

**SPECIFICATIONS
FOR**

Chestnut Ridge Maintenance Shops (CRMS)

**OAK RIDGE NATIONAL LABORATORY
OAK RIDGE, TENNESSEE**

November 2011

Chestnut Ridge Maintenance Shops (CRMS)

Prepared by
UT-Battelle
for
OAK RIDGE NATIONAL LABORATORY
Oak Ridge, Tennessee 37831



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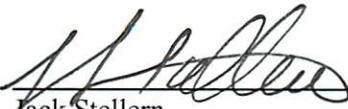
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TABLE OF CONTENTS

<u>Division 01: GENERAL REQUIREMENTS</u>		<u>No. of Pages</u>
010100	General Work Requirements	10
011100	Safety and Health.....	19
015000	Temporary Facilities and Site Controls	3
015500	Environmental Protection	23
017419	Construction Waste Management and Disposal	2
018000	Design Build Requirements.....	7
018050	Company Interface	9
018100	Overview	6
018100.1	Room Data Sheets	21
018100.2	Conceptual Drawings	11
018113	Energy and Sustainability	3
018200	Structural	8
018200.1	Soils Information	12
018200.2	Fork Truck Specifications.....	9
018300	Architectural.....	17
018300.1	Chestnut Ridge Interior Finish Standard	3
018300.2	Chestnut Ridge Signage Performance Specifications.....	34
018613	Fire Protection	12
018616	Piping.....	17
018619	Heating, Ventilating, and Air Conditioning (HVAC).....	26
018626	Electrical.....	17
018629	Communications.....	6
018633	Security.....	4
018900	Civil	8
019113	General Commissioning Requirements	2

SECTION 010100 - GENERAL WORK REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY OF WORK

- A. Work is located at the Chestnut Ridge Campus of the Oak Ridge National Laboratory (ORNL), a government owned facility, managed by UT-Battelle, LCC, (the Company), for the Department of Energy (DOE), in Oak Ridge, TN.
- B. Design and construction of a new approximately 19,500 sq. ft. two-story Maintenance Shops Facility, designed to blend with existing facilities located on the Chestnut Ridge campus.
- C. Perform work in accordance with 29 CFR 1926 and applicable portions of 29 CFR 1910.
- D. Work shall be completed in strict accordance with the subcontract documents.

1.2 COMPANY INTERFACE

- A. Communication between the Seller and the Company shall be through the Company's Technical Project Officer (TPO). The Seller shall communicate issues affecting the contract with a Request for Information (RFI). An RFI form is posted on the Procurement website.

1.3 SECURITY

- A. Badge and dosimeter requirements.
 - 1. Workers must be badged to enter ORNL. Access points are located on Bethel Valley Road. Submit the badge request form, located on the Procurement website at least seven calendar days, but not more than 14 calendar days, in advance of scheduled plant entrance. Proof of the following current training is a prerequisite for obtaining a badge and for performing work at ORNL:
 - a. The ORNL Site Access Training (SAT) within the past two years.
 - b. The ORNL Environmental Management System Awareness Training.
 - 2. Request badges only for employees assigned or scheduled to work at the site.

Beta-gamma external radiation dosimeters will be issued to workers if they are to enter controlled areas, radiological areas, or radioactive material areas. The dosimeters shall be worn with the badge above the waist on outer clothing. Issuance of dosimeters is not anticipated for this project.

3. Submit temporary badge request forms for one-time visitors at least 48 hours in advance of scheduled visit using the Construction Badge Request Form on the Procurement website.
 4. Return all badges and dosimeter upon completion of work. **Final payment will not be processed until badges and dosimeters are returned.**
- B. Vehicle requirements.
1. Personal vehicles may only be parked in spaces designated for open employee parking. Parking violations may result in termination of employee access to ORNL.
 2. Parking and work site access for vehicles used to conduct the subcontract work shall be coordinated with the TPO.
 3. Parking along roads is prohibited.
 4. If vehicle access is required to a designated secure area of ORNL (High Flux Isotope Reactor complex, portions of Spallation Neutron Source, etc.), submit a written list of vehicles needing access to these areas at least 48 hours in advance of required access. Provide the make of vehicle, model, license plate number, and insurance carrier. A Vehicle Access Request Form is located on the Procurement website.

1.4 SUBMITTAL REQUIREMENTS

- A. Coordinate submittal information through the Company's TPO, and Procurement representative.
- B. Provide the submittal information as stated in the subcontract documents. A preferred submittal form is included on the Procurement website.
- C. Identify submittal information with contract number, project title, the Seller's name, and date submitted. Submittal information will be managed electronically. Details for electronic submittals will be given to the Seller at the kickoff meeting.
- D. Number of submittal copies: three, except as noted otherwise within the specification.
- E. Items submitted for review and comment will be returned to the Seller within five business days.
- F. Items submitted for approval will be returned within five business days with one of the following comments:
 1. Approved As Is.
 2. Approved with comments, revise and resubmit.
 3. Approved with comments, resubmittal not required.

4. Not approved, revise and resubmit.
5. Review not required.

1.5 SPECIFICATION AND DRAWINGS

A. Specification.

1. The specification is written in a streamlined form and directed to the Seller, unless specifically noted otherwise.
2. The words "shall be" are included by inference where a colon (:) is used within sentences or phrases.
3. The term "provide" means to furnish and install, complete and ready for intended use.

B. Drawings.

1. Work shall conform to the drawings.
2. Reference drawings are furnished for information only.

1.6 WORKING AND STORAGE AREAS

- A. Limit activities and storage to the immediate project site and designated storage areas. Limit travel to the main roads.
- B. Store only work-related material and equipment in stockpile areas, storage trailers, and designated storage sites located on government-controlled land.
- C. Perform cleanup, trash disposal, and neatly arrange material and equipment on a daily basis.
- D. The ORNL has a smoking policy that limits cigarette smoking to certain designated ORNL areas. For work in existing ORNL facilities, the Seller shall only allow its employees, and employees of its lower tier providers, to smoke in the ORNL designated smoking areas. For work on other ORNL construction sites (e.g., outdoor work and/or new facilities) the Seller may request that a site-specific, outdoor smoking area be designated for the Seller's work; such designated area must be 25' away from any building entrance or building air intake.

1.7 PROJECT WORK AND PAYMENT SCHEDULE

- A. The Seller shall be substantially complete with work by or before July 15, 2013. All work shall be complete 30 days after substantial completion is achieved. Substantial completion is when work is sufficiently complete in accordance with the subcontract documents so the company can occupy or utilize the facility/area for its intended use.

- B. Within 30 days of award, the subcontractor shall submit a cost-loaded, baseline project schedule with activities and related costs that match the schedule of values.

The baseline schedule shall consist of a precedence network diagram using the critical path method (CPM) to show each individual essential activity in sequence to meet the contract milestones. The schedule shall also show durations and dependencies, including off-jobsite activities such as design, fabrication of equipment, and procurement and delivery of material, as well as total float and free float times. A rolling four-week schedule showing one week actual progress and a three-week look-ahead forecast shall be reviewed and maintained weekly in the Company weekly review meetings. The baseline schedule shall be used for critical path and total float analysis.

- C. Submit for approval, within 30 calendar days after the award of contract, a schedule of values (payment schedule) allocated to various portions of the work. The schedule of values shall be in enough detail to verify applications for payment and be traceable to the activities and progress on the schedule. Activities with substantial material values shall be listed separately.
- D. Update the project work schedule monthly during design, and bi-weekly during on site work.

1.8 PROJECT COORDINATION

- A. Normal construction working hours are 7:00 a.m. to 5:00 p.m., Monday through Thursday. Provide sufficient personnel to complete the project within the specified time. Notify the Company at least 48 hours in advance if performing work at times other than the normal working hours.
- B. The Company holidays are New Years Day, Martin Luther King's Birthday, Good Friday, Memorial Day, Independence Day, Labor Day, Thanksgiving and the day after, and Christmas (two days). Request 72 hours in advance to access the plant on holidays observed by the Company. The Company retains the right to reject requests to work on holidays.
- C. A pre-construction meeting will be held at ORNL five calendar days before starting field work. The Seller's superintendent and key personnel shall attend. The date and time will be mutually agreed upon by the Company and the Seller.
- D. A progress and coordination meeting will be held weekly. This meeting will be chaired by the Company's TPO, Construction Field Representative (CFR), or the Company's PM. The Seller's superintendent shall attend this meeting and have authority to resolve field problems and make changes in cost and schedule. The project schedule shall be updated prior to the meeting and used as a basis for the discussion.
- E. All work shall be coordinated with the Company, to allow integration with the balance of ORNL's activities, to ensure the mutual safety all work activities. The Seller shall notify the TPO, CFR, or the Project Manager (PM) no later than 24 hours in advance of work activities scheduled by the Seller. No work shall take place on any day without explicit approval from the TPO, CFR, or PM.

1. For all work in or around existing ORNL facilities or infrastructure, protect the existing ORNL facilities and infrastructure from damage, and protect all personnel from injury resulting from the Seller's activities.
 - F. Submit requests for outages a minimum of eight calendar days in advance of need. Hold outages to a minimum in number and duration.
 - G. Request project specific permits such as hot-work and lockout/tag-out at least 48 hours in advance of need.
 - H. Provide 48 hours advance notice before shut down of the sprinkler system to make proper arrangements with the Company's Fire Protection Department.
 - I. Provide 48 hours advance notice before shut down of any portion of the Public Address System as may be required for a project.
 - J. Provide 48 hours advance notice before shut down of any safety systems devices.
- 1.9 UNUSUAL CONDITIONS
- A. Work within existing confined space areas will not be required for this project.
- 1.10 SEQUENCING
- A. The Seller is responsible for the sequencing of all construction elements to result in the successful completion of the work in accordance with the approved design.

PART 2 - PRODUCTS

2.1 PROPERTY FURNISHED TO THE SELLER

- A. Includes S&C switchgear and transformer as specified in 018626.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Training.
 1. Ensure work-specific training is provided before performing work activities.
 2. Each worker shall provide proof of current SAT.

3.2 TESTING

- A. The Seller shall perform subcontract specified tests in accordance with the following:
1. Provide labor and technical support, annually calibrated (unless more frequent calibration is specified) and properly maintained equipment, and materials required to perform testing. Equipment calibration records shall be submitted upon request.
 2. Notify the Company 24 hours before performing tests and inspections, 48 hours for fire or sprinkler systems.
 3. Perform tests and inspections in a manner that allows observation by the Company.
 4. Submit a copy of tests performed within 48 hours after test completion.

3.3 EXCAVATION AND PENETRATION ACTIVITY

- A. An excavation/penetration permit will be provided at the pre-construction meeting. A representative of the Seller is required to sign the permit. Ensure the issuance of an approved permit before starting excavation or penetration work. Work covered by the excavation/penetration permit requires an underground survey by the Company before work begins. Contact the Company TPO before digging or penetrating the surfaces.
- B. The permit owner (or designee) makes sure that the entity performing work complies with the following:
1. If at any time during the excavation or penetration work the entity performing work cannot clearly determine where the subsurface utilities or structures are located, based on existing location markings or markings recently disturbed by the work, the work is suspended until utilities or structures in the work area can be relocated and remarked.
 2. Ensures that Tennessee One Call markings in an active work area are not older than 15 days from the date on the One Call Ticket received from the Tennessee One Call Center. If they are older than 15 days from the ticket date, the work is suspended until utilities or structures in the work area can be relocated and remarked.
- Note: Details of the Tennessee One Call law can be found on their [website](#).
- C. The following special work requirements and precautions are to be followed for excavation activities:
1. When excavating within a distance of 15' or less from energized electrical power circuits, the following applicable requirements apply:

- a. The energized circuits must be de-energized and grounded or guarded effectively by insulation or other means. See [Electrical Work](#) and [Lockout/Tagout](#).
 - b. Until underground-energized utility structures are exposed, personnel using hand tools (jackhammers, shovels, etc.) must be provided with personal protective equipment (PPE) appropriate to protect them from the hazard associated with contacting the utility structure. Selection of the [PPE](#) will be part of the Job Hazard Evaluations.
 - c. Proper warning signs shall be posted and maintained where underground-energized circuits are suspected but the exact locations are unknown. Personnel shall be advised of such circuits, the hazards involved, and alternative and/or protective measures to be taken.
 - d. Use of heavy excavation equipment (non-hand-held equipment) in these areas shall be approved and noted. Also, this use shall require compliance with other requirements as deemed appropriate and so noted.
2. When an excavation will cross other potential energy utilities, those utilities should be de-energized, if at all possible. If the utility cannot be de-energized, then the supervisor must establish strict controls to ensure the safety of all personnel; no less than an ORNL Level-3 Manager must approve controls utilized.
- a. Hand digging is required with 24" (any direction) to positively identify the location of any active utility. Adjustments to the depth are required based upon the location of the marked utilities (i.e., begin hand digging at 24" if the slope of the marked utility is not parallel with the ground surface or of unknown slope). Mechanized clearing (toothless bucket if using mechanized machinery such as a backhoe) of soil above the depth of hand-dug clearing is permissible.
 - b. Once the utility has been exposed and cleared by hand digging below 12" of the utility, mechanized means of digging can commence if supervision determines appropriate.
3. At the discretion of supervision, heavy equipment (i.e., other means than hand excavation) may be used to expose out-of-service utilities so long as reasonable caution is exercised to preclude physical damage to the utility.
4. Flag-persons (ground-level observers) shall be required for heavy excavation equipment (non-hand-held equipment) operations in areas of inexactly located energized electrical circuits and other in-service utilities, as well as when the equipment operator can no longer maintain eye contact with the surface being excavated.
- D. The Seller shall obtain approval by the Company before covering existing or newly installed utilities. The Company shall verify that utility locations are recorded before allowing the utilities to be covered.
- E. Penetrations less than 2" deep:
1. For penetrating activities (including installation of fasteners less than 2") where subsurface elements are unknown, the following requirements will be performed:

- a. Investigate and/or survey for subsurface elements.
- b. Use ground fault circuit interruption protection or electrically-operated equipment and tools.
- c. Connect non-double insulated electrically operated equipment and tools with an insulated #8 American Wire Gage (AWG) or larger copper conductor. This applies to non-electric coring/cutting machines also.
- d. Workers shall wear appropriately rated electrically insulated gloves.

3.4 CONTROL OF MOLD DURING CONSTRUCTION

- A. The Company recognizes that mold infestation represents a risk during the construction phase. To reduce the risk of mold infestation the Company requires the following actions by the Seller:
 1. Avoid trapping water in finished work.
 2. Replace or clean any material that has visible signs of mold.
 3. Protect building materials and components from flowing or standing water once the building roof is installed.
 4. Keep interior spaces and materials or components stored in those spaces, reasonable clean and protected from water damage.
 5. Maintain drywall, ceiling tiles, insulation, and other porous materials dry. Replace or properly dry any porous materials that get wet.
 6. Don't cover any fireproofing, insulation or other porous materials that are clearly wet.
 7. Maintain appropriate levels of ventilation during construction. Ventilate spaces and storage areas that are enclosed before construction is completed.

3.5 PROJECT SIGN

- A. Post identification and emergency notification signs in a conspicuous location at the work site. All points of entry shall have a sign warning of the pre-requisites.
- B. Identification signs shall be weatherproof and have the following information:
 1. Project title and contract number.
 2. Name, address, and phone number of the Seller's business.
 3. Name and phone number of person available 24 hours, seven days per week, to be notified in case of an emergency. Phone number may be pager or cellular phone.

3.6 NEW BURIED UTILITIES

- A. Buried underground utilities shall include a tracer wire.
- B. Requirements for the tracer wire include:
 - 1. Tracer wire shall be No. 10 or No. 12 AWG copper wire with water resistant thermoplastic (Type TW) insulation.
 - 2. Tracer wire shall be installed on top of the buried utility.
 - 3. Tracer wire shall be positively attached to the buried utilities by plastic wire ties or similar type of attachment every 10' for straight utility segments and at all changes of direction.
 - 4. The ends of the tracer wire shall be exposed above finished grade with a 12" coil of wire at each end. Depending on the circumstances the ends of the tracer wire exposed above finished grade shall be attached to the utility as it leaves the ground or secured in a valve box or junction box.
 - 5. Tracer wire shall be continuous between locations where wire ends come to the surface. Tracer wire shall be tested for continuity in the presence of a representative of the Company.

3.7 AS-CONSTRUCTED DRAWINGS, MANUALS AND WARRANTY INFORMATION

- A. The Seller shall maintain one set of contract documents that reflect the "as-constructed" conditions. The "as-constructed" conditions shall be noted in red.
- B. The Seller shall submit an operations and maintenance (O&M)/warranty package. The package shall be organized and tabbed by construction specification divisions and shall contain at minimum the following information:
 - 1. The O&M manuals for all systems/equipment.
 - 2. Test/Balance reports as required by subcontract documents.
 - 3. List of contacts for service and warranty issues for all equipment.
 - 4. List and summary of warranties (including at minimum the scope of the warranty, term of warranty, and required preventive maintenance to maintain valid warranty).
 - 5. Copies of specific written vendor warranties if required by contract (e.g., roof warranties).
- C. At substantial completion of the project, the Seller shall update and submit the design drawings to incorporate the "as-constructed" redline documents and the O&M/warranty package to the Company. Final payment will not be made until both submittals are received and approved by the Company.

3.8 MANAGEMENT REPORTING OF ACCIDENTS AND INCIDENTS

A. Notification.

1. If there is any unplanned, unusual work condition that presents an actual or potential hazard or threat to workers or facility infrastructure, it shall be reported to the Company as soon as possible after the event occurs, and in no case longer than 15 minutes after the event occurs unless acute personnel or facility hazards associated with the event prevent subcontractor personnel from contacting the TPO.

B. Preservation of the site following an accident or incident:

1. The Seller shall make every effort to preserve the site following an accident or near-miss incident.
2. Taking care of any injured personnel takes precedence over preservation of the accident site.

C. Accident/Incident report:

1. Submit an "Individual Accident/Incident Report" (DOE Form 5484) within two working days of a recordable or lost time injury or illness (Occupational Safety and Health Administration definition). The Company will provide the report form upon request.
2. The Seller must perform a structured accident investigation for any recordable or lost time injury and/or for any significant non-injury accident/incident that disrupts project operations. An accident investigation report (in addition to the Form 5484, if applicable, discussed in Section C.1 above) containing the following information must be submitted to the Company within three working days:
 - a. A timeline of critical events before, during, and immediately after the accident/incident.
 - b. A causal analysis listing the direct cause, contributing cause(s), and root cause(s) of the accident/incident; the causes shall also identify in which area of the five core functions of ISM (see Section 011100, 1.2.A) the cause occurred.
 - c. A corrective action plan listing actions and completion dates that the Seller has taken or plans to take, to correct any deficient conditions or worker behaviors that led to the accident/incident. The corrective action plan should also consider the applicability of the actions to other projects that the Seller may be performing at ORNL.

END OF SECTION

SECTION 011100

TABLE OF CONTENTS

PART 1: GENERAL

- 1.1 SAFETY AND HEALTH PROGRAM
- 1.2 SAFETY AND HEALTH ENFORCEMENT
- 1.3 APPLICABLE CODES, REGULATIONS, AND STANDARDS
- 1.4 HAZARDOUS WORK REQUIREMENTS
 - A. Airborne Contaminants
 - B. Confined Space
 - C. Demolition
 - D. Electrical
 - E. Excavation/Penetration
 - F. Hazard Communication
 - G. Heat/Cold Stress
 - H. Hoisting and Rigging
 - I. Lockout/Tag-out
 - J. Noise/Hearing Protection
 - K. Respiratory Protection Requirements
 - L. Welding, Cutting, and Hot-work Requirements
- 1.5 ADDITIONAL SAFETY REQUIREMENTS
- 1.6 OCCUPATIONAL HEALTH PROTECTION THRESHOLD EXPOSURE LIMITS
- 1.7 EMERGENCY SERVICES AND EQUIPMENT
- 1.8 EMERGENCY PREPAREDNESS AND RESPONSE
- 1.9 EQUIPMENT AND MACHINERY

PART 2: EXECUTION

- 2.1 PREPARATION
- 2.2 PROTECTION OF WORK AREA
- 2.3 WORKING AND STORAGE AREAS

SECTION 011100 - SAFETY AND HEALTH

PART 1 - GENERAL

1.1 SAFETY AND HEALTH PROGRAM

A. Oak Ridge National Laboratory (ORNL) is committed to accomplishing construction work in a manner that ensures protection of workers, the public, and the environment. In order to meet that commitment, ORNL has implemented an Integrated Safety Management System (ISMS). The objective of ISMS is to WORK SAFELY. By systematically integrating safety into management and work practices at all levels, work is accomplished while protecting the public, the worker, and the environment. Safety management activities can be grouped into five core safety management functions:

1. Define the scope of work;
2. Analyze the hazards;
3. Develop and implement hazard controls;
4. Perform work within controls; and
5. Provide feedback and continuous improvement.

These five core safety management functions provide the necessary structure for safely accomplishing any work activity and are applied as a continuous cycle with the degree of rigor appropriate to address the type of work activity and the hazard involved.

B. Submit for approval a written project specific Safety and Health (S&H) Plan 21 calendar days prior to site activities. The plan shall:

1. Address how the Seller will implement the S&H requirements described in the project subcontract documents, i.e., terms and conditions, technical specifications, and drawings.
2. Designate the individual responsible for on-site implementation of the plan and who has authority to act on behalf of the Seller, including the qualifications of the designated individual.
3. Provide a list of those project activities for which subsequent hazard analyses are to be performed.

- C. Submit for approval a written hazard analysis (HA), addressing project specific hazards, to the Company 21 calendar days prior to site activities. Using ISMS as described in Section 1.1.A, the HA shall identify work tasks anticipated during the construction work, as well as any potential health, safety, and environmental hazards that could reasonably be expected during the work activities, and list specific actions or precautions that will be taken to minimize the risk of such hazards that could cause an accident, injury, illness, or environmental insult. Prior to submission to the Company for approval, the HA shall be approved by a safety manager (or equivalent) and a line manager in the Seller's work execution team.

The HA shall be revised whenever activities, hazards, or hazard controls change. Minor revisions (not significantly changing the safety risk profile of the job) shall be approved by a competent manager or supervisor of the Seller. In addition, significant revisions to the HA (changes in job scope, the Seller means and methods, etc. from the previously approved HA that result in a significant change in the safety risk profile of the work) shall be submitted to the Company for approval. All final, approved changes to the HA shall be communicated to the affected workers.

The HA shall identify competent persons required for workplace inspections of the construction activity, where required by Occupational Safety and Health Administration (OSHA) standards.

The HA shall provide drawing and/or other documentation of protective measures for which applicable OSHA standards require preparation by a Professional Engineer or other qualified professional.

A copy of the HA shall be readily available at the work site in such a way as to make the information readily available to workers in the work area on a continuous basis. Anyone performing hands-on work and anyone requiring unescorted access to the site shall be required to review and sign the HA prior to entering the work area. Each worker shall be briefed on the hazards specific to their work before signing the HA, and shall be re-briefed as often as necessary to ensure their understanding of the HA hazard controls applicable to their daily work activities.

A sample of the Change Summary sheet, HA Form, and signature sheet are available on the ORNL Procurement web site.

- D. The Seller and its lower tier subcontractors shall conduct pre-task briefings, sufficient to ensure job site safety, with affected workers to review hazards and hazard controls for tasks planned that day.
- E. The Seller shall confirm that training for their employees and their lower tier subcontractor employees is adequate for the tasks being performed. Documentation of training shall be provided if requested by the Company.
- F. Submit tabulation of man-hours worked on a monthly basis using the "Tabulation of Work Hours" form provided on the Procurement website. This should include all work hours for both manual and non-manual personnel on the job.

1.2 SAFETY AND HEALTH ENFORCEMENT

- A. During all execution of field construction activities, the Seller shall designate a person to be responsible for enforcement of safety rules and regulations associated with the ongoing work. This designated individual shall have sufficient knowledge and understanding of the work, the Seller's means and methods, and any applicable regulatory requirements to ensure the work can be prosecuted safely and compliantly. This person shall also have:
1. Minimum 30-hour OSHA Construction Safety Course.
 2. Experience and the authority to stop work if the S&H of a worker or the environment are in danger.
 3. Sufficient time and resource to execute the designated S&H responsibilities as a first priority of work. The designated person may have concurrent additional jobsite duties only to the extent those additional duties do not interfere with the ability to perform S&H responsibilities. The S&H shall be the first priority and any other duties shall be immediately suspended if they interfere.
- B. The designated S&H person shall have the following responsibilities:
1. Attend a one-hour ORNL Construction Safety Meeting every month. The location and time will be designated.
 2. Perform and document **daily** safety inspections and correct deficiencies immediately. If deficiencies cannot be corrected, immediately stop related work until correction is completed. Maintain a logbook of inspections, safety meetings, and other project related activities.
 3. Conduct safety meetings/briefings with workers to discuss precautions, needed improvements, and relevant safety topics for the work being performed prior to beginning new tasks, and as often as necessary thereafter to assure that workers recall the essentials HA elements of the work they're undertaking.
 4. Ensure project personnel and un-escorted visitors review and sign-off as having reviewed a copy of the project HA before entering the construction site.
 5. Revise the HA to reflect changes in the project scope of work, the Seller means and methods, or changes resulting from site conditions. Document additional work tasks, hazards associated with those tasks, and required safety actions in the HA.
 6. Serve as the Seller's point of contact for site S&H concerns.
 7. Ensure appropriate industrial hygiene monitoring and safety services are provided, including instrument calibration and record keeping.
 8. Remain on site or ensure a competent, designated alternate remains on site at all times during work activities.

9. Ensure initial and daily inspections of equipment and certification/qualification of equipment operators are current.
10. Submit documentation for resolution of serious findings identified by the Company.

1.3 APPLICABLE CODES, REGULATIONS, AND STANDARDS

A. Work shall be performed in accordance with the following codes and regulations without limitations:

1. The OSHA 29 CFR 1926 (with the exception of 1926.53 superseded by 10 CFR 835) and applicable sections of 1910 including all referenced codes and standards.
2. Department of Energy (DOE) 10 CFR 851.
3. American National Standards Institute, Inc. (ANSI) B30 Series.
4. ANSI/Site Area Emergency J67 (Oct80), Shovel Dipper, Clam Bucket, and Dragline Bucket Rating (equipment design specification only).
5. ANSI/Social Impact Analysis A92.2 (1990), American National Standard for Vehicle-Mounted Elevating and Rotating Aerial Devices (equipment design specification only).
6. American Society of Mechanical Engineers (ASME) B56.6 (1993), Rough Terrain Fork Lift Trucks (equipment design specification only).
7. National Safety Council A10.31 (1995), Construction and Demolition--Digger Derricks Safety Requirements (equipment design specification only).
8. U. S. Department of Transportation, (DOT) Hazardous Materials Regulations, 40 CFR 106 199 and 49 CFR 325-399.
9. National Fire Protection Association (NFPA) Standards including NFPA 51B-1989, "Fire Prevention in Use of Cutting and Welding Processes".
10. National Electrical Code Handbook.
11. American Conference of Governmental Industrial Hygienists (ACGIH) "Threshold Limit Values and Biological Exposure Indices".
12. ANSI Z49.1, "Safety in Welding and Cutting".
13. ANSI Z88.6, 1984, "For Respiratory Protection - Respirator Use - Physical Qualifications for Personnel" and ANSI Z88.2, "Practices for Respiratory Protection".

14. DOE Standard. Hoisting and Rigging, DOE-STD-1090-2007 (available on the ORNL Procurement web site).

B. In the event of conflicts between the cited regulations, notify the Company for resolution.

1.4 HAZARDOUS WORK REQUIREMENTS

A. Airborne contaminants.

1. Airborne contaminants (chemicals, dust, cutting/grinding debris, etc.) shall be minimized to the extent reasonably practical, and in no case shall personnel exposures be allowed greater than the accepted standards for airborne contaminants to:

a. Workers without personal protective equipment (PPE) or other protective measures outside the designated work area;

b. Workers inside the work area, including those utilizing protective measure or equipment.

2. Use appropriate dust-reducing methods such as vacuuming, wetting, enclosures, air flow control, and PPE during operations that can introduce airborne contaminants.

3. The Company shall be notified of planned activities that produce airborne contaminants so that it can assess whether appropriate protections are in place to avoid over-exposures outside the job boundary, and/or to avoid plant upset conditions (such as inadvertently triggering a facility smoke alarm).

B. Confined space.

1. The ORNL confined spaces are classified as permit-required or non-permit-required.

a. Non-permit spaces require a job hazard evaluation, work guideline, or a standard operating procedure approved by the Company.

b. Permit-required spaces require a confined space permit, which addresses all the elements of 29 CFR 1910.146.

2. Any construction operation involving a confined space entry requires an evaluation of work by the Seller and the Company's S&H representative to classify the space as permit-required or non-permit required.

3. Provide retrieval equipment to facilitate non-entry rescue for all permit-required spaces unless evaluation of the permit-required confined space determines that the use of retrieval equipment creates greater S&H hazards. In this case, rescue services shall be notified that entry into the confined space may require rescue operations.

C. Demolition.

1. An engineering survey of the structure to determine the condition of the framing, floors, and walls, and possibility of unplanned collapse of any portion of the structure shall be performed. The Seller shall provide written evidence that such survey has been performed.
2. The Company shall ensure electric, gas, water, steam, other service lines be shut off, capped, otherwise controlled outside building line before demolition work is started.
3. The Company shall determine if any type of hazardous chemicals, gases, explosives, flammable materials, or similarly dangerous substances have been used in any pipes, tanks, or other equipment on the property. When the presence of any such substances is apparent or suspected, testing and purging shall be performed and the hazard eliminated before demolition is started.

D. Electrical.

1. Electrical safety.
 - a. Conduct electrical installation and maintenance operations in accordance with requirements in 29 CFR 1926 Subpart K, applicable requirements in 29 CFR 1910 Subpart S, NFPA *Standard for Electrical Safety in the Workplace* (NFPA 70E) 2004 edition, and the National Electrical Code.
 - b. Ensure electrical work is performed by qualified persons as defined in 1910.331-335.
 - c. Provide a ground fault circuit interrupter for cord sets, receptacles, and electrical tools including plug and cord connections to generators and equipment for employee use.
2. The HA is utilized to ensure workers understand their role in the work to be performed, as well as what others involved in that project or task will be doing. Supervisory approval for “working on or near” or “working hot” shall be given in the Electrical Energized Work Permit (available on the ORNL Procurement web site). “Working on or near” or “working hot” requires approval by the Subcontractor Supervisor, UT-Battelle, LLC (UT-B), Technical Project Officer, and UT-B Level II Manager. Subcontractor shall follow the guidelines presented in the NFPA 70E tables for determining approach boundaries and PPE.
3. Safety concerns regarding shared neutrals.

The Seller shall be aware that the lockout/tag-out (LO/TO) of individual electrical circuits will not ensure that its associated electrical wiring will be completely de-energized. Disconnected neutrals of circuits which employ shared neutrals can remain energized with normal system voltage, a condition which is prevalent in industry wide 120/240V, 120/208V and 277/480V building circuitry.

For example, in 120/208V lighting circuits, a shared neutral is commonly used for up to three 120V circuits. Three-phase wires fed from three circuit breakers (circuits 1, 3 & 5; etc.) and a shared neutral are sent from an electrical panel board to distant light fixtures via a common conduit and junction box system. If one of the circuit breakers is locked out and the other two remain energized, and the shared neutral conductor is disconnected, 120V will routinely be present on the disconnected neutral conductor. In such cases, 120V will be fed from an associated circuit breaker hot phase, through the electrical load (such as the filament of an incandescent bulb), to energize the disconnected neutral conductor with 120V.

When working on circuitry employing shared neutrals, measuring for the presence of voltage on disconnected neutrals is not an adequate safety measure. For example, a light switch on one of the associated circuits may be off, with its circuit breaker still closed (light switches are typically not locked out). A case can result, when zero voltage is measured on a disconnected neutral, due to a light switch being turned off. If one proceeds to work on the disconnected neutral of that circuit, and a light switch is turned on, then 120V will be injected onto the disconnected neutral. Note that a similar situation can exist in facilities where the neutrals are cross-connected between circuits (including circuits from different panels); hence isolating all the circuits in a single panel (using a main breaker or disconnect) may also not ensure that circuit wiring is de-energized and/or isolated.

Due to the above, when work is performed on neutral conductors of any building electrical system, the neutral conductors should be considered as “energized”, regardless of LO/TO actions, and “on or near” electrical safety measures shall be exercised. Appropriate safety precautions to minimize the hazards of “energized” disconnected neutral conductors shall be listed in the project specific HA.

E. Excavation/Penetration.

1. The Company will provide the Seller with an excavation/penetration permit, as applicable, prior to the excavation/penetration of surfaces in order to identify the Company utilities and other subsurface company infrastructure. The Seller shall utilize Tennessee One Call services in accordance with state law to manage protection of non-company utilities at ORNL. Protect underground or subsurface installations from damage or displacement. The excavation permit and requirements to utilize Tennessee One Call shall be referenced in the HA and be available at the work site.

F. Hazard communication.

1. Demonstrate compliance with a written hazard communication program as required by 29 C FR 1926.59, including employee information and training, provisions for labeling and availability of material safety data sheets (MSDS) as a section of the Seller S&H plan.

2. List all hazardous chemicals/materials brought on site on the form entitled “Contractor Hazardous Materials Inventory Report” (available via the Procurement web site) before starting on-site work. Provide to the TPO a copy of the MSDS for each chemical/material listed. Update the report monthly and provide a final inventory upon completion of work.
 3. The Seller shall maintain the MSDS for hazardous chemicals brought onsite and shall supply information regarding hazardous chemicals to the Company representative prior to initiation of activities that may potentially expose the Company personnel to a hazard at the job location.
 4. The Seller shall remove all unused chemicals or materials brought to the site at the completion of the job.
- G. Heat/Cold stress.
1. Personnel exposed to temperature extremes should be protected in accordance with the ACGIH guidelines by implementing appropriate engineering controls, work rest regimens, and/or PPE. Activities must be evaluated for variables such as air temperature, wind speed, humidity, clothing and/or PPE being worn, and acclimatization status of workers to determine if there is a threat of heat/cold stress. Appropriate work rest regimens are selected based on environmental and/or physiological monitoring.
 2. Personnel shall receive proper training on the hazards of working in temperature extremes. The instruction should include signs and symptoms associated with heat/cold stress, appropriate controls to protect against these hazards, first aid measures, and other factors which may increase a worker's susceptibility to heat/cold injury (e.g., age, weight, consumption of alcohol, taking medications such as diuretics, infection, pre existing medical conditions, etc.).
 3. In hot environments, cool liquids shall be made available to workers and workers shall be encouraged to frequently drink small amounts, e.g., one cup every 15-20 minutes.
 4. Since prolonged exposure to cold air or to immersion in cold water, at temperatures well above freezing can lead to dangerous hypothermia, whole body protection must be provided. Personnel should be protected by proper clothing and implementing a work/warm-up schedule per the ACHIH guidelines.
- H. Hoisting and rigging.
1. General.

- a. Perform hoisting and rigging activities in accordance with the DOE Hoisting and Rigging Standard (DOE-STD-1090-2007), and the applicable parts of 29 CFR 1910 Subpart N, 29 CFR 1926 Subparts H and N, and ASME B30 and B56 Series. Provide for review by the Company upon request, documents of certification that the Seller's hoisting and rigging equipment meets the requirements in these documents. If an inspection certificate expires while the equipment is on site, re-inspect the equipment and update the inspection certificate before continuing work activities.
 - b. The Seller shall develop an HA content specifically for hoisting and rigging operations required for the work.
 - c. Provide load-rating plates attached in a prominent location. When modifications or changes are made to lifting or hoisting equipment or when equipment is modified to permit lifting or hoisting, attach a new manufacturer's load rating plate. In lieu of a manufacturer's load rating plate, a certification that the equipment has safely undergone a performance test of at least 125% of the maximum anticipated load may be furnished. This load rating shall then be affixed to the equipment.
 - d. The Seller's hoisting and rigging equipment/devices may be inspected by the Company with the right to suspend operations if found deficient or unsafe.
 - e. Cranes, boom trucks, and other types of hoisting equipment which do not have an anti-two-blocking device shall be equipped with a warning feature sufficient to alert the operator before the cable hook assembly is drawn into the top pulley, e.g., cable coating, cable wrapping, alarm device, etc.
 - f. The use of forklifts, backhoes, and track-hoes for hoisting or rigging activities is not permitted unless the manufacturer's written documentation specifies the equipment is designed for that purpose and lifting limits are properly identified.
 - g. Do not operate forklifts within 10' of any electrical lines without the Company approval. Contact the Company's TPO for a determination of safety requirements to conduct forklift operations that must be performed within 10' of electrical lines.
2. Operator qualifications.
- a. Equipment operators and riggers, including alternates, shall be qualified to perform their assigned functions. Qualifications shall include physical, knowledge, and skills proficiency based on job function.

- b. The Seller or their lower tier subcontractor shall maintain a program for evaluating crane operators. The program shall be available for review by the Company. The program shall include written testing to evaluate operator knowledge and performance testing to evaluate operator skills. Elements of the program shall be consistent with the requirements of DOE hoisting and rigging standard, and include but not be limited to the following:
 - 1) Pre-use crane inspection.
 - 2) Crane specifications, operator's manual, load charts, instrumentation, controls, operator aides, and operating characteristics.
 - 3) Operating procedures under emergency conditions.
 - 4) Setup, shutdown and parking of the crane.
 - 5) Crane attachments.
 - 6) Configurations and loading effects on the crane.
 - 7) Standards, rules and regulations.
 - 8) Rigging practices.
 - 9) Personnel lifting procedures.
3. Ordinary, critical, and pre-engineered lifts.
 - a. Ordinary lifts less than 5000 lbs.
 - 1) The Seller is responsible for ensuring that all lifting meets the requirements of the regulatory documents noted in this section.
 - b. Ordinary lifts above 5000 lbs.
 - 1) The Seller shall require an appropriate review and approval by the Seller's field supervisor and hoisting and rigging supervisor in a documented "lift planning" or equivalent format. An example of a lift planning document is available on the Procurement web site.
 - c. Critical lifts.
 - 1) A lift shall be designated as a critical lift if the requirements applicable for ordinary lifts do not adequately eliminate or control the likelihood or severity of the following:
 - a) Personnel injury or significant adverse health impact (on site or off site).

- b) Significant release of radioactivity or other hazardous material or other undesirable conditions.
- c) Undetectable damage that would jeopardize future operations or the safety of a facility.
- d) Damage that would result in delay to schedule or other significant program impact such as loss of vital data.
- e) The use of two or more cranes or forklifts or special hoisting/rigging equipment.
- f) If the lift exceeds 75% capacity of crane (steel erection only).

NOTE: A lift could also be designated as critical if the load requires exceptional care in handling because of size, weight, close-tolerance installation, high susceptibility to damage, or other unusual factors.

- 2) The Seller shall submit a critical lift plan, using the Critical Lift Plan Form (available on the Procurement web site), to the Company for approval. The plan shall be submitted at least 10 days in advance of the scheduled lift. The lift shall not be made until approval in writing from the Company is received.

- a) Include a layout sketch of the crane set up plan that includes the planned and maximum operating radii for the lift. Also show the item to be lifted.

NOTE: Show set up plans for other lifting machinery [e.g. forklift] if not using a crane.

- b) Include Proof Load Tests for Slings, Shackles, and Hooks used for the hoisting and rigging activities. The same components that were tested must be used for the critical lifting activities.

- 3) The Seller shall conduct a pre-lift meeting prior to making the lift. The Company TPO (or designee) and all the Seller personnel involved in the lift shall attend.

I. LO/TO.

- 1. Hazardous energy sources (electrical, mechanical, etc.) that are present at the work site must be de-energized and locked out before the Seller can begin work involving these hazardous energy sources. The Seller prepared HA shall include identification of hazardous energy sources, methods for performing LO/TO, and a sufficiently detailed LO/TO implementation plan addressing how the Company (if applicable to the work) and all tiers of subcontractors will perform LO/TO on the project in order to ensure a clear understanding of LO/TO coordination between all parties (e.g., will all sub-tier subcontractors use the prime subcontractor's locks and tags; or will each sub-tier use their own style of locks and tags; etc.)?

2. The Company will perform a LO/TO of applicable company-controlled systems and equipment. The Seller must provide at least five calendar days advance notice to the Company field representative of systems requiring LO/TO.
 3. For work in existing ORNL facilities, the Seller's work may not proceed until the Company has conducted a coordination briefing with the Seller to facilitate integration between the Company and the Seller LO/TO activities (including determination of the Company versus the Seller control of applicable systems and equipment).
 4. Following any applicable isolation and LO/TO by the Company, a representative of the Seller shall review and approve the protection provided. In cases where the Company LO/TO permit is issued, the Seller's representative shall indicate this approval by signing the permit as the "Service Supervisor". The Seller employees shall verify isolation, and over-lock isolation points (or a lockbox) with their personal locks. These locks shall be identified with the Seller employee's name and a unique employee identification number. The Seller shall, as necessary, provide sub-tier authorized and/or affected employees with a pre-job briefing (approximately one hour). The briefing will cover the scope of work to be performed, the method(s) of energy isolation, and the method(s) for verifying isolation and safe energy conditions.
 5. Upon completion of work, the Seller employees shall remove all personal locks and notify the Company's TPO. The removal of the Company's lock(s) shall not precede the removal of the Seller's lock(s) except in emergency conditions approved by the ORNL Laboratory Shift Superintendent (LSS).
 - a. Unforeseen circumstances may require the Company to temporarily suspend the LO/TO and have the Seller to remove the over-lock. If the temporary suspension occurs during the Seller's off-shift hours, the Company's LSS will contact the Seller for removal of the over-lock. If the Seller cannot be contacted, the LSS will remove the Seller's LO/TO or over-lock device and inform the Seller prior to start of the Seller's next work shift.
 6. Hazardous energy sources introduced by the Seller must be controlled through the use of the Seller's hazardous energy control procedure contained in the Seller's S&H Program. The Seller shall also provide sub-tier authorized and/or affected employees with a pre-job briefing (approximately one hour). The briefing will cover the scope of work to be performed, the method(s) of energy isolation, and the method(s) for verifying isolation and safe energy conditions.
- J. Noise/Hearing protection.
1. When employees are exposed to sound levels exceeding those specified by the ACGIH, "Threshold Limit Values and Biological Exposure Indices," feasible administrative or engineering controls shall be utilized. If such controls fail to reduce sound levels within those specified by the ACGIH, PPE shall be provided and used to reduce the sound levels.

NOTE: The more stringent ACGIH criteria are used instead of the OSHA criteria presented in 29 CFR 1926.52.

- K. Respiratory protection requirements.
1. The Seller personnel are required to follow all OSHA (29 CFR 1926.103) requirements for respirator use.
 2. The Seller personnel will determine which respirator type or class will offer adequate protection based on:
 - a. Respiratory hazard(s) to which the worker may be exposed.
 - b. Workplace and user factors that have the potential to affect respirator performance and reliability.
 - c. His or her informed professional judgment.
 - d. Scientific literature.
 3. Seller shall provide respirators in accordance with the following:
 - a. The Seller employees required to wear negative or positive pressure, tight-fitting respirators shall be medically evaluated per 29 CFR 1926.103. The Seller is responsible for the medical evaluation.
 - b. Ensure respirator wearers have completed the respirator quantitative or qualitative fit testing and respirator training.
 - c. Provide respirators and cartridge type specified to protect worker from exposure to identified or suspected hazards as specified in the Seller prepared HA.
 - d. Provide breathing air, if required. The compressed breathing air quality supplied to the air respiratory protections systems meet the ANSI/Compressed Gas Association G7.1, Commodity Specification for Air, requirements.
 - e. Provide optical corrections for appropriate respirators.
 - f. All respirators shall be certified by the National Institute for Occupational Safety and Health.
 4. Temporary storage of respirators for reuse shall be in accordance with 29 CFR 1926.103(h) (2).
- L. Welding, cutting and hot-work requirements.

1. The Seller shall have a permit system addressing S&H and fire prevention for the following applications when work is conducted in a non designated area; welding and allied processes, grinding, heat treating, thawing pipes with a torch or flame, torch-applied roofing, powder driven fasteners, hot riveting, and similar applications producing a spark or flame. Designated areas are permanent locations designed or approved for hot work operations to be performed regularly. Examples of hot work permits are contained in NFPA 51B.
2. All hot work operations shall be coordinated with the Company to ensure protection of surrounding work areas, and avoid accidental trips of fire protection alarms.
3. Welders and burners shall wear protective clothing which meets requirements of ANSI Z49.1. The selected clothing shall be specified in the Seller's HA for hot-work activities. Protective clothing requirements shall be determined and noted on each hot-work permit issued during this project. Fire watchers who may be exposed to the same hot-work hazards as the welders and burners shall also wear the selected protective clothing.
4. If operations require welding/burning/hot-work where anti-contamination clothing is required, the Seller personnel shall wear flame-resistant clothing for all layers. Flame resistant clothing shall meet the requirements of NFPA 701. Fire watchers who may be exposed to the same hot-work hazards as the welders and burners shall also wear the selected protective clothing.
5. A fire watch must be designated if any of the following conditions exist:
 - a. A significant amount of combustible material is closer than 35' to the point of operations.
 - b. A significant amount of combustible material is more than 35' away, but could be easily ignited by sparks.
 - c. Hot work is conducted in areas where the employee must wear multiple layers of clothing and respiratory protection.
6. The fire watch shall be instructed to:
 - a. Remain present in direct line of sight to the work area and perform no other activities other than fire watch duties.
 - b. Be alert for any condition that could lead to a fire.
 - c. Guard passers-by from welding hazards.
 - d. Interrupt the work when a hazardous condition develops and deal with the situation appropriately.
 - e. Ensure that appropriate fire extinguishing equipment is readily available and know how the equipment is to be used.

- f. Remain on the scene for at least 30 minutes after completion of hot work to detect and report a fire resulting from stored heat.

1.5 ADDITIONAL SAFETY REQUIREMENTS

- A. Explosives (other than powder-actuated tools) are prohibited unless written approval is obtained from the Company.
- B. The Seller shall not obstruct fire protection equipment, including fire extinguishers and sprinkler systems.
- C. Warnings or indications of impending severe weather conditions (heavy rains, strong winds, tornadoes, floods, etc.) shall be monitored and appropriate precautions taken to protect personnel and property from the effects of the severe weather.

1.6 OCCUPATIONAL HEALTH PROTECTION THRESHOLD EXPOSURE LIMITS

- A. Exposure to any chemical or physical agent via inhalation, ingestion, skin absorption, or physical contact in excess of the acceptable limits specified in 29 CFR 1926, Subpart Z and/or the ACGIH “Threshold Limit Values and Biological Exposure Indices” shall be prohibited. In the event of conflicts between ACGIH and OSHA criteria, the more stringent shall prevail.
- B. The Seller shall be responsible for all monitoring to ensure compliance with the exposure criteria. Approved and calibrated testing devices shall be provided for the measurement of hazardous substances, agents, or environments. Individuals performing testing and monitoring shall be trained in testing and monitoring procedures and hazards. Testing devices shall be used, inspected, and maintained in accordance with the manufacturer’s instructions.
- C. Determination of the concentrations of, and hazards from, hazardous substances, agents, and environments shall be made by a qualified industrial hygienist or other competent person during initial start up and as frequently as necessary to ensure the safety and health of the work environment.

1.7 EMERGENCY SERVICES AND EQUIPMENT

- A. The Seller shall make provisions prior to commencement of the project for prompt medical attention in case of serious injury. If professional medical attention is not available within a reasonable time, the Seller is required to have a person trained in first aid at the work site and have the necessary first aid supplies. The OSHA regulations do not set specific response time requirements for the term “reasonable time”. However, OSHA’s interpretation is that in areas where accidents resulting in suffocation, severe bleeding, or other life threatening or permanently disabling injury or illness are likely, a three to four minute response time, from time of injury to time of administering first aid, is required. In other circumstances, i.e., where a life threatening or permanently disabling injury is an unlikely outcome of an accident, a longer response time, such as 15 minutes, is acceptable.

- B. Proper equipment for prompt transportation of the injured person to a physician or hospital, or a communication system for contacting necessary ambulance service shall be provided by the Seller.
- C. If a serious or life-threatening injury occurs, the Company will provide emergency ambulance and fire fighting services. The Seller employees must use the Company facility phone to dial 911 or pull a fire alarm box to notify the Company for emergency response. If using a privately owned cell phone, the Seller must call the LSS at 574-6606.
- D. The ORNL Health Division will attend any serious life-threatening injury to the level of stabilization. After stabilization, the Seller employee should be transported to the emergency facility of their choice.
- E. The Company will provide fire fighting services. The Seller employees must use the Company facility phone to dial 911 or pull a fire alarm box to notify the Company for emergency response. If using a privately owned cell phone, the Seller must call the LSS at 574-6606.

1.8 EMERGENCY PREPAREDNESS AND RESPONSE

- A. Observe and participate in notices to evacuate the work area. The evacuation notices may be a drill or actual event.
- B. The Seller shall appoint a person to ensure that all the Seller employees are aware of an evacuation alert.
- C. Evacuate to the assembly point identified in the HA.
- D. Before evacuating the work areas shut down or make safe equipment or processes that could become a safety or fire hazard if left unattended.

1.9 EQUIPMENT AND MACHINERY

- A. The Seller employees shall be trained in the operation, inspection, and maintenance of the equipment; and the safety features and procedures to be utilized during operation, inspection, and maintenance of the equipment.
- B. Before any machinery or mechanized equipment is placed in use, it shall be inspected and tested by a competent person and certified to be in safe operating condition. Inspections and tests shall be in accordance with manufacturer's recommendations and shall be documented. Records of tests and inspections shall be maintained by the Seller, and shall be made available upon request.
- C. All machinery and equipment shall be inspected daily (when in use) to ensure safe operating conditions. The Seller shall designate competent persons to conduct the daily inspections and tests.

- D. Whenever any machinery or equipment is found to be unsafe, or whenever a deficiency that affects the safe operation of equipment is observed, the equipment shall be immediately taken out of service and its use prohibited until unsafe conditions have been corrected. A tag indicating that the equipment shall not be operated, and that the tag shall not be removed, shall be placed in a conspicuous location on the equipment.
- E. Only designated qualified personnel shall operate machinery and mechanized equipment. Machinery and equipment shall not be operated in a manner that will endanger persons or property nor shall the safe operating speeds or loads be exceeded. Utilize equipment only for the purpose for which it was designed and in accordance with the manufacturer's instruction and recommendations. Modifications, extensions, replacement parts, or repairs of equipment shall maintain at least the same factor of safety as the original equipment. The manufacturer shall authorize modifications in writing.

PART 2 - EXECUTION

2.1 PREPARATION

- A. Before starting on-site work provide the following:
 - 1. Notify the Company in advance of all scheduled on-site activities.
 - 2. Notify the TPO of any of the Seller employees receiving radiopharmaceutical treatment.
 - 3. Notify the Company of employees who are "Declared Pregnant Workers".
 - 4. Brief everyone entering the work-site boundaries on identified hazards, control measures, and proper work practices. Maintain documentation of this briefing by signature on HA Log Sheet.

2.2 PROTECTION OF WORK AREA

- A. Ensure that the work areas and storage areas are conspicuously flagged and barricaded, as needed, prior to initiation of work.
- B. Furnish, post, erect, and install safety devices, equipment, signs, barricades, flagging, and any other item necessary to give adequate warning and caution of hazards, and to provide instructions and directions to workers and the public. Signs identifying the Seller shall be posted for the work area and storage areas.

2.3 WORKING AND STORAGE AREAS

- A. Limit activities and storage to the immediate project site and designated storage areas. Limit travel to the main roads.

- B. Store only work-related material and equipment in stockpile areas, storage trailers, and designated storage sites located on government-controlled land.
- C. Perform cleanup, trash disposal, and neatly arrange material/equipment on a daily basis.

END OF SECTION

SECTION 015000 - TEMPORARY FACILITIES AND SITE CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

- A. This section provides the requirements for temporary utilities, control of project area, borrow areas, and dust control.

1.2 REFERENCES

- A. American National Standards Institute (ANSI) A225.1, 1987, Manufactured Home Installation.
- B. ANSI/NFPA 70-1993, National Electrical Code (NEC).
- C. NFPA 501A, 1992, Manufactured Home Installation, Sites, and Communities.
- D. ANSI D 6.1, "Manual on Uniform Traffic Control Devices for Streets and Highways."

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Barrier Fence: 48" high, orange plastic barrier fence, Vallen Safety Catalog No. FNC-450.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Temporary utilities.
 - 1. Provide temporary lines to use existing plant utilities. Tie-ins and disconnects to existing systems will be performed by the Company. Provide material and equipment, in place and ready for tie-in. Remove temporary utilities after final disconnect.

2. Electric power is available near the work site. The Company will provide utility pole and transformer from nearest available service location. It is the responsibility of the Seller to provide all labor, equipment and material for service from transformer to project site and temporary facilities. Provide Ground Fault Circuit Interrupters (GFCIs) for temporary electrical lines. Perform temporary electrical work in accordance with American National Standards Institute, Inc. (ANSI)/National Fire Protection Association (NFPA) 70 National Electric Code (NEC) requirements.
 3. Water is available at the work site. Install reduced-pressure backflow preventers for all temporary water lines. Sanitization of all water lines shall be performed by the subcontractor and verified by the Company prior to placing into service. If temporary water service is used for potable water, subcontractor shall test/verify water quality at all service points prior to use.
 4. Telephone service is available through Verizon. The Seller is responsible for providing their telephone service.
 5. Provide chemical toilet facilities at the site location. Maintain the toilets in a clean, safe, and sanitary condition for duration of the project.
- B. Protection of the work area.
1. Provide and maintain an orange plastic barrier fence around the perimeter of the work site and storage areas with delineated entrances and exits, appropriate signage identifying the hazards of the work area, and the appropriate PPE required to enter the work area.
 2. Provide additional flagging, signage and barricades inside the job site to delineate storage areas and hazardous work areas.
 3. Post project signs providing the Seller's name, 24-hour telephone number(s), project title and contract number at the project site and for storage areas not located within the work site.
- C. Traffic and pedestrian control.
1. At the kick-off meeting, provide a schedule of plant roads needed to be closed to perform work.
 2. A traffic control plan shall be developed to identify required road closures and potential impediments to emergency vehicle traffic. Submit plan, for approval, at least four calendar days before implementation. The plan shall be approved by the Company before implementation.
 3. Provide and maintain sufficient traffic control signs, barriers, and reflectors when closing lanes.
 4. Provide structurally sound temporary crossing walkways for pedestrian traffic over open excavations.
 5. Provide and maintain pedestrian walkways and building access during the project. The work area shall be flagged with orange plastic barrier fencing or other approved separation methods, with applicable project signs.
- D. Trailer facility.
1. Locate the trailer a minimum of 40' clear of existing buildings. Coordinate location with the Company construction field representative (CFR).

2. Provide a platform, stairs, and handrails at each exterior door. Platforms shall be level with the trailer floor. Platforms and steps shall have a non-skid surface.
 3. Anchor and support the trailer to prevent sliding and overturning according to ANSI A225.1 and NFPA 501A.
 4. Outside the trailer, provide a sign containing the Company's name, and the name and phone number of supervisor. Provide a listing of phone numbers to reach a responsible individual at all times including off-shift and weekend hours.
- E. Borrow materials, if required, are the responsibility of the Seller.
- F. Dust control.
1. Control dust emissions during work. Prevent dust from migrating to areas adjacent to the work site. Limit use of water to prevent erosion. Provide hoods, enclosures, and other methods of containment during sandblasting or similar operations.

END OF SECTION

SECTION 015500 - ENVIRONMENTAL PROTECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Specification Section 010100, General Work Requirements.
- B. Specification Section 011100, Safety and Health.
- C. Specifications Section 017419, Demolition Waste Management and Disposal.

1.2 ATTACHMENTS

- A. Attachment 1, ORNL Environmental Management System Awareness Training for Construction and Service Contractors.
- B. Attachment 2, Construction Site Sedimentation and Erosion Control Measures Form.
- C. Attachment 3, Managing Construction Waste Waters.

1.3 REFERENCES

- A. EPA 40 CFR 260 – 280 and TN Rule 1200-1-11-.01.
- B. EPA, Designation, Reportable Quantities and Notification, 40 CFR 302.
- C. EPA, National Emission Standards, Hazardous Air Pollutants, 40 CFR 61 and TN Rules 1200-2-8-.01, Fugitive Dust, and 1200-3-11-.02, Asbestos.
- D. Solid Waste Processing and Disposal, TN Rule 1200-1-7.
- E. 29 CFR 1926.1101.

1.4 DEFINITIONS

- A. Environmental protection: the prevention/control of pollution and habitat disruption that may occur to the environment during construction. The control of environmental pollution and damage requires consideration of land, water, and air; biological and cultural resources; and includes management of visual aesthetics; noise, solid, chemical, gaseous, and liquid waste; radiant energy and radioactive material as well as other pollutants.
- B. Resource Conservation and Recovery Act (RCRA) hazardous waste: any discarded material that is not excluded by 40 CFR Part 261.4(a) and that is listed in 40 CFR Subpart D or exhibits any of the characteristics identified in 40 CFR 261 Subpart C.

- C. Respiratory hazard wastes: fiberglass with loose fibers, mineral wools, slag wools, rock wools, and other manmade mineral fiber material.
- D. Sanitary waste: waste generated by offices, cafeteria, medical facilities and laboratories, and includes textile products (Personal Protective Equipment (PPE), coveralls, cotton items, carpet, etc.).
- E. Special waste: wastes that are either difficult or dangerous to manage such as friable or non-friable asbestos, empty aerosol or paint containers, petroleum contaminated soil, bulk product Polychlorinated Biphenyl (PCB) waste, PCB remediation wastes, etc.

1.5 TRAINING

- A. All on-site personnel performing work activities with potential to negatively impact the environment shall be provided with environmental awareness training in accordance with requirements of the Oak Ridge National Laboratory (ORNL) Environmental Management System (EMS). The attached electronic file (Attachment 1) represents the minimum level of EMS Awareness Training to be provided to construction and subcontract workers. The training shall be provided by the Seller as part of the initial employee site orientation and Environment, Safety & Health (ES&H) briefing.
- B. The Sellers, their subcontractors and all employees who use hazardous materials and may generate or handle a hazardous waste, must provide evidence of having received RCRA Hazardous Waste Awareness Training and annual refresher training as required by 40 CFR 265.16 and 262.34 prior to starting any work involving these items.

1.6 SUBMITTALS

- A. A project specific SWPPP shall be submitted in triplicate to the Company for approval at the 30% design submittal. The SWPPP shall be prepared by a Tennessee Department of Environment and Conservation (TDEC) Level II trained individual and shall be in compliance with the current Tennessee General National Pollutant Discharge Elimination System (NPDES) Permit for Discharges of Storm Water Associated with Construction Activities, with an effective date of May 24, 2011. Documentation of the SWPPP preparer's TDEC training shall be submitted with the SWPPP. Documents must have the Seller's original signatures in blue ink.
- B. Submit for information only electronic copies of completed Construction Site Inspection Forms each month.
- C. Submit for information only the original signed Storm Water Pollution Prevention Site Inspection Forms at project completion.
- D. Submit for information only the original signed SWPPP, complete with any revisions, addendums, and supplemental information at project completion.

- E. Submit for approval a Treatment and Discharge Plan to address the generation, capture, treatment and disposition of heavily chlorinated or super chlorinated water used to disinfect potable water systems. The Treatment and Discharge Plan shall minimally include but not be limited to specific details such as calculated concentration levels, treatment standards, treatment basin construction, discharge flow rates, and discharge monitoring parameters
- F. Submit for approval a list of non-storm water/waste water streams that are anticipated to be generated and the treatment and disposal methods for each stream. This must be approved prior to the start of work.
- G. Submit documentation of vendor compliance with United States/Tennessee Department of Agriculture (US/TDA) invasive species quarantines before starting work involving the use of agricultural products such as straw, mulch, topsoil, live trees, shrubs, etc.

1.7 REQUIREMENTS TO COMPLY WITH APPLICABLE LAWS AND REGULATIONS

- A. The Seller shall provide written proof of registration, licensing, insurance, or other requirements upon request. It is the Seller's responsibility to ascertain and comply with all applicable federal, state, local and multi-jurisdictional laws, ordinances, and regulations pertaining to the registration, licensing, handling, transportation, packaging, management, processing, resale and disposal of these materials under this contract. These federal, state, and local laws include but are not limited to the Clean Air Act; the Toxic Substances Control Act; the Atomic Energy Act; the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA); the Hazardous Materials Transportation Regulations; the Federal Motor Carrier Safety Regulations; the Tennessee Motor Vehicle Laws Annotated; the Emergency Planning and Community Right-to-Know Act, 40 CFR 279; and TDEC Rule Chapter 1200-1-11-11.

PART 2 - ENVIRONMENTAL PROTECTION

2.1 PERMITS

- A. Conduct all work so as to comply with applicable permits and regulatory requirements. The Company will identify the applicable permits and other regulatory requirements.
- B. Conduct all work in accordance with the Tennessee General Permit No. TNR10-0000, "Storm water Discharges from Construction Activities" (hereafter referred to as the General Permit). A copy of the Notice of Coverage will be provided by the Company.

2.2 GENERAL REQUIREMENTS

- A. Placement of fuel or oil storage tanks on-site is not allowed. Fluids needed for construction equipment shall be provided by off-site delivery trucks, as needed.
- B. The Seller shall minimize environmental pollution and damage that may occur as the result of demolition, renovation and/or any other construction operations.

- C. The Seller shall address environmental issues, potential negative impacts, and appropriate control measures in the Hazards Analysis (per Specification 011100) and discuss these topics during site orientation and pre-job briefings.
- D. Conduct all work that generates waste requiring disposal so as to comply with waste acceptance criteria of the disposal facility, in a manner that avoids negative impacts to operational or compliance status of the disposal facility.
- E. The Seller's personnel shall be cognizant of all aspects of environmental protection applicable to the Seller's work activities, including, but not limited to storm water pollution prevention and control, spill prevention and control, erosion and sediment control, fugitive dust and air emission control, and waste management requirements.
- F. Pollution prevention and waste minimization principles shall be incorporated in abatement and demolition activities to ensure the greatest environmental benefits and minimize future liability for the waste that is generated.
- G. Comply with all requirements of Section 017419, Demolition Waste Management and Disposal, including but not limited to the implementation of work planning and work practices to facilitate, where feasible, the recycle and/or salvage of at least 50% of non-hazardous construction and demolition debris.

2.3 SPILL PREVENTION

- A. Petroleum products stored in quantities greater than or equal to 55 gallons shall be appropriately labeled and have secondary containment capable of preventing any release to a drainage system or the environment. Secondary containment shall be configured so as to capture leaks and spills from both dispensing equipment and/or container(s). Containers 55-gallons or greater that store oil or CERCLA Hazardous Substances (40 CFR 302) must comply with the requirements in the ORNL Spill Prevention Control and Countermeasures (SPCC) plan.
- B. Prior to mobilization to the site, perform an inspection of equipment containing liquid systems including, but not limited to, bulldozers, backhoes, bobcats, drill rigs, trucks, hoists, and cranes, to ensure no leaks exist. Verify hoses, tubing, and hydraulic lines are in good operating condition. Make all necessary repairs before delivery of equipment or vehicles to the construction site.
- C. Perform daily inspections to ensure continued good operating condition of equipment and promptly repair all deficiencies. The Seller shall maintain documentation of inspections and provide to the Company upon request.
- D. Use due caution when operating oil-bearing equipment near aquatic resources. Where necessary, implement appropriate control measures, including but not limited to the use of physical barriers (plastic or tarps, berms, etc.) and/or absorbent materials to prevent leaks or spills from entering waterways.
- E. Use due caution when refueling vehicles or equipment, transferring fuels or other liquids to or from containers; have spill kit on hand for immediate cleanup as necessary. Avoid performing such transfer of fuels near streams or storm water inlets.

2.4 SPILL CONTROL AND CLEAN-UP

- A. When on-site, all personnel shall report spills of any hazardous substance and chemical/radiological releases. The Laboratory Shift Superintendent's (LSS) Office should be called for any spill or other emergency at 574-6606. Specially trained spill response teams clean up all types of spills at ORNL, including oil, hazardous substances, and hazardous waste and are available on shift 24 hours per day, 365 days per year. All spill response personnel have had, at a minimum the initial 24-hour Hazardous Waste Operations (HAZWOPER) Training. The Company will provide initial response; the Seller shall be responsible for all cleanup costs after initial response for activities caused by the Seller.
- B. The person discovering a spill should give the following information to the LSS:
 - 1. Type of spill if known (oil, gasoline, acid, base, etc.).
 - 2. Estimated volume of the spilled material.
 - 3. Location of the spill.
 - 4. Extent of the spill.
 - 5. Observer's location and telephone number.
- C. For outside work, provide a spill kit, inspect equipment for leaks, and repair leaking equipment in a timely manner.
- D. For inside work, provide a spill kit, prevent spills to floor drains and do not discharge waste into any ORNL systems without the Company approval.

2.5 STORM WATER POLLUTION PREVENTION AND CONTROL

- A. Conduct all work activities and maintain site conditions in accordance with the approved SWPPP.
- B. Do not allow liquids, including but not limited to, gasoline, diesel fuel, lubricating oil, or antifreeze to enter the storm sewer systems, waterways, drainage ditches, or the ground.
- C. Be aware of storm drain inlets and utilize appropriate control methods and or devices, and cover or contain debris stored outside.
- D. Tanks, drums, other containers, pumps and other dispensing units, and any secondary containment structures shall be located indoors, or under a canopy, or otherwise sheltered from contact with storm water in an appropriate and effective manner.
- E. Store all materials indoors or otherwise protected from weather.
- F. For outdoor painting operations, minimize overspray, and use tarps/vacuums/enclosures to contain sandblasting waste and paint chips from paint removal operations.
- G. Flushing empty concrete trucks or dumping excess concrete is prohibited. Transport excess concrete back to the batch plant. The truck chute may be washed onsite at a location to be designated and approved by the Company. Solidified cement waste from truck chute cleaning is solid waste and shall be cleaned up, and transported to Oak Ridge Reservation (ORR) landfill.

- H. Prevent contamination of storm water by appropriate and effective control methods, such as daily removal of debris to the extent practicable, covering spoil material and debris piles from demolition or other activities, and otherwise diverting storm water from contact with same. Implement other effective controls to detain and filter or collect and treat waste waters generated by storm water contact with radiological or chemical contaminants. Controls shall be sized to handle the 25 year, 24-hour storm event.
- I. Minimize the use of deicing compounds and other chemical surface treatments; application should be performed at the minimum effective rates.
- J. Maintain a 59' minimum buffer zone from streams, be aware of storm drain inlets, and cover or contain debris stored outside.

2.6 MANAGING WASTE WATER

- A. Manage all waste waters in compliance with Attachment 3, "Managing Construction Waste Waters".
- B. Water used to suppress dust during concrete cutting, demolition, or other activities shall not be discharged directly to storm drains, sanitary sewer, etc. Positive controls shall be used to protect drains from unfiltered discharges of this type. Water generated by demolition activities and decontamination that include Class 1 ACM will require filtration to 10 microns or less for asbestos fibers. This also applies to water from showers provided for asbestos workers.
- C. Unless otherwise directed by the Company, all chlorinated or treated water shall be discharged through a treatment/detention basin and monitored for chlorine levels, other contaminants when applicable, and standard water quality indicators. The treatment/detention basin may consist of a field-constructed structure or portable tank per the Seller's approved water management plan.
- D. The Seller shall establish a hold point for the Company inspection of the Seller-installed water diversion and collection system prior to initiation of demolition activities with the potential for release.
- E. Storm water accumulated in demolition areas, chlorinated rinse water, and chlorinated water used to sterilize/flush pipelines shall not be directly discharged, or otherwise allowed to enter the storm systems, waterways, or drainage ditches without written approval from the Company.
- F. Notify the Company at least one week prior to any activities that will generate waste water. The Seller's water management plan identifying the source and composition of the waste water, and describing the control methods to be used for management and disposal shall be approved prior to generating the water. Notify the Company prior to any discharge of water, waste water or other liquid material at least 24 hours in advance, then again immediately prior to initiating discharge.

2.7 EROSION AND SEDIMENT CONTROL

- A. Appropriate temporary sediment controls will be in place prior to initiation of site clearing activities. Observe site conditions and inspect sediment controls at least twice weekly, and document the inspections using the “Construction Site Sedimentation and Erosion Control Measures Form” (Attachment 2).
- B. Appropriate effort will be made to avoid and/or mitigate damage to trees and shrubs adjacent to work activities. When it is deemed necessary to prune or remove branches from a tree or shrub (or when other damage occurs), the limb shall be cut off clean with chainsaw or other suitable device, and the wound dressed with an appropriate coating to mitigate future damage from insects or fungi.
- C. Manage excavated soil and spoil material in a manner protective of the environment. Cover stockpiled material to prevent erosion and/or install appropriate sediment controls. Use due caution during excavation or any other soil management in the vicinity of sanitary or storm systems, waterways, or drainage ditches.
- D. All erosion prevention measures and sediment controls (silt fence, straw bales, catch basins, etc.) shall be in place and approved by the Company prior to beginning excavations, demolitions, road building, etc. Sediment barriers such as silt fence and straw bales shall be entrenched and of sturdy construction.

2.8 FUGITIVE DUST AND AIR EMISSION CONTROL

- A. Equipment operation, activities, or processes performed by the Seller shall be in accordance with all federal, state, and local air pollution standards.
- B. Asbestos debris shall be kept adequately wet in accordance with 40 CFR 61.
- C. Use water mist, temporary enclosures, and other suitable methods to limit spread of dust and dirt.
- D. Burning will not be allowed on the project.
- E. Manage all equipment containing ozone-depleting substances (e.g. refrigerants) in accordance with the requirements of 40 CFR 82.

PART 3 - WASTE MANAGEMENT

3.1 WASTE MANAGEMENT REQUIREMENTS

- A. The Seller shall comply with all waste management instructions provided by the Company, including but not limited to written specifications, drawing notes, waste management plans, policy or procedures, verbal instructions and waste accumulation area postings.

- B. Substantive requirements for waste management planning and execution, landfill requirements, salvage and recycling goals and methods are provided within Section 017419, "Demolition Waste Management and Disposal".

END OF SECTION

ORNL Environmental Management System
Awareness Training for Construction and Service Subcontractors

I. POLLUTION

Water Pollution:

Release of pollutants directly into surface waters, or indirectly via storm water runoff, fuels, oil, chlorine, & other chemical products, uncured cement, erosion & sedimentation, etc.

Fish kills, impairment of water quality and aquatic habitat

Land pollution:

Windblown litter from job sites and/or moving open bed trucks, improper management of chemical products and hazardous wastes

Air pollution:

Fugitive dust from site grading, sandblasting, demolition, etc.

Many construction activities have potential to pollute the environment:

Refueling operations	Site clearing, grading and excavation
Spills & leaking equipment	Demolition & other dust-producing activities
Material handling & storage	Concrete finishing, cutting, concrete pumper and/or delivery chute flush out
Paint & coatings applications	Water line disinfection and flushing

II. CONSEQUENCES

Fines and penalties, suspension of permits

Cost and schedule impacts, work stoppage, abatement measures, corrective actions

Loss of eligibility to participate in future projects

Potential negative impacts to funding for future projects

ORNL Environmental Management System
Awareness Training for Construction and Service Subcontractors

III. PREVENTION

The ORNL Environmental Management System:

Applies to everyone whose work has the potential to impact the environment

Requires that all workers be made aware of potential environmental consequences associated with their work activities, and use appropriate control measures

Requires notification of construction field representative (CFR) and LSS in response to spills and other environmental incidents or unusual conditions

Environmental Requirements are communicated to Subcontractors:

To managers and supervisors through technical specifications, plans & drawings, electronic postings, correspondence, etc.

To individual workers, during site orientations and Hazards Analysis (HA) review, at ES&H briefings, and whenever assigning specific tasks that could result in a negative environmental impact

Environmental Expectations

Construction and Service Subcontractors are expected to:

Plan, bid, and conduct work in accordance with specifications

Communicate & enforce requirements with employees and with lower tier subcontractors

Workers are expected to:

Understand and comply with environmental requirements,

Report unusual conditions and/or environmental incidents, and

Consult supervision with any environmental concerns, questions, or observations

Construction Site Sedimentation and Erosion Control Measures Inspection Form (2006)

Inspections must be performed at least twice every calendar week and at least 72 hours apart. Where sites have been temporarily stabilized, or runoff is unlikely due to winter conditions (e.g., site covered with snow or ice), such inspection only has to be conducted once per month until thawing results in runoff or construction activity resumes. However, written notification of the intent to conduct only monthly inspections and the justification for such a request must be submitted to TDEC. Repairs to control measures must be completed before the next rainfall, but no later than **7 days** after the need is identified. Also, based upon the results of this inspection, the site description and pollution prevention measures identified in the SWPPP shall be revised no later than **7 days** following this inspection.

PROJECT: _____
 INSPECTED BY: _____ INSPECTION DATE: _____

TITLE OF INSPECTOR: _____
 SCOPE OF INSPECTION: _____

QUESTIONS	YES	NO	N/A	COMMENTS
Are silt fencing and hay bales in good condition (remaining sediment trapping capacity; no signs of undercutting or bypassing; materials in good shape)?				
Do check dams or temporary sediment traps have greater than 50% sediment trapping capacity?				
Are previously planted and mulched areas in good condition (i.e., no replanting or re-mulching is necessary)?				
Are material storage areas that are exposed to precipitation adequately secured to prevent pollutants from entering nearby storm drains or waterways?				
Are streams and wetlands free of significant deposits of construction-derived sediment and debris?				
Are outfalls draining the construction site discharging clean storm water free from sediment, discoloration, or sheens?				
Are wet-weather conveyances free of heavy sediment accumulation and accelerated erosion?				
Are construction site run-on controls (berms, channels, sediment traps, etc.) in good condition and effective?				
Are sediment basins and traps in good condition (adequate remaining capacity, inlets and discharges are free of debris, no erosion of dams or at points of discharge, etc.)?				
Are culverts and storm water inlets free of debris?				
Are areas that have been or will be unfinished for more than 15 days stabilized with vegetative cover, mulch, etc.?				
Are entry and exit points to the site in good condition (significant amounts of sediment are not being tracked off site, dust generation minimal)?				

APPROVAL OF THE ORNL SITE-WIDE CONSTRUCTION STORM WATER POLLUTION
PREVENTION PLAN BY CONSTRUCTION SUBCONTRACTORS

This form must be signed by a responsible corporate officer of the company, as defined in section 6.7.1 of the State of Tennessee NPDES Permit No. TNR100000, Storm Water Discharges Associated with Construction Activity.

By signing this form, the responsible corporate officer commits his/her company, for the project indicated below, to:

- (1) become knowledgeable of the requirements contained within the "Storm Water Pollution Prevention Plan For Selected UT-Battelle Managed Construction Activities at Oak Ridge National Laboratory (March 2006 version) prior to his/her company's initiation of ground disturbing activities on the construction site, AND
- (2) implement the requirements of this storm water pollution prevention plan on all parts of the construction site which are under his/her company's control.

Construction Project: _____

Name of Company: _____

"I certify under penalty of law that I have reviewed this document, any attachments, and the SWPPP referenced above. Based on my inquiry of the construction site owner/developer identified above and/or my inquiry of the person directly responsible for assembling this NOI and SWPPP, I believe the information submitted is accurate. I am aware that this NOI, if approved, makes the above-described construction activity subject to NPDES permit number TNR100000, and that certain of my activities on-site are thereby regulated. I am aware that there are significant penalties, including the possibility of fine and imprisonment for knowing violations, and for failure to comply with these permit requirements."

Name and Title of Responsible Corporate Officer (Print or Type)

Signature of Responsible Corporate Officer

Date: _____

For the purposes of these guidelines, when a construction process utilizes water from any source, water that is not used up in the process (or lost by evaporation) should be considered to be waste water.

Typical construction waste waters include those listed below, although particular circumstances and/or site specific conditions may alter the nature of these waste waters, or result in the generation of non-typical waste waters not addressed under these guidelines. When project planners determine that non-typical wastewaters may be generated or discover that they have been, consultation with an Environmental Compliance Representative should take place as soon as practicable.

Mechanical construction activities:

Pipeline draining, flushing, disinfection, hydrostatic testing

Civil construction activities:

Removing accumulated storm water from trenches & other excavations or structures

Flushing concrete truck chute and/or cleaning associated tools and equipment

Water from high pressure washing and/or hosing down surfaces

Demolition activities:

Asbestos worker shower facilities & tool decontamination

Concrete cutting systems (blade coolant/dust suppression water)

General dust suppression water

Work Activity	Waste water description - potential contaminants	Method(s) of disposal	Applicable procedure or permit(s)
Mechanical Construction			
Draining non-waste water piping systems	Rust preventative, algaecide, Chlorine (2 ppm or less), other chemical products, and:	Accumulate, characterize, and dispose of as liquid hazardous waste when appropriate	SBMS, EM Subject Area: Hazardous and Mixed Waste Management
		Sewage Treatment Plant (STP) or Process Waste Treatment Complex (PWTC)	Variance required SBMS, EM Subject Area: Wastewater, Managing
	(waters exhibiting high temperature shall not be allowed to enter storm drains or surface water)	or discharge to upland area in a manner that prevents erosion (when deemed acceptable)	General Permit for Storm Water Discharges from Construction Activities (TNR10-0000), Project Storm Water Pollution Prevention Plan
	(waters exhibiting high temperature shall not be allowed to enter storm drains or surface water)	or, if chlorine is known to be the only contaminant, discharge to storm drain system	Field verification of successful de-chlorination is required, ORNL Site Wide NPDES Permit (TN0002941)

Notes: Rust preventative & algaecide are considered non-hazardous at typical concentrations utilized in cooling water and other closed loop systems. Negative impacts to aquatic resources are possible, however, and care shall be taken to prevent release to surface waters. Chlorine is typically absent from existing systems other than potable or process water (i.e. chilled water, etc)

Work Activity	Waste water description - potential contaminants	Method(s) of disposal	Applicable procedure or permit(s)
Mechanical Construction			
Flush non-waste water piping systems	Chlorine (2 ppm or less), nominal sediment, scale, etc.	STP or PWTC	Variance required SBMS, EM Subject Area: Wastewater, Managing
		Or discharge to upland areas in a manner that prevents erosion – chemical treatment of discharge to remove chlorine – filtration as necessary to remove sediment/scale	General Permit for Storm Water Discharges from Construction Activities (TNR10-0000), Project Storm Water Pollution Prevention Plan
		or, if chlorine is known to be the only contaminant, discharge to storm drain system	Field verification of successful de-chlorination is required, ORNL Site Wide NPDES Permit (TN0002941)

Notes:

Work Activity	Waste water description - potential contaminants	Method(s) of disposal	Applicable procedure or permit(s)
Mechanical Construction			
Hydrostatic testing	Chlorine (2 ppm or less)	STP or PWTC	Variance required SBMS, EM Subject Area: Wastewater, Managing
		or discharge to upland areas in a manner that prevents erosion – chemical treatment of discharge to remove chlorine	
		or, if chlorine is known to be the only contaminant, discharge to storm drain system	Field verification of successful de-chlorination is required, ORNL Site Wide NPDES Permit (TN0002941)

Notes:

Work Activity	Waste water description - potential contaminants	Method(s) of disposal	Applicable procedure or permit(s)
Mechanical Construction			
Disinfect piping systems	Chlorine (50 – 200+ ppm)	Discharge to STP, PWTC (Collection and pre-treatment may be required)	Variance required SBMS, EM Subject Area: Wastewater, Managing
		or to treatment basin via suitable and effective de-chlorination system – monitor discharge and basin overflow for chlorine, pH, temperature, turbidity, etc. and halt or modify operations as needed	Field verification of successful de-chlorination is required, ORNL Site Wide NPDES Permit (TN0002941)

Notes: Heavily chlorinated water is extremely toxic to aquatic systems; exceptional care shall be taken to prevent release of untreated or insufficiently treated water to the environment. Overflow from treatment basin shall be released onto a suitable upland area (or storm drain system, if necessary) only after verification of acceptable de-chlorination and other water quality parameters

Work Activity	Waste water description - potential contaminants	Method(s) of disposal	Applicable procedure or permit(s)
Civil Construction			
De-watering excavations	Sediment, suspended solids, chemical or radiological contaminants (previously existing or due to construction activities)	Filtration, discharge to STP or PWTC	Variance required SBMS, EM Subject Areas: Wastewater, Managing; Hazardous & Mixed Waste Management; Managing PCB Waste
		Or, Filtration and discharge to vegetated upland areas taking care to ensure that pump intake does not agitate water within the excavation, discharging to upland areas through filtration and in a manner that prevents erosion	By approval of Construction Field Representative and/or Environmental Protection General Permit for Storm Water Discharges from Construction Activities (TNR10-0000), Project Storm Water Pollution Prevention Plan

Notes: Excavations associated with construction or maintenance of potable water lines or other liquid-carrying pipelines may present with chlorine or other potential contaminants which must be addressed on a case by case basis. The presence of regulated contaminants in excavation water or adjacent soils requires investigation by EP Staff prior to disposition.

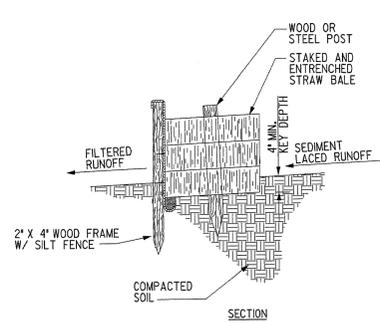
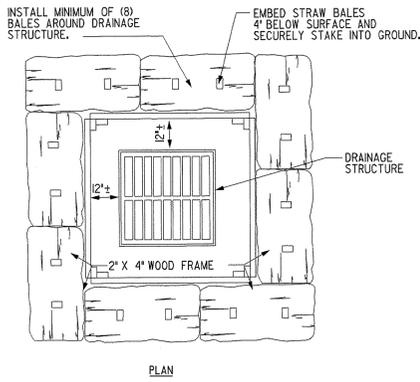
Work Activity	Waste water description - potential contaminants	Method(s) of disposal	Applicable procedure or permit(s)
Civil Construction			
Flushing concrete truck chute/cleaning tools	Moderate alkalinity, Chlorine (2 ppm or less), suspended solids	Discharge to STP, PWTC,	Variance required SBMS, EM Subject Area: Wastewater, Managing.
		or upland areas, followed up by removal of cured concrete residues cement-contaminated water shall not be released into storm drains or surface water, or runoff otherwise allowed beyond the construction site boundaries	By approval of Construction Field Representative and/or Environmental Protection
Pressure washing surfaces	Chlorine (2 ppm or less), suspended solids	Discharge to STP	Variance required SBMS, EM Subject Area: Wastewater, Managing.
		or upland areas, collect/filter prior to entering aquatic features	(TNR10-0000), Project SWPPP
<p>Notes: No detergent or other cleaning agent allowed where runoff may reach aquatic features! Chlorine typically absent from tank-stored water and/or lost during use due to agitation, exposure to sunlight and wind. Prevent contamination of storm water runoff or other surface water sources due to contact with uncured cement and/or other suspended solids</p>			

Work Activity	Waste water description - potential contaminants	Method(s) of disposal	Applicable procedure or permit(s)
Demolition			
Asbestos worker showers & tool decontamination	Asbestos, Chlorine (2 ppm or less)	HEPA filtered (10 micron or better) & discharged to STP.	Variance required SBMS, EM Subject Area: Wastewater, Managing.

Notes: Discharge permitted under NESHAP when HEPA filtered and disposed of to Sewage Treatment Plant

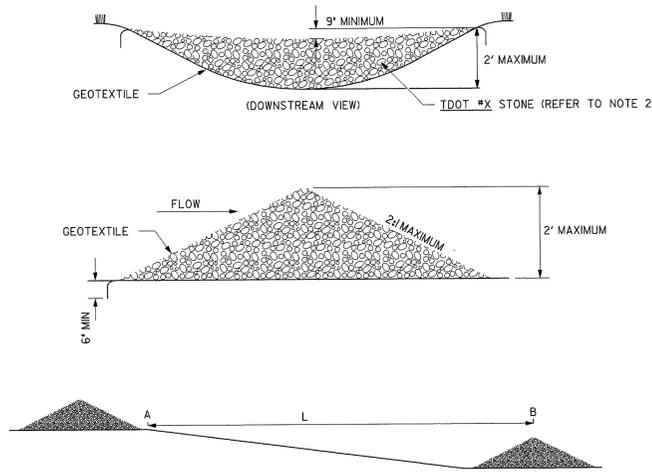
Concrete cutting blade coolant/dust suppression	Moderate alkalinity, Chlorine (2 ppm or less), suspended solids	Discharge to STP or PWTC	Variance required SBMS, EM Subject Area: Wastewater, Managing.
		or to upland areas, collect/filter prior to entering aquatic features	(TNR10-0000), Project SWPPP
General dust suppression	Chlorine (2 ppm or less)	Discharge to upland areas, collect/filter prior to entering aquatic features	

Notes: Chlorine typically lost during water use due to agitation, exposure to sunlight and wind, depending upon volumes and flow rates. Monitor runoff and treat discharge as necessary to remove chlorine and/or suspended solids. Prevent runoff to storm drains or surface water if pH is determined to be above 8.5



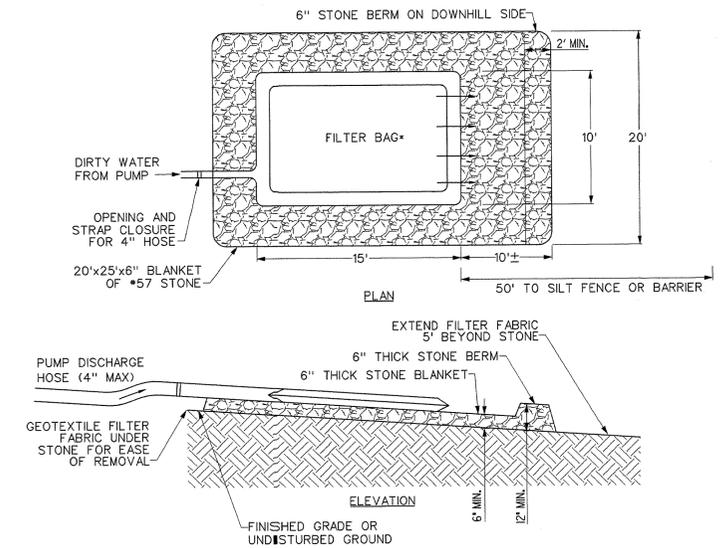
- NOTES:**
1. MINIMUM 2" (NOMINAL X 2" NOMINAL) - (1.5" ACTUAL X 1.5" ACTUAL) (2-25 SO, N) HARDWOOD POST (OAK OR HICKORY) - LENGTH 48" OR MINIMUM 1.33 LB./FT. STEEL POST (STD. OR U) SECTION.
 2. WHEN STEEL POSTS ARE USED THEY SHALL HAVE A PROTRUSION FOR FASTENING WIRE TO THEM. THE WIRE FASTENERS SHOULD BE EVENLY SPACED WITH AT LEAST FIVE PER POST.
 3. BINDING WIRE OR TWINE SHALL REMAIN ON STRAW BALES.
 4. DO NOT REMOVE SEDIMENT FILTER UNTIL SURROUNDING AREA HAS BEEN STABILIZED BY SEEDING AND MULCHING OR PAVING.

STRAW BALE / SILT FENCE FILTER
N.T.S.



- NOTES:**
1. L=THE DISTANCE SUCH THAT POINTS A AND B ARE OF EQUAL ELEVATION.
 2. USE TDOT #1 OR #2, WITH MINIMUM STONE SIZE OF 1.5 INCHES, FOR DRAINAGE AREAS UP TO 1 ACRE. USE TDOT CLASS A-1, WITH STONE SIZES FROM 2-15 INCHES, FOR DRAINAGE AREAS UP TO 5 ACRES. AN UPSTREAM LAYER OF FINE STONE SHALL BE USED ON THE CHECK DAMS FOR 1 TO 5 ACRE DRAINAGE AREAS. ALL STONE SHALL NOT CONTAIN FINES.

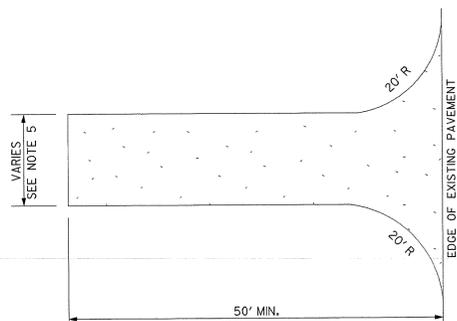
CHECK DAM DETAIL
N.T.S.



- NOTES:**
1. FILTER BAG SHALL BE MADE OF NON-WOVEN GEOTEXTILE WITH A MINIMUM SURFACE AREA OF 225 SQUARE FEET PER SIDE.
 2. ALL STRUCTURAL SEAMS SHALL BE SEWN WITH A DOUBLE STITCH USING A DOUBLE NEEDLE MACHINE WITH HIGH STRENGTH THREAD. SEAM STRENGTH SHALL WITHSTAND 100LB/M USING ASTM D-4884 TEST METHOD.
 3. FILTER BAG SHALL HAVE A NOZZLE LARGE ENOUGH TO ACCOMMODATE A 4" DIAMETER PUMP DISCHARGE HOSE. NOZZLE SHALL BE SEALED TIGHTLY AROUND THE PUMP DISCHARGE HOSE WITH A STRAP OR SIMILAR DEVICE TO PREVENT UNFILTERED WATER FROM ESCAPING.
 5. FILTER BAG SHALL BE PLACED ON A LEVEL OR GENTLY SLOPING (5% MAXIMUM) WELL VEGETATED AREA AS FAR AWAY AS POSSIBLE FROM STREAMS, WETLANDS, OTHER AQUATIC RESOURCES AND POINTS OF CONCENTRATED FLOW.
 6. FILTER BAG SHALL BE PLACED UPON A BASE OF CLEAN #57 STONE TO PROMOTE DEWATERING. STONE BASE SHALL BE 6" THICK AND SHALL BE SEPARATED FROM EXISTING SOIL WITH FILTER FABRIC. A 6" STONE BERM SHALL BE CONSTRUCTED ON THE DOWNHILL SIDE OF THE STONE BED TO CONTAIN SEDIMENT SHOULD THE FILTER BAG BURST.
 7. PUMPING RATE SHALL BE CONTROLLED TO PREVENT EXCESSIVE PRESSURE WITHIN THE FILTER BAG. AS THE BAG BECOMES FILLED WITH SEDIMENT THE PUMPING RATE SHALL BE REDUCED.
 8. FILTER BAG SHALL BE REMOVED AND DISPOSED OF AFTER IT IS FILLED WITH SEDIMENT AND HAS DEWATERED. THE DEWATERED SEDIMENT FROM THE BAG SHALL BE SPREAD IN AN UPLAND AREA AND STABILIZED WITHIN 24 HOURS.
 9. THE GEOTEXTILE FABRIC SHALL MEET THE FOLLOWING MINIMUM REQUIREMENTS WITH PROPERTIES DETERMINED IN ACCORDANCE WITH THE FOLLOWING PROCEDURES:

WEIGHT	100Z/YD	ASTM D-3776
GRAB TENSILE	20 LBS	ASTM D-3776
PUNCTURE	150 LBS	ASTM D-3776
FLOW RATE	70 GAL/MIN/FT2	ASTM D-3776
PERMITIVITY (SEC-1)	1.3	ASTM D-3776
UV RESISTANCE	70%	ASTM D-3776
APPARENT OPENING SIZE (AOS)	40-80	ASTM D-3776

PUMPED WATER FILTER BAG
N.T.S.



- NOTES:**
1. THE PURPOSE OF THE STABILIZED CONSTRUCTION ENTRANCE IS TO AID THE SELLER IN ELIMINATING TRACKING OF MUD ONTO PUBLIC STREETS. THE DETAIL DOES NOT LIMIT THIS RESPONSIBILITY. OTHER METHODS OF SEDIMENT REMOVAL SHALL BE IMPLEMENTED IF THIS DOES NOT ADEQUATELY REMOVE THE MUD.
 2. CONSTRUCT THE PAD WITH A 1-FT. (MIN.) THICKNESS OF TDOT #1 OR #2 STONE, WASHED AND WELL GRADED.
 3. ADD CRUSHED STONE TO THE PAD AS NECESSARY TO MAINTAIN THE PROPER FUNCTIONING OF THE PAD.
 4. LOCATION TO BE COORDINATED WITH THE COMPANY.
 5. WIDTH SHALL BE 20-FT. FOR ONE WAY TRAFFIC AND 30-FT. FOR TWO-WAY.
 6. GEOTEXTILE FABRIC SHALL BE PLACED BENEATH THE STONE THE FULL LENGTH AND WIDTH OF THE ENTRANCE.
 7. REGULAR REMOVAL OF MATERIALS TRACKED ONTO THE STREET IS REQUIRED.

CONSTRUCTION ENTRANCE
N.T.S.

GENERAL NOTES

1. EACH EROSION AND SEDIMENT CONTROL (E&SC) SHALL BE INSTALLED PRIOR TO INITIATION OF THE ACTIVITIES THE CONTROL IS DESIGNED TO PROTECT. E&SCS MAY BE INSTALLED INCREMENTALLY, DEPENDING ON AREAS OF DISTURBANCE, UPON APPROVAL BY THE COMPANY. E&SCS MAY ALSO INCLUDE CONTROL OF STORM WATER RUN-OFF FROM ADJACENT PROPERTIES.
2. E&SCS SHALL BE STRICTLY ENFORCED. ALL E&SCS ARE SUBJECT TO FIELD MODIFICATION AS DIRECTED BY THE COMPANY.
3. REFER TO SECTION 3122 70-EROSION CONTROL FOR ADDITIONAL REQUIREMENTS.
4. E&SCS SHALL BE INSTALLED AND MAINTAINED UNDER THE SUPERVISION OF TENNESSEE DEPARTMENT OF ENVIRONMENT AND CONSERVATION (TDEC) LEVEL I EROSION PREVENTION AND SEDIMENT CONTROL CERTIFIED PERSONNEL. ALL INSPECTIONS OF E&SCS SHALL BE COMPLETED BY TDEC LEVEL I EROSION PREVENTION AND SEDIMENT CONTROL CERTIFIED PERSONNEL.
5. E&SCS SHALL BE INSPECTED AFTER EVERY RAIN EVENT. INSPECTION FORMS SHALL BE COMPLETED AS PER SECTION 0155 00-ENVIRONMENTAL PROTECTION. E&SCS THAT ARE NOTED TO BE DAMAGED OR INEFFECTIVE SHALL BE REPAIRED OR MODIFIED WITHIN 7 CALENDAR DAYS OR PRIOR TO THE NEXT RAIN EVENT, WHICHEVER OCCURS FIRST.
6. E&SCS SHALL BE MAINTAINED IN ACCORDANCE WITH TDEC'S EROSION AND SEDIMENT CONTROL HANDBOOK.
7. REFER TO SECTION 0155 00-ENVIRONMENTAL PROTECTION FOR ADDITIONAL E&SC REQUIREMENTS.
8. E&SCS SHALL BE MAINTAINED UNTIL FINAL STABILIZATION, AS APPROVED BY THE COMPANY, IS COMPLETE. SELLER IS RESPONSIBLE FOR REMOVAL OF E&SCS, WITHOUT DAMAGING FINAL STABILIZATION, AND PROPER DISPOSAL OF E&SCS OFF-SITE. SEDIMENT COLLECTED IN E&SCS SHALL EITHER BE REMOVED AND PROPERLY DISPOSED OFF-SITE OR STABILIZED TO PREVENT EROSION, WITH STABILIZATION APPROVED BY THE COMPANY.
9. SEDIMENT SHALL BE PREVENTED FROM DISCHARGING FROM THE PROJECT SITE.
10. WORK AND DISTURBANCE WITHIN RIPARIAN ZONES SHALL BE MINIMIZED.
11. EXISTING VEGETATION SHALL BE PROTECTED AS MUCH AS FEASIBLE.
12. FOLLOWING INITIAL SOIL DISTURBANCE, IF WORK ON A PORTION OF THE PROJECT SITE PERMANENTLY OR TEMPORARILY CEASES, TEMPORARY OR PERMANENT STABILIZATION SHALL BE COMPLETED WITHIN:
 - A. SEVEN (7) CALENDAR DAYS FOR ALL PERIMETER CONTROLS, DIKES, SWALES, DITCHES, PERIMETER SLOPES, AND ALL SLOPES GREATER THAN 3 HORIZONTAL TO 1 VERTICAL (3H) AND.
 - B. FIFTEEN (15) CALENDAR DAYS FOR ALL OTHER DISTURBED OR GRADED AREAS.
13. THIS DOES NOT APPLY TO THOSE AREAS WHICH ARE CURRENTLY BEING USED FOR STORAGE, STOCKPILES, OR WHERE ACTIVE CONSTRUCTION ACTIVITIES ARE OCCURRING. MAINTENANCE SHALL BE PERFORMED TO ENSURE THAT STABILIZED AREAS CONTINUOUSLY MEET COMPANY'S APPROVAL.
14. COVER SEEDED SLOPES WHERE GRADE IS 3 HORIZONTAL TO 1 VERTICAL (3H) OR GREATER OR OTHER AREAS AT LOCATIONS SHOWN ON PLANS WITH EXCELISIOR MATTING.
15. SELLER SHALL INSTALL APPROPRIATE SEDIMENTATION CONTROL (E.G. SILT FENCE) ON DOWNHILL/DOWNGRADIENT SIDE OF ANY STOCKPILE OR DISTURBED AREA THAT SHALL REMAIN FOR MORE THAN ONE DAY. SILT FENCE MAY NOT BE REQUIRED FOR TRENCH EXCAVATION AND BACKFILL THAT IS COMPLETED ON THE SAME DAY. EXCAVATION EQUIPMENT AND STOCKPILES SHALL BE ON THE UPHILL SIDE OF THE EXCAVATION UNLESS AN ALTERNATIVE ARRANGEMENT IS APPROVED BY THE COMPANY.
16. SEEDING AND MULCHING (BOTH TEMPORARY AND PERMANENT) SHALL COMPLY WITH REQUIREMENTS IN SECTION 32 92 19-SEEDING AND SECTION 3122 70-EROSION CONTROL.
17. ROADWAYS SHALL BE KEPT CLEAR OF ACCUMULATED SEDIMENT. BULK CLEARING OF ACCUMULATED SEDIMENT SHALL NOT INCLUDE FLUSHING THE AREA WITH WATER. SEDIMENT SHALL BE RETURNED TO THE LIKELY POINT OF ORIGIN OR OTHER AREA APPROVED BY THE COMPANY.
18. THE SELLER SHALL CONTROL WASTES, GARBAGE, DEBRIS, WASTEWATER, AND OTHER SUBSTANCES ON THE SITE IN SUCH A WAY THAT THEY SHALL NOT BE TRANSPORTED FROM THE SITE BY STORM WATER RUNOFF.
19. E&SCS MAY BE TEMPORARILY REMOVED IF NECESSARY TO ACCOMPLISH WORK ACTIVITIES, BUT MUST BE REINSTALLED BEFORE ANY RAIN EVENT AND BEFORE THE END OF THE WORK SHIFT.
20. ROUTINE INSPECTIONS OF E&SCS SHALL INCLUDE OBSERVATIONS OF LOCATIONS WHERE STORM WATER RUNOFF IS DISCHARGED TO A RECEIVING STREAM TO ENSURE THAT E&SCS ARE EFFECTIVELY PREVENTING DISCHARGE OF SEDIMENT TO THE RECEIVING STREAM. DURING DEWATERING ACTIVITIES, LOCATIONS WHERE WATER IS DISCHARGED FROM THOSE ACTIVITIES (BOTH STORM DRAINS AND RECEIVING STREAMS) SHALL BE INSPECTED TO VERIFY THAT SEDIMENT IS BEING ADEQUATELY CONTROLLED. IF SEDIMENTATION CONTROLS ASSOCIATED WITH DEWATERING ACTIVITIES ARE FOUND TO BE INEFFECTIVE, THE DEWATERING ACTIVITY SHALL BE HALTED AND EFFECTIVE CONTROLS SHALL BE IMPLEMENTED BEFORE THE ACTIVITY IS RESUMED.

NO REPRESENTATION OR WARRANTY, EXPRESSED OR IMPLIED, IS MADE AS TO THE ACCURACY, COMPLETENESS OR USEFULNESS OF THE INFORMATION OR STATEMENTS CONTAINED IN THESE DRAWINGS, OR THAT THE USE OR DISCLOSURE OF ANY INFORMATION, APPARATUS, METHOD, OR PROCESS DISCLOSED IN THESE DRAWINGS MAY NOT INFRINGE PRIVATE RIGHTS OF OTHERS. NO LIABILITY IS ASSUMED WITH RESPECT TO THE USE OF, OR FOR DAMAGES RESULTING FROM THE USE OF ANY INFORMATION, APPARATUS, METHOD, OR PROCESS DISCLOSED IN THESE DRAWINGS. DRAWINGS MADE AVAILABLE FOR INFORMATION TO BIDDER ARE NOT TO BE USED FOR OTHER PURPOSES AND ARE TO BE RETURNED UPON REQUEST OF THE FORWARDING CONTRACTOR.

SECTION AND DETAIL KEY

NUMBER OF SECTION OR DETAIL	DRAWING ON WHICH SECTION OR DETAIL IS SHOWN
1	SECTION AND DETAIL KEY

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CHANGE CONTROL SYSTEM 4

ENGINEERING PROCEDURE FDD-DM-330

REV	DATE	DESCRIPTION	DSN	DATE	CHK	DATE	RPE	RPE NO	DATE	PE	DATE	PM	DATE	RED	DATE	CFM	DATE	ST	CV	EC	EE	EM	IE	M	PD	SE	AR	FPE
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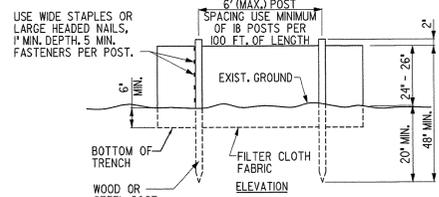
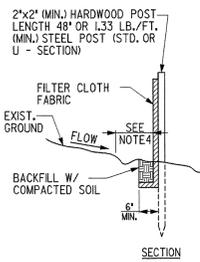
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UT-BATTELLE Oak Ridge National Laboratory
managed for the DEPARTMENT OF ENERGY under U.S. GOVERNMENT CONTRACT DE-AC05-84OR21400

ENGINEERING STANDARDS
EROSION AND SEDIMENT CONTROL

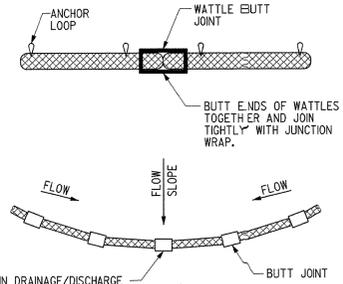
SITE ORNL BLDG XAREA-02 FL X SH. 1 OF 2 UNCLASSIFIED

31 22 70.1



- NOTES:**
- SILT FENCE SHALL BE PRE-ASSEMBLED AND INSTALLED IN ACCORDANCE WITH THE MANUFACTURERS SPECIFICATIONS.
 - SILT FENCE SHALL HAVE AN APPROVED BACKING OR A BUILT-IN REINFORCED STRUCTURE AS RECOMMENDED BY THE MANUFACTURER TO SUPPORT THE GEOTEXTILE FABRIC.
 - REMOVE SILT FENCE ONCE PERMANENT VEGETATION IS ESTABLISHED. LEGALLY DISPOSE OF REMOVED FENCE OFF-SITE.
 - PLACE SILT FENCE AT LEAST 5 TO 7 FEET AWAY FROM STEEP OR LONG SLOPES TO IMPOUND STORMWATER RUNOFF.
 - TURN LAST 7 TO 10 FEET OF SILT FENCE UPHILL.
 - STRAW BALES TO BE PLACED END TO END UP AGAINST THE DOWNHILL SIDE OF THE SILT FENCE IN ALL LOW AREAS.
 - WHERE A JOINT IS REQUIRED, THE SILT FENCE SHALL BE OVERLAPPED BY AT LEAST TWO SECTIONS (2 FT. IF SPACING BETWEEN STAKES IS 6 FT.). JOINTS SHOULD NEVER BE USED AT LOW SPOTS ON CONTOURS.

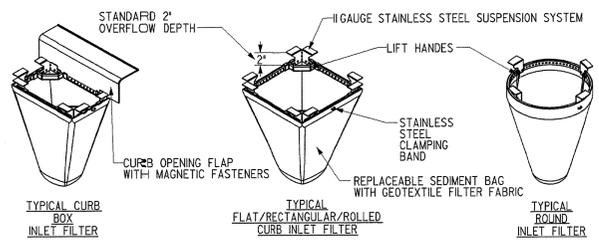
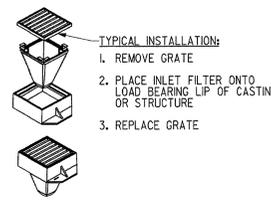
SILT FENCE
N.T.S.



MAIN DRAINAGE/DISCHARGE PATH FROM WATERSHED. INSTALL FLOCMAT CRADLE UNDER WATTLES AT THESE LOCATIONS.

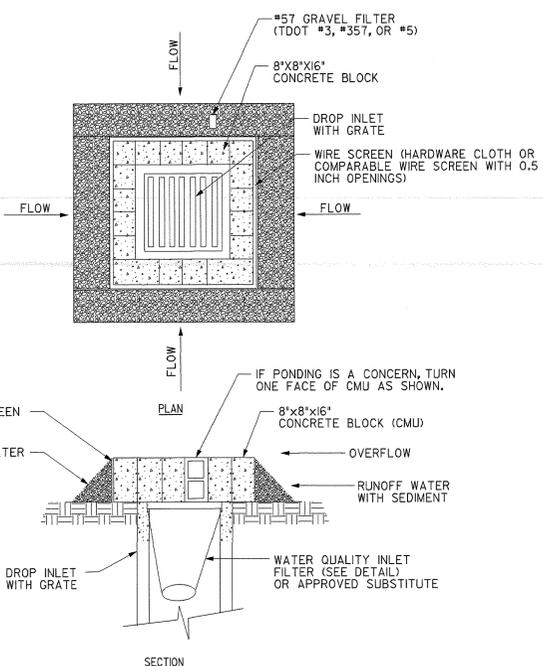
- NOTES:**
- INSTALL EROSION WATTLES PARALLEL TO SLOPE.
 - EROSION CONTROL WATTLES SHALL BE EROSION EELS (TM) OR EQUAL (AS APPROVED BY COMPANY).

EROSION CONTROL WATTLE
N.T.S.



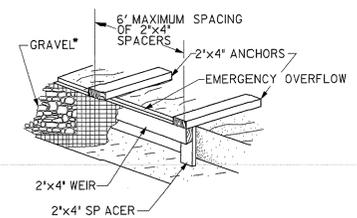
- NOTES:**
- THE INLET SEDIMENT CONTROL DEVICE SHALL BE FLEXSTORM OR EQUAL.
 - FOR EMPORARY SEDIMENT CONTROL (DURING CONSTRUCTION) THE FILTER BAG SHALL BE FX (STANDARD WOVEN BAG) WITH STANDARD DEPTH. FOR PERMANENT WATER QUALITY CONTROL (POST-CONSTRUCTION) THE FILTER BAG FOR THE INLET STRUCTURE SHALL BE PCP (POST CONSTRUCTION BAG W/ MYCELO) WITH STANDARD DEPTH. PERMANENT FILTER BAGS SHALL BE CAPABLE OF TREATING AT LEAST XXXXX CFS. REFER TO FLEXSTORM SPECIFICATIONS FOR MATERIAL PROPERTIES.
 - TO ENSURE PROPER FIT, CONTRACTOR SHALL FIELD VERIFY SIZES OF ALL EXISTING FRAMES AND GRATES. SPECIFIC BAG AND FRAME SIZE SHALL BE CONFIRMED BY THE COMPANY AFTER EXISTING GRATE SIZES HAVE BEEN DETERMINED IN THE FIELD BY THE CONTRACTOR, COMPANY'S AND MANUFACTURERS CONFIRMATION MUST BE RECEIVED BY THE CONTRACTOR PRIOR TO ORDERING AND INSTALLING DEVICES. ANY REVISIONS TO THESE PRODUCTS SHALL BE SUBMITTED TO THE COMPANY FOR APPROVAL PRIOR TO INSTALLATION.
 - AFTER SITE IS STABILIZED REMOVE TEMPORARY INLET PROTECTION AND DEBRIS FROM DRAINAGE STRUCTURES AND PIPES. INSTALL PERMANENT INLET PROTECTION FOR ALL CATCH BASINS WITHIN PROJECT. TYP.

WATER QUALITY INLET FILTER
N.T.S.

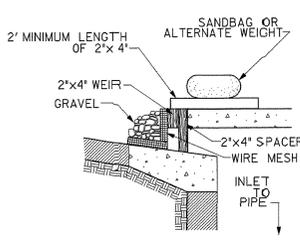


- NOTES:**
- ROCK FILTER INLET PROTECTION TO BE REMOVED AFTER CONSTRUCTION IS COMPLETE AND ALL AREAS OF THE SITE ARE STABILIZED, AS APPROVED BY THE COMPANY.
 - GEOTEXTILE FABRIC TO BE USED BENEATH GRAVEL.

ROCK FILTER INLET PROTECTION
N.T.S.



PERSPECTIVE VIEW

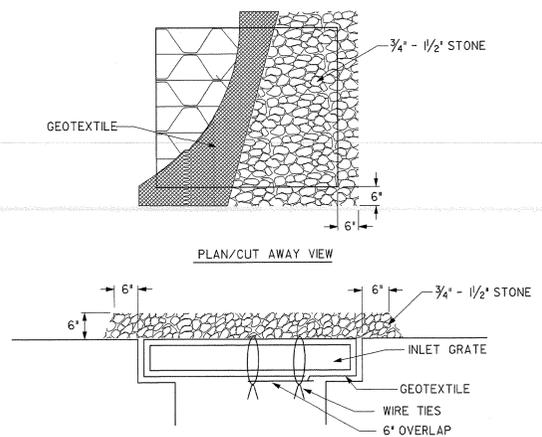


SIDE ELEVATION

SPECIFIC APPLICATION

THIS METHOD OF INLET PROTECTION IS APPLICABLE TO CURB INLETS WHERE A STURDY, COMPACT INSTALLATION IS DESIRED. EMERGENCY OVERFLOW CAPABILITIES ARE MINIMAL, SO EXPECT SIGNIFICANT PONDING WITH THIS MEASURE. WATER QUALITY INLET FILTER (SEE DETAIL) OR APPROVED SUBSTITUTE SHALL BE INSTALLED.

CURB INLET PROTECTION (CIP)
WITH 2"x4" WOODEN WEIR
N.T.S.



- NOTES:**
- SYNTHETIC FILTER FABRIC SHALL BE A PERVIOUS SHEET OF PROPYLENE, NYLON, POLYESTER OR ETHYLENE YARN.
 - SYNTHETIC FILTER FABRIC SHALL CONTAIN ULTRAVIOLET RAY INHIBITORS AND STABILIZERS TO PROVIDE A MINIMUM OF SIX MONTHS OF EXPECTED USABLE CONSTRUCTION LIFE AT A TEMPERATURE RANGE OF 0° F TO 120° F.
 - LIFT GRATE AND WRAP WITH FILTER FABRIC TO COMPLETELY COVER ALL OPENINGS, THEN SET GRATE BACK IN PLACE.
 - PLACE 3/4" TO 1/2" STONE, 4"-6" THICK ON THE GRATE TO SECURE FABRIC AND PROVIDE ADDITIONAL FILTRATION.

AT GRADE INLET PROTECTION (AGIP)
N.T.S.

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SECTION AND DETAIL KEY

NUMBER OF SECTION OR DETAIL: 4

DRAWING ON WHICH SECTION OR DETAIL IS SHOWN: SECTION

DRAWING ON WHICH SECTION OR DETAIL IS TAKEN: DETAIL

THIS DOCUMENT CONTROLLED BY

CHANGE CONTROL SYSTEM: 4

ENGINEERING PROCEDURE: FDD-DM-330

REV	DATE	DESCRIPTION	DSN	DATE	CHK	DATE	RPE	DATE	PE	DATE	PM	DATE	REG	DATE	CFM	DATE	ST	CV	EC	EE	EM	IE	M	PD	SE	AR	FPE	
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ORIGINAL ISSUE																												

UT-BATTELLE

Oak Ridge National Laboratory
managed for the DEPARTMENT OF ENERGY under
U.S. GOVERNMENT contract DE-AC05-84OR21400
UT-BATTELLE, LLC • Oak Ridge, Tennessee

PROJECT NAME:
ENGINEERING STANDARDS
EROSION AND SEDIMENT CONTROL

SITE	BLDG	FL	SH.	OF	UNCLASSIFIED
ORNL	XAREA-00	X	2	2	

DRAWING NUMBER: 31 22 70.1

REV: 0

SECTION 017419 – DEMOLITION WASTE MANAGEMENT AND DISPOSAL

PART 1 - GENERAL

1.1 RELATED SECTIONS

- A. Specification Section 010100, General Work Requirements.
- B. Specification Section 011100, Safety and Health.
- C. Specification Section 015500, Environmental Protection.

1.2 ATTACHMENTS

- A. None

1.3 REFERENCES

- A. None

1.4 SUBMITTALS

- A. Submit the Hazard Analysis (HA) in accordance with Section 011100. The HA shall include language identifying potential environmental and waste management hazards associated with tasks within the project scope of work and appropriate controls for mitigation of those hazards. Whenever additional tasks and/or hazards are identified within the scope of work, the HA shall be updated to address the new tasks and/or changed conditions.

1.5 DEFINITIONS

- A. Construction waste: building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.
- B. Disposal: removal off-site of construction waste and subsequent recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.
- C. Recycle: recovery of demolition or construction waste for subsequent processing in preparation for reuse.

1.6 TRAINING

- A. None

1.7 REQUIREMENTS TO COMPLY WITH APPLICABLE LAWS AND REGULATIONS

- A. None

PART 2 - WASTE MANAGEMENT

2.1 WASTE MANAGEMENT REQUIREMENTS

- A. The Seller will be responsible for removal of all construction waste for off-site disposition at a permitted landfill.
- B. The Seller will spoil any excavated material (i.e., soil, rock, gravel, asphalt, and concrete) at the Company direction at a pre-approved on-site location within the boundaries of the Chestnut Ridge Campus.

2.2 RECYCLING CONSTRUCTION/DEMOLITION (C/D) WASTE

- A. Metals: separate metals by type.
1. Structural steel: stack members according to size, type of member, and length.
 2. Remove and dispose of bolts, nuts, washers, and other rough hardware. Recycle if able to be "green-tag surveyed". No inaccessible surfaces allowed.
- B. Packaging: recycle the items below only if used in non-radiological areas.
1. Cardboard and boxes: break down packaging into flat sheets. Bundle and store in a dry location.
 2. Polystyrene packaging: separate and bag materials.
 3. Pallets: as much as possible, require deliveries using pallets to remove pallets from the site. For pallets that remain on-site, disposition per the direction of the construction field representative (e.g. deliver to Excess Property Sales, break down and deliver to burn pile, etc.).
 4. Crates: break down crates into component wood pieces and comply with requirements for recycling wood.

END OF SECTION

SECTION 018000 - DESIGN BUILD REQUIREMENTS

PART 1 - GENERAL

1.1 DESIGN BUILD REQUIREMENTS

- A. In general, the work consists of furnishing labor, materials, tools, equipment, and services (except that specified to be furnished or performed by others) for designing and building a maintenance facility and associated infrastructure in accordance with the design-build specifications.
- B. The Seller will design and build a two-story building as the base project scope. The first floor of the building will house the maintenance shops and the second floor shall house offices, change room facilities, toilets, kitchen and a large meeting room. Option One will include a 2000 sq. ft. addition to the shop area. Option Two will include the build out of certain areas of the second floor. See Section 018100 – Overview, Paragraph 1.2 for additional information.
- C. Notable work scope items include:
 - 1. A 20' separation from existing adjacent buildings is allowed by variance granted by the Authority Having Jurisdiction (AHJ). If the building is only 20' from the existing adjacent building then the side facing the existing building is limited to 20% openings.
 - 2. Maintain access paths to the Target Building for deliveries and for ongoing movement of technical equipment between beam line buildings in this area.
 - 3. Protect existing technical survey monuments that are critical to the operation of the Spallation Neutron Source (SNS).
 - 4. Reroute the existing surface drainage around the new building.
 - 5. The design and construction methods must avoid conflicts with the 14" and 36" storm drainage lines to the south of the site. A separation distance of 30' minimum is recommended without other engineering provisions incorporated to protect the lines.
 - 6. Connect to existing utilities (see Site Plan in Section 018000.2).
 - 7. **The use of natural gas or propane is not allowed in this facility as a design component or temporarily during construction.**
 - 8. Rooftop equipment is not desirable, but, if proposed, is to be hidden by full height architectural screen system that matches the building's exterior.

9. If fill materials are required for the project, it will be required that they are to be brought by the Seller from off-site. No on-site fill material will be available (with the exception of suitable materials that may be removed from the project boundary as part of this solicitation). Also, if carry-off soil and rock materials from the project site are required, the Company will designate an area on the Chestnut Ridge Campus for placement. Construction waste materials may be legally disposed of offsite, or taken to the Y12 landfill provided Oak Ridge National Laboratory (ORNL) procedures are followed. See Section 015500 in Division 1 Specifications.
- D. In addition to codes and standards identified in other divisions of this specification, perform work in accordance with International Building Code (IBC), International Plumbing Code (IPC), International Mechanical Code (IMC), International Fire Code (IFC), National Electric Code (NEC), National Fire Protection Agency (NFPA), Factory Mutual (FM) Approval Guide, and Americans with Disabilities Act (ADA).
- E. Design documents require a 30%, 60%, and 90% review by the Company. All comments shall be resolved before issuing certified for construction (CFC) documents. Work shall not begin until the CFC documents for the package are signed by the Company. An “early” design package that *could* be comprised of site, foundations, structural steel or other preliminary construction details is encouraged to expedite the construction schedule. This “early” package will be reviewed at 50%, 90% complete and can be CFC’d prior to the CFC of the primary design. See Section 018050 for early packages.
- F. Submit drawings at the project completion on the Company's formatted title-block. Drawing numbers will be provided by the Company.
- G. Final record drawings shall represent "as built" conditions.

1.2 DEFINITIONS

- A. Delegated Design Services, A-E: an Architect-Engineering (A-E) firm(s) that is currently licensed in the state of Tennessee and normally engages in A-E design work.
- B. Contract documents, CFC: contract documents issued, signed and professionally stamped by the A-E.
- C. Company: UT Battelle, LLC.
 1. The Company is the Code Authority and the AHJ.
- D. The Seller: the entity responsible for designing building the project in accordance with the contract documents.

1.3 PRE-DESIGN MEETING

- A. Schedule a pre-design meeting within five days after award of the contract. Representatives of the Seller, A-E firm, and the Company shall attend the meeting. This meeting does not replace the pre-construction meeting.
- B. Discuss scheduled dates for design review submittals, including partial submittal dates. Based on this discussion, dates will be established for CFC document sign off and a pre-construction meeting.
- C. The Company's representative assigned to work with the A-E during design development will be identified at this meeting.

1.4 DESIGN STANDARDS

- A. See individual discipline sections for applicable codes.
- B. The design and construction of this project at the ORNL shall adhere to the following code. Additional discipline specific codes, procedures, standards, and specifications are noted in individual sections of this specification.
 - 1. 29 CFR 1910 – Occupational Safety and Health Standards (OSHA).
 - 2. 29 CFR 1926 – Safety and Health Regulations for Construction (with the exception of 1926.53 superseded by 10 CFR 835).

1.5 ARCHITECT ENGINEER REQUIREMENTS

- A. Drawings.
 - 1. Submit a list of all drawings to the Company for assignment of drawing numbers.
 - 2. For the 30% review, an on board review will be conducted in the A-E's office. For the 60%, and 90% review submittals, provide electronic submittals of drawings, specifications, and calculations in Adobe portable document format (PDF) format.
 - 3. At CFC for each package, provide one full size set of reproducible drawings and one unbound hard copy of construction specifications for signatures and final distribution. Once signed and scanned, provide 12 sets of drawings (1/2 size) and construction specifications to the Company. Also provide electronic computer-aided design (CAD) files of all drawings in AutoCAD 2006 format, with each sheet bound and all blocks exploded. Provide electronic specifications in Microsoft (MS) Word format.
 - 4. The CFC drawings shall be reviewed and initialed by all the A-E design disciplines in every drawing's squad-check block to signify that interfaces are correct, interferences do not exist and overall coordination of design has taken place.

5. Provide a complete design for all work required to complete the project.
 6. See Section 018050 – Company Interface, for additional submittal and formatting requirements.
 7. The CFC drawings shall be signed and sealed by the professional engineer or an architect registered in the state of Tennessee before distributing for field work.
 8. Provide a cover drawing that lists the project design drawings, reference drawings, and general notes. Include the drawing number, title, and revision number. The cover sheet shall also include a site access plan, work area, parking area, and construction laydown area.
- B. Construction specifications:
1. Construction specifications for Division 2 through Division 33 shall be provided utilizing the Construction Specifications Institute (CSI) 2004 format. The A-E shall edit the ORNL Engineering Master Technical Specification where available. Where ORNL Engineering Master Technical Specifications are unavailable the A-E shall develop new specifications utilizing MasterSpec format. The Company's Master Technical Specifications are available for use upon request.
 2. The CFC construction specifications shall be provided in MS Word format and in searchable PDF format.
 3. Each division's index sheet shall be signed and stamped by the responsible registered engineer or architect. Specifications shall be signed and sealed by professional engineer or an architect registered in the state of Tennessee before distributing for field work or equipment procurement.
- C. Field requirements.
1. Perform weekly field surveillance to verify work is in accordance with final approved design documents.
 2. After each job site visit during construction, submit a progress and surveillance report. Briefly summarize activities occurring during the reporting interval including material deliveries, work progress, testing, and engineering changes.
 3. Perform off-site inspection and witnessing of tests at location of production, manufacture or shipment to ensure a quality product.
 4. Supervise, document, and certify the Seller required tests.
 5. Participate in start-up activities and final inspections.
 6. Maintain field records and provide A-E stamped "as-constructed" drawings.
- D. Final acceptance.

1. Upon project completion, submit a letter of certification that work has been completed in accordance with the contract documents.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Pre-construction requirements.

1. Excavation-Penetration permits.
 - a. Provide Engineering portion of all excavation-penetration permits that will be required for construction in accordance with Standards Based Management System (SBMS) subject area, "Excavation/Penetration".
2. Activity Hazard Analysis (AHA) – (Job Hazard Analysis – [JHA]).
 - a. Provide a document that addressed potential hazards that will occur in performance of the construction work and a plan describing how these hazards will be managed and mitigated.
 - b. The AHA (JHA) must be approved by the company prior to any work commencing.
3. Commissioning plan.
 - a. In conjunction with the commissioning agent (CxA), a commissioning plan will be developed describing all testing, balancing, and verifications of systems performance near the end of construction and prior to final acceptance.
4. The Leadership in Environmental and Energy Design (LEED) Scorecard indicating achievement of Gold certification level, and proof of project registration with United States Green Building Council (USGBC). The number of points proposed must exceed the certification requirement by a minimum of 10% unless otherwise approved by the Company.

B. Construction phase.

1. Perform weekly field surveillance to verify construction work is in accordance with final design documents.
2. After each job site visit during construction, provide a progress and surveillance report. Briefly summarize activities occurring during the reporting interval including material deliveries, work progress, testing and engineering changes.
3. Review and approve submittals such as vendor and manufacturer data, concrete design mixes, and shop drawings before submittal to the Company. Indicate the A-E review was performed by signing the submittal cover sheet.

4. Perform off-site inspection and witnessing of tests at location of production, manufacture, or shipment to ensure a quality product. Off-site inspection and witnessing of tests shall be performed as instructed by the Seller.
 5. Provide oversight, document, and certify the Seller required tests.
 6. Participate in punch list identification, start-up activities, commissioning and final inspections.
 7. Maintain field records for purposes of A-E providing record documents.
- C. Final acceptance.
1. Upon project completion, submit a letter of certification that work has been completed in accordance with the contract documents.

2.2 MATERIAL RESTRICTIONS

- A. Unless approved prior to design by Company, the following materials are not allowed:
1. Material or components containing asbestos, polychlorinated biphenyl (PCB), chlorofluorocarbons (CFCs), lead, and carcinogens shall not be utilized in any portion of the design or construction.
 2. Wood material shall not be used for any part of new, permanent construction except for:
 - a. Fire-retardant plywood, Underwriter's Laboratory (UL) listed, is permitted in the electrical equipment rooms for telephone and computer terminal boards only.
 - b. Zinc hardware/material shall not be utilized
 - c. Zinc chromate paint shall not be utilized.
 - d. Other material restrictions are identified in other divisions.

PART 3 - EXECUTION

3.1 ROLES AND RESPONSIBILITIES

- A. The Company: the Company will provide oversight for project design and construction.
- B. A-E: The A-E shall provide the contract documents as established in this specification.
- C. The Seller: a design-build Seller will be utilized for the design and construction of the project.
- D. Delegated design: engage a qualified professional engineer, A-E, as defined in Division 01 Section "Quality Requirements," to design all portions of this scope.

- E. The CxA will be provided by the Company and will witness all test, balance, and verifications and provide a commissioning report of all findings.

END OF SECTION

SECTION 018050 - COMPANY INTERFACE

PART 1 - GENERAL

1.1. KICK-OFF MEETING AND DESIGN STATUS MEETINGS

- A. A design kick off meeting shall be held by teleconference with participation by the Architect-Engineer (A-E) discipline leads and project manager.
- B. An on-site programming verification meeting(s) prior to 30% design submittal shall be held at Oak Ridge National Laboratory (ORNL) with participation by the A-E and project manager with the project team. The purpose of these programming verification meetings will be to verify the A-E/the Seller and the Company “end-user” are in agreement with the intended scope and the room data sheets. Also discuss A-E interfaces with the Company and the dates for design review submittals, including any partial submittal dates.
- C. Every two weeks, a status meeting (one hour) will be held with participation by telephone by the Seller discipline leads and project manager. These meetings will be used to discuss progress, solve design problems, and discuss design to cost issues, etc. Minutes of these meetings to be prepared by A-E with an action item list.

1.2. CONTRACT DOCUMENTS

- A. General.
 - 1. The minimum contract documents are listed in Table 018050-1, Design Document Submittal Schedule. Other documents may be listed in the body of this design-build specification.
 - 2. Drawings, specifications, and calculations shall be sealed by the responsible professional engineer or architect registered in the State of Tennessee.
 - 3. Text documents shall be provided electronically in Microsoft (MS) Word format, unless otherwise indicated.
 - 4. The A-E shall issue an early construction package for the site work, foundations, and structural steel as applicable (the Seller’s discretion) to allow construction to proceed prior to CFC of complete building package.
- B. Drawings.
 - 1. Drawings shall include all demolition plans, dimensional plans, elevations, sections, details, notes, and identification of materials and equipment necessary to complete construction of project.

2. Certified for Construction (CFC) drawings shall be reviewed and initialed by all the A-E design disciplines in every drawing's squad-check block to signify that interfaces are correct, interferences do not exist and overall coordination of design has taken place.
 3. Drawing shall be produced using electronic software compatible with AutoCAD Version 2006 format with all sheets bound and all blocks exploded. Specifications shall be provided electronically in MS Word format.
 4. The minimum drawing scale, unless otherwise approved in writing by the Company, shall be:
 - a. 1/8" = 1'-0" for plans.
 - b. 1/4" = 1'-0" for building sections.
 - c. 1/2" = 1'-0" for detail sections.
 - d. 1" = 20'-0" for site plans.
 5. ORNL grid system north shall be used. Indicate north to the top of the drawing sheet except where site conditions dictate otherwise.
 6. Key plans shall be provided as appropriate.
 7. Drawings shall be AMSI "E" size (34" x 44") with standard company title block (the Company to provide electronic border file). The Company will provide guidance on filling out title block to ensure finished drawings will go directly into the Company's electronic storage system without modifications.
 8. Drawing numbers will be provided by the Company.
 9. Compatibility with the Company's electronic storage and indexing system shall be tested prior to schematic design review. A representative electronic set of project drawings from each discipline shall be provided for compatibility. The Company will provide guidance for correction of any problems encountered. Problems shall be corrected by the A-E and resubmitted to the Company in two weeks.
 10. Electronic master seed file provided by the Company.
- C. Construction specifications.
1. Construction specifications for Division 2 through Division 33 shall be provided utilizing the Construction Specifications Institute (CSI) 2004 format. The A-E shall edit the ORNL Engineering Master Technical Specifications where available. Where ORNL Engineering Master Technical Specifications are unavailable the A-E shall develop new specifications utilizing Master Spec format. The Company's Master Technical Specifications are available on the following web site:

https://www.fo.ornl.gov/fdd_EXTERNAL/csitechspecs/csitechspecs_index.htm

User name: fdd

Password: masterspec

2. During design development and contract document phases, the Company will generate Division 1 - General Requirements. This division shall be included in the final contract document package.
 3. CFC construction specifications shall be provided in MS Word format as well as searchable Portable Document Format (PDF) format, and shall include a table of contents.
 4. Each division's index sheet shall be signed and stamped by the responsible registered engineer or architect.
- D. Engineering standards.
1. Engineering standards can be found on the same web site as the construction specifications.
- E. Design calculations.
1. Design calculations clearly documenting design decisions, assumptions, and basis for design (codes, standards, design loads, design factors) shall be submitted for review. Calculations shall be prepared, dated, checked, signed, and sealed by a professional engineer or an architect registered in the state of Tennessee for final submittal. Submit the following calculations, which include but are not limited to:
 - a. Structural (PDF format).
 - 1) Building foundation and floor designs.
 - 2) Steel framing and connections.
 - 3) Reinforced concrete items.
 - 4) Building resistance to seismic and wind loading.
 - b. Electrical.
 - 1) Total connected load and estimated demand load.
 - 2) Short circuit calculations.
 - 3) Circuit breaker coordination.
 - 4) Lighting calculations.
 - 5) Voltage drop.
 - c. Piping.
 - 1) Sizing of systems.
 - 2) Sprinkler system design.
 - d. Heating, ventilation, and air conditioning (HVAC).

- 1) Heating and ventilating loads.
 - 2) Make-up and exhaust air requirements.
 - 3) Equipment sizing.
 - 4) Ductwork sizing - static pressure losses (as appropriate).
2. Calculations shall be provided in hard copy and electronically in PDF format.
- F. Design Basis Document (DBD).
1. Prepare a DBD, providing the programmatic detail to describe systems, subsystems and major components, identify relevant codes and standards. Provide a cost benefit analyses as an attachment to the DBD. The DBD shall contain piping and instrumentation diagram (P&ID's), one-line diagrams, floor loadings, room data sheets, and system descriptions at a minimum.
 2. The DBD shall be organized using the Uniformat II per ASTM International (ASTM) Uniformat II E1557 in MS Word format at 30% and 90% review and shall include a table of contents.
- G. Control points and as-built requirements.
1. Design drawings shall utilize the ORNL grid system. A minimum of two survey control points with their coordinate values and elevations shall be shown on the design drawings.
 2. Design coordinates and elevations shall be determined for utilities, roads, and parking areas at their principal points of definition. This information shall be provided on the design drawings.
 - a. The principal points of definition for utility systems shall include utility poles, obstructions, manholes, valves boxes, and crossings with other systems.
 - b. Principal points of definition for potable water and natural gas distribution systems shall be valve boxes, main line intersects, and fire hydrants.
 3. Design documents shall require the Seller (contractor) to maintain red line as-built drawings during the construction and incorporate all final red line changes into the record drawings by the A-E upon completion of project.
 - a. The Seller shall submit as-built coordinates and elevations of the underground utilities as soon as they are available.
 - b. Electronic record drawings will be created from the red line as-built drawings by the A-E, under the construction support phase.
 - 1) Record drawings shall be in AutoCAD 2006 format.

- 2) Record drawings provided by the A-E or the Seller shall be stamped by the registered professional engineer or architect to certify that the as-built changes made during the construction of the facilities and systems did not adversely affect the original design requirements. A three point caveat should be included on the sealed as-built drawings as noted on the ruling by the Tennessee Board of Architectural and Engineering Examiners, adopted May 22, 2008. The verification basis of the as-built information shown on the as-built drawings for field routed and installed items shall be from field measurements.

H. Leadership in Environmental and Energy Design (LEED) scorecard.

1. LEED scorecard shall be provided in the United States Green Building Councils (USGBCs) format.
2. The Seller shall be responsible for registering the project with USGBC and for providing the fee for registration and for certification reviews as may be necessary to achieve LEED Gold Certification, as a minimum.

I. Miscellaneous design documents.

1. See Table 018050-1, Design Document Submittal Schedule, and discipline sections for more information.
2. Miscellaneous design documents shall be provided in hard copy and MS Word format, unless other electronic format is approved.

1.3. DESIGN REVIEW

A. Formal design reviews with the Company shall be held at the following as a minimum:

- | | |
|-----------------------------|-----------------------|
| 1. Preliminary design | 30% complete |
| 2. Design development phase | 60% complete |
| 3. Contract document phase | 90% complete |
| 4. CFC | 100% company-approved |

B. The “early” package (if used) will require design reviews at 50%, 90%, and CFC. It is implied that a 50% “early” package submittal will occur at the 30% design submittal or shortly thereafter.

C. The Company will return comments to the Seller within 15 days of receipt of submittal packages.

D. The Seller shall provide formal written responses to the Company’s design review comments 10 days after receipt of the Company comments.

- E. The Seller will issue an early construction package(s) for the site work, foundations and structural steel (and/or other components) to allow construction to get an accelerated start.

1.4. DESIGN DOCUMENT SUBMITTALS

- A. Identify submittal information with contract number, project title, A-E's name, and date submitted.
- B. See Table 018050-1, Design Document Submittal Schedule, for a limited summary of submittal information at each design phase. The Seller shall verify submittals as identified throughout the document.
- C. For each submittal provide ten hard copies and one electronic copy.
- D. At CFC submittal, provide one additional unbound hard copy of construction specifications, in 8 ½" x 11" formats.
- E. Specific submittals.
 - 1. Construction specification.
 - a. A 30% submittal shall only include the index of proposed construction specification sections.
 - b. A 60% submittal shall be an edited version of the construction specification with all edits highlighted using MS Word work track changes or similar.
 - c. A 90% submittal shall have all 60% comments incorporated and 60% highlights removed. The 90% submittal shall have all of the edits made from 60% to 90% highlighted. The 90% submittal shall be equal to the 100% submittal as far as the Seller is concerned. It is not intended that 10% of the work remains uncompleted as this phase of submittal.

Table 018050-1 Design Document Submittal Schedule				
DISCIPLINE	REVIEW			
	30%	60%	90%	CFC
1. MULTI-DISCIPLINE:				
Demolition Plans	X		X	X
Demolition Specifications		X	X	X
Cost Estimate	X	X	X	X
LEED Scorecard & Cost Summary	X	X	X	X
Energy Star Computer Generated Benchmark Score	X			X
Energy Analysis – All Computer Generated Output (i.e. printouts)	X			X
Life Cycle Cost Analysis Documentation – BLCC Computer Output. Including input and output electronic files.	X			X
Energy Efficiency and Sustainability Report			X	X
Value Engineering Study	X			X
ASHRAE 90.1 Compliance Documentation	X			X
Excavation/Penetration Permit		X	X	X
Formal written responses to design review comments	X	X	X	X
Construction Specification – Provide index only at 30%	X	X	X	X
Design Basis Document	X		X	X
Data Drawings		X		X
2. CIVIL:				
Site Access Plan - Index drawing & notes		X	X	X
Geotechnical Report	X			X
Access Road Improvements & Additions Plans and Details	X	X	X	X
Site utilities Plan and Details	X	X	X	X
Site Grading Plan	X	X	X	X
Storm Drain - Plans and details and Profiles	X	X	X	X
Calculations (including 500 yr hydrologic evaluation)	X	X	X	X
Project Specific SWPPP		X	X	X

Table 018050-1 continued Design Document Submittal Schedule				
DISCIPLINE	REVIEW			
	30%	60%	90%	CFC
3. STRUCTURAL:				
Framing - Plans & Elevations	X	X	X	X
Framing - Sections and details		X	X	X
Foundations – Plans	X	X	X	X
Foundations - Sections and details		X	X	X
Miscellaneous - Plans, sections and details		X	X	X
Calculations	X	X	X	X
4. ARCHITECTURAL:				
Finish Board/Mock up		X	X	X
Floor Plans	X	X	X	X
Roof Plan		X	X	X
Exterior Elevations	X	X	X	X
Wall Sections		X	X	X
Partial Plans	X	X	X	X
Reflected Ceiling Plan		X	X	X
Miscellaneous Schedules (Door, Room Finish, etc.)		X	X	X
Miscellaneous Plans and Details		X	X	X
Calculations		X	X	X
5. MECHANICAL – HVAC:				
Plans	X	X	X	X
Elevations, Sections and Details		X	X	X
Equipment Schedules	X	X	X	X
Controls Diagrams/P&ID's/Sequence of Operations	X	X	X	X
Calculations		X	X	X
See MULTI-DISCIPLINE items for additional requirements.				X
6. MECHANICAL - PIPING:				
Building Systems Plans	X	X	X	X
Site Utility Systems Plans & Details	X	X	X	X
Isometrics		X	X	X
Systems Details		X	X	X
Schedules	X	X	X	X
Control diagrams/P&IDs/Sequence of Operations	X	X	X	X
Calculations		X	X	X
Equipment Specifications		X	X	X

Table 018050-1 continued Design Document Submittal Schedule				
DISCIPLINE	REVIEW			
	30%	60%	90%	CFC
7. FIRE PROTECTION:				
Code Footprint	X	X	X	X
Fire Protection Systems	X	X	X	X
Fire Alarm Plan		X	X	X
Fire Alarm Wiring and Riser Diagrams		X	X	X
Compliance Review	X	X	X	X
8. ELECTRICAL:				
Electrical Site Plan, Legend, and Notes	X	X	X	X
One Line Diagram	X	X	X	X
Panel Schedules		X	X	X
Building Power and Receptacle Plan		X	X	X
Grounding Plan		X	X	X
Duct Bank Details		X	X	X
Conduit and Cable Schedules		X	X	X
Schematics, Interconnection, and Wiring Diagrams		X	X	X
Miscellaneous Details, Sections, and Elevations		X	X	X
PLC Interconnection Wiring Diagram		X	X	X
Instrument Loop Diagrams		X	X	X
Process & Instrument Diagram		X	X	X
9. COMMUNICATION				
Communication Plan		X	X	X
10. SECURITY				
Security Plan		X	X	X

END OF SECTION

SECTION 018100 – OVERVIEW

PART 1 - GENERAL REQUIREMENTS

1.1 PROJECT OVERVIEW

- A. Design and construction of a new two-story general maintenance facility of approximately 19,500 sq. ft., designed to blend with existing facilities located on the Chestnut Ridge campus. The facility will provide space for the consolidation of maintenance support for the Chestnut Ridge campus. The facility is sized to provide the support space required for general maintenance activities for buildings and equipment located on the Chestnut Ridge campus.
- B. The scope of work will include the following:
 - 1. Mechanical and electrical shop areas as well as some shared shop area. These shops are technical shops for maintaining, repairing, and testing equipment necessary to produce the research.
 - 2. A separate De-Ionized Water (DI)/Mechanical Room for a DI water system skid (skid to be provided by the Company at a later date).
 - 3. Shower and change/locker rooms for 60 full time employees. This part of the facility will serve the campus, not just this facility, and needs to be convenient for access from outside.
 - 4. Offices, open office space, for employees within the facility.
 - 5. A meeting space to serve as a training area, meeting area, and break room.
 - 6. Adequate support space for building occupants and building mechanical, electrical, communications, and plumbing systems.
 - 7. Relocation of any utilities required for the building footprint. Site utilities shall not run under the footprint of the facility. Utility relocations shall include all work and materials, required to relocate utilities, including valves and connection pieces. Final connections will be made by the Company with materials and access provided by the Seller.
 - 8. Final cleanup of the site and restoration of gravel parking lot in areas not required for the new building.
- C. Government Furnished Equipment (GFE).
 - 1. GFE represents equipment that will be provided and installed by the Company. The GFE includes shop equipment and benches, electrical test gear, deionized water system, furnishings for office areas and break room, and kitchen appliances. Built in casework will be provided by the Seller.

2. The Seller shall provide services to this equipment, and disconnects or valves to a logical point for connection of services to this equipment. Power and communications to free standing work stations shall be via power poles to junction boxed in the ceiling. Do not use floor boxes for this area. Power to conference room tables shall be through floor box(s) centered under the conference table.
3. The Seller shall accommodate installation of GFE as may be required prior to the completion of construction, and shall cooperate with the Company's installers.
4. Office furniture (including modular systems workstations) will be provided by the Company as government furnished and installed equipment. However, furniture layouts shall be shown in the design documents to assure that proper layouts are accommodated. Specific research equipment shall be provided and installed by the Company as well. All other furnishings and equipment (including, but not limited to, blinds, toilet fixtures, toilet accessories, shower curtains and benches, lockers, cloak hooks, shelving and racks, signage, etc.) shall be provided by the Seller.

1.2 BASE BID AND ALTERNATES

- A. The base bid shall include a two-story building of approximately 19,500 sq. ft. including the following:
 1. Fully furnished and complete areas:
 - a. Main shop.
 - b. DI/Mechanical room and utilities for future DI equipment.
 - c. Power supply test cage.
 - d. Magnet test area.
 - e. Medium Energy Beam Transport (MEBT)/Low Energy Beam Transport (LEBT) chopper test area.
 - f. High Voltage Converter Modulator (HVCM) development test area.
 - g. Chassis fabrication.
 - h. Weld/Pipe shop.
 - i. Locker/Shower/Toilet rooms for both men and women.
 - j. Uniform storage.

2. All other areas not listed above but that are included in the program are to be provided as follows. The remaining space is to be utilized as a site-wide meeting room unless Option 2 is accepted, and therefore must be habitable as such. Include the following minimum levels of finish:
 - a. Exterior skin installed and watertight (skin and windows).
 - b. Sealed concrete floor, no floor finishes required.
 - c. Finished drywall on metal stud framing at perimeter walls with insulation as required.
 - d. Finished acoustical lay-in ceiling with general lighting.
 - e. Mechanical units set with main truck ductwork only.
 - f. Electrical power to panels only and minimal outlets required by code.
 - g. Emergency lighting and fire alarm provided.
 - h. Plumbing rough-in only for break area.
 - i. Vertical conveyance systems (elevator and stairs) finished with rated drywall, metal stud framing, doors and frames as required.
 - j. Fire protection sprinkler system provided with heads turned up.
 - k. Roughed-In utilities for Option 2 to be valved and capped as appropriate.
 - l. All mechanical, plumbing, fire protection and electrical services equipment and systems are to be provided for the ultimate finish-out of all spaces.
- B. Option 1 will include a 2000 sq. ft. addition to the shop area (in addition to the base bid area), including all additional electrical, mechanical, and piping to accommodate this addition. The fit-out of this addition is to be powered, plumbed, and air-conditioned to the same level as the base bid shop areas.
- C. Option 2 will include the build out of all remaining space into office and small meeting spaces as programmed in the room data sheets, including all built in casework, electrical and communications, lighting, and finishes. Mechanical systems shall be completed for these areas under this alternate.

1.3 PROJECT SPECIFIC CRITERIA

- A. Under a fixed price design/build contract, the Seller will provide architectural, engineering, and construction services for the generation of contract documents to meet the requirements described within this document for the CRMS, as well as complete construction of the facility as described in this document. The Seller will have expertise in the design and construction of shop and office facilities. A design team licensed in the state of Tennessee shall prepare all drawings, calculations and specifications for the construction activity. A contractor licensed for the limits of this project will provide construction of this project.
- B. As a measure of the environmental performance of the CRMS, the project will be designed, constructed, and registered for certification with the United States Green Building Council (USGBC), and performance tracked using the 2009 LEED Version 3.0 (Leadership in Environmental and Energy Design) Green Building Rating System, to result in achievement of a LEED Gold Certification.
- C. The CRMS will provide mechanical and electrical maintenance facilities in support of the Spallation Neutron Source (SNS) and the Chestnut Ridge Campus.

The facility provides space to meet the programmatic needs of the Department of Energy's (DOE) Office of Science.

This project will provide a maintenance facility of approximately 19,500 gross sq. ft. consisting of shops and associated offices, multi-purpose room, conference room, and change facilities. The first floor (ground floor) portion of the facility will house the mechanical and electrical shop and test facilities. The second floor will house offices and change facilities, as well as a large multi-purpose room.

The site for the facility is in the Chestnut Ridge Campus of Oak Ridge National Laboratory (ORNL), adjacent to other current research areas that will be served – primarily the Target Building 8700, and the Klystron Hall 8300 and associated beam line facilities. The facility will be located in the existing parking lot just southwest of the Target Building.

Paved parking will not be required as a part of this project except that a gravel area shall be maintained for service vehicles adjacent to the building. Also, reestablish as many parking places in the existing gravel parking lot as possible. Current walkway paths shall also be maintained during and after construction. Provide connections from sidewalks and paved building access from new facility to existing sidewalks and paved access drives. See Civil Section 018900 for roads and parking materials guidelines.

Refer to Civil Section 018900 and associated site drawings for known site utilities and conditions.

- D. The Seller shall be responsible for having a geotechnical evaluation done and will subsequently provide the results to the Company.

1.4 DEFINITIONS

- A. Certified for Construction (CFC): contract documents issued, signed and professionally stamped by the Architect-Engineer (A-E).
- B. Company: UT Battelle, LLC.
 - 1. The Company is the code authority and the Authority Having Jurisdiction (AHJ).
- C. The Seller: the design and build contractor responsible for building the project in accordance with the contract documents.
- D. Square footages.
 - 1. “The Standard Method for Measuring Floor Area in Office Buildings”, American National Standards Institute, Inc. (ANSI)/Building Owners and Managers Association (BOMA) Z65.1, shall be used for calculating square footages.
 - a. Net usable square footage.
 - 1) Programmed square footage that meets the user requirements as specified in the room data sheets. Net usable square footage does not include walls enclosing program spaces.
 - b. Gross square footage.
 - 1) The area encompassed by the exterior dimensions of the facility at each floor level, not to include any open roof area. Upper levels of two story spaces and exterior decks are to be included at ½ the actual square footage.

1.5 DESIGN STANDARDS

- A. See individual discipline sections for codes and standards that apply to specific areas of design work.

1.6 PROJECT EXECUTION

- A. General.
 - 1. The execution of the project will be as follows:
 - a. Design-Build.
 - 1) Fixed Price Subcontractors (FPSC) for design and construction. Design reviews by the Company shall be conducted at 30%, 60%, 90%, and at CFC design intervals. Construction may not commence until formal approval of the CFC design documents.

- B. The Company.
 - 1. The Company will provide project oversight for design and construction. See Section 018050 Company Interface, for more information.

- C. The Seller.
 - 1. The Seller shall provide the contract documents as established in this design build specification.
 - a. The conceptual floor plans and renderings in the appendices establish the master plan concept that integrates the facility with the Chestnut Ridge campus, both in style and configuration. The overriding factors for the configuration are in meeting the unique program requirements outlined in this document and the room data sheets. These plans are conceptual in nature and were developed only for the purpose of generating a government estimate for the project's approval. The A-E shall utilize the room data sheets and space plan summary, not the conceptual drawings, to establish the facility's configuration and style for approval by the Company.

- D. See "Room Data Sheets, Section 018100.1", for net usable square footage and program requirements.
 - 1. Each space is unique in terms of its utility and space requirements. The square footages for the net usable areas specified in the room data sheets are minimums and may vary slightly to allow creativity and flexibility in design and layout for achieving a highly efficient facility that meets ORNL needs.
 - 2. Detailed programmatic space requirements are given in the following room data sheets. Also see the architectural section, Section 018300 for requirements for typical spaces.

END OF SECTION

SECTION 018100.1

ROOM DATA SHEETS

ROOM SUMMARY SHEET

INDIVIDUAL ROOM DATA SHEETS

SECTION 18100.1 - ROOM DATA SHEETS

PROGRAM SUMMARY				
Rm. No.	Room Name	Quantity	Minimum Floor Area	NUSF
Admin/Support				
1	Multi-Purpose Room	1	1,400	1,400
2	Conference Room	1	250	250
3	Office	2	125	250
4	Technician Cubicle	26	64	1,664
5	Kitchen	1	330	330
6	Uniform Storage	1	480	480
7	Men's Locker	1	870	870
8	Women's Locker	1	320	320
9	Training Workstation	4	25	100
Group subtotal:				5,664
Shops				
10	Main Shop	1	4,900	4,900
11	Power Supply Test Cage	1	168	168
12	HVCM Test Area	1	80	80
13	MEBT/LEBT Chopper Test Area	1	120	120
14	Magnet Test Area	1	750	750
15	Chassis Fabrication	1	1,420	1,420
16	Weld / Pipe Shop	1	720	720
17	DI / Mechanical Room	1	600	600
Group subtotal:				8,758

Total Net Usable SF for Building: 14,422
 Estimated Net to Gross: 1.35 (approximate)
Total Gross SF for Building: 19,470 (approximate)

General Note: All items defined in the room data sheets shall be provided by the Seller unless specifically noted as GFE.

ROOM NAME: Multi-Purpose Room **Room Number:** 1

GENERAL

Number of Occupants: 65-70 Max. **Minimum floor area:** 1,400 **Room Quantity:** 1
Hours per Day: Not Applicable **Days per Week:** Not Applicable
Primary Adjacencies: Kitchen
Secondary Adjacencies: Offices and Open Office Area
Function: Break/Lunch/Training
Function Comments: Sized to accommodate a minimum of 65-70 people seated at 4-6 person tables.

CONSTRUCTION AND FINISHES

Wall Material: Gypsum Board **Wall Finish:** Painted
Ceiling Height: 10' **Ceiling Material:** Acoustical Ceiling Tile
Floor Finish: Vinyl Tile **Wall Base:** Rubber - 4" cove
Finish Comments: None
Construction Comments: None
Furniture Comments: All Furniture is GFE:
Table and chairs to seat 65-70 people (tables are to be 4-6 person tables)
4-6 Standing computer kiosks stations
Small lockable credenza
Casework Comments: None
Equipment Comments: All Equipment is GFE:
Wall mounted 54" Flat Panel TV (and mounting bracket) for group training sessions or meetings.
PC with wireless keyboard and mouse with connection to TV (for web based training & presentations)
Laptop with connection to TV and access to ORNL network.
PC station at each kiosk.

HVAC

Relative Humidity: See Comments **Directional Airflow:**
Heat Generating Equip.:
HVAC Comments: a. This space shall be an independent thermal control zone with 72 and 76 degree F winter and summer inside design temperatures.
b. HVAC equipment & controls shall maintain space temperature within 2 degrees of set point (i.e. 70 – 78 F)
c. HVAC system operation shall produce coincident space relative humidity levels between 30 and 60 percent.

HAZARDS

Hazard Comments: None

ELECTRICAL

Electrical Comments: Power:
As required for wall mounted TV, PC and items identified in the equipment list.
Convenience receptacles located throughout the room
Power for PC's at kiosks.
Refer to Section 018626 for additional information

LIGHTING

Light Level: 30 fc **Light Type:** Refer to Section 018626
Lighting Comments: Refer to Section 018626

COMMUNICATION

Comments: Data: 2 data drops at credenza, 1 data drop at each kiosk
Phone: 1 phone drop at credenza

PIPING/PLUMBING

Comments: None

GASES

Gases Comments: None

OTHER

Fire Protection: Refer to Section 018613
Acoustical: None
Security: Refer to Section 018633

ROOM NAME: **Conference Room** Room Number: 2

GENERAL

Number of Occupants: 20 Minimum floor area: 250 Room Quantity: 1
 Hours per Day: Not Applicable Days per Week: Not Applicable
 Primary Adjacencies: Offices
 Secondary Adjacencies: Open Office Area
 Function: Typical conference room functions
 Function Comments: Conference Room shall be designed to accommodate 20 persons.

CONSTRUCTION AND FINISHES

Wall Material: Gypsum Board Wall Finish: Typical Wall Paint
 Ceiling Height: 10' Ceiling Material: Acoustical Ceiling Tile
 Floor Finish: Carpet Tile Wall Base: Rubber - 4" cove
 Finish Comments: None
 Construction Comments: Walls shall extend from floor to structural deck.
 Provide blocking in wall for TV mounting.
 Furniture Comments: Furniture is GFE. Conference Table and chairs to accommodate 20 people.
 Casework Comments: None
 Equipment Comments: Provide wall mounted 4'x8' marker board.

Equipment listed below is GFE:
 Wall mounted 54" Flat Panel TV (and mounting bracket) for group training sessions or meetings.
 PC with wireless keyboard and mouse with connection to TV (for web based training & presentations)

HVAC

Relative Humidity: See Comments Directional Airflow:
 Heat Generating Equip.:
 HVAC Comments: a. This space shall be an independently controlled thermal zone with 72 and 76 degree F winter and summer inside design temperatures.
 b. HVAC system operation shall produce coincident space relative humidity levels between 30 and 60 percent.
 c. The conditioned supply air stream shall contain outside air in quantities that will meet or exceed the minimum requirements for acceptable indoor air quality during occupancy.

HAZARDS

Hazard Comments: None

ELECTRICAL

Electrical Comments: Refer to Section 018626

LIGHTING

Light Level: 30 fc Light Type: Refer to Section 018626
 Lighting Comments: Dimmable fixtures located over the table, no lights over marker boards without a separate switch. Refer to Section 018626 for additional information

COMMUNICATION

Comments: Data: 2 data drops at credenza, 1 data drop at floor box centered on conference table.
 Phone: 1 phone drop at credenza, 1 phone drop at floor box centered on conference table

PIPING/PLUMBING

Comments: None

GASES

Gases Comments: None

OTHER

Fire Protection: Refer to Section 018613
 Acoustical: Walls shall have minimum STC-45 rating.
 Security: Refer to Section 018633

ROOM NAME: **Office** Room Number: 3

GENERAL

Number of Occupants: 1 Minimum floor area: 125 Room Quantity: 2
 Hours per Day: Not Applicable Days per Week: Not Applicable
 Primary Adjacencies: Open Office Area
 Secondary Adjacencies: No Requirement
 Function: Manager Office
 Function Comments: Managers Office for individual who oversees craft and technicians.

CONSTRUCTION AND FINISHES

Wall Material: Gypsum Board Wall Finish: Painted
 Ceiling Height: 10' Ceiling Material: Acoustical Ceiling Tile
 Floor Finish: Carpet Tile Wall Base: Rubber - 4" cove
 Finish Comments: None
 Construction Comments: Walls shall extend from floor to structural deck.
 Furniture Comments: All furniture in this room is GFE
 Casework Comments: None
 Equipment Comments: None

HVAC

Relative Humidity: See Comments Directional Airflow:
 Heat Generating Equip.:
 HVAC Comments: a. This space shall be an independently controlled thermal zone with 72 and 76 degree F winter and summer inside design temperatures.
 b. HVAC system operation shall produce coincident space relative humidity levels between 30 and 60 percent.

HAZARDS

Hazard Comments: None

ELECTRICAL

Electrical Comments: Power: Minimum of 3 duplex receptacles. Provide one dedicated circuit.

LIGHTING

Light Level: 30 fc Light Type: Refer to Section 018626
 Lighting Comments: Refer to Section 018626

COMMUNICATION

Comments: 2 Data drops in each office and 1 phone drop.

PIPING/PLUMBING

Comments: None

GASES

Gases Comments: None

OTHER

Fire Protection: Refer to Section 018613
 Acoustical: Walls shall have minimum STC-45 rating.
 Security: Refer to Section 018633

ROOM NAME: **Technician Cubicle** Room Number: 4

GENERAL

Number of Occupants: 1 Minimum floor area: 64 Room Quantity: 26
 Hours per Day: Not Applicable Days per Week: Not Applicable
 Primary Adjacencies: Offices
 Secondary Adjacencies: Multi Purpose Room
 Function: Work Station for Technicians
 Function Comments: ORNL Standard 8'x8' workstation located in an open office area.

CONSTRUCTION AND FINISHES

Wall Material: Gypsum Board Wall Finish: Painted
 Ceiling Height: 10' Ceiling Material: Acoustical Ceiling Tile
 Floor Finish: Typical Floor Carpet Wall Base: Rubber - 4" cove
 Finish Comments: Finishes indicated are in reference to the open office area where cubicles are located
 Cubicle finishes will be as determined by the Company
 Construction Comments: None
 Furniture Comments: All furniture in this room will be GFE.
 Systems Furniture for a minimum of 26 - 8'x8' cubicles.
 Arrange cubicles against walls to the extent possible.
 Casework Comments: None
 Equipment Comments: None

HVAC

Relative Humidity: See Comments Directional Airflow:
 Heat Generating Equip.:
 HVAC Comments: a. Provide a sufficient amount of conditioned supply air in each cubicle area to maintain standard office temperatures and coincident relative humidity levels.
 b. Do not group cubicles of different exterior exposures together in the same thermal control zones.

HAZARDS

Hazard Comments: None

ELECTRICAL

Electrical Comments: Power: Minimum of 2 receptacles per cubicle. Maximum of 2 cubicles/20A Circuit.
 Floor outlets are not acceptable. Where power poles are required to serve cubicles, they will be GFE as part of the systems furniture. Service to power poles shall be from the ceiling. The Seller shall provide rough-in. Final connections shall be by the Company.

LIGHTING

Light Level: 30 fc Light Type: Refer to Section 018626
 Lighting Comments: Refer to Section 018626

COMMUNICATION

Comments: One data port at each cubicle.

PIPING/PLUMBING

Comments: None

GASES

Gases Comments: None

OTHER

Fire Protection: Refer to Section 018613
 Acoustical: none
 Security: Refer to Section 018633

ROOM NAME: **Kitchen** Room Number: 5

GENERAL

Number of Occupants: Varies Minimum floor area: 330 Room Quantity: 1
 Hours per Day: Not Applicable Days per Week: Not Applicable
 Primary Adjacencies: Multi Purpose Room
 Secondary Adjacencies: No Requirement
 Function: Kitchen for lunch and daily staff activities
 Function Comments: None

CONSTRUCTION AND FINISHES

Wall Material: Gypsum Board Wall Finish: Painted
 Ceiling Height: 10' Ceiling Material: Acoustical Ceiling Tile
 Floor Finish: Tile or other durable surface Wall Base: Coordinate with floor finish
 Finish Comments: At countertop, provide washable/protective finish such as wall tile or stainless steel panel at wet area(s).
 Construction Comments: None

Furniture Comments:

Casework Comments: Minimum of 18 LF of base and wall cabinets.

Equipment Comments: All Equipment is GFE
 2 Full size refrigerator/freezers with icemaker
 4 Microwave Ovens
 2 Coffee makers
 1 full size residential grade Range/Oven
 Vending Machines - 2 drink machines, 2 snack machines

HVAC

Relative Humidity: See Comments Directional Airflow:
 Heat Generating Equip.:
 HVAC Comments: a. This space shall be an independently controlled thermal zone with 72 and 76 degree F winter and summer inside design temperatures.
 b. HVAC system operation shall produce coincident space relative humidity levels between 30 and 60 percent.
 c. Provide an exhaust hood, fan, ductwork and associated controls for each cooking range.
 d. Provide a dedicated range hood chemical fire extinguishing system designed to shut off all associated power to the appliance and simultaneously send an alarm signal to the fire alarm control panel when activated.

HAZARDS

Hazard Comments: None

ELECTRICAL

Electrical Comments: Power: Convenience outlets and as required for equipment listed in Equipment Comments. Provide dedicated circuits at each vending machine. See section 018626 for additional information.

LIGHTING

Light Level: 30 fc Light Type: Refer to Section 018626
 Lighting Comments: Refer to Section 018626

COMMUNICATION

Comments: None

PIPING/PLUMBING

Comments: 1 Large Commercial grade Stainless Steel double bowl sink.
 As required for appliances listed in equipment notes.
 Minimum of 1 Floor Drain

GASES

Gases Comments: None

OTHER

Fire Protection: Refer to Section 018613
 Acoustical: None
 Security: Refer to Section 018633

ROOM NAME: **Uniform Storage** Room Number: 6

GENERAL

Number of Occupants:	Varies	Minimum floor area:	480	Room Quantity:	1
Hours per Day:	Not Applicable	Days per Week:	Not Applicable		
Primary Adjacencies:	No Requirement				
Secondary Adjacencies:	Men and Women Shower/Change Rooms				
Function:	Pick up and drop off for uniforms				
Function Comments:	ORNL craft will pick up clean uniforms and drop off soiled uniforms in this room. The room will be accessed by the contractor providing laundry service for the uniforms. Direct exterior access is not required for this room, but access for the Laundry Contractor should be considered in the design and placement.				

CONSTRUCTION AND FINISHES

Wall Material:	Gypsum Board	Wall Finish:	Painted
Ceiling Height:	10'	Ceiling Material:	Acoustical Ceiling Tile
Floor Finish:	Vinyl Tile	Wall Base:	Rubber - 4" cove
Finish Comments:	None		
Construction Comments:	None		
Furniture Comments:	None		
Casework Comments:	None		
Equipment Comments:	All Equipment is GFE 2 door storage cabinets for clean uniforms. Laundry cart(s) for soiled uniforms		

HVAC

Relative Humidity:	See Comments	Directional Airflow:	
Heat Generating Equip.:			
HVAC Comments:	a. This shall be a tempered, or partially air-conditioned, area without any thermostatic temperature controls in the space. b. Air shall be supplied from an air-conditioning system that serves other internal spaces.		

HAZARDS

Hazard Comments: None

ELECTRICAL

Electrical Comments: None

LIGHTING

Light Level:	30 fc	Light Type:	Refer to Section 018626
Lighting Comments:	Refer to Section 018626		

COMMUNICATION

Comments: None

PIPING/PLUMBING

Comments: None

GASES

Gases Comments: None

OTHER

Fire Protection:	Refer to Section 018613
Acoustical:	None
Security:	Refer to Section 018633

ROOM NAME: **Men's Locker** Room Number: 7

GENERAL

Number of Occupants: Varies Minimum floor area: 870 Room Quantity: 1
 Hours per Day: Not Applicable Days per Week: Not Applicable
 Primary Adjacencies: No Requirement
 Secondary Adjacencies: No Requirement
 Function: Shower/Changing room
 Function Comments: None

CONSTRUCTION AND FINISHES

Wall Material: Moisture Resistant Gypsum Board Wall Finish: See finish comments below
 Ceiling Height: 10' Ceiling Material: See finish comments below
 Floor Finish: See finish comments below Wall Base: See finish comments below
 Finish Comments: Wall Finish:

Showers and Drying area – floor to ceiling ceramic tile.
 Remaining areas – Moisture Resistant Enamel with epoxy (tile-like) semi-gloss (G5) finish

Floor Finish:

Shower and Drying area – Slip resistant ceramic tile.
 Remaining areas – Vinyl Tile (2 color pattern)

Wall Base:

Shower and Drying area – Ceramic tile.
 Remaining areas – Rubber 4" cove

Ceiling Material:

Showers and Drying area – Moisture resistant gypsum board.
 Remaining areas – Moisture resistant acoustical tile

Construction Comments: Wall assembly shall extend from floor slab to structural deck.

Furniture Comments:

Casework Comments: Lavatories shall be solid surface with integral bowls color shall be as

Equipment Comments: 37- Double Tier Lockers (total locker count - 74).

HVAC

Relative Humidity: See Comments Directional Airflow:

Heat Generating Equip.:

HVAC Comments:

- Space shall be equipped with a dedicated exhaust system.
- The exhaust fan motor controls shall be interlocked with the lighting circuit and fan of the air-conditioning system providing make-up air supply to the space.
- Make-up air supply shall be a mixture of transfer air and direct supplied conditioned air to provide a partially air-conditioned space.
- Provide thermostatically controlled ceiling heaters near exterior walls.

HAZARDS

Hazard Comments: None

ELECTRICAL

Electrical Comments: None

LIGHTING

Light Level: 30 fc Light Type: Refer to Section 018626

Lighting Comments: Refer to Section 018626

COMMUNICATION

Comments: None

PIPING/PLUMBING

Comments: 4 showers including one ADA compliant shower.
 Provide minimum of 3 water closets, 3 urinals and 4 lavatories or as required by code (the greater of the two).
 Provide floor drains in toilet and changing areas.

GASES

Gases Comments: None

OTHER

Fire Protection: Refer to Section 018613

Acoustical: None

Room Data Sheets: Refer to Section 018633

ROOM NAME: **Women's Locker** Room Number: 8

GENERAL

Number of Occupants: Varies Minimum floor area: 320 Room Quantity: 1
 Hours per Day: Not Applicable Days per Week: Not Applicable
 Primary Adjacencies: No Requirement
 Secondary Adjacencies: No Requirement
 Function: Shower/Changing room.
 Function Comments: None

CONSTRUCTION AND FINISHES

Wall Material: Moisture Resistant Gypsum Board Wall Finish: See finish comments below
 Ceiling Height: 10' Ceiling Material: See finish comments below
 Floor Finish: See finish comments below Wall Base: See finish comments below
 Finish Comments: Wall Finish:
 Showers and Drying area – floor to ceiling ceramic tile.
 Remaining areas – Moisture Resistant Enamel with epoxy (tile-like) semi-gloss (MPI G5) finish

Floor Finish:
 Shower and Drying area – Slip resistant ceramic tile.
 Remaining areas – Vinyl Tile (2 color pattern)

Wall Base:
 Shower and Drying area – Ceramic tile.
 Remaining areas – Rubber 4" cove

Ceiling Material:
 Showers and Drying area – Moisture resistant gypsum board.
 Remaining areas – Moisture resistant acoustical tile

Construction Comments: Walls shall extend from floor slab to structural deck.
 Furniture Comments:
 Casework Comments: Lavatories shall be solid surface with integral bowls color shall be as specified by the Company.
 Equipment Comments: Six - Double Tier Lockers 18" wide x 24" deep (total locker count 12).
 Toilet Accessories as appropriate.

HVAC

Relative Humidity: See Comments Directional Airflow:
 Heat Generating Equip.:
 HVAC Comments: a. Space shall be equipped with a dedicated exhaust system.
 b. The exhaust fan motor controls shall be interlocked with lighting circuit and the fan of the air-conditioning system providing make-up air supply to the space.
 c. Make-up air supply shall be a mixture of transfer air and direct supplied conditioned air to provide a partially air-conditioned space.
 d. Provide thermostatically controlled ceiling heaters near exterior walls.

HAZARDS

Hazard Comments: None

ELECTRICAL

Electrical Comments: None

LIGHTING

Light Level: 30 fc Light Type: Refer to Section 018626
 Lighting Comments: Refer to Section 018626

COMMUNICATION

Comments: None

PIPING/PLUMBING

Comments: Provide of 2 showers including one ADA compliant shower.
 Provide minimum of 2 lavatories and toilets or as required by code (the greater of the two).
 Provide floor drains in toilet and changing areas.

GASES

Gases Comments: None

OTHER

Fire Protection: Refer to Section 018613
 Room Data Sheets: None
 Security: Refer to Section 018633

ROOM NAME: **Training Workstation** Room Number: 9

GENERAL

Number of Occupants: 1 Minimum floor area: 25 Room Quantity: 4
 Hours per Day: Not Applicable Days per Week: Not Applicable
 Primary Adjacencies: Located in the open office area
 Secondary Adjacencies: No Requirement
 Function: Workstation for web based training
 Function Comments: 4'-0" wide seated work station for individual online web based training. Shared workstations to be located in the open office area.

CONSTRUCTION AND FINISHES

Wall Material: Gypsum Board Wall Finish: Painted
 Ceiling Height: 10' Ceiling Material: Acoustical Ceiling Tile
 Floor Finish: Carpet Tile Wall Base: Rubber - 4" cove
 Finish Comments: Finishes indicated are for the Open Office area where the stations are located. Cubicle finishes shall be as specified by the Company
 Construction Comments: None
 Furniture Comments: All Furniture is GFE. Four single person 4' wide by 30" deep computer workstations. Workstations shall provide adequate amount of visual privacy for the purpose of web based training and testing.
 Casework Comments: None
 Equipment Comments: Complete PC with all necessary peripherals at each station.
 All equipment is GFE

HVAC

Relative Humidity: See Comments Directional Airflow:
 Heat Generating Equip.:
 HVAC Comments: See Technician Cubicle room data sheet for HVAC comments.

HAZARDS

Hazard Comments: None

ELECTRICAL

Electrical Comments: Minimum of 1 duplex at each training station

LIGHTING

Light Level: 30 fc Light Type: Refer to Section 018626
 Lighting Comments: Refer to Section 018626

COMMUNICATION

Comments: Data drop at each cubicle.

PIPING/PLUMBING

Comments: None

GASES

Gases Comments: None

OTHER

Fire Protection: Refer to Section 018613
 Acoustical: None
 Security: Refer to Section 018633

ROOM NAME: **Main Shop** Room Number: 10

GENERAL

Number of Occupants: Varies **Minimum floor area:** 4,900 **Room Quantity:** 1
Hours per Day: Not Applicable **Days per Week:** Not Applicable
Primary Adjacencies: Chassis Fabrication, Weld/Pipe Shop
Secondary Adjacencies: No Requirement
Function: Assembly and Fabrication of Research Equipment
Function Comments: Shop shared by electrical and mechanical trades. Shop includes the areas listed below. The equipment, tools, storage cabinets and shelving units for each area are listed in Equipment Comments unless noted otherwise.

AREAS:

Motor Pump Rebuild Area
 Shared Fabrication
 Mechanical Staging/Assembly
 Shelving and Storage Area
 Hoist Staging Area
 MEBT/LEBT Chopper Test Area (refer to individual room data sheet for details)
 Magnet Test Area (refer to individual room data sheet for details)
 HVCM Development Test Area (refer to individual room data sheet for details)
 Power Supply Test Cage (refer to individual room data sheet for details)
 AC Power Supply (located adjacent to Power Test Cage)

CONSTRUCTION AND FINISHES

Wall Material: Durable Material (metal panel or CMU) **Wall Finish:** Light color
Ceiling Height: 16' **Ceiling Material:** Open to Structure (painted)
Floor Finish: Epoxy **Wall Base:** Rubber - 4" cove
Finish Comments: None
Construction Comments: Provide a 12' x 16' power roll up door for direct access to the exterior.
 Provide a 3'-7' man door adjacent to the roll up door.
Furniture Comments: None
Casework Comments: None
Equipment Comments: Provide a 10' jib crane or 20' monorail crane located at the roll up door of the main shop. The crane is not required to serve any area outside the building. If a Monorail crane is provided, it shall be centered on the roll up door and extend a minimum of 20' into the shop area. If a Jib crane is provided, it shall be mounted adjacent to the jamb of the roll up door to service the area immediately inside the roll up door in a manner that minimizes interference with shop activities at the roll up door. Refer to Section 018200 Structural for crane capacity and minimum hook height.

HOIST STAGING: (equipment listed below is GFE)
 A-frame with Hoist 10'-6" x 7'-6" 120V (2) – on casters
 Conduit Rack 4' x 10' (1)

SHELVING/STORAGE: (equipment listed below is GFE)
 Pipe Rack 3' x 21' (1)
 Shelving Units 36" x 74" (16 oriented to allow access from both sides)
 Ladder (on casters) 36" x 72" (1)
 Two Door Storage Cabinets 24" x 60" (18Conduit Rack 4' x 10' (1)

MOTOR PUMP REBUILD AREA: (area includes the areas and related equip. listed below)
 (equipment listed below is GFE)
 Tool Boxes 24" x 48" (10)

SHARED FABRICATION AREA (considered part of Motor Pump Rebuild Area):
 Work Table 36" x 66" (3)
 Break/Bender Work Table 36" x 72" (1) requires min. of 72" clear area on all sides of table
 Parts Washer L-3' x W-2' x H-3'-3" 120v (1)
 Drill Press L-2'-6" x W-1'-10" x H-6'-6" 208v 3Ph (1)
 Band Saw L-1'-4" x W-1'-8" x H-5'-8" 120v (1)
 Grinder L-2' x W-1'-6" x H-4' 120v (1)
 Belt Sander L-1'-8" x W-1'-6" x H-5' 120v
 Chop Saw – mounted on 32" x 44" wide cart with casters

MECHANICAL STAGING/ASSEMBLY AREA: (considered part of Motor Pump Rebuild Area)
 Water Cart L-7' x W-3' x H-6'-8" 120v (1)
 Bead Blaster L-4'-4" x W-2'-2" x H-5'-4" 120v (1)
 Work table 36" x 72" (2)
 Work table 35" x 72" (2)
 Two Door Storage Cabinets 24" x 60" (10)

ROOM NAME: **Main Shop**

Room Number: 10

HVAC

Relative Humidity: See Comments **Directional Airflow:**

Heat Generating Equip.: See Equipment Comments

HVAC Comments:

- a. Provide sufficient amount of conditioned supply air in each main shop area to maintain space temperatures between 70 and 78 degrees F with coincident relative humidity levels between 30 and 60%.
- b. Main shop areas with exterior walls shall not share the same HVAC system thermal control zone with solely interior spaces.
- c. Do not group main shop areas of different exterior exposures together in the same thermal control zone.
- d. Main shop areas shall be slightly positive with respect to the outside and adjacent spaces with local exhaust systems.
- e. Main shop air-conditioning system supply shall contain outside air in quantities that will support building air balance and occupant air quality requirements.

HAZARDS

Hazard Comments: None

ELECTRICAL

Electrical Comments: Provide multiple 120V/20A receptacles in main shop walls where hard walls are available and a minimum of 4 on columns that are located in the shop area.

Provide a 8 Ceiling Mounted Cord Reels in the shop area. Exact location of cord reels will be reviewed and approved by the Company during design.

Refer to Equipment Comments for power requirements related to power tools and other shop equipment.

POWER CENTER for Power Supply Test Cage - see Power Supply Test Cage room data sheet for details.

LIGHTING

Light Level: 50 fc **Light Type:** Refer to Section 018626

Lighting Comments: Refer to Section 018626

COMMUNICATION

Comments: No requirements for general shop area. See room data sheets for individual test areas.

PIPING/PLUMBING

Comments: Provide hand wash fountain(s) as required per the design layout (minimum of 1).

GASES

Gases Comments: Provide compressed air drop at Bead Blaster and adjacent to the roll up door

OTHER

Fire Protection: Refer to Section 018613

Acoustical: None

Security: Refer to Section 018633

ROOM NAME: **Power Supply Test Cage** Room Number: 11

GENERAL

Number of Occupants: Varies Minimum floor area: 168 Room Quantity: 1
 Hours per Day: Not Applicable Days per Week: Not Applicable
 Primary Adjacencies: Service panels as identified in electrical comments below
 Secondary Adjacencies: DI Room (to minimize piping run to serve DI manifold)
 Function: Area dedicated to testing electrical power supply equipment for Chestnut Ridge site.
 Function Comments: None

CONSTRUCTION AND FINISHES

Wall Material: Per Design Wall Finish: Painted
 Ceiling Height: 16' Ceiling Material: Open to Structure (painted)
 Floor Finish: Sealed Concrete Wall Base: Rubber - 4" cove
 Finish Comments: None
 Construction Comments: The cage is GFE. Cage dimensions are 14' x 12' and include a 4'-0" wide lockable gate/door. Cage shall be located/arranged to provide minimum of one hard wall for DI Manifold installation.
 Furniture Comments: None
 Casework Comments: None
 Equipment Comments: Control Racks located adjacent to Power Test Cage - provide min. of 3'-8" clear from racks to cage to allow circulation on all sides of racks. Allow room above racks for communication & power distribution cable. Refer to electrical comments for power service required at racks.
 Racks: (racks are GFE)
 Four - 32" x 24" wide x 84" high
 One - 32" x 22" wide x 84" high

HVAC

Relative Humidity: See Comments Directional Airflow:
 Heat Generating Equip.:
 HVAC Comments: See Main Shop room data sheet for HVAC comments.

HAZARDS

Hazard Comments: None

ELECTRICAL

Electrical Comments: Provide minimum of 2 120V/20A duplex receptacles located on hard wall.
 Power service for racks:
 208V 3PH 100amp
 Power Supply adjacent to and outside the cage
 One - 480V, 600A Distribution Panel
 One - 75kva Transformer
 One - 208/120V 225A Distribution Panel
 One - 480V, 100A Disconnect/Receptacle - This device is GFE
 One - 480V, 225A Disconnect/Receptacle - This device is GFE
 Two - 208V 60A Disconnect - This device is GFE

LIGHTING

Light Level: 50 fc Light Type: Refer to Section 018626
 Lighting Comments: Refer to Section 818626

COMMUNICATION

Comments: Provide a minimum of 1 data drop.

PIPING/PLUMBING

Comments: DI Manifold 25 gpm (manifold and related piping is GFE)

GASES

Gases Comments: None

OTHER

Fire Protection: Refer to Section 018613
 Acoustical: None
 Security: Refer to Section 018633

ROOM NAME: **HVCM Test Area** Room Number: 12

GENERAL

Number of Occupants: 1-2 Minimum floor area: 80 Room Quantity: 1
 Hours per Day: Not Applicable Days per Week: Not Applicable
 Primary Adjacencies: No Requirement
 Secondary Adjacencies: No Requirement
 Function: Area for testing High Voltage Converter Modules
 Function Comments: None

CONSTRUCTION AND FINISHES

Wall Material: Per Design Wall Finish:
 Ceiling Height: 16' Ceiling Material: Open to Structure (painted)
 Floor Finish: Sealed Concrete Wall Base: Rubber - 4" cove
 Finish Comments: None
 Construction Comments: This is an area located in the Main Shop. The area shall be arranged to have a minimum of one hard wall.
 Furniture Comments: None
 Casework Comments: None
 Equipment Comments: 36" x 60" Work Table (1)
 2 Door Storage Cabinet (1)
 Equipment is GFE

HVAC

Relative Humidity: See Comments Directional Airflow:
 Heat Generating Equip.:
 HVAC Comments: See Main Shop room data sheet for HVAC comments.

HAZARDS

Hazard Comments: None

ELECTRICAL

Electrical Comments: Power : Minimum of one - 120V/20A receptacle.

LIGHTING

Light Level: 50 fc Light Type: Refer to Section 018626
 Lighting Comments: Refer to Section 818626

COMMUNICATION

Comments: Provide a minimum of 1 data drop.

PIPING/PLUMBING

Comments: None

GASES

Gases Comments: None

OTHER

Fire Protection: Refer to Section 018613
 Acoustical: None
 Security: Refer to Section 018633

ROOM NAME: **MEBT/LEBT Chopper Test Area** Room Number: 13

GENERAL

Number of Occupants: Varies Minimum floor area: 120 Room Quantity: 1
 Hours per Day: Not Applicable Days per Week: Not Applicable
 Primary Adjacencies: No Requirement
 Secondary Adjacencies: DI Room (to minimize piping run to serve Di manifold)
 Function: Test Area for Beamline Equipment
 Function Comments: None

CONSTRUCTION AND FINISHES

Wall Material: Per Design Wall Finish:
 Ceiling Height: 16' Ceiling Material: Open to Structure (painted)
 Floor Finish: Sealed Concrete Wall Base: Rubber - 4" cove
 Finish Comments: None
 Construction Comments: This area located in the Main Shop. The area shall be arranged to have a minimum of one hard wall (CMU or Metal Stud with Gypsum construction) to allow for DI Manifold installation.
 Furniture Comments: None
 Casework Comments: None
 Equipment Comments: Work Benches 30" x 72" wide (2)
 2 Door Storage Cabinets 24" x 60" wide (1)
 Equipment is GFE

HVAC

Relative Humidity: See Comments Directional Airflow:
 Heat Generating Equip.:
 HVAC Comments: See Main Shop room data sheet for HVAC comments.

HAZARDS

Hazard Comments: None

ELECTRICAL

Electrical Comments: Power : Two - Duplex receptacles at each workbench
 Two - 208V 3PH 60amp Receptacles

LIGHTING

Light Level: 50 fc Light Type: Refer to Section 018626
 Lighting Comments: Refer to Section 818626

COMMUNICATION

Comments: Provide a minimum of 1 data drop at work bench.

PIPING/PLUMBING

Comments: DI Manifold 15 gpm (manifold and related piping is GFE)

GASES

Gases Comments: None

OTHER

Fire Protection: Refer to Section 018613
 Acoustical: None
 Security: Refer to Section 018633

ROOM NAME: **Magnet Test Area** Room Number: 14

GENERAL

Number of Occupants: Varies Minimum floor area: 750 Room Quantity: 1
 Hours per Day: Not Applicable Days per Week: Not Applicable
 Primary Adjacencies: No Requirement
 Secondary Adjacencies: DI Room (to minimize piping run to serve DI manifold)
 Function: Area in shop reserved for testing magnets used for research facilities.
 Function Comments: Preferred dimensions are 25'x30'

CONSTRUCTION AND FINISHES

Wall Material: Per Design Wall Finish:
 Ceiling Height: 16' Ceiling Material: Open to Structure (painted)
 Floor Finish: Sealed Concrete Wall Base: Rubber - 4" cove
 Finish Comments: None
 Construction Comments: The area shall be arranged to have a minimum of three hard walls. Di Manifold will be installed on one of the 3 hard walls. Provide a 10' wide clear continuous path of access from the roll up door to the Magnet Test Area. Provide a 24' x 24' reinforced concrete apron on the exterior of the building adjacent to the roll up door. This apron is for off-loading and maneuvering large magnets (estimated weight - 10 tons) into the facility. The floor of the Magnet test Area and the path of access shall be extra heavy duty reinforced concrete. Refer to Section 018200 Structural regarding the slab design.
 Furniture Comments: None
 Casework Comments: None
 Equipment Comments: All Equipment is GFE:
 Flow Test Work Benches 30" x 72" wide (2-located side by side near the 480 V disconnect receptacle)
 2 Door Storage Cabinets 24" x 60" wide (4)
 4' x 6' Supply Rack Cabinet Locate in front of DI Manifold
 6' x 8' Magnet (provide 6'-8" clear floor area for magnet)

HVAC

Relative Humidity: See Comments Directional Airflow:
 Heat Generating Equip.:
 HVAC Comments: See Main Shop room data sheet for HVAC comments.

HAZARDS

Hazard Comments: None

ELECTRICAL

Electrical Comments: 120V/20A receptacles: Minimum of 4, or as defined by user during design.
 One - 480V 225A Disconnect Receptacle

LIGHTING

Light Level: 50 fc Light Type: Refer to Section 018626
 Lighting Comments: Refer to Section 818626

COMMUNICATION

Comments: Provide a minimum of 1 data drop.

PIPING/PLUMBING

Comments: DI Manifold 20 GPM (manifold and related piping is GFE)

GASES

Gases Comments: None

OTHER

Fire Protection: Refer to Section 018613
 Acoustical: None
 Security: Refer to Section 018633

ROOM NAME: **Chassis Fabrication** Room Number: 15

GENERAL

Number of Occupants: Varies Minimum floor area: 1,420 Room Quantity: 1
 Hours per Day: Not Applicable Days per Week: Not Applicable
 Primary Adjacencies: No Requirement
 Secondary Adjacencies: Main Shop
 Function: Room used for fabrication chassis for rack assemblies.
 Function Comments: None

CONSTRUCTION AND FINISHES

Wall Material: Per Design Wall Finish: Painted
 Ceiling Height: 16' Ceiling Material: Open to Structure (painted)
 Floor Finish: Sealed Concrete Wall Base: Rubber - 4" cove
 Finish Comments: None
 Construction Comments: This is a fully enclosed room with a double door with direct access to the large Main Shop. Additional man door(s) may be required for egress requirements due to the size and configuration of the room.

Furniture Comments: None
 Casework Comments: None
 Equipment Comments: All Equipment is GFE

Located in Shop:
 Tool Boxes - 24" x 48" wide (8)
 Vidmar Cabinets - 30" x 30" (6)
 Work bench (seated) 30" x 72" wide (14)
 2 Door Metal Storage Cabinets 24" x 60" wide (6)

Located Adjacent to Shop (not inside shop)
 Wire Racks 24" x 48" (2)
 Small Parts Cabinet 16" x 38" wide (1)

HVAC

Relative Humidity: See Comments Directional Airflow:
 Heat Generating Equip.:
 HVAC Comments: a. This space shall be an independently controlled thermal zone with 72 and 76 degree F winter and summer inside design temperatures.
 b. HVAC equipment & controls shall maintain space temperature within 2 degrees of set point (i.e. 70 – 78 F)
 c. HVAC system operation shall produce coincident space relative humidity levels between 30 and 60 percent.
 d. Provide local exhaust system with minimum of 1 snorkel hood for every 2 work benches. Snorkels shall be locally switched at workbench.
 e. Interlock the exhaust system operation with air-conditioning and ventilation equipment to provide make-up air supply and maintain space pressure relationships.

HAZARDS

Hazard Comments: None

ELECTRICAL

Electrical Comments: Provide a dedicated circuit with 1 quad receptacle at each work bench.
 Distribute 120V/20A convenience receptacles in room.
 Provide 2 ceiling mounted cord reels exact location shall be approved by the Company during design.
 Power Center:
 One - 480V 3PH 30A Receptacle
 One - 208V 1PH 30A Receptacle
 One - 208V 3PH 30A Receptacle

LIGHTING

Light Level: 50 fc Light Type: Refer to Section 018626
 Lighting Comments: Refer to Section 818626

COMMUNICATION

Comments: Provide multiple data drops (min. of one on each wall).

PIPING/PLUMBING

Comments: None

ROOM NAME: **Chassis Fabrication**

Room Number: 15

GASES

Gases Comments: None

OTHER

Fire Protection: Refer to Section 018613

Acoustical: None

Security: Refer to Section 018633

ROOM NAME: **Weld / Pipe Shop** Room Number: 16

GENERAL

Number of Occupants: Varies Minimum floor area: 720 Room Quantity: 1
 Hours per Day: Not Applicable Days per Week: Not Applicable
 Primary Adjacencies: No Requirement
 Secondary Adjacencies: No Requirement
 Function: General Fabrication of Equipment
 Function Comments: Room dimensions shall be adequate to accommodate maneuvering a 21' length of 6" pipe in the room.

CONSTRUCTION AND FINISHES

Wall Material: Per Design Wall Finish: Painted
 Ceiling Height: 16' Ceiling Material: Open to Structure (painted)
 Floor Finish: Sealed Concrete Wall Base: Rubber - 4" cove
 Finish Comments: None
 Construction Comments: This shop is a fully enclosed room. Provide one double door with direct access to the Main Shop. Minimum room dimensions are 24'x30'.
 Furniture Comments: None
 Casework Comments: None
 Equipment Comments: All Equipment is GFE:
 Equip. located in Shop
 Work Table 48" x 48" (2)
 Drill Press 208V 3PH 30A (1)
 Welder #1 480V 3PH 60 A (1)
 Welder #2 208V 3PH 30 A (1)
 Smoke Eater 120V (1)
 2 Door Storage Cabinets 24" x 60" wide (4)
 Equip. Adjacent to Shop (not inside shop):
 Flammable Storage Cabinet 24" x 36" (2)
 Tool Cage 36" x 96" wide (1)
 Two Door Cabinet 24" x 60" (1)

HVAC

Relative Humidity: See Comments Directional Airflow:
 Heat Generating Equip.:
 HVAC Comments: a. This space shall be an independently controlled thermal zone with 72 and 76 degree F winter and summer inside design temperatures.
 b. HVAC equipment & controls shall maintain space temperature within 2 degrees of the set point (i.e. 70 – 78 F)
 c. HVAC system operation shall produce coincident space relative humidity levels between 30 and 60 percent.
 d. Provide a local exhaust ventilation system to maintain the space at a slightly negative pressure with respect to adjacent areas and avoid unacceptable indoor air contaminant concentration levels in accordance with OSHA.
 e. The exhaust system shall consist of a centrifugal fan, galvanized steel ductwork and exhaust registers of sufficient size and orientation for the capability of adjusting general exhaust intake flow rates for the addition and/or operation of snorkel exhaust hoods for planned welding activities.
 f. Design and operation of the exhaust and air-conditioned supply systems shall be integrated to provide sufficient make-up air and maintain space pressure relationships.

HAZARDS

Hazard Comments: None

ELECTRICAL

Electrical Comments: 120V/20A receptacles: Distribute multiple outlets in main shop area at minimum of 10' o.c. or as defined by user during design.

LIGHTING

Light Level: 50 fc Light Type: Refer to Section 018626
 Lighting Comments: Refer to Section 018626

COMMUNICATION

Comments: Provide one data drop.

PIPING/PLUMBING

Comments: None

GASES

Gases Comments: Provide a Compressed Air Hose Reel

OTHER

Fire Protection: Refer to Section 018613
 Room Data Sheets: None
 Security: Refer to Section 018633

ROOM NAME: **DI / Mechanical Room** Room Number: 17

GENERAL

Number of Occupants: None Minimum floor area: 600 Room Quantity: 1
 Hours per Day: Not Applicable Days per Week: Not Applicable
 Primary Adjacencies: No Requirement
 Secondary Adjacencies: Magnet Test Area, Chopper Test Area, & Power Supply Test Cage (to minimize piping run to serve DI manifold)
 Function: Houses exhaust system equipment, compressed air equipment and the GFE DI system. Other
 Function Comments: DI Room should be located to minimize piping runs to serve DI manifolds in Magnet Test Area, Power Supply Test Cage, and Chopper Test area.

CONSTRUCTION AND FINISHES

Wall Material: Per Design Wall Finish: Painted
 Ceiling Height: 10' Ceiling Material: Open to Structure (painted)
 Floor Finish: Sealed Concrete Wall Base: Rubber - 4" cove
 Finish Comments: None
 Construction Comments: Preferred room dimensions - 20' x 30'
 Provide double door with exterior access.
 Furniture Comments: None
 Casework Comments: None
 Equipment Comments: DI System and related piping is GFE.

HVAC

Relative Humidity: See Comments Directional Airflow:
 Heat Generating Equip.:
 HVAC Comments: Provide space heating and ventilation to maintain 68 degrees F in the winter and 85 degrees F in the summer.

HAZARDS

Hazard Comments: None

ELECTRICAL

Electrical Comments: 480V 100amp Distribution Panel

LIGHTING

Light Level: 30 fc Light Type: Refer to Section 018626
 Lighting Comments: Refer to Section 018626

COMMUNICATION

Comments: None

PIPING/PLUMBING

Comments: Potable water source. Refer to Section 018616 Piping

GASES

Gases Comments: None

OTHER

Fire Protection: Refer to Section 018613
 Acoustical: None
 Security: Refer to Section 018633

SECTION 018100.2

CONCEPTUAL DRAWINGS

NOTE THAT THE DRAWINGS INCLUDED IN THIS SECTION ARE CONCEPTUAL IN NATURE AND DO NOT REPRESENT A FINAL PRODUCT. THEY HAVE BEEN GENERATED FOR SQUARE FOOTAGE VERIFICATION AND BUDGET DEVELOPMENT AND ARE TO BE USED AS REFERENCE ONLY FOR CLARIFICATION OF DESIGN CRITERIA REQUIREMENTS, AND SHOULD NOT BE INTERPRETED AS A FINAL DESIGN FOR THIS PROJECT. THE FINAL DESIGN SHALL BE BASED ON INFORMATION CONTAINED IN THE ROOM DATA SHEETS FOUND IN SECTION 018100.1

GENERAL SITE LOCATION PLAN

EXISTING SITE CONDITIONS

CONCEPTUAL FLOOR PLAN - FIRST FLOOR

CONCEPTUAL FLOOR PLAN – SECOND FLOOR

CONCEPTUAL RENDERINGS

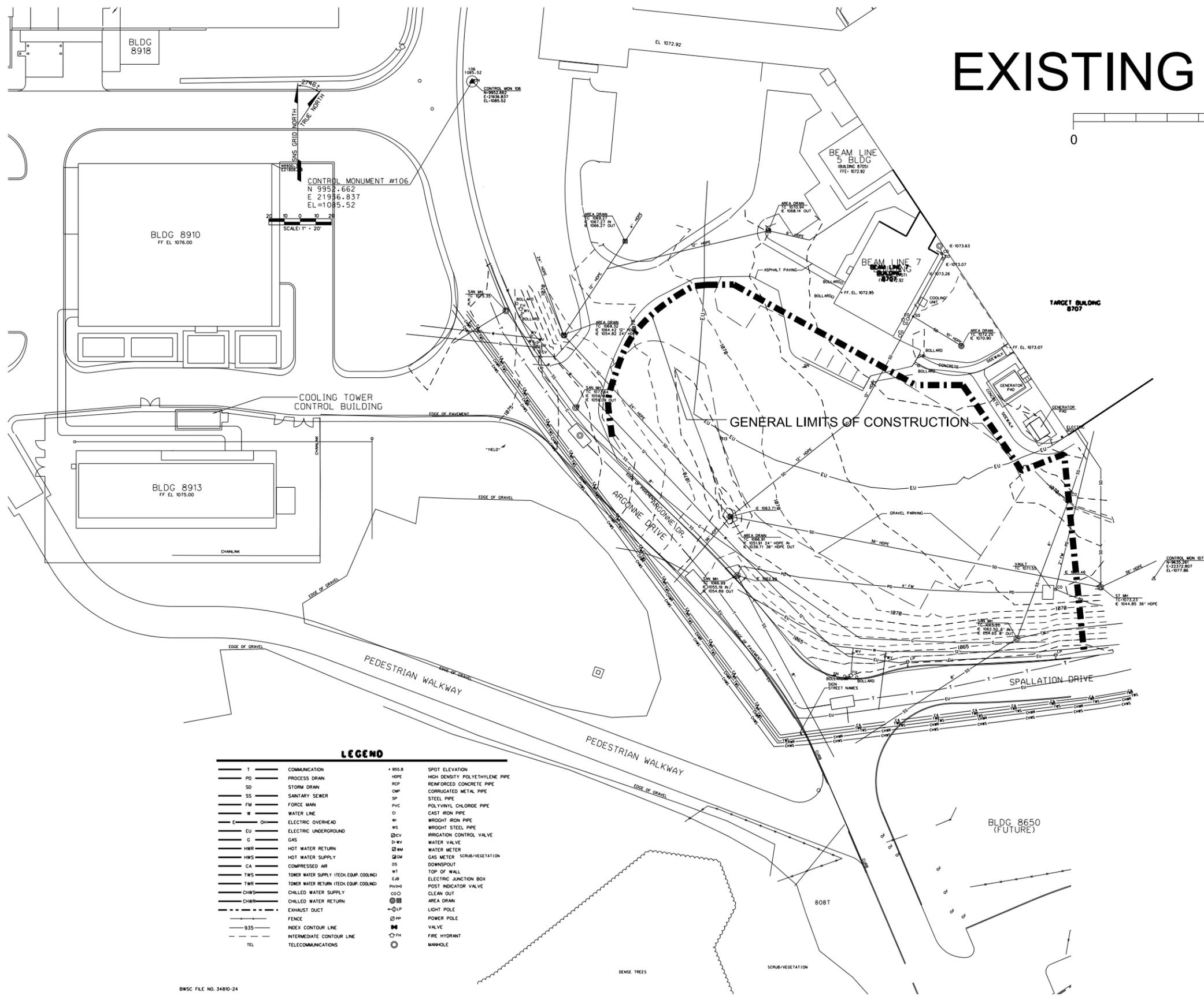
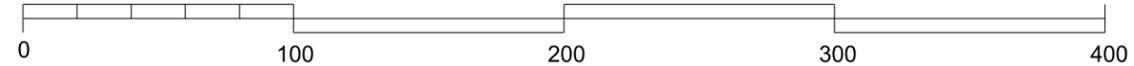
AERIAL PHOTOGRAPHS



TARGET BUILDING SITE

GENERAL SITE LOCATION

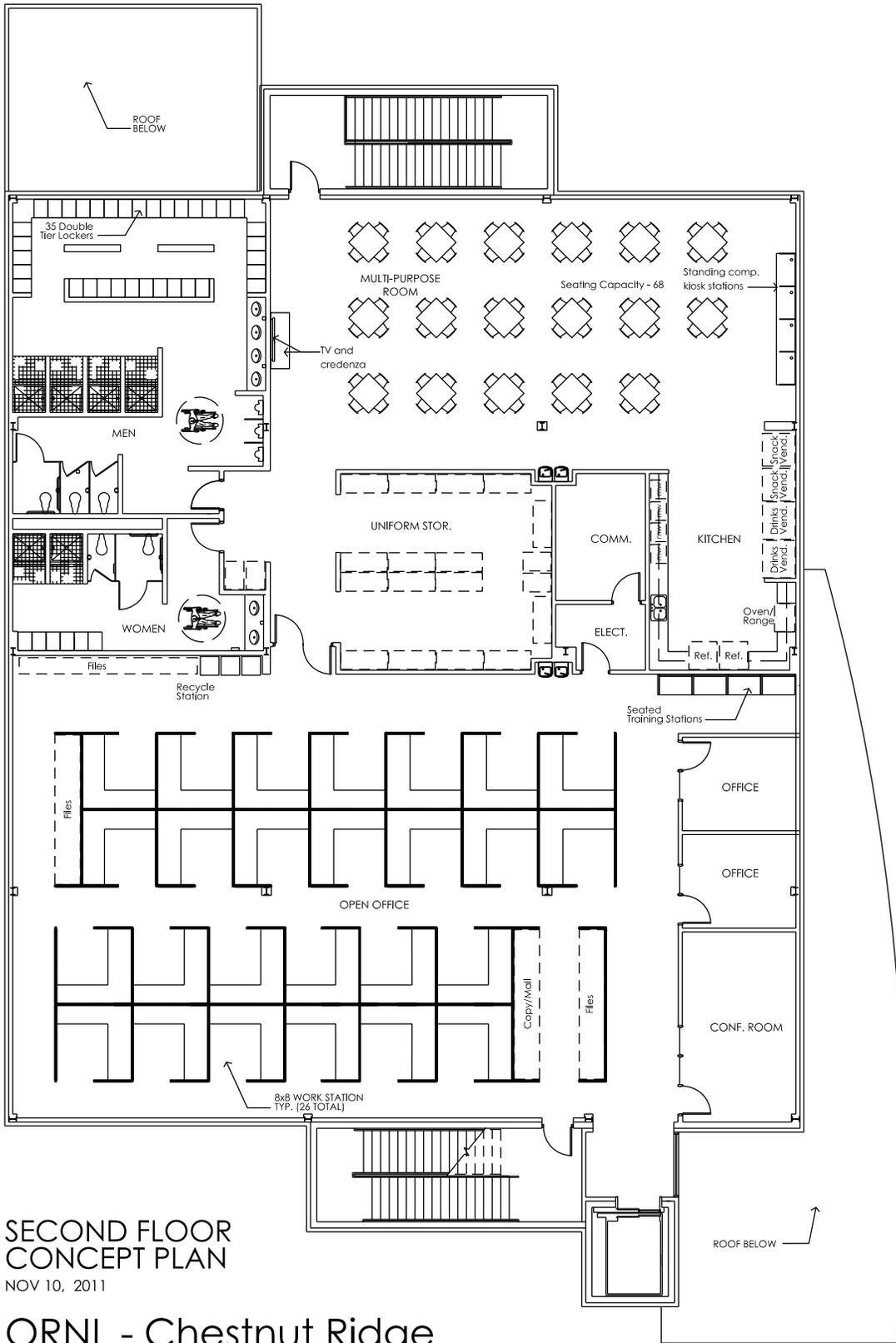
EXISTING SITE CONDITIONS



LEGEND

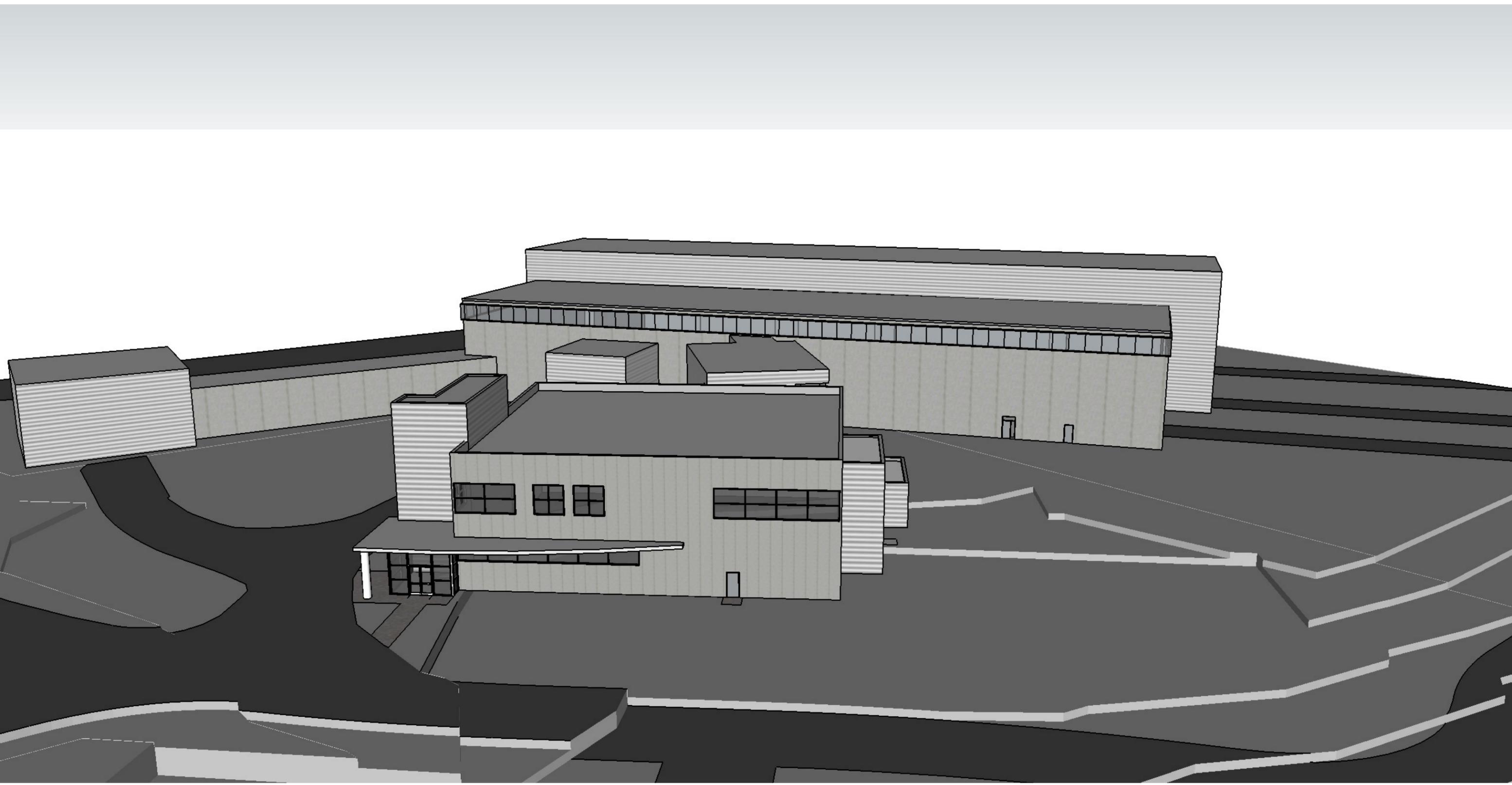
— T —	COMMUNICATION	• 955.8	SPOT ELEVATION
— PD —	PROCESS DRAIN	HDPE	HIGH DENSITY POLYETHYLENE PIPE
— SD —	STORM DRAIN	RCP	REINFORCED CONCRETE PIPE
— SS —	SANITARY SEWER	CMP	CORRUGATED METAL PIPE
— FM —	FORCE MAIN	SP	STEEL PIPE
— W —	WATER LINE	PVC	POLYVINYL CHLORIDE PIPE
— OH —	ELECTRIC OVERHEAD	CI	CAST IRON PIPE
— EU —	ELECTRIC UNDERGROUND	W	WROUGHT IRON PIPE
— G —	GAS	ICV	IRRIGATION CONTROL VALVE
— HWR —	HOT WATER RETURN	D-WV	WATER VALVE
— HWS —	HOT WATER SUPPLY	WM	WATER METER
— CA —	COMPRESSED AIR	GM	GAS METER TORUS/VEGETATION
— TWS —	TOWER WATER SUPPLY (TECH. EQUIP. COOLING)	DS	DOWNSPOUT
— TWR —	TOWER WATER RETURN (TECH. EQUIP. COOLING)	WT	TOP OF WALL
— CHWS —	CHILLED WATER SUPPLY	EJB	ELECTRIC JUNCTION BOX
— CHWR —	CHILLED WATER RETURN	PIV-9	PISTON INDICATOR VALVE
— ED —	EXHAUST DUCT	COO	CLEAN OUT
— F —	FENCE	AD	AREA DRAIN
— 9.35 —	INDEX CONTOUR LINE	LP	LIGHT POLE
— 10.00 —	INTERMEDIATE CONTOUR LINE	PP	POWER POLE
— TEL —	TELECOMMUNICATIONS	V	VALVE
		FH	FIRE HYDRANT
		M	MANHOLE

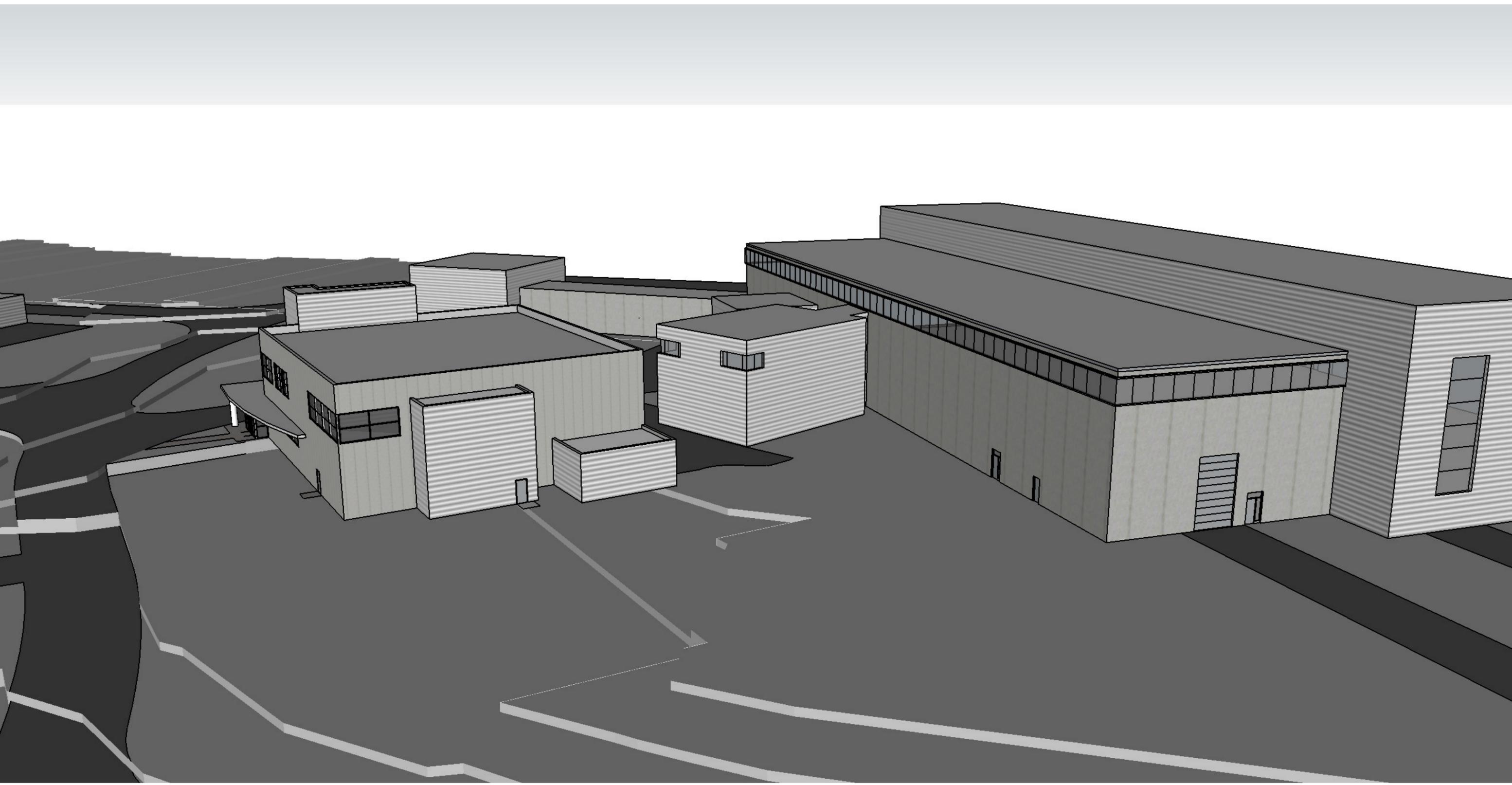
- NOTES**
- NORTH IS BASED ON THE SNS COORDINATE SYSTEM NAD 83 1981. THE SNS GRID ORIGIN POINT IS LOCATED AT X-Y GRID COORDINATES N-27,612.730050 AND E-38,196.144070 WITH THE SNS GRID BEING ROTATED 4 DEGREES CLOCKWISE FROM THE X-Y GRID AT THAT POINT. (88) REFERS TO THE YEAR MARTIN MARBETTA ENERGY SYSTEM (AMES) ESTABLISHED G.P.S. MONUMENTS ON THE OAK RIDGE RESERVATION USING VALUES PUBLISHED IN 1985 BY THE TN DEPT. OF TRANSPORTATION WHICH TIED THE AMES G.P.S. MONUMENTS TO THE TENNESSEE GEODETIC REFERENCE NETWORK SYSTEM.
 - DASHED UTILITY LINES TAKEN FROM DESIGN DRAWINGS AND ARE NOT FIELD AS-BUILTS.
 - UNDERGROUND UTILITIES AND THEIR LOCATIONS ARE SHOWN APPROXIMATELY BY AVAILABLE UTILITY MAPS AND VISIBLE APPURTENANCES AS MARKED BY OTHERS. ADDITIONAL UTILITIES MAY BE PRESENT AND ALL LOCATIONS SHOULD BE VERIFIED BY THE APPROPRIATE UTILITY AUTHORITY BEFORE EXCAVATION OR CONSTRUCTION.



SECOND FLOOR
 CONCEPT PLAN
 NOV 10, 2011

ORNL - Chestnut Ridge Maintenance Shops













PROPOSED GENERAL SITE

SECTION 018200 - STRUCTURAL

1.1. Project Specific Requirements

- A. See Section 018100 – Overview, for general requirements.
- B. See Section 018300 – Architectural, for building layout.
- C. See Section 018613 – Fire Protection, for the type of construction.
- D. See Section 018113 – Energy and Sustainability, for LEED certification requirements on recycled content.
- E. The design criteria listed in this section are minimum requirements. Specific operational requirements may demand designs that exceed the minimum requirements listed herein. During the design, the A-E will be required to meet with the research teams that are programmed to occupy the facility to determine/verify specific requirements along with additional structural performance needs (e.g., special loadings, vibration limits, crane performance requirements, etc) not currently in this design criteria.
- F. The proposed facility shall be designed to meet the requirements of DOE-STD-1020-02 for Performance Category PC-1 structures by complying with the 2009 International Building Code (IBC), Chapter 16, with Importance Factors consistent with Occupancy Category II.
- G. Minimum Live Loads:
 - 1. Shop floors (slab-on-grade) to Magnet Test Area & Magnet Staging area
 - a. Uniformly distributed 1,000 psf
 - b. Concentrated: 10T magnet supported by a 20T capacity fork truck (see 018200.2)
 - 2. Shop floors (slab-on-grade), All other areas
 - a. Uniformly distributed 500 psf
 - b. Concentrated: 5,000 lbs
 - 3. Mezzanine floor (if any)
 - a. Uniformly distributed: 200 psf
 - b. Concentrated: 2,000 lbs
 - 4. Office floors
 - a. Uniformly distributed: 80 psf
 - b. Concentrated: 2,000 lbs
 - 5. Mechanical rooms
 - a. Uniformly distributed: 150 psf
 - b. Concentrated: 2,000 lbs
 - 6. Corridors
 - a. Uniformly distributed Equal to the largest Live Load of any room to which they are connected.
 - b. Concentrated 2,000 lbs
 - 7. Stairs

- a. Uniformly distributed 100 psf
 - 8. Roof
 - a. Uniformly distributed: 20 psf (non-reducible)
 - b. Concentrated: Roof supported equipment loads
 - c. Collateral: 20 psf
 - 9. Assembly area
 - a. Uniformly distributed: 100 psf
 - H. Monorail/Jib Crane – a monorail or jib crane will be located inside the roll-up door to the main shop area. See Room Data sheets for additional functional requirements.
 - 1. Capacity: 2 ton
 - 2. Hook height: 12 feet above finish floor (must also extend to the floor)
 - I. Deflection Limits – In accordance with IBC 2009, Section 1604.
- 1.2. Design Standards.
- A. Work Smart Standards.
 - 1. International Building Code (IBC), 2009.
 - 2. DOE Order O-420.1, Facility Safety.
 - B. Additional Codes & Standards.
 - 1. DOE STD-1020-2002, Natural Phenomena Hazards Design & Evaluation Criteria for DOE Facilities.
 - 2. American Society of Civil Engineers (ASCE) ASCE 7, Minimum Design Loads for Buildings and Other Structures.
 - 3. ASME B30.11 – Monorails and Underhung Cranes
 - 4. ASME B30.16 – Overhead Hoists (Underhung)
- 1.3. General.
- A. The following facility information/classifications shall be denoted on the drawings:
 - 1. DOE STD 1020-02: Performance Category (PC) 1.
 - 2. International Building Code:
 - a. Occupancy Classification: Mixed, refer to 018613, Fire Protection.
 - b. Construction Type: IIB.
 - B. All structural drawings, specifications, and calculations shall be sealed by a PE licensed in the State of Tennessee.
- 1.4. Structural Systems.
- A. General.

1. A description of the structural systems, including the lateral force resisting system, geotechnical parameters, design loads, site class, and seismic design category shall be summarized on the design drawings and any design assumptions.
 2. Any structural feature requiring concrete shall contain a minimum of 20% flyash in the mix, unless performance requirements dictate otherwise.
 3. Walls used to support equipment, cabinetry, etc. shall be designed to safely carry all imposed loads.
- B. Foundations.
1. The building's foundations shall be designed to support all design loads within the allowable soil parameters defined in the Geotechnical Report.
 2. Field testing shall be performed during construction to verify that actual bearing pressure capacities meet or exceed the design values.
 3. Provide waterproofing for all below grade exterior walls and water stops in all construction joints.
- C. Floors - Floor systems shall be designed to carry the intended loads and meet the following provisions:
1. Design of concrete slabs on grade shall utilize the subsurface soil parameters defined the Geotechnical Report. Minimum concrete strength shall be 4000 psi.
 2. All concrete floors not receiving epoxy finish or similar floor treatment shall have sealer applied to prevent dusting.
 3. Concrete floor slab flatness and levelness shall be specified in the construction documents to meet the intended use of the floors and shall be tested in accordance with ASTM E1155, as required. Remedial action shall be required by the Seller at no cost to the Company if measured F numbers are less than those specified.
 4. For slabs on grade where a vapor barrier is required, a 3 inch sand layer shall be specified between the vapor barrier and slab.
 5. Elevated floor systems shall be designed to avoid resonant vibration due to human activity (reference AISC Design Guide 11: Floor Vibrations Due to Human Activity).
- D. Roofs.
1. Secondary (overflow) drainage shall be provided.
 2. The roof system shall be designed to support the maximum depth of ponded water assuming the primary drainage system is blocked.
- E. Concrete
1. Concrete construction must be in accordance with ACI 301.
 2. Concrete floors and slabs must be in accordance with ACI 302.1R.
 3. Concrete construction tolerances must be in accordance with ACI 117.
 4. Any structural feature requiring concrete shall contain a minimum of 20% flyash in the mix, unless performance requirements dictate otherwise.
- F. Masonry
1. All masonry design and construction must be in accordance with ACI 530.
 2. All concrete masonry must have a specified compressive strength of not less than 1,500 psi.

3. Provide control joints in masonry walls in accordance with NCMA Tek 10-2B or Tek 10-3 and BIA Technical Notes 18A. The structural engineer must coordinate with the architect to assure that the requirements for masonry control and expansion joints are clearly shown on the construction drawings.
4. Concrete masonry unit foundation walls below grade must be completely filled with grout.
5. Shear walls must use running bond construction.
6. Air spaces, cavities, chases, expansion joints and spaces to be grouted must be kept free from mortar and other debris.
7. Provide anchors and ties for cavity walls. Do not use corrugated metal ties or ties with an integral drip in cavity walls.

G. Structural Steel

1. Structural steel fabrication and erection procedures must be in accordance with AISC Code of Standard Practice.
2. Provide Tension Control (TC) bolts or Direct Tension-Indicating (DTI) washers at all bolted connections.
3. All structural steel exposed to weather must be adequately protected to prevent corrosion. All galvanized structural steel must be in accordance with ASTM A123/123M or ASTM A153/A153M, as applicable. Galvanize after fabrication where practical. Repair galvanized coatings using ASTM A780 zinc-rich paint for galvanizing damaged by handling, transporting, cutting, welding or bolting.
4. All weld metal and base metal subjected to cyclic tension must be supplied with “charpy” V-notch testing in accordance with ASTM A6 supplementary requirement SS (5 specimen option). The impact test must meet a minimum average value of 27.1 Joules (20 ft-lbs.) absorbed energy at -18 degrees C (0 degrees F).

H. Steel Joists

1. All steel joist design and construction must be in accordance with the latest standards and specifications of the Steel Joist Institute (SJI).

I. Steel Deck

1. All steel deck design and construction must be in accordance with the latest standards and specifications of the Steel Deck Institute (SDI).
2. Steel form deck must be a minimum of 28 gage in thickness. Roof and composite decks must be a minimum of 20 gage in thickness.
3. At a minimum, all steel deck must be galvanized in accordance with ASTM A 653/653M G60 specifications.

J. Cold-Formed Steel Framing

1. All cold-formed steel framing design and construction must be in accordance with the latest standards and specifications of the American Iron and Steel Institute (AISI).
2. Design using cold-formed steel studs and joists must comply with the material specifications, nomenclature, section properties and load tables found in SSMA Product Technical information.
3. Minimum thickness of cold-formed steel framing members to be welded must be 16 gage in thickness.

4. All cold-formed steel framed walls must be anchored to foundations with galvanized anchors as needed to resist the design forces. Anchors for exterior walls, interior load bearing walls, and shear walls must not be less than ½ inch diameter embedded anchor bolts, expansion bolts or adhesive anchor systems with 4 inch embedment spaced at a maximum of 48 inches on center. Anchors for interior non-bearing, non-shearwall partitions must not be less than 3/8 inch diameter embedded anchor bolts, expansion anchors or adhesive anchor systems with 4 inch embedment spaced a maximum of 48 inches on center, or with 0.145 inch diameter powder-actuated fasteners spaced at 24 inches on center.
5. Cold-formed steel members must be connected with screw fasteners or by welding. The use of “pneumatic nailing” is not permitted.

K. Precast Concrete.

1. The precast concrete plant shall be certified by the Precast/Prestressed Concrete Institute’s (PCI) Plant Certification Program prior to the start of production.
2. Manufacturing procedures and tolerances shall comply with PCI MNL-116, Manual for Quality Control for Plants and Production of Precast and Prestressed Concrete Products.
3. Exposed surfaces shall be free of form lines and other surface blemishes. Inspection and acceptance of the first production units will be required before delivery.

1.5. Equipment Supports.

- A. Seismic design of equipment supports and anchorage shall be in accordance with IBC 2009.

1.6 Delegate-Engineered System of Component Parts

- A. The engineer-of-record for the facility may delegate responsibility for the design of the following systems or component parts of the structure to a qualified delegated engineer. Both the engineer-of-record and the delegated engineer must comply with the design criteria of this section. The following systems/components may be delegated:
 1. Cast-in-place, post-tensioned concrete structural systems
 2. Precast, pre-stressed components
 3. Open web steel joists and joist girders
 4. Structural steel connections
 5. Cold-formed steel joist/stud/truss framing and pre-fabricated components
 6. Seismic anchorage of equipment
- B. The structural construction documents must include the following:
 1. Complete dimensional information as required to design the system or component part.
 2. The nature, location and magnitude of all design loads to be imposed on the structure.
 3. All design criteria for both the overall structure and the system or component part to be designed by the delegated engineer.
 4. All serviceability limits states that apply to the system or component part to be designed by the delegated engineer.
- C. The delegated engineering submittals must include the following information:

1. Identification of the project.
2. A printed title block bearing the printed name, address, license number of the delegated engineer, and the date on the drawing.
3. The seal and signature of the delegated engineer.
4. Installation or erection drawings, showing full details of materials to be used, including necessary accessories and instruction for construction, component details and connection details.
5. Calculations, showing all loads and other design criteria, and the magnitude and location of loads and reactions on other parts of the structural system.

1.7. Fall Protection

- A. Fall prevention and protection must be considered for the facility whenever there is a need to perform maintenance work or store materials at heights. During preliminary design, fall hazards shall be considered and eliminated whenever possible. When elimination or prevention of fall hazards is not feasible, the design must include certified fall protection system and anchorages meeting the requirements of OSHA and ANSI/ASSE Z359. (Recommended pre-engineered systems are available from DBI/SALA and Miller).
- B. Fall protections will be totally inspected annually and all parts of the system must be visible for inspection (no collars or covers).

1.8. Quality Control and Testing

- A. At a minimum, quality control and testing of construction materials and activities shall be performed as outlined in Chapter 17 of the 2009 International Building Code. All Cost of construction inspections and testing shall be the responsibility of the Seller. When warranted by the project scope, the structural engineer of record must require additional inspections, tests, certifications, documentation and observation beyond those required in IBC. The construction documents must contain a list of all required special inspections, field tests, laboratory tests, certifications, documentation and field observations required.

1.9. Design Drawing Information and Calculations

- A. All structural drawings, specifications, and calculations shall be sealed by a PE licensed in the State of Tennessee
- B. Drawings shall include, all geotechnical parameters, and identify the source of all loads including Live Loads, Dead Loads, Collateral Loads, Wind pressures, the DOE performance Category (PC), a description of the lateral force system, the site class, and seismic design parameters.
- C. Clearly define the types, grades and properties of materials for each structural element and system.



- D. Provide a summary of the quality assurance requirements.
- E. An electronic copy of the structural calculations (pdf file format) shall be provided to the Company by the AE firm.

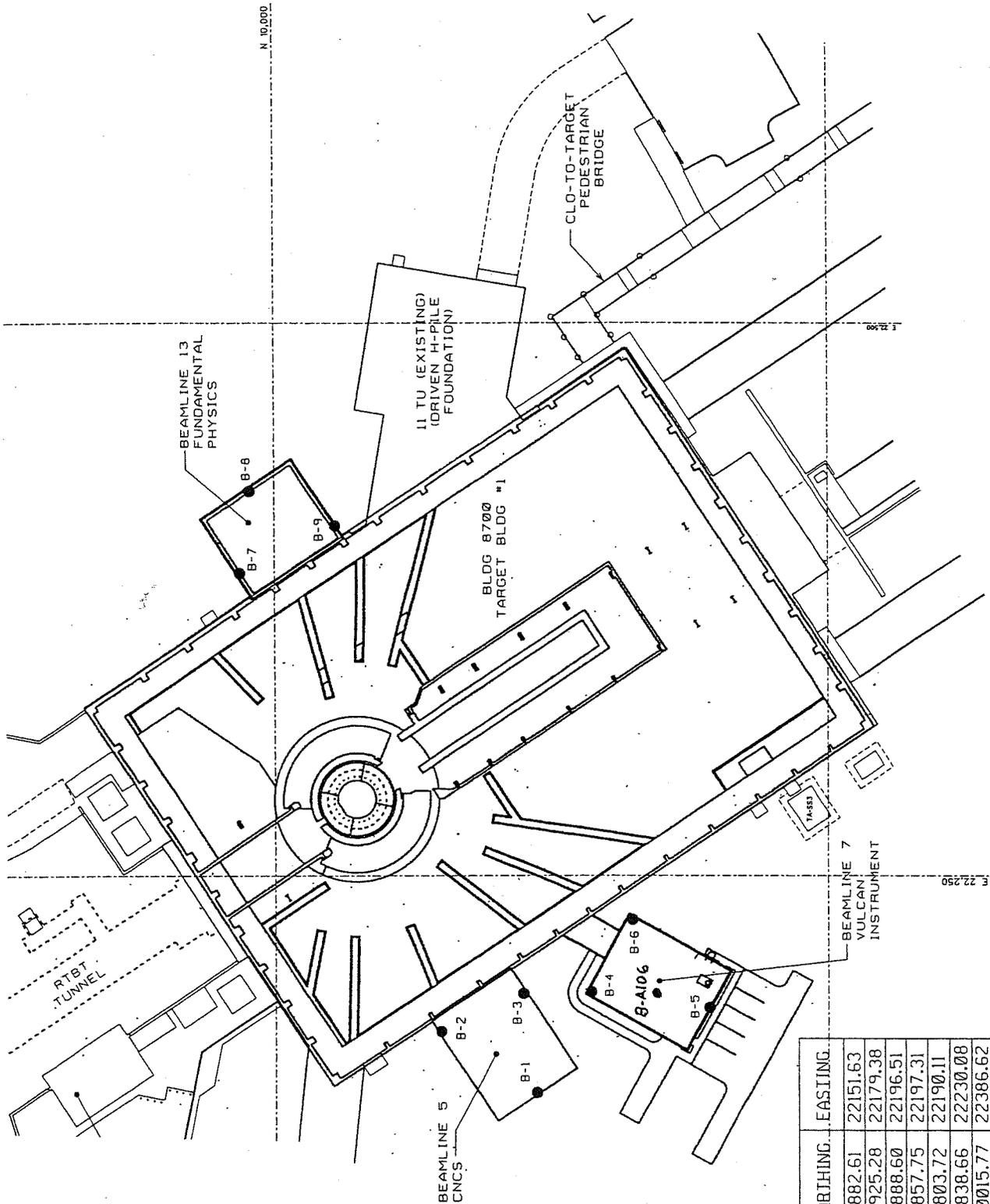
END OF SECTION 018200 - STRUCTURAL



SECTION 018200.1

SOILS INFORMATION

(To be used at the discretion of the A/E until a formal report is obtained by the Seller)



● Boring Location
 Base map provided by ORNL
 Boring locations are shown in general arrangement only and
 should not be used for determination of distances or quantities.

BORING NUMBER	NORTHING	EASTING
B-1	9882.61	22151.63
B-2	9925.28	22179.38
B-3	9888.60	22196.51
B-4	9857.75	22197.31
B-5	9803.72	22190.11
B-6	9838.66	22230.08
B-7	10015.77	22386.62
B-8	10011.21	22423.81
B-9	9972.65	22408.26

SCALE:	As Shown
CHECKED BY:	DAH
DRAWN BY:	TCS
DATE:	June 2, 2005



Boring Location Plan	
Proposed Vulcan External Facility	
Oak Ridge, TN	
JOB NO:	1431-05-156

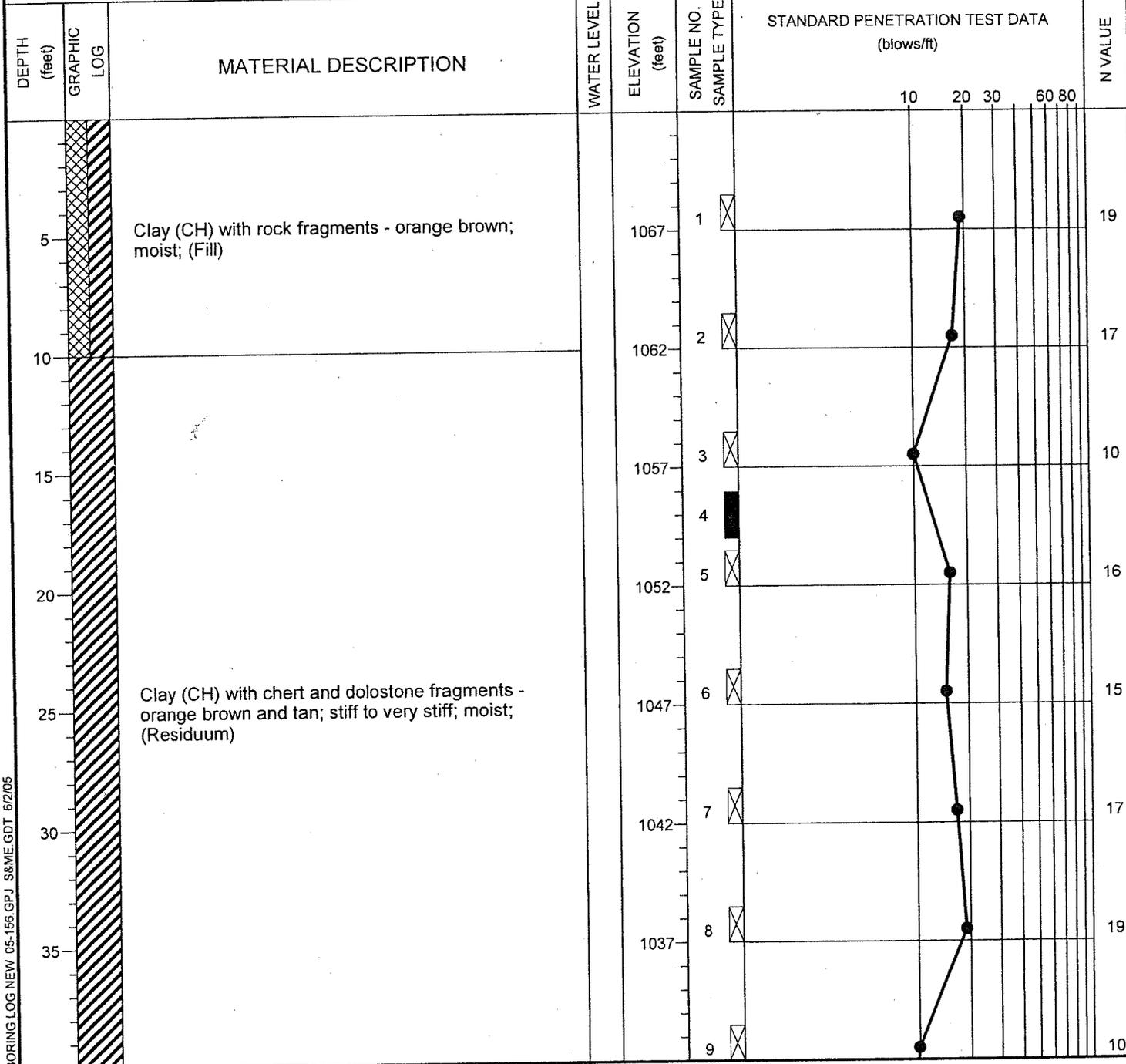
FIGURE NO:	1
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PROJECT: Instrument Buildings SNS Campus ORNL
Oak Ridge, Tennessee
S&ME Project No. 1431-05-156

BORING LOG B-5

DATE DRILLED: 3/17/05 ELEVATION: 1072
 DRILLING METHOD: CME 550, 3/4" H.S.A. BORING DEPTH: 70.0 feet
 LOGGED BY: J. Cole WATER LEVEL @ TOB: Dry
 DRILLER: T. Hall WATER LEVEL @ 24 hrs: Dry

NOTES: Soil descriptions based on visual observation of obtained samples.
N = 9803.72
E = 22190.11



BORING LOG NEW 05-156.GPJ S&ME.GDT 6/2/05

NOTES:

1. THIS LOG IS ONLY A PORTION OF A REPORT PREPARED FOR THE NAMED PROJECT AND MUST ONLY BE USED TOGETHER WITH THAT REPORT.
2. BORING, SAMPLING AND PENETRATION TEST DATA IN GENERAL ACCORDANCE WITH ASTM D-1586.
3. STRATIFICATION AND GROUNDWATER DEPTHS ARE NOT EXACT.
4. WATER LEVEL IS AT TIME OF EXPLORATION AND WILL VARY.



DATE DRILLED: 3/17/05	ELEVATION: 1072	NOTES: Soil descriptions based on visual observation of obtained samples.
DRILLING METHOD: CME 550, 3/4" H.S.A.	BORING DEPTH: 70.0 feet	
LOGGED BY: J. Cole	WATER LEVEL @ TOB: Dry	
DRILLER: T. Hall	WATER LEVEL @ 24 hrs: Dry	

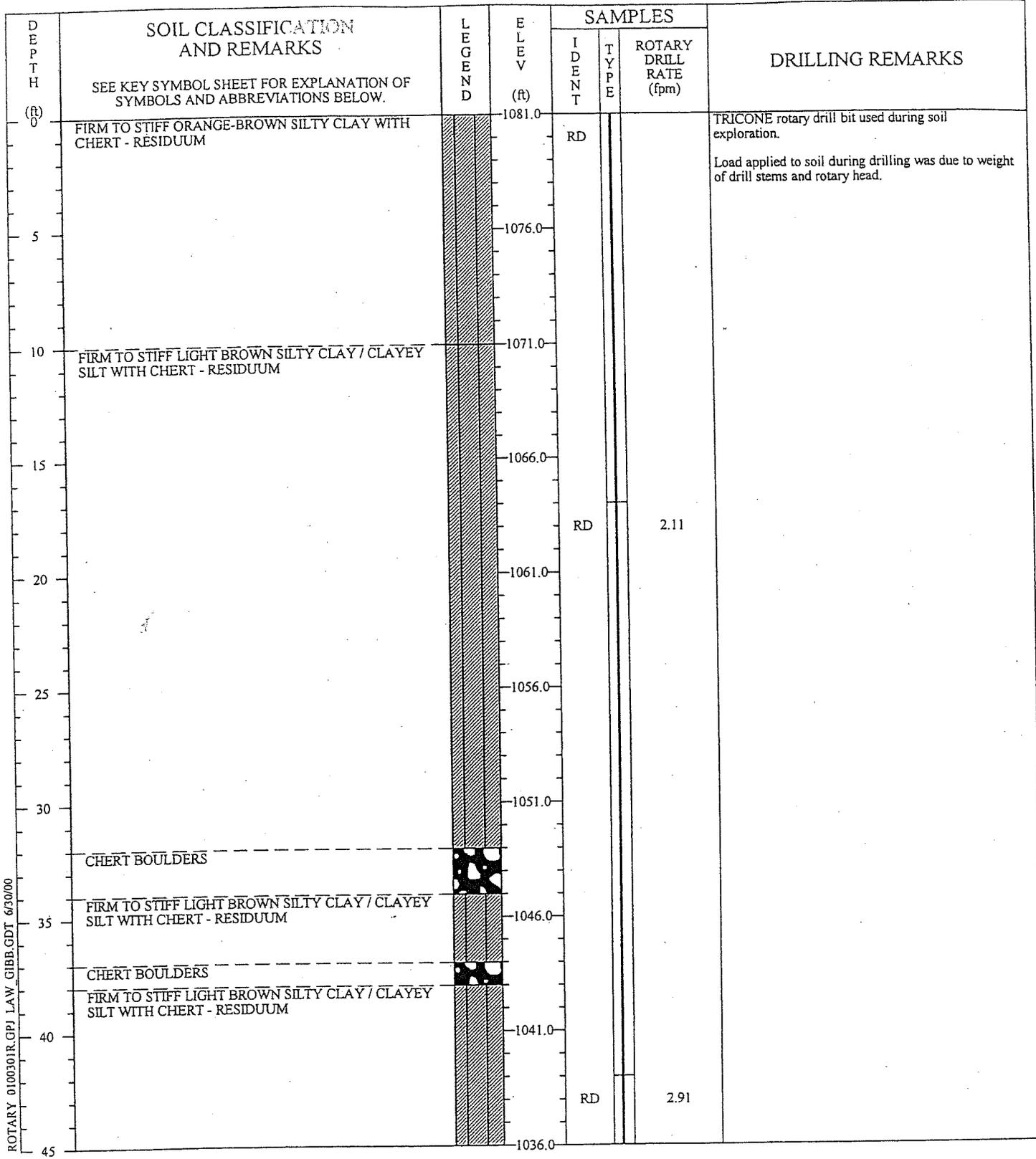
DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet)	SAMPLE NO. SAMPLE TYPE	STANDARD PENETRATION TEST DATA (blows/ft)	N VALUE
45		Clay (CH) with chert and dolostone fragments - orange brown and tan; stiff to very stiff; moist; (Residuum) (continued) --- with sand		1027	10	10	9
50				1022	11	20	16
55				1017	12	15	14
60				1012	13	60	61
65				1007	14	15	15
70				1002	15	15	17
		Boring Terminated at 70 feet					

BORING LOG NEW 05-156.GPJ, S&ME.GDT, 6/2/05

NOTES:

1. THIS LOG IS ONLY A PORTION OF A REPORT PREPARED FOR THE NAMED PROJECT AND MUST ONLY BE USED TOGETHER WITH THAT REPORT.
2. BORING, SAMPLING AND PENETRATION TEST DATA IN GENERAL ACCORDANCE WITH ASTM D-1586.
3. STRATIFICATION AND GROUNDWATER DEPTHS ARE NOT EXACT.
4. WATER LEVEL IS AT TIME OF EXPLORATION AND WILL VARY.





ROTARY 0100301R.GPJ LAW GIBB.GDT 6/30/00

REMARKS: SOIL CONSISTENCIES WERE JUDGED BY
ENGINEER BY OBSERVING AND MONITORING
DRILL RATES.

THIS RECORD IS A REASONABLE INTERPRETATION
OF SUBSURFACE CONDITIONS AT THE EXPLORATION
LOCATION. SUBSURFACE CONDITIONS AT OTHER
LOCATIONS AND AT OTHER TIMES MAY DIFFER.
INTERFACES BETWEEN STRATA ARE APPROXIMATE.
TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

SOIL TEST BORING RECORD	
PROJECT:	Spallation Neutron Source - SNS
DRILLED:	May 22, 2000
PROJ. NO.:	50300-0-1003/01/800
BORING NO.:	B-A106
PAGE 1 OF 5	
 LAWGIBB Group Member 	

DEPTH (ft)	SOIL CLASSIFICATION AND REMARKS SEE KEY SYMBOL SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS BELOW.	LEGEND	ELEV (ft)	SAMPLES		DRILLING REMARKS
				IDENT	TYPE	
45	FIRM TO STIFF LIGHT BROWN SILTY CLAY / CLAYEY SILT WITH CHERT - RESIDUUM		1036.0			
50	CHERT BOULDERS SOFT TO FIRM GRAY-BROWN CLAYEY SILT WITH CHERT - RESIDUUM		1031.0			
55			1026.0			
60			1021.0			
65			1016.0			
70	CHERT BOULDERS SOFT TO FIRM GRAY-BROWN CLAYEY SILT WITH CHERT - RESIDUUM		1011.0	RD	5.56	
75			1006.0			
80			1001.0			
85			996.0			
90			991.0			

ROTARY 0100301R.GPJ LAW_GIBB.GDT 6/30/00

REMARKS: SOIL CONSISTENCIES WERE JUDGED BY ENGINEER BY OBSERVING AND MONITORING DRILL RATES.

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SOIL TEST BORING RECORD	
PROJECT:	Spallation Neutron Source - SNS
DRILLED:	May 22, 2000
BORING NO.:	B-A106
PROJ. NO.:	50300-0-1003/01/800
PAGE 2 OF 5	
	

DEPTH (ft)	SOIL CLASSIFICATION AND REMARKS SEE KEY SYMBOL SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS BELOW.	LEGEND	ELEV (ft)	SAMPLES		DRILLING REMARKS
				IDENT	TYPE	
90	SOFT TO FIRM LIGHT BROWN SILTY CLAY / CLAYEY SILT WITH CHERT - RESIDUUM		991.0			
95				RD		4.05
100			986.0			
105			981.0			
110			976.0			
115			971.0			
120			966.0			
125			961.0	RD		
130			956.0			
135			951.0			
			946.0			

ROTARY 0100301R.GPJ LAW_GIBB.GDT 6/30/00

REMARKS: SOIL CONSISTENCIES WERE JUDGED BY ENGINEER BY OBSERVING AND MONITORING DRILL RATES.

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SOIL TEST BORING RECORD	
PROJECT:	Spallation Neutron Source - SNS
DRILLED:	May 22, 2000
BORING NO.:	B-A106
PROJ. NO.:	50300-0-1003/01/800
PAGE 3 OF 5	
 LAW LAWGIBB Group Member 	

DEPTH (ft)	SOIL CLASSIFICATION AND REMARKS SEE KEY SYMBOL SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS BELOW.	LEGEND	ELEV (ft)	SAMPLES			DRILLING REMARKS
				IDENT	TYPE	ROTARY DRILL RATE (fpm)	
135	FROM 134.0' TO 162.0', ENCOUNTERED HIGHLY FRACTURED AND WEATHERED ZONE WITH CAVITIES, DOLOMITE SEAMS AND CHERT INTERMITTENT	[Solid black bar]	946.0				TRICONE rotary drill bit used during rock exploration. Load applied to rock during drilling was 17,500 lbs.
140			941.0				
145			936.0				
150			931.0				
155			926.0				
160			921.0				
	WEATHERED BEDROCK - DOLOMITE	[Horizontal lines]					
165	FROM 164.0' TO 170.5', ENCOUNTERED HIGHLY FRACTURED AND WEATHERED ZONE WITH CAVITIES, DOLOMITE SEAMS AND CHERT INTERMITTENT	[Solid black bar]	916.0				
170			911.0				
	DOLOMITE	[Horizontal lines]					
	FROM 171.5' TO 177.5', ENCOUNTERED HIGHLY FRACTURED AND WEATHERED ZONE WITH CAVITIES, DOLOMITE SEAMS AND CHERT INTERMITTENT	[Solid black bar]	906.0				
175			906.0				
	SOUND (UNWEATHERED) BEDROCK - DOLOMITE	[Horizontal lines]					
180			901.0				

ROTARY 0100301R.GPJ LAW.GIBB.GDT 6/30/00

REMARKS: SOIL CONSISTENCIES WERE JUDGED BY ENGINEER BY OBSERVING AND MONITORING DRILL RATES.

THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BETWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

SOIL TEST BORING RECORD			
PROJECT:	Spallation Neutron Source - SNS		
DRILLED:	May 22, 2000	BORING NO.:	B-A106
PROJ. NO.:	50300-0-1003/01/800	PAGE 4 OF 5	
 LAW LAWGIBB Group Member 			

DEPTH (ft)	SOIL CLASSIFICATION AND REMARKS SEE KEY SYMBOL SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS BELOW.	LEGEND	ELEV (ft)	SAMPLES			DRILLING REMARKS
				IDEN T	TY PE	ROTA RY DRILL RATE (fpm)	
180	SOUND (UNWEATHERED) BEDROCK - DOLOMITE		901.0	RD		0.60	
				RD		0.73	
185			896.0	RD		0.57	
				RD		0.67	
190			891.0	RD		0.69	
				RD		0.50	
195			886.0	RD		0.41	
200			881.0	RD			
	AIR ROTARY BORING TERMINATED AT 202.5'						
205			876.0				
			871.0				
210			866.0				
215			861.0				
220			856.0				
225							

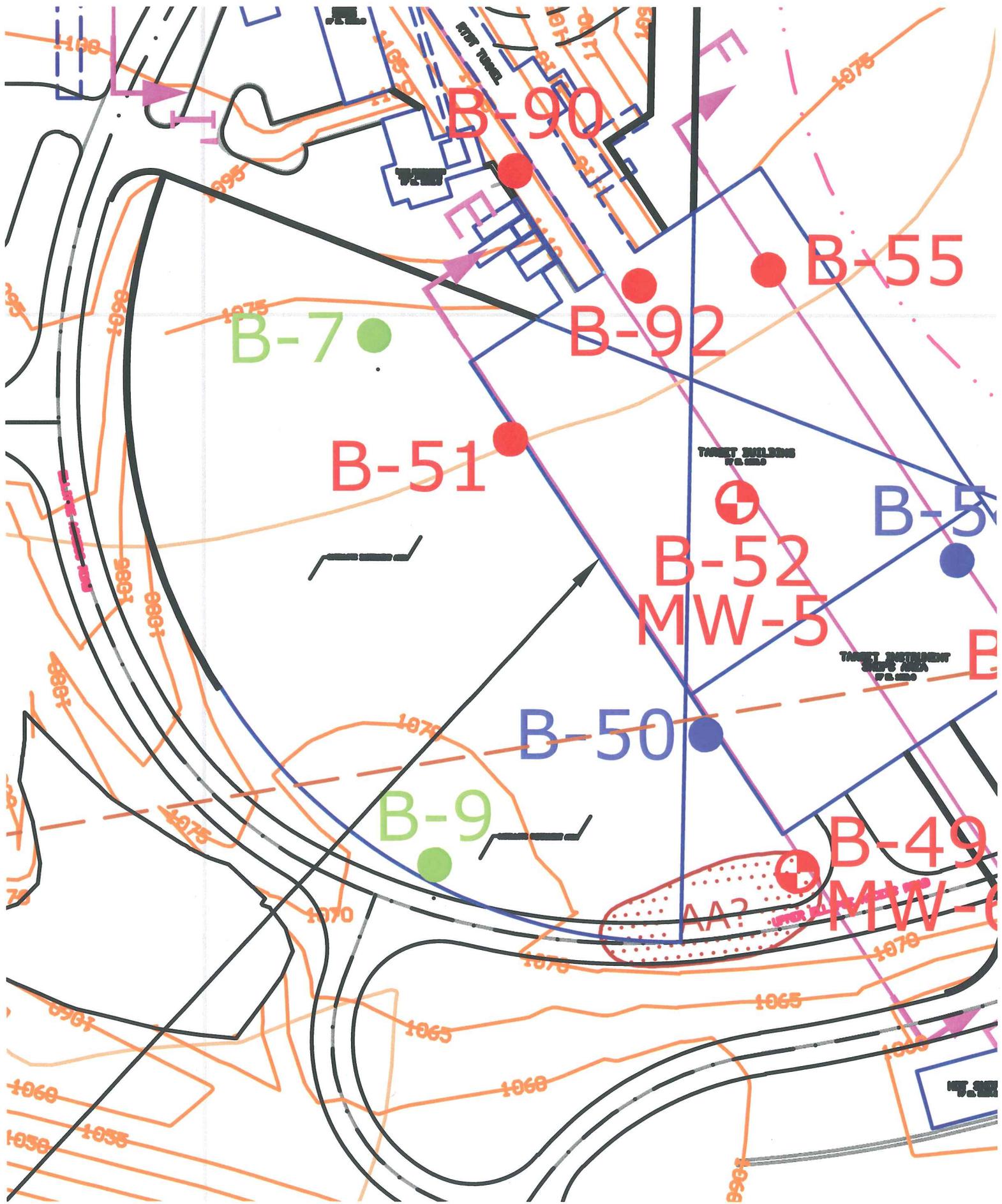
ROTARY 0100301R.GPJ LAW GIBB GDT 6/20/00

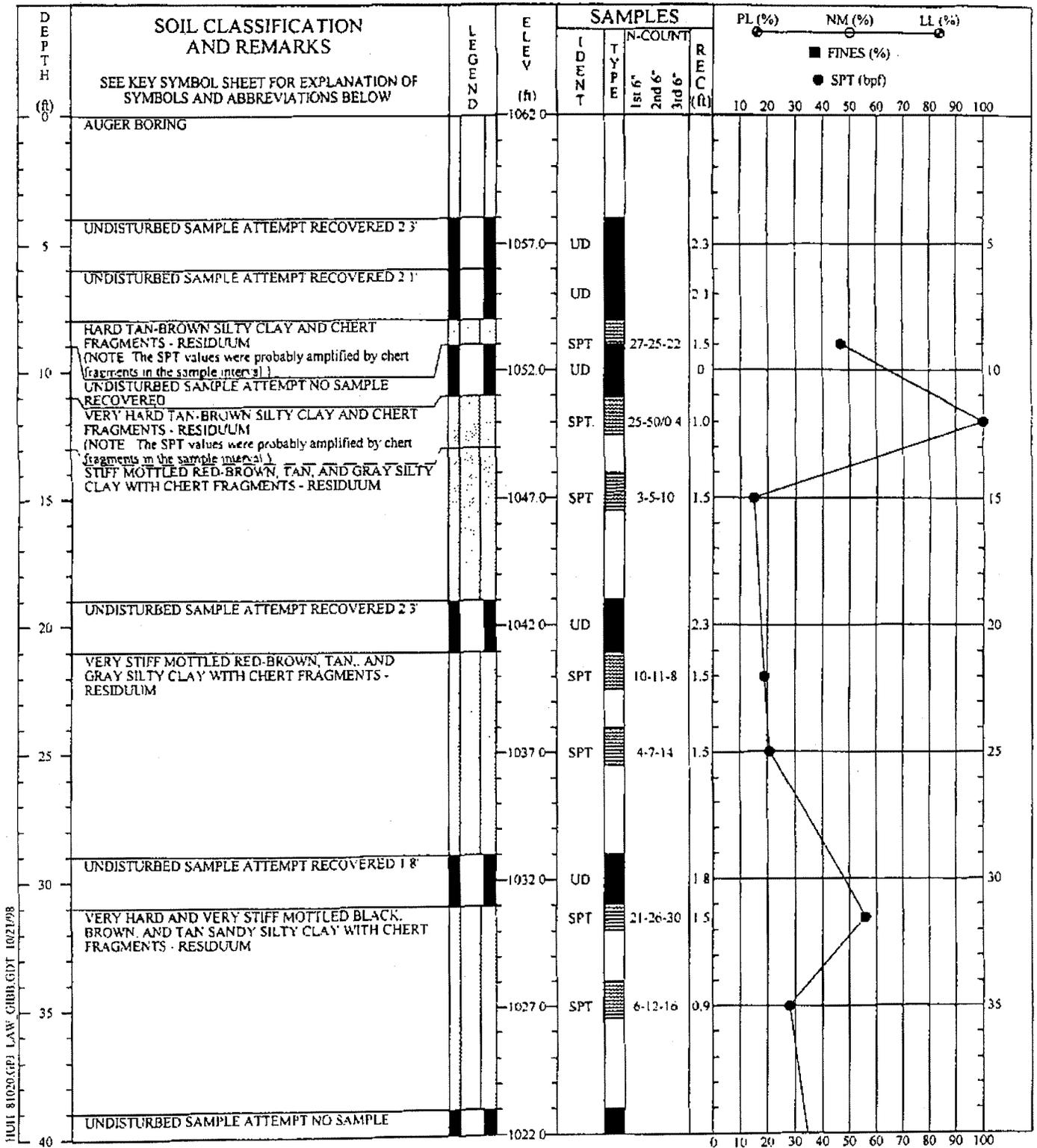
REMARKS: SOIL CONSISTENCIES WERE JUDGED BY ENGINEER BY OBSERVING AND MONITORING DRILL RATES.

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SOIL TEST BORING RECORD

PROJECT: Spallation Neutron Source - SNS
 DRILLED: May 22, 2000 BORING NO.: B-A106
 PROJ. NO.: 50300-0-1003/01/800 PAGE 5 OF 5



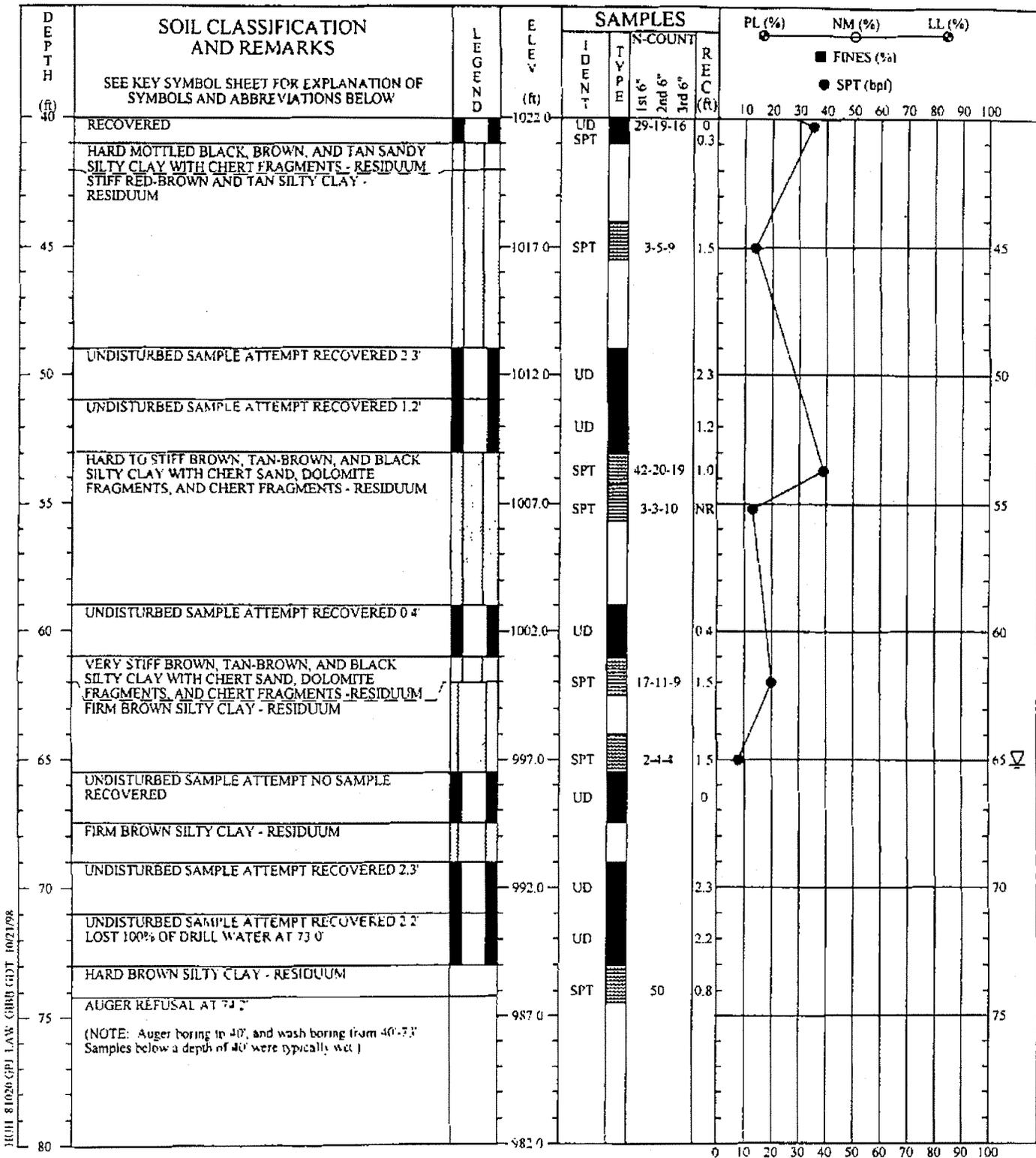


HUI 81020.GPJ LAW GIBB.GDT 10/21/98

REMARKS: STANDARD PENETRATION RESISTANCE TESTING PERFORMED USING AN AUTOMATIC HAMMER. GROUND ELEVATION AT BORING IS APPROXIMATE APPROXIMATE OAK RIDGE ADMINISTRATIVE GRID COORDINATES OF BORING ARE N-27175 AND E-40234

THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BETWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

SOIL TEST BORING RECORD	
PROJECT:	SNS
DRILLED:	July 31, 1998
BORING NO.:	B-9
PROJ. NO.:	50300-8-1020/02
PAGE 1 OF 2	



ICHH 81020 GPT LAW GIBB GPT 10/21/98

REMARKS: STANDARD PENETRATION RESISTANCE TESTING PERFORMED USING AN AUTOMATIC HAMMER GROUND ELEVATION AT BORING IS APPROXIMATE APPROXIMATE OAK RIDGE ADMINISTRATIVE GRID COORDINATES OF BORING ARE N-27175 AND E-40234

THIS RECORD IS A REASONABLE INTERPRETATION OF SURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BETWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

SOIL TEST BORING RECORD	
PROJECT: SNS	BORING NO.: B-9
DRILLED: July 31, 1998	PROJ. NO.: 50300-8-1020/02
PAGE 2 OF 2	

SECTION 018200.2

FORK TRUCK SPECIFICATIONS



LIFTMASTERS™

PNEUMATIC TIRE LIFT TRUCKS

STANDARD SPECIFICATIONS

P400 - PL520

**40,000 LBS TO 55,000 LBS
RATED LOAD CAPACITIES**



Models Include: P400 / P450 / P500 / P550 / PL520

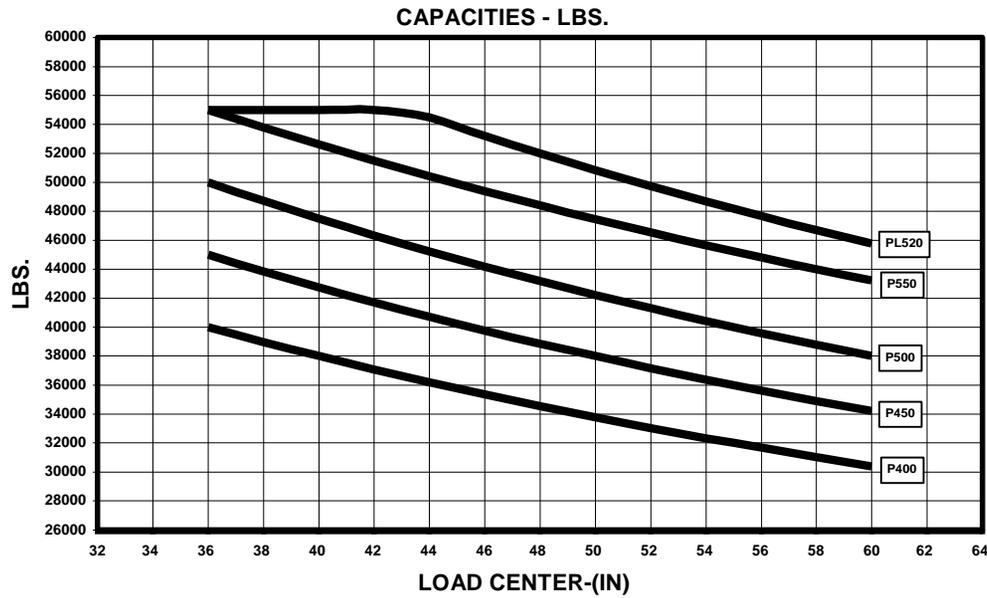


STANDARD MODEL SPECIFICATIONS

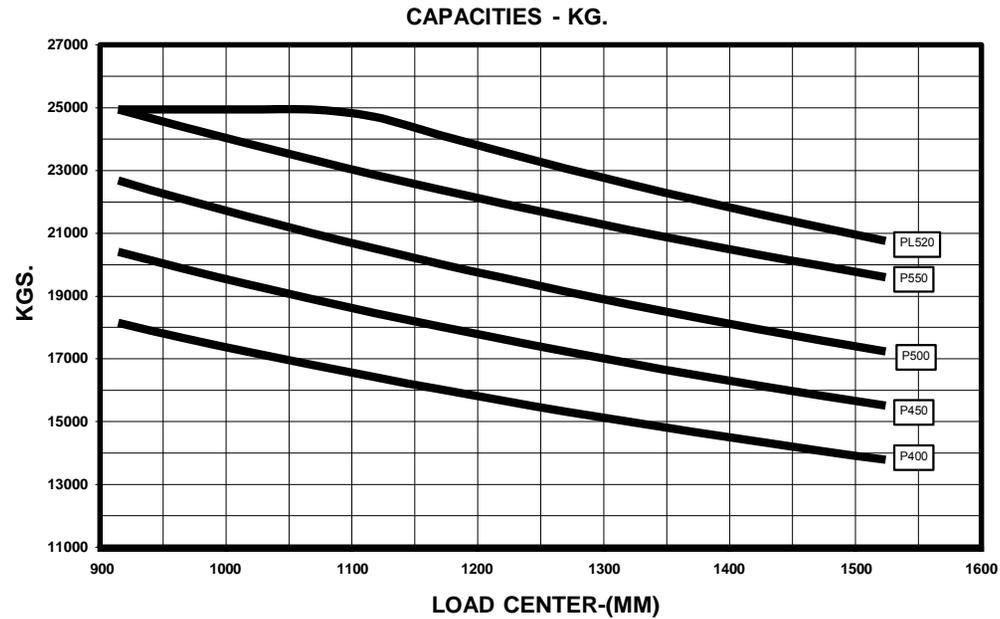
MODEL		P400	P450	P500	P550	PL520	
1	Rated Capacity	lbs. (kg)	40,000 (18,144)	45,000 (20,412)	50,000 (22,680)	55,000 (24,948)	52,000 (23,587)
2	Load center	in. (mm)	36 (914)	36 (914)	36 (914)	36 (914)	48 (1,219)
3	Maximum Fork Height (MFH)	in. (mm)	168 (4,267)	152 (3,861)	152 (3,861)	136 (3,454)	136 (3,454)
4	Overall Lowered Height (OAL)	in. (mm)	142 (3,607)	142 (3,607)	142 (3,607)	142 (3,607)	142 (3,607)
5	Overall Raised Height (OAR)	in. (mm)	228 (5,791)	220 (5,588)	220 (5,588)	212 (5,385)	212 (5,385)
6	Tilt Angle, Forward/Backward	Degrees	15/12	15/12	15/12	8/12	8/12
7	Free Fork Height (FFH)	in. (mm)	4 (102)	4 (102)	4 (102)	4.5 (114)	5 (127)
8	Fork Thickness	in. (mm)	4 (102)	4 (102)	4 (102)	4.5 (114)	5 (127)
9	Fork Width	in. (mm)	8 (203)	10 (254)	10 (254)	10 (254)	10 (254)
10	Fork Length	in. (mm)	72 (1,829)	72 (1,829)	72 (1,829)	72 (1,829)	96 (2,438)
11	Wheelbase	in. (mm)	120 (3,048)	132 (3,353)	132 (3,353)	144 (3,658)	160 (4,064)
12	Overall Width - Drive Axle	in. (mm)	100 (2,540)	100 (2,540)	100 (2,540)	120 (3,048)	120 (3,048)
13	Overall Width - Steer Axle	in. (mm)	100 (2,540)	100 (2,540)	100 (2,540)	100 (2,540)	100 (2,540)
14	Length to Fork Face	in. (mm)	193 (4,902)	205 (5,207)	205 (5,207)	217 (5,512)	233 (5,918)
15	Load Distance	in. (mm)	40 (1,016)	40 (1,016)	40 (1,016)	40 (1,016)	40 (1,016)
16	Height Over Tilt Tower	in. (mm)	127 (3,226)	127 (3,226)	127 (3,226)	127 (3,226)	127 (3,226)
17	Minimum Ground Clearance	in. (mm)	9 (229)	9 (229)	9 (229)	9 (229)	9 (229)
18	Maximum Travel Speed	mph (km/h)	15 (24.2)	15 (24.2)	15 (24.2)	16 (25.8)	16 (25.8)
19	Maximum Gradeability - No Load	%	35	35	33	33	35
20	Maximum Gradeability - With Load	%	32	31	28	32	32
21	Tire Size Front	inches	14.00 x 24 20 Ply	14.00 x 24 28 Ply			
22	Tire Size Rear	inches	14.00 x 24 20 Ply	14.00 x 24 28 Ply			
23	Carriage Width	in. (mm)	100 (2,540)	100 (2,540)	100 (2,540)	120 (3,048)	120 (3,048)
24	Maximum Fork Spread	in. (mm)	95 (2,413)	95 (2,413)	95 (2,413)	115 (2,921)	115 (2,921)
25	Outside Turning Radius	in. (mm)	181 (4,597)	193 (4,902)	193 (4,902)	207 (5,258)	228 (5,791)
26	Weight-No Load- Front	lbs. (kg)	29,750 (13,495)	31,000 (14,062)	30,000 (13,608)	31,000 (14,062)	34,247 (15,534)
27	Weight - No Load - Rear	lbs. (kg)	33,750 (15,309)	34,500 (15,649)	38,500 (17,464)	38,830 (17,613)	38,225 (17,339)
28	Weight - No Load - Total	lbs. (kg)	63,500 (28,804)	65,500 (29,711)	68,500 (31,072)	69,830 (31,675)	72,472 (32,873)
29	Weight - With Rated Load - Front	lbs. (kg)	95,100 (45,137)	101,900 (46,222)	108,800 (49,352)	115,030(52,178)	114,847 (52,095)
30	Weight - With Rated Load - Rear	lbs. (kg)	8,400 (3,810)	8,600 (3,901)	9,700 (4,400)	9,800 (4,445)	9,625 (4,366)
31	Weight - With Rated Load - Total	lbs. (kg)	103,500 (46,948)	110,500 (50,123)	118,500 (53,752)	124,830 (56,623)	124,472 (56,460)

NOTE: Nominal performance specifications shown may vary depending on standard manufacturing tolerances, vehicle condition, application, configuration or operating environment. Specific performance requirements should be discussed with your Royal Lift Truck Dealer. Materials and specifications are subject to change without notice. Gradeability values with load are at stall condition and are based on engine operating under S.A.E. Standard J1349 (77° F[25°C] and 29.61 in. Hg. [100 kPa] barometric pressure).

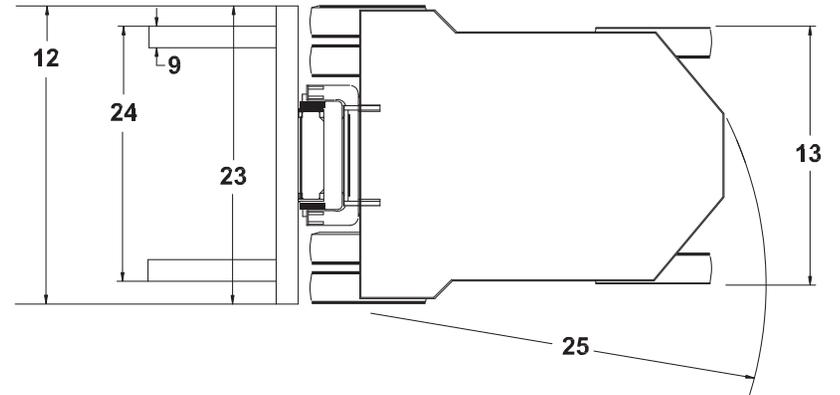
Rated Capacities with Standard Equipment



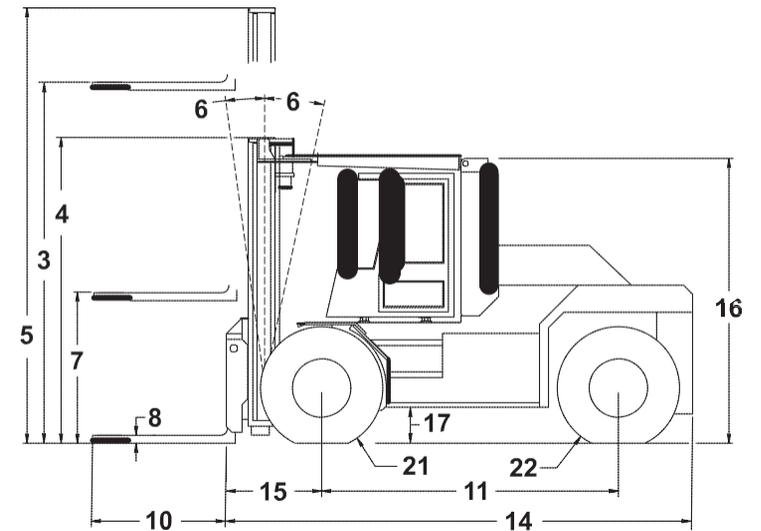
Capacities are approximate. Contact the Royal Sales Department for more specific capacities or for capacities with options and attachments.



Dimensions with Standard Equipment



P400 - PL520





P400 - PL520

PNEUMATIC TIRE LIFT TRUCKS

STANDARD SPECIFICATIONS*

ENGINE - Diesel Standard - P400,P450, P500 Cummins QSB5.9C/ECM CAC - 6 Cylinder

Specifications:

Bore	4.02 in.	102 mm
Stroke	4.72 in.	120 mm
Displacement	359 cu.in.	5.88 litre
Gross Power @ 2,500 rpm	173 HP	129 kW
Electric System	12 volt	95 amp
Fuel Tank Capacity	52 Gal.	197 litre

ENGINE-Standard Diesel -P550, PL520 Cummins QSB5.9C/ECM CAC, 6 Cylinder

Specifications:

Bore	4.02 in	102 mm
Stroke	4.72 in	120 mm
Displacement	359 cu. in	5.88 litre
Gross Power @ 2,500 rpm	205 HP	153 kW
Electric System	12 volt	95 amp
Fuel Tank Capacity	72 gal.	273 litre

ENGINE-Optional Diesel -P400, P450, P500 Caterpillar Model 3126B CAC, 6 Cylinder

Specifications:

Bore	4.33 in	110 mm
Stroke	5.0 in	127 mm
Displacement	442 cu. in	7.2 litre
Gross Power @ 2,500 rpm	175 HP	131 kW
Electric System	12 volt	100 amp
Fuel Tank Capacity	52 gal.	197 litre

ENGINE-Optional Diesel -P550, PL520 Caterpillar Model 3126B CAC, 6 Cylinder

Specifications:

Bore	4.33 in	110 mm
Stroke	5.0 in	127 mm
Displacement	442 cu. in	7.2 litre
Gross Power @ 2,500 rpm	200 HP	149 kW
Electric System	12 volt	100 amp
Fuel Tank Capacity	72 gal.	273 litre

ENGINE-Optional LPG, P400, P450, P500 GM8.1L OHV V-8, ECM

Specifications:

Bore	4.25 in	108 mm
Stroke	4.37 in	111 mm
Displacement	496 cu. in	8.1 litre
Gross Power @ 2,400 rpm		
LP Gas	200 HP	149 kW
Electric System	12 volt	70 amp

EXHAUST:

Single vertical mounted muffler with side discharge. (diesel)

AIR FILTER:

Replaceable canister type air filter, high mounted in-take with mechanical precleaner and restriction indicator.

TRANSMISSION-Full Electric Power Shift:

Three speeds, forward and reverse. No mechanical linkage required to change speed ranges or direction. Combination torque converter and straight constant mesh gears. Oil-cooled, pressure lubricated, self adjusting, multiple disc clutches.

DRIVE AXLE:

Sealed planetary wheel reduction with floating ring and sun gears. Positive oil flow lubrication. Splined, double universal joint driveline connects differential and transmission.

STEER AXLE:

High strength steel, fabricated I-beam design with a single double-action cylinder that eliminates tie rods and minimizes wear points. Anti-friction thrust and radial bearings reduce wear at oscillating points. Steer wheels are mounted with heavy-duty, tapered roller bearings.

BRAKES:

Service brakes are hydraulic actuated 17" wet disc brakes with circulating oil for cooling and lubrication which provides extended life and reduced maintenance. Parking brake is driveline mounted spring applied.

HYDRAULIC SYSTEM:

Features positive displacement gear pumps and mechanically actuated fully proportional control valves for multi-function operations. Two double-acting tilt cylinders with chrome plated rods and spherically bushed end connections increase packing life. Anti-cavitation valve helps prevent hydraulic voids in the tilt circuit. System filter with replaceable element is located inside hydraulic tank.

OPERATOR STATION:

Ergonomically designed for maximum operator efficiency. Tilt and telescoping steering column, 7-way adjustable air ride suspension seat with seat belt and arm rests. Easily accessible rocker switch panel. All hydraulic functions are electric over hydraulic, console mounted in an arm rest for convenient right hand operation. Steering column mounted "twist-grip" electronic controls for vehicle direction and speed range. Left foot operated, declutching in all speed ranges. Anti-restart ignition switch. Enclosed cab optional.

STEERING:

Fully filtered hydrostatic steering. Manual emergency steering actuation provides steering power in case of engine power loss.

FRAME:

Combination heavy-duty box/steel slab. Narrow width and short wheel base for excellent maneuverability in tight work areas. Designed for easy access for component maintenance. Removeable counterweight bolts to frame.

STANDARD MAST:

Hi-visibility two-stage telescoping roller mast with fabricated alloy steel channels. Two lift cylinders are nested behind the channels to give optimum view through center of mast. Heavy-duty leaf type lift chains run on anti-friction bearing mounted rollers.

CARRIAGE:

Shaft-type carriage operates on four large diameter load rollers and four side-thrust rollers. Heavy-duty hydraulic fork positioning and/or side shift carriage optional.

INSTRUMENTATION:

Instrument panel with international pictograph symbols includes gauges for engine oil pressure, engine coolant temperature, air pressure, voltmeter, hourmeter, fuel, and warning lights for engine coolant temperature, transmission oil temperature, engine oil pressure, parking brake light, and battery. All gauges are weather proof and fuse protected.

FORKS:

Standard pallet type.

PAINT:

Yellow body with non-reflecting black overhead guard, mast, carriage and forks.

PROTECTIVE FEATURES:

Skid resistant steps, floorplates, and overhead guard (F.O.P) conforms to A.N.S.I. Specifications B56.1. Tail and side marker lights, turn signals, emergency flashers, audible back-up alarm, amber strobe warning light, electric air horn, and electronic engine monitoring.

OPTIONS AND ACCESSORIES:

Mast, carriage, fork, tilt, hydraulic system, transmission, counterweight, protective, and attachment options along with engine and operator accessories are available upon request.

*Specifications are subject to change without notice.



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E-Mail: websales@royaltractor.com

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SECTION 018300 – ARCHITECTURAL

PART 1 - GENERAL

1.1. PROJECT GENERAL ARCHITECTURAL REQUIREMENTS

- A. This project is located in the Chestnut Ridge Area of Oak Ridge National Laboratory (ORNL) near the Spallation Neutron Source (SNS) site. The entire complex utilizes metal panel exterior skin systems with anodized aluminum window frames and painted exterior hollow metal doors and frames. The siding color is champagne gold, matching PPG Industries color CRP5VMA80110P, with mica added. The appearance of the new structure shall blend into the existing campus architecture and shall use the same siding profiles and color. A review and approval by the Company of the proposed exterior design concept will be required at each design submittal stage of the project. Prior to commencing construction of exterior finishes, the exterior materials mock-up panel must be approved by the Company. Sustainable features such as sun shading built in as part of the exterior rather than applied to the windows is encouraged. The layout of the building shall consider the possibility of limited expansion.
- B. Rooftop mechanical equipment is discouraged, but if required, shall be screened from view with a screen or penthouse of compatible material matching the building exteriors. Ductwork shall, to the extent possible, not be run exposed across the roof. If rooftop ductwork is approved by the Company, all ducts shall be positioned so as to facilitate future roof replacement or repairs. If rooftop equipment is provided, at least one stairway shall be extended to the roof for access. Ship's ladders are not acceptable for roof access to service rooftop equipment. Personnel access to all areas outside of the screen is required.
- C. All areas requiring routine maintenance shall be provided with a minimum 42" high fall protection barrier of material and design to match the building exteriors. Items such as roof drains and other items that do not require routine maintenance shall be provided with fall protection life line anchor points as a minimum.
- D. All exterior entry doors at main entries shall be provided with double leaves. Provide vestibules to minimize impact on indoor air comfort. A cover shall be provided over all doors. For main entries, the card reader shall be provided inside the vestibule area, controlling the interior set of doors.
- E. Day-lighting shall be maximized to the extent practical as allowed by program requirements.
- F. Provide dumpster pad and access.
- G. Standard space requirements.
 - 1. Offices – general.

- a. Hard-wall offices shall be minimum 120 sq. ft. and workstations shall be 6' by 9', unless shown otherwise in the room data sheets in Section 018000.1.
 - b. All modular cubicles not located adjacent to a hard wall or interior column shall be provided with junction boxes in the ceiling, not more than one workstation on a circuit, for power, data, and communications. Power poles extending from the ceilings will be provided by the Company. All work stations or offices should be provided with a minimum of three duplex power outlets, two data and two communications outlets, and general lighting.
 - c. Arrangements of hard-wall offices to the building interior, with glass fronts, and modular offices near the exterior window with low partitions must be considered for day-lighting.
2. All areas in facility to follow finish requirements as outlined in room data sheets in Section 018100.1, unless noted otherwise in this document.
- H. See Section 018613 - Fire Protection, for building occupancy classifications, construction types required, and setbacks required.
- I. See Section 018100 – Overview, for other general requirements.
- J. See room data sheets in Section 018000.1, for specific room requirements.

1.2. STANDARDS

- A. Work Smart Standards (WSS).
1. International Building Code, 2009 (IBC).
 2. National Fire Protection Association (NFPA).
 3. Americans with Disabilities Act (ADA), guidelines (ADAAG).
- B. Additional standards.
1. “Managing the Risk of Mold in the Construction of Buildings” developed by the Mold Litigation Task Force of the Associated General Contractors of America., Inc.
 2. United States Green Building Council’s (USGBC) Leadership in Environmental and Energy Design (LEED).
- C. Interior finishes: shall follow the ORNL/SNS standard finishes specifications unless otherwise pre-approved by the Company. The standard finishes specification is included in Section 018300.1 of this document.
- D. Signage:

1. The standard ORNL signage specification is included in Section 018300.2 of this document. For this project, color of background shall match acidic stress index (ASI) Modulus standard black SC-905 with SMYK 100-35-0-100. The white lettering shall match standard white SD-901 with CMYK 2-0-0-5. Submit sample for approval.
2. Exterior (building identification) and interior signage shall be approved by the Company.
3. During the contract document drawing phase, provide numbering for all spaces in a manner which facilitates the final way-finding plan and avoids the need to re-number spaces for signage.

1.3. MATERIAL REQUIREMENTS

A. Materials restrictions.

1. Materials or components containing asbestos, polychlorinated biphenyl (PCB), chlorofluorocarbons (CFCs), hydro chlorofluorocarbons (HCFCs), lead, and carcinogens shall not be utilized in any portion of the design or construction.
2. Wood material shall not be used for any part of building construction with the exception of fire-retardant, Underwriters Laboratory (UL) listed plywood, which is permitted in the telecommunications rooms for telephone and computer terminal boards only and wood for roof flashing attachment. Wood doors may also be used, but they must comply with fire code requirements.
3. Zinc hardware/material shall not be utilized.
4. Zinc chromate paint shall not be utilized.
5. Class I refrigerants shall not be utilized.
6. See LEED requirements when seeking USGBC's LEED certification.

B. General materials selection.

1. As part of the master plan for ORNL, a schematic architectural vocabulary and direction has been established to assure that the master planning principles are expressed in architectural form. The intention of this section is to provide insight and direction to the architectural development of the campus. Elaborations and extensions of these ideas and expressions, or their creative equivalents, shall be integrated into the architectural and site design strategies for the facility. They shall include the following:
 - a. The creation of an open research campus, which reflects in physical form the history, transitions, and ideals and identify ORNL.
 - b. The use of sustainability as a major organizing design principle for buildings and landscape.

- c. The creation of a flexible yet coherent site and building structure that allows for growth and change.
 2. Use sustainable materials and design principles identified in Section 12 – Energy and Sustainability.
 3. The design, materials and systems of a building shall follow the practices contained in “Managing the Risk of Mold in the Construction of Buildings” developed by the Mold Litigation Task Force of the Associated General Contractors of America., Inc.
- C. Exterior building materials.
1. Exterior wall materials.
 - a. Mock-up.
 - 1) Provide for a mock up that includes all exterior materials and represents the majority of conditions presented by the building. Include windows and glazing with flashing and sealed joints.
 - 2) The mock up shall be tested for water infiltration using ASTM International (ASTM) requirements for testing on site.
 - 3) Mock-up should demonstrate outside corner, inside corner, cap, and joinery range and workmanship.
 - b. Masonry.
 - 1) Provide continuous thru-wall flashing at the bottom of all wall cavities and over all openings and stone copings. Maintain minimum clear airspace of 1”, exclusive of cavity insulation, for drainage within wall cavity to weep holes.
 - 2) Use ties that are a minimum of 3/8” thick and that allow movement to prevent cracking in the facing. Galvanized corrugated metal strap ties are not acceptable.
 - c. Metal panels.
 - 1) The exterior of the facility shall receive a metal panel finish matching the color and profile of other panels on adjacent facilities.
 - 2) Metal panels shall match the following:
 - a) Type 1: architectural metal wall panel equal to Centria Formawall dimension series.
 - b) Type 2: architectural metal wall panel equal to Centria Formawall FWDS-60 2” panel.

- c) Type 3: Industrial metal wall panel equal to Centria Versawall.
 - d) Other listed manufacturers that offer panels designed to meet performance requirements and profiles of basis-of-design noted above include Alply, Inc., (insulated panels); Benchmark Architectural Systems, Inc. (Designwall 2000, Designwall 2000R, and Designwall 2000S); Protean, Inc. (200 series panels); Metl-Span (CF architectural wall panel, CF striated wall panel); Fabral (Deep Rib 2, Deep Rib 4, Décor-Flush).
- 3) Metal panels shall be of heavy enough gages, or with adhered backing, that will not present “oil canning” of the finish surface.
 - 4) Air infiltration for building enclosure panels shall not exceed the recommended limits established by National Association of Architectural Metal Manufacturers (NAAMM) Standard TM-1.
- d. Pre-Cast concrete.
- 1) Panels shall contain either coal fly ash and/or ground granulated blast furnace slag, unless performance requirements cannot be met using these materials.
 - 2) Layout of panels and joints and detailing shall be simple and as repetitive as practical. Align joints horizontally and vertically with architectural elements, such as wall openings, floor levels, etc.
 - 3) See Section 018300 – Structural, for more requirements.
 - 4) Unless otherwise approved by the Company, all concrete exposed to view shall be precast or poured-in-place architectural concrete.
- e. Poured-in-place concrete.
- 1) See requirements of Section 018200 – Structural.
- f. Exterior Finish and Insulation System (EIFS).
- 1) Use EIFS systems only as pre-approved by the Company for soffits and mechanical screens.
 - 2) Install according to the EIFS Industry Manufacturers’ Association (EIMA) guidelines.
 - 3) Minimum thickness of foam backing to be 2”.
 - 4) Use heavy duty facing materials to prevent denting.

2. Windows, curtain walls, and storefronts.
 - a. Standard window colors shall be mill finish aluminum.
 - b. Maximum window, glass, and/or day lighting in areas of personnel occupancy is desirable.
 - c. Glazing methods and materials shall comply with the Flat Glass Marketing Association's (FGMA) glazing manual and sealant manual. Float glass shall comply with ASTM C1036-01.
 - d. Exterior windows shall be placed where the function requires them and generally located to create flexibility in furniture placement.
 - e. Glazing shall be high performance thermal pane glazing units installed in a thermally broken frame. Designer to determine the "U" values and shading coefficients to provide the most energy efficient units.
 - f. Color of glass and frame shall be as approved by the Company.
 - g. Provide insect screens for all operable windows. Screens shall be installed from inside to the extent practical.

3. Exterior doors.
 - a. Exterior doors shall be a minimum of 3'-0" by 7'-0". Insulate exterior doors.
 - b. Material of main entry doors shall be as selected by the architect. However, exterior doors shall not be constructed of wood.
 - c. Hollow metal doors shall be constructed in accordance with the Steel Door Institute (SDI) standard SDI-100, unless otherwise noted.
 - d. Exterior hollow metal doors shall have a minimum of 16-gage, flush-face panel welded construction. Exterior hollow metal frames shall be a minimum 2", 14-gage, welded construction and ground smooth.
 - e. Provide a minimum of three hinges for each leaf, unless top and bottom pivot hinges are specified.
 - f. Provide a minimum of three anchors for each jamb.
 - g. Main entryways shall have airlocks and protection from weather (overhangs).
 - h. Refer to Section 10 – Security, for security hardware requirements. All locksets, including dead bolts and exit devices, shall receive Best seven-pin A-series lock cores, for master keying by the Company. Exterior locksets shall be mortised type construction.

- i. See Section 10 – Security, for proximity card readers and lock sets.
4. Roofing systems.
 - a. General.
 - 1) Specify roofing systems with a minimum 20-year warranty, unless the Company approves otherwise. The warranty shall include roofing and all penetrations as well as flashings and copings – everything required to make the roof watertight from the coping in. Warranty shall be carried by the roofing manufacturer, not the installer.
 - 2) Low-sloped roofs (pitch less than or equal to 2:12) must be designed and installed with a minimum three year aged solar reflectance of 0.55 and a minimum three year thermal emittance of 0.75 in accordance with the Cool Roof Rating Council program, or with a minimum three year aged solar reflectance index (SRI) of 64 in accordance with ASTM Standard E1980-01. Steep sloped roofs (pitch exceeding 2:12) must have a three year aged SRI of 29 or higher.
 - 3) Roof systems shall provide a minimum R-30 thermal resistance.
 - 4) Provide roofing systems that comply with Energy Star rating requirements, and labeled, and having emissivity of at least 0.9 when tested in accordance with ASTM 408.
 - 5) Roofing system shall meet or exceed UL Class A fire exposure requirements.
 - 6) Roofing system shall comply with Factory Mutual (FM) Class 1-90 for fire performance and wind uplift. Wind uplift shall also meet ASTM 1592. Tests utilizing UL 580 are not acceptable.
 - 7) Design roof systems to ensure that the dew point does not occur within the roof system. See Managing the Risk of Mold in the Construction of Buildings.
 - 8) Roof construction details shall comply with the National Roofing Contractors Association (NRCA) Roofing and Waterproofing Manual, and the Sheet Metal and Air Conditioning Contractors National Association's (SMACNA) Architectural Sheet Metal Manual.
 - 9) Provide permanent fall protection anchors for all roof areas spaced to comply with Occupational Safety and Health Administration (OSHA) requirements.

- 10) Where roof drainage is directed toward the uphill side of the building, downspouts shall be connected to underground rain-water leaders that direct the flow to the downhill side of the building.
 - 11) Provide splash at the bottom of all downspouts that spill directly to grade or the roof below.
 - 12) Roof drains shall be a minimum of 4" diameter. Provide a minimum of two drains for any single roof area or on either side of an expansion joint.
 - 13) All roofing systems, single-ply or built-up shall have cant strips at the intersection of roof plane with the back of parapet.
- b. Built-up roofing systems.
- 1) Provide Energy Star coating.
 - 2) Minimum roof slope shall be 1/4" per foot.
 - 3) Minimum cap sheet thickness shall be 115 mils.
 - 4) Reinforce with at least one mat of 100 mil minimum polyester base sheet.
 - 5) Built up roof systems shall be 4-ply, hot-applied roofing systems, unless otherwise approved by the Company.
 - 6) Provide traffic pads of recycled rubber from roof access points to, and around, roof mounted equipment such as cooling towers, Heating, Ventilating, and Air Conditioning (HVAC) equipment, satellite dishes, etc. If heavy traffic is expected, or if the roof is a public access area, concrete pavers should be used.
- c. Modified bitumen roofing systems.
- 1) Roofing with Energy Star coating.
 - 2) Minimum slope shall be 1/4" per foot.
 - 3) Provide a minimum cap sheet thickness of 115 mils.
 - 4) Modified bitumen roofing system shall be a minimum of 3-ply.
 - 5) Reinforce with at least one mat of 100 mil minimum polyester base sheet.

- 6) Provide traffic pads of recycled rubber from roof access points to, and around, roof mounted equipment such as cooling towers, HVAC equipment, satellite dishes, etc. If heavy traffic is expected, or if the roof is a public access area, concrete pavers should be used.
- d. Single-ply roofing systems.
- 1) Energy Star rating.
 - 2) Minimum slope shall be ¼” per foot.
 - 3) Single-ply roofs are not allowed in areas where roof traffic is expected to be moderate or heavy, such as, to service roof top equipment.
 - 4) Follow guidelines set forth by the Single Ply Roofing Institute and NRCA.
 - 5) Membrane shall be polyester reinforced, 45 mils minimum thickness.
 - 6) Provide surface membrane meeting reflective requirements for LEED certification.
 - 7) Thermal plastic Olefin or polyolefin (TPO) roofing systems shall not be used without prior written permission from the Company.
- e. Metal roofing systems.
- 1) Minimum slope shall be 1½” per foot. Roof panels shall be provided with minimum 24-gage thickness.
 - 2) System shall be standing seam design with concealed fasteners.
 - 3) Fabricate fascia, trim, flashing, and other metal components from same material and finish as metal roof panels.
5. Thermal and moisture protection.
- a. Flashing and sheet metal.
- 1) Provide flashing as a positive water stop around all openings (head, jamb, and sill) in walls such as windows, doors, louvers, etc.
 - 2) Provide scuppers for all roofs with a cross sectional area equal to that of the designed roof leader system. Slope scuppers slightly to the exterior and extend a minimum of 3” from the face of the wall to provide a positive drip.

- 3) Interior built-in gutters shall be avoided.
 - 4) All flashing and sheet metal shall be detailed in accordance with SMACNA plates.
 - 5) All openings in walls shall have flashing at head, jamb, and sill. Head and sill flashings shall have end dams at each end. Jamb flashing shall have at least two bends to provide a positive block for wind driven moisture.
- b. Damp-proofing.
- 1) Vapor barriers shall be provided in accordance with the IBC and American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) fundamentals handbook.
 - 2) Damp-proofing of concrete shall comply with American Concrete Institute (ACI) Guide to the Use of Waterproofing, Dampproofing, Protective and Decorative Barrier Systems for Concrete.
 - 3) Damp-proofing of concrete masonry shall comply with National Concrete Masonry Association (NCMA) Waterproof Coatings for Concrete Masonry and Concrete Masonry Basements and Earth-Sheltered Structures.
 - 4) Damp-proof walls, floors, and other building elements that at any time are subject to high humidity, dampness, or frequent direct water contact, but are not subject to hydrostatic pressure, are not below the water table, or are not immersed in water, including the outer face of block back-up walls for brick. Also, dampproof on the damp side of shower rooms, cold storage areas, built-in refrigerators and freezers, and areas using water wash-down.
- c. Waterproofing.
- 1) Waterproof walls, floors, and other building elements that at any time are subject to hydrostatic pressure, are below the water table, or are liable to be immersed in water.
 - 2) Cementitious waterproofing is not allowed.
 - 3) Bentonite clay shall be used for waterproofing at all walls and floors below the water table or otherwise subject to high hydrostatic pressures.
- d. Exterior sealants.
- 1) Exterior sealants shall be two-part composition, able to accept 50% movement.

- 2) A minimum 10-year life expectancy shall be provided under severe weather conditions (20-years under mild conditions).
 - 3) Sealants shall have low volatile organic compounds (VOCs) within LEED limits.
 - 4) Sealants shall be compatible with the surfaces on which they are being applied and are non-staining.
 - 5) Seal all exterior joints air tight and waterproof.
 - 6) Sealants shall not be relied upon for waterproofing.
- e. Insulation.
- 1) Combustibility for insulation, including wrappings, inside the building skin shall be limited to a flame spread of 25 and smoke developed of less than 50.
 - 2) Do not use spray-on or foamed-in-place polyurethane insulation.
 - 3) Insulation shall meet the minimum recycle material content per LEED certification.
6. Exterior stairs.
- a. Exterior stairs shall be a minimum of 4'-0" wide.
 - b. Provide slip resistant stair treads.
 - c. Cover exterior egress stairs as required by IBC.
- D. Building interior.
1. Materials selection.
 - a. The selection of materials shall be compatible with the architectural concept and the performance requirements outlined in 018100 – Overview, and 018300.1 – Chestnut Ridge Interior Finish Standards.
 - b. Use materials with higher percentages of recycled content wherever practical.
 2. General requirements.
 - a. The building's interior organization shall provide functional spaces as established in Section 1 – Overview and this section.
 - b. Corridors shall be a minimum of 5'-0" wide.

- c. All finish materials for walls, ceilings, and floors, as well as open plan partition assemblies, shall have a Class A rating, with a flame spread less than or equal to 25, a fuel contribution of less than or equal to 25, and a smoke development of less than or equal to 450.
3. Partitions.
 - a. Typical walls and partitions shall stop a minimum of 6" (where possible) above the finished ceilings.
 - b. Where required for fire rating, sound, security, or environmental control, walls shall be extended to the underside of the roof or floor above.
 - c. Wood framed partitions shall not be used and wood blocking shall be minimized.
 - d. In addition to code required locations, management offices, break rooms, conference rooms, restrooms, and copy/mail/workrooms shall have walls extending from the floor to the structural ceiling/slab above and shall be fully insulated for sound.
 - e. Where interior concrete block walls are used, the joints shall be struck flush and the walls sealed and painted.
 - f. Movable wall systems are acceptable in office areas, assuming acoustical requirements are met.
 - g. Ceramic tile shall be installed for the full height of all walls in toilet rooms and shall have a gloss finish. In areas where moisture is present, tile shall be installed over a cementitious backer board. Install tile in accordance with the Tile Council of America's (TCA) Handbook for Ceramic Tile Installation, latest edition.
 - h. Vinyl wall covering shall be Type II, Class A, and installed with low VOC water-based adhesives. Pattern and color shall be approved by the Company.
 - i. Structural fiberboard and laminated paperboard shall contain a minimum recycled content as per the LEED certification.
 - j. Fire rated partitions shall be clearly marked above the ceiling in red letters not less than 4" tall minimum, indicating the rating of the wall (one hour, two hour, smoke partition, etc.).
 4. Floors.
 - a. Floor coverings are not required for janitor closets, electrical/comm. closets (rooms), or mechanical rooms. In these areas painted or sealer finishes shall be provided.

- b. Floor coverings.
 - 1) Carpet.
 - a) See 018300 – ORNL Interior Finish Standards. Carpet to be carpet squares.
 - b) Carpet contains maximum recycle content as per the LEED certification.
 - c) Direct glue-down with no pad.
 - d) Critical radiant flux of 0.45 W/sq. cm. (Class I) or 0.22 W/sq. cm. (Class II) in accordance with NFPA 101 floor finishes criteria.
 - e) Use of carpet tiles requires the Company approval except in areas with raised computer flooring and in corridors.
 - f) Use adhesives that comply with LEED VOC limits.
 - 2) Ceramic tile.
 - a) See 018300.1 – ORNL Interior Finish Standards.
 - b) Ceramic floor tile shall be set in a minimum ¾” setting bed, recessed to provide a surface that is even with adjacent floor finishes.
 - c) Install tile in accordance with the TCA Handbook for Ceramic Tile Installation, latest edition.
 - d) Toilet room tile walls shall extend from floor to ceiling, all walls.
 - 3) Epoxy floor coatings.
 - a) Epoxy floor coatings shall be selected to meet performance requirements under the specified exposures.
 - b) Installation shall be performed or supervised by a certified installer.
 - 4) Vinyl composition flooring.
 - a) See 018300.1 – ORNL Interior Finish Standards.
 - b) Vinyl composite flooring shall be selected to meet performance requirements under the specified exposures.
 - 5) Floor tiles.
 - a) See 018300.1 – ORNL Interior Finish Standards.
 - b) Floor tiles shall contain minimum recycle content as per the Environmental Protection Agency (EPA) Comprehensive Procurement Guidelines.
- 5. Base.
 - a. See 018300.1 – ORNL Interior Finish Standards.

- b. Unless otherwise approved by the Company, provide minimum 4” high, 1/8” thick rubber cove wall-base in all areas with carpet, paint or sealer, and vinyl composition flooring.
6. Ceilings.
 - a. See 018300.1 – ORNL Interior Finish Standards.
 - b. Finish ceilings are not required for janitor closets, electrical closets (rooms), or mechanical rooms.
 - c. Area above suspended ceiling shall not be used as an air plenum unless approved by the Company.
7. Doors.
 - a. Interior doors shall be a minimum of 3’-0” by 7’-0”.
 - b. Provide 1¾” thick solid core wood doors unless otherwise required by fire codes or approved by the Company.
 - c. Where interior hollow metal doors are used, they shall be minimum 18-gage, flush-face, welded construction.
 - d. All locksets, including dead bolts, shall be specified to receive Best seven-pin A Series lock cores with master keying by the Company. The Seller shall provide the cores, but the cores will be shipped from Best directly to the Company for keying. Refer to Section 10 – Security, for security requirements.
 - e. Frames shall be minimum 2” hollow metal frames, minimum 16-gage, welded construction and ground smooth. Knock-down frames may be used with prior approval from the Company.
8. Paint.
 - a. See 018300.1 – ORNL Interior Finish Standards.
 - b. All items without factory-applied finishes and exposed to view shall be painted, unless otherwise specified.
 - c. Consolidated and reprocessed latex paint shall be use when practical, and shall contain a minimum recycled content as per LEED certification.
 - d. Paints selected shall meet the VOC limits of LEED certification.
9. Interior sealants.
 - a. Interior sealants shall be one-part, permanently flexible, but with a tough exterior film.

- b. Sealants shall have low VOC content complying with LEED limits.
10. Furnishings.
- a. Window coverings.
 - 1) Window coverings shall block out undesirable sun in areas normally occupied.
 - 2) The ORNL standard window covering is roller shades and shall be used in all cases.
 - b. Manufactured casework (other than Government Furnished Equipment [GFE]).
 - 1) Use modular units and dimensionally interchangeable elements.
 - 2) To the extent practical, use stock sizes, and finishes.
 - 3) Use rapidly renewable materials to the extent practical.
 - c. Millwork.
 - 1) Millwork shall conform to the Architectural Woodwork Institute Quality Standards, Guide Specifications and Quality Certification Program, latest edition.
 - 2) Countertops shall be solid surface material.
 - 3) Millwork and architectural woodwork items are permanently attached to the building and/or built in place.
 - d. See 018300.1 – Chestnut Ridge Interior Finish Standards for colors.
 - e. Lockers.
 - 1) Lockers shall be double tier 18" wide x 24" deep x 36" high (72" total height) without legs, unless otherwise approved by the Company. Provide a minimum of 24" hardwood bench per pair of lockers.
 - 2) Doors shall be vented and have a lockable lift handle.
 - 3) Provide interior shelf, three clothes hooks, and metal number tag. Lockers shall be on metal 4" base with top sloped, a minimum of 12".
 - f. Shower and restroom dividers/partitions.

- 1) Shower and restroom dividers/partitions shall contain a minimum recycled material content as per the EPA's Comprehensive Procurement Guidelines whether plastic or steel is used.
 - 2) Each shower shall be provided with a dry off area outside the shower no less that 42" clear by the width of the shower, with a hardwood, solid surface, or tile seating bench. Provide shower curtains and hanging hardware for two curtains per shower. Also provide a minimum of two robe hooks in the dry-off area.
- g. Toilet accessories.
- 1) Provide seat cover dispensers for all water closet stalls.
 - 2) Provide soap dispensers for each pair of sinks as a minimum. Soap dispensers shall be GOJO NXT Space Saver, Item 2130-06, and Dove Gray. No substitutes.
 - 3) Preferably provide paper towel dispensers for each pair of sinks as a minimum, or logistically located if a central dispenser is used. Paper towel dispensers shall be Georgia Pacific enMotion Automatic Touchless type. Provide Product Number 59460 in Splash Blue or similar model in stainless steel. No substitutes.
 - 4) Toilet paper dispensers shall be provided in each stall and shall be Georgia Pacific Vista Jumbo Jr., Translucent Smoke, and Item Number 58250. No substitutes.
 - 5) Provide faucet for water hose under lavatory in each toilet area.
- h. Janitor's closets.
- 1) Provide at least one janitor closet on each floor, easily accessible for cleaning.
 - 2) Closet shall include mop sink, faucet with bucket hook, storage for supplies, and hanging apparatus for mops and brooms, as well as storage for vacuum and mop bucket trolleys.
11. Elevators.
- a. Elevators shall comply with the requirements of ASME A17.1, Safety Code for Elevators and Escalators, NFPA 70, and requirements of the State of Tennessee Elevator Code.
 - b. Minimum clear interior dimensions of cab shall be 80" wide by 51" deep (54" to face of door).
 - c. Minimum elevator capacity shall be 2500 lb. The minimum opening size for doors shall be 3'-6" wide and 8' tall.

- d. Elevator interior finish shall be determined during design however, front door and frame, as well as front panel shall be stainless steel.
 - e. Controls shall not preclude ORNL maintenance personnel from maintaining elevators. Any special tools, programming codes, and manuals required for maintenance shall be turned over to the Company upon acceptance of the elevator.
 - f. Provide an elevator lobby at each level as a point of entry from the elevator to the corridors connecting spaces.
12. Fire extinguisher cabinets (FEC).
- a. FEC must accommodate Ansul Sentry. SY 10-14, 10-pound, ABC extinguishers. Extinguishers will be furnished as GFE.
13. Signage.
- a. Interior signage complying with Chestnut Ridge standard signage specifications, Section 018300.2, shall be provided for identification of all interior spaces.
 - b. Exterior (building identification) and interior signage shall be approved by the Company.
 - c. During the contract document drawing phase, provide numbering for all spaces in a manner which facilitates the final way-finding plan and avoids the need to renumber spaces for signage.

END OF SECTION

**SECTION 018300.1
CHESTNUT RIDGE INTERIOR FINISH STANDARD**

	Chestnut Ridge	ORNL Main Campus
OFFICE		
Typical Floor	Shaw, Grid, F748C-0	Blueridge, 2081 Arbor, Pebble P218
Accent Floor	Shaw, Gold, D894k-2	Richmond, Cogwheel 2211, Homecoming 2200
Base	Johnsonite, Charcoal 20	Johnsonite, Charcoal 20
Typical Wall	Benjamin Moore, Decorators White	Sherwin William, Alabaster
Window Treatment	Mecho, Shades, Black / Brown	Mecho, Shades, Black / Brown
Special Wall Surfaces	RJF International, Stone 04	RJF International, Stone 04
Ceiling	Armstrong, Cool White	Armstrong, Cool White
Furnishing Items		
- Workstation / Chair Frame	Steel Case, Charcoal, Grey Value 5 (Confirm)	Steel Case, Charcoal, Grey Value 5 (Confirm)
- Workstation Chair Fabric	Haworth, Graphite, Lead Mesh	Haworth, Graphite, Lead Mesh
- Workstation Work Surfaces	Nevamar, Maple	Nevamar, Washington Apple
- Side Chair Fabric	Haworth, Icon, K-8 Sulfur, K-2 Argon	Haworth, Icon, K-12 Fluorine, K-2 Copper
- Workstation Fabric	Steel Case, Camel P303	Haworth, Savoy FJ-AT Shallot
CONFERENCE		
Typical Floor	Shaw, Grid, F748C-0	Blueridge, 2081 Arbor, Pebble P218
Accent Floor	Shaw, Gold, D894k-2	Richmond, Cogwheel 2211, Homecoming 2200
Base	Johnsonite, Charcoal 20	Johnsonite, Charcoal 20
Typical Wall	Benjamin Moore, Decorators White	Sherwin William, Alabaster
Accent Wall	Benjamin Moore, Hale Navy, HC-154	Benjamin Moore, Hale Navy, HC-154
Vertical Casework	Nevamar, Maple	Nevamar, Washington Apple
Work Surfaces / Countertops	Pionite, Olive Organix , AV 674	Pionite, Select
Window Treatment	Mecho, Shades, Black / Brown	Mecho, Shades, Black / Brown
Special Wall Surfaces	Marker Surface: RJF, Matte White	Marker Surface: RJF, Matte White
Ceiling	Armstrong, Cool White	Armstrong, Cool White
Furnishing Items		
- Table Top	Select	Select
- Chair Frame	Select	Select
- Chair Fabric	Select	Select
OFFICE CORRIDOR		
Typical Floor	Shaw, Grid, F748C-0	Blueridge, 2081 Arbor, Pebble P218
Accent Floor	Shaw, Gold, D894k-2	Richmond, Cogwheel 2211, Homecoming 2200
Base	Johnsonite, Charcoal 20	Johnsonite, Charcoal 20
Typical Wall	Benjamin Moore, Decorators White	Sherwin William, Alabaster
Ceiling	Armstrong, Cool White	Armstrong, Cool White
LAB CORRIDOR		
Typical Floor	Armstrong, Cottage Tan, 51830	Select
Accent Floor	Armstrong, Sandrift White , 51858	Select

Base	Johnsonite, Charcoal 20	Johnsonite, Charcoal 20
Typical Wall	Benjamin Moore, Decorators White	Sherwin William, Alabaster
Ceiling	Armstrong, Cool White	Armstrong, Cool White
LOBBY / LOUNGE		
Typical Floor	Concrete, Polished	KDA 41092302, Smokey, Crossville 0635
Accent Floor		KDA 41092302, 09310
Base	Johnsonite, Charcoal 20	Johnsonite, Charcoal 20
Typical Wall	Benjamin Moore, Decorators White	Sherwin William, Alabaster
Vertical Casework	Nevamar, Maple	Nevamar, Washington Apple
Work Surfaces / Countertops	Pionite, Olive Organix , AV 674	Pionite, Select
Window Treatment	Mecho, Shades, Black / Brown	Mecho, Shades, Black / Brown
Special Wall Surfaces	RJF International, Stone 04	RJF International, Stone 04
Ceiling	Armstrong, Cool White	Armstrong, Cool White
Furnishing Items		
- Sofa	Select	Select
- Side Chair	Select	Select
- Coffee Table	Select	Select
TOILETS		
Typical Floor	American Olean, Doe A55 1x1	American Olean, Select
Base	American Olean, Doe A55 1x1	American Olean, Select
Typical Wall	American Olean, Doe A55 2x2	American Olean, Select
Accent Wall	Benjamin Moore, Hale Navy, HC-154 Eggshell	Benjamin Moore, Hale Navy, HC-154 Eggshell
Work Surfaces / Countertops	Solid Surface - Selection	Solid Surface - Selection
Ceiling	Benjamin Moore, Decorators White	Benjamin Moore, Decorators White
Toilet Partitions	Fisher Hamilton, Charcoal	Fisher Hamilton, Charcoal
Accessories		
- Toilet Paper Dispenser	Select	Select
- Paper Towel Dispenser	Select	Select
- Trash Receptacles	Select	Select
BREAK / WORKROOMS		
Typical Floor	Armstrong, Cottage Tan, 51830	Select
Base	Johnsonite, Charcoal 20	Johnsonite, Charcoal 20
Typical Wall	Benjamin Moore, Decorators White	Sherwin William, Alabaster
Accent Wall	Benjamin Moore, Quincy Tan, DC-25	Benjamin Moore, Roxbury Caramel, HC-42
Vertical Casework	Nevamar, Maple	Nevamar, Washington Apple
Work Surfaces / Countertops	Select	Select
Special Wall Surfaces	RJF International, Stone 04	RJF International, Stone 04
Ceiling	Armstrong, Cool White	Armstrong, Cool White
Furnishing Items		
- Table	Select	Select
- Chair	Select	Select
LAB / LAB SUPPORT		

Typical Floor	Armstrong, Cottage Tan, 51830	Armstrong, Quincy Tan,
Accent Floor	Armstrong, Sandrift White , 51858	Armstrong, Celery,
Seamless Floor	Mannington, Cool Beige,	Mannington, Cool Beige,
Base	Johnsonite, Charcoal 20	Johnsonite, Charcoal 20
Typical Wall	Benjamin Moore, Decorators White	Sherwin William, Alabaster
Accent Wall	Benjamin Moore, Hale Navy, HC-154	Benjamin Moore, Hale Navy, HC-154 Eggshell
Vertical Casework	Fisher Hamilton, Chameleon 1320, Khaki 1346	Fisher Hamilton, Chameleon 1320, Khaki 1346
Work Surfaces / Countertops	Epoxy Products, Black	Epoxy Products, Black
Window Treatment	Mecho, Shades, Black / Brown	Mecho, Shades, Black / Brown
Special Wall Surfaces	RJF International, Stone 04	RJF International, Stone 04
Ceiling (Paint on Structure)	Benjamin Moore, Decorators White	Sherwin William, Alabaster
Furnishing Items		
- Stools	Select	Select

END OF APPENDIX 4.3

SECTION 018300.2 – CHESTNUT RIDGE SIGNAGE PERFORMANCE SPECIFICATIONS

PART 1 – GENERAL

1.1 DESCRIPTION - WORK IN THIS SECTION INCLUDES THE FOLLOWING:

- A. All interior signs and graphics exposed to view of the public and staff as noted below for the Oak Ridge National Laboratory [ORNL] (the Company) and described in the signage drawings and related documents.

The following sign types are included in this work: *<Specify determine and include by numbers of each sign type and/or by a Sign Layout Plan>*

1. Sign Type 1 – Americans with Disabilities Act (ADA) room identification signs – one at each restroom, one at entrance to each stair with Rescue Assistance at each RA area, and a sign inside the stairwell with instructions of whom to call in the case of emergency.
2. Sign Type 2 - evacuation plan holders – one at each floor at elevator and one at each ground floor exit.
3. Sign Type 3 - fire stair signs – one inside each stair at each level, appropriately noted. Include “No Roof Access” as appropriate per Life Safety Code (LSC) 7.2.2.5.4.1(k).
4. Sign Type 4 - building directory – one each in the main lobby.
5. Sign Type 5 - reception desk logo – one each in the main lobby.
6. Sign Type 6 - street signs.
 - a. Sign Type 6.1 - street signs - flag mounted – one at each corridor intersection.
7. Sign Type 7 - floor directory – only as requested.
 - a. Sign Type 7.1 - directional signs – only as requested.
 - b. Sign Type 7.2 - notice holders - 11" x 17" – only as requested.
 - c. Sign Type 7.3 - notice holders - 8 1/2" x 11 – only as specifically noted.
8. Sign Type 8 - division name signs - one at entry door to each office suite.
9. Sign Type 9 - room identification – staff – at every office door and at every cubicle entrance.
 - a. Sign Type 9.1 - pod identification – staff.

10. Sign Type 10 - utility room identification – staff - at all mechanical, electrical, janitors closet, communications room, and other utility rooms, as well as at break rooms.
 11. Sign Type 11 - lab identification signs – at each laboratory room door.
 - a. Sign Type 11.1 - hazard insert – to accompany each lab sign (Type 11).
 12. Sign Type 12 - fire extinguisher sign – at every fire extinguisher.
 - a. Sign Type 12.1 - fire pull flag sign - at every fire pull station.
 - b. Sign Type 12.2 - eyewash sign – at every eye wash.
 - c. Sign Type 12.3 - emergency shower and eye wash sign - at every emergency shower (and eye wash).
 13. Sign Type 13 - vinyl graphics at entrances.
- B. Each type of sign is indicated on the drawings and requires various materials, finishes, fabrication, and installation techniques. Use Chestnut Ridge color combinations as follows:
1. Black to match ASI Modulex color SC-905 with CMYK 100-35-0-100
 2. White to match ASI Modulex color SC-901 with CMYK 2-0-0-5
- C. Requirements for shop drawings, layouts, mock-ups, and samples for the Company's approval.
- D. Structural design and calculations when appropriate to substantiate design.
- E. Installation of all signs, including all fasteners and fastenings.
- F. Coordination with the Company during all phases of development, fabrication and installation.
- G. Development of sign schedules by the sign contractor listing the specific, final message for each sign based on input from the Company and use of the design drawings for sign layouts. This work also includes correct Grade II Braille interpretations for messages requiring corresponding Braille.
- H. Provide sign insert layouts, electronic templates for inserts and software required for generation of future sign inserts by the Company. Intent is that the Company will be able to produce future inserts without sign contractor's involvement.

1.2 SUBMITTALS

- A. Specifications and Instructions: submit to the Company for information only, two copies of manufacturer's specifications and installation instructions, in addition to shop drawings, for each applicable type of sign.
- B. Shop drawings shall be prepared by the sign contractor for all items called for, in detail for all signs noted including full size sections of typical members. Submit prints thereof as called for elsewhere in this document. These shop drawings will indicate applicable method and type of anchorage, field dimensions, and accessory items including material types, thickness, gages and finishes. Provide template drawings for stud and anchorage fastening locations. At the conclusion of the work contractor shall provide the Company, as part of a maintenance manual copies of as-built shop drawings that fully record any changes to the signs. Note that copies of the attached design documents do not constitute shop drawings.
- C. Submittal of samples: submit to the Company three copies of each different finish, color and substrate material. All samples shall be 6"x6" minimum in size, properly labeled for use and intent. One approved sample shall remain at the manufacturer's plant during fabrication to serve as quality standard for color and finish.
- D. Full scale layouts: note that the sign drawings and layouts have been generated via computer and the fonts used are readily available for reproduction. Letter and word spacing is to match that shown on the drawings. Submit full scale sample layouts in the form of messages, templates, bluelines, or pen plots for approval of letter and word spacing for sample messages. Provide such layouts for each message at each size it is used. Multiple messages of one size, such as 'Women', need only be submitted once in each different size. It is a requirement of the contract that letter and word spacing be approved by the Company.

NOTE: do not substitute any fonts or graphic elements for those shown on the drawings.

- E. Full scale graphic elements: submit full scale layouts or agreed-upon scaled layouts in the form of templates, bluelines, or pen plots of each symbol, project arrow, or other graphic element on the project. Where elements are repeated on several sign types, submit only one copy at each size for approval.
- F. Submit signage guarantee: the sign contractor shall guarantee all workmanship and material for the product he has furnished and erected for a period of one year after the final acceptance of the product, and if during the guarantee period any defects or faulty materials are found he shall immediately upon notification by the Company proceed at his own expense to replace and repair same, together with any damage to all finishes, fixtures, equipment and furnishings that may be damaged as a result of this defective equipment or workmanship.
- G. Maintenance data and operating instructions: manufacturer's instructions and recommendations for maintenance and cleaning of products shall be provided as a project manual to accompany as-built shop drawings referenced in Item B above.

1.3 QUALITY ASSURANCE

- A. For the purposes of continuity in design and finished product, the contractor shall use a single signage subcontractor for execution and installation of all the signs in the contract unless otherwise specifically stated by the Company.
- B. Fabricator qualifications: it is required that the fabricator and any subcontractors for the work have in-house, the broad knowledge, diverse shop and field experience, flexibility, coordinating ability, skilled craftsmen, and physical plant necessary to produce quality products as judged by the Company.
- C. Design criteria.
 - 1. Structural design: details on drawings indicate a design approach for sign fabrication but do not necessarily include all fabricating details required for the complete structural integrity of the signs, including consideration for static, dynamic and erection loads during handling, erection and service at the installed locations, nor do they necessarily consider the preferred shop practices of the individual general sign fabricators. It shall be the responsibility of the fabricator to perform the complete structural design of the applicable signs and to incorporate all the reasonable safety factors necessary to protect the Company against public liability. Minimum design requirements shall be as specified in the most recent issue of the Standard Building Code.
 - a. Include anchor hardware as a part of the sign and graphics work.
 - b. Attachments to metal structures and existing ceilings must be approval of the Company. Whenever design calculations are required, they shall be designed by an engineer currently registered in the state of Tennessee and shall be submitted to the Company for approval.
- D. Requirements of regulatory agencies: comply with all Life Safety and state of Tennessee building codes and all other code agencies having jurisdiction over the project. Notify the Company of any conflicts between the specifications and such agencies.

1.4 PRODUCT HANDLING

- A. Procedure: pack, wrap, crate, bundle, box, bag, or otherwise package, handle, transport and store all fabricated work as necessary to provide protection from damage by every cause. Properly label all cartons, boxes or other containers with list of contents.

1.5 WARRANTY

- A. Warrant all work against failure because of faulty materials, workmanship, and design for a period of one year from date of substantial completion.

- B. Fading, cracking, warping, peeling, delamination, rusting, corroding, and structural failure, including distortion by whatever cause, shall be construed to mean failure because of faulty materials and workmanship.
- C. Failures during the warranty period shall be repaired or replaced to the satisfaction of the Company and at no cost to the Company.

1.6 MAINTENANCE MATERIALS

- A. Touch-Up paint: provide the Company with one quart can of touch-up paint of each color, thinner and cleanup solvent, and instructions for use. Label all such items. Reference use of maintenance materials in the aforementioned maintenance manual to be provided to the Company.

1.7 INSPECTION

- A. Company reserves the right to inspect work in the fabrication shop before it is shipped to the job site for installation.
- B. Fabricator shall inspect installation locations for conditions which will adversely affect execution, permanence and quality of work and shall notify the Company of any discrepancies and shall not proceed with installation until the conditions have been addressed.

PART 2 - PRODUCTS

2.1 FABRICATION AND INSTALLATION - GENERAL

- A. The following information describes in general terms the products to be provided in this contract and the expectations of the Company. Any deviation from this expectation is to be approved by the Company prior to execution of the work.
 - 1. Sign types.
 - a. The following descriptions are a synopsis of the design intent and are further illustrated on the design drawings.
 - 1) Sign Type 1 - ADA room identification signs.
 - a) The ADA compliant plaques fabricated of painted acrylic with vinyl graphics and photopolymer panel with room name or number and corresponding Grade II Braille.
 - b) Mount to various surfaces using double faced foam core tape and silicone adhesive.
 - 2) Sign Type 2 - evacuation plan holders.

- a) Insert holders fabricated of acrylic layered up with spacers to accept a page size insert slipped into a slot accessible from both ends of the sign.
 - b) Header and footer painted.
 - c) Vinyl graphics applied to header per drawing layout.
 - d) Insert computer generated color output onto card stock or onto paper stock laminated both sides.
 - e) Sign contractor to provide evacuation plan inserts for each sign location.
 - f) Mount to wall surfaces using double faced foam core tape and silicone adhesive.
- 3) Sign Type 3 - fire stair signs.
- a) Painted acrylic panel with vinyl graphics applied to surface.
 - b) Mount to various surfaces using double faced foam core tape and silicone adhesive.
- 4) Sign Type 4 - building directory.
- a) Non-lighted, strip directory with changeable name strips and fixed header and footer.
- NOTE: that exact size of the directory is not yet determined in the design drawings pending development of content by the Company.
- b) Provide color insert of plan of buildings similar to image shown on drawing.
 - c) Plan and insert to be provided by the sign contractor and subject to approval of the Company prior to production.
 - d) Mount the directory onto wood surface of the lobby wall using concealed fasteners and anchors.
- 5) Sign Type 5 - reception desk logo.
- a) Brushed aluminum logo cut from solid aluminum plate, 1/4" thick.
 - b) Horizontal drag grain.
 - c) Mount to wall surface using stainless steel studs threaded into back surface of logo components set into pre-drilled holes.
 - d) Space off wall 1/4" using threaded nuts.
 - e) Paint studs and spacing nuts black.
 - f) Artwork of the logo is available from the Company.
- 6) Sign Type 6 - street signs.

- a) Sign panels cut from 1/8" thick aluminum flat plate, finished and painted one side and all edges.
 - b) Street letter applied using white vinyl one side only.
 - c) Trim piece brushed aluminum applied to corner of corridor with street name panels butted to trim and mounted to wall using double faced tape and silicone adhesive.
- 7) Sign Type 6.1 - Street signs - flag mounted.
- a) Sign panel cut from 1/8" thick aluminum flat plate, finished and painted both sides and edges.
 - b) Sandwich panel between two 1/8" thick brushed aluminum angles using short threaded rod and acorn nuts both sides to capture panel securely.
 - c) Mount sign assembly to wall surface using flush, countersunk wall anchors.
 - d) Wall material may vary.
- 8) Sign Type 7 - floor directory.
- a) Changeable sign fabricated from layered acrylic to provide a pocket for card stock insert accessible from both sides of sign.
 - b) Paint header and footer to conceal spacers.
 - c) Carry color of header and footer around to sides of signs.
 - d) Provide computer generated card stock inserts with messages to be provided by the Company.
 - e) Mount to various wall surfaces using double faced tape and silicone adhesive.
 - f) Should weight of sign warrant, add minimum of two mounting studs threaded into back of sign for intent of carrying shear load of sign.
- 9) Sign Type 7.1 - directional signs.
- a) Changeable sign fabricated from layered acrylic to provide a pocket for card stock insert accessible from both sides of sign.
 - b) Paint header and footer to conceal spacers.
 - c) Carry color of header and footer around to sides of signs.
 - d) Provide computer generated card stock inserts with messages to be provided by the Company.
 - e) Mount to various wall surfaces using double faced tape and silicone adhesive.
 - f) Should weight of sign warrant, add minimum of two mounting studs threaded into back of sign for intent of carrying shear load of sign.

- 10) Sign Type 7.2 - notice holders - 11" x 17".
 - a) Changeable sign fabricated from layered acrylic to provide a pocket for card stock insert accessible from both sides of sign.
 - b) Paint header and footer to conceal spacers.
 - c) Carry color of header and footer around to sides of signs.
 - d) Provide computer generated card stock inserts with messages to be provided by the Company.
 - e) Mount to various wall surfaces using double faced tape and silicone adhesive.
 - f) Should weight of sign warrant, add minimum of two mounting studs threaded into back of sign for intent of carrying shear load of sign.

- 11) Sign Type 7.3 - notice holders - 8 1/2" x 11".
 - a) Changeable sign fabricated from layered acrylic to provide a pocket for card stock insert accessible from both sides of sign.
 - b) Paint header and footer to conceal spacers.
 - c) Carry color of header and footer around to sides of signs.
 - d) Provide computer generated card stock inserts with messages to be provided by the Company.
 - e) Mount to various wall surfaces using double faced tape and silicone adhesive.
 - f) Should weight of sign warrant, add minimum of two mounting studs threaded into back of sign for intent of carrying shear load of sign.

- 12) Sign Type 8 - division name signs.
 - a) Changeable sign fabricated from layered acrylic to provide a pocket for card stock insert accessible from both sides of sign.
 - b) Paint header and footer to conceal spacers.
 - c) Carry color of header and footer around to sides of signs.
 - d) Graphics white vinyl applied to header along with ADA compliant room number panel made of photopolymer.
 - e) Provide computer generated card stock inserts with messages to be provided by the Company.
 - f) Mount to various wall surfaces using double faced tape and silicone adhesive.
 - g) Should weight of sign warrant, add minimum of two mounting studs threaded into back of sign for intent of carrying shear load of sign.

- 13) Sign Type 9 - room identification – staff.
- a) Changeable sign fabricated from layered acrylic to provide a pocket for card stock insert accessible from both sides of sign.
 - b) Paint header and footer to conceal spacers.
 - c) Carry color of header and footer around to sides of signs.
 - d) Graphics white vinyl applied to header along with ADA compliant room number panel made of photopolymer.
 - e) Provide computer generated card stock inserts with messages to be provided by the Company.
 - f) Mount to various wall surfaces using double faced tape and silicone adhesive.
 - g) Should weight of sign warrant, add minimum of two mounting studs threaded into back of sign for intent of carrying shear load of sign.
- 14) Sign Type 9.1 - pod identification – staff.
- a) Changeable sign fabricated from layered acrylic to provide a pocket for card stock insert accessible from both sides of sign.
 - b) Paint header and footer to conceal spacers.
 - c) Carry color of header and footer around to sides of signs.
 - d) Graphics white vinyl applied to header along with ADA compliant room number panel made of photopolymer.
 - e) Provide computer generated card stock inserts with messages to be provided by the Company.
 - f) Mount to various wall surfaces using double faced tape and silicone adhesive.
 - g) Should weight of sign warrant, add minimum of two mounting studs threaded into back of sign for intent of carrying shear load of sign.
- 15) Sign Type 10 - utility room identification – staff.
- a) Changeable sign fabricated from layered acrylic to provide a pocket for card stock insert accessible from both sides of sign.
 - b) Paint header and footer to conceal spacers.
 - c) Carry color of header and footer around to sides of signs.
 - d) Graphics white vinyl applied to header along with ADA compliant room number panel made of photopolymer.
 - e) Provide computer generated card stock inserts with messages to be provided by the Company.
 - f) Mount to various wall surfaces using double faced tape and silicone adhesive.

- g) Should weight of sign warrant, add minimum of two mounting studs threaded into back of sign for intent of carrying shear load of sign.
- 16) Sign Type 11 - lab identification signs.
- a) Changeable sign fabricated from layered acrylic to provide a pocket for card stock insert accessible from both sides of sign.
 - b) Paint header and footer to conceal spacers.
 - c) Carry color of header and footer around to sides of signs.
 - d) Graphics white vinyl applied to header along with ADA compliant room number panel made of photopolymer.
 - e) Provide computer generated card stock inserts with messages to be provided by the Company.
 - f) Mount to various wall surfaces using double faced tape and silicone adhesive.
 - g) Should weight of sign warrant, add minimum of two mounting studs threaded into back of sign for intent of carrying shear load of sign.
 - h) Provide quantity of lab hazard card inserts as determined by the Company.
- NOTE: that final message of hazard insert to be determined by the Company.
- i) Laminate final inserts and trim laminate so that laminate does not protrude out of insert slot.
- 17) Sign Type 11.1 - hazard insert.
- a) Laminated card stock bearing message to be determined by the Company.
 - b) Provide inserts in quantity to be determined by the Company.
 - c) Laminate final inserts and trim laminate so that laminate does not protrude out of insert slot.
- 18) Sign Type 12 - fire extinguisher signs.
- a) Sign panels cut from 1/8" thick acrylic cut to shape and painted red all surfaces.
 - b) Apply white vinyl graphics to sign face.
 - c) Mount sign panels to T shaped aluminum extrusion using double faced tape and silicone adhesive.
 - d) Provide spacer 1" inside outer edge of sign assembly to maintain uniform thickness of space between sign panels.
 - e) Paint spacer black so that it is not seen.

- f) Mount sign brackets to wall surfaces using flush, countersunk fasteners.
- 19) Sign Type 12.1 - fire pull flag signs.
- a) Sign panels cut from 1/8" thick acrylic cut to shape and painted red all surfaces.
 - b) Apply white vinyl graphics to sign face.
 - c) Mount sign panels to T shaped aluminum extrusion using double faced tape and silicone adhesive.
 - d) Provide spacer 1" inside outer edge of sign assembly to maintain uniform thickness of space between sign panels.
 - e) Paint spacer black so that it is not seen.
 - f) Mount sign brackets to wall surfaces using flush, countersunk fasteners.
- 20) Sign Type 12.2 - emergency eyewash sign.
- a) Sign panels cut from 1/8" thick acrylic cut to shape and painted dark green all surfaces.
 - b) Apply white vinyl graphics to sign face.
 - c) Mount sign panels to T shaped aluminum extrusion using double faced tape and silicone adhesive.
 - d) Provide spacer 1" inside outer edge of sign assembly to maintain uniform thickness of space between sign panels.
 - e) Paint spacer black so that it is not seen.
 - f) Mount sign brackets to wall surfaces using flush, countersunk fasteners.
- 21) Sign Type 12.3 - emergency shower and eyewash sign.
- a) Sign panels cut from 1/8" thick acrylic cut to shape and painted dark green all surfaces.
 - b) Apply white vinyl graphics to sign face.
 - c) Mount sign panels to T shaped aluminum extrusion using double faced tape and silicone adhesive.
 - d) Provide spacer 1" inside outer edge of sign assembly to maintain uniform thickness of space between sign panels.
 - e) Paint spacer black so that it is not seen.
 - f) Mount sign brackets to wall surfaces using flush, countersunk fasteners.
- 22) Sign Type 13 - vinyl graphics at entrances.

- a) Graphics shall be premium cast 2 mil vinyls as manufactured by 3M, or approved equal, and cut using computer controlled device for accurate reproduction of typography and graphic elements.
- b) Apply directly to clean sign surfaces.

NOTE: that this spec shall be used for all vinyl messages used on every sign type where vinyl is called for.

2.2 MATERIALS - PLASTICS

- A. Acrylic: made with methyl methacrylate polymers, as manufactured by Rohm and Haas, or equivalent as approved by the Company.
 1. Provide solid sheet, laminated sheet, or cast acrylic in size, thickness, clarity, opacity, texture, and color noted in drawings.

2.3 MATERIALS - ADHESIVE FILM (VINYL GRAPHICS)

- A. Vinyl graphics:
 1. Where ever noted in these specifications, pressure sensitive adhesive type, cast 2 mil premium vinyl's, pre-spaced, gloss finish, manufactured by 3M Corporation, Gerber Scientific Products, Anacast, Inc., or approved equal. Apply free of air pockets, bubbles, or other surface blemishes or deformities.
 2. Where graphics are photo silkscreened onto vinyl sheet, use screen ink appropriate for exterior conditions and compatible with vinyl.

2.4 MATERIALS - MISCELLANEOUS

- A. Adhesives:
 1. Silicone: clear silicone adhesive #1201 as manufactured by General Electric or #732 silicones adhesive as manufactured by Dow Corning as approved by the Company.
 2. Epoxy: type approved by the Company.
 3. Versiloc adhesive as manufactured by Lord Chemical Company.
 4. Adhesive tapes: double-faced tape – 1/16” thick, or thinner, foam core tape with adhesive both sides as manufactured by 3M or equal. Color of tape to be black or white to match the color of the surface the sign is installed upon, i.e., signs or letters installed on light colored walls use white tape; signs or letters installed on dark walls use black tape.

5. Cement for acrylic plastic. No. 4 cements by Industrial Polychemical Co., or approved equal.

2.5 MATERIALS - PAINT

- A. Exposed surfaces: paint to be two-component acrylic polyurethane formulation as manufactured by Mathews Paint Company, Wyandotte Paint Company, or approved equal. Apply primers and finish coats according to manufacturer's instructions. Finish being eggshell.
- B. Samples: provide required samples of paint for approval on properly cleaned and primed material paint is to be ultimately applied to.
- C. Colors: various finishes and colors have been used in the building and sign colors have been chosen to compliment and work with the building design elements. A list of colors will be provided to the successful contractor. Colors are noted on drawings in a generic manner, i.e., 'dark green'; 'yellow', etc. The intent is to match the specified colors.

2.6 WORKMANSHIP - GENERAL

- A. Trades work: it is intended that the workmanship be of the highest quality obtainable by the respective trades and crafts experienced in the fabrication of signs, and that all work be done by journeymen, or by tradesmen under the direct supervision of journeymen.
 1. "Journeymen" shall be interpreted to mean those craftsmen who have the qualifications and experience to meet the requirements described in the job classification and descriptions for the electric sign industry, as developed by the National Electric Sign Association (NESA)/TRI-Trades Committee.
- B. Artisans: it is intended that work of an artistic or specialized nature such as laser cutting and engraving, artistic painting, when included as part of contract, be executed by artisans with experience, credentials, and reputation to satisfy the demands of the Company.

2.7 FABRICATION - GENERAL

- A. Intent of specifications: it is intended that all finished work be of the highest quality to pass eye-level examination and scrutiny by the Company.
 1. Construct all work to eliminate burrs, cutting edges, and sharp corners.
 2. Finish welds on exposed surfaces to be imperceptible in the finished work.
 3. Except as indicated or directed otherwise, finish all surfaces smooth.
 4. Surfaces which are intended to be flat shall be without bulges, oil-canning, or other physical deformities.

5. Surfaces which are intended to be curved shall be smoothly free-flowing to required shapes.
6. Except where approved otherwise by the Company, conceal all fasteners.
7. Make access panels tight-fitting and flush with adjacent surfaces.
8. Conceal all identification labels inside signs. Do not apply labels of any type which cannot be concealed. Provide sample of all labels to the Company for review of size and location.
9. All material shall be new stock, free from defects impairing strength, durability, and appearance.
10. No fabrication of installation materials or procedure shall be used that will in any way change the visual quality or in any manner have an adverse effect on existing materials and surfaces.
11. All adhesives shall be used in accordance with recommendations made by the manufacturer of the materials to be laminated or adhered.
12. No adhesives that will fade, discolor, or delaminate as a result of proximity to ultraviolet light source or heat therefrom shall be used, and shall not change the color of or deteriorate the materials to which they are to be applied. The adhesives shall be of non-staining, non-yellowing quality, and all visible joints shall be free from air bubbles and other defects.
13. Sign faces must be clean and free of glue or other foreign material. Edges to be smooth and straight.
14. Painted surfaces to be resistant to crazing, peeling, scratching and fading. All coatings shall conform to manufacturer's requirements.
15. Full size original art for each sign shall be prepared by the contractor. The messages are to be photo-typeset or computer generated; no handcutting of screens or templates is permitted. All symbols, logos, etc. are to photographically reproduce or computer generated.
16. If messages do not fit in a specific format shown on the drawings, submit alternate layout of the message in question to the Company for approval.
17. All lettering shall be executed in such manner that all edges and corners of finished letter forms are true, sharp and clean. Letterforms with rounded positive or negative corners, edge build-up, bleeding, sawtoothing, pinholes, etc. will not be accepted.
18. All vinyl letters or silkscreening shall be on the top surface of the recommended material unless otherwise specified on the drawings.

19. All letterforms shall be aligned as to maintain a base line parallel to the sign format unless otherwise noted.
20. All die-cutting or computer generated knife cutting shall be executed in such a manner that all edges and corners of finished letterforms are true and clean. Letterforms with rounded positive or negative corners, niched, cut or ragged edges, etc. will not be accepted.
21. All inks and paints required for engraving or silkscreen and imprinted surfaces shall be of a type made for the surface material on which it is applied and recommended by the manufacture of the ink or paint. Exact identification of all inks and paints shall be noted on the shop drawings, together with date describing the method of application, if other than "air drying".
22. No paints or inks that will fade, discolor, or delaminate as a result of proximity to ultraviolet light source or heat therefrom shall be used.
23. All inks and paints shall be evenly applied and without pinholes, scratches, orange peeling, application marks, and other defects. Workmanship in connection with finishes and formation of letters shall conform to the highest standards of the trade.
24. Cleaning of any kind, prime coats or other surface pre-treatment, where recommended by the manufacturer for inks and paints, shall be included in the work as part of the finished surface work at no extra cost to the Company.
25. Carefully follow manufacturer's recommended fabricating procedures regarding expansion, contraction, fastening, and restraining of acrylic plastic or glass.
26. Exercise care to assure that polished and plated surfaces are unblemished in the finished work.
27. Isolate dissimilar materials. Exercise particular care to isolate non-ferrous metals from ferrous metals.

PART 3 - EXECUTION

3.1 INSTALLATION - GENERAL

- A. Verify the exact location with the Company at the job-site for all signs which are not exactly dimensioned on the drawings.
- B. Sign installation work shall be under the direct supervision of a journeyman sign erector.
- C. Securely anchor work in proper location using anchors, anchorage's, fasteners, or other methods approved on shop or erection drawings. All anchors and fasteners shall be appropriate for the anchorage condition. All hardware in locations subject to moisture or other corrosive elements are to be stainless steel.

- D. Final adjustments and cleaning:
 - 1. Touch up all scratched, marred, abraded, or otherwise damages surfaces to match original finishes.
 - 2. Clean up work area after installation has been completed.
- E. The Company is the final arbiter on i nterpretation of the documents. Questions concerning format, actual message copy, and actual sign location should be forwarded to the Company in writing. Decision by the Company as to compliance with the documents will be final.

END OF SECTION

Drawing List

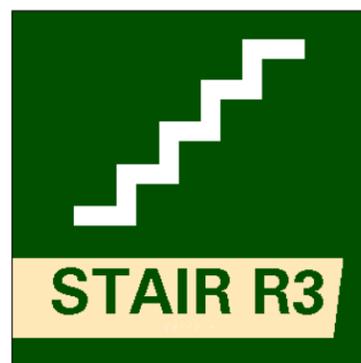
- EC.A Graphic Elements
 - EC.1 Sign Type 1 - ADA Room Identification Signs
 - EC.2 Sign Type 2 - Evacuation Plan Holders
 - Sign Type 3 - Fire Stair Signs
 - EC.3 Sign Type 4 - Building Directory
 - EC.4 Sign Type 5 - Reception Desk Logo
 - EC.5 Sign Type 6 - Street Signs
 - EC.5.1 Sign Type 6.1 - Street Signs - Flag Mounted
 - EC.6 Sign Type 7 - Floor Directory
 - EC.7 Sign Type 7.1 - Directional Signs
 - EC.8 Sign Type 7.2 - Notice Holders - 11" x 17"
 - Sign Type 7.3 - Notice Holders - 8 1/2" x 11"
 - EC.9 Sign Type 8 - Division Name Signs
 - EC.10 Sign Type 9 - Room Identification - Staff
 - Sign Type 9.1 - Pod Identification - Staff
 - EC.11 Sign Type 10 - Utility Room Identification - Staff
 - Sign Type 10.1
 - EC.12 Sign Type 11 - Lab Identification Signs
 - EC.12.1 Sign Type 11.1 - Hazard Insert
 - EC.13 Sign Type 12 - Emergency Marker Flag Signs
 - Sign Type 12.1 - Fire Pull Flag Signs
 - EC.14 Sign Type 14 - Vinyl Graphics at Entrances



OAK RIDGE
NATIONAL
LABORATORY

SIGNAGE
DESIGN

CONSTRUCTION DOCUMENTS

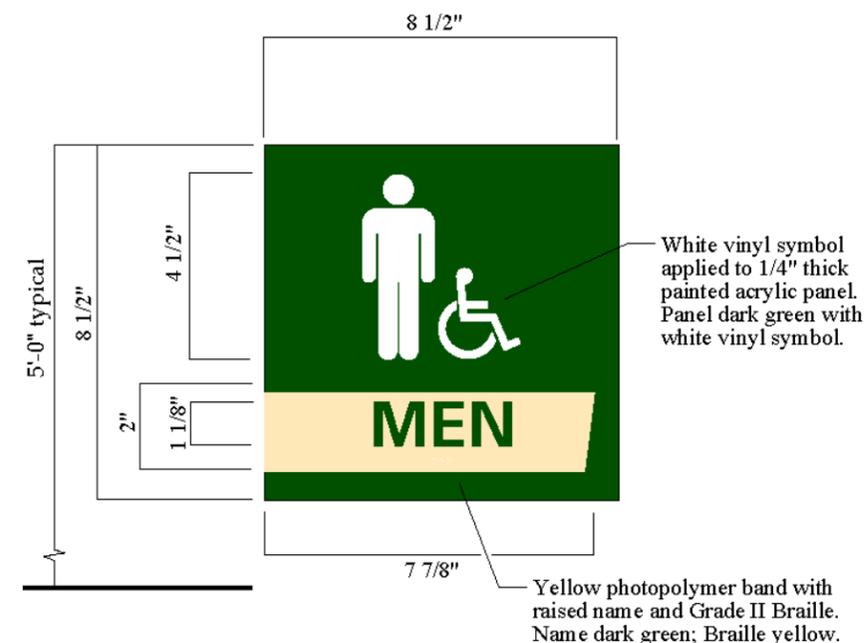


Stair sign for use on corridor side of stair doors. Stair numbers vary.



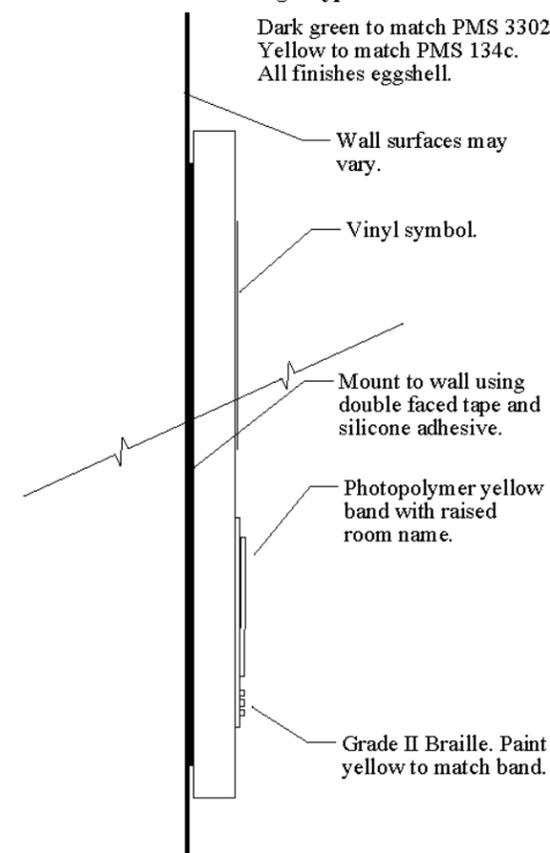
Typical Elevations 1/4"=1"

Confirm quantities of each sign layout with owner.

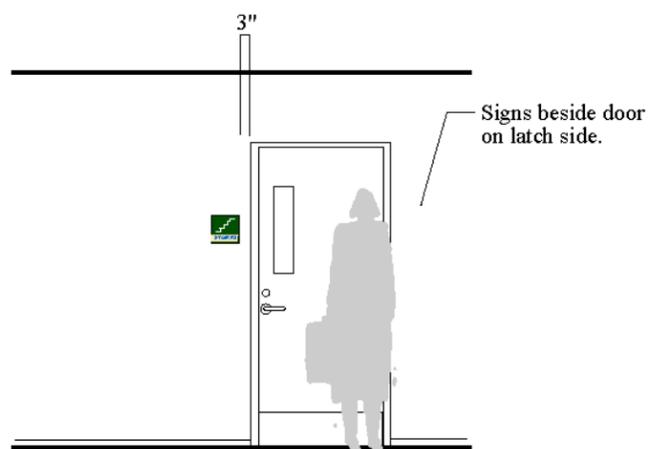


Sign Type 1 - ADA Room Identification Signs 1/4"=1"

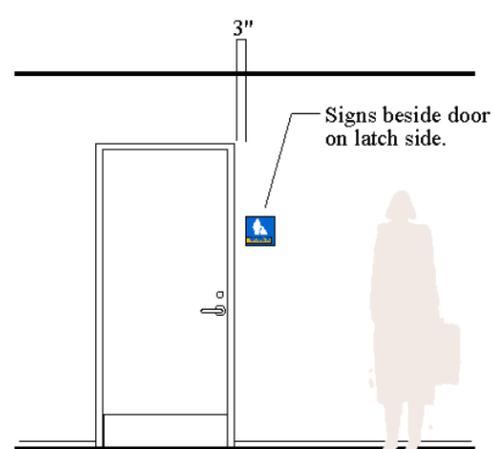
Dark green to match PMS 3302c
Yellow to match PMS 134c.
All finishes eggshell.



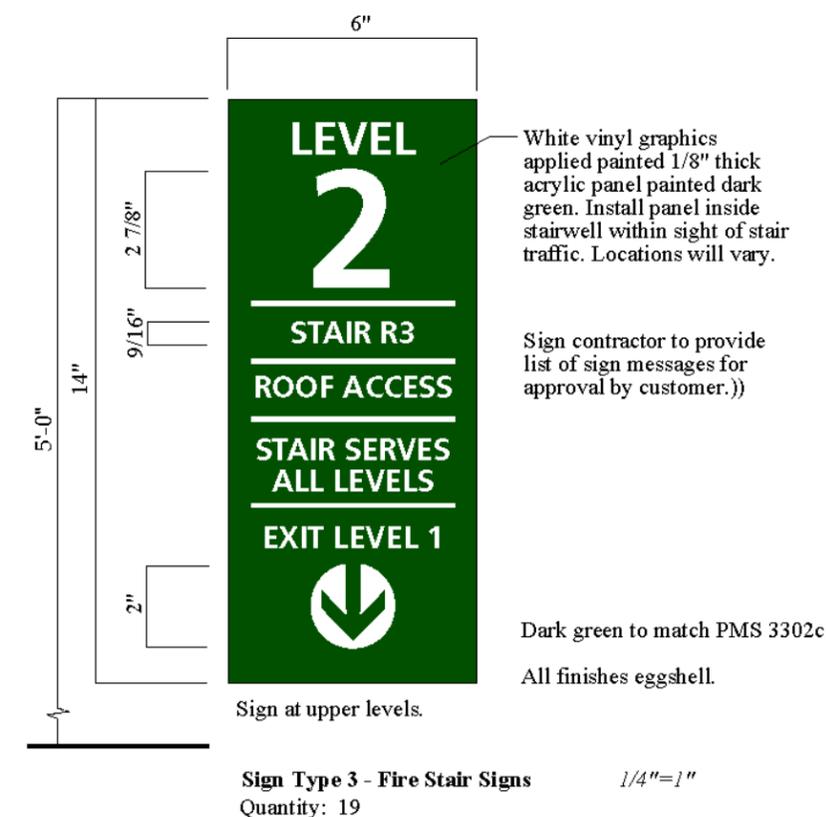
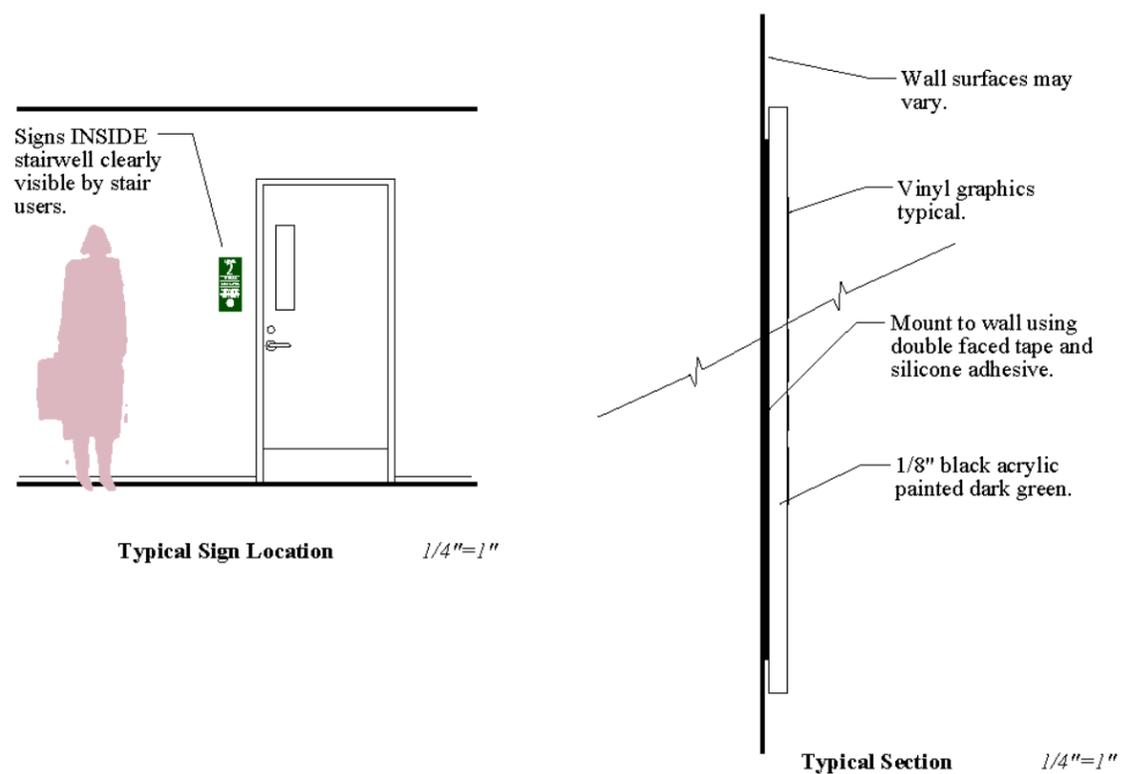
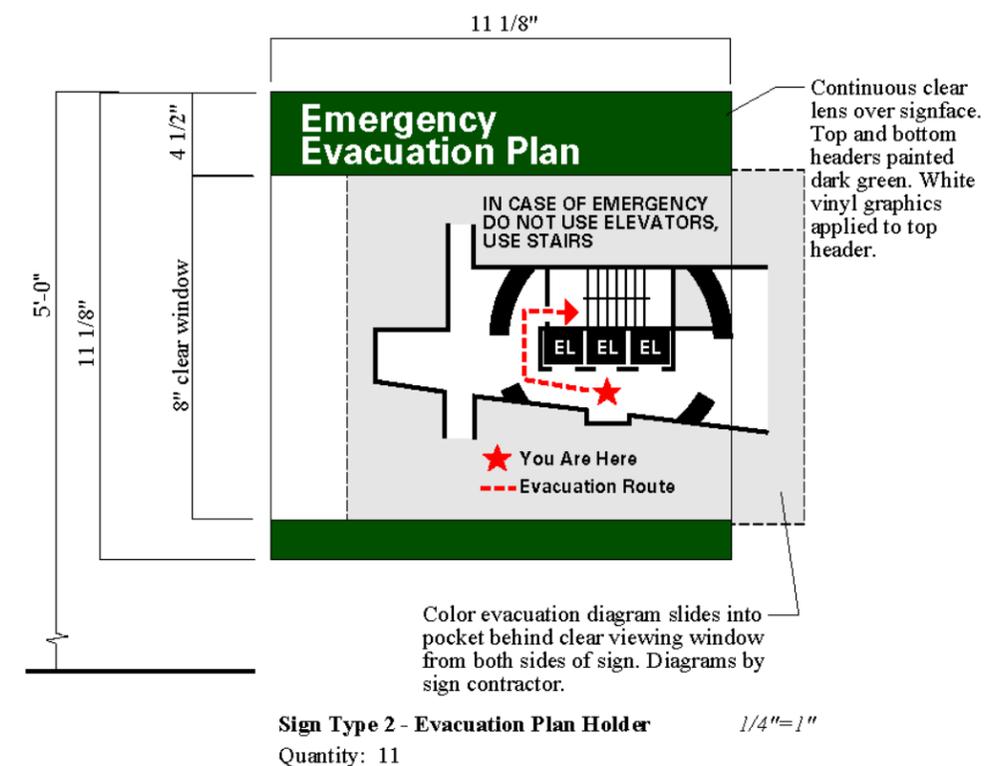
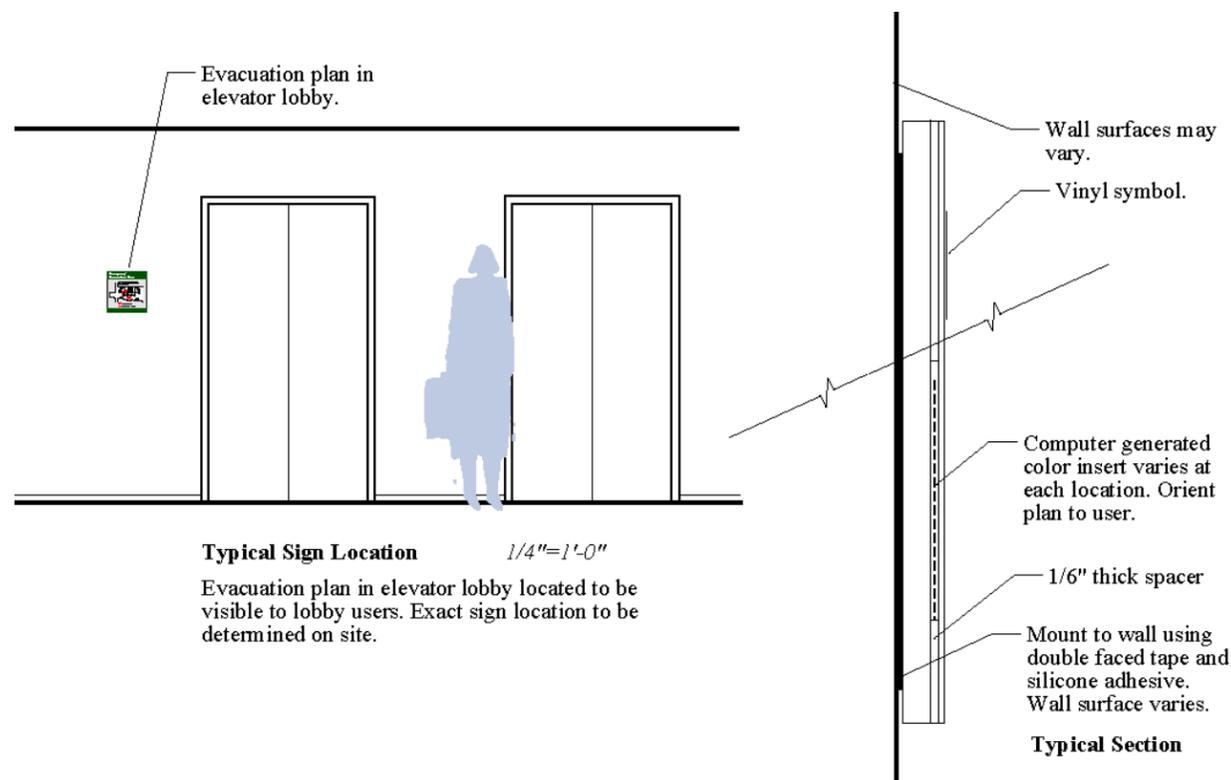
Typical Section 1/4"=1"

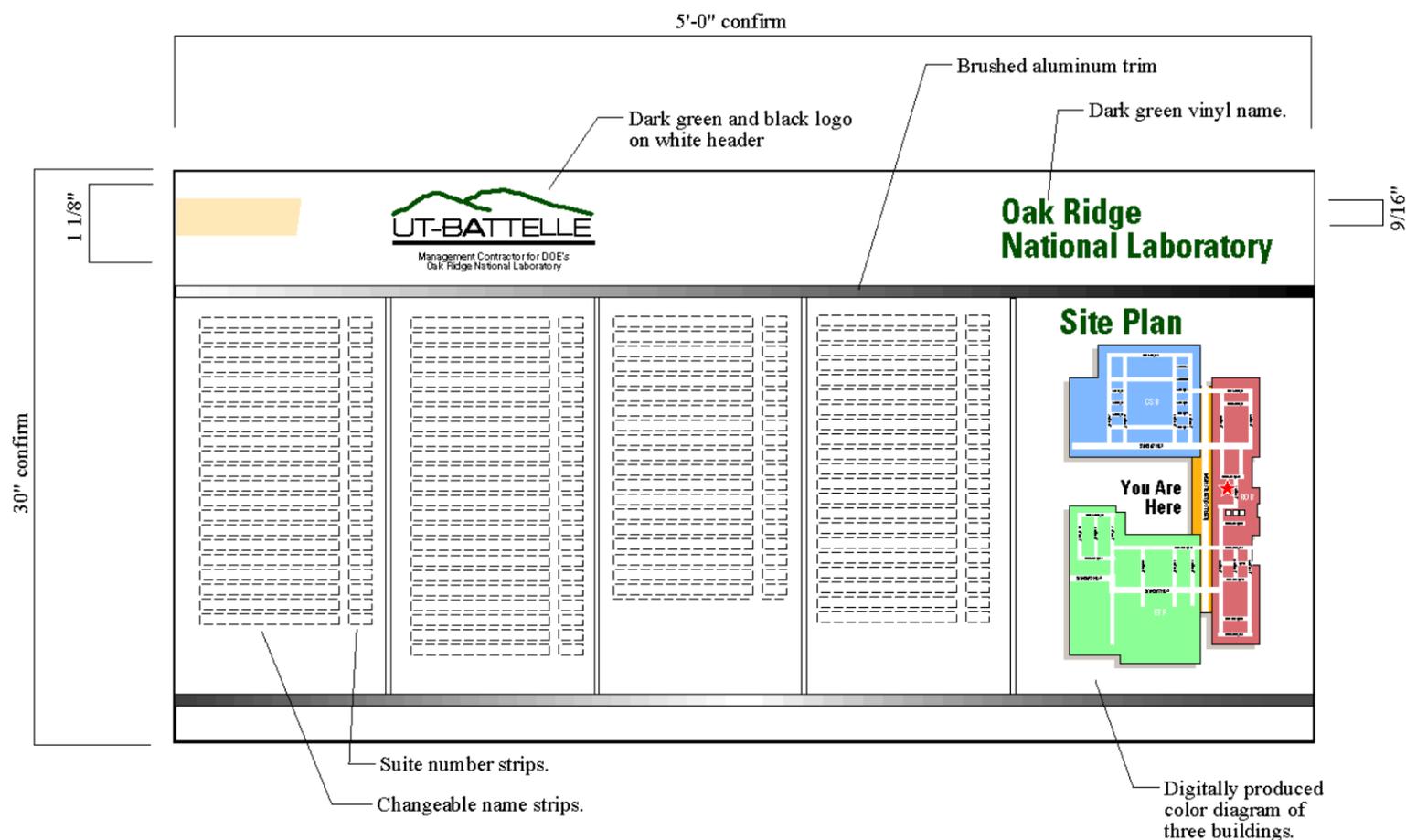


Typical Stair Sign Location 1/4"=1'-0"



Typical Toilet Sign Location 1/4"=1'-0"

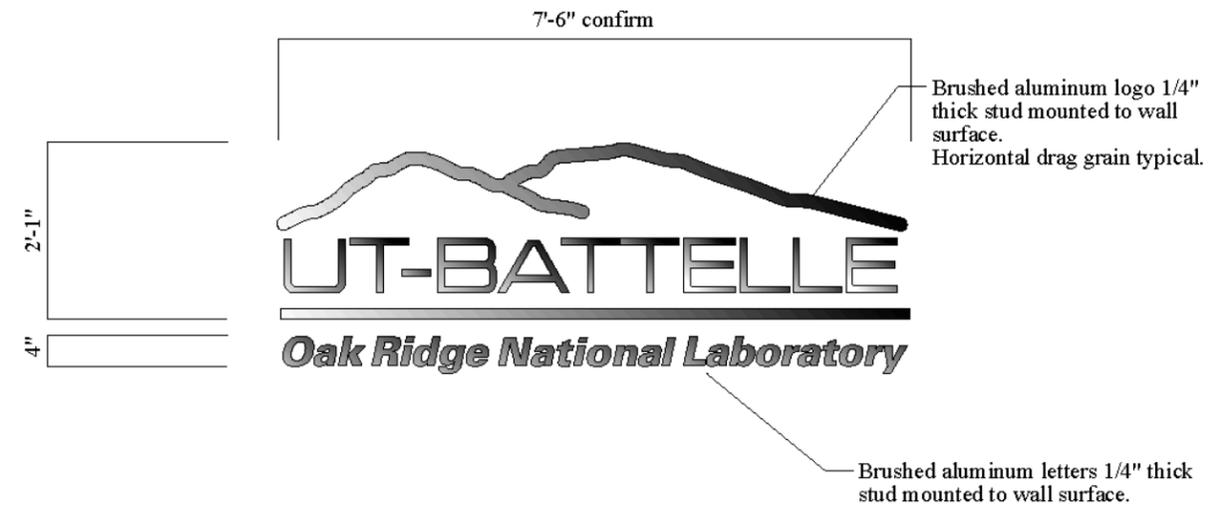




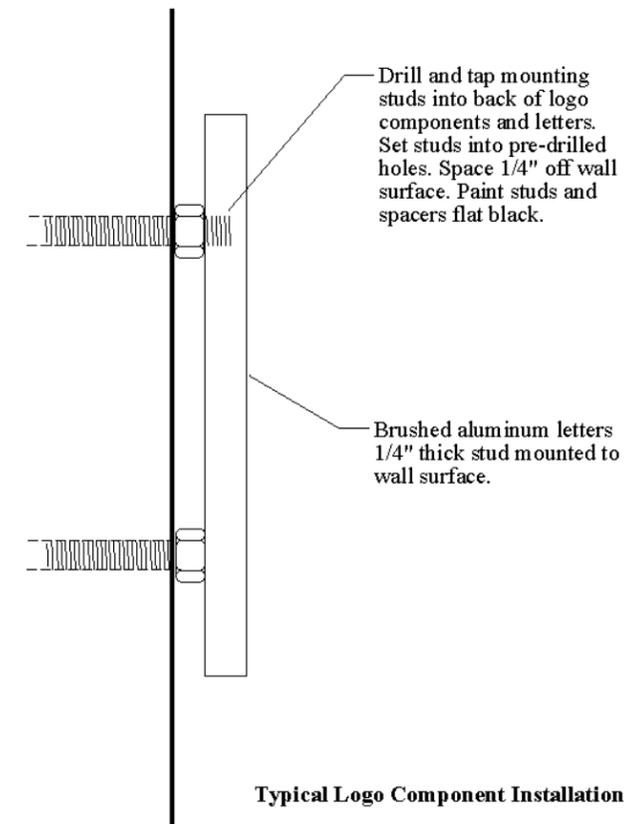
Sign Type 4 - Building Directory 1/4"=1"

Mount directory in building lobby. Size to be determined.

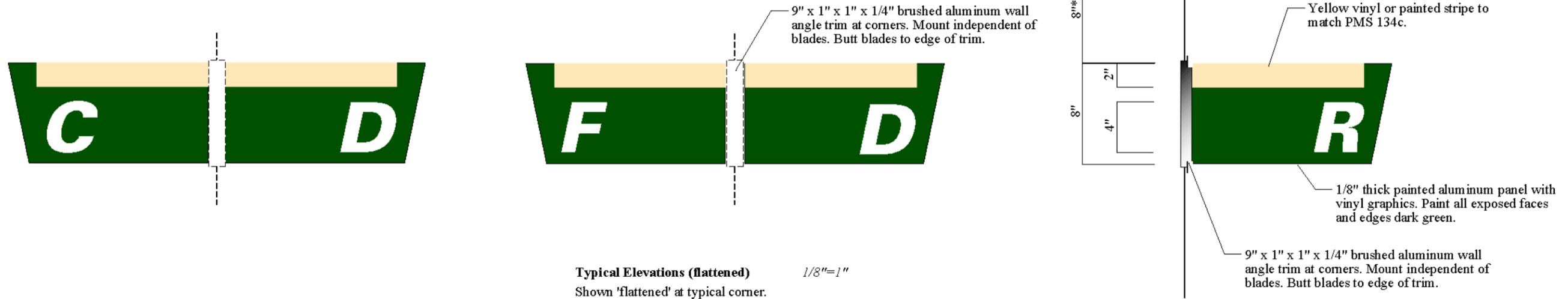
Directory not lighted internally.



Sign Type 5 - Building Identification in Lobby *1/2"=1'-0"*



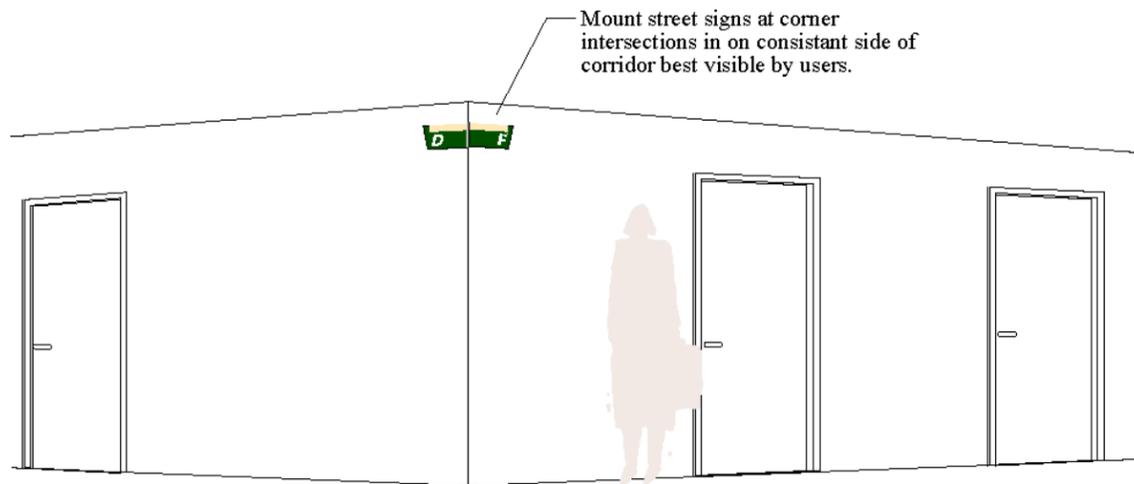
Typical Logo Component Installation *full size*



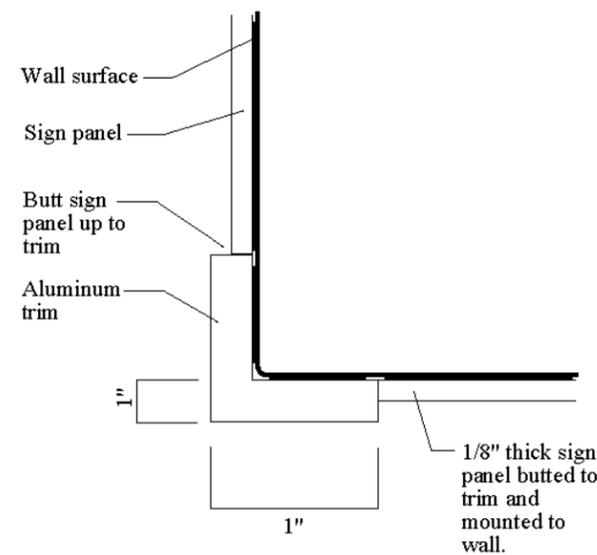
Dark green to match PMS 3302c
Yellow to match PMS 134c.
All finishes eggshell.

Sign Type 6 - Street Signs 1/8"=1"

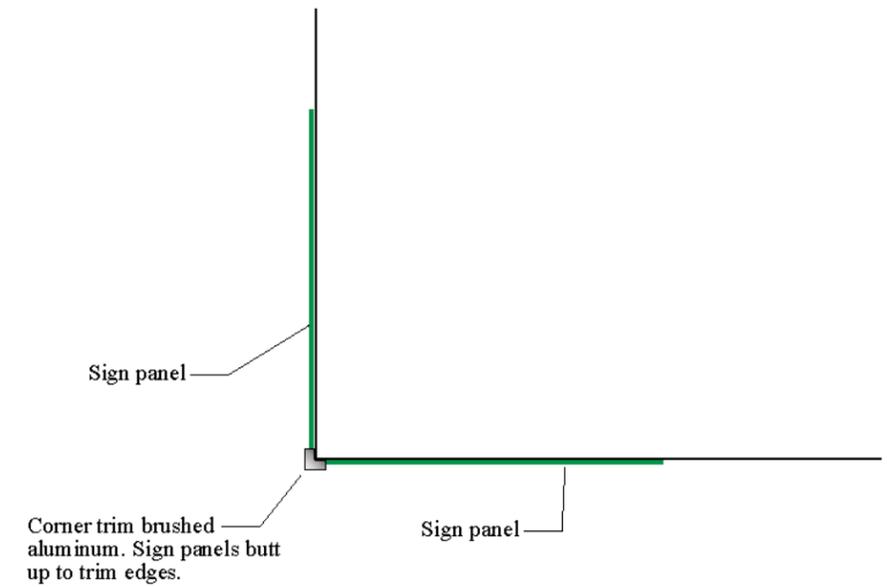
* Should conflicts arise with ceiling mounted components such as pipes, conduits, etc., distance down from ceiling may vary subject to owner's approval.



Typical Sign Location 1/4"=1'-0"

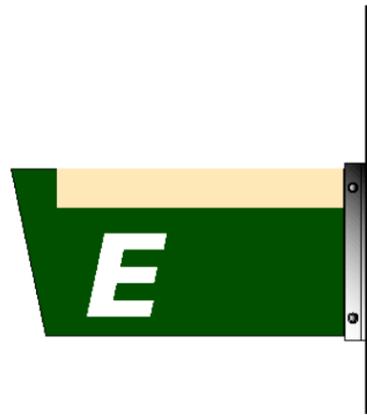


Enlarged Corner Detail full size

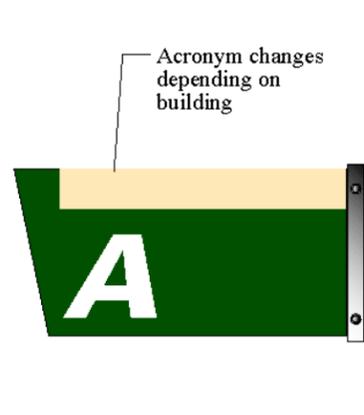


Plan View at Corner 1/8"=1"

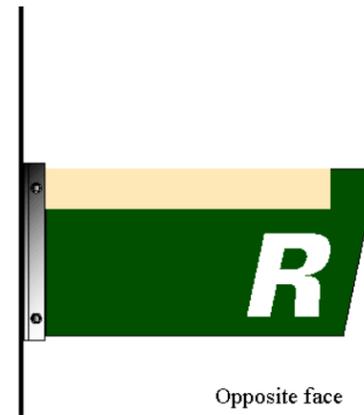
Signs mounted at each intersection of corridors.



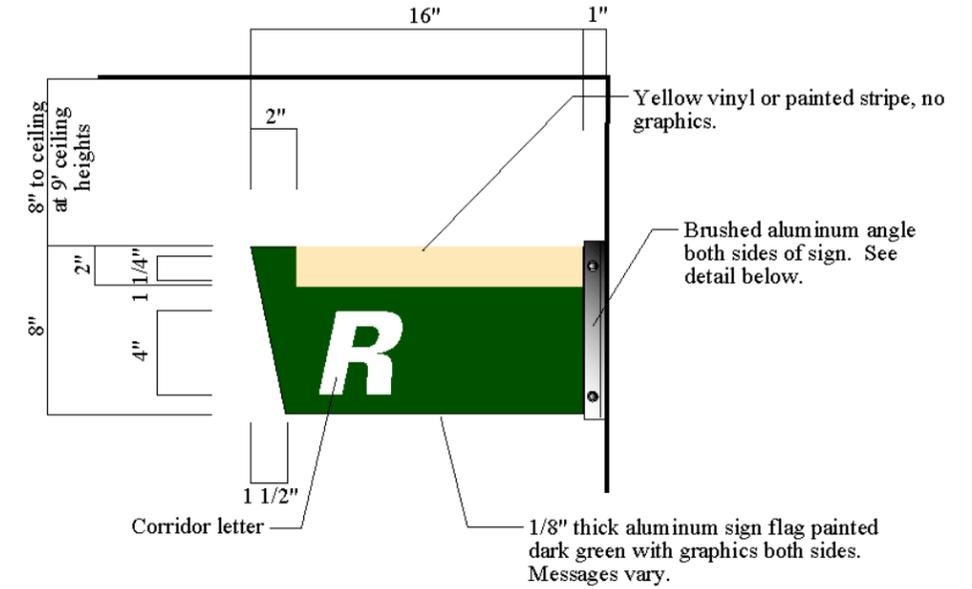
Sample layout from ETF.



Sample layout from CSB.

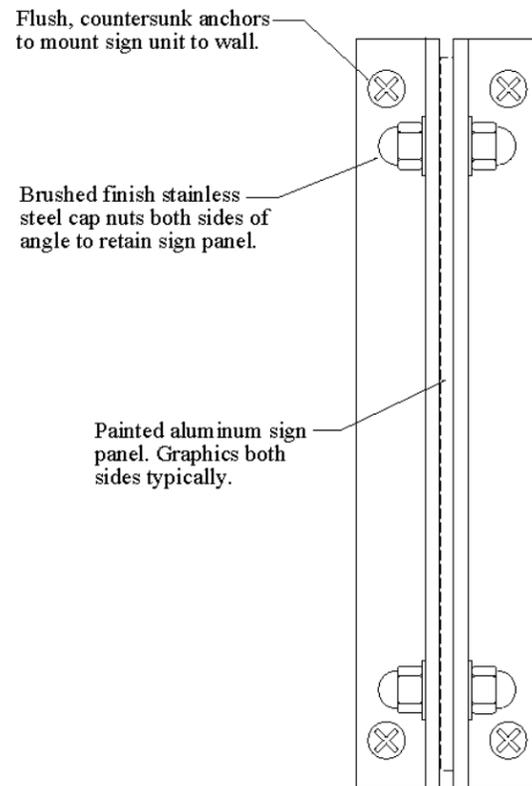


Opposite face

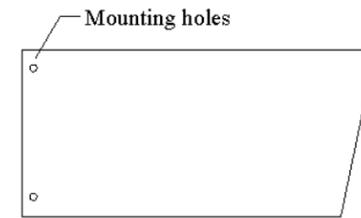


Sign Type 6.1 - Street Signs 1/8"=1"

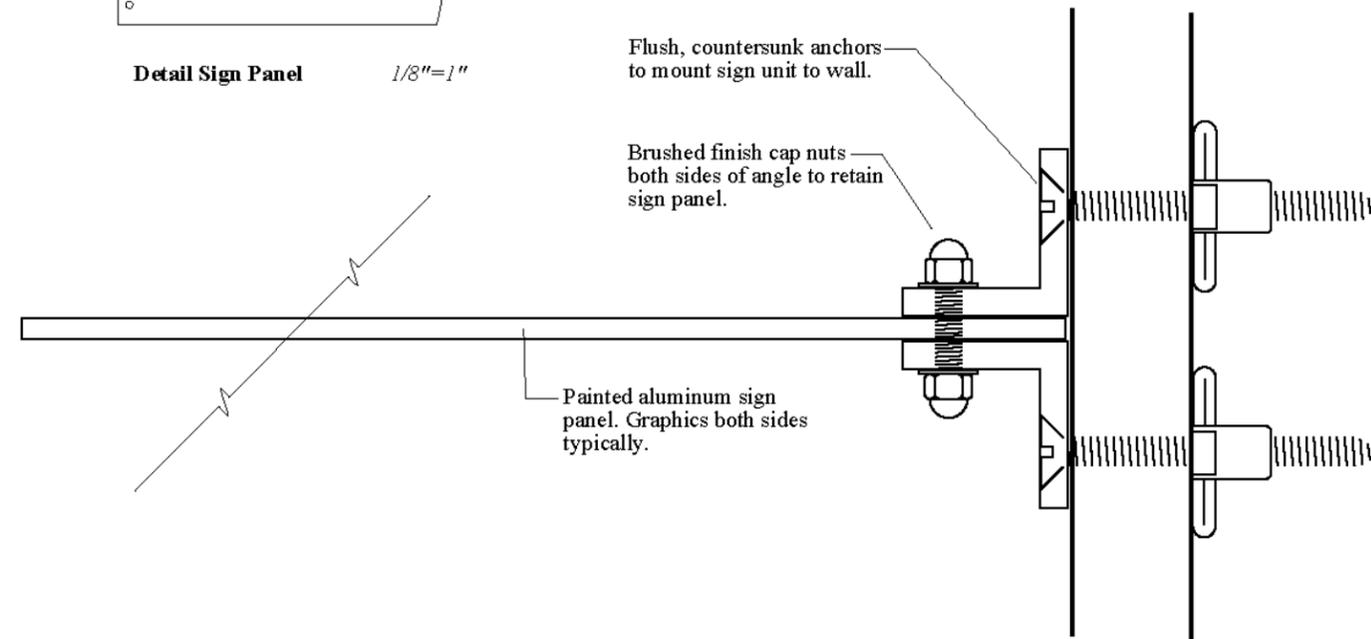
* Should conflicts arise with ceiling mounted components such as pipes, conduits, etc., distance down from ceiling may vary subject to owner's approval.



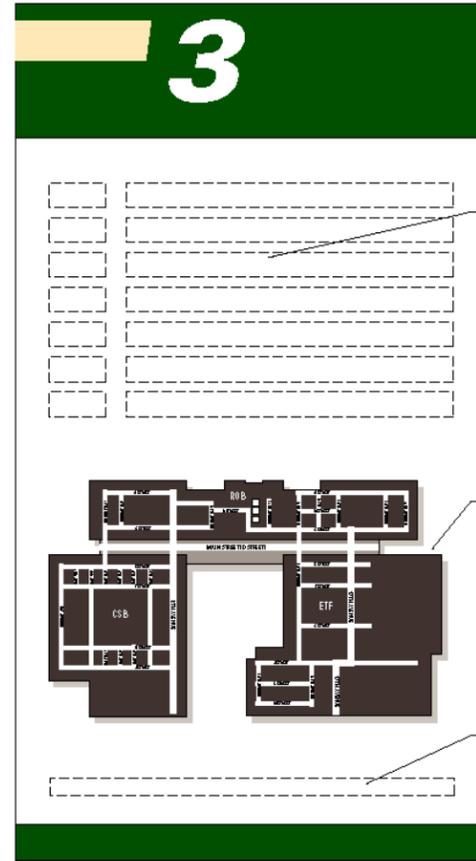
End View half size



Detail Sign Panel 1/8"=1"



Plan View at Mounting Bracket full size
Confirm location of all flag signs along Main Street.

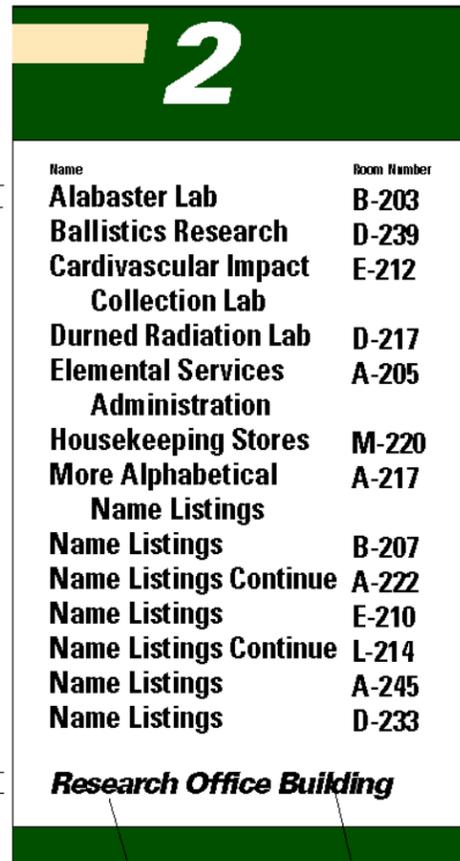


Alternate Insert Layout with Plan 1/4"=1"

Limited lines of occupant names.

Schematic building diagram with corridors and 'you are here' marker. Orient plan to user.

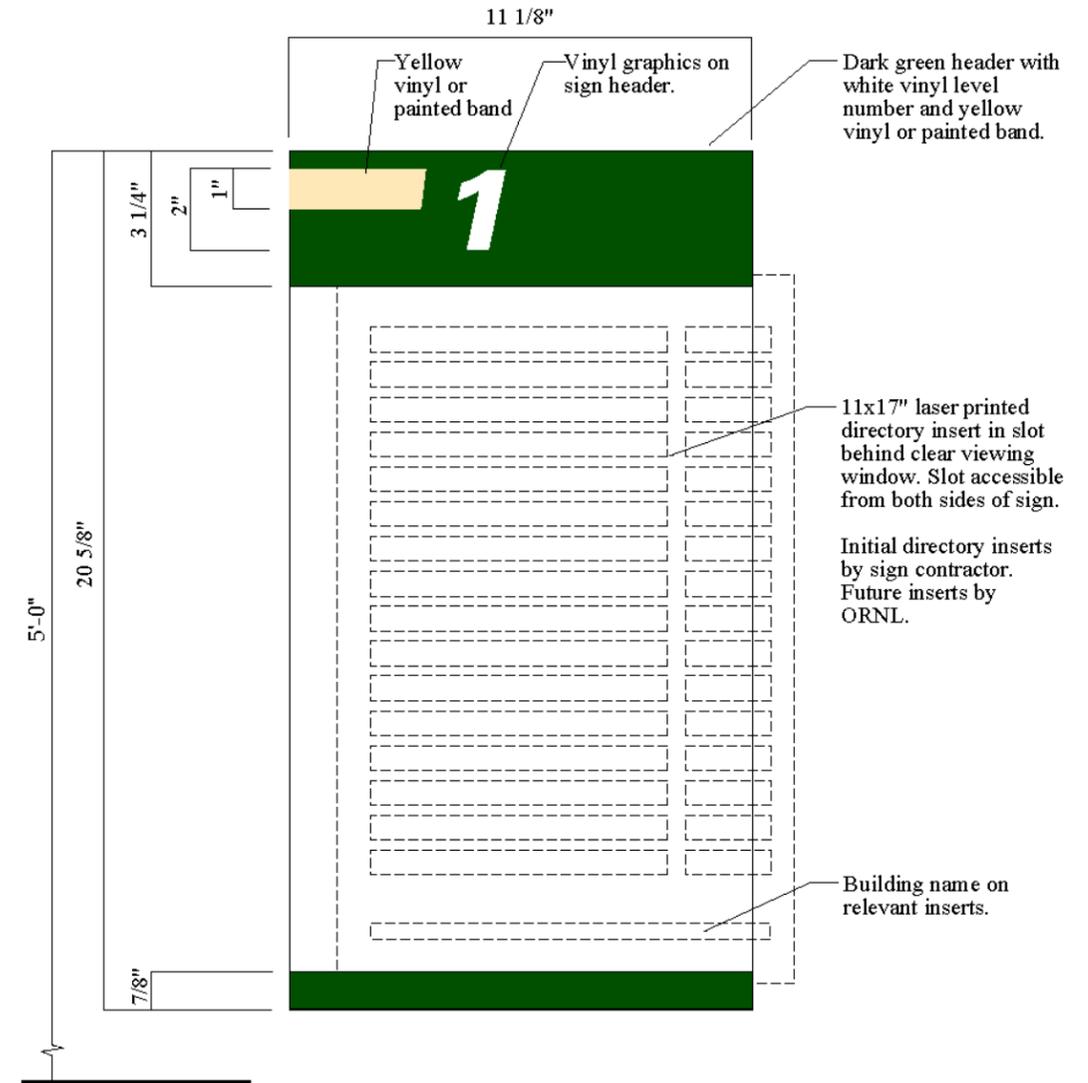
Building name on relevant inserts.



Building name on relevant inserts.

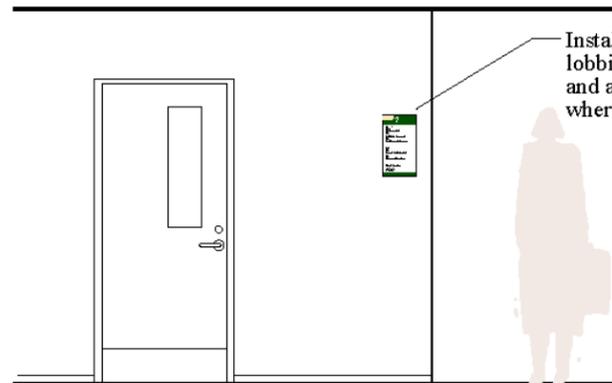
11x17" laser printed directory insert.

Typical Insert Layout 1/4"=1"



Sign Type 7 - Floor Directory 1/4"=1"

Dark green to match PMS 3302c
Yellow to match PMS 134c.
All finishes eggshell.

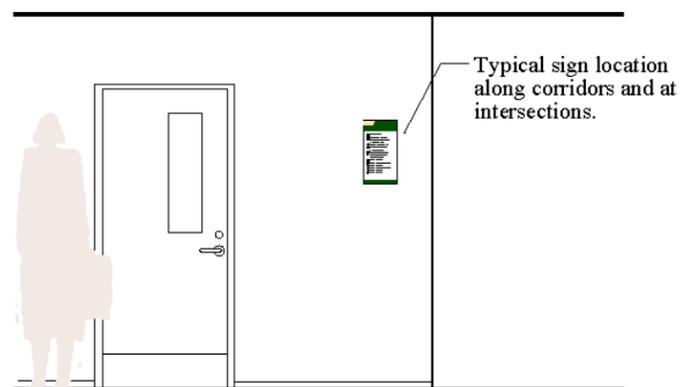


Typical Sign Location 1/4"=1'-0"

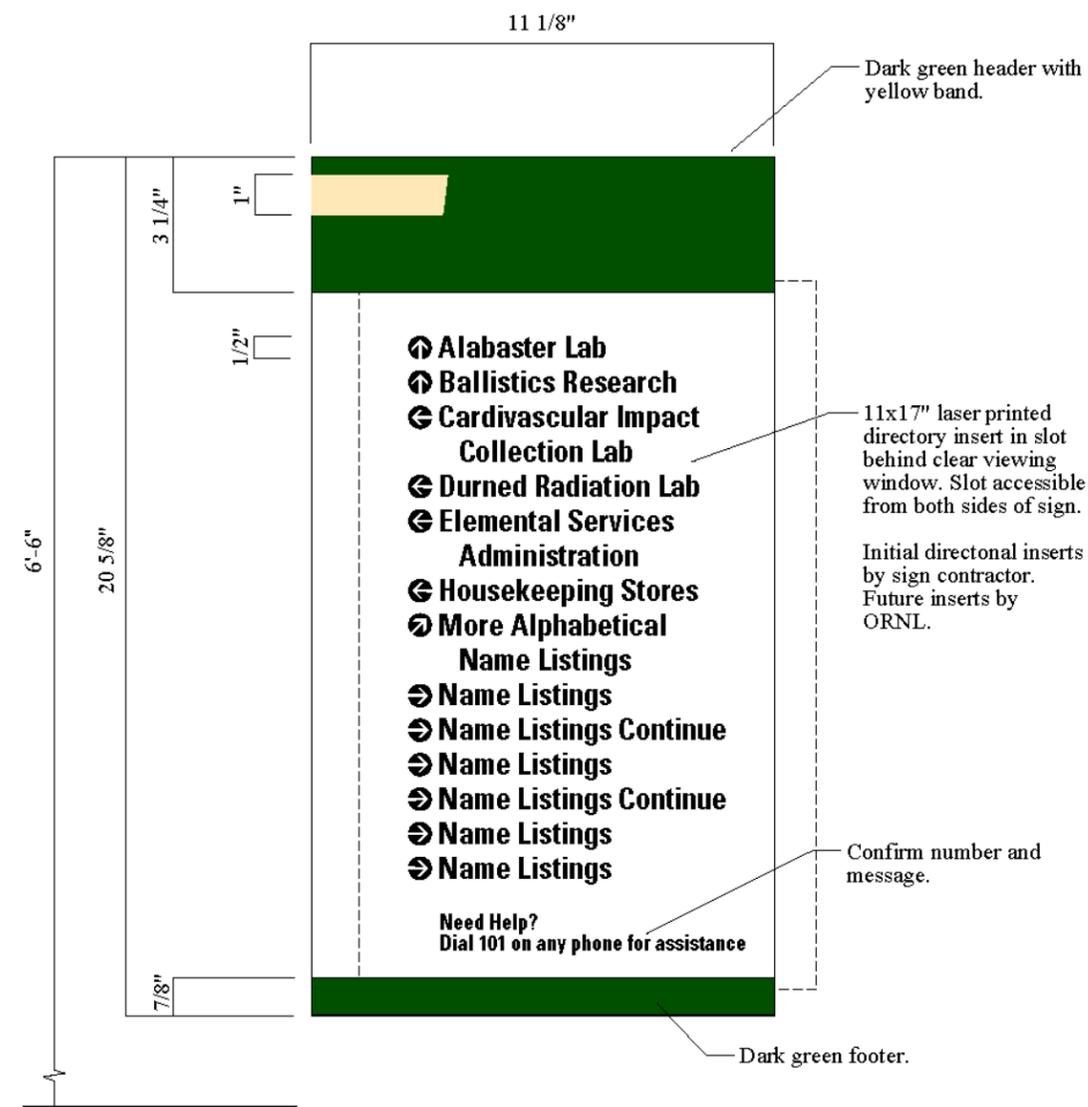
Install signs in elevator lobbies on each floor and at other locations where traffic intersects.



Full Size Message Sample *f.s.*



Typical Sign Location $1/4"=1'-0"$

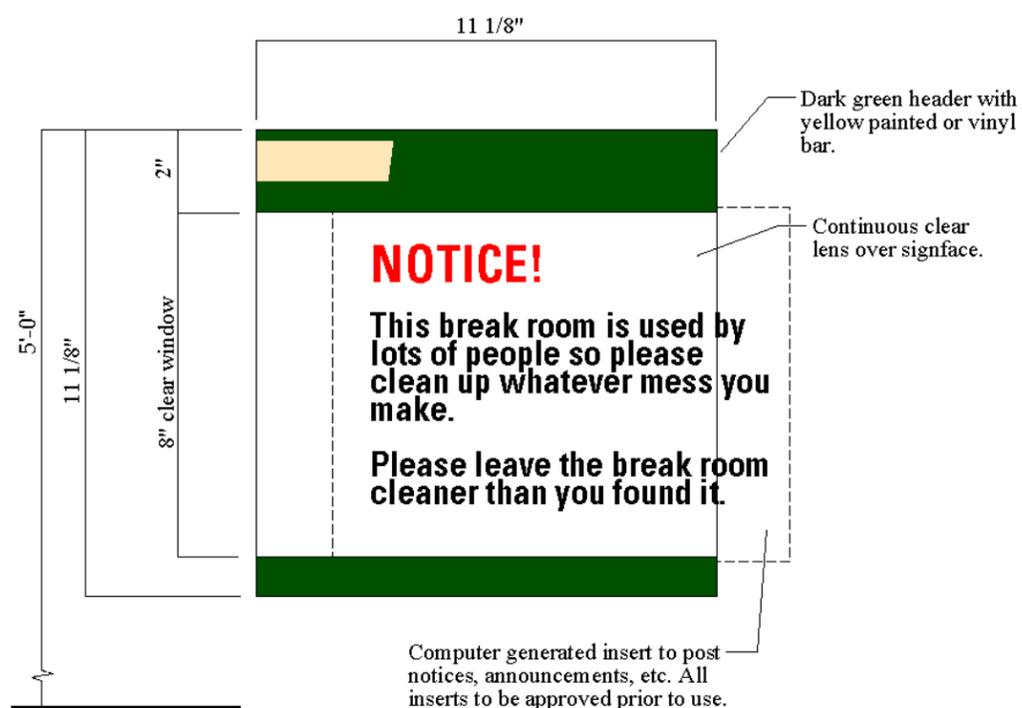


Sign Type 7.1 - Directional Signs $1/4"=1"$

Dark green to match PMS 3302c
Yellow to match PMS 134c.
All finishes eggshell.

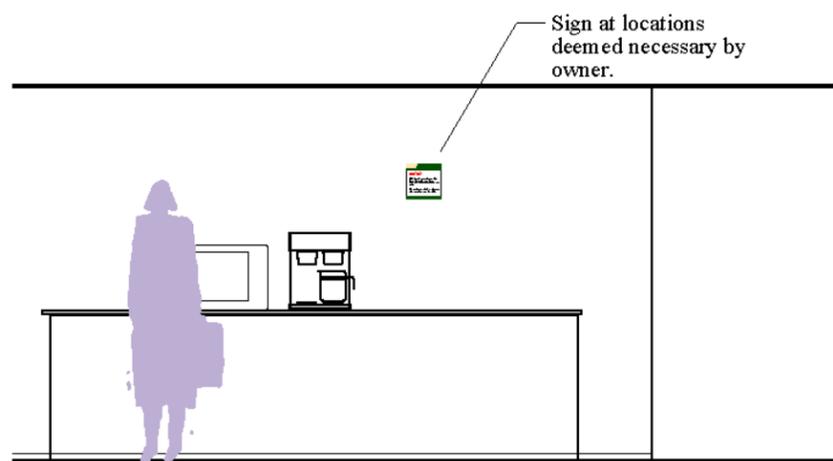
- Alabaster Lab
- Ballistics Research
- Cardiovascular Impact Collection Lab
- Durned Radiation Lab Administration
- Housekeeping Stores
- More Alphabetical Name Listings
- Name Listings
- Name Listings Continue
- Name Listings
- Name Listings Continue
- Name Listings
- Name Listings

Need Help?
Dial 101 on any phone for assistance

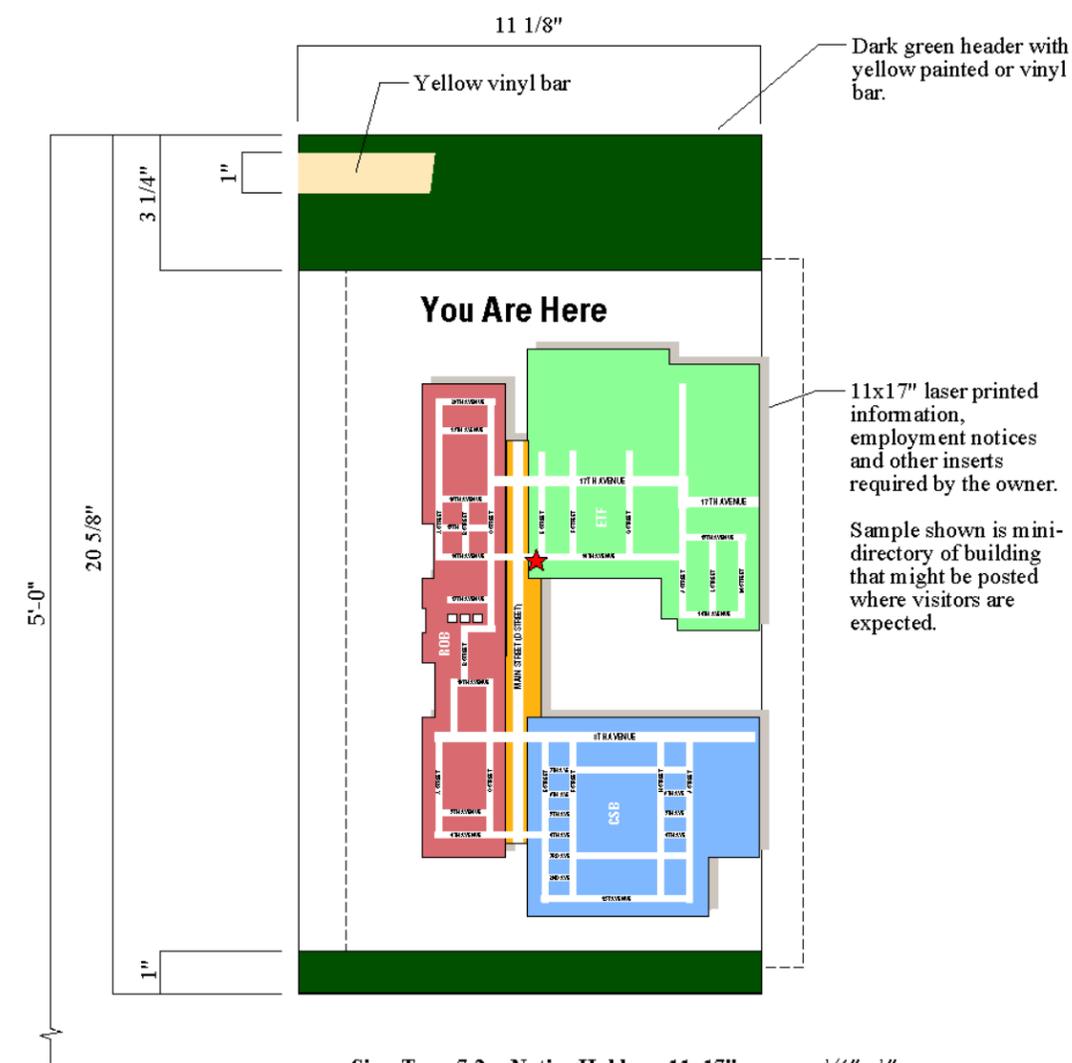


Sign Type 7.3 - Notice Holder - 8 1/2 x 11" 1/4"=1"

Dark green to match PMS 3302c
Yellow to match PMS 134c.
All finishes eggshell.

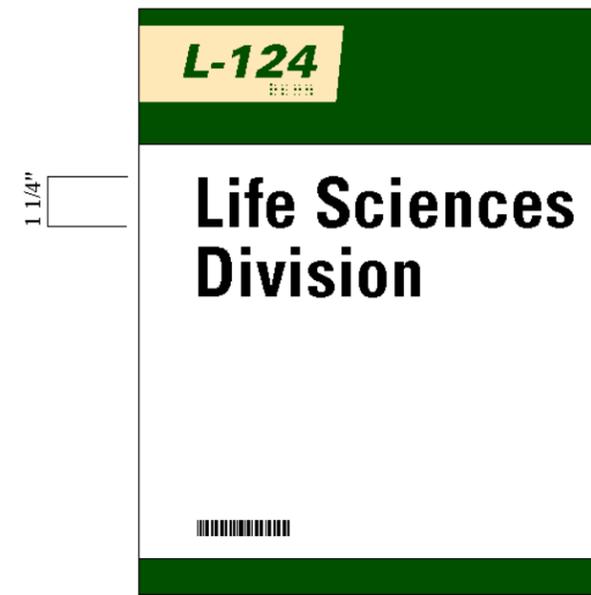
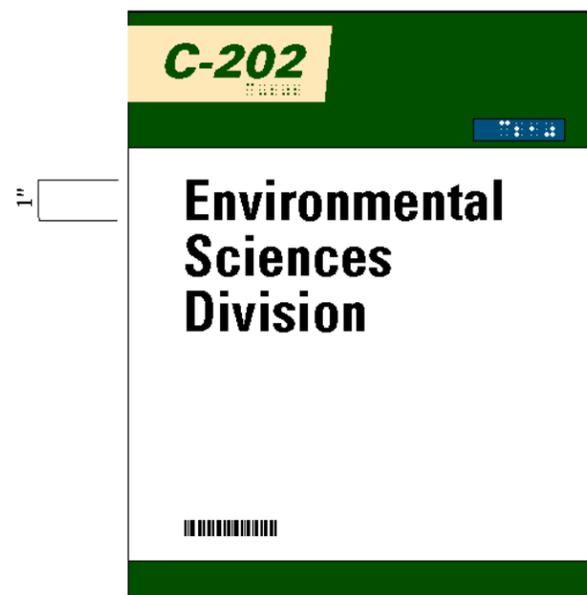


Typical Sign Location 1/4"=1'-0"

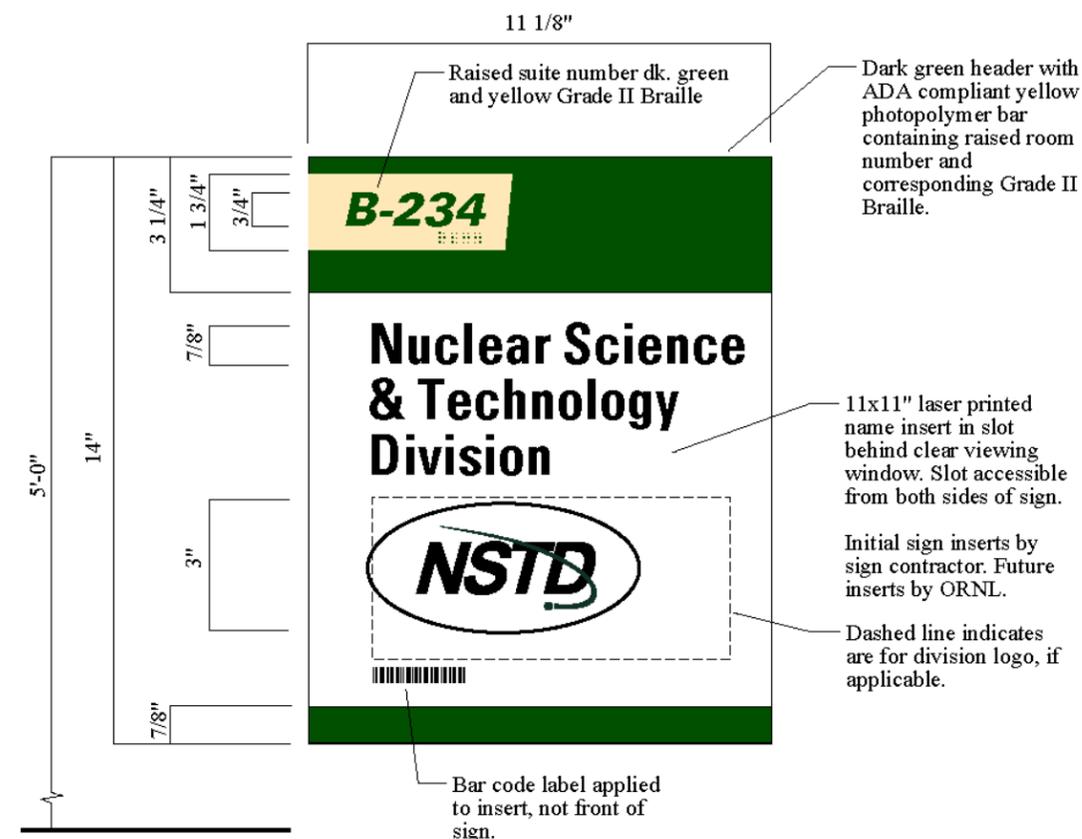


Sign Type 7.2 - Notice Holder - 11x17" 1/4"=1"

Dark green to match PMS 3302c
Yellow to match PMS 134c.
All finishes eggshell.

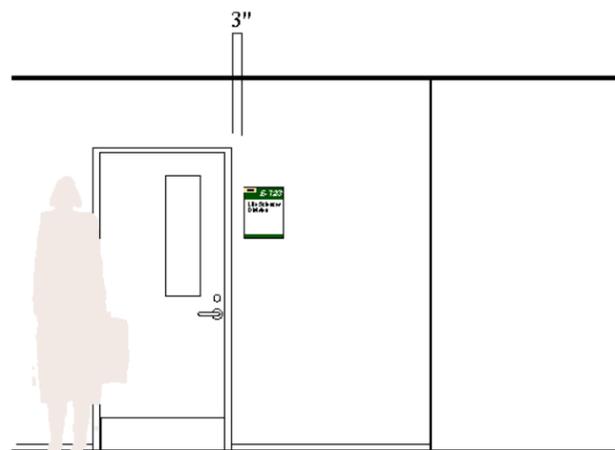


Typical Sign Layouts 1/4"=1"

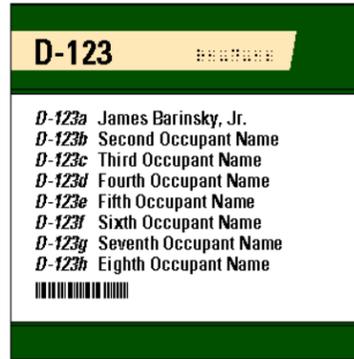


Sign Type 8 - Division Name Signs 1/4"=1"

Dark green to match PMS 3302c
Yellow to match PMS 134c.
All finishes eggshell.

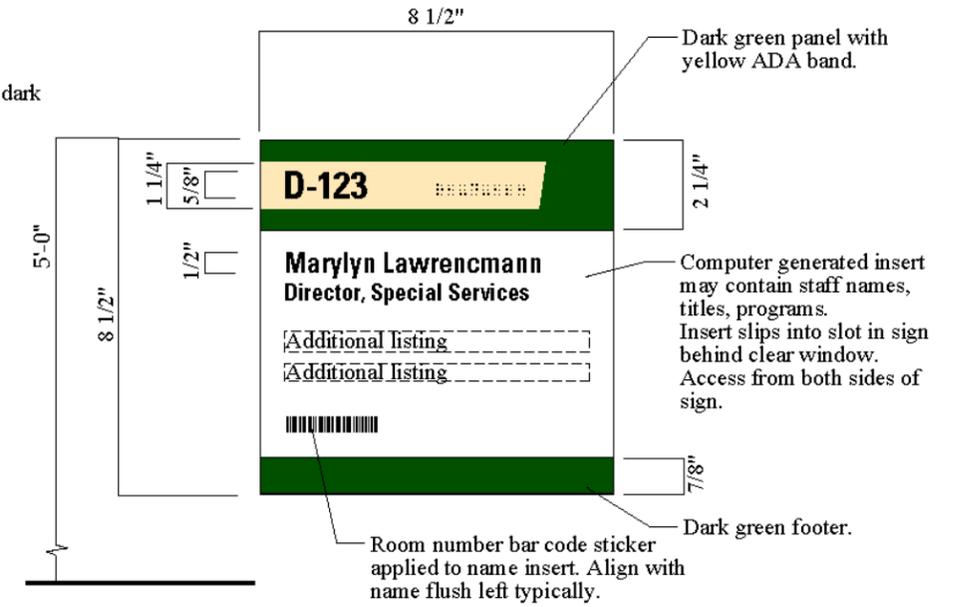
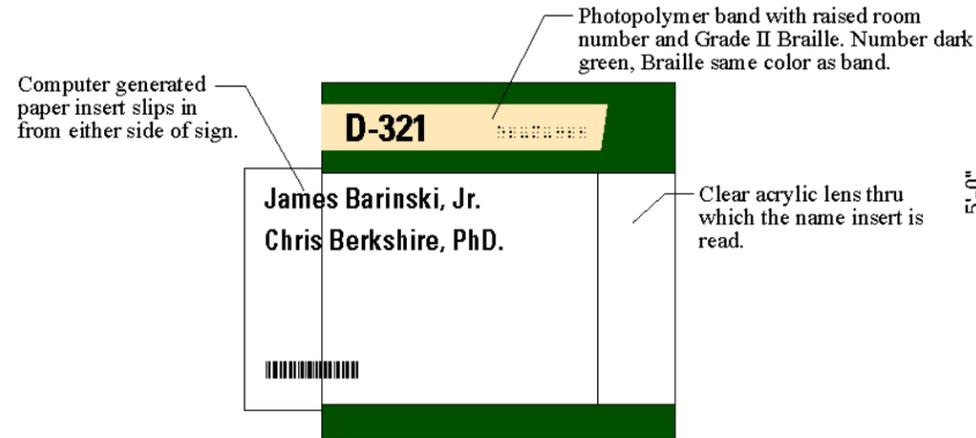


Typical Sign Location 1/4"=1'-0"



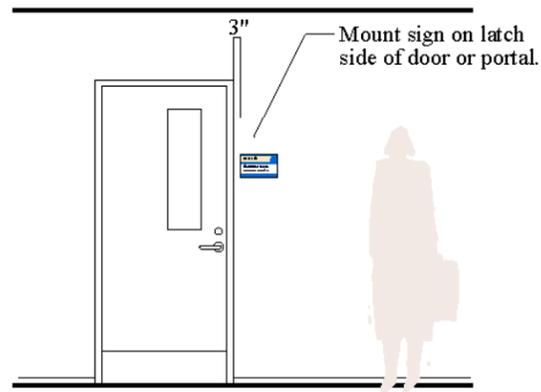
Sign Type 9.1 - Pod Identification - Staff 1/4"=1"

Sign may contain 3 - 8 names depending on positions along the corridor.

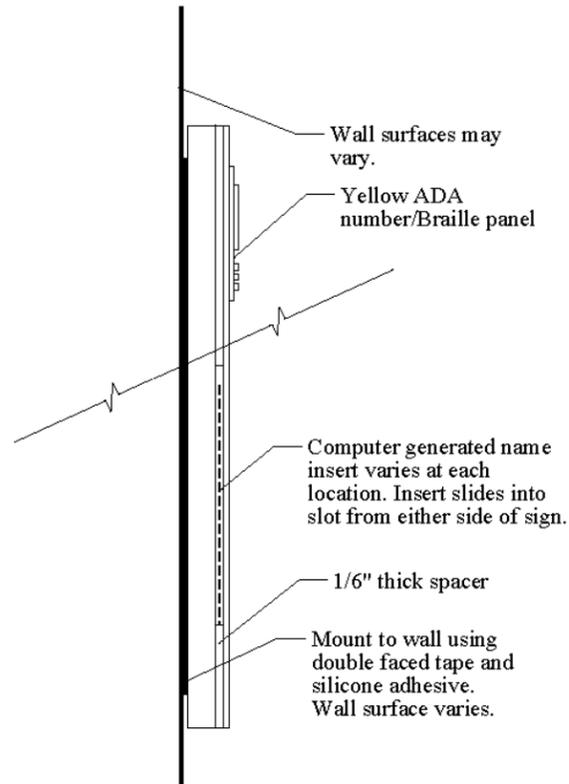


Sign Type 9 - Room Identification - Staff 1/4"=1"

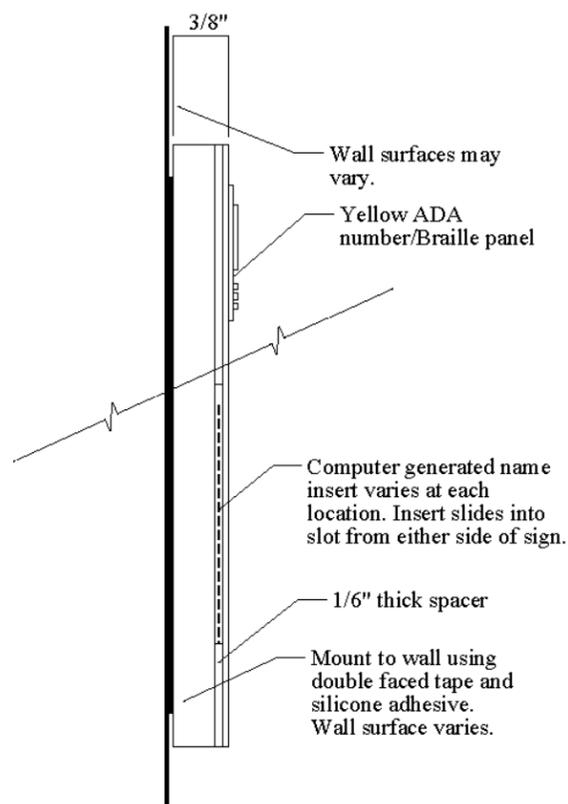
Dark green to match PMS 3302c
Yellow to match PMS 134c.
All finishes eggshell.



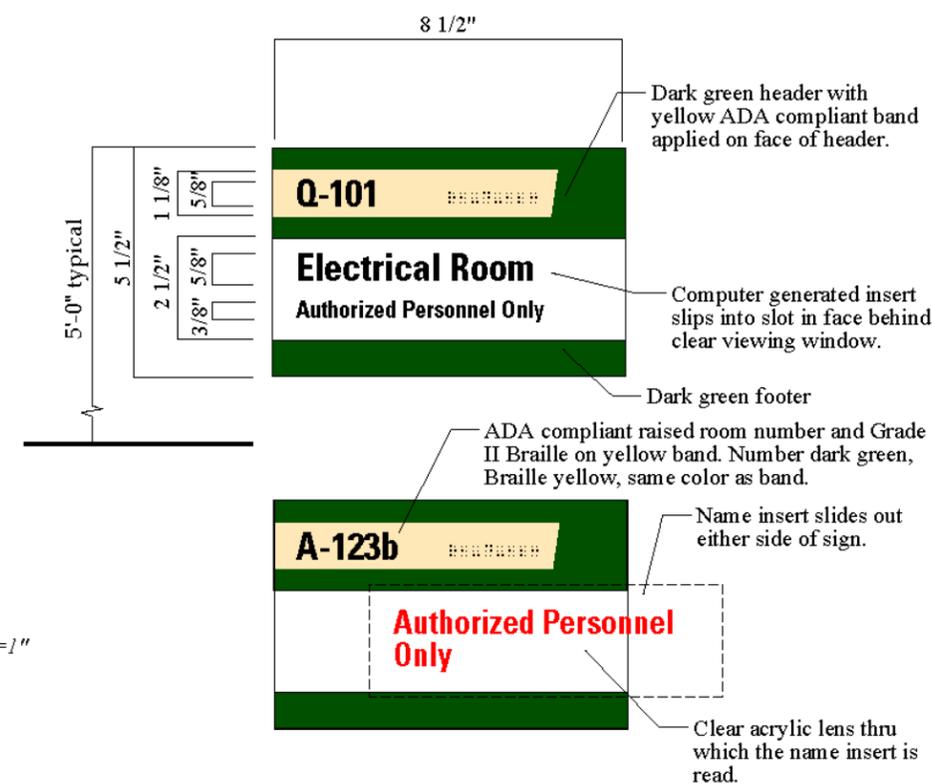
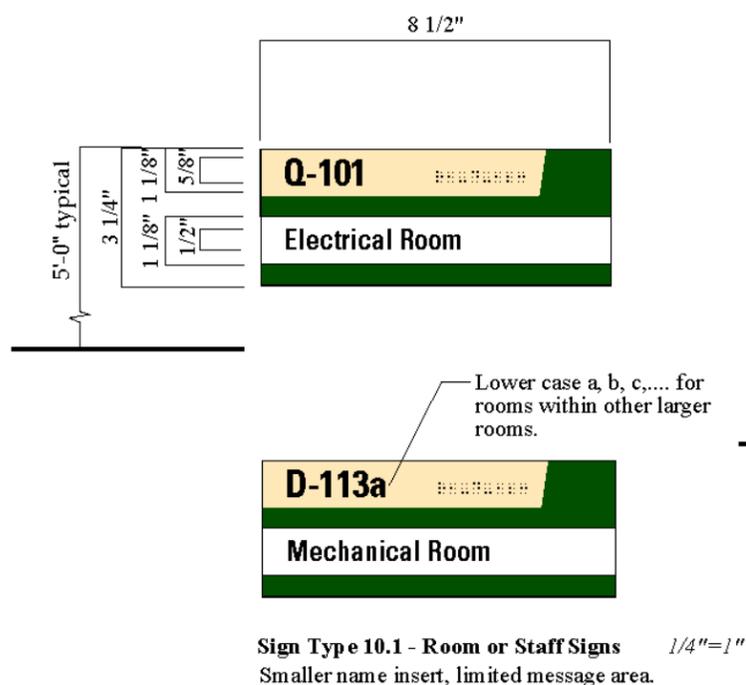
Typical Sign Location 1/4"=1"



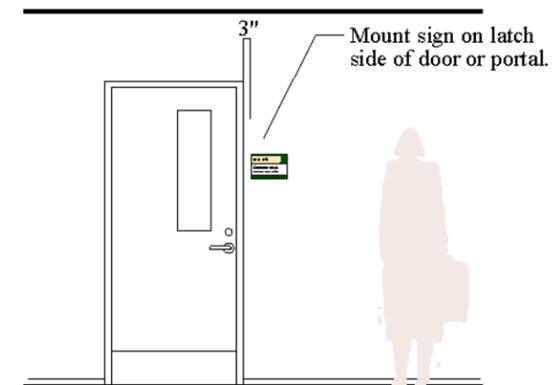
Typical Section 1/4"=1"



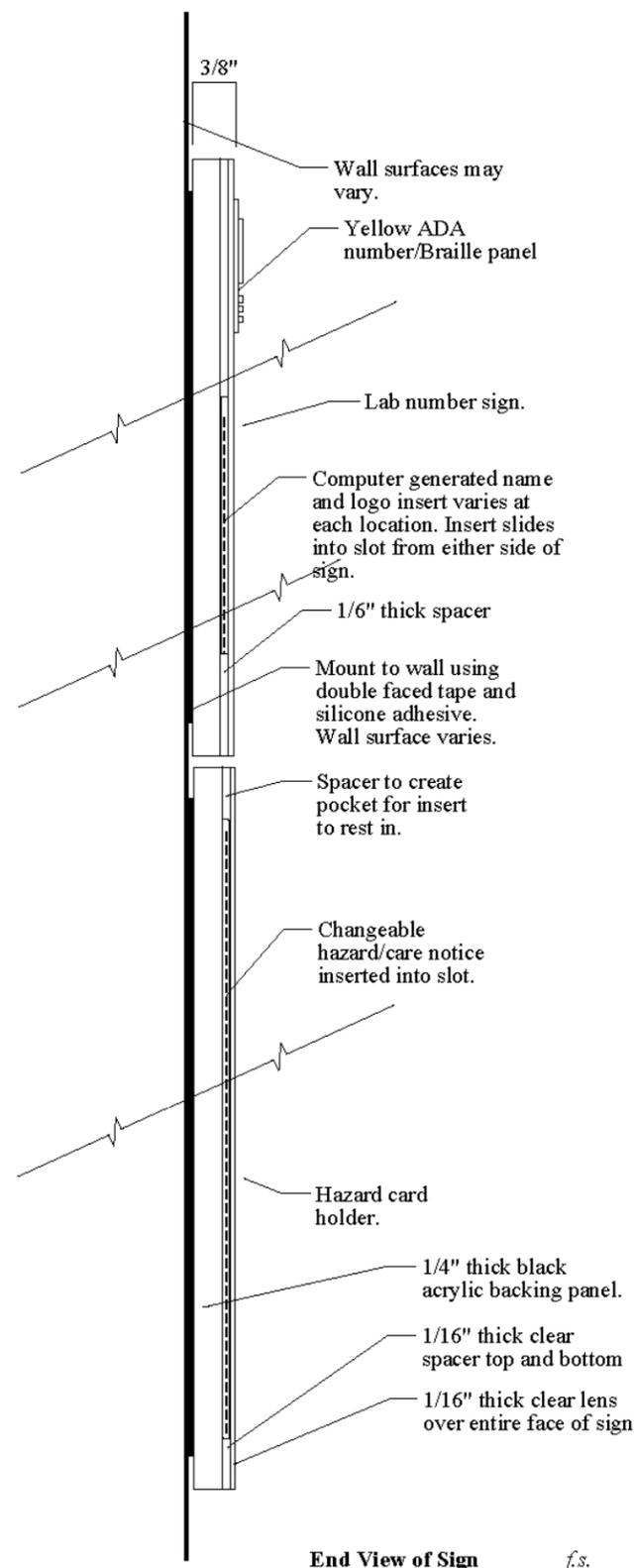
Typical Section 1/4"=1"
Sign type 10 shown, Option 1 similar.
Option 2 similar but no slot for inserts.



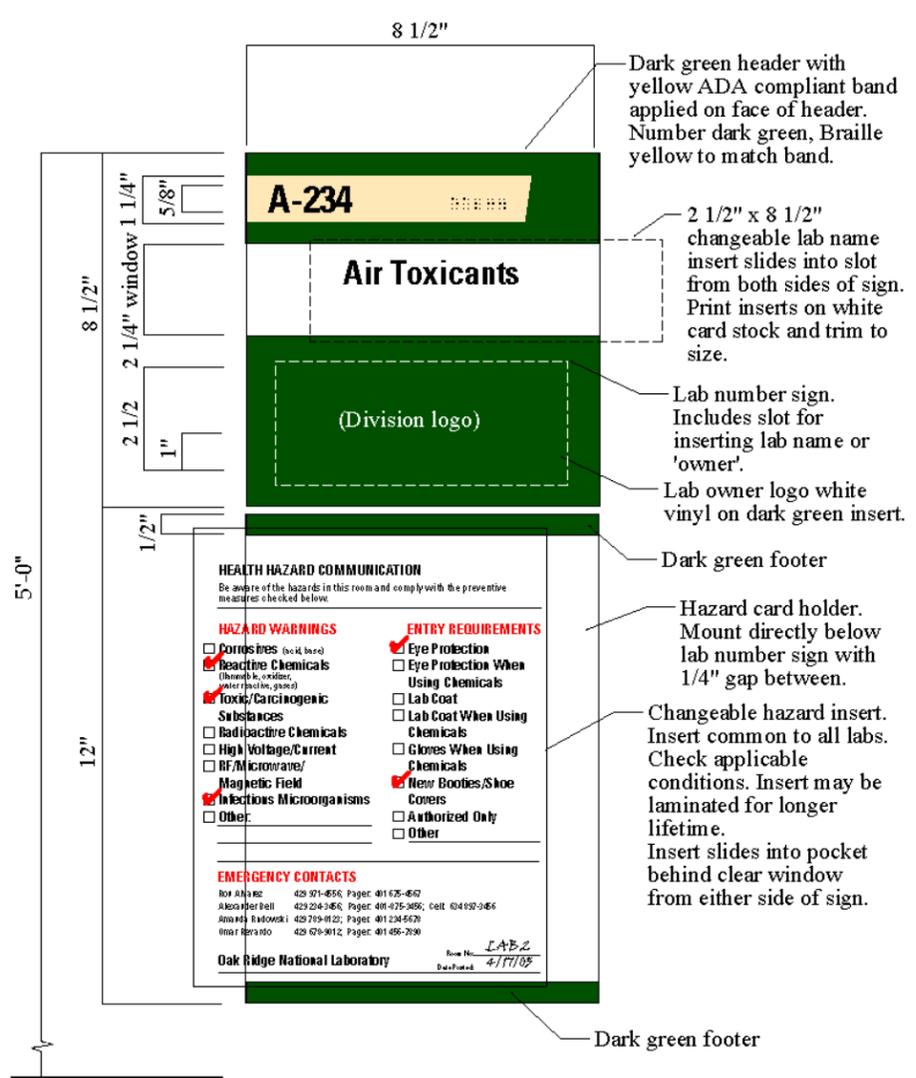
Sign Type 10 - Utility Room Signs 1/4"=1"
Note: confirm with owner that no bar code is needed for fixed rooms such as electrical, mechanical rooms.
Dark green to match PMS 3302c
Yellow to match PMS 134c.
All finishes eggshell.



Typical Sign Location 1/4"=1'-0"

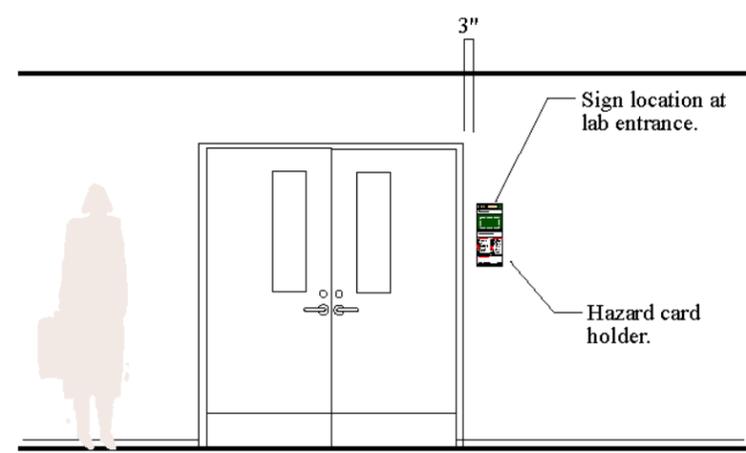


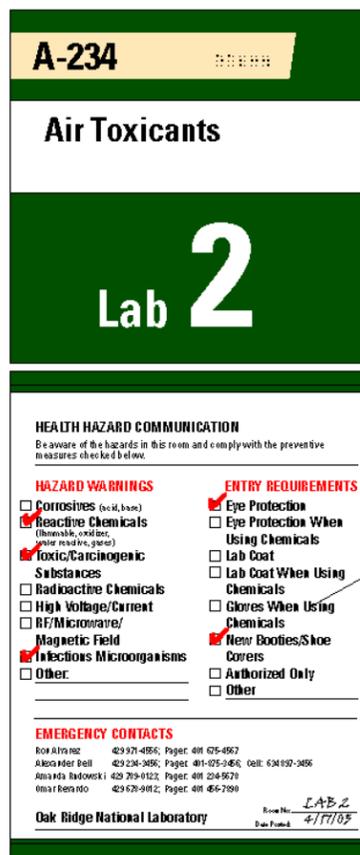
Owner to check off appropriate hazard items with marker or grease pencil.



Sign Type 11 - Lab Identification Signs 1/4"=1"

Dark green to match PMS 3302c
Yellow to match PMS 134c.
All finishes eggshell.





Changeable health hazard insert. Insert common to all labs. Check applicable conditions. Insert may be laminated for longer lifetime. Insert slides into pocket behind clear window from either side of sign.

Provide boxes so that lab owner can check appropriate safety precautions before inserting sign into slot of holder.

HEALTH HAZARD COMMUNICATION
Be aware of the hazards in this room and comply with the preventive measures checked below.

<p>HAZARD WARNINGS</p> <p><input type="checkbox"/> Corrosives (acid, base)</p> <p><input type="checkbox"/> Reactive Chemicals (flammable, oxidizer, water reactive, gases)</p> <p><input type="checkbox"/> Toxic/Carcinogenic Substances</p> <p><input type="checkbox"/> Radioactive Chemicals</p> <p><input type="checkbox"/> High Voltage/Current</p> <p><input type="checkbox"/> RF/Microwave/Magnetic Field</p> <p><input type="checkbox"/> Infectious Microorganisms</p> <p><input type="checkbox"/> Other: _____</p>	<p>ENTRY REQUIREMENTS</p> <p><input type="checkbox"/> Eye Protection</p> <p><input type="checkbox"/> Eye Protection When Using Chemicals</p> <p><input type="checkbox"/> Lab Coat</p> <p><input type="checkbox"/> Lab Coat When Using Chemicals</p> <p><input type="checkbox"/> Gloves When Using Chemicals</p> <p><input type="checkbox"/> New Booties/Shoe Covers</p> <p><input type="checkbox"/> Authorized Only</p> <p><input type="checkbox"/> Other _____</p>
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EMERGENCY CONTACTS

Ron Alvarez 429 971-4556; Pager: 401 675-4567
 Alexander Bell 429 234-3456; Pager: 401-875-3456; Cell: 634 897-3456
 Amanda Rudowski 429 789-0123; Pager: 401 234-5678
 Omar Revarado 429 678-9012; Pager: 401 456-7890

Oak Ridge National Laboratory Room No: _____
Date Posted: _____

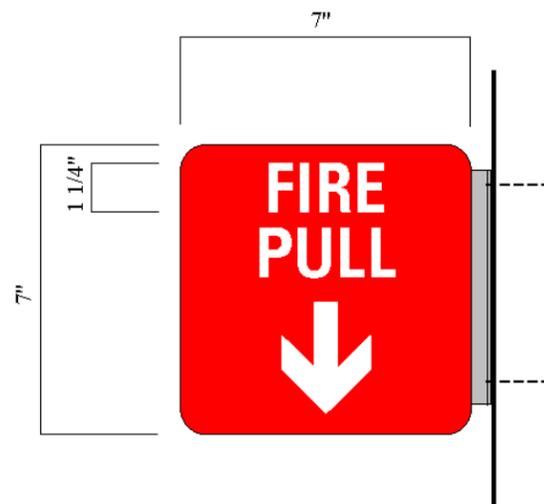
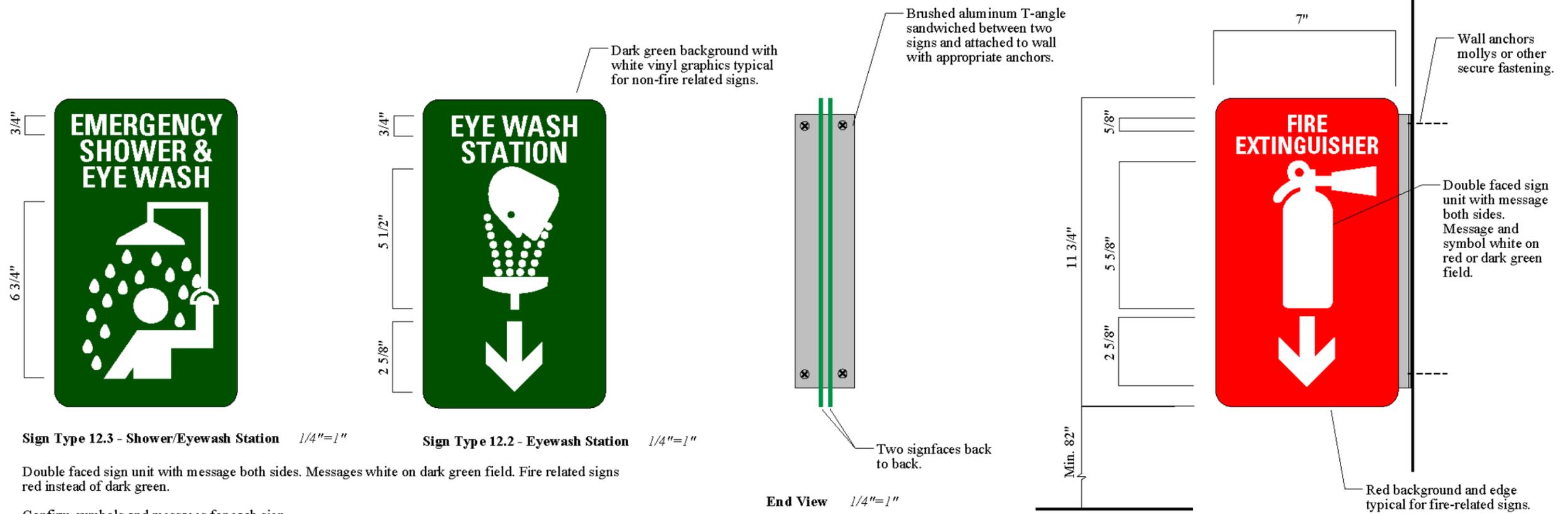
Sign Type 11 - Lab Identification Signs

1/8"=1"

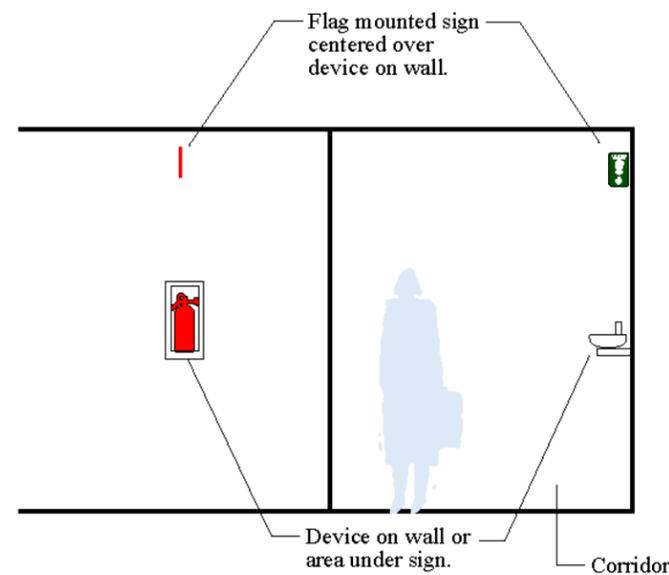
Size: 8 1/2" x 11"

Sign Type 11.1 Health Hazard Insert Card *half size*

This layout shown for design/discussion purposes. Actual content of card to be determined by owner. Clear laminate cards and trim so that laminate does not protrude out of sign slot. Confirm cards slide in and out of slot easily with no blockage of messages.



Two sign panels, back to back with T-angle sandwiched between. Provide spacer at outside edge of sign to maintain space between signfaces.
 Sign contractor to confirm symbols for each sign.



Sign Type 12 - Emergency Marker Signs 1/4"=1"
 Perpendicular to wall over, or adjacent to, item indicated by sign message.
 Two sign panels, back to back with T-angle sandwiched between. Provide spacer at outside edge of sign to maintain space between signfaces.
 Sign contractor to confirm symbols for each sign.
 Dark green to match PMS 3302c
 Red to match PMS 485c (fire signs only).
 All finishes eggshell.

**Oak Ridge
National
Laboratory**

**Research
Office Building**

**Badged Employees
Only**

Message on entrance doors or side
lights off Main Street

**Oak Ridge
National
Laboratory
Federal Credit
Union**

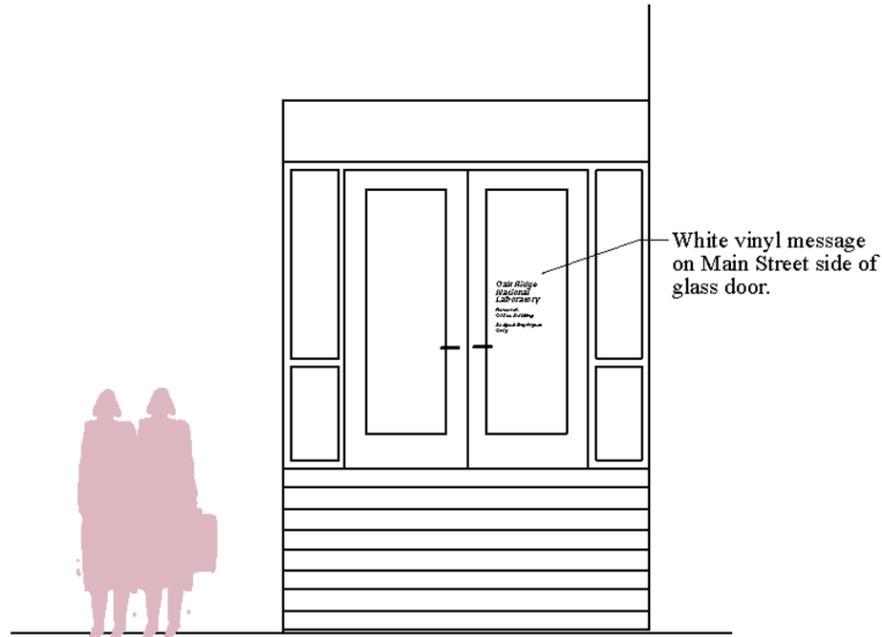
**M - T 8:30 - 5
Fridays 8:30 - 6:30**

No Smoking

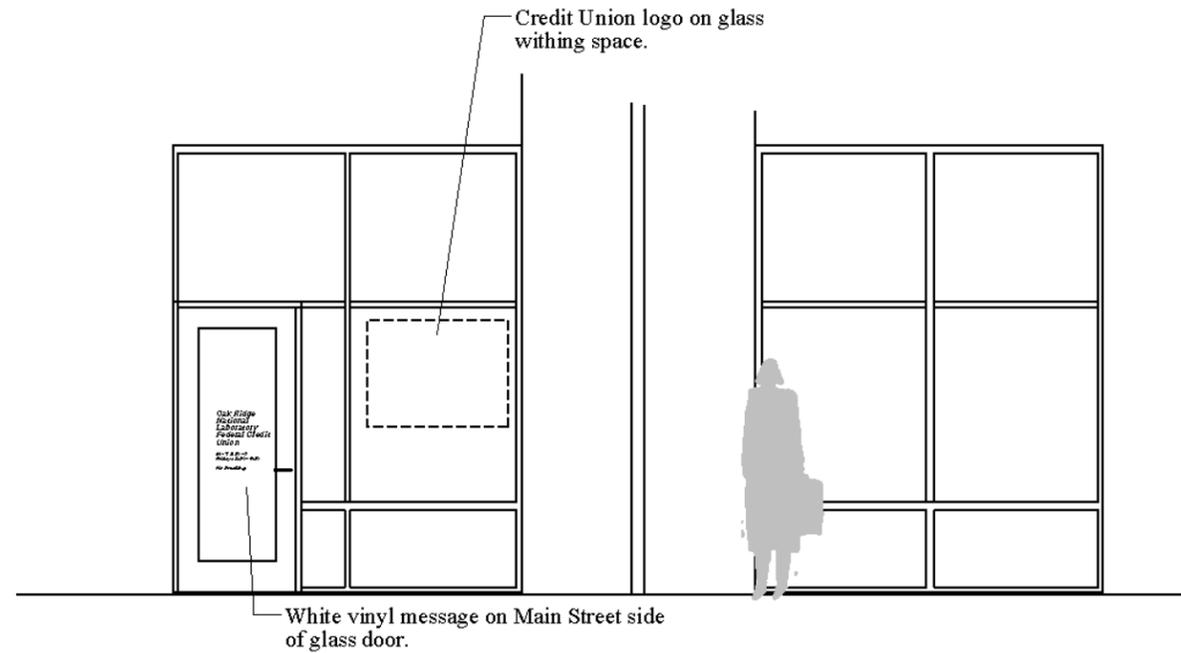
Confirm name and
hours.



Sign Type 13 - Vinyl Graphics at Entrances 1/8"=1"



Elevation at Stairs to ROB 1/4"=1'-0"



Elevation at Entrance to Credit Union 1/4"=1'-0"

ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz
1234567890!@#\$%&*()+.,/;:'"

Typestyle 1: Univers 65 Bold *n.s.*

ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz
1234567890!@#\$%&*()+.,/;:'"

Typestyle 1: Univers 67 Bold *n.s.*

ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz
1234567890!@#\$%&*()+.,/;:'"

Typestyle 1: Univers 75 Black Oblique *n.s.*



Project Logo
Artwork available.



Project Arrow *n.s.*
Arrow artwork available

 Dark Green
Match PMS 3302c
to match ORNL
green sign color.

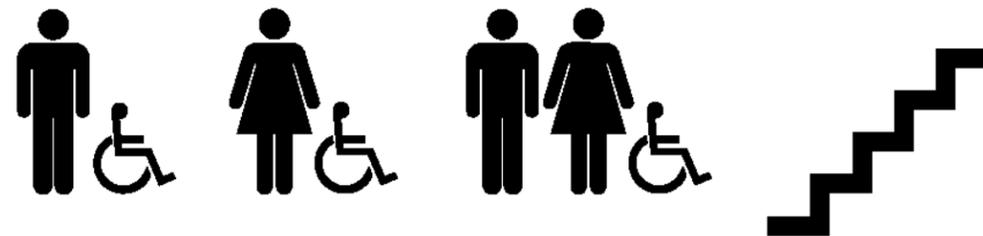
 Yellow
Match Devoe paint
#7751W 'Beach Grass'

 Red (flag signs)
Match PMS 485c

Project Sign Colors *n.s.*
All finishes eggshell.



Arrow/Letter Spacing Typical
Always measure capital height on straight/vertical
letter such as B, H, I.



Project Symbols *n.s.*
US DOT Symbol Signs used. Artwork available.

SECTION 018613 - FIRE PROTECTION

PART 1 - GENERAL

1.1. PROJECT SPECIFIC CRITERIA

- A. The facility shall be classified by the International Building Code (IBC) as a mixed use building with non-separated occupancies. The first floor shall be designated as Group F1-Moderate Hazard while the second floor will be designated as Group B-Business and Group A-Assembly. The multi-purpose room and the locker rooms will be designated as Group A-Assembly due to the calculated occupant load. As a non-separated occupancy, the means of egress facilities and other safeguards in the building shall comply with the most restrictive fire and life safety requirements of the occupancies involved.
- B. The minimum type of construction shall be Type II-B as defined by the IBC.
- C. Fire and smoke barrier requirements shall be as required by the IBC and Life Safety Code (LSC) and the building shall also be provided with fire rated stair enclosures.
- D. The entire building shall be considered to be a single hazardous material control area (HMCA).
- E. The facility shall be protected throughout with an automatic wetpipe sprinkler as described in Section 1.4 below. The occupancy hazard classification as defined by National Fire Protection Association (NFPA) 13 is Ordinary Hazard Group 2.
- F. A fully addressable fire alarm signaling system shall be provided and installed as described in Section 1.4 below.
- G. Roof system shall be a Factory Mutual (FM) Global Class I90 (ASTM International [ASTM] 1592) approved type and shall meet Underwriters Laboratory (UL) Class A fire exposure requirements.
- H. Internally illuminated exit identification and directional signs shall use light-emitting diode (LED) type illumination. Emergency light units and exit signs with internal back up power shall be a self-diagnostic type, if provided.
- I. If provided, emergency power provisions shall comply with the requirements of the International Codes Council[®] (I-Codes) package, including NFPA 110, Standard for Emergency and Standby Power Systems and other references.

- J. Modifications to the underground water supply system shall be of the looped grid type providing multiple flow paths, with sectional valves installed and arranged to provide alternate flow paths to any point in the system. Fire mains shall be at least 8" diameter, except those supplying a single fire hydrant or extensions of existing smaller mains. Water supply mains shall be sized to supply the largest expected fire suppression flow demand plus the largest potable water domestic demand. Residual sprinkler system pressure requirements shall be included in the design. The design and installation of all combined potable and fire water supply system components shall be in accordance with the requirements of the applicable I-Codes and references, including NFPA 24, Standard for the Installation of Private Fire Service Mains and Their Appurtenances.
- K. Portable fire extinguishers shall be located for placement by the designer in accordance with the I-codes package, including NFPA 10, Portable Fire Extinguishers. The designer shall determine if any facility hazards require specific types or quantities of portable fire extinguishers. The hazard(s) to be protected, type(s), locations, and quantity of portable extinguishers by type shall be indicated on the documentation described in this section. Using project funds, the Company will provide the required number of portable fire extinguishers. Recessed wall cabinets shall be installed where appropriate to accommodate portable fire extinguishers for areas with ordinary hazards. The wall cabinets shall accommodate the Company supplied extinguisher, Ansul Sentry A10H, 10-A:60-B:C. Placards shall be mounted above each unit for identification.
- L. Direct access to fire department connection(s) and the fire alarm system control panel(s) shall be provided. Fire Department access shall be provided in accordance with the I-Codes package, and as accepted by the Company. Keyed access shall be provided to all areas and spaces of the facility for emergency response forces.
- M. All ventilation and duct smoke detection components and functions shall be in accordance with the applicable I-Codes package, including NFPA 90A, Standard for the Installation of Air-Conditioning and Ventilation Systems. In-Duct-Type smoke detectors shall be photoelectric-type. The design and installation of the smoke detectors shall be in accordance with the current edition of NFPA 72, National Fire Alarm Code and shall be connected to the building fire alarm signaling system.
- N. The building's electrical system shall be designed and installed in accordance with the applicable I-Codes package, including the current edition of NFPA 70, the National Electrical Code. Interior electrical transformers shall be dry-type. Exterior transformers shall be FM approved or otherwise properly protected and/or located.
- O. Seismic bracing for sprinklers shall be provided. Installation of seismic bracing shall be in accordance with NFPA 13.

- P. As required by Section 712.4.1.1.2 of the IBC, through penetrations and membrane penetrations shall be protected by an approved through-penetration firestop system installed and tested in accordance with ASTM E814 or UL 1479. Drywall compound shall not be accepted for sealing either through-penetrations or membrane penetrations in a fire resistance rated barrier. All firestop caulk and putty shall be the color red with the exception that elastomeric sprays and sealants for fire rated construction joints may be the color white. Firestop sealant requirements shall be written for compliance with the product requirements of Specified Technologies Inc. (STI) and/or equal. The Seller shall determine the manufacture's brand of firestop materials to be used on the project, and all project subcontractors shall be required to use the manufacture's products selected by the Seller. In all applicable shop drawing submittals, the Seller shall be required to submit on the drawings an appropriate Firestop UL System Assembly File Number and Detail for each type of fire barrier penetration to be made by their system and/or equipment. Installation of firestop sealants shall be completed as soon as possible by the Seller before access to penetrations becomes obstructed by other systems and equipment.
- Q. Cooling towers shall be in accordance with the I-Codes package, including NFPA 214 Standard on Water-Cooling Towers. Construction shall be of noncombustible materials, or be FM-Approved cooling towers. Noncombustible is defined as materials that pass ASTM E-136, Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750 C.

1.2. CODES, STANDARDS, AND SPECIFICATIONS

- A. ORNL work smart standards.
1. The design and construction shall comply with the following I-Codes requirements:
 - a. IBC, 2009
 - b. International Fire Code, (IFC), 2009
 - c. International Fuel Gas Code, (IFGC), 2009
 - d. International Mechanical Code, (IMC), 2009
 - e. International Plumbing Code, (IPC), 2009
 2. The design and construction shall also comply with the following NFPA requirements:
 - a. NFPA Standards (except NFPA 5000), as applicable as determined by the Authority Having Jurisdiction (AHJ).
 - b. NFPA 1, *Uniform Fire Code*[®].
 - c. NFPA 70, *The National Electrical Code*[®].
 - d. NFPA 101[®], *Life Safety Code*[®].
- B. Other.

1. These requirements shall be considered minimum requirements for the facility design solution. Where conflicts between the two sets of requirements arise, the most stringent requirements shall be used as determined by Oak Ridge National Laboratory (ORNL) Fire Protection and documented in the design documentation.
2. Modifications of the intent of the I-Codes and NFPA requirements shall be presented to the Company for acceptance before execution, with adequate time allowed for review and consideration. Documentation of the modification(s) shall be included in the required documentation.
3. Technical standards, codes, and guidance required for the design solution development, which are in addition to the I-Codes and references, shall be identified and submitted to the Company for acceptance. Acceptance shall be documented before being implemented in the design.
4. Design solution requirements shall be based on the edition of the codes and standards in effect at the time the facility design is accepted. These codes and standards, and the edition used, shall be documented and shall establish the "Codes of Record."
5. As-built drawings and documentation, consisting of the code footprint and drawings and documents required by the codes and standards for fire protection systems, shall be provided to the Company before facility acceptance.

C. General.

1. The Company's Fire Protection Engineering (FPE) section will provide code compliance review, interpretation, application, and oversight services pertaining specifically to the non-structural aspects of the I-Codes requirements and the additional fire protection requirements in this document. For general reference, the I-Codes non-structural code sections and references include (but may not be limited to) the following:
 - a. IBC: Chapters 1-11, 14, 15, 27, 28, 30, 31, 33, 34, and 35, and referenced codes and standards.
 - b. IFC: entire document and referenced codes and standards.
 - c. IMC: entire document and referenced codes and standards.
 - d. International Gas Code: entire document and referenced codes and standards.
 - e. NFPA Codes and Standards.
 - f. National standards and guidance documents from American Society of Mechanical Engineers (ASME), American National Standards Institute, Inc. (ANSI), American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE), UL, FM Global, American Water Works Association (AWWA), and others as determined by the designer and accepted by the Company.

1.3. AHJ (CODE COMPLIANCE REVIEW AND ACCEPTANCE AUTHORITY)

- A. Pertaining to subjects included in this section, the Company representative for code compliance design review and acceptance, as generally specified in the IBC Chapter 1, is ORNL Fire Protection.

1.4. FIRE PROTECTION SYSTEM DESIGN AND INSTALLATION REQUIREMENTS

A. Qualifications.

1. All fire protection design packages, including fire suppression, fire detection and fire alarm drawings, specifications, and calculations, shall be prepared by a Tennessee licensed engineer in accordance with applicable state law, rules, regulations, and the guidance and policies promulgated by the Tennessee Board of Architectural and Engineering Examiners. Design and installation activities of all fire protection systems shall comply with the State of Tennessee requirements for such systems, including contractor licensing and documentation. Designs shall be submitted to the Company for review and acceptance. Fire Protection System design submittals shall comply with the applicable I-Codes and references, NFPA 1, Fire Prevention Code and references, the submittal requirements of this section, and the requirements of the applicable codes and/or standards for the particular type of system. All Fire Protection design approaches must be approved by the ORNL AHJ or designee prior to construction.
2. Fire sprinkler systems.
 - a. All sprinkler system designs and submittals shall be consistent with the State of Tennessee "Standard of Care." The design shall be sealed, signed and dated by a registered engineer (licensed in the state of Tennessee) competent in the design of sprinkler systems as required by Paragraph 1.4.A.1 above. Sprinkler shop drawings submitted by a licensed sprinkler system contractor shall be coordinated with and approved by the registered engineer.
 - b. All fire sprinkler system installations shall be performed by a fire protection sprinkler system contractor licensed as required by Item 1.4.A.1 above. All sprinkler systems shall be installed under the supervision of a competent registered engineer or National Institute for Certification in Engineering Technologies (NICET) Level III engineering technician.
3. Fire detection and alarm systems.
 - a. All fire alarm system designs shall be sealed, signed, and dated by a registered engineer competent in the design of alarm systems as required by Item 1.4.A.1 above.
 - b. All system installations shall be performed by a fire protection alarm system contractor licensed as required by Item 1.4.A.1 above. All fire detection and alarm systems shall be installed under the supervision of a competent registered engineer or NICET Level II engineering technician.

- B. The design of fire sprinkler systems shall comply with NFPA 13 Installation of Sprinkler Systems and the following additional requirements.
1. The automatic sprinkler system shall be a wetpipe system.
 2. The system shall be hydraulically designed using no less than the ordinary Hazard Group 2 Area/density curve. Adequate allowance shall be provided for the installation of required backflow prevention devices.
 3. Seismic bracing for sprinklers shall be provided.
 4. The hydraulically designed automatic sprinkler system shall contain no pipe size smaller than the sizes specified in the hazard pipe schedule design approach.
 5. An alarm check valve shall be provided and equipped with an approved waterflow switch and tamper switch for valve indicating and supervising the valve position.
 6. Sprinkler protection shall be installed in all areas and spaces per the applicable codes/standards and as specified and accepted by the Company.
 7. Sprinklers shall be standard sprinkler type and contain no O-rings in the operating design, have a current date, and use a frangible bulb operating element.
 8. Pipe shall be at least Schedule 40 steel as specified in the applicable codes and standards.
 9. Non-Metallic pipe and fittings are not to be used unless specifically authorized by the Company.
 10. The riser supply main shall be provided with a supervised post indicator gate valve (PIV).
 11. The indoor sprinkler system riser shall be provided with an outside stem and yoke (OS&Y) gate valve.
 12. The sprinkler system design and installation shall coordinate as needed to electronic supervision of the system supply PIV, OS&Y control valve at the riser, and alarm bypass (test) valve.
 13. The sprinkler system installer shall coordinate as needed to ensure efficient and effective tie-ins of sprinkler system fire alarm connections and water supply connections. Water flow alarm switches shall be provided for all sprinkler systems.
 14. Sprinkler water supply line shall be no smaller than 6" diameter pipe, and no smaller than the system riser size.

15. Locate sprinkler system riser in a dedicated room at an exterior wall with access from the building exterior. The riser room size and layout shall accommodate installation of the required backflow prevention device(s) and associated isolation valves.
 16. Valving and associated piping shall be provided on the sprinkler riser as necessary to facilitate the forward flow test requirements of NFPA 25 *Standard for Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems*.
 17. The fire department connection shall be located for best emergency access as accepted by the Company.
 18. Acceptance testing shall be witnessed by a representative of the Company, and shall be in accordance with the applicable codes and standards for the type of system. Required documentation shall include marked-up drawings at acceptance. Accurate as-built drawings shall be completed and submitted electronically to the Company upon completion of the job.
 19. Pipe and components shall be labeled in accordance with applicable codes and standards. Sprinkler pipe located in an area with other pipes or systems in such a way that the sprinkler pipe is not readily identifiable shall be primed and painted red (Chip 21105).
- C. The design of the fire detection and alarm system shall comply with NFPA 72, National Fire Alarm Code and the following additional requirements:
1. A fully addressable Fire Alarm Control Panel (FACP) shall be provided for a building. The FACP shall be an Edwards Systems Technology EST3 Multiplex Fire Alarm System, installed in a location accepted by the Company. Design and installation shall be in accordance with the applicable codes and standards, and the additional requirements in the electrical section and this section. The fire alarm shall be provided and installed in accordance with Technical Specification Section 283113.
 - a. The primary purposes of the system shall be to provide local alarm notification, both audible and visual to facility occupants and transmit system signals to the ORNL emergency response forces.
 - b. The fire alarm panel shall have printer device connection capability for report generation. The panel shall be provided with switches capable of disabling functions and shutdowns as determined during system design.
 - c. The system shall be EST3 FireWorks compatible via fiber optic communications. Provide multi-mode fiber optic cabling in conduit between the FACP and the fire alarm fiber optics patch panel in the telecommunications room. The Company will make arrangements to connect to the fire alarm fiber optics backbone system. The transmission equipment shall transmit compatible system signals to the ORNL central alarm receiving system (EST3 FireWorks). Appropriate and acceptable reception of signals at the central receiving system shall be considered an integral function of the building fire alarm signaling system.

2. Manual fire alarm pull stations shall be provided adjacent to each designated required exit. The manual pulls shall be recessed and shall be identified with signs mounted above the device.
3. Multi-sensor detector with base, photoelectric, ionization and heat detecting. Detector plugs into separate base. Alarm LED on unit. Being UL listed for use with control equipment provided. At a minimum, multi-sensor detectors are required for elevator recall service and above the FACP. Duct smoke detectors shall also be provided as required by applicable codes.
4. The fire alarm system installer shall coordinate as needed to ensure efficient and effective tie-ins of sprinkler system fire alarm and supervisory connections.
5. All fire alarm wiring shall be run in dedicated, metallic raceways; no other wiring shall be allowed in the fire alarm raceways, enclosures, or junction boxes (except interfaces to devices and circuits controlled by the fire alarm system). Conductors supplying ac power to the fire alarm system shall not be installed in the same raceways, enclosures, or junction boxes as fire alarm signal circuits. All fire alarm junction box covers shall be red in color for ease of identification.
6. Where a fire alarm system must interface with other systems, such as motor control or scram circuits, 24V dc interface relays shall be provided in a separate enclosure to isolate the fire alarm system from the devices being controlled. The interface relays' contact ratings and configurations shall be specified as required for the application.
7. Where a fire alarm system interfaces with other systems for the purpose of fire control, such as an air conditioner or electrical power shutdown circuit, a means shall be provided to test the fire alarm system without affecting the other systems. This is usually accomplished by installing one or more supervised key switches in lockable enclosures. The method used shall have the approval of the ORNL Electrical Engineering and Fire Protection Engineering Departments.
8. Interface equipment (modules, tamper switches, flow and/or pressure switches, etc.) shall be indicated on design drawings and provided as necessary to monitor components associated with the sprinkler system. In addition, duct smoke detectors, monitor modules, control modules, shall be provided as required by code to interface and manipulate the air handling equipment.
9. Acceptance testing shall be witnessed by a representative of the Company, and shall be in accordance with the applicable codes and standards for the type of system. Required documentation shall include marked-up drawings at acceptance. Complete as-built drawings (CAD) shall be completed and submitted to the Company upon completion of the job.

1.5. CALCULATIONS

- A. Hydraulically designed sprinkler calculations shall be provided in accordance with NFPA 13. An estimate of the available water supply in the vicinity of the proposed location is a static pressure of 100 psi and a residual pressure of 90 psi at the point of interconnection with the 12" fire main west of the new building. In the sprinkler contractor hydraulic calculations, the static and residual pressures are required to be reduced by at least 10% to provide a margin of safety. This safety margin will account for potential degradation of the underground water distribution system over the life of the facility. The Company will provide actual flow test data to the sprinkler contractor prior to detailed design.
- B. Fire detection and alarm system power supply calculations for both primary and secondary (battery) shall be provided in accordance with NFPA 72.

1.6. DOCUMENTATION

- A. Fire protection systems design, calculations, acceptance testing, drawings and other as-built documentation shall be in accordance with the applicable I-Codes and references, the submittal requirements of this section, the requirements of the applicable codes and/or standards for the particular type of system, and State of Tennessee requirements for such systems. The following specific documentation is required as a minimum.
 - 1. Fire sprinkler submittals shall include:
 - a. Calculations, drawings, and equipment data as required by NFPA 13.
 - b. Sprinkler layout and piping arrangement.
 - c. Sprinkler riser details including water supply tie-in.
 - d. Elevation views as necessary for clarity.
 - 2. Fire detection and alarm submittals shall include:
 - a. Calculations, drawings, and equipment data as required by NFPA 72.
 - b. Device and circuit layout including device logical address in coordination with the riser and input/output matrices.
 - c. Riser drawings.
 - d. Input/output matrices.
 - e. The FACP detail drawings.
 - f. Fire alarm interface details.
- B. The "non-structural" aspects of facility fire protection, occupant safety, and code implementation and compliance shall be documented for design review, for documentation of changes, and for as-built documentation as described below:
 - 1. Single "code footprint" sheet for each floor.
 - 2. Graphic, contextual, schematic floor plan showing only the code compliance aspects of the design, containing the information described in this section.
- C. Minimum requirements for the "code footprint."

1. Schematic floor plan shall include:
 - a. Graphic bar scale.
 - b. North indicator.
 - c. Complete floor plan.
 - d. All permanent partitions taller than 6’.
 - e. Each room and space clearly labeled with plain text, key notes, or legend.
 - f. Occupant load for assembly areas and total for each floor.
 - g. Stair and shaft enclosures with identification of ratings and opening protectives.
 - h. Rated corridors with identification of ratings and opening protectives.
 - i. Occupancy and area separations.
 - j. Horizontal exit arrangements, exit passageways, and smoke compartments.
 - k. Designated required exits and their capacity.
 - l. Fire department connections and access to facility.
 - m. Access to property and buildings.
 - n. Power and fuels shut-off locations.
 - o. Small scale site plan.
 - p. Distances to exposures and “property” lines.
 - q. Grade elevation at each building corner.
 - r. Any special hazards or conditions.
 - s. Location of any planned future additions.

2. Narrative information on the code footprint shall include:
 - a. Project purpose (new construction, addition, etc).
 - b. Codes of record, including edition.
 - c. Other significant requirements, including source.
 - d. Building location.
 - e. Facility name and owner.
 - f. Date developed, and space for revision dates.
 - g. Designer’s information (name, address).
 - h. Designer’s seal.
 - i. ORNL Fire Department identified as emergency response organization.
 - j. Occupancy type(s).
 - k. Construction type.
 - l. Total floor area of each occupancy, with actual design area compared to allowed area, and explanation of any increases.
 - m. Actual building height/stories, with actual height/stories compared to allowed, and explanation of any increases.
 - n. Structural fire ratings.
 - o. Identification of fire suppression systems and areas covered.
 - p. Identification of fire alarm signaling systems and areas covered.
 - q. Emergency lighting provisions.
 - r. Any smoke management provisions.
 - s. Any special systems or protection approaches.
 - t. Hazardous materials identified by hazard class, storage areas, use areas and systems, both inside and outside the building envelope as needed.
 - u. Water supply information for fire protection.

- v. Alternative design, modifications, methods, systems, or construction to document rationale and acceptance.

- D. The code footprint shall be developed as early in the initial design process as possible, and shall be the code compliance review submittal. It shall be the documentation method for any changes which involve the non-structural code aspects of the design. It shall be used to track and communicate design changes, for review submittals, and to capture and portray the as-built facility code compliance status. It shall be modified as needed during the design and construction process to accurately reflect current facility design status, and shall be part of the required as-built documentation.

1.7. REQUIREMENTS FOR REVIEW SUBMITTALS

- A. Formal design reviews shall be performed by the Company, and documentation of acceptance of the reviewed design will be accomplished before any work involving the reviewed material begins. The reviews will be conducted on submittals which meet the Company's requirements as follows:
 - 1. Code footprint drawings for general non-structural code compliance as described in this section.
 - 2. Plans and specifications for fire protection systems meeting the documentation requirements of the pertinent code and/or standard.

1.8. ROLES AND RESPONSIBILITIES

- A. The designer shall be responsible for compliance with the requirements in the applicable codes, standards, and referenced material, regardless of whether or not any reviews are conducted, and regardless of any acceptance or rejection of any review items or elements. Any features or elements of the design solution which meet the intent of the code and standards, and is accepted by the Company as an appropriate alternative or equivalent approach to compliance, in accordance with IBC 104.11, shall be documented according to the documentation requirements in this section.

- B. The designer's area of responsibility includes all aspects of compliance with the I-Codes package and references and NFPA 1 and references such as identification and characterization of hazards, application of the appropriate referenced codes and standards, definition of occupancy, technical documentation/justification of particular compliance elements as needed, and all other aspects of facility design. It shall be the designer's role to evaluate any alternative or equivalent methods, materials, or systems proposed for use in the design, and the designer shall present justification documentation to the Company for acceptance according to the documentation requirements in this section.

- C. Design, installation, testing, and acceptance of fire protection systems shall be performed by entities meeting the requirements of Tennessee state law concerning licensing and practice standards for work involving fire protection systems. Compliance with the applicable codes, standards, and references in the I-Code package shall be demonstrated in design, installation, testing, and acceptance of fire protection systems by the ORNL AHJ.

- D. The designer shall prepare an NFPA 101[®] *Life Safety Code*[®] compliance evaluation to ensure conflicts with other guidance documents are appropriately addressed. All interpretive approaches must be approved by the ORNL AHJ.

END OF SECTION

SECTION 018616 - PIPING

PART 1 - PROJECT SPECIFIC CRITERIA

1.1 GENERAL

- A. Piped services to Chestnut Ridge Maintenance Facility (CRMF) from site service lines include cold potable water, and sanitary sewer (SS). Natural gas shall not be used in this facility due to its proximity to the Target Building. Purified water (DI) shall be provided by a self-contained DI system as part of this project.
- B. There are no central services available for chilled water, hot water, compressed air, or steam to this facility.

1.2. PIPING SYSTEMS

A. General.

1. Piped services to the Chestnut Ridge Maintenance Shops (CRMS) may include but are not limited to: cold potable water and SS.
2. Provide header isolation valves for maintenance and leak repair. At a minimum, provide isolation valves at each floor and at each branch header connection. Where long runs exist on a single floor, provide additional isolation valves and crossovers if necessary.
3. Compressed Air system will be provided that has the capacity to supply 80 cubic feet per minute (CFM).
4. The DI system piping will be installed by the Company later; therefore a reserved clear space area of 12" x 12" perpendicular to the shop wall shall be provided to route the subject supply and return piping from the DI/mechanical room to the Magnet Test Area, Power Supply Test Cage, & Chopper Test Area.
5. The Building Automation System (BAS) shall monitor the water meter and the other requirements of this section. Additional piping monitoring points will be determined at the 30% review. Additional requirements of the BAS are included in Section 018619, Heating, Ventilating, and Air Conditioning (HVAC).
6. Provide design and construction for the all areas requiring piping. Specific piping services are identified on the room data sheets located in the Section 018100.1.
7. Required design analysis/calculations and equipment sizing include but are not limited to the following: potable hot and cold water equipment and pipe sizing; potable water system pressure drop; SS gravity sizing; sanitary vent sizing.
8. Locate all piping and plumbing in areas which are conditioned or heated to prevent freezing.

2. Plumbing.

1. Provide restrooms with low flow fixtures to include a white vitreous china lavatory and toilet.
2. Size water heater(s) to accommodate all potable hot water as needed.
3. Potable water.
 1. Provide a reduced pressure back flow preventer for potable water and locate in a heated space.
 - a. Refer to civil drawings to determine source of potable water tie in point.
 - b. Separate feeds into the building are needed for potable and fire water. Coordinate tie-in and trenching work with the fire sprinkler contractor.
 - c. For making a tie-in to existing ORNL utilities provide the trench (and access as needed for work), all piping materials and all necessary preparation work. The ORNL forces will perform the work required for the tie-in. Provide back fill and restoration of the site after all work is complete.
4. SS.
 1. Provide gravity SS to existing manholes. Refer to civil site drawing to determine exact tie in point.
 2. Minimum SS line size under the slab and elsewhere shall be 6".
 3. For making a tie-in to existing ORNL utilities provide the trench (and access as needed for work), all piping materials and all necessary preparation work. The ORNL forces will perform the work required for the tie-in. Provide back fill and restoration of the site after all work is complete.
 5. Provide header isolation valves for maintenance and leak repair. At a minimum, provide isolation valves at each floor and at each branch header connection. Where long runs exist on a single floor provide additional isolation valves and crossovers if necessary.
 6. The BAS shall monitor the water supply systems. Additional piping monitoring points will be determined at the 30% review. Additional requirements of the BAS are included in Section 018619, HVAC.

1.3 DESIGN STANDARDS

- A. Work smart standards.
 1. American Society of Mechanical Engineers (ASME) B31.3, Process Piping.
 2. ASME Boiler and Pressure Vessel Code (BPVC) Sections I, II, IV, V, VI, VII, VIII, IX and X.
 3. American Water Works Association (AWWA) D100, Standard for Welded Steel Tanks for Water Storage.

4. National Fire Protection Association (NFPA) standards.
 - a. NFPA 22, Standard for Water Tanks for Private Fire Protection.
 - b. NFPA 24, Standard for the Installation of Private Fire Service Mains and Their Appurtenances.
 - c. NFPA 51, Standard for the Design and Installation of Oxygen–Fuel Gas Systems for Welding, Cutting, and Allied Processes.
 - d. NFPA 54, National Fuel Gas Code, American National Standards Institute, Inc. (ANSI) Z223.1.
 - e. List as determined by the Authority Having Jurisdiction (AHJ).
5. International Building Code (IBC), 2009.
6. International Plumbing Code (IPC), 2009.
7. Additional standards/guides.
 - a. Economic Insulation Thickness Guidelines for Piping and Equipment.
 - b. Underwriter’s Laboratories (UL).
 - c. Factory Mutual (FM).
 - d. American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) 90.1, Energy Standard for Buildings except Low-Rise Residential Buildings.
 - e. The International Safety Equipment Association (ISEA) Z358.1, Emergency Eyewash and Shower Equipment.
 - f. The ASME B31.8, Gas Transmission and Distribution Piping Systems.
 - g. The AWWA M41, Manual of Water Supply Practices, Ductile Iron Pipe and Fittings.
 - h. The ANSI A 13.1 Scheme for Identification of Piping Systems.
 - i. The ANSI A 17.1 Elevator Code.
 - j. Foundation for Cross-Connection Control and Hydraulic Research.
 - k. Americans with Disabilities Act (ADA).

PART 2 - SYSTEM SPECIFIC CRITERIA

2.1 GENERAL

- A. Reliability – systems for critical applications shall be designed with sufficient backup so that the failure of any one component does not preclude operation of the system.
- B. Maintainability.
 - 1. Equipment arrangements shall allow for all maintenance access requirements, component removal space, lay down areas and any other clearances necessary for safe operation, maintenance, replacement, and repair of all equipment.
 - 2. Maintainability designs shall minimize disruption of building functions. Every effort will be made to design, layout and install equipment in locations, which will tend to encourage routine preventive maintenance by providing easy access for maintenance personnel.
- C. Manual isolation valves will be provided to enable servicing, expansion of, renovation or construction of any part of the existing facility without unscheduled interruption of services in adjacent areas.
- D. Flexibility – the piping systems shall be sized to meet their intended load, plus 50% spare capacity unless otherwise specified. Utilize typically standard pipe sizes.
- E. Provide all utility connections and services required for a complete and operational building.
- F. Capacities and sizes of pipes, pumps, and other equipment shall be determined by performing calculations based upon the requirements noted on Room Data Sheets and other building area requirements contained herein.
- G. If new building or other permanent structures are to be built above existing underground mechanical utilities the underground utilities shall be relocated.
- H. All materials/equipment shall bear the UL label or be approved by FM where UL labels or FM approval is available for the type of products specified.
- I. Material or components containing asbestos, polychlorinated biphenyl (PCB), chlorofluorocarbons (CFCs), lead, and carcinogens shall not be utilized. Space shall be free from hazardous materials according to applicable federal, state, and local environmental regulations.
- J. Acrylonitrile butadiene styrene (ABS) plastic pipe shall not be utilized.
- K. The AHJ is the Company.
- L. Relief valves shall be easily removed from the piping systems by means of flanges, threaded couplings, or other method.

2.2 TRACER WIRE

- A. Tracer wire shall be laid continuously along to top of all buried piping.
- B. Attach the wire at five foot intervals to the pipeline with several wraps of tape.
- C. Tracer wire shall run up and down exterior side of valve boxes, looped but not cut, into the valve box just below the cover.
- D. Splices shall be avoided. Splices and wire ends shall be waterproofed.
- E. Verify electrical continuity by applying an electrical current.
- F. Wire specifications: 14 American Wire Gauge (AWG) conductor, solid white, THW solid copper with plastic coat. Splice connectors: Burndy KS-90 16-10 wrapped with insulating mastic tape.
- G. The ends of the tracer wire shall terminate inside a valve or junction box. A minimum of 12" of wire shall be located within the box.

2.3 BACKFLOW PREVENTERS

- A. Backflow preventers shall be approved by the Foundation for Cross-Connection Control and Hydraulic Research and the State of Tennessee, and shall be warranted for one year after accepted by the Company.
- B. Label all pipes in accordance with ANSI A 13.1.

2.4 PIPING SYSTEMS

- A. Water.
 - 1. Water main.
 - a. The water main shall be designed, installed and tested to the more stringent requirements of the Division of Water Supply, Tennessee Department of Environment and Conservation, or Community Public Water Systems Design Criteria or NFPA-24, Private Fire Service Mains.
 - b. Water main is defined as potable water and firewater piping from the water treatment facility up to and including the building isolation valve.
 - c. The ORNL water supply system is a combined potable water and fire service main.
 - d. Water mains should maintain the following distances from building foundations: 8" diameter or less – 10' clearance, greater than 8" diameter – 20' clearance.
 - e. Design for normal operating pressure range of 40 - 125 psi.
 - f. Test pressure 200 psi.

- g. Design the water main to deliver peak potable flow of 2½ times the average daily demand plus any special demands, at a minimum residual pressure of 30 psi at ground elevation.
 - h. Pipe restraint systems shall be designed per AWWA M41, Manual of Water Supply Practices, Ductile Iron Pipe and Fittings. Restraint systems can consist of concrete thrust blocks, EBBA Megalugs, and/or US Pipe Field Lok gaskets. Pipe restraint locations and details shall be shown on the drawings.
 - i. The building water supply and fire protection system water supply shall have separate piping feeding the building.
 - j. The building water supply shall be isolatable without affecting the fire protection systems.
2. Building water supply.
- a. Building water supply system shall be designed to the IPC.
 - b. Building water supply system is defined as potable water pipe including the necessary connecting pipes, fittings, control valves and all appurtenances in the structure downstream of the building isolation valve.
 - c. Building water supply pressure shall not exceed 80 psi, IPC 604.8.
3. Backflow prevention.
- a. Reduced pressure principle backflow preventers (RPPBP) 2½” and larger shall be manufactured by Watts Regulator Company. Reduced pressure principle backflow preventers 2” and smaller shall be manufactured by Wilkins Water Control Products.
 - b. Provide RPPBP at potable water supply from automatic fire sprinkler and stand pipe systems.
 - c. Provide RPPBP at branch lines supplying process or other water systems.
 - d. Provide pressure regulator on building water supply.
 - e. Provide a vacuum breaker at all hose connections.
 - 1) Potable water heating shall meet the requirements of ASHRAE 90.1.
 - 2) Provide ASME code stamped tanks for hot water generation. Provide ASME approved relief devices.

- 3) Valves shall be placed to isolate individual fixtures within one room or a battery of fixtures within one room.
 - 4) Provide an industrial water meter which has a local display as well as an electronic output for BAS connection on the building water supply.
 - 5) Wall hydrants shall be placed in recessed boxes on the exterior of the building a maximum of 150' on center.
 - 6) Water piping shall be sized based on the number of water fixture units connected, and the minimum flow pressure required at each fixture or piece of equipment. Pipe velocities shall be maintained between 4' and 8' per second and shall not exceed 8' per second.
4. Fixtures.
- a. Minimum fixture count shall be 1½ times the IPC minimum based on allowable occupancy floor, unless otherwise approved by the company.
 - b. Water closets shall be elongated bowl, vitreous china and wall hung.
 - c. Water closet flush valves shall be low consumption with dual flush type manual valves.
 - d. Urinals shall be vitreous china, ultra-low consumption, and 1/8 gallon per flush, hardwired electronic flush valves.
 - e. Lavatory.
 - 1) Faucets shall be hardwired sensor system with 0.5 gpm vandal resistant aerator and temperature mixing valve.
 - 2) Wall mounted lavatories shall be white vitreous china.
 - 3) Countertop sinks shall be integral with the countertop.
5. Shower systems shall be ADA compliant and low flow, with a single handle pressure balancing mixing unit.
 6. Kitchen sink faucets shall be ADA compliant and low flow, with 1.5 gpm vandal resistant aerator. Sinks shall be 18 gauge Type 302 self-rimming stainless steel with three faucet holes.
 7. Mop sink faucets shall have integral vacuum breakers, hose threaded outlet, and a pail hook. Mop basins shall be 24" x 24" x 10" deep service basin of crushed stone, resins and reinforcing strands.
 8. Mop sinks shall be floor mounted.
 9. Water coolers shall be split level electric delivering 8 gpm of 50°F drinking water, with stainless steel trim.

4. Include strainers at all chilled water coils that will filter 100 micron particles.
 5. Dust particles, suspended or partially dissolved solids, etc. shall not be filtered and shall remain in the system.
 6. Pipe hangers and supports shall not penetrate the insulation on chilled water lines.
 7. Once through cooling systems are not allowed.
 8. Specify that all chilled water systems conform to these performance requirements:
 - a. Chilled water closed loop systems: conductivity 800-5000 mmhos, hydrogen-ion concentration notation (pH) 8-9.5, Bio scan 40 Rlu, Nitrite 600-1200 parts per million (ppm), total hardness 70-100 ppm total dissolved solids (TDS).
 - b. Condenser water open loop systems: conductivity 1100-1300 mmhos, pH 8-9, Molybdenum tracer (ppm as molybdenum [Mo]) 0.8 to 1.2, Chlorine-Total ppm as Cl₂ 0.0 to 1.0, Bioscan 40 Rlu.
 - c. Corrosion rate coupons shall be provided as part of the water treatment system on both chill water and condenser water. Corrosion coupon rates will be maintained under 1.0 mils/year for mild steel and 0.5 mils/year for copper.
 - d. Corrosion inhibitor system shall be Nalco, or approved equal.
 9. Specify that the chilled water systems and tower/condenser water systems are cleaned prior to start-up per ORNL construction specifications.
 10. See Section 018619 – HVAC for additional requirements.
- F. Wastewater.
1. General.
 - a. Definitions.
 - 1) Wastewater drainage systems - floor drains, SS, storm water management system, chemical drains and laboratory waste.
 - 2) Sanitary drainage system – all of the piping within a building that conveys sewage to the building sanitary drain.
 - 3) Building sanitary drain – the lowest piping of a sanitary drainage system inside a building extending 30 inches beyond the wall of the building.

- 4) Building SS – from the building sanitary drain to the ORNL SS system.
 - 5) The ORNL SS system – the common SS conveying sanitary sewage to the ORNL Sewage Treatment Plant.
 - 6) Storm drainage system – all of the piping within a building that conveys rainwater, condensate, cooling water or similar liquid wastes to the ORNL storm sewer system or other point of disposal to the environment.
 - 7) The ORNL storm sewer system – the common storm sewer conveying rainwater, surface water, subsurface water and similar liquid wastes to the ORNL outfalls.
 - 8) Laboratory waste water – a wastewater stream originating within laboratory areas which are routed through a holding tank.
 - 9) Sanitary waste water – a wastewater stream meeting the criteria of waste acceptance criteria for the Sewage Treatment Plant.
 - 10) Other waste water – a wastewater stream not meeting :
 - a) Waste water Discharge Criteria for Process Wastewaters Generated at Oak Ridge National Laboratory.
 - b) Waste acceptance criteria for the Sewage Treatment Plant.
 - c) The requirements of the storm drainage system.
- b. Wastewater systems shall be in compliance with the following criteria:
- 1) Storm Water Pollution Prevention Plan.
 - 2) Waste acceptance criteria for the Sewage Treatment Plant.
 - 3) Wastewater discharge criteria for process waste waters generated at ORNL.
 - 4) Waste acceptance criteria for liquid waste systems operated by the liquid and gaseous waste operations project at ORNL.
- c. Design wastewater collection systems for gravity flow unless such systems are not economically feasible.
- d. Prior to acceptance of facility piping, the wastewater piping greater than 3” shall be internally videotaped. The video taping equipment shall record in color and shall be self leveling. All defects located during inspection shall be repaired by the Seller prior to system acceptance. Construction debris found during videotaping shall be flushed from the waste water systems.

2. Sustainability.
 - a. Wastewater shall be evaluated for recovery and reuse where possible.
 - 1) Air Handling Unit (AHU) condensate water may be recovered and used for tower water makeup.
 - 2) Indirect waste from computer room air conditioners may be recovered and used for tower water makeup.
3. Sanitary drainage.
 - a. Design sanitary drainage systems to meet the requirements of IPC.
 - b. The sanitary drainage system shall connect to each fixture requiring connection and where required will be provided with water seal traps. A vent system shall be provided for fixtures as required to ventilate the waste system and to prevent siphonage of fixture traps.
 - c. Sanitary drainage and vent piping shall be sized based on the number of fixture units connected. Pipe shall be routed by gravity to maintain a positive slope with a maximum velocity of 2' per second. Sanitary drainage system shall be routed by gravity to the site SS system.
 - d. Kitchen and break room design shall consider grease traps to meet the requirements of IPC.
 - e. See Section 2, Civil, for building SS and ORNL SS system criteria.
4. Storm drainage.
 - a. Design storm drainage system to meet the requirements of IPC.
 - b. See Section 2, Civil, for ORNL storm sewer system criteria.
 - c. The storm drainage system shall not be used for discharging of laboratory waste or sanitary drainage.
 - d. The storm drainage system shall not be used for chlorinated water or water above 140°F without pretreatment. Upset flows can contain chlorine or be hot for short durations (quantities) or long durations when corrective actions can be initiated.
5. Floor drains.
 - a. Design floor drains to meet the requirements of IPC.
 - b. Where there is the possibility of the loss of the seal in floor/funnel drain traps, provide a trap primer valve and floor/funnel drain with a trap primer valve discharge connection.

- c. Do not route floor drains to the storm sewer.
 - d. Floor drains shall go to SS unless located in rooms where fuels, chemicals or other similar hazardous materials exist.
 - e. Where fuels, chemicals, and other hazardous materials may be found, route floor drains to a waste tank, provide no floor drains or provide raised drains to SS.
 - f. Minimize the number of floor drains in mechanical rooms and central energy plants to prevent possible contamination (oil, etc.) transfer to the SS system.
 - g. Floor drains located in restrooms shall be placed out of the walking areas, i.e. between the stalls or under the lavatories.
6. Elevator pit.
- a. Elevator sump pump, where provided, shall discharge to the sanitary drainage system.
 - b. Elevator sump pump shall have an oil monitoring system that prevents the pump from operating when hydraulic oil is present and sends an alarm to the BAS.
7. Other waste.
- a. Other waste shall be collected at the point of discharge in carboys or other tanks. The waste shall be pretreated prior to discharge or collected for offsite treatment by the waste originator.
8. Handling of water and waste water at ORNL unless otherwise noted.
- a. Types of waste water going to SS:
 - 1) Janitor mop sinks.
 - 2) Toilets, urinals, lavatories, showers, hand sinks, water fountains, break room sinks, ice makers, etc.
 - 3) Floor drains in restrooms.
 - 4) Floor drains in mechanical rooms and central energy plants.
 - 5) Mechanical room utility sink.
 - 6) Small point-of-use air compressor condensate discharge after going thru an oil/water separator may discharge to SS if no SD is locally available.

- 7) Hand sinks in labs. (Lab sinks will drain to laboratory waste tank.)
 - 8) Elevator sump pump.
 - 9) Sump discharge from computer room raised floor
- b. Types of waste water going to storm drain (SD):
- 1) No chlorine or hot temperature for normal conditions. Upset flows can contain chlorine or be hot for short durations (quantities) or long durations when corrective actions can be initiated (i.e. add de-chlorinator to fire water flows before entering creek).
 - 2) Roof drains.
 - 3) AHU condensate. See waste water sustainability section.
 - 4) Elevator sump water after it goes thru an oil/water separator. Elevator sumps shall be provided with a pump. No local drains.
 - 5) Humidifier water blow-down or recover water and send to cooling tower makeup.
 - 6) Condensate from large oil-less air compressors.
 - 7) Condenser/tower water blow-down.
 - 8) Condenser/tower water over-flow.
 - 9) Neutralized, condensate, these shall be oil-less compressors if used.
- c. Types of waste water piped to the sanitary drainage system or storm drainage system:
- 1) Small point-of-use air compressor condensate discharge after going thru an oil/water separator.
 - 2) Condenser/tower water blow-down.
 - 3) Condenser/tower water over-flow.
 - 4) Condenser water relief.
 - 5) Evaporator make-up water relief and air separator drain.
 - 6) Boiler water relief and drain.
 - 7) Water treatment chemical feeder bleed-off.

- 8) Water treatment chemical pot feeder drain.
 - 9) Heating make up water relief and air separator drain.
 - 10) Water heater relief.
 - 11) Back flow preventer relief.
 - 12) Condensate (neutralized) from the condensing boiler stacks.
- d. Types of waste water piped to laboratory waste tank.
- 1) Lab sinks.
 - 2) Fume hood cup sinks.
 - 3) Safety showers floor drains.
 - 4) Eye washes.
 - 5) Laboratory floor drains.
- G. Compressed air.
1. Design compressed air systems made from steel or copper tubing systems to meet the requirements of ASME B31.3 - Process Piping, Category D fluid service.
 2. Instrument air is defined as compressed air that is oil free and dried to a specified dew point.
 3. Maximum pressure at air hose outlets is 15 psi.
 4. Provide compressed air that is oil free and dried to -40°F dew point.
 5. The system shall supply 100 psi to the risers and specific equipment with pressure reducing stations on each floor as required for distribution of 15 psi to the work benches. Sizing of the system will be based on one standard cubic feet per minute (SCFM) per outlet. Specific equipment may require more flow and will be determined as required.
 6. Compressed air redundancy requirements shall be determined and specified.
 7. Provide flow instrumentation with electronic output for connection to BAS system.
- H. Refrigerants.
1. Piping systems for refrigerants is covered under Section 018619, HVAC.
- I. Tanks.

1. Vented steel water tanks, stand pipes, and reservoirs shall comply with NFPA 22 and AWWA D-100.
 2. Pressurized and/or heated tanks and vessels shall be designed, fabricated, inspected, and stamped in accordance with the requirements of ASME Boiler and Pressure Code, Section VIII.
 3. ASME pressure vessels shall be inspected after installation. Inspection shall be scheduled prior to placing the vessel in service. Inspections will be performed by the Company.
 4. All pressure relief valves shall be tested by the Company before being put in service. Manufacturer's test report should be submitted with each pressure relief valve.
- J. Steam.
1. Steam piping systems are to meet the requirements of ASME Code B31.1
 2. All piping subject to ASME code shall satisfy the requirements of the ASME code.
 3. All piping shall satisfy the requirements of ASME B31.1 Code for the working pressure and service temperature involved.
 4. All valves, fittings, flanges, and unions shall be marked according to Manufacturers' Standardization Society (MSS) SP-25 standards.
 5. Heating steam – steam used for heating air or potable water.
 6. Process steam – all other steam usage.
 7. Provide expansion loops with welded fittings to compensate for expansion of steam lines. Do not use expansion joints.
 8. Provide meter for building steam usage. Include a bypass around the meter with isolation valves.
 9. At strategic points, provide double isolation valves for maintenance of the equipment without effecting the steam system operation in the rest of the building.
 10. Test completed piping systems in accordance with the ASME B31.1 Code.
- K. Steam boilers.

1. Power boilers and high pressure, high temperature water boilers shall be designed, fabricated, inspected, and stamped in accordance with the requirements of ASME Boiler and Pressure Code, Section I in which steam is generated greater than 15 psig or high temperature boilers with pressures greater than 160 psig and/or temperatures greater than 250°F. For water boilers operating at 15 psig or less the rules of ASME Code, Section IV applies.
2. The ASME pressure vessels shall be inspected after installation. Inspection shall be scheduled prior to placing the vessel in service. Inspections will be performed by the AHJ which is the Company if the site is located on Department of Energy (DOE) property and otherwise is the local/state regulatory agency.

PART 3 – EXECUTION

3.1 INSULATION

- A. Insulation for piping systems and auxiliary components and equipment shall minimize energy loss, prevent condensation, protect from freezing and provide safe surface temperatures. The Economic Insulation Thickness Guidelines for Piping and Equipment prepared by the North American Insulation Manufacturers Association (NAIMA) shall be the basis for determining insulation thickness.
- B. Insulation shall be expanded closed-cell elastomeric insulation. Do not use fiberglass insulation.
- C. Pipe hangers and supports shall not penetrate the insulation on chilled water lines.
 1. Supports/Hangers.
 - a. Piping systems, components and equipment shall be designed and anchored in accordance with Section 018200 – Structural.
 - b. Provide engineered pipe shields at support locations.
 - c. Support spacing shall not exceed spans given per ASME B31.1 Code, Section 121 Table 121.5 for metallic pipe and ASME B31.3 Code for non-metallic piping.
 - d. Locate, detail, and number and tag all anchors, hangers, and supports for piping larger than 2” in diameter. Provide an isometric drawing showing as-built information identifying the same with the pipe configuration and pipe support locations.

3.2 CORROSION PROTECTION

- A. Protect piping against corrosion either by natural resistance of the material or by other protective measures, see Section 018626 - Electrical for cathodic protection.
- B. Provide di-electric nipples between dissimilar pipe materials when the fluid is liquid. Di-electric unions shall not be used.

3.3 DRAWING INFORMATION

- A. Flow diagrams shall show system designations, line numbers, line sizes, and piping specification number. System designations shall be defined on the drawings and may be the Architect-Engineer's (A-E's) standard designations.
- B. Valves shall be identified by a standard valve number and unique valve identifier. Valve identification numbers (VIN) will be provided by the Company.
- C. Include the following tables on the piping drawings:
 - 1. Table listing each service, designation, and specification subsection.
 - 2. Table listing each service design pressure, test pressure, test type, and test media.
 - 3. Valve table that includes the VIN, standard valve number, type, and (if applicable) instrument number.
 - 4. Table listing pressure reducing and relieving devices that shows type, size, pressure setting and capacity.
 - 5. Table listing insulation type and thickness.
 - 6. Table listing backflow protection devices include location and backflow preventer device type.

END OF SECTION

SECTION 018619 - HEATING, VENTILATING AND AIR-CONDITIONING (HVAC)

PART 1 - GENERAL

1.1. SPECIFIC REQUIREMENTS

A. Work scope summary.

1. Natural gas will not be allowed in this facility due to its proximity to the Target Building.
2. There is no central steam available for this facility.
3. There are no central cooling plant utilities available for this facility.
4. All refrigerants shall be R-410A or R-134A. Ozone depleting refrigerants are not acceptable.
5. Provide HVAC design for environmental control of facilities where fabrication, testing, maintenance, clerical and other related activities will be performed.
 - a. The facility will be monitored and controlled by standalone direct digital control (DDC) and building management system (BMS) interface controllers.
 - 1) Johnson Controls, Inc. (JCI) shall be the design basis for all HVAC and BMS related controls equipment.
 - 2) The BMS shall match the current Oak Ridge National Laboratory (ORNL) standard Johnson Controls Metasys web-based system.
 - 3) Utility services shall be monitored by the BMS to provide real time measurement and verification of mechanical, electrical and plumbing systems.
 - 4) Each DDC controller shall have a minimum 10% spare points of each type at each panel. Universal spare points shall be divided evenly between analog and digital.
 - b. Provide air-conditioning of telecom and electrical rooms to maintain spaces within acceptable temperature and relative humidity operating ranges as specified by the equipment manufacturers.
 - c. Provide heating and ventilation of mechanical rooms. Provide tempered or conditioned air supply to mechanical rooms if required to maintain acceptable environmental conditions for microprocessor based controls or other sensitive equipment.
 - d. Provide heating at entrance vestibules, storefronts and/or other high fenestration areas as necessary to prevent surface condensation problems.

- e. Local exhaust ventilation systems shall be provided for the shop areas as needed to capture local generation of particulates or other air contaminants.
 - f. Air distribution systems and equipment shall contain minimum efficiency reporting value (MERV)-13 rated filtration products.
 - g. Provide exhaust for janitor's closets, restrooms, locker rooms, and break rooms as required.
 - h. Provide adequate ventilation of forklift operation areas and/or battery charging stations as applicable to avoid accumulation of hazardous gases.
6. The design shall be performed in accordance with the requirements of this criteria document, referenced standards and applicable codes.
 7. The mechanical systems shall be designed for effective energy conservation and to enhance overall building sustainability goals.
 8. The design shall comply with the guiding principles for federal leadership in high performance and sustainable buildings as set forth in the Federal Leadership in High Performance and Sustainable Buildings Memorandum of Understanding (2006).
 9. The design shall support achievement of Leadership in Environmental and Energy Design (LEED) Gold Certification.
 10. See also room data sheets for additional requirements.
- B. Calculations.
1. All HVAC related calculations shall be submitted for review and record copy project files.
 2. Applicable HVAC related calculations include, but are not limited to, the following:
 - a. Heating and cooling loads.
 - b. Minimum ventilation rates.
 - c. Pressure drop (ductwork and piping) calculations.
 - d. Equipment sizing and performance characteristics.
 - e. Air distribution sizing performance characteristics.
 - f. Resultant sound level estimation.
 - g. Energy simulation calculations.

- h. Life cycle cost analysis.
 - i. Calculations to support all applicable LEED credits.
3. Submittal of project calculations shall include all applicable computer based program input and output data printed out on 8-1/2" x 11" sized paper.
- C. Reliability.
- 1. Size and select HVAC equipment and components to duplicate, when possible, products for improved maintenance and repair efficiencies.
 - 2. Design HVAC systems to accommodate modular equipment additions and replacements.
- D. Flexibility.
- 1. The HVAC system design shall be flexible enough to accommodate frequent equipment replacements to support changing research requirements.
- E. Special requirements.
- 1. The building mechanical systems will be designed to mitigate sound generation and provide an acoustic environment for each area conducive to its use.
- F. Testing, Adjusting, and Balancing (TAB) and commissioning.
- 1. Provide detailed testing, adjusting and balancing specifications edited for project specific requirements.
 - 2. Provide detailed specifications outlining the mechanical commissioning requirements as applicable for HVAC equipment and systems for the project specific scope of work.
 - 3. Provide a design intent document with each design review submission and with the approved certified for construction package.
- G. Controls.
- 1. The JCI shall be the design basis manufacturer of all HVAC and Building Automation System (BAS) related controls.
 - 2. Specify DDC controllers and expansion modules with at least 10% spare points for each type of input and output for future expansion capability.
 - 3. Provide a local workstation (i.e. laptop and printer) for connection to the BAS system in an occupied space within the facility. Hardwire to the network automation engine (NAE) controller for system access without web interface.
- H. Reports.

1. Provide a report outlining the base preliminary design's minimum energy efficiency performance for comparison with the American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) 90.1 standard minimum requirements.
2. Provide energy and sustainable design report at end of design.

1.2. DESIGN STANDARDS

A. Work smart standards.

1. Standard 10 CFR 434, Energy Conservation Voluntary Performance Standards for New Buildings; Mandatory for Federal Buildings.
2. Standard 10 CFR 436, Federal Energy Management and Planning Programs.
3. American Society of Mechanical Engineers (ASME) B31.3, Process Piping.
4. The ASME B31.5, Refrigeration Piping.
5. The ASME Boiler and Pressure Vessel Code (BPVC) Section VIII.
6. International Building Code (IBC), 2009.
7. National Fire Protection Association (NFPA) (<http://www.nfpa.org>).
 - a. The NFPA 90A, Standard for the Installation of Air Conditioning and Ventilating Systems.
 - b. The NFPA 90B, Standard for the Installation of Warm Air Heating and Air Conditioning Systems.
 - c. The NFPA 91, Standard for Exhaust Systems for Air Conveying of Vapors, Gases, Mists, and Noncombustible Particulate Solids.
 - d. The NFPA 101, Life Safety Code.

B. Additional standards/guides.

1. Industry standards and guides.
 - a. Air-Conditioning, Heating and Refrigeration Institute (AHRI) (<http://www.ahrinet.org/>).
 - 1) The AHRI 210/240, Unitary Air-Conditioning and Air-Source Heat Pump Equipment.
 - 2) The AHRI 310/380, Packaged Terminal Air-Conditioners and Heat Pumps.
 - 3) The AHRI 340/360, Commercial and Industrial Unitary Air-Conditioning and Heat Pump Equipment.
 - 4) The AHRI 365, Commercial and Industrial Unitary Air-Conditioning Condensing Units.

- 5) The AHRI 410, Forced-Circulation Air-Cooling and Air-Heating Coils.
 - 6) The AHRI 430, Central-Station Air-Handling Units (AHUs).
 - 7) The AHRI 550/590, Water Chilling Packages Using the Vapor Compression Cycle.
 - 8) The AHRI 670, Fans and Blowers.
 - 9) The AHRI 880, Air Terminals.
 - 10) The AHRI 890, Rating of Air Diffusers and Air Diffuser Assemblies.
 - 11) The AHRI 1230, Performance Rating of Variable Refrigerant Flow (VRF) Multi-Split Air-Conditioning and Heat Pump Equipment.
- b. Air Movement Contractors Association (AMCA) (<http://www.amca.org/publications/>).
- 1) Publication 201, Fans and Systems.
- c. The ASHRAE (<http://www.ashrae.org>).
- 1) Standard 15, Safety Code for Mechanical Refrigeration.
 - 2) Standard 20, Method of Testing for Rating Remote Mechanical-Draft Air-Cooled Refrigerant Condensers.
 - 3) Standard 51, Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating.
 - 4) Standard 52.1, Gravimetric and Dust-Spot Procedures for Testing Air-Cleaning Devices Used in General Ventilation for Removing Particulate Matter.
 - 5) Standard 52.2, Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size.
 - 6) Standard 55, Thermal Environmental Conditions for Human Occupancy.
 - 7) Standard 62, Ventilation for Acceptable Indoor Air Quality.
 - 8) Standard 90.1, Energy Efficient Design of New Buildings Except Low-Rise Residential Buildings.
 - 9) Standard 105, Standard Methods of Measuring and Expressing Building Energy Performance.
 - 10) Standard 111, Practices for Measurement, Testing, Adjusting and Balancing of Building Heating, Ventilation, Air-Conditioning and Refrigeration Systems.
 - 11) Standard 135, Building Automation and Control (BAC)net – A Data Communication Protocol for Building Automation and Control Networks.
 - 12) Applications handbook.
 - 13) Fundamentals handbook.
 - 14) Refrigeration handbook.
 - 15) Systems and equipment handbook.
 - 16) Cooling and Heating Load Calculation Manual.
- d. Sheet Metal and Air Conditioning Contractors National Association (SMACNA) (<http://www.smacna.org>).

- 1) The HVAC Duct Construction Standards Metal and Flexible.
 - 2) Rectangular Industrial Duct Construction Standards.
 - 3) Round Industrial Duct Construction Standards.
- e. Mold Litigation Task Force of the Associated General Contractors of America, Inc. (<http://www.abcwestwa.org/ManagingMold.pdf>).
- 1) Managing the Risk of Mold in the Construction of Buildings.

1.3. HVAC DESIGN REQUIREMENTS

A. General.

1. Equipment specifications shall reflect standard, commercially available equipment that allows a reasonable range of competitive bidding. At least three reputable companies capable of manufacturing the specified equipment shall be identified as potentially acceptable manufacturers for competitive bidding. In addition, manufacturers of major equipment (e.g., boilers and chillers) shall have obtained a satisfactory commercial, industrial and ORNL/Chestnut Ridge Site record of past equipment experiences before their addition in the specifications as acceptable manufacturers. Manufacturers identified by UT-Battelle, LLC (UT-B)/ORNL/Facilities Development Division (FDD) personnel as having a poor performance or reliability record shall not be included as acceptable manufacturers.
2. The following HVAC product types have a preferred manufacturer identified. The preference applies only to the product type listed.
 - a. Chillers – Trane.
 - b. Boilers – Cleaver Brooks.
 - c. AHUs – York.
 - d. Variable air volume units – Enviro-Tec.
 - e. Packaged terminal air conditioners/heat pumps – General Electric (GE) Zoneline.
3. The heating fuel source, HVAC equipment and system selections shall be determined by a life cycle cost analysis evaluation based on project specific constraints.
4. The HVAC systems and equipment shall meet the minimum energy efficiency requirements of 10CFR434 and the latest edition of ASHRAE 90.1 as follows:
 - a. New federal buildings shall exceed the minimum energy efficiency requirements of ASHRAE 90.1 by 30 percent.

- b. The inside wintertime design temperature for personnel comfort shall be 72°F db unless otherwise directed by the project criteria.
 - c. Winter humidification for personnel comfort and health shall not be provided unless recordings or engineering computations indicate inside relative humidity levels less than 30%. Where such conditions exist, a design relative humidity of 30% shall be used in establishing minimum humidification equipment requirements.
 - d. Ventilation design for general heat relief shall limit the temperature rise of spaces to 10°F maximum above the outside design dry bulb temperature.
3. Outside design temperatures.
- a. For space personal comfort conditions, the design professional shall size the HVAC system equipment using outside design temperatures as indicated in ASHRAE Fundamentals Handbook for the Oak Ridge/Knoxville, Tennessee area. The winter design temperature shall be the ASHRAE 99% value and the summer design shall be the 1% value.
 - b. Process designs, i.e. non comfort conditioning applications, shall use the 99.6% and 0.4% ASHRAE winter and summer temperatures respectively.
 - c. Cooling tower and evaporative condensers sizing shall use the 0.4% mean coincident wet bulb temperatures for design purposes.
- C. Mechanical insulation.
1. General requirements.
 - a. All supply and return air ductwork, casings, and air-handling equipment for the air conditioning systems that are not within the conditioned area shall be insulated in accordance with the Company's technical specifications. Minimum thickness for fiberglass duct wrap shall be 1½" and other insulating material shall be sized to provide an equivalent insulating value. Additional insulation thickness shall be determined from 10 CFR 434 and the life cycle cost analysis.
 - b. Insulation inside AHUs shall have a neoprene coating or tightly bonded aluminum on the side exposed to the air.
 - c. The AHU housing shall be constructed entirely of double wall galvanized steel (G90) construction with 1-1/2 lb. per cubic feet density rigid glass fiber insulation tightly bonded to the panels. Exterior surface finish shall be in accordance with project specific criteria.

- d. Insulation shall be provided for equipment, ductwork, flue pipe and breeching to minimize energy loss, to prevent condensation, and to provide safe surface temperatures.
 - e. All insulation material, media used to apply insulation, and jacketing material shall have a maximum flame spread of not more than 25 fuel-contributed and smoke-developed ratings of not over 50 when tested using Underwriters' Laboratories, Inc. (UL) 723, Test Methods.
 - f. Asbestos or asbestos-containing materials shall not be used.
 - g. Insulation material, thickness, and jacketing shall be designed to provide an exterior skin surface temperature greater than the minimum anticipated ambient dew point for condensation prevention.
2. Refrigerant piping insulation.
 - a. Refrigerant suction lines shall be insulated with closed-cell type rubber tubing insulation, as manufactured by Armaflex or Rubatex Corporation, or its equivalent. Insulation and adhesives used must be the self-extinguishing, fire retardant type.
 - b. Minimum insulation thickness shall be 1" and method of application shall be as recommended by the insulation manufacturer.
 3. Plant and equipment insulation.
 - a. All hot surfaces within 7' of the plant floor or any catwalk shall be insulated to prevent surface temperatures above 130°F where contact would be inadvertent and 120°F where contact is likely or necessary for equipment operation.
- D. Fire protection requirements.
1. General.
 - a. Fire protection methods must be reviewed and accepted by the Authority Having Jurisdiction (AHJ). Some Section 018613 - Fire Protection requirements (fire suppression, fire rated construction, physical separation, etc.) may impact the HVAC system.
 - b. See Section 018613 - Fire Protection, for comprehensive project specific requirements.
 2. Fire rated construction.
 - a. Ductwork shall also be designed to comply with NFPA 90A and the International Mechanical Code (IMC), including specification and installation of smoke and fire dampers at fire wall penetrations and smoke pressurization/containment dampers as required for smoke pressurization/evacuation systems.

- b. All mechanical and electrical penetrations made into fire rated plenum enclosures shall be fire stopped by listed materials meeting the requirements of ASTM International (ASTM) E-814 with a fire rating not less than the rated enclosure.
- c. Fire dampers.
 - 1) Fire dampers in ductwork shall not be utilized when penetrating the fire rated construction where the ductwork is an integral part of the air filter system equipment that is required to continuously function as part of the confinement system or any system that meets the requirements of NFPA 91.
 - 2) Duct material penetrating fire rated construction without fire dampers shall be made part of that fire rated construction by either: wrapping, spraying, or enclosing the duct with an approved material.
 - 3) Ductwork penetration shall be made part of that fire rated construction by separating the duct material from other parts of the building with equivalent required fire rated construction.
 - 4) Ductwork penetration fire rated construction shall be qualified by an engineering analysis in accordance with Department of Energy Standard (DOE-STD)-1066-99, Appendix D.
 - 5) Provide access panels in ductwork strategically placed to facilitate resetting dampers as well as for maintenance of damper systems inside ductwork.

1.4. TAB

A. General.

- 1. Test and measuring locations shall be noted on construction drawings. The use of duct mounted airflow monitoring stations shall be considered where limited duct space or configuration restrict the use of Pitot tube traverse procedures or where especially sensitive measuring requirements are dictated by the project criteria. All automatic/electronic means of measurement shall be capable of directing communicating with the ORNL campus standard Johnson Controls "Metasys" building management system.
- 2. A listing of the inspections, tests and submittals required by the project specifications shall be prepared and detailed on the Commissioning Agent's forms and attached to Commissioning Report.
- 3. Operational startup, testing, and balancing shall not begin until preoperational checkout activities are completed with signatures.

B. Testing and balancing devices.

1. The HVAC air and water distribution systems shall be provided with permanently installed calibrated testing and balancing devices and all water systems shall have permanently installed flow and temperature measuring equipment. Accessibility shall be provided to accurately measure and adjust water or air flows, pressures, or temperatures as required.
2. All permanently installed flow and temperature measurement equipment shall be capable of directing communicating with the Chestnut Ridge campus standard Johnson Controls “Metasys” building management system.
3. The design professional shall provide as a minimum the balancing devices in Tables 5.1 and 5.2 on the following page. Test devices shall be located and installed according to the Associated Air Balance Council (AABC) National Standards for Total System Balance 2002.

Table 5.1

Required balancing devices for air distribution systems

System Components	Required System Devices
Diffusers, grilles	Round butterfly or square/rectangular opposed blade volume damper, either registers integral with device or in spin-in take offs
Branch ductwork runs	Rectangular/square or round (with more than one opposed blade damper and terminal device). Sealed test hole for Pitot tube traverse
Fan discharge ductwork	Sealed test holes for Pitot tube traverse. Sealed test hole for static pressure measurements
Fan suction ductwork	Sealed test hole for static pressure measurement
Coil suction and discharge airstreams	Duct-mounted air stream thermometer
Mixed air plenum air stream	Duct-mounted air stream thermometer

Table 5.2

Required balancing devices for water distribution systems

System Components	Required System Devices
Chiller evaporator water suction and discharge piping	Thermometer and pressure gauge and gage cock
Chiller condenser water suction and discharge piping	Same devices as required for chiller evaporator piping
Heating or cooling coil (AHU) suction and discharge piping	Thermometer and pressure gauge
Heating or cooling coil (AHU) discharge piping	Pre-settable calibrated balancing valve with integral pressure test ports
Discharge and Suction piping for reheat coils, fan coil units, etc.	Pre-settable calibrated balancing valve with integral test ports, temperature gauge, pressure gauge
Three-way control valves for suction and discharge piping	Pre-settable calibrated balancing valve with integral test ports in bypass
Boiler discharge piping	Flow measuring device (orifice or venturi type)

1.5. CENTRAL COOLING AND HEATING REQUIREMENTS

A. General.

1. Connection to the nearest existing source of central steam and chilled water supply is not economically feasible given the excessive distance.
2. Provisions for new central cooling and heating equipment for the facility shall be provided, if required, to achieve energy efficiency, sustainable design requirements of the project.
3. The design shall meet the following equipment criteria requirements as applicable.

B. Plant equipment.

1. Water chillers.
 - a. The selection of chillers, if applicable, shall consider coefficients of performance at full load and part load conditions.
 - b. Size, selection, and design shall be based on applicable ASHRAE handbooks and ASHRAE 90.1. Refrigeration equipment shall comply with all applicable AHRI standards, unless otherwise noted. The use of multiple chillers for chilled water loads greater than 400 tons is preferred.
 - c. Compression refrigeration machines shall be designed with the safety controls and relief devices. Chiller controls shall at a minimum include:
 - 1) High discharge refrigerant pressure cutout switch.
 - 2) Low evaporator refrigerant pressure or temperature cutout switch.
 - 3) High and low oil pressure switches.
 - 4) Chilled water flow interlock switch.
 - 5) Condenser water flow interlock switch (on water cooled equipment).
 - 6) Chilled water low temperature cutout switch.
 - d. Refrigeration compressors shall be selected and designed for capacity modulation down to 20% or below without surge.
 - e. Selection and specification of equipment shall not allow hot gas bypass control of compressors except when providing capacity modulation below 10% of rated load, if required.
 - f. Liquid coolers (evaporators) shall be designed to meet requirements of ASHRAE Standard 15 and ASME Boiler and Pressure Vessel Code, Section VIII.

- i. Bearings shall have fittings for lubrication and relief. Pipe extensions and fittings shall be provided to allow lubrication of equipment without removal of the safety guards.
 - j. Belt drives shall be designed in accordance with engineering data developed by the drive industry. Designs shall include overload service factors and operating conditions in determining the total percentage above fan motor nameplate hp; 140% is a minimum for any application.
 - 1) Safety guards shall be provided in accordance with SMACNA Standards and Occupational Safety and Health Administration (OSHA) requirements to enclose the exposed sides of moving parts, including, but not limited to, couplings, sheaves, shafts, and belts.
 - 2) Tachometer openings with removable covers shall be provided for measuring driver and driven shaft speeds without removing the safety guard.
 - k. Assemblies shall be dynamically balanced to a minimum of Grade 6.3 per Acoustical Society of America (ASA) S2.19. Special applications requiring especially low vibration levels should be individually evaluated and may require balancing at Grade 2.5 or better per ASA S2.19.
 - l. Vibration isolation bases shall be provided for rotating equipment. The transmissibility of vibration from rotating equipment on vibration isolators shall generally be limited to 20% for shops, equipment rooms, storage areas, etc., and to 10% for offices, auditoriums, etc. Areas with special requirements for noise and/or vibration control shall be individually evaluated.
2. AHUs.
- a. The design of air handling equipment and air distribution systems shall optimize both initial cost and air handling system operating and maintenance costs.
 - b. The design professional shall provide air handling system equipment (fans, terminal units, AHUs, etc.) with vibration isolators and flexible ductwork connectors to minimize transmission of vibration and noise.
 - c. Systems shall satisfy the noise control levels recommended for various types of spaces and vibration criteria as listed in the ASHRAE handbooks or as specified in the project criteria. Sound attenuation devices shall be installed in the air handling systems if necessary to maintain specified noise levels.

- d. Airflow diagrams and system piping and instrumentation diagrams (P&ID's) shall be developed and provided in the preliminary design phase for each air handling and air distribution system and shall include capacities and locations of fans, coils, filters, terminal devices, and other major air distribution system equipment, as well as airflows and system air pressures and space pressure differentials.
 - e. Airflow velocities shall be designed to minimize settling of entrained particles as outlined in the ACGIH Industrial Ventilation Manual.
3. Coils – general.
- a. Heating and cooling coil performance shall comply with and be certified to AHRI 410.
 - b. Cooling coils shall be designed with a maximum face velocity of 500 feet per minute (fpm). Coils shall be specified with drain feature.
 - c. All mixed air systems shall be designed with a preheat coil.
 - d. Preheating coils shall be specified and designed to maintain discharge air temperature of 50°F without use of integral face and bypass dampers.
 - e. Coils shall be tested by the manufacturer at 300 pounds per square inch (psi).
4. Cooling coils.
- a. Chilled water, brine, and direct expansion cooling coils shall be certified and rated in accordance with the latest edition of AHRI Standard 410. Aluminum fins and copper tubes shall be used. Tubes (1" outside diameter [O.D.]) shall have a minimum wall thickness of 0.032"; 0.625" O.D. tubes shall have a minimum wall thickness of 0.024". The fin thickness shall be a minimum of 0.009. Coils shall be tested at 300 pounds per square inch, gage (psig).
 - b. Cooling coils for spray coil service shall have copper fins to resist corrosion.
 - c. Water and brine coils shall be provided with accessible plug drains and air vents.
5. Heating coils.
- a. Hot water coils shall be rated and certified in accordance with the latest edition of AHRI Standard 410. Water heating coils shall have a maximum face velocity of 500 fpm. Heating coils shall have a maximum face velocity of 700 fpm.
 - b. Hot water coil materials, tube wall, and fin thickness shall be as described above for chilled water coils.

6. Electrical heating coils.
 - a. Electrical heating coils shall have low mass, exposed wire heating elements, unless hazardous or corrosive atmospheres require enclosed, finned tube elements.
 - b. Electrical heating coils shall be protected with automatic and manual reset type snap disc or bulb type safety devices in both the power and control circuits. A sail switch or other airflow sensor shall be interlocked with the fan and a visual alarm. See Section 018626, Electrical, for additional information on protective devices.
 - c. Heating coils operating on 120 and 240V power shall be controlled by single or multistage line voltage thermostats. Heating coils operated on 480V power shall be controlled by a temperature sensor coupled with a time proportioning switch, step controller, and electrical contactors or silicon-controlled rectifier (SCR) controller if precise control is required.
 - d. Controls, such as contactors, step and proportional controllers, time proportioning switches, disconnects, pressure electric switches, SCR controllers, and differential pressure switches, shall be installed in accessible, visible locations outside the duct heater enclosure.
 - e. Coils shall bear a UL label (preferred) or state that they have been manufactured in compliance with UL design criteria and production requirements, and could bear the UL label if they were assembled with a UL tested and approved contactor and/or with a flow sensing device installed by the duct heater manufacturer."

1.6. DECENTRALIZED COOLING AND HEATING

A. Unitary split systems.

1. Condensers/Condensing units.

- a. Water cooled condensers shall comply with and be selected in accordance with ASHRAE Standard 15, AHRI 450 and ASME Boiler and Pressure Vessel Code, Section VIII.
- b. Water cooled condenser shell and tube types shall be designed and specified with removable heads.
- c. Air cooled condensers and condensing units shall meet the standards, rating, and testing requirements of AHRI 460 and ASHRAE Standard 20. These units shall not be located on roofs unless required by project criteria.
- d. The design professional shall locate air cooled condenser intakes away from any obstructions that will restrict the airflow and from locations that receive peak solar heat gain.

- e. Air cooled equipment shall be located away from noise sensitive areas, and air cooled condensers shall have refrigerant low head pressure control to maintain satisfactory operation during light loading.
- f. The use of once through process or sanitary cooling water is prohibited at ORNL. Use cooling towers, dry coolers, air cooled condensing, etc.

B. Auxiliary components.

1. Heat generating equipment.

- a. A building heat generation system shall not be provided unless one of the following conditions exists:
 - 1) Connection to the central plant distribution system is not cost effective.
 - 2) The central plant has insufficient capacity to accept the building load.
 - 3) The use of the building precludes connection to a potentially interruptible central system.

2. Refrigerant piping.

- a. Split refrigeration systems shall have a complete refrigerant diagram prepared on the drawings. The diagram shall include line sizes and approximate location of a r efrigerant specialty including access ports/valves, shut off valves, expansion valves, filter dryers, etc.
- b. A bill of material, including a description and a manufacturer's catalog number, shall be prepared on t he drawing for each refrigerant component.
- c. Refrigerant piping shall be sized and configured in accordance with the ASHRAE Refrigeration Manual.

C. Other requirements.

- 1. The performance of variable refrigerant flow equipment and systems shall be rated in accordance with AHRI 1230.

1.7. AIR DISTRIBUTION SYSTEMS

A. Ductwork.

- 1. All sizes, materials, construction, and support systems shall be designed in accordance with the ASHRAE handbooks, SMACNA, and the Company engineering standards.
- 2. Ductwork systems shall be designed to meet the leakage rate requirements of SMACNA HVAC Air Duct Leakage Test Manual.

3. The routing of ductwork shall be directed to reduce air resistance unless additional turns would be beneficial in reducing the noise transmission from mechanical equipment or between adjacent rooms of the building.
 4. Single-wall, internally insulated ductwork shall not be used.
 5. Round elbows shall have a minimum turning radius of 1½ duct diameters.
 6. Mitered elbows with turning vanes should be used only where space is limited.
 7. The use of computerized duct sizing methods is encouraged to obtain economical designs and the benefits of sizing ductwork by the static regain method.
 8. Access doors shall be installed at:
 - a. Fire dampers for servicing spring latches and fusible links.
 - b. Both air entering and leaving sides of cooling and heating coils.
 - c. Air entering side of multi-blade balancing dampers.
 - d. Locations requiring periodic inspection, adjustment, and/or maintenance.
 - e. Locations shown on the drawings.
- B. Ductwork accessories.
1. All supply air outlets and return or exhaust intakes shall achieve the specified noise levels in the spaces served. Anti-smudge type air diffusers with fixed cones designed to discharge air horizontally along the ceiling are preferred. Air turning and straightening devices shall be provided for supply air outlets where space is available. Opposed blade volume control dampers shall be provided for supply, return, and exhaust outlets for system balancing.
 2. Weather caps shall be constructed in accordance with SMACNA and ASHRAE guidelines.
 3. Stacks shall be supported independently of associated equipment.
 4. Flexible connections shall be provided between motor driven equipment and the stacks.
 5. Instrument test openings shall be provided for Pitot tube traverses in accordance with ASHRAE Standard 111.
- C. Terminal equipment.
1. Variable air volume boxes and fan-powered variable air volume boxes.

- a. Zone thermostats or temperature sensors and controllers initiate adjustment of a volume-regulating device in the variable air volume (VAV) boxes changing the supply airflow rates as required to maintain the space set point temperature.
- b. Reheat coils in the VAV terminal boxes provide perimeter heat.
- c. Calculation of minimum airflow to a zone shall consider minimum ventilation rates in the zone in accordance with ASHRAE guidelines, exhaust air requirements for the zone, and minimum air movement in the zone.
- d. The outside air damper shall be closed during warm up and unoccupied periods.
- e. Specify high entrainment types of outlets to achieve higher air velocity at minimum flow.
- f. Automatic controls should be used in VAV systems to assure a constant/minimum amount of outside air to comply with ventilation codes.
- g. Provide reheat coil discharge air temperature sensor after all reheat coils.

1.8. EXHAUST, RETURN AND OUTSIDE AIR VENTILATION AND FILTRATION SYSTEMS

A. General.

1. Design exhaust stack(s) per ASHRAE fundamentals and to preclude exhaust to intake return of air to a facility.
2. Minimum outside air requirements for ventilated and air conditioned occupied spaces shall be as specified in ASHRAE 62 and the project criteria.
3. Spaces should be maintained under slightly positive pressure with respect to the atmosphere except for toilets, rest rooms, change houses, and similar areas shall be maintained at a negative pressure with respect to adjacent areas. Fresh air intakes shall be located where incoming air will be relatively free of exhaust effluent gases and particulates such as grass cuttings and cooling tower drift. Debris screens shall be accessible for cleaning. Intake air velocity shall be less than 500 fpm.
4. Ductwork shall comply with NFPA 91.
5. Ductwork constructed of aluminum should be considered for air exhausted from shower rooms, dishwashing areas, or other areas causing condensation on the duct interior, and have drainage at low points.

6. Rest rooms, janitor closets, garbage rooms, and other malodorous spaces shall be exhausted at a rate of not less than 2 cubic feet per minute (cfm)/ft² or as specified in ASHRAE Standard 62, whichever is the more stringent, regardless of any other calculated ventilation requirements.
- B. Return.
1. If the indoor air quality does not meet or exceed the limits given in ASHRAE Standard 62, the re-circulated air must be treated and monitored.
 2. Areas from which air shall not be re-circulated include areas that produce or emit dust particles, heat, odors, fumes, spray, gases, smoke, or other contaminants that cannot be sufficiently treated and could be potentially injurious to health and safety of personnel or are potentially damaging to equipment. These areas shall be 100% exhausted. Project criteria shall indicate other areas of non-recirculation.
- C. Particulate air filtration.
1. Selection of an air cleaning device for a given particulate shall be based on the recommendation of the ASHRAE Equipment Handbook, Section I, Chapter II, Industrial Gas Cleaning and Air Pollution Control, and ACGIH Industrial Ventilation Manual. The MERV 13 filtration media is required for LEED credit 3.2, Construction IAQ Management.
 2. Air cleaning equipment for ductwork installation shall be easily removable, serviceable, and maintainable. Air cleaning equipment shall have face velocities as recommended by the filter manufacturer to achieve maximum efficiency and minimum pressure drop.
 3. Filters shall be constructed of noncombustible materials meeting the requirements for UL 900 Class I. Air filters shall be located on the suction side of fans and coils and in other special locations as required for air treatment. Air filter pressure drop gages of the diaphragm actuated, dial type (preferred) or the inclined manometer type shall be located on filter assemblies. Electronic pressure drop sensors shall be provided and shall be capable of direct communication with the ORNL campus standard Johnson Controls Metasys building management system.

1.9. HVAC CONTROL SYSTEMS

- A. General.
1. Special control requirements shall be indicated in the project specific criteria.
 2. All control equipment shall be easily accessible. One temperature control panel shall be provided for each system, complete with panel face mounted indicators, switches, pilot lights, and tags. Control interlocks shall be through hands off-automatic (HOA) switches.

3. Control air compressors shall be duplex non-lubricated type with oil lubricated crankcase and distance piece. Air shall be filtered and dried using refrigerated air dryers for dew point of 15°F and regenerative silica type for dew point below 15°F.
4. Copper piping shall be used for high pressure air in inaccessible locations. Transmitters shall be capable of field calibration and thermometers or pressure gages shall be provided at transmitters. Controllers and thermostats shall be pilot bleed type.
5. Instrument and control specifications shall be prepared for each item. A master instrument index shall be used to locate instruments and their respective specifications.
6. Automatic shutoff/on controls with manual override shall be provided where practical.
7. Provisions shall be made for fail safe operation in case of emergency.
8. Control system drawings and specifications shall be detailed sufficiently to allow installation of the entire system by a contractor without additional engineering. Notes shall be shown in a legend on the drawing. Drawings shall include a sequence of operation for each system.

B. Zoning.

1. Zoning for automatic control of space temperatures, static pressures, humidity, ventilation, smoke and fire detection, security, and lighting shall satisfy health and safety requirements as indicated in the project criteria, NFPA 101, space operational and occupancy requirements, and zoning exposure with relation to building size, orientation, and configuration.
2. Each HVAC system shall have a separate thermostat for space temperature regulation and a separate humidistat if humidity control is provided.
3. No zone shall contain more than a single building floor regardless of floor space.
4. Automatic controls shall be provided to shut off heating or cooling to any individual zone.
5. Interior zones shall not be combined with external zones.
6. Interior space zones and external zones shall be served by separate equipment.
7. External space zones shall be selected for each individual exposure.
8. For office facilities and similar occupancies, each major orientation shall be zoned to have no more than 2,000 ft² of floor area with exterior exposure and no more than 3,000 ft² of floor area without exterior exposure.

C. Control setback and shutoff devices.

1. Provide control setback, manual override, and shutoff functions in the Metasys BMS.
- D. Humidity control.
 1. No controls shall be provided humidify spaces to greater than 30% relative space humidity.
- E. Control of air-handling systems.
 1. Mechanical ventilation control.
 - a. The BMS shall be provided with the feature to control all supply, return, and exhaust ventilation systems to shut off the fan when ventilation is not required.
 - b. Systems that circulate air shall be provided with minimum outdoor air damper position control to assure that the minimum outdoor air quantity is being introduced to the system.
 - c. Automatic dampers should fail open for return air and fail closed for outside air.
 - d. Supply air temperature shall be reset based on space temperature and humidity.
 2. Outdoor cooling controls (economizer cycle).
 - a. All air handling systems shall be designed to automatically use outside air quantities up to 100% of the fan system capacity for cooling the space, with the exceptions noted in 10 CFR 434.
 - b. The economizer cycle control system shall have a reset feature.
 - c. The economizer cycle control system shall be designed with a relief air control cycle to positively relieve the supply air from the space by sequencing return or relief fans or dampers to maintain a constant room static pressure.
 - d. Systems using the economizer cycle should be provided with adequate air filtration to handle the quality of the outside air.
 - e. Economizer shall compare the outside air (OA) and return air (RA) enthalpy for controlling economizer operation.
 3. Automatic control dampers.
 - a. Automatic air control dampers shall be specified to be the low leakage type with a maximum leakage of 6 cfm/ft² at maximum system velocity of 1500 fpm and 1" pressure differential.

- b. The dampers shall be opposed blade type for modulating control.
 - c. Dampers shall be sized for at least 20% of the total ductwork resistance pressure drop.
 - d. Pilot positioners and operators shall be located out of the airstream.
4. Variable air volume system fan control.
- a. Variable air volume systems shall be designed with control devices to sense ductwork static air pressure and velocity air pressure and control supply fan air flow and static pressure output through modulation of variable frequency electric drive controls.
 - b. Exhaust fans, supply fans, and return or relief fans shall have control devices that interface the operation of the fans to "track" air volumes and maintain fixed minimum outdoor air ventilation requirements.
 - c. The controls shall have a program to reset static pressure set-point to optimize supply fan operation.
5. Fire and smoke detection and protection controls.
- a. All air handling systems shall be provided with the smoke and fire protection controls required by NFPA 101.
6. Control of chilled water and hot water distribution systems.
- a. Zone control/distribution system control.
 - 1) Each zone or air handling system shall be designed with individual terminal unit valve control.
 - b. Control valve selection.
 - 1) Temperature control valves shall be either two-way or three-way, two position or proportioning type valves. Valves controlling modulation shall be equal-percentage proportioning valves.
 - 2) Control valves shall be sized for a 5 psi pressure differential across the valve or a pressure differential of 50% of the combined branch piping and coil pressure drop, whichever is greater.
 - 3) Control valves shall use either pneumatic, electric, electronic, or self contained controllers.
 - 4) Valves in cooling and heating systems shall be fail-safe.
 - 5) Valve operators shall be selected to close against pump shutoff head for two way valves and one half-pump shut off head for three way valves.
 - 6) Set points shall be selected to maintain either a fixed space temperature or a fixed coil discharge temperature.

- c. Load control for hot water systems.
 - 1) The supply delivery temperature shall be reset based on the temperature outside.
 - d. Load control for chilled water systems.
 - 1) Central station cooling equipment shall modulate to control capacity.
 - 2) Central station cooling equipment shall be provided with controls to limit the current draw of the cooling equipment in periods of high electrical demand.
- F. BMS and DDC system.
- 1. The JCI controls equipment compatible with the Metasys BMS.
 - 2. Design documents shall require the system supplied to communicate with the current ORNL campus wide BMS's, JCI Metasys M5 from the ORNL intranet.
 - 3. Design shall specify BACNet Level 4 (web based) compliant DDC equipment, compatible interface devices and programming to access and control the BMS from remote workstations with approved web browsers and connection to the ORNL intranet (Ethernet) system.
 - 4. Control software shall include Optimum Start/Stop, Scheduled Start/Stop, Night Purge, Night Setback, Chiller Optimization, Tower Optimization, and Chilled Water Reset.
 - 5. The BMS/DDC system shall not interfere with or override any safety feature on any HVAC system. The HVAC system discharge temperature, space temperature, fan differential pressure, and filter differential pressure shall be monitored by the BMS.
 - 6. All facility fans shall be designed and installed for automatic start and stop operation from the BMS. Provide local hands-off-automatic switch pushbutton control and indication light at each fan installation.
 - 7. The Seller shall be responsible for providing BMS/DDC system testing, checkout, installation of wire, conduit, sensors, relays, switches, etc.

1.10. SPECIAL HVAC SYSTEMS

- A. Building Distribution Facility (BDF) and/or telecommunication rooms.
 - 1. Provide adequate cooling for lights and personnel and $\frac{3}{4}$ ton of cooling to offset heat generated by networking and other telecommunication equipment.

2. The cooling systems for the BDF room and telecommunications closets shall be stand alone units and shall be supplied from an emergency/standby generator, if emergency/standby power is available at the facility.
3. Provisions shall be made for the BMS to monitor the temperature of the BDF room and telecomm rooms and provide alarm indication if temperature exceed allowable limits

END OF SECTION

SECTION 018626 – ELECTRICAL

PART 1 - GENERAL

1.1. PROJECT SPECIFIC CRITERIA

- A. Programming and field investigations.
 - 1. Provide programming and field investigations as required to determine the electrical requirements for the facility and for the proposed equipment to be installed in the facility. Design shall provide for the installation of existing and proposed equipment within the facility and shall also be flexible to provide for future research programs.
- B. Medium voltage service.
 - 1. The facility will be served by an existing manhole located adjacent to the facility.
 - 2. An underground primary duct bank shall be routed from the manhole to a S&C medium voltage pad-mounted switchgear type PMH-10 located adjacent to the CRMS. The underground primary duct bank shall consist of six 5” conduits.
 - 3. The S&C switch shall provide service to a pad-mounted transformer rated 13.8KV-480Y/277V for the facility and reconfigured service to Building 8700. An underground duct bank consisting of two 5” conduits shall be routed from the medium voltage switchgear to the pad-mounted transformer.
 - 4. The Company will provide medium voltage cabling and medium voltage switchgear. The Seller shall provide all underground duct banks. The Seller shall provide a precast reinforced concrete riser box for the switchgear.
- C. An underground service lateral shall be routed from the transformer to serve a 480Y/277V switchboard inside the facility.
- D. Emergency power.
 - 1. Emergency power shall be supplied from existing panelboard TA-3EDP1 located in room TA-128 in the adjacent Building 8700 (Target Building). Emergency service shall be sized to provide an additional 50% capacity above original design demand load. The following systems shall be served by emergency power:
 - a. Emergency lighting.
 - b. Elevator(s).
 - c. Fire alarm control panels, booster power supply panels, etc., in addition to being provided with integrated back up batteries.
 - d. Access control system and electric door operators.

- E. Uninterruptable power.
 - 1. A rack mounted uninterruptable power supply (UPS) shall be provided in the main telecommunications room. The UPS shall be served by emergency power. Equipment served by the UPS shall include:
 - a. Telecommunications.
 - b. Public address system.
 - c. Cellular repeater system.
 - 2. See Communications Section 018629 for additional requirements.
- F. A minimum of two 480V welding receptacles shall be provided in the welding/pipe shop area.

1.2. STANDARDS AND SPECIFICATIONS

- A. Work smart standards.
 - 1. The National Fire Protection Association (NFPA) 70-2011, National Electrical Code.
 - 2. The NFPA 70E-2012, Standard for Electrical Safety in the Workplace.
 - 3. Institute of Electrical and Electronics Engineers, Inc. (IEEE) C2-2012, National Electrical Safety Code.
- B. This document contains references to the general codes, standards, procedures, specifications, and technical definitions that are applicable to the design work to be performed, to the electrical equipment and materials to be furnished, to the methods of installation, to the requirements for inspection and testing, and to acceptance criteria. Requirements of the latest editions shall apply.
 - 1. American National Standards Institute (ANSI).
 - 2. Code of Federal Regulations (CFR).
 - 3. Factory Mutual Engineering and Research Corporation.
 - 4. Illuminating Engineering Society of North America (IESNA).
 - 5. The IEEE.
 - 6. National Electrical Manufacturer's Association (NEMA).
 - 7. The NFPA.
 - 8. Oak Ridge National Laboratory (ORNL) Electrical Engineering Standards.
 - 9. Underwriter's Laboratories Inc. (UL).

1.3. GENERAL DESIGN REQUIREMENTS

- A. Electrical safety shall be the foremost consideration in the design of all facilities and equipment. Electrical design shall provide for the minimization of working on or near energized parts and equipment during construction, operation, and maintenance activities.
- B. Electrical design shall provide for the ease of future electrical maintenance and modifications in regards to lockout/tag-out requirements and for limiting the extent of outages caused by future maintenance and modifications of electrical distribution equipment.
- C. The electrical design and all electrical installation work shall be in accordance with the National Electrical Code (NFPA 70), the National Electrical Safety Code (IEEE C2), NFPA codes, Occupational Safety and Health Act (OSHA) standards and any other applicable codes and standards. All materials and equipment shall conform to applicable ANSI, IEEE, NEMA, NFPA and UL standards.
- D. Design analysis and calculations.
 - 1. Calculations shall include but are not limited to the following:
 - a. Short circuit currents.
 - b. Overcurrent device coordination.
 - c. Arc flash hazard analysis to determine the arc flash protection boundary, limited, restricted, prohibited approach boundaries, incident energy analysis and personal protective equipment (PPE) category requirements for panelboards, switchboards, motor control centers, switchgear, disconnect switches, etc., operating at 600V or less.
 - d. Connected load, demand load, demand factor, and diversity factor for overall building and for emergency, standby and uninterruptible loads.
 - e. Voltage drop.
 - f. Conductor capacities.
 - g. Lighting footcandle level.
 - h. Electric heat tracing (including in rush current).
 - i. Raceway/cable tray sizes.
 - j. Pull/junction box/enclosure sizes.
 - k. Cable bending radius.
 - l. Conduit sizes.
 - m. Grounding.
 - 2. Hard copy and electronic files (in native format) for calculations and design analysis shall be provided. The SKM software shall be utilized for short circuit, overcurrent coordination, and arc flash hazard analysis. The complete SKM model shall be provided to ORNL.

3. Specifications shall include the requirement for the contractor to procure the services of a qualified professional engineer to provide an update to the SKM model using the specific electrical equipment provided and other as-built characteristics of the electrical system. This analysis shall be used for overcurrent device coordination. An updated arc flash hazard and incident energy exposure analysis shall be provided. Hard copies and the updated SKM model (complete native files) shall be provided.
 4. Specifications shall include the requirement for all electrical equipment to be labeled to indicate the arc flash protection boundary, limited, restricted, and prohibited approach boundaries, incident energy exposure and required category of PPE.
- E. Energy conservation.
1. Energy conservation shall be a primary consideration in the design of the electrical system. System equipment selection shall maximize efficient energy usage and shall minimize energy losses within the electrical system on a life-cycle cost (LCC)-effective basis.
 2. Specifications for motors, transformers, lighting and other miscellaneous equipment shall require the use of ENERGY STAR labeled or Department of Energy's (DOE) Federal Energy Management Program (FEMP) recommended products when such products are available.
- F. Electrical load, demand factors and diversity factors.
1. Electrical load, demand, and diversity factor calculations shall be prepared for the facility and shall be performed in accordance with Chapter 2 of IEEE 241, Electric Power Systems in Commercial Buildings and Chapter 2 of IEEE 141, Electric Power Distribution for Industrial Plants. Feeder and service calculations shall comply with Article 220 of NFPA 70.
- G. Electrical energy usage metering.
1. At each facility's incoming power service (service entrance equipment, generators, etc.), watt hour meters shall be provided to measure and record the electric energy usage, power demand, and other parameters. Metering shall be capable of integrating with Modbus Transmission Control Protocol/Internet Protocol (TCPIP) and ORNL's ION enterprise system.
- 1.4. POWER DISTRIBUTION SYSTEMS
- A. The S&C PMH-10 pad mounted switchgear.
1. The switchgear shall be rated for 14.4kV. The gear shall be mounted on a 3' tall precast reinforced concrete riser box (manufactured by Hubbell/Quazite). The riser box shall be set on a subgrade concrete pad so that the top elevation of the riser box is 6" above grade.

2. All conduits entering and exiting the riser box shall do so through the subgrade concrete pad.
 3. Provide drain piping to avoid excessive collection of surface water inside the riser box.
- B. Medium voltage pad mounted transformer.
1. Edit specification 261200 to limit approved manufacturers to General Electric (GE), Square D, Cooper Power Systems and A.B.B.
 2. Transformer shall be in accordance with all applicable ANSI C57 series standards. The transformer shall be Factory Mutual (FM) approved and UL listed. The transformer shall include the following:
 - a. Kilovolt-Ampere kVA rating; sized at 70% demand load.
 - b. A 95 kV basic impulse level (BIL) (primary), 30kV BIL (secondary).
 - c. Two taps above and below 2½% nominal voltage, externally operated tap changer with hot-stick operable handle.
 - d. A 55°C winding temperature rise above ambient/65°C rise at 112% rating.
 - e. Six 15 kV loop feed dead-front primary bushings, rated 600A dead-break.
 - f. Externally removable loadbreak expulsion bay-o-net current limiting fuse assemblies with three spare fuses. Interlocks shall be provided to prevent the fuses from being removed until the transformer is disconnected via the load break primary switch.
 - g. Externally mounted, 15kV class, 15kV duty cycle, 12.7 Maximum Continuous Over Voltage (MCOV), Metal Oxide Varistor Elbow (MOVE) surge arrestors.
 - h. Single position primary loadbreak switch.
 - i. Dielectric fluid shall be Envirottemp® FR3, manufactured by Cooper Power Systems.
 - j. Accessories shall include liquid level gauge, dial type thermometer, pressure vacuum gauge, drain valve/sampling device in low voltage compartment, globe type upper fill valve, pressure vacuum bleeder, ground connectors, Mr. Ouch warning signs, Danger High Voltage warning signs, touch up paint, engraved station number and feeder number(s) nameplates.
 - k. The 15kV, 200A, load-break elbow connectors. Coordinate cable jacket outside diameter with ORNL Utilities Division.
 3. Clearances shall be provided in accordance with applicable ANSI C57 Series Standards, FM data sheets, NFPA 70, and for typical maintenance activities. Heavy vehicle access shall be provided to transformer locations.
- C. Main switchboard.
1. Edit Specification Section 262413 to limit approved manufacturers to Square D and Siemens.

2. Initial design demand load shall not exceed 60% of the switchboard's rated capacity. Provide 20% spare breaker mounting space for future loads.
 3. Switchboards shall comply with NEMA PB-2 and UL 891.
- D. Motor control and motor control centers.
1. Motor control equipment shall comply with NEMA ICS 2, NEMA ICS 6 and UL 508 standards. Single phase motors may be controlled directly by automatic control devices of adequate rating. Polyphase motors controlled automatically and all polyphase motors rated greater than 1 horsepower (hp) shall have magnetic starters.
 2. Control devices shall be of adequate voltage and current rating for the duty to be performed. Pilot control circuits shall operate with one side grounded, at no greater than 24 alternating current volt (VAC). Where control power transformers are required, they shall be located inside the associated motor starter housing, shall be protected against faults and overload by properly sized overcurrent devices, and shall be of sufficient capacity to serve all devices connected to them.
 3. Except where special conditions require, motors smaller than ½ hp shall be specified as single phase. Motors ½ hp or larger shall be specified as 460V, three phase.
 4. All 480V, three phase, 60-Hz motor control centers (MCCs) shall be NEMA 1, Class B. The MCC construction shall be in accordance with UL 845.
- E. Distribution panelboards.
1. Edit Specification Section 262416 to limit approved manufacturers to Square D and Siemens.
 2. Panelboard circuit breakers capable of interrupting the available short-circuit current shall be selected.
 3. Distribution panelboards shall be supplied with doors.
 4. Distribution panelboards shall be furnished with a separate grounding bus for equipment grounds and a solid neutral bus where a neutral is required.
 5. Initial design demand load shall not exceed 70% of the panelboard's rated capacity. Provide 20% spare breaker mounting space for future loads.
- F. Low voltage transformers (600V).
1. Edit Specification Section 262200 to limit approved manufacturers to Square D and Siemens.
 2. Transformer efficiency shall be in compliance with 10 CFR 431, Part III, Final Rule 72 FR 58190.

3. Interior step-down low voltage transformers (480:120/208V; 480:120/240V; etc.) for lighting, receptacle and miscellaneous loads shall be dry type, floor or wall mounted, with a minimum of four full capacity 2½% taps, with two taps above and two taps below rated voltage.
- G. Lighting and power panelboards.
1. Edit Specification Section 262416 to limit approved manufacturers to Square D or Siemens.
 2. Dedicated panelboards for lighting shall be provided.
 3. Lighting and power panelboards shall be provided with copper buses and bolt-on circuit breakers.
 4. Approximately 20% of the branch circuit breakers installed shall be spares. The demand load of panelboards shall not exceed 70% of the panel's rated capacity. Panelboards shall be furnished with a separate grounding bus for equipment grounds. Neutral buses shall not be grounded at the panelboard.
 5. Panel schedules shall be provided for all panelboards and shall indicate which circuits require ground fault protection (equipment and personal), shunt trip, etc.
- H. Interior distribution voltage levels.
1. Power shall be distributed at 480Y/277V three phase, four wire, grounded; 208Y/120V, three phase, four wire with grounded neutral; and/or 120/240V, single phase with grounded neutral.
- I. Control voltages.
1. All control circuits shall be designed with operating personnel safety as the primary consideration. Control transformers shall be provided such that the control voltage for equipment does not exceed 24VAC. Controls and control wiring shall be provided to make all required systems functional and operational.
- J. Electrical distribution equipment identification.
1. In each building or facility, equipment that distributes electrical power (480V switchgear, 480V motor control centers, 480V panelboards, electrical plug-in busways, distribution switchboards, distribution racks, load centers, lighting and power panelboards; etc.) shall be identified in accordance with ORNL Engineering Standard Electrical System Identification Scheme.
 2. Each piece of electrical distribution equipment (switches, starters, panelboards, receptacles, etc.) shall be clearly marked with the voltage, number of phases, source of supply (panel and circuit; etc.), and the equipment being served.

1.5. LIGHTING SYSTEMS

A. General.

1. Exterior lighting systems.

- a. Exterior lighting systems shall comply with the IESNA Lighting Handbook, and applicable Recommended Practice (RP) manuals. Street lighting assemblies shall be Chestnut Ridge Campus standard type.
- b. Photocell control shall be implemented to provide nighttime illumination. Provide lighting contactor(s) rather than individual photocells at each luminaire.
- c. The entire building exterior perimeter shall be provided with cut-off type wall pack fixtures. Fixtures shall be architectural type and of a custom color to coordinate with the building exterior finish.
- d. Pole mounted fixtures shall be Spaulding Medallion 1 Series CM1 with 250W pulse start metal halide lamps that operate at 480V. Fixtures shall be mounted on 25' poles with 5" square straight aluminum shafts. Fixture and pole color shall be platinum silver.
- e. Pole foundations shall include a flush mounted, 12" x 12" curved lid non-metallic junction box such as Carlon catalog number E1212C24.

2. Interior lighting systems.

- a. Interior lighting systems shall comply with the IESNA Lighting Handbook.
- b. Direct or indirect fluorescent lighting fixtures shall be installed in office areas, conference rooms, corridors, lunchrooms, restrooms, and other similar areas with low ceilings (12' or less).
- c. Fixtures may be recessed, surface, or pendant mounted depending on ceiling height and method of construction. The choice of fixtures and lamps to be used should be based on mounting height, desired footcandle level, and the type of work to be performed in the area.
- d. Provide high bay fluorescent fixtures for main shop and chassis building areas.
- e. The number of lamps and ballasts per fixture shall be determined by footcandle level requirements and requirements for multiple lighting level control.

B. Lighting circuit voltage levels.

1. Interior lighting shall operate at 277V. Exterior pole lighting shall operate at 480V. All other exterior lighting shall operate at 277V.

C. Illumination levels.

1. Lighting calculations based on the type of luminaire and the number of lamps per luminaire shall be prepared for each area. The lighting level in each area shall be in accordance with IESNA unless specifically noted in the room data sheets.

2. Lighting in telecommunication rooms shall provide 50' candles in the aisles between telecommunication equipment racks.
- D. Lighting controls.
1. All offices and other rooms with floor to ceiling partitions shall have individual lighting controls. Occupancy sensors, timers, photo-electric (PE) controls, or other automatic lighting control shall be provided for all spaces. Day lighting control shall be provided for all spaces receiving ambient day light.
 2. Large areas such as the main shop area, open office area, and multi-purpose (gathering/break room) area shall use dimmable addressable ballasts and include occupancy sensors, day lighting controls, and manual controls.
 3. Where emergency lighting is required in areas served by addressable ballasts, ballasts shall be provided with emergency power and controlled in the same manner as ballasts served by normal power. A UL listed transfer device shall be provided to energize the addressable ballasts upon sensing loss of normal power.
 4. A handheld device, such as an iPod touch shall be provided to set up and modify controls for the addressable ballasts.
- E. Conference room lighting.
1. Provide dimmable ballasts. Provide wall switch and remote (table) controls for all fixtures. Coordinate lighting fixture layout with overhead projector and avoid lighting that washes out the projector screen.
- F. Lighting circuits.
1. Wiring for lighting circuits shall be run in conduit. Type metal-clad (MC) cable may be used above suspended grid ceilings.
- G. Exit lighting.
1. Exit lighting fixtures shall be light-emitting diode (LED) type. Exit lighting shall comply with NFPA 101 and NFPA 110.
 2. Electrical service for exit lighting fixtures shall be supplied from a dedicated emergency circuit. These circuits shall be clearly identified on panel directories as supplying exit lighting fixtures.
- H. Emergency egress lighting.
1. Building hallways, corridors, stairways, evacuation routes, exit discharges, etc., shall be provided with emergency lighting circuits for emergency egress. Emergency egress lighting systems shall comply with NFPA 101 and NFPA 110.
 2. Emergency lighting shall be provided for all electrical and telecommunication rooms.

I. Personnel entrance lighting.

1. Layout of the exterior perimeter cut-off wall pack fixtures shall be designed to provide sufficient lighting at personnel entrances and for walkways that provide access to a roadway or parking area. Fixtures that provide illumination for these areas shall be served by emergency power.

1.6. GROUNDING AND BONDING

A. General.

1. A grounding electrode system, in conjunction with grounding and bonding requirements for electrical systems, building structural steel, and facility equipment, shall be provided and installed per NFPA 70. The supplemental grounding electrode(s) required by NFPA 70 shall be a building grounding grid.
2. Where utilized or required, ground buses and ground floor inserts, metal fences and gates, outdoor structures and pipelines, flammable compressed gas cylinder manifolds, drilling and cutting equipment, flammable liquids storage cabinets, and tanks shall be grounded.
3. Grounding and bonding systems designed and installed in accordance with NFPA 70 are intended to protect equipment and personnel. Additional consideration shall be given for installations involving sensitive electronic equipment and networks.

B. Ground grid.

1. Ground grid systems shall consist of a buried No. 4/0 bare copper cable and driven ground rods located around the perimeter of the building. The cable shall be buried a minimum of 30" deep and be located a minimum 36" away from the building. Driven ground rods shall be 3/4" diameter X 10' long and be spaced at nominal 25' intervals around the perimeter of the building. The grounding system shall be designed and tested so that the resistance to earth does not exceed 1 ohm.

C. Ground loop.

1. Provide a minimum of four ground rods, 3/4" diameter X 10' long, at each medium voltage transformer, switchgear, etc., and a ground loop consisting of a buried No. 4/0 bare copper cable circling the equipment pad. For medium voltage transformers with a secondary neutral bonded to the transformer enclosure, prevent connection of the ground loop to the facility grounding grid to prevent paralleling of the service entrance grounded (neutral) conductor. Ground loops shall be designed and tested so that the resistance to earth does not exceed 5 ohms.

D. Grounding electrode conductor and bonding jumpers.

1. The size for grounding electrode conductors and bonding jumpers shall be, as a minimum, No. 2/0 bare copper or larger, as required by NFPA 70, Article 250. Grounding electrode conductors and bonding jumpers shall be extended from the ground grid to the electrical service entrance equipment, foundation reinforcing steel, structural steel, internal step-down transformers, ground buses, and to dedicated telecommunication equipment areas. The secondary neutral of step-down transformers shall be grounded in accordance with Article 250 of NFPA 70.
- E. Structural bonding and ground buses.
1. For facilities that utilize a ground grid, the structural steel shall be bonded at each alternate column by means of a No. 4/0 bare copper cable. Ground buses, as required, shall be connected to the ground grid by means of a 4/0 bare copper cable.
- F. Equipment grounding and bonding.
1. Equipment which is electrically connected such as panelboards, junction boxes, safety switches, terminal boxes, transformers, etc., shall be grounded and bonded with a dedicated equipment grounding conductor run with the circuit conductors supplying the equipment as stated in Article 250 of NFPA 70. Metallic raceways, enclosure, etc., shall be bonded together to form an effective ground fault current path per NFPA 70, article 250.
 2. Other equipment such as motor control centers, switchboards, main distribution panels, etc., shall have an auxiliary ground consisting of a No. 4/0 bare copper cable connected to the grounding grid.
 3. Non-electrical equipment as defined in article 250 of NFPA 70, which is required to be grounded, may be connected to ground buses strategically located on columns or walls.
- G. Transient voltage surge suppression (TVSS).
1. Transient voltage surge suppression shall be provided in order to obtain a UL Master Label for the lightning protection system, but shall go beyond that requirement and provide surge protection at all levels of the power distribution system in order to provide a total coordinated, engineered system. TVSS products shall comply with UL 1449-3rd Edition, IEEE 62.41, and IEEE 62.45.
- 1.7. MISCELLANEOUS SYSTEMS
- A. Lightning protection.
1. The facility shall have a lightning protection system and shall be designed, installed and tested in accordance with NFPA article 780. The system shall be provided with a UL master label.
- B. Electric heat trace systems.

1. Electric heat tracing systems for exterior piping and vessels shall be provided and installed in accordance with Article 427 of NFPA 70. Signs and labels shall be provided on pipelines and vessels to indicate the presence of heat trace systems. Branch circuits serving heat trace circuits shall be supplied with equipment ground fault protection (Class B). Electric heat trace cable shall be self-regulating type with tinned copper braid and overall jacket. Splicing of heat trace cable under pipe insulation is unacceptable. Heat trace systems shall be verified by a megger test before energization. Start-up testing shall include in-rush and steady state current measurements.
- C. Access controls.
1. Dedicated emergency branch circuits shall be provided as required for access control panels at each location where control panels are installed. Additional dedicated branch circuits shall be provided for power supplies serving electric latches and strikes. Power supplies for electric latches are located in the proximity of the latch. Power supplies for electric strikes are typically located adjacent to the access control panels. Dedicated emergency branch circuits shall be supplied for electric door operators.
- D. Conference room.
1. Provide a Leviton 47617-REB recessed entertainment box (or equal) with all necessary power and communication outlets at locations for wall mounted flat screen monitor/TV. Provide floor box under the table for power, phone, and network. Provide an additional floor box with a conduit (largest possible size) routed from the floor box to a recessed entertainment box with communication outlets only, to be located behind credenza for the conference room personal computer (PC). Provide largest possible raceway between monitor/television entertainment boxes to the credenza entertainment box.
- E. Elevators and material handling systems.
1. The design, installation, and testing of electrical equipment and fire protection systems for related machine rooms, elevators, and material lifts shall be in accordance with the NFPA 70 and ANSI/American Society of Mechanical Engineers (ASME) A17.1.
- 1.8. EQUIPMENT
- A. Conductors and cable.
1. General.
 - a. The color coding system for branch circuits shall be provided at all lighting and power panelboards in facilities where more than one nominal voltage system exists.
 - b. Phase and neutral (grounded) conductors shall be identified by circuit number at all accessible locations.

- c. All conductors for interior electrical systems shall be copper. Conductors for power and lighting branch circuits shall not be smaller than No. 12 American Wire Gage (AWG).
 - d. Conductors for Class 1 non-powered limited remote-control and signaling circuits shall be enclosed in conduit and shall comply with NFPA 70. Conductors for Class 2 low-energy remote-control and signaling circuits shall not be smaller than No. 18 AWG.
 - e. Megger tests are required for all 600V cables #4 and larger and may be performed by the contractor or independent testing agency.
2. Multi-wire circuits.
- a. Multi-wire circuits are not permitted. Provide a dedicated neutral for all circuits.
 - b. Where multiple neutral wires are routed together within a raceway, white striped neutral wiring shall be provided with different colors (to match phase conductor color) in accordance with NFPA 70 to prevent mis-wiring.
 - c. Multiple neutrals in junction boxes shall be identified by circuit number or tied to the phase conductor it serves.
 - d. Where multiple neutral wires enter a panelboard from a single conduit, the neutral wires shall be identified by circuit number.
3. Power and lighting cables.
- a. Cable (Type MC), per Article 330 of NFPA 70, may be used whenever practical in lieu of conduit and conductors in concealed locations. The MC cable may be used to supply receptacles, recessed and mounted in steel stud partitions.
4. Inspections and tests.
- a. Inspection and testing of electrical equipment, such as motors, switchgear, lighting, power, and distribution panels, MCCs, power receptacles, power and lighting transformers, wire and cable, ground systems, etc., shall be provided for in the specifications.
- B. Conduit and race-ways.
1. General.
- a. Raceways that penetrate fire-rated assemblies shall be metallic. All through penetration fire-stops shall be UL listed assemblies and be selected from the UL Fire Resistance Directory. Raceways shall be ½” minimum in diameter. Raceways embedded in concrete or masonry shall be ¾” minimum.
2. Rigid metal conduit and intermediate metallic conduit.

- a. Galvanized rigid metal conduit (RMC) or intermediate metallic conduit (IMC) shall generally be used in industrial areas where conduits are exposed to damage from forklifts, trucks, cranes, etc., or where there is the possibility of leaking oil or water. Galvanized RMC or IMC shall also be used in classified locations and for outdoor and underground installations.
3. Electrical metallic tubing.
 - a. Electrical metallic tubing (EMT) shall generally be used in office and similar areas and also in industrial areas where physical damage is unlikely. The EMT shall not be installed in wet areas, underground, or outdoors and shall not be encased in concrete.
 4. Nonmetallic conduit.
 - a. Nonmetallic conduit may be used where allowed by NFPA 70.
 5. Flexible conduit.
 - a. Flexible metal conduit shall be used for terminating rigid raceway at motor terminal boxes or other equipment subject to vibration and/or mechanical adjustment. It also shall be used for connection between junction boxes and recessed lighting luminaires. Liquid-tight flexible conduit shall be used outdoors and indoors where there is the possibility of leaking fluids.
- C. Underground conduits.
1. General.
 - a. All underground conduits shall be installed within a duct bank. The exception would be for 120V direct buried receptacle and lighting circuits not routed under roadways.
 - b. Underground duct banks shall be concrete encased and reinforced per ORNL Engineering Standard ES-8-4. Heavy reinforced duct banks shall be provided under roadways.
 - c. Underground conduits emerging from grade shall be galvanized rigid steel. Provide a tracer wire for all duct banks. See civil section for tracer wire requirements.
 - d. Specifications shall indicate that as-built survey information (location and elevation) shall be provided for all underground direct buried conduits and duct banks.
 2. Medium voltage circuits.
 - a. Provide a bare #2/0 copper cable on top of duct banks containing medium voltage circuits.
 - b. Underground conduits for medium voltage circuits shall be 5". Underground conduits sweeps for medium voltage circuits shall be galvanized RMC and have a 48" radius.

3. Telecommunication circuits.
 - a. Underground telecommunication conduits shall be 4”.
 - b. Underground conduit sweeps for telecommunication circuits shall have a 36” radius.

- D. Receptacles.
 1. General.
 - a. All receptacles shall conform to NEMA WD-1. All receptacles shall be industrial specification grade. Duplex receptacles shall typically be fed from power panelboards with 20-A branch circuits with a maximum of six duplex receptacles per circuit.

 2. The 120V receptacles.
 - a. As a minimum, 120V receptacles shall be provided in accordance with NFPA 70, room data sheets, and be consistent with established engineering practices.
 - b. Duplex receptacles installed on finished walls shall be recessed. Duplex receptacles installed in unfinished areas shall be surface mounted in cast boxes.
 - c. In conference and teleconference rooms, receptacles shall be provided to serve audio-visual equipment, including conference tables, desks, podiums, cameras, and projectors (above suspended ceilings).
 - d. Duplex receptacles shall be installed every 25’ along corridors in the building. A duplex receptacle shall be provided at each stairwell landing. All corridor and stairwell receptacles shall be placed on a separate circuit. A minimum of one duplex receptacle shall be installed in each rest room.
 - e. A duplex receptacle fed from a separate dedicated circuit shall be provided at each proposed area for photocopier equipment. Additional receptacles for copier/fax/printer rooms shall be provided as required to serve the proposed equipment.
 - f. Where applicable, duplex receptacles shall be provided in the elevator machine room, elevator hoist-way pit, fire protection riser room, electrical/mechanical equipment room, janitor’s closet, etc.
 - g. Receptacles for specific pieces of equipment, such as room air-conditioning/heating units, shall be installed as required. Receptacles located in restrooms, kitchens, within 6’ of sinks, within 6’ of an exterior door, and exterior to buildings shall be ground fault circuit interrupter (GFCI) type, or be fed from branch circuits equipped with GFCI circuit opening devices.
 - h. Provide a minimum of one 120V receptacle served by emergency power in the main electrical room.

 3. The 208V and 240V receptacles.

- a. Single 208V and 240V receptacles shall be provided and located as required, based on equipment to be served in the facility. The number to be supplied by a circuit shall be determined by the demand.
4. 480V receptacles.
 - a. Single 480V, three phase receptacles shall be provided and located as required, based on equipment to be served in the individual facility as well as for maintenance purposes. The number of receptacles to be supplied by a circuit shall be determined by the demand. Receptacles shall be pin and sleeve type, rated 600V, 60-A, and shall be compatible with Crouse-Hinds Cat. No. APJ6485 plug. Receptacles shall be provided with integral/interlocked disconnect switch.
 5. Exterior receptacles.
 - a. Surface mounted exterior receptacles shall be housed in cast type conduit boxes.
 - b. Exterior outlets shall be provided with “in-use” metallic covers that form a rain-tight assembly with their respective boxes and that shall maintain the rain-tight protection while the attachment cord and plug are in place. All exterior receptacle circuits shall be provided with GFCI protection.
 - c. Receptacles shall be 20 A, 120 V, single phase, duplex, two pole, three wire, orange color, with isolated ground, Hubbell IG-5262, identified as “clean power – isolated ground”. The ground connections to these receptacles shall be isolated from the normal equipment and building ground grid. These ground connections shall consist of insulated conductors connecting between the receptacle ground terminals and the isolated ground bus.
- E. Motors.
1. Permanently wired polyphase motors of 1 hp or more shall be of a premium energy efficient design and also comply with the requirements of 10 CFR 435, where required. Motors shall comply with NEMA Standard MG-1, except that hermetic refrigerant compressor motors shall comply with UL 984.
 2. Motor enclosures shall be drip proof for indoor dry locations and totally enclosed or totally enclosed fan cooled for outdoor or other wet locations, except where special conditions require.
 3. Variable Speed Drives (VSDs) shall be provided where motor speed requirements vary widely during normal operation or for energy conservation in regards to heating, ventilating, and air conditioning (HVAC) systems. In all cases, the driven motor shall be selected in accordance with the drive manufacturer's recommendations to ensure a coordinated system and to avoid overheating the motor. Motors shall be premium efficiency motors.
- F. Electric duct heaters.

1. All electric duct heaters shall be supplied with accessible, manually resettable or replaceable thermal protective devices connected in the heater power circuit. An automatic resetting thermal device also shall be supplied for connection in the heater control circuit. These protective devices shall be supplied as integral parts of the heater. The heater shall in all cases be interlocked with its associated ventilation fan. The wiring of protective devices shall conform to NFPA 70. All other control and/or disconnect devices with exception of the room thermostat shall be installed in a readily accessible (no more than 6' 6" above the operating floor) separate control panel.
- G. Industrial control panels.
1. All control panels shall meet the requirements of NFPA 70, Article 409, and UL 508A.
- H. Miscellaneous equipment.
1. Local disconnect switches that are lockable in the open position shall be installed adjacent to the following equipment:
 - a. Roof or outdoor mounted fan motors, pump motors, etc.
 - b. Refrigeration equipment (indoor and outdoor), unless the local electrical control panel on the equipment has a main disconnect switch or main breaker that is lockable in the open position.
 - c. Cranes, hoists, elevators, and conveyors.
 - d. Pump motors, fan motors, and other motors that are out of sight of or more than 75' from the motor controller.
 - e. Water heaters, except those operating at 120V in which case a grounding-type receptacle may serve as the local disconnect.
 - f. Power distribution and lighting transformers (the primary circuit breaker shall be permitted to serve as the disconnecting means if capable of being locked in the open position).
 - g. Machine tools, unless the local electrical control panel on the equipment has a main disconnect switch or circuit breaker that is lockable in the open position.
 - h. Procured or shop-fabricated equipment assemblies containing electrical motors, solenoid valves, transformers, control devices, etc., unless the electrical control panel has a main disconnect switch or circuit breaker that is lockable in the open position.

END OF SECTION

SECTION 018629 – COMMUNICATIONS

PART 1 - GENERAL

1.1. PROJECT SPECIFIC CRITERIA

- A. Telecommunication service shall originate from the Building 8700 (Target Building). An underground duct bank shall be routed from Room TA-128 in Building 8700 to the main telecommunications room in the facility. The duct bank shall consist of four 4" conduits.
- B. The Seller shall provide all incoming service cables from Building 8700 as indicated below.
- C. Telecommunication design shall be performed by a Building Industry Consulting Service International (BICSI) Registered Communication Distribution Designer (RCDD). Installation of all wiring shall be performed by a BICSI registered Level 2 Installer. Testing shall be supervised by a BICSI Registered Technician. Specifications shall require submittal of personnel qualifications.
- D. The Seller shall provide a 3000 volt-ampere (VA), 120V, rack mounted uninterruptable power supply (UPS). The UPS shall be capable of a run time of 1000VA for 120 minutes. The UPS shall be network manageable.
- E. Oak Ridge National Laboratory (ORNL) will supply all telecommunication network electronics. The Seller shall provide telecommunication racks and patch panels as required to terminate incoming service cables, horizontal, and vertical wiring, UPS, and ORNL supplied electronics.
- F. The Seller shall provide one 36" x 36" lockable cabinet for at least one equipment rack to serve incoming service cables and ORNL supplied electronics. Additional patch panels and horizontal wiring may be provided within the cabinet as space permits. The cabinet shall be accessible on all four sides.
- G. The ORNL will provide a cellular repeater system within the facility. Space shall be provided in the telecommunication room for this system.

1.2. DESIGN STANDARDS

- A. Work smart standards.
 - 1. NFPA 70, National Electrical Code.
- B. Additional standards include but are not limited to the following:
 - 1. Telecommunications Industry Association/Electronic Industries Alliance (TIA/EIA)-568-B.1, Commercial Building Telecommunications Cabling Standard - Part 1.

2. TIA/EIA-568-B.2, Commercial Building Telecommunications Cabling Standard - Part 2.
 3. TIA/EIA-568-B.3, Optical Fiber Cabling Components Standard.
 4. TIA/EIA-569-A, Commercial Building Standard for Telecommunications Pathways and Spaces.
 5. TIA/EIA-607, Commercial Building Grounding and Bonding Requirements for Telecommunications.
- C. Certified for Construction (CFC) design drawings (construction documents) shall include enlarged telecommunication plans. Design shall include coordination with ORNL Information Technology Services Division (ITSD) and Security to generate enlarged telecommunication room equipment layout design.

1.3. GENERAL REQUIREMENTS

- A. Telephone service, point to point fiber optics, local area network (LAN)-cabled and wireless, public address (PA) systems, access control systems, and fire alarm systems shall be provided in the building and shall be designed to connect to and operate with ORNL systems.

1.4. ORNL COMMUNICATIONS ARCHITECTURE AND ROOM REQUIREMENTS

- A. Main telecommunications room.
1. The facility shall have a main telecommunications room to serve as a main distribution point for telecommunications circuits required in the building. The facility shall have additional telecommunication rooms as required to ensure that no horizontal wiring exceeds a length of 328' (100 meters).
 2. Underground telecommunication ducts extending from Building 8700 to CRMS shall originate in this room.
 3. The main telecommunications room shall be a minimum of 120 square feet with a minimum width of 10'. More space may be required if this room also contains, access control and fire alarm systems.
 4. A 12" wide x 4" deep aluminum cable tray system shall interconnect the main telecommunications room with other telecommunication rooms located on the same level.
 5. Fire retardant plywood shall be installed on all walls to allow installation of equipment, patch panels, and punch down blocks. The plywood shall be installed such that the fire rating label is visible. Once the Company has approved the plywood installation, it shall be painted to match the walls.
 6. Overhead cable trays shall be installed around the perimeter of the room and above the lockable equipment cabinet.
 7. Grounding provisions shall be provided per TIA/EIA-607.
 8. See Section 10 - Security, and/or room data sheets for additional requirements.

1.5. CABLE TRAYS AND WIREWAYS

- A. Building areas shall be served by either an overhead cable tray system or enclosed wire-way system. This system must be accessible for servicing, adding, or removing cable, fiber, etc.
- B. Center hung cable tray will not be allowed.
- C. Cable trays and wire-ways shall be sized to allow 100% spare capacity.
- D. Cable trays and wire-ways shall be located in corridors adjacent to offices and other spaces where data/communications or wireless networking drops will be provided.
- E. Cable trays and wire-ways shall not be located over conference rooms, kitchen area, restrooms, offices and other normally occupied areas to avoid having to interfere with room activities when new cables and circuits are installed.

1.6. CIRCUITS BETWEEN BUILDINGS

- A. The cables to be installed are as follows:
 - 1. One 18 count multimode and one 18 count single mode fiber optic cable will be installed to serve LAN systems, building automation systems, PA, and miscellaneous systems. Route to Building 8700, Room TA-128.
 - 2. One 25 pair Cat 3 cable for telephone service. Terminate on 110 blocks in the new facility. Termination in Building 8700 will be by owner. Route to Building 8700, Room TA-103.
 - 3. Two 6 count multimode fiber optic cables for fire alarm system. Route to Building 8700, Room TA-103.
 - 4. One 12 count multimode and one 12 count single mode fiber optic cable for access control. Route to Building 8700, Room TA-103.
 - 5. One 4 count single mode fiber optic cable for cell phone repeater system. Route to Building 8700, Room TA-103. Cellular repeater system shall be provided by the Company.

1.7. CIRCUITS WITHIN BUILDING

- A. General.
 - 1. All horizontal wiring and communication outlets shall be supplied by the Seller. Architect-Engineer (A-E) design drawings and specifications are required.
- B. Voice and LAN cabling from telecomm rooms to data/communication outlets (including open office cubicle partitions) shall be installed by the Seller; A-E design drawings and specifications are required and shall consist of the following, at a minimum:
 - 1. Voice and LAN cabling shall be one continuous non-spliced, Category 6A.
 - 2. Category 6A cable shall be installed, terminated, tested, and labeled in accordance with applicable TIA/EIA standards using TIA/EIA 568B color code.

3. To ensure performance of Category 6A cable and terminations, specifications shall require that test results be provided to the Company.
 4. Provide metallic conduits from flush mounted communication outlets to area above ceiling and terminate conduit with plastic bushing. Leave 10' of excess cable coiled up in ceiling space above each outlet location to allow future re-termination of cable.
 5. Cabling in unfinished areas shall be routed in conduit from outlet to closest cable tray.
 6. Cabling to open office cubicles shall be routed from ceiling to cubicles via power poles.
- C. Communication outlets shall be double-ganged and shall be flush mounted. If flush mounting is not practical, a surface mounted box may be used if approved by the Company. Faceplates and/or fiber jack installations shall be sloped/angled type to maintain proper bend radius for work area cable and have four available modular inserts. Typically, wall mounted data/comm. outlets are to be located 18" inches above the floor with final location being contingent on furniture location. Modular inserts shall be RJ45 data modular jacks that meet or exceed the latest TIA/EIA standard for Category 6A cable.
- D. The number of communication outlets per room shall be per the room data sheets.
- E. If more than one communication outlet is to be installed in an office, they shall be installed on opposing walls with the final arrangement approved by the Company before completion of design.
- F. Terminations for fiber optic cables within the building shall be fusion type or SC connectors.

1.8. COMMUNICATIONS RACEWAY AND MANHOLES BETWEEN BUILDINGS

- A. Install inner duct in all of the incoming conduits. All conduits shall be installed with 36" radius sweeping elbows.
- B. Inner ducts shall be MaxCell fabric type with cable pulling tape in all cells. Each inner duct shall provide for three cable placements (cells). Three inner ducts shall be installed in each conduit.

1.9. FIBER OPTIC AND TWISTED PAIR CABLE REQUIREMENTS

- A. Multimode fiber optic cable shall be 62.5/125 (micron/cladding). Singlemode fiber optic cable shall be 9/125 (micron/cladding), or non-zero dispersion-shifted.
- B. Installation of all cables shall be in accordance with the manufacturer's recommendations. Recommended pulling tension, bend radius, and other critical parameters shall not be exceeded.

1.10. WIRELESS NETWORKING EQUIPMENT

- A. Provide cabling from telecommunication rooms to locations throughout the facility as needed to provide a wireless network throughout the facility.
 - 1. Cables shall be terminated and tested for Cat 6A performance and shall be terminated in patch panels in the telecommunication rooms. Wireless transceivers cable ends shall be terminated with a RJ45 plug.
 - 2. Wireless network hardware will provided by the Company. Coordinate with ORNL's ITSD to determine proposed hardware and coverage requirements.

1.11. PUBLIC ADDRESS SYSTEM

- A. Service for the ORNL PA system is provided via ORNL network connection.
- B. The Seller to provide complete PA system using Class Connection components by Valcom and Valcom Services LLC.
- C. The PA coverage shall be provided for all corridors, stairwells, restrooms, locker rooms, shop areas, open office areas, break rooms, and other areas where multiple occupancies are expected.
- D. The Seller to submit system shop drawings developed by the vendor or distributor established as a PA system designer.
- E. The PA systems typically consist of the following components:
 - 1. Networked station port Model VE8011.
 - 2. Networked trunk port Model VE8021.
 - 3. Networked page zone extender Model VE8001.
 - 4. The 24VDC, 6A power supplies.
 - 5. The 15 and 5 watt horn, self-amplified.
 - 6. Flush mount 8" ceiling speaker, self-amplified.
 - 7. Surface-mount speakers, self-amplified.
- F. Provide components necessary to provide local paging for two zones (floors).
- G. Speaker cable shall be Category 5. Route speaker cables in telecommunication cable trays where available or provide other suitable means to support cable in non-exposed areas. Provide conduit or other suitable raceway in non-finished areas.
- H. The number of speakers required for adequate coverage of an area shall be based upon a comfortable listening level of paging for personnel in close proximity to speakers. Speakers shall typically be spaced at 25' in interior finished areas such as open offices and corridors.
- I. Exterior horn speakers shall be provided; a minimum of four 15 watt units.

1.12. FIRE ALARM SYSTEM

- A. See Section 018613 Fire Protection for fire alarm system requirements.

1.13. TELECOMMUNICATIONS EQUIPMENT COOLING

- A. Adequate cooling shall be provided in telecommunication rooms to offset heat generated by networking and other telecommunication equipment. See Section 018619 Heating, Ventilating, and Air Conditioning (HVAC) for more requirements.

END OF SECTION

SECTION 018633 – SECURITY

PART 1 - GENERAL

1.1. PROJECT SPECIFIC CRITERIA

- A. The Seller to provide the following:
 - 1. All conduit, back boxes, and wiring necessary for a complete access control system.
 - 2. Emergency power for controllers and power supplies.
 - 3. Telecommunication service to controllers.
 - 4. Door hardware such as electric door strikes, electric door latches and required power supplies.
- B. Government furnished equipment (GFE).
 - 1. The GFE shall include controllers, card readers, door switches, and network interface devices.

1.2. WORK SMART STANDARDS

- A. National Fire Protection Association (NFPA) 70, National Electrical Code.
- B. International Building Code, 2009 (IBC).
- C. Americans with Disabilities Act (ADA), guidelines (ADAAG).

1.3. GENERAL SECURITY AND ACCESS CONTROL REQUIREMENTS

- A. Building access control shall be provided as follows:
 - 1. The entire building perimeter shall be controlled by a Hirsch system connected to Oak Ridge National Laboratory's (ORNL's) central alarm system. Perimeter entrances shall be provided with proximity card readers.
 - 2. Telecommunication rooms, mechanical rooms, and electrical rooms shall be provided with proximity card readers connected to the Hirsch system, similar to perimeter entrances.
- B. All security features and functions will comply with the requirement of the IBC and ADA and shall not create any impairment of the means of egress.

- C. Doors controlled using proximity card readers shall be provided with electric door strikes or latches, and magnetic door switches.
- D. All door locksets shall be provided with Best 7-pin A series lock cores, for master keying by the Company.

1.4. CONTROLLERS FOR ALARMS AND ACCESS CONTROLS

- A. Hirsch control panels will be provided and installed by the Company. The Seller shall provide rough in and cabling from the controller(s) to access control devices. An 8" wireway shall be provided over the controllers.
- B. Controllers shall be connected to the central alarm system via multimode fiber optic cable. This cable will be part of the network cabling provided by the Seller.
- C. The controller for access control shall be a Hirsch Model 8. One Model 8 is capable of controlling eight doors. Provide space in the telecommunications equipment room for the quantity of Model 8's required.
- D. The controller for alarms shall be a Hirsch Model 16. Alarm control is typically required for perimeter entrances that do not have proximity card access (overhead coiling high bay doors). Provide space in the telecommunications equipment room for one Model 16.
- E. One wall mounted fiber optic patch panel cabinet shall be provided in the telecommunications room specifically for the Hirsch controllers. Specific cabinet shall be specified by ORNL Security Division.
- F. Provide space for one empty Hirsch Model 8 enclosure adjacent to the alarm and access control panels to house network interface equipment for connection to ORNL central alarm system. The enclosure shall be located between the fiber optic patch panel and the line up of Hirsch controllers.
- G. Three 120V, 20 amp dedicated branch circuits, shall be provided for the controllers and enclosure for communications hardware. These circuits shall be supplied by emergency power when and shall be installed in metal conduit. Additional emergency branch circuits shall be supplied for remote located power supplies serving electric latches.

1.5. ACCESS CONTROLS

- A. Security switches.
 - 1. Provide rough in and wiring at exterior doors, interior doors, telecommunication rooms, electrical rooms, mechanical rooms, and other doors at access control locations identified in the room data sheets for high security balanced magnetic switches wired to a junction box located above the door.
 - a. Switches shall be provided and installed by the Company.
 - b. Provide one #22 gauge twisted, shielded pair, Belden Cat No. 8761 from the junction box to the Model 8 controller location.

- c. Double leaf door installations shall provide rough in and wiring for two switches, only one home run is required.

B. Proximity card readers.

1. Provide rough in and wiring at exterior doors, interior doors, telecommunication rooms, electrical rooms, and mechanical rooms and other doors at access control locations identified in the room data sheets that require proximity card readers and door strikes wired to a Model 8 controller.
2. Proximity card readers consist of a proximity card reader and an interface board. Interface boards are located close to the card reader, above suspended ceiling where applicable.
 - a. Card readers shall be installed in accordance with ADA standards.
 - b. Provide rough in and wiring from the interface board (located above the door) to the controller utilizing two #22 gauge twisted pair cable with overall shield, Belden Catalog No. 9302. The proximity card reader will be wired to the interface board using one 9 conductor #22 gauge cable with overall shield, Belden Catalog No. 9945.
3. Provide rough in and wiring for separate card readers that shall be supplied for electric door operators used for handicap entrance. This will require using two zones of the Model 8 for doors with electric door operators.

C. Door hardware.

1. Where crash bars are required, door hardware shall be Von Duprin EL99N, electric latch.
2. Where conventional door hardware is allowed, door strikes shall be a HES Model No. 7000-24D, 701 face plate with Model No. 2005 power regulator or the Company approved equal.
3. Provide wiring from the power supply to the latch or strike via one 18 gauge twisted pair unshielded cable, Belden Catalog No. 8461. Power supplies for electric strikes are typically located at the controller location. Power supplies for electric latches are required to be located close to the door due to excessive inrush current. Provide one 18 gauge twisted pair unshielded cable from the remotely located power supplies to the Model 16 controller location.

1.6. ALARMS

A. Security switches.

1. Exterior doors, roll up doors, roof access hatches, and other doors without access controls shall have high security balanced magnetic switches wired to the Model 16 controller.

- a. Provide rough in and wiring from the switch to the Model 16 controller location utilizing one #22 gauge twisted shielded pair, Belden Cat. No. 8761.

1.7. WIRING

- A. All cables shall be installed in metal conduit and shall be routed within the secured area.

1.8. DRAWINGS AND SHOP DRAWINGS

- A. Drawings shall be developed in accordance with Section 018050, Company Interface.
- B. Drawings shall include system plans, elevation details, and legend.
 1. System plans shall show locations of access control devices and panels.
 2. Provide elevation details for each type of installation, for panel layout and interconnection.

END OF SECTION

SECTION 018900 – CIVIL

PART 1 - GENERAL

1.1. PROJECT SPECIFIC CRITERIA

- A. See Section 018100 – Overview.
- B. A site specific topographic survey will be provided by the Company.
- C. During the design phase of the project, the Architect-Engineer (A-E) shall be required to meet with the researchers to identify any additional site requirements not identified in the following criteria.
- D. The Seller shall be responsible for having a geotechnical evaluation done.

1.2. RELATED SECTIONS

- A. Section 018616 - Piping, for all potable water and wastewater/sanitary sewer.
- B. Section 018050 - Company Interface, for general requirements regarding drawings, surveying, specifications, etc.

1.3. DESIGN STANDARDS

- A. Oak Ridge National Laboratory (ORNL) work smart standards.
 - 1. International Building Code (IBC), 2009.
 - 2. Fed-Std-795, Uniform Federal Accessibility Standards.
 - 3. Public Law 101-336, Americans with Disabilities Act (ADA).
 - 4. American Association of State Highway & Transportation Officials (AASHTO) - A Policy on Geometric Design of Highways and Streets (GDHS).
 - 5. Department of Energy Order (DOE-O)-420.1, Facility Safety (Flood Criteria).
- B. Additional standards/guides.
 - 1. Design Criteria for Sewage Works, State of Tennessee, Department of Health and Environment, Division of Water Pollution Control.
 - 2. National Oceanic and Atmospheric Administration (NOAA) Atlas 14, Volume 2, Version 2 – Precipitation Frequency Atlas of the United States (US).

3. Department of Agriculture's Soil Conservation Service Technical Report TR55, Urban Hydrology for Small Watersheds.
4. American Society of Civil Engineers' (ASCE), Manual of Standard Practice ASCE 77 - Design and Construction of Urban Stormwater Management Systems.
5. Tennessee Department of Environment & Conservation (TDEC) Erosion and Sediment Control Handbook.
6. Tennessee Department of Transportation (TDOT), Standard Specification for Road and Bridge Construction.
7. The TDOT Drainage Manual.
8. DOE-STD-1020 – 2002, Natural Phenomena Hazards and Evaluations Criteria for DOE Facilities.

1.4. EXTERIOR UTILITIES

A. General.

1. Above ground utilities shall be avoided if at all possible.
2. Locate new utilities so as to minimize connection costs. Underground utilities shall not be routed under buildings or other permanent structures. If new buildings or other permanent structures are sited over existing underground utilities, then those underground utilities must be relocated.
3. When flowable fill is required for trench backfill or other applications, it shall meet the minimum recycled content per the Environmental Protection Agency's (EPA's) Comprehensive Procurement Guidelines.
4. Provide coordinate locations and elevations for all underground utilities, indicating horizontal and vertical locations of connection points, abrupt changes in direction and system components, as well as enough locations along the lines to clearly establish their location.
5. Tracer wire shall be provided along any non-metallic piping and installed in accordance with requirements in Section 018616 - Piping and 018626 - Electrical.

B. Underground utilities.

1. Sanitary sewer (see Section 018616 – Piping also).
 - a. Definitions.
 - 1) The ORNL sanitary sewer system – the common sanitary sewer conveying sanitary sewage to the ORNL Sewage Treatment Plant.

- 2) Building sanitary sewer – external sewer piping extending from the building sanitary drain to the ORNL sanitary sewer system.
 - 3) Building sanitary drain – the lowest piping of the building sanitary drainage system. It extends 30” beyond the face of the building and conveys sewage to the building sanitary sewer. (See Section 018616 - Piping, for sanitary drain criteria.)
 - 4) Building sanitary drainage system – all of the piping within a building that conveys sewage to the building sanitary drain (see Section 018616 - Piping, for criteria).
- b. Design, installation and testing of the ORNL sanitary sewer system and building sanitary sewer shall be in accordance with the Design Criteria for Sewage Works, State of Tennessee.
 - c. Minimum sizes of gravity sewers shall be 6” for building connections and 8” for all other sewers.
 - d. Septic tanks shall not be used.
2. Storm water management system.
- a. As this project is seeking United States Green Building Council’s (USGBC’s) Leadership in Environmental and Energy Design (LEED) certification, the storm water collection and management system may be designed to include features which control both the quantity and quality of the storm water run-off from the site. Any portions of the storm water management system which requires run-off to be channelized and/or piped shall be designed so as to minimize the number of drainage structures required provided the design meets the following criteria.
 - b. The storm water management system shall be designed for not less than the 25-year, 24-hour storm.
 - c. The total area to be drained shall be considered when analyzing and sizing the storm water system. All runoff shall be controlled and tied to the storm water system, as appropriate.
 - d. Hydraulic design of storm drainage systems shall comply with American Society of Civil Engineers’ (ASCE), Manual of Standard Practice ASCE 77 - Design and Construction of Urban Stormwater Management Systems. The minimum storm drain pipe diameter shall be 12”. The minimum culvert diameter shall be 15”. For roof drains, the minimum pipe diameter for laterals and collectors shall be 4”.
 - e. Provide straight alignments for piping between storm drainage structures with deflection at structures no greater than 90 degrees for main line flow (24” diameter and greater) and 120 degrees for contributory flow lines. Use of curvilinear alignment is not allowed.

- f. Provide a structure at collection and inlet points, at least every 300' for pipes 24" in diameter and less, pipe junctions, and changes in horizontal or vertical alignment of a pipe run.
- g. In the design of culverts and storm drains, consider headwater and tailwater and their effects on hydraulic grade line and capacity. The hydraulic grade line for the drainage system shall not exceed an elevation 1' above the pipe crown, or 1' below the structure rim or gutter flow line at inlets, whichever is the lower elevation at each structure. Culverts shall not be surcharged more than 1' at either end. At structures, the inlet pipe crown elevation must be equal to or greater than the outlet pipe crown elevation to minimize hydraulic turbulence at the junction. Provide adequate slope in the structure's flow channel to accommodate the hydraulic losses through the structure.
- h. The pipe size must not decrease downstream in the direction of flow. This shall include connections of new collection systems to existing facilities.
- i. Provide a minimum flow velocity of 2½' per second and a maximum velocity of 10' per second using the Manning equation with the pipe flowing full and under no surcharge at peak flow conditions.
- j. Locate drainage structures out of paved areas wherever possible. Adjust structure locations to avoid primary wheel tracks when structures must be located in roadways. All drainage structures shall be specified to be in accordance with TDOT's Standard Specifications for Road and Bridge Construction.
- k. The storm drainage system shall not be used for discharging of process or sanitary related waste.
- l. Head walls or flared end sections shall be provided at the ends of permanent culverts and at storm drain outfalls unless approved in writing by the Company. Protection from erosion and scouring at head wall and flared end section outfalls shall be provided as needed.
- m. Limit maximum velocities and gradients on open channels to prevent erosion on soil type and lining in accordance with the TDOT Drainage Manual.
- n. Where practical, roof drains shall be tied to the storm drain system. Where roof drainage is discharged to grade, provide splash blocks/channels to direct the flow away from the structure. Eliminate safety hazards from ice, ponding, flooding etc. in pedestrian and vehicular traffic areas.
- o. Where underground collection of roof drainage is used, provide an air break between the downspouts and underground piping.

- p. No more than three downspouts shall be collected in a single outlet before connecting to a storm drainage structure, and the length of pipe from the most distant downspout to a drainage structure shall not exceed 150 feet. Provide a cleanout for each downspout connection and the collection header.
 - q. New material shall be:
 - 1) Reinforced concrete pipe (RCP) in accordance with ASTM International (ASTM) C76/AASHTO M170, Class III Wall B with bell and spigot joints and gaskets per ASTM C443. The RCP shall be used under all roadways.
 - 2) High density polyethylene (HDPE) corrugated with smooth inner wall per AASHTO M-294, and rubber gasket joints per ASTM D3212.
 - 3) Poly Vinyl Chloride (PVC), American National Standards Institute, Inc. (ANSI)/ASTM D3034, Type PSM, SDR-35. Use PVC for storm drains 10" and smaller.
- C. Above ground utilities.
- 1. Aboveground utilities are to be avoided if possible.
 - 2. Aboveground features shall not be located in front of or in such a manner as to detract from the facility.
 - 3. Maintain a minimum clear height of 23' at all overhead road crossings.

1.5. SITEWORK

- A. Earthwork and grading.
- 1. Plan facilities to fit the topography with a minimum of grading and to preserve the site character in an efficient and economical manner. Follow all applicable recommendations in the project geotechnical report.
 - 2. To prevent surface drainage from entering or ponding adjacent to the structure, place finished floor elevations sufficiently above the existing ground gradient or the roadway grade, and slope the outside grade away from the building.
 - 3. Maximum finish graded slopes shall be 1:3, unless positive erosion protection is provided, such as rip rap.
 - 4. Permanent seeding will be required on all disturbed areas. Seed mixture shall be a turf type tall fescue.

1.6. SIDEWALKS

- A. Contraction and expansion joints shall be provided and shown on the drawings.
- B. Walks shall comply with ADA/Uniform Federal Accessibility Standards (UFAS) and have a medium to heavy broom finish for slip resistance.
- C. Concrete mix shall be 4000 psi minimum with 5%-7% air entrainment to minimize damage due to freeze-thaw cycles and ice melt chemicals. Testing is only required for air entrainment, not strength.
- D. Base the width of sidewalks on anticipated traffic, with a minimum width of 4'.
- E. Sidewalks construction shall be 4" thick minimum over a 3" base of #57 stone. Also, sidewalks shall be reinforced with welded wire fabric.

1.7. ROADS AND PARKING

- A. Provide access to existing traffic patterns.
- B. Design of parking areas shall include 9' wide spaces with 90 degree parking being preferred. All striping shall be 4" wide, white in color except blue for handicap.
- C. Parking area circulation must allow for all types of traffic that may be associated with the facility, including deliveries, emergencies and garbage pick-up. Refer to Section 018100 – Overview for additional details.
- D. Clearly indicate turning radii requirements on parking area entrances and islands. If access for fire, maintenance and trash service vehicles is required for the facility and routing through the parking area is necessary, provide layout with turning radii in accordance with the latest edition of the AASHTO publication, A Policy on GDHS for appropriate design vehicle type.
- E. Design and details for construction of flexible and rigid pavements shall comply with TDOT, Standard Specification for Road and Bridge Construction, and any recommendations made in the site geotechnical report.
- F. Geometric design and gradients of all roads, streets, access drives and parking areas shall comply with AASHTO - A Policy on GDHS.
- G. Road and street grade changes in excess of 1% shall be accomplished by means of vertical curves; the length of vertical curves shall be determined in accordance with AASHTO - GDHS.
- H. Roadway centerline gradient profiles shall be shown for vertical control.
- I. Positive drainage shall be provided for parking area pavements. Slopes shall be 1% minimum and 4% maximum.
- J. Concrete curbs and gutters shall be provided for all parking areas.

- K. Bollards must be 4' high, 6" diameter steel pipe filled with concrete and painted yellow. Provide bollards around any structures subject to damage from vehicular traffic by incidental contact. Ensure that an adequate concrete foundation is designed for the bollard.
- L. Traffic control devices shall be in accordance with AASHTO – Manual on Uniform Traffic Control Devices (MUTCD). Provide signs, and associated pavement markings to facilitate proper utilization of the project site.
- M. Where dumpsters are required, provide a dumpster pad with an enclosure. Provide a concrete pavement pad to support and accommodate the dumpsters and front wheels of the service truck.
- N. Flexible pavements shall be used for roadways, access drives, and parking areas. Rigid pavements shall be used for dumpster pads, loading dock aprons, and other pavement areas subjected to high stresses.
- O. Pavement systems shall include provisions for under-pavement drainage, if required by the site geotech report.

1.8. QUALITY CONTROL & TESTING

- A. At a minimum, quality control and testing of construction materials and activities shall be performed as recommended in the project's geotechnical report, the 2009 Edition of the IBC and TDOT's Standard Specification for Road and Bridge Construction. All cost of construction inspections and testing shall be the responsibility of the Seller. The construction documents must contain a list of all required special inspections, field tests, laboratory tests, certifications, documentation and field observations required.

1.9. DESIGN DRAWING INFORMATION

- A. Design drawings shall use the ORNL grid system. A minimum of two survey control points with their coordinate values and elevations shall be shown on the project site drawings.
- B. Provide ORNL north arrows and graphic scales on all applicable drawings.
- C. Demolition plans shall clearly show what is to be demolished at an appropriate scale and shall indicate the beginning and ending points of utility removals and methods of plugging pipes. Show locations of valves to be used for isolating work. Describe existing items to be removed in detail with supplemental descriptions if necessary. Provide a demolition sequence if necessary and include any known requirement for continuous operation and limited shutdown requirements. Do not show any items that are being demolished with the current project on subsequent civil plan sheets. Provide an appropriate tree protection detail for existing trees which are to be preserved during construction.

- D. Site plans shall show all new aboveground features with adequate layout data and existing aboveground features after demolition has occurred. Show areas requiring pavement patching, repairs and new pavement. Provide pavement jointing plans for rigid pavements. Eliminate extraneous items that may congest the drawing and detract from the layout information. Show locations of any additional erosion and sedimentation control items not already identified on the demolition plan. Indicate all trees and plant material to remain.
- E. Utility plan sheets shall provide profiles where needed for clarity and to avoid potential conflicts. Indicate structure tops, pipe invert elevations, slopes, lengths and diameters of all new gravity lines. Reference the plan sheets where pipes/structures are shown. Show and label existing and new surface materials, concrete pads, curbs, roads, etc. traversed by the new lines. Accurately show the depth of existing pavements. Show and label all crossing utility lines, both existing and new. Indicate the method of new utility installation routing above or below conflicts, i.e. concrete encasement, pressure pipe, etc.
- F. Grading plans shall provide spot elevations and existing contours at intervals to clearly indicate existing drainage patterns. Provide spot elevations and new contours when appropriate to clearly indicate new grading and drainage patterns. New spot elevations/contours must be easily distinguished (bolder font) from existing. Indicate where new grading ties to existing grading (limits) and verify that new work will not block existing adjacent drainage. Show all benchmarks, other vertical control and datum notes on this plan. Show finished floor elevations on the grading plans. Coordinate with the landscaping plans to prevent new plantings from blocking site drainage. Provide numbers (or letters) for each drainage structure so that plans and profiles are easily coordinated. Erosion and sediment control details should be shown.
- G. Details of items shown in TDOT's construction standards or other appropriate local/commercial standards are required to be included on the plan sheets.
- H. An electronic copy of the civil calculations (portable document format [pdf]) shall be provided to the Company by the Seller. The calculations shall be sealed by a professional engineer licensed in Tennessee for record purposes.

END OF SECTION

SECTION 019113 - GENERAL COMMISSIONING REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the contract, including General and Supplementary Conditions and Specification Sections, apply.

1.2 SUMMARY

- A. Section includes general requirements that apply to implementation of commissioning without regard to specific systems, assemblies, or components.

1.3 DEFINITIONS

- A. Commissioning plan: a document that outlines the organization, schedule, allocation of resources, and documentation requirements of the commissioning process.
- B. Commissioning authority: (CxA).
- C. Systems, subsystems, equipment, and components: where these terms are used together or separately, they shall mean "as-built" systems, subsystems, equipment, and components.

1.4 COMMISSIONING TEAM

- A. Members appointed by the Seller(s): individuals, each having the authority to act on behalf of the entity he or she represents, explicitly organized to implement the commissioning process through coordinated action. The commissioning team shall consist of, but not be limited to, representatives of the Seller, including project superintendent and subcontractors, installers, suppliers, and specialists deemed appropriate by the CxA.
- B. Members appointed by the Company:
 - 1. CxA: the designated person, company, or entity that plans, schedules, and coordinates the commissioning team to implement the commissioning process.
 - 2. Representatives of the facility user and operation and maintenance personnel.
 - 3. The Company and engineering design professionals.

1.5 COMPANY'S RESPONSIBILITIES

- A. Assign engineering, operations, and maintenance personnel and schedule them to participate in commissioning team activities.
- B. The CxA will be provided by the Company under a separate contract. The Seller's responsibilities for coordination with the CxA are outlined below in Paragraph 1.6.

1.6 THE SELLER'S RESPONSIBILITIES

- A. The Seller shall assign representatives with expertise and authority to act on its behalf and shall schedule them to participate in and perform commissioning process activities including, but not limited to, the following:
 - 1. Evaluate performance deficiencies identified in test reports and, in collaboration with entity responsible for system and equipment installation, recommend corrective action.
 - 2. Integrate and coordinate commissioning process activities with construction schedule.
 - 3. Review and accept commissioning process test procedures provided by the CxA.
 - 4. Support commissioning process test procedures, by providing necessary manpower and incidental support services for the CxA.

1.7 THE CxA'S RESPONSIBILITIES

- A. Organize and lead the commissioning team.
- B. Provide commissioning plan.
- C. Provide project-specific commissioning process test procedures.
- D. Perform systems, assemblies, equipment, and component testing.
- E. Compile test data, inspection reports, and certificates; include them in the final commissioning report.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION