OK ___	Problem_____
Inlet/Outlet Erosion	OK ___	Problem_____
Other	OK ___	Problem_____
Catch Basin Protection		
Sed. Accumulation	OK ___	Problem_____
Damage	OK ___	Problem_____
Clogged Filter	OK ___	Problem_____
Other	OK ___	Problem_____
Interceptor Dike/Swale		
Damage	OK ___	Problem_____
Sed. Accumulation	OK ___	Problem_____
Overtopping	OK ___	Problem_____
Other	OK ___	Problem_____
Pipe Slope Drain		
Damage	OK ___	Problem_____
Inlet/Outlet	OK ___	Problem_____
Secure Fittings	OK ___	Problem_____
Other	OK ___	Problem_____
Ditches		

Damage	OK ___	Problem_____
Sed. Accumulation	OK ___	Problem_____
Overtopping	OK ___	Problem_____
Other	OK ___	Problem_____

Outlet Protection

Scour	OK ___	Problem_____
Other	OK ___	Problem_____

Level Spreader

Damage	OK ___	Problem_____
Concentrated Flow	OK ___	Problem_____
Rills/Gullies	OK ___	Problem_____
Sed. Accumulation	OK ___	Problem_____
Other	OK ___	Problem_____

Miscellaneous

OK___	Problem_____
OK ___	Problem_____
OK ___	Problem_____
OK ___	Problem_____
OK ___	Problem_____
OK ___	Problem_____
OK ___	Problem_____
OK ___	Problem_____
OK ___	Problem_____
OK ___	Problem_____

Actions Taken:

_____

_____

_____

_____

_____

Problems Unresolved:

_____

_____

_____

_____

i) Sensitive Area Restrictions

Any construction that will result in disturbed areas on or within a stream or associated buffer, a wetland or associated buffer, or within 50 feet of a lake shall be subject to the special provisions below. UNC-CH may require more conservative BMPs, including more stringent cover requirements, in order to protect surface water quality.

Sensitive Areas Special Provisions

Any project that disturbs areas on or within a stream or associated buffer, a wetland or associated buffer, or within 50 feet of a lake has the potential to seriously damage water resources, even if the project is relatively small. While it is difficult to require specific measures for such projects because the ESC plan must be very site specific, the following recommendations shall be incorporated into the plan and implemented on the site where appropriate:

All projects shall be completed and stabilized as quickly as possible. Limiting the size and duration of a project is probably the most effective form of erosion control.

Where appropriate, sandbags or an equivalent barrier shall be constructed between the project area and the surface water in order to isolate the construction area from high water that might result due to precipitation.

Additional perimeter protection shall be considered to reduce the likelihood of sediment entering the surface waters. Such protection might include multiple silt fences, silt fences with a higher AOS, construction of a berm, or a thick layer of organic mulch upslope of a silt fence.

If work is to occur within the ordinary high water mark of a stream, most projects must isolate the work area from the stream by diverting the stream or constructing a coffer dam. Certain small projects that propose only a small amount of grading may not require isolation since diversions typically result in disturbance and the release of some sediment to the stream. For such small projects, the potential impacts from construction with and without a diversion must be weighed.

If a stream must be crossed, a temporary bridge shall be considered rather than allowing equipment to utilize the streambed for a crossing.

Any runoff generated by dewatering shall be treated through construction of a sediment trap when there is sufficient space, or by releasing the water to a well-vegetated, gently sloping area. Since pumps are used for dewatering, it may be possible to pump the sediment-laden water well away from the surface water so that vegetation can be more effectively utilized for treatment. A straw bale filter shall be placed around the discharge from the dewatering pump. If there is not space for a sediment trap or 25 feet of suitable vegetation, other filtration methods shall be required.

5. DESIGN GUIDELINES FOR PERMANENT FALL PROTECTION

a) Summary

This guideline sets a framework for establishing permanent fall protection systems on the facilities at the University of North Carolina at Chapel Hill (UNC). The intent of this document is to eliminate exposure to fall hazards where possible and to protect personnel that are exposed to fall hazards at UNC.

Permanent fall prevention/protection measures must be included as an integral part of the design phase for all new construction projects and roof renovation/repair projects at UNC. All walking/working surfaces where employees are exposed to fall hazards (i.e. roof systems and floor openings) shall be permanently guarded or have qualified anchorages for personal fall arrest systems. Buildings that utilize powered platforms for exterior maintenance shall be provided with qualified anchorages and tie-in guides as necessary.

b) Governing Regulations

The North Carolina Department of Labor's Occupational Safety & Health Administration (OSHA) regulates fall protection for both General Industry and Construction. The General Industry Standards are located in the North Carolina Administrative Code (NCAC) under 13 NCAC 07F.0101 and incorporate by reference Federal OSHA 29 CFR 1910 Subpart D – Walking – Working Surfaces and 29 CFR 1910.66 (Powered Platforms for Building Maintenance). The Construction Standards are located under 13 NCAC 07F.0201 and incorporate by reference 29 CFR Subpart M, 1926.501-503 (Fall Protection). The primary objective of these standards is to prevent employees from falling from working surfaces and to provide adequate protection in the event of a fall.

In addition, the American National Standards Institute (ANSI) has set voluntary consensus standards for personal fall arrest systems, subsystems, and components which supplement the above referenced regulations (ANSI Z359.1-1992 (R1999)). The scope of this ANSI standard establishes requirements for manufacturer's design, performance, testing, and qualifications of personal fall arrest equipment. In addition, the standard addresses requirements for user training, inspection, maintenance, and use of equipment used for personal fall arrest equipment. It is important to note that compliance with ANSI standard does not ensure compliance with the above referenced OSHA standards and vice versa.

c) Design Requirements

All new construction projects and renovations, alterations, or repairs to existing roof systems or roof mounted equipment must comply with the above regulations, as well as any applicable building codes. In addition, any installations or renovations of equipment that would subject personnel to fall hazards must incorporate fall protection solutions into the project design phase.

A qualified person with extensive experience in fall protection solutions is required to plan, evaluate, design, and select the most appropriate fall protection solution. Building anchorages, tie-downs, and any other affected parts of the building shall be designed and certified by a registered Professional Engineer (PE) with expertise in fall protection systems.

A variety of fall protection solutions are available and it is important to select a system based on the specific building type, roof system, or work application. It is imperative that the designers consider the continuity of the fall protection systems selected throughout campus. All fall protection systems shall be designed and installed similarly with compatible components to reduce

variability in fall protection systems on campus. Users of these systems must be trained on how to properly use, inspect, and maintain the selected fall protection systems.

A complete understanding of the work procedures will enable the design team and/or qualified person to select the most appropriate fall protection system. The schematic design phase shall include a meeting to consult with affected campus maintenance personnel that are exposed to fall hazards. The purpose of this meeting will help identify specific building maintenance and/or equipment service activities required to be conducted throughout the life of the building. In addition, the design team can discuss maintenance and inspection requirements of the proposed personal fall arrest systems and identify areas of concern.

It is essential that during the design phase, the qualified person and/or contract designer gives consideration to the prevention of falls for future maintenance of the building, structure, or facility. Considerations should include the following:

(1) Safe access to or egress from any potential work area.
(2) Provisions for permanent guardrail systems or edge protection such as parapets that meet the height criteria established for guardrails by OSHA.
(3) Selection of materials that can withstand harsh environments.
(4) Location of and access to equipment for maintenance purposes.
(5) Location and operations of the type of equipment selected and devices used (e.g., using adjustable light fixtures that can be lowered to the ground for replacement of bulbs).
(6) Identification and location of utilities that service the buildings (e.g., location of power lines, etc.).
(7) Use of fall-arrest systems and devices, including the provision of suitably located permanent rooftop anchorages and field identification of all required anchorage point locations. (See Appendices A, B, & C for information on anchorages).

The primary goal of this guideline is to eliminate fall hazards where feasible. Where preventing exposure to the fall hazard is not possible, UNC shall provide the means for proper fall protection for all personnel working at elevated heights during construction, maintenance, and repair work.

d) Hierarchy of Controls

Control measures are not intended to be mutually exclusive and in many cases a combination of controls should be implemented to reduce exposure to fall hazards.

(1) Engineering Controls that are designed to eliminate hazards are the preferred method for protecting employees from or controlling exposure to fall hazards. Examples of engineering controls used to eliminate or reduce exposure are listed below:

    (a) Changing equipment or processes to control hazard (e.g. using aerial lifts to access work area)
    (b) Installing screens/gutter guards to reduce frequency of exposure

(2) Passive Fall Protection Systems do not require operational involvement from the employee in order to be protected while performing work at elevated heights. Examples of passive systems are listed below:

    (a) Installation of guardrail systems
    (b) Construction of parapet walls meeting height criteria for guardrails
    (c) Installation of warning line systems

(d) Use of Safety Net Systems

(3) Active Fall Protection Systems require that employees understand when they are exposed to fall hazards and have a working knowledge of the fall protection system available for their protection. Active systems begin with a qualified anchorage point and have components connected to the worker (body harness, lanyard, self-retracting lifeline, rope grab, etc). Proper training in the use of active systems is essential for an effective fall protection system.

(4) Personal Fall Arrest Systems (PFAS) are considered active systems and shall be incorporated into the building design when elimination of the fall hazard or a passive system is not feasible. Examples of PFAS are listed below:

(a) Fixed point anchors certified as an attachment point for workers that work locally
(b) Horizontal Lifeline (HLL) systems to serve as an anchorage attachment for continuous fall protection

PFAS shall provide secure anchorages to arrest a fall while preventing the users from free falling more than six (6) feet. Anchorages must be easily accessible from the roof access in order to avoid fall hazards during connection to the fall protection system. Systems shall provide uninterrupted access to the entire length of the structure without having to disconnect from the system to pass through intermediate support points. All PFAS shall be capable of supporting at least two (2) workers at a time. All essential components shall be designed and tested as part of the system in order to provide a complete and fully operational fall arrest system.

e) Specific Requirements

Fall protection must be provided for each employee working on elevated surfaces 4 feet above a lower level or whenever there is a possibility of falling onto dangerous equipment or into a hazardous environment, or where there are impalement hazards present.

(1) Skylights

Every skylight shall be guarded by a standard skylight screen or a fixed standard railing on all exposed sides. Skylight screens must be capable of withstanding a load of at least 200 lbs applied perpendicularly at any one point on the screen. In addition, screens must be constructed and mounted such that when subjected to ordinary loads they will not deflect downward and break the glass below the screen.

(2) Flat or Low Slope Roof Systems

Employees engaged in work on low slope roofs shall be protected from unprotected edges of the roof by one or more of the following methods:

(a) Approved Guardrail System or parapet wall meeting OSHA height criteria
(b) Safety Net System
(c) Employee use of a fall-restraint or fall-arrest system

(3) Steep Slope Roof Systems

Employees engaged in work on steep slope roof shall be protected from falling from all unprotected edges of the roof by one or more of the following methods:

(a) Approved Guardrail System or parapet wall meeting OSHA height criteria
(b) Safety Net System
(c) Employee use of a positioning devices, fall-restraint, or personal fall-arrest system (e.g. PFAS or HLL)

f) Notes:

(1) Warning lines and safety monitor systems are prohibited on steep slope surfaces exceeding a 4 to12 pitch.
(2) Mechanical equipment shall be placed only in areas where employees are protected by a warning-line system, fall restraint, or fall arrest systems.
(3) The anchorage connectors and all components of fall arrest systems must be made of stainless steel or other corrosion resistant materials and comply with all sections of ANSI Z359.1.
(4) A laminated reduced roof plan showing all fall protection system locations, anchor load ratings, number of authorized users that may attach to the system at one time, date of initial certification, and name of registered professional engineer who certified anchorages shall be posted at every roof access.
(5) A log book shall be maintained on site with a thorough description of certification and inspection procedures. The certification test and inspection results shall be entered into the logbook and signed and dated by the competent person.
(6) Fall protection design shall consider prompt rescue procedures in the event an employee is subjected to a fall using a fall arrest system. Emergency contact information and rescue procedures shall be laminated and posted at all roof access points.
(7) The certified fall arrest system must be marked on the as-built drawings with the PE seal.
(8) Personal Fall Arrest Systems shall:

(a) be rigged such that an employee can neither free fall more than six (6) feet or contact a lower level.
(b) limit the maximum arresting force on an employee to 1800 pounds when used with a full body harness.
(c) bring an employee to a complete stop and limit the maximum deceleration travel distance to 42 inches.
(d) have sufficient strength to withstand twice the potential impact energy of an employee free falling six (6) feet or the free fall distance permitted by the system, whichever is less.

(9) Fall arrest equipment subjected to an impact load shall be immediately removed from use and/or tagged “Do Not Use”.

g) APPENDIX A

Guide to Selecting Safe Anchorages for Fall Protection Systems

(1) The strength of a personal fall-arrest system depends on its subsystems and components, as well as how the system is attached to the anchorage point. Such attachment shall not significantly reduce the strength of the system, including the structural members such as beams, columns, or any rigid structure.
(2) All components and sub-components of the selected fall-arrest system shall be compatible with each other and constructed of stainless steel, galvanized steel, or other materials with a corrosion resistant finish. All surfaces shall be smooth to prevent damage to interfacing parts of the system.

(3) When planning and selecting a point of anchor location, take into consideration the accessibility and ease of securing to it.
(4) Select the point of anchor as high as possible. This will minimize the freefall distance and total fall distance and will prevent any contact with an obstruction or the ground below.
(5) The point of anchorage shall be located in such a way to minimize swinging the worker (pendulum-like motion) that can occur during a fall. The farther away in a horizontal direction a worker moves from a fixed tie off point, the greater is the swinging angle if a fall should occur. If any obstruction exists in the path of the swing fall, the force generated by such a fall is the same as the force in a vertical fall. The maximum angle of swing away from the point of anchor should not be more than 30 degrees.
(6) Always specify the number of authorized users that are allowed to attach to a specific anchorage point.
(7) The diameter of the anchorage eye, tieback, or eyebolt shall be compatible to the snap hook or carabiner attachment. If an eyebolt is selected as a point of anchor, it should be rated along its axis. Eyebolt strength is greatly reduced if the force is applied at an angle to the eyebolt axis.
(8) When tying off to a beam or column, do not attach the anchorage connection to a hole in the beam unless evaluated by a PE, because the forces generated by a fall may weaken the beam structure. Do not drill a hole for tying off. This attachment will compromise the structural integrity of the beam. If anchorage connectors are not available, the most favorable way to tie off is to wrap an anchor strap around the beam or column, or use a designed beam clamp.
(9) Do not tie a knot in the anchorage connection.
(10) The most favorable location to tie off to a beam is in the center of the span. This action will distribute the forces evenly at the supports. The force on the supports will increase accordingly the closer the tie off point is to the beam support.
(11) Take into consideration the impact of shear forces and the bending moment at the supports and also the distribution of forces beyond the supports onto other structural members.
(12) When selecting the point of anchor in a column, take into consideration the impact of fall forces due to axial loading and bending stresses.

h) APPENDIX B

Requirements for Anchorage Design, Certification, and Identification

(1) Anchorages shall be designed and installed under the supervision of a Registered Professional Engineer (PE) with experience in designing fall-protection systems and in strict accordance with the manufacturer's instructions. If there is a need to devise an anchor point from existing structural members such as beams, rafters, or columns, a PE shall be used to evaluate these anchorages.
(2) Qualified anchorages for personal fall arrest shall be capable of supporting 5,000 pounds per employee attached and be designed, installed, and used under the supervision of a qualified person as part of a complete fall-arrest system.
(3) The forces generated by arresting a fall; total loading; and impact on the structural members should be calculated in order to determine the optimal safe location and how to properly tie-off to qualified anchorages.
(4) Only a PE shall certify the structural integrity of the anchorages. Anchorage conditions should be field-verified by a qualified person.
(5) Before initial use, the anchorage assemblies and fall arrest equipment shall be successfully load tested at the rated load and documentation provided to UNC. The load test shall be prescribed, defined, and certified by a registered PE. Elastic

deformation of the test anchorage or anchorage connector may be determined by theoretical calculations performed and certified by a PE.

(6) A laminated reduced roof plan showing all fall protection system locations, anchor load ratings, number of authorized users that may attach to the system at one time, date of last inspection, and name of registered professional engineer who certified anchorages shall be posted at every roof access.

i) APPENDIX C

Inspection and Re-certification of Anchorages

(1) Fall arrest, positioning, and restraint equipment shall be inspected by the user before each use and annually by a competent person in accordance with the manufacturer's instructions. Workers are not qualified to inspect anchor points; however, they shall be trained to pay special attention to any cracks developing around the anchor points or if the anchor points are unstable or loose. End users shall not tie-off to unsafe anchorages and they must bring it to the attention of the competent person if such a situation exists. Questionable anchorages must be immediately tagged or labeled "Do Not Use" until recertification can be performed.
(2) Anchorages that show signs of degradation during the inspection shall be reviewed by a qualified person to determine if recertification testing is required. If it is determined that testing is necessary, then a PE shall develop a non-destructive test procedure and certify the results.
(3) A preventative maintenance program shall be developed for fall protection systems to include recertification requirements of permanent anchorages which should not exceed a five year frequency.
(4) Anchorage Recertification depends on the design, type, location, and the size of the structural member to which the anchorage is attached. The environment and weather conditions also contribute to how often anchorages should be inspected and recertified. The type and frequency of recertification shall be determined by the manufacturer or the PE who designed the fall protection system.
(5) The recertification of anchorage connectors shall be done by the manufacturer's representative or a qualified person under the supervision and direction of a PE.
(6) Any component of a fall arrest system subjected to an impact load shall immediately removed from service and not used again for employee protection until it has been recertified as stated above.

j) APPENDIX D

Fall Protection Post Job Submittals

(1) The qualified person/contract designer and the installation contractor shall ensure that documentation of anchorage certification and annual recertification requirements are provided to UNC prior to the system being put into use.
(2) Detailed user instructions for the fall arrest system must be printed and provided to UNC. User instructions shall include at least the following:

(a) manufacturer's name, address, and telephone number
(b) manufacturer's user instructions for part and model number
(c) statement of manufacturer's intended use and purpose
(d) description of proper methods and limitations on use
(e) printed information or illustrations of fixed equipment markings
(f) description of detailed inspection/recertification procedures for fall arrest system

(g) criteria for failing inspections and determining unusable equipment
(h) procedures for maintenance and repair requirements (who is authorized to make adjustments and repair to equipment)
(i) Appropriate warnings regarding altering, misusing, and limitations of equipment

(3) Submit reduced shop drawings illustrating the fall protection system to be affixed at all roof accesses.
(4) Submit manufacturer warranty information and documentation that the system was installed in accordance with manufacturer's instructions.

k) APPENDIX E

Definitions

Active fall protection systems are made up of components and systems that require some manipulation by the worker to make the protection effective.

Anchorage means a secure point of attachment for lifelines, lanyards or deceleration devices and at a minimum must meet the design loads outlined in the applicable OSHA regulations.

Body harness means straps which may be secured about the employee in a manner that will distribute the fall arrest forces over at least the thighs, pelvis, waist, chest and shoulders with means for attaching it to other components of a personal fall arrest system.

Competent Person is one who by way of training or expertise is knowledgeable of applicable standards, is capable of identifying workplace hazardous or dangerous conditions relating to the specific operation, is designated by the employer and has the authority to take corrective actions.

Engineering Controls are methods to reduce exposure to potential hazards either by isolating the hazard or by removing it from the work environment.

Guardrail system means a barrier erected to prevent employees from falling to lower levels and shall consist of a top rail, intermediate rail, toe board and posts and shall have a vertical height of 42" from upper surface of top rail to the floor. The anchoring of posts and framing of members for railings of all types shall be of such construction that the completed structure shall be capable of withstanding a load of at least 200 pounds applied in any direction at any point on the top rail, with a minimum of deflection.

Lanyard means a flexible line of rope, wire rope, or strap which generally has a connector at each end for connecting the body belt or body harness to a deceleration device, lifeline, or anchorage.

Lifeline means a component consisting of a flexible line for connection to an anchorage at one end to hang vertically (vertical lifeline), or for connection to anchorages at both ends to stretch horizontally (horizontal lifeline), and which serves as a means for connecting other components of a personal fall arrest system to the anchorage.

Low-slope roof means a roof having a slope less than or equal to 4 in 12 (vertical to horizontal).

Opening means a gap or void measuring 12 inches or more in its least dimension, in any floor, platform, pavement, or yard, through which persons may fall; such as a hatch, stair, or ladder opening, pit, or manhole.

Parapet Wall is a low wall along the edge of a roof or balcony

Passive fall protection systems consist of components and systems that do not require any action on the worker's part.

Personal fall arrest system means a system used to arrest an employee in a fall from a working level. It consists of an anchorage, connectors, body harness and may include a lanyard, deceleration device, lifeline, or suitable combinations of these. The use of a body belt for fall arrest is prohibited.

Positioning device system means a body harness system rigged to allow an employee to be supported on an elevated vertical surface, such as a wall, and work with both hands free while leaning.

Qualified Person is one with a recognized degree or professional certificate and extensive knowledge and experience in the subject field who is capable of design, analysis, evaluation and specifications in the subject work, project, or product.

Registered Professional Engineer is one who is licensed and has professional experience in the practice of design and installation of permanent fall protection systems and is familiar with all applicable codes and standards.

Rated Load is the combined weight of the employee, tools, equipment, materials that the device is designed to support.

Rope grab means a deceleration device, which travels on a lifeline and automatically, by friction, engages the lifeline and locks so as to arrest the fall of an employee. A rope grab usually employs the principle of inertial locking, cam/level locking, or both.

Roof means the exterior surface on the top of a building. This does not include floors or formwork, which, because a building has not been completed, temporarily becomes the top surface of a building.

Safety monitoring system means a safety system in which a competent person is responsible for recognizing and warning employees of fall hazards.

Self-retracting lifeline/lanyard means a deceleration device containing a drum-wound line which can be slowly extracted from, or retracted onto, the drum under slight tension during normal employee movement, and which, after onset of a fall, automatically locks the drum and arrests the fall.

Steep roof means a roof having a slope greater than 4 in 12 (vertical to horizontal).

Unprotected sides/edges means any side or edge (except at entrances to points of access) of a walking/working surface, e.g., floor, roof, ramp, or runway where there is no wall or guardrail system at least 42 inches high.

Walking/working surface means any surface, whether horizontal or vertical on which an employee walks or works, including, but not limited to, floors, roofs, ramps, bridges, runways, formwork and concrete reinforcing steel but not including ladders, vehicles, or trailers, on which employees must be located in order to perform their job duties.

Warning line system means a barrier erected on a roof to warn employees that they are approaching an unprotected roof side or edge, and which designates an area in which roofing work may take place without the use of guardrail, or safety net systems to protect employees in the area.

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

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).

a) General Requirements for Contractors on all construction projects (critical issue recap):

(1) Establish a list of building representative contacts for buildings that will be impacted by the construction project
(2) Keep the fire lanes, hydrants and fire department connections clear at all times. (Should be specified on the drawings)
(3) Provide and maintain directional signs around construction fences, barricades and at blocked exits.
(4) Maintain pedestrian walkway protection near the project.(From overhead falling objects, projectiles and construction material which may protrude through the fence)
(5) 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.
(6) Provide covered chemical secondary containment and spill response equipment.
(7) Protect streams, storm drains, sanitary sewer- no chemicals, dirt or construction chemicals or debris.
(8) Exposures to:

(a) Noise: equipment placement, mufflers, other noise control techniques such as constructing enclosures
(b) Dust: ensure dust control techniques are used routinely including wet drilling/cutting of masonry materials, wet cleaning methods
(c) Fumes: locate welding/cutting, heated tar pots etc. away from building air intakes

(d) 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.

(9) Lay down areas must occur in designated areas only to prevent pedestrian slips, trips and falls and to keep fire lanes open.
(10) Maintain MSD sheets on site for rapid access in the event of an emergency.
(11) Repair vehicle and equipment leaks immediately to prevent fuel, coolants, and oils (hydraulics and gear box) spills.
(12) "Maintain access and clearance for service vehicles, including trash and recycling collection vehicles."

b) Protecting Adjacent Building

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

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

c) 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).

(1) Communication

(a) 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.
(b) Controls:

(i) Identify the primary and secondary building contact person for contractors and occupants

(ii) Weekly meetings with the building occupants lead by the building liaison with the construction manager in attendance.
(iii) Record minutes for the meeting
(iv) Minutes should indicate what the construction plans are for the coming week and any changes to building access and services.
(v) Minutes should reflect employee concerns and resolution completed
(vi) 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

(2) Life/Fire Safety

(a) 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.

(b) Controls:

(i) Maintaining life safety features
(ii) Means of egress
(iii) Alternate means of egress
(iv) Clear directional signs to alternate exits
(v) Sprinklers/Fire alarm systems/fire watch provisions
(vi) Additional fire extinguishers where required
(vii) Emergency communication method

(3) 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.

(a) Controls:

Physical Barriers

(i) Each project phase shall have designated on the drawings
(ii) Temporary wall locations and sound insulation requirements-sealed air tight
(iii) Locations to seal off wall and floor penetrations to be dust tight

(iv) Designated construction worker travel paths in the building separate from occupants
(v) Designated building occupant paths with barriers at the construction zone.
(vi) Areas around floor and walls to be penetrated to be blocked with barricades to keep occupants out when the penetrations are made.
(vii) All floor penetrations to be covered with steel plate, fixed in place to prevent objects from falling through to the floors below.
(viii) Which occupied areas must be secured and vacated before wiring, pipes and conduit are run overhead through walls or ceilings.
(ix) 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.

(4) 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.

(5) Indoor Air Quality

(a) Issues:

(i) Every construction project generates dust and odors at various points throughout the project that may include:
(ii) Masonry dust (cutting, jack hammering, blasting)
(iii) Sheet rock and spackle dust – sanding
(iv) Solvents- adhesives, caulks, finishes, sealants, resins
(v) Metal fumes/dust (welding and cutting)
(vi) Fungi (mold and mildew)
(vii) Asphalt fumes

(b) Controls:

(i) Block and seal off any ductwork shared with occupied areas.
(ii) Protect all active building air intakes from external contaminants (dust, exhaust, chemicals etc.)
(iii) Maintain a continuous negative air pressure in the construction zone
(iv) Use of exhaust fans (include filters for dust)
(v) Pressurize the occupied areas with excess clean outside air
(vi) 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.
(vii) Use wet methods for masonry cutting
(viii) Use wet methods or HEPA vacuum for cleaning (no compressed air or dry sweeping)
(ix) Stop work if exposures exceed specified limits outside of the construction area (see the monitoring section).

(x) Use low or no VOC content in paints, adhesives and finishes
(xi) Avoid the use of isocyanates and urea formaldehyde resin containing materials.
(xii) Perform certain tasks when the building is unoccupied including extremely loud activity, overhead crane work etc.
(xiii) Use covered chutes to drop materials from upper levels to the ground
(xiv) 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.
(xv) Facilities services must check HVAC filters more frequently to avoid plugging with dust and debris.

(6) Noise

(a) 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.
(b) Controls:

(i) Restrict high noise operations to unoccupied periods.
(ii) Provide suitable mufflers for air operated tools and engine powered equipment
(iii) Provide acoustical enclosures for noisy fixed equipment
(iv) Prefab building components outside or offsite.
(v) Incorporate sound insulation in construction barriers

(7) Maintenance of Building Mechanical Systems

(a) 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.
(b) Controls:

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

(i) HVAC
(ii) Plumbing
(iii) Electrical/lighting
(iv) Telephone
(v) Data lines

(8) Inclement Weather

(a) 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.

(b) 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.

(9) Housekeeping

(a) Issues: Areas in and around construction sites are often characterized by the accumulation of dust and dirt, trash and debris.
(b) 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.

(10) Exposure Monitoring

(a) 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.
(b) 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:

(i) Total dust: 1 mg/M3
(ii) Carbon monoxide: 10 PPM
(iii) Noise: < 60 dB averaging the speech frequencies (500, 1000, 2000, 4000 Hz) and < 80 dB using the A weighted scale
(iv) Total Hydrocarbon: 10 PPM
(v) 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.

(vi) The EHS Department will review the construction logbook data and will perform additional assessments as needed.

7. INCREASE UTILIZATION OF HISTORICALLY UNDERUTILIZED BUSINESSES (HUB) IN CONSTRUCTION PROJECTS

G.S. 143.128.2 requires that The University of North Carolina develop and implement a Minority Business Participation Outreach Plan. The University recently developed a University wide plan. This plan meets the requirements of the legislation and requires that the Chancellor of each constituent institution identify HUB Liaison representatives for directing and implementing the plan, and that each campus establish a campus-specific outreach participation plan consistent with the University HUB Plan.

The University of North Carolina at Chapel Hill has adopted the University of North Carolina Historically Underutilized Business Plan as amended in March 2002, and incorporated the following two (2) documents in our plan:

- The Guidelines for Recruitment and Selection of Minority Businesses for Participation in University of North Carolina Construction Contracts
- The University of North Carolina at Chapel Hill Bid Rules for Informal Contracts.

The Guidelines for Recruitment and Selection of Minority Businesses for Participation in University of North Carolina Construction Projects outlines responsibilities and actions to be undertaken by the designer, prime contractor, Department of Administration, State Construction Office, and owner, in compliance with this plan.

"Under the single-prim bidding, separate prime bidding, construction manager at risk, or alternative contracting method, the designer will:

- Attend the scheduled pre-bid conference to explain minority business requirements to the prospective bidders.
- Assist the owner to identify and notify prospective minority businesses of potential contracting opportunities.
- Maintain documentation of any contacts, correspondence, or conversation with minority business firms made in an attempt to meet the goals.
- Review jointly with the owner, all requirements of G.S. 143-128.2(c) and G.S. 143-128.2(f) – (i.e. bidders' proposals for identification of the minority businesses that will be utilized with corresponding total dollar value of the bid and affidavit listing Good Faith Efforts..) – prior to recommendation of award.
- During construction phase of the project, review "MBE Documentation for Contract Payments" (Appendix E) for compliance with minority business utilization commitments. Submit Appendix E form with monthly pay applications to the owner and forward copies to the State Construction Office.
- Make documentation showing evidence of implementation of Designer's responsibilities available for review by State Construction Office, the University, and The Department of Administration HUB Office upon request."

a) Goal

The goal of The University of North Carolina (the University) in adopting its plan for expansion of participation by Historically Underutilized Businesses (the Plan) is to ensure and promote equal and increased opportunities for all segments of the design and construction community to participate in University construction projects. The University seeks to include those businesses owned by ethnic minorities and women that have been historically underutilized and excluded from the prime contractor or subcontractor market. The University encourages all those associated with the University construction program to commit to this goal through a good faith effort.

b) Statement of Policy

It is the policy of The University of North Carolina to provide businesses owned by minority persons equal access and opportunity to participate fully in all aspects of the University construction program; to prohibit discrimination against businesses on the basis of race, color, national origin, or gender; to promote and encourage full and open competition; and to promote equal access to contracting opportunities among the various contractors and vendors that do business with the University. Minority persons are defined in North Carolina General Statutes 143-128.

c) Plan Objectives

The objectives of the Plan are:

(1) To provide Historically Underutilized Businesses (HUBs) equal access and opportunity for participating in The University of North Carolina construction program.
(2) To demonstrate commitment to the State of North Carolina HUB program.
(3) To meet and strive to exceed the State's goal of 10% for HUB utilization.
(4) To raise the awareness of the State's HUB program within both the University and the design / construction community.
(5) To increase the level of knowledge within the University about HUB utilization and to raise the awareness of available construction services offered by HUBs.
(6) To provide clear and efficient procedures for monitoring compliance with the HUB program.
(7) To encourage minority- and women-owned businesses to obtain certification with the North Carolina Department of Administration's Office of Historically Underutilized Businesses.

d) Administration

Businesses owned by minority persons are referred to as Historically Underutilized Businesses (HUBs). The terms "minority businesses" and "minority persons" are defined in the North Carolina General Statutes (G.S.143-128(f). G.S. 143-128 governs minority participation goals for the University capital projects and states "the State shall have a verifiable ten percent (10%) goal for participation by minority businesses…" The statute further requires the awarding authority to adopt written guidelines to ensure a good faith effort in the recruitment and selection of minority businesses. The awarding authority for University construction projects costing under $500,000 is the University and the awarding authority for construction projects costing in excess of $500,000 is the Department of Administration's State Construction Office. Both awarding authorities (the University and the State Construction Office) have adopted written guidelines to improve utilization of HUBs. Under the established guidelines, The Office for Historically Underutilized Businesses in the North Carolina Department of Administration certifies firms qualifying as minority businesses. Further, that office is directed to maintain a current list of certified HUB firms and furnish that list to awarding authorities. The awarding authority is directed to provide prime contractors, subcontractors, material suppliers and other bidders for State construction projects the requirements of the General Statutes of North Carolina regarding minority business participation. State agencies (including the constituent institutions) are called "owners" under the guidelines and are directed to do the following:

(1) Develop and implement a minority business participation outreach plan to identify minority businesses that can perform public building projects and to implement outreach efforts to encouraged minority participation.

(2) Attend the scheduled pre-bid conference.
(3) Notify HUB firms, at least 10 days prior to the scheduled day of bid opening, of potential contracting opportunities.
(4) Maintain documentation of any contacts, correspondence or conversation with HUB firms made in an attempt to meet the States goals.
(5) Review, jointly with the designer, all requirements of G.S. 143-128.2(c) and G.S. 143-128.2(f) prior to recommendation of award to the State Construction Office.
(6) Evaluate documentation to determine good faith effort has been achieved for minority business utilization prior to recommendation of award.

The University now seeks to supplement and expand, where reasonable and practicable, the efforts of the State's Department of Administration in recruiting and selecting minority contractors for University construction projects.

The President of the University, through the Vice President for Finance, is responsible for the implementation of this Plan. The Vice President for Finance shall designate an Associate or Assistant Vice President to be responsible for coordinating, implementing and managing the Plan at a system-wide level.

This Plan will apply to all construction contracts, project-related procurements, design, and other construction-related professional service contracts administered by The University of North Carolina. The provisions of the Plan shall be communicated to personnel at all constituent institutions and affiliated organizations of the University that engage in construction activities.

The Associate or Assistant Vice President for Finance designated to carry out the provisions of the Plan will serve as the University's HUB Liaison Officer and will be responsible for administering the plan on a day-to-day basis. This Officer will specifically be responsible for accomplishing the following:

(1) Assisting each constituent institution, affiliate, and UNC-GA with implementation, management and evaluation of the Plan for all construction projects greater than $5000.
(7) Providing each constituent institution, affiliate, and UNC-GA with assistance in resolving specific problems related to implementation of the Plan;
(8) Providing reports, as needed and as requested, to The University of North Carolina Board of Governors; the North Carolina General Assembly, members of the North Carolina Legislative Black Caucus; the Office of Historically Underutilized Businesses; the North Carolina Institute of Minority Economic Development; the Bond Oversight Committee; and Chancellors of the constituent institutions; Directors of affiliated organizations; and others.

The Chancellor at each of the constituent institutions and the Director of each affiliated organization will appoint a representative to serve as that entity's HUB Liaison Officer. The HUB Liaison Officers will be responsible for implementing, managing, and evaluating the HUB programs for both formal and informal projects. Each entity's HUB Liaison Officer will accomplish the following:

(1) Promote the University's HUB program internally and externally.
(9) Develop an outreach agenda to facilitate HUB utilization.
(10) Participate in training seminars for the purpose of informing potential bidders, proposers, and vendors of HUB programs and business opportunities available.

(11) Assure that projects are reviewed to determine the possibility of subdividing the work among multiple contractors. Requests for bids may be subdivided to encourage HUB participation.
(12) Assist the design team in developing methods for structuring bids, proposals, specifications, and plans so as not to unreasonably prejudice or limit HUB participation.
(13) Review HUBs listed in the directories provided by the Department of Administration and local municipalities to verify HUB's availability, contact information, specific work type, and relevant experience.
(14) Become knowledgeable of HUBs that are potential contractors and include HUBs on contract solicitation lists.
(15) Ensure that HUB goals and "Good Faith Effort" requirements are included in requests for bid/proposals and are discussed during pre-bid/proposal conferences.
(16) Attend proposal interviews (designer, construction manager, etc.) to discuss proposer's plan to assist the University with meeting the HUB goals and to assess the proposer's utilization of HUBs.
(17) Assist HUBs in obtaining adequate information about plans, specifications and construction requirements.
(18) Review good faith documentation for completeness.
(19) Conduct debriefing sessions, when requested, on awarded contracts, to explain why bids/proposals by HUBs may have been unsuccessful.
(20) Maintain records sufficient for verification of steps taken and evaluate efforts to increase HUB participation.
(21) Maintain a file of successful bid/proposal documents from past procurement and permit HUBs to review and evaluate these documents.
(22) Monitor HUB utilization throughout the duration of construction.
(23) Monitor enforcement of Article 17 of the "General Conditions of the Contract…" which requires sub-contractors receive payment within seven days of the contractor receiving payment from the owner.
(24) Engage the designer and construction manager during the design development phase to identify minority businesses and investigate methods of structuring bids that might increase minority participation.

e) Program Monitoring

The system wide HUB liaison officer will establish a data collection and monitoring system for both formal and informal projects to evaluate compliance with this Plan. The HUB Liaison Officer will provide the President and the Vice President for Finance with regular updates and will recommend modifications to the Plan as needed. Summaries of these updates will be included in the construction program updates provided regularly to the Board of Governors. The system wide HUB Liaison Officer will include the following in his/her reports: each construction project awarded showing the total contracted amount, awards to prime contractor(s), awards to subcontractor(s), participation by HUB firms (scope and contract amount), percentage of the project completed, and any change orders associated with the project that affect HUB participation in the overall project.

f) Identification

The University will continue to use the database maintained by the Office of Historically Underutilized Businesses as its primary source of identifying HUB firms. Additionally, the University will collect its own data, as needed, to supplement the information contained in the database. The constituent institutions will be responsible for building upon established relationships with local HUB offices and minority trade organizations to utilize their services to identify HUB contractors. Certification of HUB firms will be consistent with G.S. 143-128.

g) Outreach

The University outreach efforts consist of broadening access to construction contract information, facilitating the development of relationships among the construction community, raising the awareness of the availability of HUBs, and providing assistance to contractors who have not historically participated in University construction projects. The following outreach efforts are targeted:

(1) The University will sponsor and participate in HUB workshops, seminars and training programs.
(2) The University will meet with community organizations, trade groups, and others as requested for the purpose of providing information on upcoming bid opportunities, issues related to doing business with the University, and improving relations.
(3) The University will implement an ongoing communications program that will incorporate a variety of methods for disseminating information regarding construction opportunities and procedures. The program will include the use of news media, brochures, email announcements, grass roots efforts, and direct mailing to contracting organizations and the statewide network of HUB officers and advocacy groups.
(4) The University will ensure that project plans are available for review by potential contractors for an appropriate length of time to provide the information needed for the submission of professional bids.
(5) The University will maintain records for public review of the scope of each project, the award amount, the contract duration, and the final construction amount.
(6) The University's outreach efforts to reach HUB contractors will be open to all contractors, including those who have not historically participated in University construction projects.

h) Good Faith Effort

The University supports HUB participation in all construction projects. For informal projects, each constituent institution must demonstrate a "Good Faith Effort" in the solicitation of HUB suppliers or subcontractors. For all other projects, contractors who fail to meet the stated HUB goal of 10% participation will be required to submit an affidavit and supplemental information with their bid, detailing all efforts that have been undertaken to demonstrate a "Good Faith Effort" in the solicitation of HUB suppliers or subcontractors and will be offered an opportunity to enhance their compliance. Contractors who meet the stated HUB goals will be recognized as successful models in HUB reports.

The supplemental information that The University of North Carolina will consider in determining whether a bidder has made a good faith effort, consistent with G.S. 143-128, includes the following:

(1) Effort: Attendance at the scheduled pre-bid conference that allowed for interaction with other contractors, including potential HUB subcontractors and suppliers.
(2) Evidence: Attendance shall be verified by a conference sign-in sheet.
(3) Effort: Contacting HUBs that reasonably could have been expected to submit a quote at least 10 days before the bid or proposal date. Placed advertisements in publications not less than 10 calendar days before the bid or submittal date in the general circulation media, trade association publications and HUB focused media. The advertisements should identify specific work items.
(4) Evidence: Copies of written notification or solicitations to minority businesses and documentation of the number of quotes / proposals received. Contractors shall

supply a list of publications where advertisements were placed in addition to copies of the advertisements. At a minimum, the advertisements should include the following: the location of the project, an indication that the University of North Carolina is the project owner; the location where plans and specifications may be obtained or viewed; the due date of bids from subcontractors; the scopes of work for which subcontractors are being solicited; a statement that the contractor intends to operate in good faith in soliciting HUB firms for participation on the project. The list should also include the names of minority publications and trade associations used by the contractor to attract HUB businesses.

(5) Effort: Making construction plans, specifications, and requirements available for review by prospective minority businesses or providing these documents to them at least 10 days before the bids are due. Documentation made available to HUBs should include:

   (a) Specific work the contractor intends to subcontract;
   (b) The date, time and location where bids by subcontractors are to be submitted;
   (c) The names of the individual within the company who will be available to answer questions about the project;
   (d) The place where the construction documents may be reviewed;
   (e) Any special requirements that may exist, such as insurance, licenses, bonds and financial arrangements; and
   (f) That active involvement by HUBs is being solicited.

(6) Evidence: Copies of written correspondence provided to subcontractors shall be provided as documentation. In addition, contractors should provide evidence that the letters, plans and specifications or other documents were sent by certified mail.

(7) Effort: Contractor follow-up to initial solicitation of minority firms to determine and document number of firms responding to the solicitation, expected bid participation, or reasons given for lack of interest.

(8) Evidence: Documentation shall be provided listing the name(s), date(s), method(s) and result(s) of follow-up communications with suppliers or subcontractors who responded to the initial solicitations. For HUB firms indicating that they are not bidding, provide documentation outlining the reasons given.

(9) Effort: The contractor identified and elected to subcontract areas of work matching the capabilities of solicited HUBs. Where appropriate and in accordance with normal industry practice, elements of work were divided into small, economically feasible units to facilitate HUB participation.

(10) Evidence: Documentation will be examined to identify steps taken to partition project elements into economically feasible units that would attract HUB contractors. Documentation provided should identify the scope of work made available to subcontractors and suppliers and should further include evidence (dates, times) when negotiations took place with HUB contractors.

(11) Effort: The contractor provided a reasonable opportunity for participation of minority businesses, and where rejection of a minority business was based on qualifications, specific reasons were documented in writing.

(12) Evidence: Documentation should identify the names, addresses and telephone numbers of suppliers or subcontractors contacted who bid on the project but were rejected due to lack of qualifications or capacity. Documentation of attempts to negotiate that were unsuccessful and the reason for the lack of success should also be included.

(13) Effort: Whether the contractor has actively sought to engage HUB contractors; minority and women community organizations; minority and women contractor associations; local, State, or federal minority and women business assistance offices;

or other organizations that provide assistance in the recruitment and placement of minority-owned or women-owned business enterprises.

(14) Evidence: Copies of letters, faxes, telephone logs, and other documentation that demonstrates an effort to contact such organizations should be provided. Copies of correspondence received from any of the organizations/groups acknowledging contact by the bidder should also be provided. A contractor is required to notify or confer with at least three HUB organizations. Contractors may provide any additional information such as history of utilizing HUBs, mentor-protégé programs, documentation of reasonable assistance provided to an otherwise qualified HUB in need of equipment, supplies, bonding, joint pay agreements, or any other additional information that would demonstrate good faith efforts to obtain HUB participation.

The University will make a recommendation as to the apparent low bidder's responsiveness to the provisions of the Plan. Each campus shall establish a "good faith committee" to review bids if consideration is being given to rejecting a bid for lack of a good faith effort. The committee should offer the contractor an opportunity to defend his/her good faith effort before a decision is made. If the committee recommends rejecting the bid, the committee shall document its reasons for making this recommendation and shall seek the chancellor's review. If the chancellor concurs, the recommendation will be forwarded to the Vice President for Finance for review. If the Vice President for Finance agrees, then the University should recommend award to the next highest bidder who did make a good faith effort (for projects within the construction download) or should request that the State Construction office do so for projects above the construction download. Pursuant to North Carolina General Statutes, contractors who fail to achieve the goals specified in this Plan and who fail to make good faith efforts to achieve the goals may have their bids rejected by the Department of Administration as non-responsive.

i) Post Award Monitoring

Contractors engaged in university construction projects will be required to submit a HUB utilization report when requesting payments for services rendered on a monthly basis. The request for payment will not be considered complete and will not be processed without the HUB utilization report. The HUB utilization report requires that the contractor list the dollar amount of HUB work completed to date and payments made to HUB contractors, as well as the amount to be paid to HUB contractors from the requested payment.

A contractor who has been awarded a project based upon a given level of HUB participation is responsible for ensuring that the HUB participation does not materially vary from that originally specified when receiving the contract award. A contractor will not:

(1) Terminate or fail to utilize a HUB contractor that was originally listed without following the procedure outlined in the bid documents;
(2) Materially modify or eliminate all or a portion of the scope of work attributable to a HUB to which the contract was awarded; or,
(3) Submit false or misleading documentation.

If the University has reason to believe that a contractor may not be operating in compliance with the terms of the contract, the University will notify the contractor in writing and request a meeting to resolve the issue. A representative from the Office of State Construction would also be invited to attend the meeting. If a contractor fails to agree to comply with the terms of the contract, the University may:

(1) Cancel the contract;
(4) Suspend any payment or part thereof; or,
(5) Reject future bids from the contractor.

j) Contract Disputes and Complaints

To the maximum extent that is legal, practical, and ethical, the University will endeavor to resolve complaints or disputes associated with HUB commitments and requirements of the Plan to the benefit of all involved parties.

k) Professional Services

The University will review and consider the utilization of HUB consultants when evaluating professional service proposals. The goal for the participation of HUBs will be consistent with their general availability within the professional communities involved. All advertisements for professional services will encourage participation of HUB firms. Providers of professional services should contact the HUB Liaisons at each constituent institution for specific institutional goals and programs.

l) Reporting and Review

The University will provide periodic updates and reports on the status of its efforts to ensure and promote equal and increased opportunities for all segments of the design and construction community to The University of North Carolina Board of Governors; the North Carolina General Assembly; members of the North Carolina Legislative Black Caucus; the Office of Historically Underutilized Businesses; the North Carolina Institution of Minority Economic Development; the Bond Oversight Committee, and others, as requested .

The President will review the Plan periodically (at least biennially) and will make a recommendation to the Board of Governors as to whether the Plan is still needed.

8. MOVING PROCEDURES FOR BOND PROJECTS

a) Organizing a Move

To ensure a smooth transition to a new location, every aspect of the move should be planned in order to eliminate confusion for the movers, new occupants, and neighboring departments. This requires close attention to details such as building access, parking, elevators, keying, communications, mail service, hazardous materials, surplus property and the ordering of new furniture. The following is a brief summary of the procedures required to perform a departmental move in an organized and coordinated manner.

(1) Appoint Department Move Coordinator for all moves:

This person will ensure the many details affecting the move are handled. For small moves this job can be managed on a part-time basis, but for large "whole building" moves a person that can devote full time to the process would be preferred. In either case the coordinator must have the full support of the Dean or Department Head.

(2) Create Move Plan:

The Facilities Planning and Construction Project Manager will create documents that will list all of the tasks involved in the move and create a plan and timetable for accomplishing each task. For complex moves these items can be put on a Gantt chart to help the Coordinator visually check the progress of each facet in relation to the total move (See Attachment C). Facilities Planning and Construction will prepare this since it is imperative that the move schedule be coordinated with remodeling and building schedules.

(3) Establish scope of the move and select a moving company:

Once all of the requirements of the move are determined, they should be sent to Purchasing on a requisition form. Upon receipt of the requisition, Purchasing will start the bid process. This process takes a minimum of 30 days and consists of the following steps:

(a) Notification of prospective bidders.
(b) Pre-bid conference and walk-through with prospective bidders.
(c) Request for bids.
(d) Bid opening.
(e) Appraisal of the successful bid.
(f) Approval of the successful bid.
(g) Issuance of Purchase Order

The Department Move Coordinator will schedule a Pre-bid conference and walk-through with prospective movers. Purchasing will furnish the names of movers who are on the University's bidder list. Movers will conduct every aspect of the move if this is specified; however, a department is expected to do its own packing.

Note: The vacated space must be entirely devoid of furnishings, equipment, recyclables, chemicals, and trash by a date agreed upon by the Move Coordinator and the Facilities Planning project manager.

b) Coordination:

Any relocation within the University will require close coordination between the different departments involved in the move. The following is a list of those departments, a brief description of their involvement in the moving process and how they impact the move. It is the responsibility of the Move Coordinator to contact the appropriate departments with ample time to insure adherence to the move schedule.

(1) Asset Management

The Capital Assets Accounting Office can furnish a printout of all for the departmental capital assets. Prior to the move, changes should be made to the printout giving the new locations of each asset. The move is a good time to conduct an asset inventory.

(2) Auxiliary Services

(a) Carolina Copy

All university copiers are handled by Carolina Copy. Movers are not allowed to relocate any copy equipment unless it owned by the department and is being sent to Surplus. In order to relocate copiers the department coordinator must contact Carolina Copy at least 2 weeks before the move. Prior to the move, any changes in department stationary and employee business cards should be handled. This needs to be done at least 2 weeks before the move.

(b) Vending Machines

In order to relocate existing vending machines or order new ones, the department Move Coordinator is required to contact auxiliary services at least one month before the move.

(3) Environmental Health and Safety (EHS)

EHS must be advised of any move within the university. This is of particular importance when it comes to the relocation laboratories and or laboratory equipment. EH&S has prepared very specific guidelines to assure the proper disposal and relocation of hazardous materials in laboratories, shops and other areas. See Attachment E or visit the EHS website for more information: http://www.ehs.unc.edu/In order to be ready for a move EHS will require notification 60 days before the move date. Some examples of EHS areas of concern include:

(a) Hazardous Waste
(b) Biosafety
(c) Radiation Safety
(d) Process Hazard
(e) Ergonomics
(f) Universal Waste

(4) Facilities Services Customer Service and Work Request Center

The Facilities Services Customer Service Center receives and assigns all requests for Building Maintenance, Signage, Lock Shop, and Elevators. All building Liaisons have

been provided with the BUILDING LIAISON GUIDE TO FACILITIES SERVICES. The Move Coordinator should consult and coordinate with the Building Liaison in the preparation of work requests for Facilities Services at least three months before the move.

(a) Elevators

Facilities Services is responsible for maintaining the campus elevators. They can also furnish keys to allow elevator cars to be stopped on floors while the movers load or unload. This is important because jamming the doors open can damage the elevators. Whenever elevators are used, movers must provide adequate padding and take care to protect the walls, floors, and doors.

(b) Key Systems

One of the most important aspects of the move is the establishment of an effective keying system. While it may be possible to duplicate the system used at the old location in small moves, moving to a larger or more complex location may require a significant amount of planning. This process should take place at least three months before the move to allow Facilities Services Lock Shop adequate time to order locks, cut keys, and install the system. It should be noted that large hardware systems might require several months to receive.

The first step in organizing a new key system is to carefully study the new location and to identify the doors to be keyed. Next a decision should be made regarding who will need access to each door. At this point the Facilities Services Lock Shop should be contacted. They can furnish a Keying Diagram that provides a hierarchic assignment of keys from masters down to individual door keys. Once there is a clear idea of what will be required, the requirements along with a floor plan of the new location indicating each door should be taken to the Hardware Shop for review. When the review is complete the Shop should be given a copy of the key plan, floor plan, and a Key Request Form indicating how many keys of each code will be needed. The Lock Shop must be kept abreast of any changes in the key requirement until the system is installed.

(c) Signage

Information to be supplied at a later time.

(d) Housekeeping

At least 6 weeks before, contact the housekeeping zone manager to get extra trash containers. This should be done concurrently with requesting additional recycling bins from the Office of Waste Reduction and Recycling. One week before the move the moving coordinator should contact University Housekeeping to insure that new space is cleaned before the relocation and that the vacated space is cleaned and all remaining trash is removed after the move is complete.

Housekeeping's Moving Crew provides moving services for moves that can be completed in one day or less. They also can provide loaner tables and chairs. See Attachment D for more information.

(5) Information Technology Services

Information to be supplied at a later time.

(6) Academic Technology and Networks

ATN should be contacted 60-90 days in advance regarding telephone service and data network connectivity requirements. Department moving should send notification email to and an analyst from ATN will meet with the department to plan relocation of their services and assist them on any new services they may desire. The analyst will give technical assistance and training to help provide for a smooth transition. It is important to note that academic units typically have their own LAN coordinators who provide computer desktop support. Administrative units get similar support centrally from AIS. The Move Coordinator must involve their LAN desktop support group early in the process to insure all network requirements are properly coordinated.

(7) Insurance and Risk Management

Supplemental insurance for moves

(8) Interior Design and Workspace Planning

(a) 12 Months before Move Date:

(i) Contact Work Management to initiate relocation and new furniture purchases.
(ii) Determine the internal budget allotted for furniture and design time. Budget Estimates can be provided to assist the department.
(iii) Complete the necessary funding document From Work Management to begin the design process for relocating ext'g furniture or planning new furniture and interior finishes and return the Documents to Work Management.
(iv) Engage in meetings with Design to discuss work space layouts and furniture specifications.

(b) 6 Months before Move Date:

(i) Make sure all layouts, furnishings, fabrics, etc are finalized with the Design Department.
(ii) Complete the necessary funding document From Work Management to begin the ordering of new furniture, carpet, artwork, etc. and return the documents to Work Management.
(iii) Meet with Project Lead to discuss the scope of the project including time lines, move phases and dates and any special needs the department may have in relation to furnishings or office layouts.

(c) 4-6 Months before the Move Date:

(i) The Department Coordinator and the Project Lead will maintain close communication to keep each other informed of the move plan, timeline and any changes that may occur such as unexpected delays or changes to the move plan.

(ii) At this time, the Project Lead will work with purchasing to conduct the bidding of furniture and create all the necessary purchase orders to put the new furniture on order and oversee the installation of the product.

(d) Consequences:

If the Department doesn't follow the outlined time line the consequences may include but are not limited to the following;

(i) Funding may not be in place with Work Management to begin the design process
(ii) Funding may not be in place with Work Management to begin the ordering of goods
(iii) The furniture may show up too early accruing storage fees from the contractor
(iv) The furniture may show up too late delaying the move

(9) Interior/Room Signage

Room signage for new buildings is usually included in the construction cost and will be coordinated through the project manager or architect. For changes necessary when moving to existing buildings, Facilities Services should be consulted. They can supply a variety of signage in accordance with the University's signage standards. Once the signs are selected, Facilities Services will require a work order and adequate lead-time to fabricate and install the signs, at least three months.

(10) Work station planning and furniture layout

Information to be supplied at a later time.

(11) Mail Services

Even though campus box numbers remain the same when a department moves, the campus mail services section should be notified so they can change the route. They should be notified when to stop delivery at the old location and when to start it at the new location. A new pick-up and delivery point will also need to be established.

(12) Office of Waste Reduction And Recycling (OWRR)

(a) Indoor recycling, confidential paper, trash and construction and demolition waste

Most people who have been at the same desk for a long time have a great collection of paper and obsolete information and this a good time to clean up. Move Coordinators should encourage their staff to PURGE BEFORE THEY PACK.

At least 6 weeks before packing starts, contact OWRR to coordinate collection of confidential paper and arrange to have extra recycling bins delivered. The Move Coordinator and an OWRR representative will conduct a walk through to evaluate the scope and type of recyclables to be discarded. Every effort should

be made to supply enough bins at an early enough date to maintain the regular recycling schedule for the building. If the volume is such that additional pick ups are needed, this must be coordinated thru OWRR.

Materials that can be recycled in the extra bins include

(i) office paper
(ii) newspapers/magazines
(iii) soft back books
(iv) hardback books
(v) office supplies

It is important to schedule final removal of the recycling bins once the department is completely moved. In some cases it is also necessary to arrange to have the trash dumpsters at the building emptied more frequently. Make sure to take desk side recycling bins with you when you move. See Attachment G for more information about planning for recycling during the move.

(13) Property Office (Leased Space)

Information to be supplied at a later time.

(14) Purchasing

See: I. ORGANIZING A MOVE, Section C. Establish scope of the move and select a moving company.

(15) Surplus Property

Moving presents an excellent opportunity to dispose of equipment and furniture that will not be needed at the new destination. Surplus property can be sold in place to other state agencies, non-profits or the public; taken to University or State Surplus Property Offices; transferred to other university departments; or scrapped. Whichever method is employed, care should be taken to keep from moving it to the new destination before disposal. To coordinate this effectively, the Move Coordinator should request a capital asset listing from the Asset Manager at least 6 months before the move or during the Design Development phase of the renovation project planning phase. At this time, a walkthrough with the Surplus Property manager and OWRR's construction waste reduction coordinator should be conducted to coordinate the advance sale of items and delivery of remaining items to the Surplus warehouse by the contracted movers. Furniture and equipment to be disposed off must be identified, flagged, and listed on an UNC-CH Surplus Disposal Form (P-110). For more information about these procedures, see Attachment F or http://www.unc.edu/mds/sp/index.htm.

(16) Telephones

Information to be supplied at a later time.

(17) Transportation

The Move Coordinator must contact the Transportation Division at least 1 week in advance for assistance in controlling traffic around both locations during the move.

Transportation can block off parking and enable the movers free access for their trucks and equipment. Transportation can be helpful in identifying periods of peak traffic that would adversely affect the move.

(18) University Archives

http://www.lib.unc.edu/mss/uars/uinv.html

In accordance with the provisions in Chapters 121 and 132 of the General Statues of North Carolina, the University Archives serves as the administrative memory of University of North Carolina Chapel Hill. Its function is to preserve records with continuing administrative, legal, and historical value to the University and make them available to departments, scholars, and all interested researchers. By centralizing these materials, the Archives promotes greater and more efficient use of such records, relieves individual offices of the responsibility of servicing them, releases considerable filing equipment and space, and reduces the fire hazard created by storing records in inaccessible areas. Moving presents an excellent opportunity to archive documents of historical importance that will not be needed at the destination. University Archives will require at least 6 months notification.

c) Relocating Heavy Equipment

Occasionally there are large pieces of equipment, which must be moved by heavy equipment riggers. These items should be identified during the programming phase of the future space and listed by the architect. Large items usually require the special skills of a rigger to safely relocate them to the destination. Some of the things that need to be considered when relocating heavy equipment are as follows:

(1) Measure doorways, passageways, and elevators through which equipment must move.
(2) Allow lead-time when renovations are required at the destination to accommodate the equipment.
(3) Be sure that power, water, air, or steam lines have been disconnected before attempting to move the equipment.
(4) Be sure that the proper services for power, water, steam, or air are available at the new location.
(5) Arrange in advance for the removal of doors or windows to facilitate the removal of equipment.
(6) Arrange in advance with the Transportation Department to provide a clear operating area for the riggers and their equipment.
(7) Protect floors, walls, elevators, walks, and grounds from damage during the rigging operation.
(8) Provide insurance coverage for the relocation of expensive scientific equipment.

It is important to remember that the employment of riggers will require a separate bidding process and involve close coordination between the movers and riggers. Since the relocation of heavy equipment often involves the disconnecting and connecting of utility services that may require design work, advance planning for the rigging and reinstallation operations should begin and end well before the move takes place. The mover will identify any item that they cannot move during the initial walk-through.

d) Packing and Labeling

(1) Moving Labels

Moving labels are furnished by the mover and are applied to each piece to be moved to enable the movers to quickly assemble items for the destination. The Move Coordinator will distribute these and provide the necessary instructions to staff for tagging and labeling procedures (the mover will assist in this process). This process should include coordination of items to be moved to the new location, transferred to other departments, sold in place (thru Surplus), taken to surplus, etc. The Facilities Planning and Construction will provide drawings of the new space to facilitate the tagging process. All labels should be uniformly placed on each piece of furniture and equipment and boxes to eliminate confusion for the movers (a tagging diagram will be provided by the mover).

(2) Desks

Pack all contents in and on top of desks. The desks will be upended during the move. The mover will not be responsible for personal items such as money, plaques, plants, or glass items. Please move these items privately. Put all loose items such a paper clips, pens, and pencils in envelopes and pack them in a moving carton. Be sure to label both pieces of furniture such as "L" shaped desks, which will be disassembled before moving.

(3) Cubicles

Pack all contents in and on top of cubicles including overhead storage cabinets and tack boards. In most cases cubicles will be reconfigured and people will move into a different cubicle. Any items that are not packed and flagged for moving should be disposed of. Cubicles should be left completely empty and any keys should be left at the cubicle. In some cases, it may be necessary to have cubicles dismantled before the move. The Move Coordinator should determine if this needs to happen and who will be responsible for this.

(4) Boxes

The most common and economical carton is the 1.5 cu. Ft. "book box". They come "knocked down" and must be assembled. They will hold either letter or legal-size files, and can easily be picked up when full of books. These boxes can be easily assembled using 2" plastic packing tape. Be sure to properly assemble all boxes to prevent them from coming apart. Place label on EITHER END (near handle) NOT TOP! Cartons are stacked when moved; please DO NOT over pack.

(5) Bookcases

Remove all books and put them into cartons. Take loose shelves out and tape them together. Brackets, clips, and pins that shelves sit on should be sealed in an envelope and then taped to the shelves or packed in a carton. Do not forget to label both the bookcase and the shelves. Discarded books and magazines should be recycled using the extra bins that are available from OWRR. In addition to the benefits of waste reduction, recycling these materials lightens the burden on housekeeping and those who empty the trash barrels.

(6) Filing Cabinets

(a) Vertical Filing Cabinets - Place label on top drawer. Be sure all pressure plates are moved forward so contents will be secured. Tape (Duct Tape) or lock drawers closed. BE SURE TO KEEP THE KEYS!
(b) Lateral Filing Cabinets - Place label on top drawer. If the cabinet has 2 or 3 drawers, contents can remain. With 4 or 5 drawer cabinets all contents must be removed and packed in cartons (except for the bottom two drawers). If the contents are packed, label both the cartons and file drawers so the contents can be easily identified for unpacking.

(7) Storage, Supply Cabinets, and Metal Shelves

Pack all of the contents in cartons. Cabinet doors should then be locked. BE SURE TO KEEP THE KEYS! If metal shelving units are connected in tandem they should be disconnected to facilitate moving. Place label on front near upper right-hand corner. Secure shelves or bundle them to be moved separately. (If moved separately, please label).

(8) Personal Computers

Label any separate piece. Do not apply labels to the glass screen. Disconnect all cables and pack all small loose items such as cables, speakers and the control "mouse".

(9) Office Machines

Disconnect all small office machines and do not pack. Typewriters should be disconnected and carriages must be centered. Pads, covers, and loose cords for the machines should be packed in a carton. Contact Carolina Copy regarding the relocation of copy machines.

(10) Telephone Equipment

Arrangements for the move of telephone equipment will be under the direction and control of ATN.

(11) Pictures and Lamps

The owner should remove all personal pictures and lamps prior to the move date. Most movers charge extra to move lamps and pictures.

(12) Recycling Bins

Individual desk side recycling bins should be flagged and moved to the new location. Centralized recycling bins should be left at the building being vacated and collected by OWRR at the end of the move as coordinated by the Move Coordinator. In situations where someone else is moving into the vacated space, the centralized recycling bins will be left in place for the new tenants. OWRR will work with the Move Coordinator to set up recycling bins and dumpsters at the new location. Moving customized and specialty recycling bins should be coordinated with OWRR.

(13) Miscellaneous

Tag chair seats and pad, carpet protector, wastebaskets, etc. The labels are designed to come off easily when the move is completed. Because of this, the stickers will not adhere to some surfaces, such as upholstered chairs and sofas. If necessary, place a piece of scotch tape over label or place label on wooden or metal leg or arm.

REMEMBER… IF IT IS NOT FLAGGED, IT WILL NOT BE MOVED. BE SURE TO DOUBLE CHECK ALL ARTICLES. PLEASE TAKE HOME ALL PERSONAL OR PRECIOUS ITEMS BEFORE THE MOVE AND RETURN THEM AFTER THE MOVE.

e) Activities at the Destination

(1) The Move Coordinator should verify that all offices and cubicles at the new location are labeled.
(2) Instruct your employees by e-mail or memo to unpack as soon as possible.
(3) As soon as unpacking is complete, break the cartons down and place them in a central area for removal.
(4) COORDINATE THE RETURN, REUSE OR RECYCLING OF THESE WITH YOUR MOVER OR HOUSEKEEPING. Have the mover, one of your employees, or housekeeping remove them from the space for return, reuse, or recycling.
(5) Walk the space and visit with each employee to adjust chair heights, work surface heights and make sure that everything is working make record of any moving damage or missing items.
(6) Inspect every lateral file cabinet to ensure that it's not unbalanced, top heavy or about to fall over. If it's dangerous, have the mover level, balance, bolt and gang it.
(7) Set up and test your computers as soon as possible including the ones in offices and at workstations where the employees are traveling or on vacation.
(8) File Damage Claims in writing as soon as possible with your mover on his Damage Claim Form. Follow-up and confirm that he has received the completed forms.
(9) Instruct your employees to place any item or carton that's not theirs in the "Lost & Found" room.
(10) Coordinate with OWRR to set up centralized recycling bins and dumpsters for the new location.

f) ATTACHMENTS

(1) Move Contact List
(2) Move Check List
(3) Move Responsibility and timeline matrix— Information to be supplied at a later time.
(4) Housekeeping Move Check List
(5) Environment Health and Safety Lab Closeout Procedures
(6) Surplus Property Procedures
(7) Office of Waste Reduction and Recycling Move and Office Cleanout Check List

Attachment A

Move Contact List

Overall estimated move timeframe:

Facilities Planning and Construction	Contact Name	Telephone	Email
Project Manager			
Construction Manager			

Contact Name/ Email/Phone:	Department(s):	From:	To:	Date:

Department	Contact Name	Telephone	Email
Asset Management	Candi Woody	962-6267	
Auxiliary Services (Carolina Copy, Vending and Laundry)	Alvin Garner	962-2799	
Vending Machines			
Copiers			
Environment Health and Safety	Peter Reinhart	843-5913	
Hazardous Waste Manager			
Biosafety Officer			
Radiation Safety Officer			
Process Hazard Review			
Ergonomics			
Etc……			
Facilities Services Customer Service and Work Request Center	Steve Copeland Steve Stoddard	962-4633 962-1565	
Sign Shop			
Lock Shop			
Elevators			
Housekeeping Services	Bill Burston	962-1440	
Insurance and Risk Management	Janet Hoernke	962-6681	
Supplemental insurance for moves			
Interior Design and Workspace Planning	Cheryl Leguillow	962-9037	
Mail Services	Tommy Brickhouse		
Office of Waste Reduction and Recycling	Sarah Myers	962-4699	
Indoor recycling and confidential paper			
Extra service of trash dumpsters			

Construction and Demolition Waste (and other unique things)		
Property Office (Leased Space)	Stephen Condrin	962-9063
Purchasing Contract Movers	Mark Sillman	962-9463
Surplus Property	Al Jeter	962-2160
Telephones	Steve Harward	962-0004
Transportation and Parking	Deborah Hawkins	962-5026
University Archives and Records	Janis Holder	962-0043

Attachment B

Move Check List

6-12 MONTHS BEFORE MOVING DAY

Department/College Moving coordinator

__ Assign Department moving coordinator
__ Assign office space
__Coordinate with Environmental Health & Safety (EHS)
__Review EH&S Lab Move Procedures check list
__Coordinate with University Archives

Facilities Division

__ Prepare move Schedule and choose the move day
__ Coordinate inventory of existing furniture
__ Coordinate furniture purchase if required
__ Send Purchasing request for moving services
__ Schedule pre bid walk through with moving vendors
__ Coordinate selection of moving vendor with Purchasing

3-6 MONTHS BEFORE MOVING DAY

Department/College Moving coordinator

__ Submit life safety plans for new facility to EH&S
__ Review EHS lab startup requirements
__ Arrange for additional trash/recycling disposal
__ Set-up cleaning service
__ Arrange for copier move or buy new equipment
__ Order keys, access cards
__ Coordinate with surplus property (Sell old equipment, furniture etc.)

Facilities Division

__ Coordinate furniture delivery
__ Coordinate furniture installation with power and data requirements

1-2 MONTH BEFORE MOVING DAY

Department/College Moving coordinator

__ Create new office layout map (to be done by individual user)
__ Create new office extension directory
__ Order new stationery
__ Order new business cards
__ Order new business forms
__ Purge old, obsolete materials
__ Create new office extension directory
__ Obtain moving crates/cartons
__ Update Web site with new information as required
__ Notify Mail Services of Change of Address
__ Back-up computers
__ Store property that will not be moved
__ Tag furniture to be moved
__ Tag items for surplus storage
__ Inventory existing computers
__ Contact University Dining for Vending machine requirements

Facilities Division

__ Verify phone line installation schedule
__ Code new office space on a map for movers

1-3 WEEKS BEFORE MOVING DAY

Department/College Moving coordinator

__ Pack up desks, personal spaces

__ Pack up common areas
__ Distribute new keys, cards
__ Collect old keys, cards
__ Empty, defrost and clean refrigerator
__ Order dry ice and coolers for items that may require continued refrigeration

Facilities Division

__ Coordinate move of systems furniture
__ Coordinate truck access with transportation
__ Coordinate protection of main moving paths and elevators

MOVING DAY

Department/College Moving coordinator

__ Assign room to be used as lost and found
__ Post coded signs in new office for movers
__ Move plants and personal items

Facilities Division

__ Final inspection of former location

Attachment C

Move Timeline Matrix

Information to be supplied at a later time.

Attachment D

Housekeeping Moving Procedures For Moves That Will Take 1 Day or Less:

- Contact Moving Office 3-4 weeks before date you want items moved
- If boxes are needed, contact moving office, give an account #, and boxes can be purchased and delivered, (but this too must be scheduled too)
- Let other staff know what needs to be moved or what they want moved. It is best to label items with destination so there is no mistake.
- Inform everyone that everything (desks, file cabinets, bookcases, etc.) must be emptied before the date of the move
- Complete move request form, return form to moving office
- If needed, contact parking and transportation to have 2-3 parking spaces at bldg. blocked off for move trucks for the day of the move
- For modular furniture, contact physical plant for break-down, dismantling
- If moving centrifuges or hoods, contact Health & Safety office to have these items flagged, (movers will not touch without a clearance form). Have Freon removed by the HVAC shop first.
- Housekeeping Services Moving Crew does not move computers, copiers, printers, etc. unless going to surplus.
- Items That Will Be Moved to Surplus (also see Attachment F):
- Send completed surplus form to Surplus Dept. (CB#1070)
- If you want the surplus picked up before the movers get to it, you must call and request a pick up date
- NOTE: Surplus is worked into the schedule unless a request for pick-up is made
- Tables & Chairs Loan:
- Call at least 3-4 weeks in advance
- If loan is for Friday, (and pick up is not until Monday), tables & chairs can not be left outside, they have to be stored in a bldg. (you must let the moving office know where they will be stored in advance)
- We do not have podiums or round tables
- Someone will have to meet the movers to sign for the table and chairs
- No loans are to go to a personal residence

Attachment E

Environment, Health and Safety

Laboratory Closeout Procedure

This form is to guide laboratory personnel when laboratory operations are moved or discontinued. Other requirements may apply.

Be sure to clean out and decontaminated freezers, coldrooms, other storage areas outside of the lab and common storage areas. If these areas will no longer be used, remove all materials, including chemicals and biologicals.

Contact the Department of Environment, Health and Safety (EHS) 60 days prior to vacating the laboratory, room or area. For more information, see ehs.unc.edu or call EHS at 262-5507.

Procedure	Date Completed
Chemicals For questions, call Hazardous Materials Manager 2-5509 or see www.ehs.unc.edu	
Evaluate all chemicals and label all containers	
Are there any unknown chemicals? Identify if possible.	
Submit waste forms, either online, (www.ehs.unc.edu), or by hard copy.	
Clean Laboratory surfaces	
Confirm Hazardous Waste has been removed	
Controlled Substances	
If you have your permit, DEA agents can be sewered with a witness signature. Keep records for at least 3 years. If no permit, call Hazardous Materials Manager, 2-5509.	
Have Controlled Substances permit available	
Gas Cylinders	
Return to supplier	
For non-returnables, send in HMTF	
Contact Scientific Storeroom: 6-5671	
*Make sure cylinder is disconnected, valve off, cap on	
Animal and Human Tissue	
Dispose of tissue. Describe method:	
Dispose of Preservative. Describe method:	
Clean refrigerators/freezers	
Transfer responsibility of samples to:	
Microorganisms and Cultures For questions, call Biological Safety Officer 2-5726 or see ehs.unc.edu	
Autoclave waste (see procedure at ehs.unc.edu)	
Radioactive Materials For questions or waste pickup, call 2-5507 or see Radiation Safety FAQ, “Moving Your Laboratory” at ehs.unc.edu	
Prepare Radioactive waste for pick-up and call 2-5507	
Lead bricks, lead pigs, shielding, source containers. Do wipe tests, attach to 102 form, and call 2-5507 for removal.	
Exit survey of rooms and equipment is required!	
Procedure	Date Completed

Recyclables To schedule pick-up, contact Office of Waste Reduction/Recycling; 2-1442. Also see www.fac.unc.edu/WasteReduction .	
Large quantities, overflows, or confidential paper pick-ups	
Laboratory Equipment/Surplus Property	
Units that may contain refrigerants must be evaluated by Facilities Services Refrigeration Shop (2-1087) to determine if refrigerant needs to be removed. If refrigerant needs to be removed, submit a work order to Facilities Services Customer Service (2-3456). The Department or owner must pays for removal.	
For equipment that may be contaminated with radioactive material, decontaminate, remove warning stickers, and complete a Safety Clearance Form and attach it to the unit prior to calling. For information, call 2-5507 or see Radiation Safety FAQ, at ehs.unc.edu	
For equipment that may be contaminated with chemicals or biological material, decontaminate, remove warning stickers, and complete a Safety Clearance Form and attach it to the equipment.	
For other discarded lab equipment, notify your Department manager; call Surplus Property (2-2134) and complete forms. Call the University Moving Crew (2-0662) to arrange for transportation of equipment to Surplus Property. (If Surplus Property determines that the equipment should be scrapped, it will be taken to the Orange County Recycling Facility at no charge.)	
Sharps	
Chemically contaminated sharps, use metal can- then trash	
Biologically contaminated sharps, use metal can, autoclave- then trash	
Radioactive sharps, plastic container, call in, 2-5507, 102 form	
Metal can for sharps, (item# SP-28700), call 6-5671	
Glassware	
Brown, empty bottles, de-face then trash	
Other glassware that is empty, use plastic-lined cardboard glass box, then trash	

Attachment F

Surplus Property Procedures

ASSET MANAGER:	Candi Woody	962-6267
SURPLUS PROPERTY MANAGER:	Al Jeter	962-2134

Timeline:

- Three to Six Months out
  - Request a Capital Asset listing from Asset Manager.
  - Department Coordinator and Surplus Manager do a walk through to determine what items surplus wants and to see what items should be scrapped as opposed to bringing these items to surplus and surplus will have to send them to a land fill.
  - Review Surplus procedures (see Section C below)
- One month out the Department Coordinator and Surplus Manager should meet to discuss.
  - Who the Private contractor is
  - Number of deliveries per day
  - Number of days needed for move
  - Surplus will not accept a move after 3:30 pm
  - To insure surplus forms are completed
  - Insure ES 102 Forms are completed
  - Insure that white goods are taken directly to county's recycling program unless cleared previously by Surplus manager
  - Insure that all equipment delivered to surplus has the Safety Clearance form
  - Insure the outside contractor know Surplus' hours of operation
  - No equipment with hospital decal numbers will be accepted by surplus
- One week out let Surplus know when the first delivery will be made.
  - If the Department Coordinator complies with the time line above than nothing else is needed by Surplus
- Consequences: If the Department doesn't keep surplus informed according to the time line consequences may include:
  - Surplus would not be able to receive of the property when it is delivered by the contractor.
  - The private contractor would charge the Department additional money
  - The moving process would be backed up, possibly for days.
  - The Surplus Property Manager would have to bring in additional people to support the unexpected delivery. The cost would be $10.00 per hour for each of the two employees for as long as required.
- Surplus Property Procedures:
  - Request a capital asset listing from Asset Management
  - Determine what items on the capital asset listing will no longer be needed by the Department
  - Items no longer needed should be flagged. Items can be flagged by using plain white paper, colored dots, labels, etc.
  - For items that appear on your equipment inventory listing, prepare a E/S-102 Form, Notice of Disposal or Change in Location for these items going to surplus or being transferred, sold, or given to another Department.
  - Do not remove decals when turning in equipment to surplus.
  - Equipment owned and/or controlled by the University may not be given away or sold, either to an individual or to another institution, without prior approval from the Director of Asset Management
  - No tool, instrument, vessel, storage cabinet, refrigerator, etc. used with radioactive material may be moved to another department or to surplus until it has been fully decontaminated and cleaned by Environment, Health, and Safety.

- Units that contain refrigerants other than R12, R22 or 134A must be evaluated by Facilities Services Refrigeration Shop. If refrigerant needs to be removed, submit a work order to Facilities Services.
- Property that is surplus to one department may be transferred directly to another department (omitting transfer to surplus). This allows the department to recover some cost for equipment that is no longer needed.
- Surplus forms P-110's can be requested from the Surplus Office. Thirteen separate individual lines may be placed on this form. The surplus form P-110 listed on the web site only six separate individual lines may be listed.
- Moves requiring less than eight hours can be requested through the Housekeeping Services moving supervisor (962-6586).
- Larger moves requiring eight hours or more, Housekeeping Services will provide the requesting departments with a list of contract moving companies.
- The Facilities Services Division moving crew makes small moves free of charge.
- The Surplus Property Receipt form should contain, at a minimum, the following:
- Department Name and number
- POC and phone number
- Location of property (room number and building)
- Description of property
- Serial number
- UNC Decal number
- Signature of persons authorizing the transfer
- The Surplus Property Receipt form P-110 must match the truckload of items being delivered to surplus
- It is not the responsibility of surplus personnel to prepare surplus forms for items received from departments, nor to notify Asset Management.
- Department Coordinators should be aware of the following:
- The fact that an item costs less than $100 and is not required to be inventoried, does not relieve fiscal agents or staff members of the responsibility for the prudent use, care and safeguarding of the item.
- An item costing $100.01 or greater but less than $500.00 and has a useful life of one year or longer is considered equipment. It is the responsibility of the fiscal agent to identify. Each item is to be identified by an identification tag (blue) to be affixed to the item. The Business Office will provide an identification tag (blue) along with a copy of the purchase order.
- Equipment items costing $500.00 or greater and equipment with a value of less than $500.00 but considered a high theft item is maintained in the University's fixed assets system. These items are added to the fixed asset system (a) after the Business Office has made payment or (b) following transfer from another location or agency.

Attachment G

Office of Waste Reduction and Recycling

Check List for Indoor Recycling

Related to Moves and File Clean-outs

- Walk through to determine bin needs (recycling, surplus, EHS, move coordinator, housekeeping…)
- Move coordinator notifies Office of Recycling with temporary indoor bin needs at least six weeks in advance
- ORS or OWRR will deliver temporary bins with instructions on different recyclables and how they should be separated
- When departments are purging, they should be sure to place recyclable materials in appropriate bins and do not contaminate! Information on materials recycled and proper sorting is available at www.fac.unc.edu/wastereduction.
- Try to have the bins picked up and delivered on scheduled pick-up days if possible (nor more than once a week)
- If more bins are necessary, please notify recycling office
- After purge is over, please notify the recycling office so these bins can be removed, again preferably on the regular route schedule
- At least one week prior to vacating the building, please contact recycling office for final walk-through and material assessment

NB: If recyclables are left in the building after the final recycling pick-up, it will be the responsibility of the move coordinator along with housekeeping to remove the additional materials

- Relocation and Move-In
- For new building set-up during/ after move- indoor recycling sites will be set up according to plans arranged during design review
- If the sites were not arranged during planning stages, then there will be a walk through and assessment of the building with a bin installation after the move.

9. CONSTRUCTION TRAILER PARKING PERMITS

Contractors should contact Mary Fox, Construction Liaison to request a trailer permit. The Construction Liaison will provide the application to the contractor upon verification that they are eligible. In order for contractors to park a trailer at the storage site they must have a current construction contract with the University Facilities Planning or Facilities Services Departments. Permit issuance is on a first-come, first served basis depending upon space availability in the lot.

Once the permit is approved, then the an application must be completed and taken to the Public Safety Building located on Manning Drive beside Morrison Residence Hall between the hours of 7:30 a.m. and 5:00 p.m., Monday through Friday.

The monthly fee for trailer parking is $70.00 per trailer per month. A portion of the fee is refundable if the trailer is removed prior to the expiration of the permit. Verification of trailer removal must be coordinated through the Construction Liaison of the Department of Public Safety.

The permit must be displayed on the rear door of an enclosed trailer or on the bumper of a flatbed trailer in a clear and unobstructed manner. Only licensed vehicles will be issued construction trailer permits.

Upon expiration of the permit, the company will be responsible for removing the trailer from the facility or renewing the permit. If the trailer is not removed and the permit is expired, the trailer will be subject to twice the normal monthly fee for parking. The monthly fee will be assessed for any portion of the month that the trailer remains on site with an expired permit. If the trailer remains on site longer than sixty days, the Department of Public Safety will remove it at the owner's expense.

All materials must be kept in an enclosed trailer or on the bed of a flatbed trailer.

Any materials not maintained as indicated will be subject to removal by the Department of Public Safety and disposed of. The expense for the material removal will be the responsibility of the construction permit holder. Debris surrounding the trailer must be removed by the contractor on an ongoing basis. Delivery pallets, wire binding straps, etc. shall not be left in the storage area.

Any attachments to the trailers (porches, steps, etc.) must be removed or disposed of by the contractor when the trailer is removed. The attachments shall not interfere with the normal flow of traffic or other trailer parking in the storage area.

No hazardous or unlawful materials as defined by State and Federal law may be stored in any trailer parked within the storage area.

a) DPS Protocol for Construction Trailer Parking

The construction liaison shall review all requests for construction trailer parking and determine if the contractor is eligible for the permit and if there is available space. If so, the contractor shall be issued an application. Registration shall be notified of the number of permits to be issued to the contractor.

The Parking Control staff shall enforce the storage trailer lot as part of their off campus areas and report any vehicles that do not have a valid permit. They will record the vehicle license number and any other identifying information and forward to the Construction Liaison. Research will be conducted to determine the owner/operator of the vehicle. Invoices will be sent to companies with expired permits.

The Registration staff shall provide a list of all current and expired permits on a monthly basis. The list will be compared with the vehicles on the lot. Owners shall be notified of vehicles with invalid permits prior to the issuance of invoices and/or impoundment.

Vehicles parked in the storage lot without a valid permit or a valid license plate for more than two weeks shall be considered abandoned. Such vehicles will be removed to the University storage area at the owner's expense and disposed of in accordance with Sections 6-7 of the Traffic and Parking Ordinance.

Department of Public Safety

UNC-Chapel Hill

Construction Trailer Parking Permit Application

Name of Company _____

Company Address _____

Company Contact _____

Telephone Number _____

UNC-CH Construction Manager _____

UNC Construction Project _____

Trailer License Plate #'s (required) _____

Project Completion Date _____

Number of Permits Requested _____

If Trailer Rented/Rental Company _____

Explain the nature of the business or service you are performing for the University. Give a brief explanation of your need for the construction permit and the materials that will be stored in your trailers.

PLEASE RETURN THIS FORM TO THE DEPARTMENT OF PUBLIC SAFETY:

I have read and agree to the attached guidelines and restrictions. I understand that if this permit is misused, it may result in fines, penalties or revocations of parking privileges as provided in the University of North Carolina at Chapel Hill parking ordinances. I agree to contact the Department of Public Safety if the permit is lost, stolen, or destroyed. I further certify that there will be no hazardous or unlawful materials stored in any of the trailers to be located at the construction vehicle storage compound.

_____ _____

Company Supervisor Date

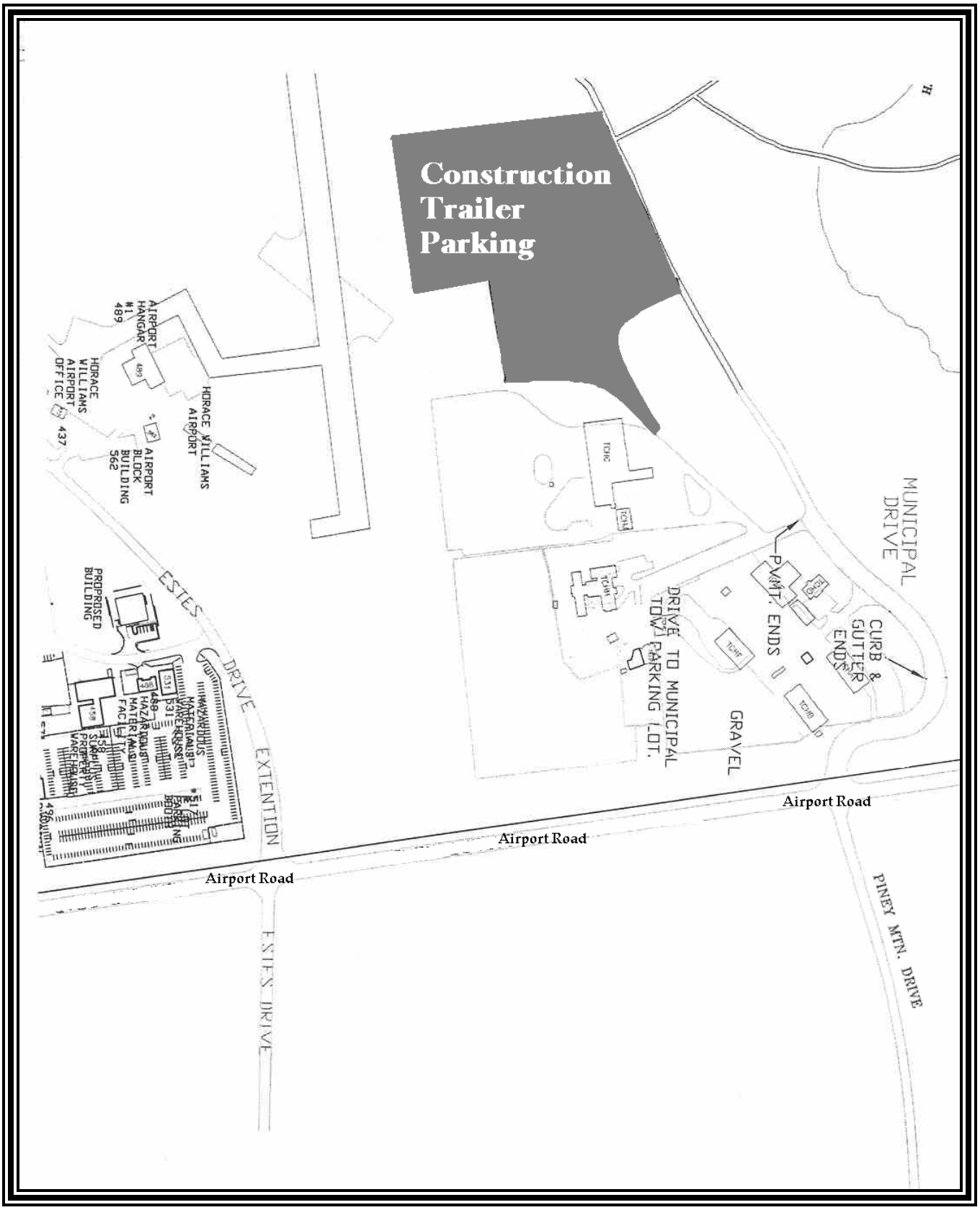
A. For Office Use Only **T2 Account # _____**

Number of Permits Approved____ Approved By _____ Date_____

Permit Numbers Issued _____ Date Issued: _____ Expiration Date: _____

Permit Numbers Issued _____ Date Issued: _____ Expiration Date: _____

Permit Numbers Issued _____ Date Issued: _____ Expiration Date: _____


Construction Trailer Parking
AIRPORT HANGAR #1 489
HORACE WILLIAMS AIRPORT OFFICE 437
AIRPORT BLOCK BUILDING 562
HORACE WILLIAMS AIRPORT
PROPOSED BUILDING
ESTES DRIVE EXTENTION
HAZARDOUS MATERIALS WAREHOUSE 531
HAZARDOUS MATERIALS FACILITY 588
SALT/SAND STORAGE BUILDING
MUNICIPAL DRIVE
PVMT. ENDS
CURB & GUTTER ENDS
DRIVE TO MUNICIPAL PARKING LOT.
GRAVEL
Airport Road
Airport Road
Airport Road
ESTES DRIVE
PINEY MTN. DRIVE

10. SUSTAINABILITY

a) The Quest for High-Quality Buildings from Program Plan to Start-up and Testing

Since late 1980s, the staff of the Department of Facilities Management of the University of North Carolina at Chapel Hill has made substantial progress in improving the processes which, we have learned, need to be followed to achieve the level of quality for which we have been striving. Following are the various elements which we consider critical to achieve the desired appearance, energy-efficiency, serviceability, reliability, and, ultimately and most importantly, user-satisfaction. In some cases, it will appear that the focus is on mechanical issues only; but this is only because of the writer's greater familiarity with this aspect of construction and renovation. Similar activities are performed for electrical, civil, geo-technical, utilities, fire & life-safety, etc.

(1) Program Plan

Since the late 1980s, it has been a policy that the appropriate Facilities Management staff review program plans as they are being developed. This has helped substantially in addressing issues which could otherwise be overlooked, such as appropriate mechanical systems and available utilities.

(2) Development of UCB Design and Construction Standards

In 1988, we began the process of developing design and construction standards to help us communicate our needs and expectations consistently to design consultants and standing-order contractors. In the ensuing years, we have updated them on the average once a year to reflect changes in technology, or our goals for resource conservation, maintainability and replaceability. We have shared them with many non-profit institutions.

(3) Selection of Consultants

Several years ago, we realized that letting the architect select the design team (Architect, Mechanical, Civil, Geo-technical and Electrical Engineers) was proving to be detrimental, because in many cases the architect could be very well qualified but not the sub-consultants or vice-versa. Once we realized this dilemma, we gradually transitioned to a process whereby the architectural firm is selected and then is asked to, as a minimum, submit the names of three mechanical and three electrical firms they are willing to work with. We then interview them separately in conjunction with the architect, to decide which firm/engineer is most qualified to provide the design services we need for the project. For the interview, the sub-consultants are required to have the person expected to be the project engineer be the primary spokesperson for the firm.

(4) Design Contract

If the architect is the lead consultant, we require being given the opportunity to review the scope of the work being arranged with the sub-consultants, to ascertain that we are going to get what we expect.

(5) Pre-Design Meeting

First of all, we require (per our contract with the consultants) that the consultants follow our Design and Construction Standards, "unless they disagree with them in writing", in which case we determine whether to formally agree or disagree with their issue. The

engineer is then invited to meet with us (mechanical engineers and shops) to clarify any questions regarding the Standards, and to provide her/him with insight regarding our knowledge of existing conditions in a building (if it is being renovated), or some ideas of what design concepts have worked well for us.

(6) Design Documents

We have been performing design reviews at the various levels of design for as long as there have been outside consultants providing design services to the University. However, due to the tremendous surge in construction in the last ten years, we have had to streamline the review process. Secondly, we invite the consultants to meet with us during the design process to help them avoid redesigns. Typically, we suggest that they do so at any of our bi-weekly Shop-Tech Meetings. These are meetings during which the UCB mechanical engineers meet with Shop foremen to exchange technical information. Thirdly, we provide written review comments at every stage of the formal reviews [Schematic, Design Development (30%), 60% and 100%], although the number of reviews will depend on the size of the project. We no longer perform 95% reviews, because at that level of design it becomes guesswork as to what is being overlooked or what has not been completed. Therefore, what we are doing is accepting review of 100% documents "with exceptions", where the consultants provide us a list of exceptions along with the documents. Once this review is done, and final corrections are made, we allow the printing bid documents.

In order to achieve greater consistency, our controls-shop staff has developed prescriptive standards for direct inclusion in the specifications. They are also responsible for reviewing the control points and sequences proposed by the engineer, which are then used by the controls-shop staff to lay out the DDC panels for engineer.

For utilities, we meet with civil engineering consultants to discuss our knowledge of existing conditions below grade. We assist civil/survey crews with on-site survey work. We may also jet sewer lines and video-inspect them before work commences, to establish existing conditions.

(7) Pre-bid Presentation

During the pre-bid meetings, we inform the prospective bidders about our expectations, that we take the specifications and codes seriously, and that unless they are truly committed to following them, it is best that they not bid the project. We also emphasize that we need to have tradespersons who have experience doing this type of work, and that we allow a maximum of two apprentices per journeyperson.

(8) Approval of Qualifications of Mechanical Sub-contractors and Foremen

If we have not pre-qualified mechanical contractors (which is typically the case), we include the minimum qualifications in the specifications. Once the bids are in and before awarding the contract, we review the qualifications of the contractors, and request that the names and qualifications of the foremen be submitted for approval. On several occasions we have interviewed the proposed foremen.

(9) Pre-construction Meetings

These have proven to be extremely valuable to the University and the contractors, because it gives us the opportunity to talk directly with the foremen. We have found that well-informed qualified foremen make a tremendous difference in the outcome of the project (probably more so than any other person). During this meeting, we provide lists of the typical mistakes which have been made in past projects, explain the need to be pro-active regarding space conflicts or possible design errors, and the importance of installing sample piping and sheet-metal components so we can inspect them before they get too far ahead. We emphasize the importance of installing the equipment such that it is accessible and maintainable. We make a point of stating that the final product depends on a partnership among all the players, and that we depend on each other to achieve something about which we can all feel proud.

(10) Construction Permits and Inspection Cards

We also have permit forms mechanical, plumbing, electrical, fire-protection and general construction that are used as construction inspection cards. We have been using these since 1989. In addition to the above cards, we also have inspection-request forms that we use to notify inspectors and to include our comments on partial inspections (which are typical in large projects). We also use inspection forms for items that do not fit into the inspection-card format.

(11) Review of Submittals

We review submittals in conjunction with the consulting engineer, who is required to check with us before responding, to make sure that we are in agreement, and that our concerns are being addressed. Our shop staff is asked to review them also, as warranted.

(12) Inspections

The University of North Carolina (UNC) has full responsibility for inspections with its own staff.

(13) For mechanical systems, the inspections are performed as follows:

(a) HVAC Systems (Piping, Air-handling systems, Controls): UNC Mechanical Engineers
(b) Plumbing: UNC Plumbing Shop Supervisor
(c) Similarly, there are inspectors for civil, fire-suppression & alarm systems, electrical, and general building components.

(14) Inspection Process

Our involvement in inspection includes compliance to codes (e.g., UBC, UPC, UMC), construction standards (e.g., SMACNA) and UNC Standards, compliance with contract documents, witnessing of pressure tests (to reduce consultant visits/costs) and assessing the quality of the work. This is in addition to the observations performed by the consultants, which are typically more focused to compliance with the drawings.

(15) Testing and Balancing

To minimize conflicts of interest, since 1992 UNC has required that pre-approved testing and balancing contractors bid to the General Contractor instead of the mechanical

contractor. We also include in the specifications that "the testing and balancing contractor is required to review and approve, in writing, the type and location of the balancing devices provided and installed by the mechanical contractor". This has virtually eliminated complaints from the testing and balancing contractor regarding this matter. We have a limited number of approved TAB contractors because we consider them an extension of our commissioning team, and we need to make sure that they are truly qualified and committed to perform good work for the University.

(16) Commissioning

For the past two years, we have been developing Commissioning Standards which incorporate our goal of "A proactive team approach to systems design and construction, which includes well-defined functional expectations, design review, construction inspection, performance verification and operational training." As noted above, we are already accomplishing all the activities encompassed in our definition of commissioning, with the exception of performance verification, for which we have developed start-up and testing (commissioning) checklists, which are included in the specifications. These component and system checklists are used by the appropriate contractor to create a binder that is specific to the project. The checklists are signed by the contractors as the work is completed, and then signed by the University's commissioning agent(s) (usually the University's project engineer and the one or more shop representatives).

We still wish to establish Commissioning Teams, composed of a UNC engineer and one representative from each appropriate shop. These designated individuals will be expected to remain involved from design through construction and start-up. Each project will have a different group of persons, in order to spread the work and opportunities for experience.

The consultant is still expected to perform final verification of the control sequence in the presence of the controls contractor and at least one representative from our controls shop.

(17) Operating and Maintenance Manuals

We review these independently of the consulting engineer. We require that the manuals include cut-sheets of all the approved components, so that we will have reference information when we need it, typically many years later. We submit our comments the consulting engineer so they can be included in his/her review list.

(18) As-Built Drawings

With the advent of CAD drawings, we now require that the original drawings be updated to include true as-built conditions, including the information on the equipment actually installed.

(19) Orientation/Training

We indicate the hours of required for orientation/training in the specifications, to match the complexity of the systems which are to be installed. The orientation/training is provided to all the personnel of the appropriate shops.

(20) Warranty

The warranty claims are handled through the UNC project mechanical engineer, because s/he is familiar with the project and can assess the severity of the problem, and which contractor to contact. Also, because of the engineer's continuous involvement in the project, it is possible to determine if it is a new problem or resurgence of a previous one.

b) Installation Requirements

(1) Sheet Metal

(a) Radius elbows with R=1.5D wherever possible. Rectangular ells only where there is no other choice and when approved by University. Square neck, radius heel ells are not allowed.
(b) Single-wall turning vanes in rectangular ells. Upstream/downstream edges parallel to sides of duct. Access doors or panels upstream of rectangular ells in exhaust and return-air systems.
(c) Screens on inside of exhaust/relief louvers, with access for cleaning. Screens on outside of air-intake louvers.
(d) Specified take-offs for all round branches. If upstream of diffusers, install dampers in take-offs.
(e) 45° take-offs for all rectangular duct connections between branches and mains, including risers, as well as supply, return and exhaust systems.
(f) Seal ductwork as it is being installed. "Butter" duct-liner edges.
(g) Access panels (w/ hemmed edges) upstream and downstream of reheat coils.
(h) Flex duct no longer than 6 feet, and supported every 3 feet.
(i) Transitions of 15° per side maximum.
(j) Smoke and fire dampers shall be installed per manufacturer's requirements, as indicated in the instructions provided with the damper.
(k) Installation, gauge, pressure-rating reinforcement, etc. per SMACNA.
(l) Duct pressure testing of supplies upstream of VAV boxes and exhaust ducts.

c) Refrigeration

(1) Prior to performing the work, arrange a meeting with the Refrigeration Shop to review proposed installation.
(2) Adequate pipe anchors.
(3) Refrigerant pipe sized for correct velocity.
(4) Vibration eliminators properly installed.
(5) Vertical riser exceeding 8' on non-unloading compressor needs oil trap installed at base discharge.
(6) Horizontal hot-gas piping run pitched away from compressor 1/2" per 10' of run to prevent oil slugging.
(7) Use of nitrogen-charged copper tubing.
(8) Correct pipe insulation on lines.
(9) Sufficient clearance from installed unit to wall, to clean condensers.
(10) Hand valves installed to isolate components on ref. system. (Suction valves have not been installed on some new installations.)
(11) Proper pipe hangers. Hangers supported properly, e.g., not hung from other pipes. No electrical tape or wires to hold tubing in place. Properly sized clamps. Piping run parallel and perpendicular to building.
(12) Tubing cuts properly cleaned and burred. Neat soldering, i.e., wiped and smooth, using approved solder.
(13) Condensate from air handling units properly sloped and with adequate "P" traps.

(14) Oil trapping as per manufacturer's recommendation.
(15) Liquid line dryers preferred to be flared fitting for maintenance.

d) Plumbing & Piping

(1) All

(a) Use type 'K' copper pipe for all open-loop water lines. Use type 'L' copper pipe for all closed-loop systems.
(b) Use ball valves or butterfly valves on waterlines.
(c) Stainless-steel ball and stem in ball valves.
(d) All valves and fittings shall be insulated. Handle extensions for CHW valves.
(e) Piping within exterior walls shall be installed as close to the interior as possible. (Wall insulation shall be installed between pipe insulation and exterior.)
(f) Plan for easy access for maintenance personnel.
(g) Dielectric Waterways, only. No dielectric unions.
(h) Ports for balancing devices shall extend beyond insulation.
(i) Ball valves with hose-end fitting instead of boiler drains.
(j) Install air vents (w/ isolation valve) at all piping high points.
(k) Provide 6" squeegee all around underground piping.

(2) Plumbing

(a) No-hub couplings shall be "super duty" for all below-grade sanitary, vent and storm drain piping, and all above-grade sanitary and storm. "Standard-duty" no-hub is acceptable for above-grade vent piping.
(b) Provide cleanouts in vents 42" above floor at all urinals, and above flood level at lavatory gangs.
(c) Make sure all plumbing fixtures are properly trapped and vented.
(d) Install quarter-turn stop valves.

(3) Steam

(a) Flange gaskets: only metallic, non-paper gaskets are allowed (e.g., Flexataulic)
(b) Use teflon tape for threaded connections. Pipe-sealing compound or "pipe dope" are not permitted.
(c) All gate valves shall be rising-stem type.
(d) Use valves that are properly pressure-rated.
(e) Use bolts with the correct pressure rating on all flanges.
(f) Use schedule 80 pipe on steam return lines and threaded supply piping, and schedule 40 on welded steam supply piping.

e) Mechanical Systems

(1) Construction

(a) Floors properly sealed and sleeved or curbed. Drains in "low" part of floor, and able to take water.
(b) House-keeping pads to be installed where necessary.

(2) Installation

(a) Accessibility to equipment; i.e., not over 5 feet high or in out-of-reach places.
(b) All equipment should be installed with maintenance and repair in mind; especially, room to pull equipment for repair.
(c) Verify mounting of pumps before running piping to equipment. Follow manufacturer's guidelines. Recheck alignment after installation.
(d) Verify that in any glycol system the total glycol added is recorded in gallons in order to verify amount of liquid in system. (Label what type and percentage at fill connection/valve).
(e) Piping must be cleaned thoroughly and passivated, per water treatment requirements.
(f) No hangers to be installed on those pumps that are designed for the pipe to support the pump (e.g., in-line pumps).
(g) Insulation of pumps only required for chilled-water pumps. Use removable Armaflex insulation with velcro straps. Allow for easy lubrication access.
(h) Only rising-stem gate valves allowed.
(i) Fan and belt guards to be easily removed and not fully enclosed, to allow visual inspection of equipment.
(j) Belt tensioners and adjusters on motor base to allow belt alignment and adjustment.
(k) Remove adjustable-pitch sheaves after balancing is done. Replace with fixed sheaves and align belts.
(l) Anchoring of all floor-mounted equipment.
(m) All equipment properly shimmed, level and grouted.
(n) Fire-safe all penetrations through floors and fire-rated walls.
(o) Labeling of ceiling grid and access doors for above-ceiling equipment.

(3) Filters

(a) Standard-size filters to be installed. All final filters to have pre-filters. Also, demonstrate that filters can be changed (no obstructions).
(b) Filter pressure gages installed with pickups upstream and downstream of filter bank.

(4) Start-Up

(a) Schedule testing and balancing as soon as systems are available.
(b) Prove that all equipment has been properly lubricated.
(c) Assemble commissioning checklist handbook as soon as possible and follow checklist as work progresses. Sign and checklists as work is completed. Ask for sign-off as soon as systems are completed.

Installation Checklist - Mechanical

		Plumbing				Piping							Sheet Metal			
		GW	WTR	DHW	SAN	SS	GAS	CHW	CON	HW	STM	REF	DW	VTG	EXH	AH
1	Slope	X			X	X										
2	Bedding	X			X	X										
3	Clean-Outs, Trap Primers	X			X	X										
4	Pipe Wrap	X					X									
5	Pipe Pen. Sleeves/Sealing		X	X	X	X	X	X	X	X		X				
6	Press. Test	X	X	X	X		X	X		X	X	X	X			
7	Insulation		X	X				X		X	X	X	X			X
8	Vapor Barrier Integrity		X					X				X	X			
9	Isolation Valves		X	X			X	X		X	X	X				
10	Rising-Stem Gate Valves										X					
11	All-metal flange gaskets										X					
12	Red. Press. Backflow Prev.		X													
13	Dielectric/Brass Ftgs.		X	X				X	X	X						
14	Press. & Temp. Gages			X				X		X						X
15	Circ. Pump & P&T Taps							*		*	*	*				X
16	Anchoring		X								X					
17	Hangers		X	X	X	X	X	X	X	X	X	X	X	X	X	X
18	Vibration Isolation (as req'd)							X	X	X	X	X			X	X
19	Escutcheons		X	X	X	X	X	X	X	X	X	X				
20	Duct Sealing												X	X	X	
21	Duct Turning Vanes												X		X	
22	Duct Lining												X			
23	Fire and F/S dampers												X		X	
24	Balancing Dampers												X		X	
25	Contr. Dampers & Actuators												X		X	X
26	Diffusers & Grilles												X		X	
27	Filters															X
28	Temp. Contr. Panel & Oper.								X	X	X					X
29	Condensate Piping										X					
30	Labeling		X	X	X	X	X	X	X	X	X	X	X	X	X	X
31	Valve Tags & Charts		X	X	X	X	X	X	X	X	X					

AH: Air Handling Equipment
CON: Condensate
DHW: Domestic Hot Water
DW: Ductwork
EXH: Exhaust
GW: Groundwork
HW: Hot Water
SAN: Sanitary Sewer
SS: Storm Sewer
STM: Steam
VTG: Venting
WTR: Water Supply
*Pumps

11. ACCESSIBILITY

a) Guidelines for Accessible Toilet Rooms

The NCSBC, Volume 1-C and the ADA provide the minimum requirements and all toilet room designs shall comply with these codes. UNC-CH has additional requirements and recommendation for design of all new and renovated toilet rooms. They are as follows:

b) Toilet Room Entry Doors

(1) Toilet rooms with 10 or less fixtures (water closets and urinals) shall have only one door from the accessible pathway into the toilet room. This does not exclude toilet partitions doors at each stall.
(2) Toilet rooms with more than 10 fixtures (water closets and urinals) should be designed without doors from the accessible pathway into the toilet room. If the toilet room entry is from an area where a door is desired (i.e. a waiting, reception or seating area), then only one door is to be provided.
(3) Entry doors for the primary toilet rooms on levels served by main entrances into the building shall have hard wired automatic door openers. All other toilet rooms shall be stubbed out for future installation of automatic door openers.
(4) Doors of common bathrooms within dormitories, outside of dorm suites, shall have automatic door openers on all floors having designated accessible dorm rooms. Doors of common bathrooms on all other floors and doors to accessible bathrooms within dorm suites shall be stubbed out for future installation of automatic door openers.
(5) The location of push plates and stub outs for the automatic door openers shall be shown on the drawings. Push plates shall be mounted at 36” above finish floor.

c) Accessible Toilet Stall

Accessible toilet stalls should have a clear floor area as defined by the NCSBC, Volume 1-C within the stall. (5’-0” diameter or equal turning space) and/or 60” clear from the front of the water closet to the opposite wall with the out swinging door located at the side or 48” clear with the out swinging door located at the end. When an in swinging door is used, its swing shall encroach no more than 12” into the clear floor area.

12. CLASSROOM DESIGN ADVISORY COMMITTEE - Project Review Requirements

Scope: These requirements apply to all Capital Improvement Projects that involve the construction or renovation of General Purpose Classrooms (GPC) in the University.

Review the current classroom design guidelines from UNC-CH Registrar Classroom Design Advisory Committee website http://regweb.oit.unc.edu/classrooms/index.php

13. SURVEYING GUIDELINES

a) SURFACE LOCATION & TOPOGRAPHIC SURVEY STANDARDS

(1) The plat or map of such survey shall bear the name, address, telephone number, and signature of the professional land surveyor who made the survey, his or her official seal and registration number, the date the survey was completed and the dates of all revisions.

(2) The survey shall be drawn to a convenient scale, with that scale clearly indicated. A graphic scale, shown in feet, shall be included. A north arrow shall be shown. Symbols or abbreviations used shall be identified on the face of the plat or map by use of a legend or other means. If necessary for clarity, supplementary or exaggerated diagrams shall be presented accurately on the plat or map. The plat or map shall be a minimum size of 11 by 17 inches. The Surveyor will provide UNC at Chapel Hill with a sealed mylar copy and digital file of the location surveys in AutoCAD 2000 or later format and a DXF file. The surveys will also require the current FGDC compliant Metadata Minimum Standards. Prior to awarding of contract, contact the UNC-Chapel Hill GIS Coordinator, Katherine O'Brien, at (919) 843-1872 for the current Metadata requirements.

(3) All locations performed will be tied to the survey control network provided by UNC-Chapel Hill by a closed loop traverse. This control network is based on the NC Grid (NAD83) coordinate system decimal feet. A minimum of two (2) survey control points of semi-permanent material such as rebar or iron pipe oriented to this system shall be established at the project location. The bearing and distance from at least one of the project control points to the UNC-Chapel Hill Control Monuments used shall be labeled.

(4) Measured and record distances from corners of parcels surveyed to the nearest right-of-way lines of streets, together with recovered lot corners and evidence of lot corners, shall be noted. The distances to the nearest intersecting street shall be indicated and verified. Names and widths of streets and highways abutting the property surveyed and widths of rights of way shall be given.

(5) The identifying titles of all recorded plats, filed maps, right of ways maps, or similar documents that the survey represents, wholly or in part, shall be shown with their appropriate recording data, map numbers, and the lot, block, and section numbers or letters of the surveyed premises. For non-platted adjoining land, names and recording data identifying adjoining owners as they appear of record shall be shown. For platted adjoining land, the recording data of the subdivision plat shall be shown. The survey shall indicate platted setback or building restriction lines which have been recorded in subdivision plats or which appear in a Record Document

(6) All evidence of monuments shall be shown and noted to indicate which were found and which were placed.

(7) The location of all buildings upon the lot or parcel shall be shown and their locations defined by measurements perpendicular to the boundaries. If there are no buildings erected on the property being surveyed, the plat or map shall bear the statement, "No buildings." Proper street numbers shall be shown where available. Show the exterior dimensions of all buildings at ground level and square footage of the exterior footprint of all buildings at ground level.

(8) Easements of record shall be shown, both those burdening and those benefiting the property surveyed, indicating recording information. If such an easement cannot be located, a note to this effect shall be included. Observable evidence of easements and/or servitudes of all kinds, such as those created by roads; rights-of-way; water courses; drains; telephone, telegraph, or electric lines; water, sewer, oil or gas pipelines on or across the surveyed property and on adjoining properties if they appear to affect the surveyed property, shall be located and noted. If the surveyor has knowledge of any such easements and/or servitudes, not observable at the time the

present survey is made; such lack of observable evidence shall be noted. Surface indications, if any, of underground easements and/or servitudes shall also be shown

(9) The character and location of all walls, buildings, fences, and other visible improvements within five feet of each side of the boundary lines shall be noted.

(10) Driveways and alleys on or crossing the property must be shown. Where there is evidence of use by other than the occupants of the property, the surveyor must so indicate on the plat or map. Where driveways or alleys on adjoining properties encroach, in whole or in part, on the property being surveyed, the surveyor must so indicate on the plat or map with appropriate measurements.

(11) As accurately as the evidence permits, the location of cemeteries and burial grounds disclosed in the process of researching title to the premises or observed in the process of performing the field work for the survey, shall be shown.

(12) Ponds, lakes, springs, or rivers bordering on or running through the premises being surveyed shall be shown.

(13) Vicinity map showing the property surveyed in reference to nearby highway(s) or major street intersection(s).

(14) Flood zone designation with proper annotation based on Federal Flood Insurance Rate Maps or the state or local equivalent, by scaled map location and graphic plotting only.

(15) Parking areas and, if striped, the striping and the type (e.g. handicapped, motorcycle, regular, etc.) and number of parking spaces. Indication of access to a public way such as curb cuts and driveways.

(16) Location of utilities existing on or serving the surveyed property as determined by: Observed evidence, observed evidence together with plans and markings provided by client, utility companies, and other appropriate sources (with reference as to the source of information), railroad tracks and sidings, manholes, catch basins, valve vaults or other surface indications of subterranean uses, wires and cables (including their function) crossing the surveyed premises, all poles on or within ten feet of the surveyed premises, and the dimensions of overhangs affecting the surveyed premises.

(17) Locate/note observable evidence of the site being use as a solid waste dump, sump or sanitary landfill.

(18) Elevations for manholes rims, inlets, inverts, curb & gutter and pavement elevations will be to a hundredth of a foot (0.01'). Spot elevation will be at 25' intervals on curb/gutter and pavement.

(19) Elevations for ground shots, water lines, steam lines, and duct banks will be to a tenth of a foot (0.10'). Spot elevation will be at 50' intervals for ground shots.

(20) For contours, the error shall not exceed one-half contour interval.

b) SUB-SURFACE UTILITY LOCATION STANDARDS

(1) Scope: Perform field location surveys of utilities installed during the construction phase. The following outline lists the utilities to be located and the data to be collected. Conventional survey standards are to be utilized during the collection of field data. A mylar copy and digital file of the location surveys are to be provided in AutoCAD 2000 or later format and a DXF file. The surveys will also require an ESRI Shapefile (shp,shx,dbf,xml) file to include the current Metadata Minimum Standards developed by the UNC-CH GIS Department. Prior to awarding of contract, contact the NC-Chapel Hill GIS Coordinator, Katherine O'Brien, at (919) 843-1872 for the current Metadata requirements.

(2) Steam Tunnel and Lines

(a) Location and elevations of the tunnel slab, top of the cap, condensation lines and manholes.

(b) Location, size and change in elevations on the steam and condensation pipes in the tunnel.
(c) List the construction material for the tunnels.
(d) Elevations are to be within a tenth of a foot (0.10').
(e) Provide a digital photograph of the tunnel, piping and expansions areas.

(3) Water Lines - (Domestic, Chilled & Hot Water other than OWASA mains)

(a) Locations, size and elevations at the top installed water lines.
(b) Locations of valves and a valve type designation.
(c) Elevations are to be within a tenth of a foot (0.10').
(d) Provide a digital photograph of bends and valves.

(4) Electric and Communication Duct Banks

(a) Location and elevation of the duct bank top and bottom.
(b) Location and elevations of conduit runs in the duct bank.
(c) Elevations are to be within a tenth of a foot (0.10').
(d) Provide a digital photograph of the tunnel and conduit configuration.

(5) Storm Sewer

(a) Locate manholes rims or inlets with invert elevations to a hundredth of a foot (0.01').
(b) Note if manhole rims are in the center of the structure or measure the offset, pipe sizes, material types and the direction of the flow.
(c) Provide a digital photograph of structures if needed for clarification.

(6) Existing Utilities

(a) Locate any existing utilities exposed during excavation of trenches for new utilities. Provide the locations and elevations of these utilities along with a digital photograph of the crossing.
(b) Elevations are to be within a tenth of a foot (0.10').

(7) Electric and telephone duct banks

(a) Locations and elevations of the bottom of the duct bank, top of the duct bank.
(b) Elevations are to be within a tenth of a foot (0.10').
(c) Locations and elevations of conduit run in the duct bank.

(8) Sanitary Sewer

(a) Location and elevations of manholes with inverts of all pipes entering and leaving the structure.
(b) Elevations are to be within a tenth of a foot (0.10').
(c) Provide digital photographs of all manholes.

(9) Deliverables

The subsurface location surveys data and platting will be continuous throughout the project. All data and plats are due to UNC-CH within two-weeks of the backfilling of utilities or completion of a construction task.

c) METADATA STANDARDS

Federal Geographic Data Committee (FGDC) compliant minimum metadata is to be delivered in an XML or TXT format as one of the required files for survey data. Metadata is required for all digital data layers created for the University of North Carolina at Chapel Hill. Metadata is supporting information that describes the digital data layer and is critical for users to understand the key components of the data. Metadata describes how the data were created, who created and maintains the data, when the data were created and/or updated, item (attribute) descriptions, transfer standards, and more. UNC-Chapel Hill requires that metadata be provided with each digital data layer and that the metadata be FGDC compliant.

Additional information can be found at :http://www.fgdc.gov/metadata

(1) IDENTIFICATION

(a) DESCRIPTION

(i) Abstract: A brief narrative summary of the data set.
(ii) Purpose: A brief summary of the intentions with which the data set was developed.
(iii) Access Constraints: Restrictions and legal prerequisites for accessing the data set.
(iv) Use Constraints: Restrictions and legal prerequisites for using the data set after access is granted.

(b) CITATION

(i) Originator: The name of an organization or individual that developed the data set.
(ii) Date: The date when the data set is published or otherwise made available for release.

(c) TIME PERIOD OF CONTENT

(i) Calendar_Date: The year (and optionally month, or month and day) for which the data set corresponds to the ground.
(ii) Currentness_Reference: The basis on which the time period of content information is determined.

(d) STATUS

(i) Progress: The state of the data set.
(ii) Maintenance and Update Frequency: The frequency with which changes and additions are made to the data set after the initial data set is completed.

(e) SPATIAL DOMAIN

(i) Bounding Coordinates:
(ii) Northern-most coordinate of the limit of coverage expressed in latitude.
(iii) Southern-most coordinate of the limit of coverage expressed in latitude.

(iv) Eastern-most coordinate of the limit of coverage expressed in longitude.
(v) Western-most coordinate of the limit of coverage expressed in longitude.

(f) KEYWORDS

(i) Theme Keyword: Common-use word or phrase used to describe the subject of the data set.
(ii) Theme Thesaurus: Reference to a formally registered thesaurus or a similar authoritative source of theme keywords.

(2) DATA QUALITY

(a) Positional Accuracy: Horizontal and Vertical Report & Explanation.

(3) DISTRIBUTION

(a) Distribution Liability

(4) SPATIAL REFERENCE

(a) Coordinate System
(b) Horizontal Datum Name

(5) METADATA_REFERENCE_INFORMATION

(a) Contact Person: The person responsible for the metadata information.
(b) Contact Organization: The organization responsible for the metadata information.
(c) Telephone: The telephone number by which individuals can speak to the organization or individual.
(d) Address: The mailing and/or physical address for the organization or individual.

Note: Go to http://geology.usgs.gov/tools/metadata/tools/doc/mp.html. for a free metadata compiler. Contact the UNC_Chapel Hill GIS Coordinator, Katherine O'Brien, if you would like additional information on creating FDGC compliant metadata.

14. UNC ROOM NUMBERING STANDARD

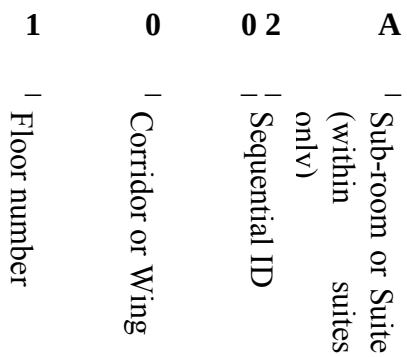
a) In order to allow for future space management and asset tracking needs, building room numbers should follow these guidelines:

(1) Each facility's room numbering system shall be structured so that the numbers flow through the building in a consistent and comprehensible pattern. The patterns shall be clear to the users of the facility, not causing confusion for individuals attempting to locate spaces

(a) All new construction shall follow these guidelines as written.
(b) During renovations, all re-numbering of renovated rooms shall be consistent with the existing numbering in adjacent spaces. When the existing numbering is not internally consistent or is confusing, the rules here are to be used as reasonable to define the best solution.

(2) For numbering, cubicles and other soft-partition or partition-less divisions of space are treated as rooms and called rooms in these guidelines.

(3) Room identification numbers will follow the following pattern:



(4) Most room numbers will be 4 characters long, with special conditions as below.

(a) Buildings with more than 10 stories will use 5 digit long numbers, the first 2 digits indicating the floor. All room numbers for 10+ story buildings use a 2-digit floor number in the first position: 01, 02, 03, etc.
(b) The Corridor or wing identifier will usually be numeric.
(c) The sequential ID will usually be numeric.
(d) Rooms within a suite of rooms are designated with an alphabetic extension in the last position.
(e) No dashes or other punctuation will be used in room numbers.

(5) The first digit, or two, of a room number indicates the floor on which the room is located.

(a) Floor number 1 shall be the lowest most level entered at grade or one half-flight above grade.

(b) If a new building is being significantly connected to an existing structure, the existing structure's floor numbering will be followed.

(i) It is recommended that, when reasonable, existing room numbers be updated to match these standards.
(ii) Room numbers in the new construction should follow this numbering standard.
(iii) Buildings which are significantly connected shall be numbered as though each building were a separate wing or corridor.

(c) Floors below level 1 will be designated as follows:

(i) G – First level below 1, if there is a direct exterior entrance.
(ii) B – first level below G or 1 with no exterior entrance
(iii) Z – Level below B. Lower floors will continue through the alphabet in reverse: Y, X, W….

(6) The second digit of the room number will indicate the wing or corridor of a room's primary access.

(a) In a building with only one dividing corridor, room numbers should flow in an ascending order beginning in the southwest corner of the building. The second digit will be a zero, 0.
(b) Any single corridor or wing directly serving more than 10000 square feet of usable space should be divided using the wing and corridor numbering concepts below.
(c) For buildings with a cross, star or "Y" configuration the Corridor or Wing section of the room number, as above, will be used to identify the wing of the building.

(i) The corridor or wing digit can use the letters N, S, E and W if the building has wings coordinated to compass directions.
(ii) For numbered wings, the southwest-most wing, will use a 1 as the corridor or wing digit.
(iii) Corridor or wing numbers will be assigned in increasing order from left to right as viewed with wing 1 on the person's left.
(iv) Rooms in the "central core" for each floor, not on a wing hallway, will use a 0 or a C as the corridor or wing digit.

(d) In a building with a ring or more complex corridor system, numbers should flow in ascending order in a counter-clockwise direction from the true southwest corner of the building.

(i) The designer may use the corridor or wing digit to indicate the corridor a room is on, or numbers may be assigned sequentially around the building.

(7) Room numbers should be assigned so that odd numbers are on one side of a corridor and even numbered rooms on the other, when possible.

(a) Odd room numbers should be on the North or West side of the corridor or on the inside of a ring-layout floor.
(b) The first room numbers on a wing or floor will end in a 1 or a 2.

(i) Room numbers 1000, 2000, 1100, and 1200 are not standard room numbers.
(ii) Use 1001 or 1002, 2001 or 2002, 1101 or 1102, 1201 or 1202, etc as the first room number of a wing or floor.

(c) Room numbers across a corridor from each other should be in matched order. Example: 125 is across from 124 and/or 126.
(d) When numbers are reserved for future room divisions, below, the room numbers on both sides will increment as appropriate so rooms across from each other have matched order numbers, even and odd.

(8) To the greatest extent possible, without creating other inconsistencies, rooms with the same digits in the last two positions should be located in the same position in the building. Thus, 1105, 2105, 3105, 4105, etc., occur in a vertical stack.
(9) Skip numbers as appropriate in order to reserve numbers for future use.

(a) A room number value should be skipped for each 60 square feet of room space or 2% of usable space on the corridor or wing, whichever is greater.
(b) Explanation: Most buildings undergo renovation many times; and when, as is often the case, larger spaces are divided into smaller areas, new room numbers will be needed. Having numbers in reserve will avoid the need to renumber an entire level.

(10) One room must have only one number regardless of the number of doors opening into it.
(11) Rooms that are part of a suite, where all are entered from a main corridor or lobby by the same primary door, share the same room number with a suffix letter.

(a) The lobby or main area of a suite is designated by the numbers with no suffix (1301, 5002, 3031, etc.).
(b) Rooms within a suite are numbered with the entrance room number, plus an alpha suffix (1301A, 1301B, 1301C, etc.), beginning with the room to the immediately left of the main entrance and proceeding in a clockwise direction.
(c) The letters O and I are not used in suite lettering.
(d) Letters should be skipped for large rooms in a suite, following the above rules for room numbering.
(e) Floors where over 50 rooms occur on one side of a corridor should be numbered as suites, even if all rooms are entered from the same corridor.
(f) Grouped support rooms or restrooms may use suite style numbers and letters to indicate service. Such as: Ventilation – V, Elevator – E, Custodial – J, Telecommunication – T, Plumbing – P, Men's – M, Women's – W, etc. as appropriate.

(12) Corridors and other required egress-ways will be numbered on plans and for space measurement. These numbers are not normally posted for use.

(a) Corridors will be numbered following the above standards with the first two digits indicating floor and wing or corridor.
(b) The 3rd character for a corridor number shall be a Q or Z: Q for Primary Circulation space. Z for a connector or secondary circulation corridor.
(c) The 4th character will be a sequential number or letter.
(d) Vestibules and airlocks shall follow the corridor numbering system.

(e) Corridors within suites will be numbered similar to the suite with the last character counting down from Z.

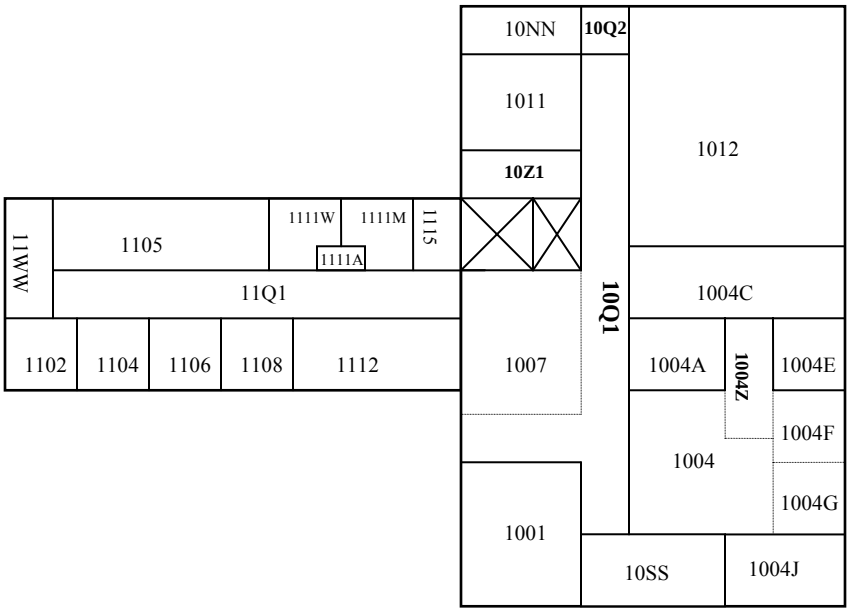
(13) Fire rated Stairways will be designated by the corridor number that they serve.

(a) The first digit(s) shall indicate the floor number of the stair landing or access door.
(b) The second digit will match the corridor primarily served.
(c) The last two digits can be numbers or letters indicating the compass direction best matching the stairwell: NN, SS, EE, WW and CC for north, south east, west and central respectively. NW NE, SW, or SE may also be used.
(d) The same stairwell will have multiple identifiers in the first two numbers based on the floor being discussed. The last letters or numbers should match across all floors of a building.

(14) Final, approved, room numbers must be on the final drawings prior to construction. Door numbers, as listed on the door schedule, shall match the room numbers.

(a) Room numbers shall be approved by EIS Plan Room, Space Management Staff.

Example of good room numbering:



Rooms Description:

Room Number	Type	Notes
1001	Conference or Classroom	Odd numbers on west side of hall, start numbering from SW corner of wing or building.
1004	Office Suite Reception	1002 and 1006 skipped because 1004 is large and 1004C could use the hallway numbering. Reception given base number for suite.
1004A	Office	First on left from entrance door
1004C	Office w/Conference	
1004E	Office	1004D skipped because 1004C is large
1004F	Office	No hard partition exists between 1004F and 1004G, the division of space is for planning, assignment and space management purposes.
1004G	Office	
1004J	Office	1004H skipped in case of future remodeling, 1004I skipped because I is not used
1004Z	Corridor	Z used because it is not a code required or permanent hallway. Arbitrary division from 1004 reception space, might continue past all offices
1007	Building Lobby	1003 and 1105 skipped because 1001 is large. Imaginary line divides 10Q2 egress corridor from 1107 on 2 sides. Could be

		divided with adjoining corridors in many ways.
1011	Classroom	1009 skipped because 1007 and 1011 are large, could be higher number to allow for further sub-division.
1012	Class or Lab	1010 skipped because 1012 is large, also matches other side of corridor. Could also be numbered to match room on floors above or below.
10NN	Stairs	North Stairs serving corridor 10Q_
10SS	Stairs	South Stairs Serving corridor 10Q_
10Q2	Airlock	Fire egress, separate from stairs for some reason. Has 0 in 2nd position because it is related to the 10Q1 corridor.
10Q1	Main corridor	Egress-way, T shaped to front door as well. First corridor on left from main elevator gets 0 in second digit.
1102	Office	
1104	Office	
1105	Office	Odd numbers on north side of hall. 1101, 1103 and 1107 skipped because it is a large room and room divisions may exist on floor above or below.
1106	Office	
1108	Office	
1111W	Women's Restroom	Numbered as part of Restroom suite
1111M	Men's Restroom	Numbered as part of Restroom suite
1111A	Custodian's Closet	Numbered as part of Restroom suite
1112	Classroom	Could be 1110 or 1114 based on door location. Numbers skipped for future division if needed
1115	Mechanical Room	Matching possible future numbers on opposite side of hallway or above. Could be 1111B if plumbing related to the restrooms is here.
11Q1	Corridor	Permanent egress-way, West egress through stairs W.
11WW	Stairs	West Stairs serving corridor 11Q_

b) Project Close-Out Responsibilities

(1) The Designer shall provide the following project closeout services upon completion of the project. These are as described in the North Carolina State Construction Manual, NCCM, with the following additions and modifications:

(a) Assemble and forward closing papers.
(b) Contractor shall conduct a review of the HVAC plans and specifications with Energy Services, EMCS, HVAC, A&E Services Engineer, and Commissioning personnel prior to the instruction period described in the project Specifications. A Basis for Design description may be required for other building systems as specified by the Commissioning Coordinator.
(c) Provide computation and disposition of liquidated damages (if required).
(d) Issue Certificate of Final Completion and Compliance to be included in the Final Report, below.

(e) For Stormwater infrastructure improvements: provide as-builts and written description of how the BMP's are designed to function with operations and maintenance requirements. Schedule and conduct training for maintenance personnel for project specific BMP's.

(2) Provide record drawings and specifications. In addition to the "reproducible" required by the NCCM, the University requires the following items updated to accurately reflect as-built conditions.

(a) Archival Drawing Set printed, Not Bound. With the State Project Code-Item, State Project ID and date last revised printed on each drawing page.
(b) Reference Drawing Set printed on acid-free or buffered paper, bound.
(c) Each CAD-drawn Drawing File matching printed drawings in electronic form.
(d) Drawings Index, printed, giving the sheet number, sheet name and corresponding electronic file name.
(e) Drawing Index as above, Electronic.
(f) Specifications book following NCCM guidelines, printed.
(g) Specifications book, electronic file.
(h) Specification Addendum for UNC, printed and bound. Details Below.
(i) Specification Addendum for UNC, electronic file.
(j) Final Report, printed. Following NCCM Section order and content with the description and details sections in narrative form. The breakdown of costs shall be separated by building and by construction discipline.
(k) Final Report description and detail content and schedules in electronic format.
(l) Operation and Maintenance Manuals including Manufacturer's Manual for all equipment installed. 3 Sets, printed. (1 set for building on-site use, 1 set for the PM O&M Library, 1 set for Shops)
(m) Operation and Maintenance Drawing Set: Covering all buildings utilities and building systems drawings. 3 sets printed and bound.
(n) HVAC Systems Manuals including a written description and Start up and Shut Down procedures and Air Balance Reports and schedule for UNC HVAC Systems Staff
(o) HVAC Systems drawing set showing all HVAC equipment locations and connections, printed and bound,

(3) The Specification Addendum for UNC shall include the following updated as built, as applicable, as sections in their own volume:

(a) Section A1: A list of Works of Art installed or acquired as part of the building contract per NCCM 237
(b) Section E1: Actual light bulbs installed along with manufacturer, model and style number.
(c) Section E2: Actual Schedule of lighting fixtures installed including manufacturer, model, style and wattage ratings.
(d) Section E3: Local Supplier for limited life items, such as ballasts and light bulbs, named in Section E1 and E2.
(e) Section F1: A schedule of all flooring types installed, including color, manufacturer, part number, VOC and recycled content, style and backing, as well as location.
(f) Section F2: A schedule of actual resilient base and flooring installed specifying color, manufacturer and style.

(g) Section F3: Names and contact information of local suppliers for the above materials keyed to the manufacturer's part number.
(h) Section W1: A schedule of paints used with actual paint chips with color, VOC content, manufacturer and location installed, including primers.
(i) Section W2: A schedule of actual wall finish materials installed with color, rapidly renewable materials content, manufacturer and location(s) installed.
(j) Section W3: A schedule of actual casework and other wood and composite wood products installed, including manufacturer and location installed.
(k) Section W4: Names and contact information of local suppliers for paints, finishes and non-custom cabinetry keyed to the manufacturer's part numbers.
(l) Section W5: Custom signage, if used, typeface, size and local supplier.

(4) Document bindings and materials for printed documents shall follow the following standards:

(a) Inside document pages must be high-quality, acid-free, xerographic 20-pound minimum (75 gsm) white paper of bond or rag base.
(b) Covers and section dividers must be acid-free cover paper or art board not to exceed 80 pound (300 gsm) stock.
(c) Document sets are to be saddle stitched, perfect bound, or screw post bound with card stock cover.
(d) All text (margins) must be at least 1 inch from a bound edge and ¾ inches from a cut or outside edge of the document.
(e) Document sets over 2 inches thick shall be split into multiple volumes with each volume having the markings required by the NCCM and an identifier giving volume number and total volume count such as "Volume 1 of 3" .
(f) The cover of each volume shall include the State Code and Item numbers, State Project ID, and Project Title as well as identify the firm preparing the document and the dates of revisions.

(5) Archival Quality Documents shall meet the following standards:

(a) Imaged upon archival quality materials, free of volatile chemicals, with storage and life expectancy characteristics similar to Mylar, Polyester film or Xerox Vellum.
(b) Imaged using stable inks that have a minimum life expectancy of 100 years.
(c) Any photographic images or shaded area shall be imaged using a line screen not to exceed 120 lines per inch.
(d) A statement of the method and materials used in producing for the Archival Set giving reasonable indication that the archival set meets the above criteria shall be included with the archival set.
(e) Note: Ink jet printing, electrostatic toner, diazo printing and wash off processes do not always produce archival quality results.

(6) Electronic Documents delivered on media shall follow the following standards:

(a) Documents may be delivered on either: magnetic media diskette, or Compact Disk.
(b) Compact Disks shall be of archival quality with a manufacturer's estimated life of over 50 years.
(c) Compact Disks using phthalocyanine dye with a gold or gold-silver alloy as reflective layer are preferred.
(d) Electronic files shall follow the following standards:

(e) Text files will be delivered in Rich Text Format, RTF, or Microsoft Word 2000 or later format.
(f) Spreadsheets will be delivered in Comma Separated Values, CSV, format or Microsoft Excel 2000 or later format.
(g) Drawing Files shall be in AutoCAD release 2000 or higher format. Each drawing shall be bound, with no x-references and purged of unreferenced objects.
(h) All electronic files shall be named with a descriptive name including the State Code and Item numbers. The file name shall not include space or punctuation characters other than hyphens, periods and underscores. Examples:

48948-318_Final_Report_Dentistry_Add.rtf

48948-318_Sheet_A-12_Wall_Sect_Dentistry.dwg

The UNC Documents shall be delivered to UNC within 60 days of project acceptance.

THE UNIVERSITY of NORTH CAROLINA at CHAPEL HILL

THE UNIVERSITY of NORTH CAROLINA at CHAPEL HILL

Engineering Information Services - Plan Room –

Document Submission Form

Version:
Rev. 14 Mar 2005
Exp. 30 Sep 2005

If you need assistance with this form, please contact a member of the Plan Room Staff. When complete, please give this form to a member of the Plan Room staff: Suzanne, Dan or Su.

Project Title: _____

Design Mgr.: _____ Est. Completion Date: _____

Const. Mgr.: _____ Code-Item or WRN: _____

Design Firm: _____ State ID: _____

Buildings Contained:

Name:	Bldg Num./ID:

Items included in this submission:

Date Revised:	# Pgs:	Item:
		Bid/Const. Plans (optional)
		Bid/Const. Specs (optional)
		As-Built Plans – Ref. Set
		As-Built Plans – Archival
		As-Built Specs Book
		As-Built Specs Addendum
		Final Report
	N/A	As-Built CAD Disk
	N/A	As-Built Specs Disk
	N/A	As-Built Specs Addendum Disk
	N/A	Final Report Disk
		Other:

Notes to be included in Holdings File (optional):

Please Check the Required Elements list on the back of this form to be certain that your submission is complete.

Submitted by: _____ Print Name: _____ Date: _____

You should receive a confirmation of submission via email within 4 business days. Contact EIS if the confirmation is not received.

Plan Room Processing Items (For Plan Room Use):

Receipts:	Init.	Date
Rcvd:		
Docs Checked:		
Acceptance Sent:		
Database:		

OCE:	Init.	Date
Scan/Export:		
Index:		

Scan IDs:

File Locations:
Object Code:
Ref. Drawer:
Vault Drawer:

Required Elements for Documents (Italic are locally required):

Phase		Bid/Const Plans (optional)	Bid/Const Specs (optional)	
Bid/Const.		__ Code-Item, __ State ID or WRN __ Site Plan __ (Room Num.) __ (Street Addr.)	__ Code-Item, __ State ID or WRN __ Site Plan __ CSI MasterFormat	
	Archive Plans (Required post 1975)	Ref. Plans (Required post 1996)	Revised Specs (Required post 1996)	Final Report (Required post 1996)
As Built - State Req.	__ Code-Item, __ State ID or WRN __ Site Plan __ Seals & Signatures __ Mylar/Vellum Stock __ Plumbing Riser __ Sprinkler Diag. __ Site - Irrigation __ All Pages per TOC	__ Code-Item, __ State ID or WRN __ Site Plan __ Seals & Signatures __ Acid-free Stock __ Plumbing Riser __ Sprinkler Diag. __ Site - Irrigation __ All Pages per TOC __ Post Bound	__ Code-Item, __ State ID or WRN __ Incl. All Work __ CSI MasterFormat __ Saddle or Post Bound	__ Code-Item, __ State ID or WRN __ Bound __ Description of Work and Dates __ Ext. Design Narrative & Permits __ Internal Const Narrative __ Internal Finish Details __ Structural Desc. w/schedules __ Plumbing Desc. w/schedules __ HVAC Desc. w/schedules __ Electrical Desc. w/schedules __ Elevators Description __ Ex. A – Sq. Footage Schedule __ Ex. B – Costs w/Pcts by category __ Ex. C – Change Orders __ Ex. D – Addresses of Suppliers __ Ex. E. – Energy Certification __ Cert. Compliance __ Cert. Completion __ Post Bound
		Ref. Plans for O&M (Req. Post 2000)	Specs Addendum (Required post 2000)	
As Built - Local Req.		__ Code-Item, __ State ID or WRN __ Site Plan __ Plumbing Riser __ HVAC __ Sprinkler Diag. __ All Pages	__ Code-Item, __ State ID or WRN __ Incl. All Work __ Bound __ F1: Flooring Type and Mfr __ F2: Base and Cove __ F3: Floor/Base Suppliers __ W1: Paints Sched. __ W2: Wall Finish Sched. __ W3: Casework Sched. __ W4: Finish & Cabinet Suppliers __ E1: Bulb & Ballast Sched. __ E2: Bulb/Ballast Suppliers	
	Drawings Disk (Required post 2002)	Specs Disk (Required post 2005)	Specs Addendum Disk (Required post 2005)	Final Rep. Disk (Required post 1996)
Electronic	__ Code-Item, __ State ID or WRN __ All Sheets __ Readable __ Archival Quality CD __ Readable DWG __ Approp. Filenames	__ Code-Item, __ State ID or WRN __ All Bldgs __ Readable RTF/DOC __ Addendum (Below) __ Approp. Filenames	__ Code-Item, __ State ID or WRN __ All Bldgs __ Readable RTF/DOC __ Addendum (Below) __ Approp. Filenames	__ Code-Item, __ State ID or WRN __ All Bldgs __ Readable RTF/DOC __ Approp. Filenames

Deficiencies:
(If any, describe, complete form, copy and return to submitter)

Notes: