Example Request for Proposal Language Annotated by the National Renewable Energy Laboratory (NREL)

DOE/NREL Ingress/Egress Project with a Site Entrance Building and Parking Structure

NREL/DOE's Energy-Performance-Based Acquisition Steps:
Step 1: Define a Performance-Based Acquisition Process
Step 2: Develop an Energy Performance Goal
Step 3: Require Energy Performance
Step 4: Manage the Performance-Based-Acquisition Process
Step 5: Verify Energy Performance

Energy-performance-based acquisition step	**Key action exemplified**	**Location of example text**
Step 1: Define a Performance-Based Acquisition Process	Select a project delivery method that will enable the project team to track and cost-effectively achieve aggressive energy performance.	Section 1 - Instructions to Offerors, Page 6
Step 1: Define a Performance-Based Acquisition Process	Select a project delivery method that will enable the project team to track and cost-effectively achieve aggressive energy performance.	Section 1 - Instructions to Offerors, Page 10
Step 1: Define a Performance-Based Acquisition Process	Assemble an integrated project team where all members share some responsibility for the energy performance goal.	Section 1 - Instructions to Offerors, Page 7
Step 1: Define a Performance-Based Acquisition Process	Assemble an integrated project team where all members share some responsibility for the energy performance goal.	Section 1 - Instructions to Offerors, Page 11
Step 1: Define a Performance-Based Acquisition Process	Assemble an integrated project team where all members share some responsibility for the energy performance goal.	Section 2 – Design & Construction Procedures, Page 84
Step 1: Define a Performance-Based Acquisition Process	Define project delivery incentives that drive the project team to continuously focus on an energy performance goal.	Section 1 - Instructions to Offerors, Page 56-57
Step 2: Manage the Performance-Based-Acquisition Process	Require that the energy goals be substantiated through contract-defined calculation methods at each phase of design.	Energy Appendix – Ingress/Egress Energy Target Definitions

Step 3: Develop an Energy Performance Goal	Set an energy performance goal specific to the building type and climate.	Section 3 – Performance Criteria, Page 188-189
Step 3: Require Energy Performance	Use a tiered structure to prioritize the energy goal among other project goals.	Section 1 - Instructions to Offerors, Page 44-45
Step 4: Manage the Performance-Based-Acquisition Process	Require that the energy goals be substantiated through contract-defined calculation methods at each phase of design.	Section 3 – Performance Criteria, Page 149
Step 4: Manage the Performance-Based-Acquisition Process	Require that the energy goals be substantiated through contract-defined calculation methods at each phase of design.	Energy Appendix – Ingress/Egress Energy Target Definitions
Step 4: Manage the Performance-Based-Acquisition Process	Require that the energy goals be substantiated through contract-defined calculation methods at each phase of design.	Section 1 - Instructions to Offerors, Page 12-13
Step 5: Verify Energy Performance	Conduct post-occupancy evaluations and collect feedback after the first year of operation.	Section 2 – Design & Construction Procedures, Page 104

National Renewable Energy Laboratory
Managed and Operated by the Alliance for Sustainable Energy, LLC

Request for Proposals Number RGH-0-40752

"Design-Build of the South Table Mountain Ingress/Egress and Traffic Capacity Upgrades"

THIS SUBCONTRACT IS FUNDED IN WHOLE WITH AMERICAN RECOVERY AND REINVESTMENT ACT (Recovery Act) FUNDS

REQUEST FOR PROPOSAL

READ THIS DOCUMENT CAREFULLY

This solicitation is being conducted under the procedures for competitive subcontracts established by the National Renewable Energy Laboratory (NREL). NREL will award a subcontract based on the following:

All Statement of Work (SOW) requirements being met with the best combination of:

- Technical factors (based on qualitative merit criteria), and
- Evaluated price (or cost)

Issue Date: June 2, 2010 Due Date: July 14, 2010 Time Due: 4:00 P.M. Mountain Time

Technical Questions must be received in writing no later than July 6, 2010

Solicitation Type Best Value Selection
Fixed Price with Award Fee

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Section 1 – Instruction to Offerors

Section 2 – Conceptual Documents

INTRODUCTION

NREL is the only federal laboratory dedicated to the research, development, commercialization and deployment of renewable energy and energy efficiency technologies.

This section of the Request for Proposal (RFP) is intended to assist the Offerors to understand some unique attributes of work at NREL.

Organization
Alliance for Sustainable Energy, LLC (Alliance) has entered into Contract No. DE-AC36-08GO28308 (hereinafter "Prime Contract") with the Department of Energy (hereinafter "DOE"), an agency of the U.S. Government (hereinafter "Government"), for the management and operation of the National Renewable Energy Laboratory (hereinafter "NREL").

The contractual relationships between DOE and the Alliance and the successful Offeror are as follows:

- The DOE and Alliance have entered into a Prime Contract for the management and operation of NREL, including facilities design and construction on the NREL site.
- Alliance and the successful Offeror will enter into a subcontract for the design-build services outlined in this RFP. All references to "NREL" or "Alliance/NREL" in the resultant subcontract shall mean the Alliance for Sustainable Energy, LLC.
- The successful Offeror will enter into lower-tier subcontracts for performance of any portion of the work outlined in this RFP that is not performed by the successful Offeror's own organization.
- For purposes of this RFP, the Statement of Work (Conceptual Documents), and any resultant subcontract, the term Owner means the Alliance for Sustainable Energy, LLC, acting in its capacity as the managing and operating contractor for the National Renewable Energy Laboratory in furtherance of the performance of the work provided for under Department of Energy Contract No. DE-AC36-08GO28308.

A. NREL CRITICAL DECISION PROCESS

1. NREL will comply with DOE Order 413.3A "Program and Project Management for the Acquisition of Capital Assets" for this project. Integral to this order are the critical decision processes which are approval points that need to be satisfied before the project can proceed to the next phase. The Critical Decisions (CD) are summarized as follows (for detailed information, refer to DOE Order 413.3A):

    a. **CD-0 Approve Mission Need:** This decision point identifies a mission need but not a particular solution. The requirements of CD-0 for this project have been completed, allowing NREL to proceed.

    b. **CD-1 Approve Alternative Selection and Cost Range**: This decision point marks the completion of the project definition stage and is characterized by completion of concept design. For this project, the Campus Master Plan and the Supplemental Environmental Assessment and associated Finding of No Significant Impact are the basis of the concept design. The requirements of CD-1 for this project have been completed, allowing NREL to proceed.

c. **CD-2 Approve Performance Baseline & CD-3 Approve State of Construction**: The CD-2 decision point marks the completion of preliminary design and the development of sufficient information to establish a Project Performance Baseline. The CD-3 decision point marks the completion of design work and verification that the project is ready to begin construction and procurement of items related to constructing the facility. A DOE independent review team will review project documentation and validate that the project has met criteria to proceed, following implementation of any corrective actions, prior to proceeding with a Request for Approval of Critical Decision 2 and 3.

d. **CD-4 Project Completion**: This decision point marks achievement of completion and transition of the facility to occupancy and operations.

2. Under a design-build approach, Critical Decisions 2 and 3 can be combined (e.g. CD 2/3) into one approval which is the strategy envisioned for this project. Approval of CD 2/3 is required prior to the award of Phase II-Design Development and Construction of this subcontract. In order to ensure a smooth transition between Phase I (preliminary design) and Phase II (design development and construction) of this subcontract, certain deliverables are required to support the CD 2/3 approval process. These deliverables require the preliminary design be developed sufficiently to have a firm grasp on project scope, schedule, cost, and risk. These deliverables will be reviewed in depth as part of the CD 2/3 approval process. Accordingly, a milestone deliverable, "Preliminary Project Performance Baseline," is required 57 calendar days after Subcontract Award for Phase I-Preliminary Design of this subcontract at which time the subcontractor shall submit the following deliverables to support CD 2/3 approval:

   a. 90% preliminary design and associated report for the entire project scope.

   b. Preliminary projected cost loaded schedule for design development and construction based on the 90% preliminary design.

   c. Preliminary projected monthly cash flow curve for design development and construction based on the 90% preliminary design.

   d. Preliminary cost estimate for design development and construction with methods and assumptions.

   e. Preliminary risk register and risk management plan.

   f. Preliminary facility energy analysis documenting how the requirements of DOE O 430.2B "Departmental Energy, Renewable Energy and Transportation Management" will be met, including a draft LEED checklist based on the 90% preliminary design.

   g. Preliminary Commissioning Plan.

   h. Preliminary Quality Assurance Plan.

   i. Assumptions Document.

3. NREL will use this information, in conjunction with other required items developed internally, to obtain approval for Critical Decision 2/3 during the 42 calendar day period after the "Preliminary Project Performance Baseline" milestone but prior to the conclusion of Phase I-Preliminary Design of the subcontract. The deliverables cited above must be as complete as possible in order to obtain the required approvals within the 42 calendar day allotted time

frame. The Subcontractor will continue to refine the preliminary design during the 42 calendar days after submittal of the Preliminary Project Performance Baseline, but cannot proceed with final design or construction activities until CD 2/3 approval is obtained. Critical Decision 2/3 approval is also required prior to award of Phase II-Design Development and Construction of this subcontract.

4. The proposed subcontract will be a two phase firm, fixed price subcontract, Phase I-Preliminary Design and Phase II-Design Development and Construction. The use of two phases is intended to mitigate risk for the responding design-build teams. As a risk management tool, Phase I-Preliminary Design will allow the Offerors to more fully develop the drawings and specifications before offering a final Firm Fixed Price for Phase II-Design Development and Construction.

    a. The Offeror is encouraged to consider the amount of labor that will be required to truly manage the risk inherent in Phase I-Preliminary Design to result in the most accurate and successful determination of a firm fixed price for Phase II-Design Development and Construction of the subcontract. Planning for an adequate amount of labor during Phase I-Preliminary Design will enhance the Subcontractor's performance during Phase I-Preliminary Design of the subcontract and provide a greater level of certainty for the firm fixed price for Phase II-Design Development and Construction of the subcontract.

    b. Phase II-Design Development and Construction of the Subcontract: At the completion of Phase I-Preliminary Design of the Subcontract, the successful Subcontractor will be asked to submit a proposal for Phase II-Design Development and Construction work as outlined in this Subcontract. The successful Offeror will be asked to provide the following information near the completion of Phase I-Preliminary Design work:

        1) Firm Fixed Price for design development and construction of the South Table Mountain Ingress/Egress and Traffic Capacity Upgrades.

        2) Phase II cost loaded schedule for completion of design development and construction.

        3) Actual scope of work defined by the Section 2 Conceptual Documents.

        4) Final cost estimate for design development and construction. The final estimate will be reviewed by an outside consultant for reasonableness and will be subject to NREL's internal cost verification review.

        5) Preliminary design substantiation as defined in the Conceptual Documents.

        6) Negotiations will be entered into with the successful Offeror for Phase II-Design Development and Construction of the Subcontract, design development and construction work at the completion of Phase I preliminary design. Negotiations will be deemed successful for Phase II-Design Development and Construction of the Subcontract work if NREL and the Subcontractor conclude successful negotiations and agree on a complete scope of work, firm fixed price, and a fixed schedule.

7) Unsuccessful negotiations for Phase II-Design Development and Construction work will result in the Subcontractor being entitled to 100% payment of the percent of work completed that meets the standards of quality established under the Subcontract, minus monthly progress payments paid to date, not-to-exceed 75% of the firm fixed price of Phase I-Preliminary Design, and the Subcontract shall be completed.

Safety

This project offers unique challenges in many different areas including energy efficiency as well as fast tracking of the design and construction. Therefore it is essential that the design build team have a comprehensive and integrated approach to safety, which includes environmental protection and occupational safety and health, that considers not only the construction, but also safe occupancy and operation. NREL applies a risk-based approach that requires the mitigation of risk to the lowest reasonable level. To achieve this level of risk NREL begins with compliance with applicable codes and then assesses the residual risk. If residual risk is unacceptable, NREL applies additional controls until the acceptable level of risk is reached. Designing controls into the work is preferred over administrative controls. Additionally, NREL's design objective from a fire protection and life safety standpoint is that of a "Highly Protected Risk". NREL has found that close collaboration between the research groups, facility design teams and the NREL Environment, Health and Safety (EH&S) staff as early in the life of the project as possible leads to the most favorable results. Please see the attached NREL Safety Plan for further safety requirements.

Integrated Project Team

NREL has appointed an Integrated Project Team (IPT) to provide direction and owner level input to the project. The IPT includes a number of specialists in related fields including safety, security, energy, engineering, building maintenance and construction oversight. Personnel from the DOE Golden Field Office, including the Federal Project Director, will be included in the IPT membership. While the Project Manager and Subcontract Administrator are the only individuals authorized to provide direction to the Subcontractor (see Proforma Subcontract Article 10), the successful offeror should expect to work directly with members of the IPT, both individually and in groups, during the design and the construction phases of the project.

Project Description

Design-Build of the South Table Mountain (STM) Ingress/Egress and Traffic Capacity Upgrades
National Renewable Energy Laboratory
South Table Mountain Campus
15003 Denver West Parkway
Golden, CO 80401

Proposed Subcontract Award, Award Fee and Period of Performance

It is the intent of NREL to award one firm fixed price with award fee type subcontract under this solicitation. The proposed subcontract award will be in accordance with the Conceptual Documents to be delivered with a total maximum price of $ 29,771,632.00 (Twenty Nine Million, Seven Hundred Seventy- One Thousand, Six Hundred Thirty Two Dollars and No Cents) which is comprised of the following and exclusive of any Award Fee incentive payment:

PROPOSAL PREPARATION INFORMATION

A. Pre-Proposal Schedule

1. A **mandatory attendance**, Pre-Proposal Briefing will be held on June 16, 2010 at Denver West Office Park, Building 17, 4th Floor. A project site visit will be held at the conclusion of the briefing.

2. A mandatory attendance one-on-one proposal meeting will be held with each offeror approximately 2-3 weeks after issuance of the Request for Proposals.

3. The National Renewable Energy Laboratory (NREL) Subcontract Administrator will communicate with each offeror to engage and coordinate a specific date and time for the one-on-one proposal meeting.

4. The one-on-one proposal meeting will be approximately two hours in length and will be focused on the answering questions related to requirements of the RFP. An agenda will be provided to the offeror prior to the proposal meeting.

5. The purpose of these one-on-one proposal meetings is to:
   a. Allow NREL access to each team in order to verify , through question and answer, each team's clarity of understanding regarding the intent of the RFP.
   b. Allow NREL access to each team in order to verify, through question and answer, each team's confidence that the requirements of the RFP are achievable within the constraints of price/cost, cchedule and other applicable project conditions.

6. The one-on-one proposal meeting is formal in nature and may be videotaped. The following rules will apply:
   a. The offeror shall not contact NREL representatives other than the Subcontract Administrator.
   b. Discussion of cost and pricing is limited to asking questions to clarify requirements of the RFP.
   c. The offeror will be allowed up to six (6) team members to respond to NREL questions. The offeror's Project Manager and the Design Manager are required.
   d. The one-on-one proposal meeting is for information only. The proposal meeting will not be evaluated.
   e. The offeror will provide the Subcontract Administrator with an electronic copy of any questions or concerns that need an NREL response.
   f. NREL will maintain confidentiality of proprietary information if information is so marked and determined to be of a proprietary nature.
   g. Details of the Offeror's proposed design solution will not be presented, discussed or evaluated.

7. ATTENTION: Due to security measures at NREL, all offerors attending the pre-proposal briefing and one-on-one proposal meeting must submit, via e-mail to the Subcontract Administrator three (3) days before the pre-proposal briefing and each one-on-one proposal meeting, a list of the individuals who will attend and their telephone numbers. On the day of the pre-proposal briefing or one-on-one proposal meeting, the attendees will be required to report to NREL

Security (location to be specified at a later date) and will be required to show a government issued picture identification to obtain a visitor's badge. Examples of proper picture identification include a driver's license or passport. Any individual not listed will be denied access to the NREL site and will not be permitted to attend the briefings or meetings.

If an offeror intends to send an individual who is not a U.S. citizen, the offeror should contact the Subcontract Administrator as soon as possible but not later than 5 calendar days before the preproposal briefing or one-on-one proposal meeting to arrange for the appropriate approvals from the Department of Energy (DOE) for admittance.

8. NREL will respond in writing to all questions concerning the solicitation and its requirements received during, or prior to, the pre-proposal briefing. Written questions received at least three (3) days prior to the pre-proposal briefing will be responded to in writing and distributed to all attendees prior to the pre-proposal briefing.

   NREL will respond in writing to all questions raised at the one-on-one proposal meeting. For questions raised at the proposal meeting which NREL considers to be "Business Confidential" or "Proprietary" in nature, written answers to these question(s) will be provided only to the design-build team who asked that particular question. If NREL determines a question to be general in nature, a written response to the question will be provided to all design-build teams participating in this solicitation.

   NREL intends to issue amendment(s) to this solicitation document following the pre-proposal briefing and one-on-one proposal meeting that will formally provide answers to all questions received in writing or verbal questions at the time of the briefing and proposal meeting. Verbal statements made at the pre-proposal briefing and proposal meeting may not be relied upon and will not be binding or legally effective.

B. Competitive Negotiated Subcontract using Best Value Selection

This solicitation shall be conducted using Best Value Selection which results in an award that is most advantageous to NREL based on the best combined value of (a) evaluated qualitative merit and (b) evaluated price and profit of the offers submitted.

C. Qualitative Merit Criteria for Best Value Selection

The Conceptual Documents in this Request for Proposal serves as NREL's baseline requirements. Best Value will be categorically evaluated based on the following Qualitative Merit Criteria.

The Qualitative Merit Criteria establishes what NREL considers the technical factors valuable in an offer. These Qualitative Merit Criteria are performance-based and permit selection of an offer that provides higher qualitative merit. The qualitative merit criteria and submission requirements capture the proposal phase substantiation requirements in Section 2, Part III – Performance Criteria.

Each qualitative merit criteria (factor) and its assigned weight are provided below:

1. **Demonstrate an understanding of the contractual obligations for the project scope and risk management in a project management plan. (20 Points Maximum)**
   a. Submission Requirements: Submit a management plan (15 page maximum) that demonstrates the integrated team approach to establishing project expectations and advancing and completing the design and construction in compliance with the Project Conceptual Documents. The management plan should address communication, collaboration, responsibility and accountability. The management plan should also demonstrate the approach to identifying and managing project risks in accordance with the subcontract. Submit an organization chart (one sheet) identifying proposed key personnel, organizations, and roles. Address the following Proposal Phase Substantiation Criteria in the narrative:
      - Performance Criteria D-Services, item F.3.d.1.a: General outline of commissioning procedures and responsibilities of the parties.

   b. Evaluation factors:
      1. The narrative demonstrates a clear understanding of the performance based design build approach to this procurement and describes how the design build team will engage Alliance/NREL staff in design development and construction.
      2. The narrative demonstrates a clear understanding of the project scope. Describe how the proposed approach references the performance criteria, how it will be measured, and how the final solution will demonstrate how the criterion has been met.
      3. The narrative clearly discusses the quality control procedures for converting the Owner's conceptual requirements into design drawings and substantiation submittals; and constructing a facility that incorporates those design requirements into a functional project. The narrative clearly recognizes that substantiation requirements defined in the conceptual documents create the basis for quality control.
      4. The narrative recognizes the project risks currently identified and discusses the plan and process to manage those risks and other identified risks.
      5. The narrative and organizational chart presents a proven management plan and team with demonstrated ability to manage the project to achieve the milestones identified.
      6. The narrative identifies the approach for engaging the project stakeholders to work together to create input on the design and construction of the facility.
      7. The narrative adequately demonstrates that the commissioning requirements will be met.

2. **Demonstrates that the proposed solution and the approach to finalize the solution follow the Campus Master Plan concepts including site circulation. Demonstrates an efficient solution to structured parking and site entrance building that is innovative in its application of level of service and user convenience. (20 Points Maximum)**
   a. Submission Requirements:
      1. Plan view (one sheet) and elevation view (one sheet) of proposed parking structure(s) showing all parking levels and demonstrating the number and type of parking spaces, vehicle circulation patterns, and ingress and egress locations for vehicles and pedestrians.
      2. Plan view of proposed site entrance building (one sheet) demonstrating that the layout meets the program requirements and facilitates security operations.

3. Plan view of the site (two sheet maximum) for the improved areas showing the size and location of proposed parking structure(s), site entrance building and vehicle/pedestrian circulation improvements. Plan view will be with annotated details of the proposed site circulation improvements and resultant circulation paths.
4. Concept design narrative (5 page maximum) to describe the concept design and that addresses the following Proposal Phase Substantiation Criteria:
    - Performance Criteria, 111 Facility Performance, item F.1.a.1: Calculation of Gross and Net Building Area for all spaces intended for human occupancy, Parking Spaces by type, and net area for all ancillary spaces identified in the Part 2-Program or otherwise required for proper function of the entire project.
    - Performance Criteria D-Services, item F.1.f.1: Description of systems required, sources, input-side capacities, and means of distribution.
    - Performance Criteria, G21-Pavements and Surfacing, item E.3.a: Basis for design of pavement section based on information provided.

b. Evaluation factors:
1. The conceptual diagrams clearly demonstrate a realistic concept that achieves the 1,500 net additional parking spaces required. Proposed solutions that provide additional parking spaces (up to 1,800 net spaces) will be rated higher then solutions providing 1,500 spaces.
2. The conceptual diagrams clearly provide a project Program in accordance with requirements of the RFP.
3. The conceptual diagrams demonstrate the approach to creating a final solution that recognizes the different categories (pedestrian, vehicle, bicycle etc.) of users and creates a circulation solution that is coordinated and achieves the goals of the Campus Master Plan.
4. The narrative and/or diagrams adequately demonstrate that the performance specifications listed will be met.

3. Demonstrates an approach to obtaining energy goals and maximizing sustainability. (15 Points Maximum)

a. Submission Requirements: Submit a narrative (10 page maximum) and LEED™ 2009 New Construction and Major Renovation project checklists (4 pages for each, site entrance building and the parking structure(s)) that demonstrates the approach to meeting the energy goals and maximizing sustainability for the proposed structure(s). In addition address the following Proposal Phase Substantiation Criteria in the narrative and/or checklists:
    - Performance Criteria, 111 Facility Performance, item A.4.h.1: LEED Checklist annotated to show specific credits to be achieved with brief description of how they will be achieved.
    - Performance Criteria, 111 Facility Performance, item F.2.a.1: Identification of method of calculation of energy efficiency to be employed.
    - Performance Criteria, B-Shell, item C.3.a.1: Identification of volumes relying on natural ventilation with description of ventilation concept and required building elements.
    - Performance Criteria, C-Interiors, item B.1.b.1: Information on overall building configuration that will permit natural ventilation of all major spaces.

- Performance Criteria, C-Interiors, item B.4.d.1: Information on overall building configuration that will permit day lighting to levels specified.

b. Evaluation factors:
   1. The narrative clearly demonstrates how the energy goals of 175 kBTU per parking space per year for the parking structure(s) and the annual energy consumption goal of 9,300 kWhr for the site entrance building can be obtained.
   2. The narrative and checklists will be evaluated to assess the reasonableness of the approach to maximizing LEED™ points to demonstrate sustainability of the project. Unsubstantiated claims will not be given credit.
   3. The narrative and/or checklists adequately demonstrate that the performance specifications listed will be met.
   4. The narrative will be evaluated to assess approach to obtain Net Zero Energy for the site entrance building (if offered in the Project Priorities Checklist). Approaches which involve Power Purchase Agreements will be viewed less favorably than owned renewable energy sources.

4. Demonstrate integration of safety and security into the design of the project. (15 Points Maximum)

a. Submission Requirements: Submit a narrative (five page maximum) and accompanying site concept diagram for the improved areas (two sheets maximum) displaying and describing security features and safe design principles. In addition address the following Proposal Phase Substantiation Criteria in the narrative:
   - Performance Criteria D92-Surveillance, item A.8.a: Outline description of systems, inter-system interfaces, and functions provided.

b. Evaluation factors:
   1. The diagrams and narrative will be evaluated for a clear and realistic approach to implementing safe design concepts and integration of campus security into safe design practices.
   2. The diagrams and narrative will be evaluated relative to how personnel and vehicle access and egress to the site will be in compliance with security requirements.
   3. The diagrams and narrative will be evaluated relative to how security functions including surveillance are proposed to function with the proposed conceptual design and how these same functions are proposed to be performed once the new south access road is operational.

5. Demonstrates an approach to achieve a "creative architectural image" that is contextually appropriate with the site's natural environment, the existing community and the Owner's identity to showcase energy efficiency and renewable energy technology. (15 Points Maximum)

a. Submission Requirements: Submit renderings (maximum two sheets) and narrative (maximum 5 pages) showing the proposed buildings and structures to be constructed at the site. Identify the proposed materials and how the new features are compatible with the natural features, existing community and existing structures. Address the following Proposal Phase Substantiation Criteria in the narrative and/or renderings:

- Performance Criteria, 111-Facility Performance, item D.1.a: Identification of major structural materials and systems
- Performance Criteria, B-Shell, item B.8.c.1: Concept renderings of proposed solution indicating overall building configuration, massing, scale, materials, and relationship to surrounding buildings.
- Performance Criteria, A-Substructure, item D.5.a: Basis for design of foundation elements based on information provided.
- Performance Criteria, B-Shell, item D.1.f.1: Identification of major structural materials and systems.
- Performance Criteria, B-Shell, item E.3.i.1: Identification of weather-exposed elements and proposed materials.

b. Evaluation factors:
   1. The renderings will be evaluated for compatibility of proposed building/structure location, form, massing, etc. with the natural features of the site and the existing facilities on the campus.
   2. The renderings indicate architectural images and building design that are consistent with NREL's identity, are aesthetically pleasing, and are thoughtful of surrounding property owners.
   3. The materials identified enhance the service lifespan of the facility and minimize maintenance requirements. The proposed solution maximizes lifecycle cost efficiency.

6. Demonstrates an aggressive yet realistic schedule. (15 Points Maximum)

a. Submission Requirements: Submit a narrative (two pages maximum) and summary level schedule (two sheets maximum) for design and construction. Show task durations in calendar days after subcontract award; include key milestones. The proposed project schedule will reflect the proposed subcontract duration. Include NREL review times for major subcontract deliverables.

b. Evaluation factors:
   1. Provides a preliminary project schedule in accordance with requirements of the RFP.
   2. The schedule and narrative will be evaluated to access the strength of understanding of the project scope and requirements. The schedule will be evaluated for inclusion of the necessary tasks, logic, and durations to complete the work.
   3. The schedule and narrative will be evaluated for the reasonableness of the performance durations. Projects with shorter performance durations will be viewed more favorably provided that the performance duration is not unreasonably condensed such that it places additional risk on NREL or the Subcontractor.

Summary of Technical Submission Requirements

Sec.	Submission Title	Pages (maximum)	Points
C.1	**Management** a. Management Plan b. Organizational Chart	 a. Up to 15 pages b. One sheet	20
C.2	**Conceptual Diagrams** a. Plan view of parking structure(s)	 a. One sheet	20

	b. Elevation view of parking structure(s) c. Plan view of site entrance building d. Plan view of site circulation e. Concept design narrative	b. One sheet c. One sheet d. Up to two sheets e. Up to 5 pages	
C.3	**Energy and Sustainability** a. Energy goals and sustainability narrative b. LEED™ checklist for parking structure(s) c. LEED™ checklist for site entrance building	 a. Up to 10 pages b. Up to four pages c. Up to four pages	15
C.4	**Safety and Security** a. Safe Design and Security narrative b. Plan view of site	 a. Up to five pages b. Up to two sheets	15
C.5	**Materials and Architectural Image** a. Renderings of proposed improvements b. Materials and architectural image narrative	 a. Up to two sheets b. Up to 5 pages	15
C.6	**Schedule** a. Schedule narrative b. Schedule	 a. Up to two pages b. Up to two sheets	15

7. Teaming Agreement/Arrangement (Go/No Go)

The offeror shall provide the Teaming Agreement/Arrangement(s) which will be in place during the subcontract period of performance as part of their proposal. NREL will use this information to understand the division of cost, fees and liabilities assigned to the various members of the team.

D. **Total Price and Profit Evaluation for Best Value Selection**

After evaluation of the qualitative merit criteria, the following price and profit evaluation will be used to determine the best value of the offer in meeting the objectives of the solicitation. **The combined qualitative merit value will be considered substantially more important than the total price and profit.**

E. Evaluation Process

NREL will evaluate offers in three general steps:

1. Step One—<u>Initial Evaluation</u>

An initial evaluation will be performed to determine if all required information has been provided for an acceptable offer. Offerors may be contacted only for clarification purposes during the initial evaluation. Offerors shall be notified if their offer is determined not acceptable and the reasons for rejection. Unacceptable offers will be excluded from further consideration.

2. Step Two—<u>Technical Evaluations</u>

In additional to the technical proposal, oral presentations will be used to evaluate an offeror's technical capabilities based on the merit criteria listed above. Each Offeror whose submitted proposal is deemed acceptable will be contacted by the Subcontract Administrator and scheduled to provide a two (2) hour presentation addressing the merit criteria listed herein. The presentation will be conducted as follows:

a. NREL will determine the order in which offerors will give their oral presentation by drawing of lots;
b. Rescheduling of appointments will only be allowed in extreme circumstances as approved by NREL;
c. All oral presentations will be given at NREL. NREL will provide the conference room. Each offeror shall provide all other materials, including all audio/visual equipment, as required;
d. After the offeror's two (2) hour presentation, NREL evaluators will have a maximum of one (1) hour for a question and answer session (the one hour does not includes time for NREL evaluators to caucus in order to determine questions to be asked);

3. Step Three--<u>Discussion, Selection, Negotiation, and Award</u>

All acceptable offers will be evaluated against the requirements set forth by the Conceptual Documents and the qualitative merit criteria listed above. Based on this evaluation, NREL has the option, depending on the specific circumstances of the offers received, to use one of the following methods of selection:

a. Make an individual selection, conduct discussions/negotiations, proposal revisions, selection, and make an award;
b. Conduct negotiations with the next ranked firm should negotiations fail with the higher ranked firm;
c. Make no award(s).

F. Proposal Preparation Information

1. The proposal must include a title page, including the RFP title and number, name of Offeror's organization and Offeror's Point of Contact (with postal address, telephone and fax numbers, and email address).

2. Offerors are to respond to RFP requirements with a conceptual approach consisting of conceptual level presentation drawings, technical approach narratives and information regarding quality of material and systems. It must clearly define the proposed project scope and quality levels that the Offeror will provide to NREL in enough detail for NREL and the Offeror to mutually understand if the proposal meets the solicitation requirements. Fully developed drawings, details, or specifications are not desired or required.

   Within this RFP NREL has provided Qualitative Merit Criteria, Submission Requirements and Metrics against which proposal will be evaluated. The technical qualitative merit criteria are on a point basis where 100 is the maximum score. Ensure concise, accurate and clear proposals written without assuming the reviewer has an extensive background in the design and construction of facilities.

3. Formatting instructions:
   a. A page is defined as one side of an 8 ½" x 11" sheet of paper.
   b. Maintain at least 1-inch margins on all sides.
   c. Copies may be either single or double-sided.
   d. All proposal documents shall be easy to read, evaluate, duplicate, and handle.

4. A **Technical Proposal** in an original and **ten (10) hard copies and ten (10) CD ROMs** directed toward meeting the requirements of this RFP.

5. A completed **Price/Cost Proposal** in an **original and ten (10) hard copies and one (10) CD ROMs** submitted with the proposal. The offeror's price/cost and delivery terms must be valid for 120 days from the due date of the offer. The proposal form should include support documentation for all categories of the proposed total price and profit. The proposal form should separate price and profit for lower-tier subcontract(s) and include support documentation for all categories of the proposed lower-tier subcontract(s) price and profit. Offerors are to include in their price proposal cost element breakdown on the forms provided in this section.

6. A completed **"Representations and Certifications"** form in an **original and one (1) copy.** (See NREL website below).

7. A completed "**Addendum to Representations and Certifications for Subcontracts"** form applicable to Subcontracts and Purchase Orders funded in whole or in part under American Recovery and Reinvestment Act of 2009

8. Organizational Conflicts of Interest: One original. Submit EITHER the "Organizational Conflicts of Interest Representation Statement" OR the "Organizational Conflicts of Interest Disclosure Statement" (**See NREL website at http://www.nrel.gov/business_opportunities/related_docs.html**).

9. A cover letter including a **summary statement** indicating acceptance of the proposed Conceptual Documents or any change with the reason(s).

10. A cover letter including a **summary of deviations/exceptions** (if any) to the subcontract schedule and the standard terms and conditions and the intellectual property terms and conditions in the appendices. The offeror will explain any exceptions (including deviations and conditional assumptions) taken with respect to the subcontract schedule and terms and conditions. Any exceptions must contain sufficient amplification and justification to permit evaluation. Such exceptions will not, of themselves, automatically cause an offer to be termed unacceptable. A large number of exceptions or one or more significant exceptions not providing any obvious benefit to the Department of Energy or the NREL may, however, result in rejection of such offer as unacceptable.

11. This solicitation does not allow the submittal of facsimile or electronic proposals.

12. This solicitation does not commit NREL to pay costs incurred in the preparation and submission of a proposal in response to this RFP. A stipend will not be paid to unsuccessful offerors.

13. If the successful offeror, upon acceptance of its proposal by the NREL within the period specified for acceptance, fails to execute all subcontract documents, the offeror is liable to NREL for any cost of acquiring the work.

14. If the successful offeror, upon acceptance of its proposal by the NREL within the period specified for acceptance, fails to furnish executed performance and payment bonds within the time specified in the subcontract, the NREL may terminate for default and the offeror is liable to NREL for any cost of acquiring the work.

G. NOTICE OF REQUIRED USE OF AMERICAN IRON, STEEL, AND OTHER MANUFACTURED GOODS—BUY AMERICAN ACT—CONSTRUCTION MATERIALS UNDER TRADE AGREEMENTS (MAR 2009) Derived from FAR 52.225-24

1. *Definitions.* "Construction material," "domestic construction material," "foreign construction material," "manufactured construction material," "Recovery Act designated country construction material," "steel," and "unmanufactured construction material," as used in this provision, are defined in the clause of this solicitation entitled "Required Use of Iron, Steel, and Other Manufactured Goods—Buy American Act—Construction Materials Under Trade Agreements" (see Addendums to Appendix B and Representations and Certifications: Applicable to Subcontracts and Purchase Orders Funded in whole or in part under the American Recovery and Reinvestment Act of 2009).

2. *Requests for determination of inapplicability*. An offeror requesting a determination regarding the inapplicability of section 1605 of the American Recovery and Reinvestment Act of 2009 (Pub. L. 111-5) (Recovery Act) or the Buy American Act should submit the request to the NREL Subcontract Administrator in time to allow a determination before submission of offers. The offeror shall include the information and applicable supporting data required by paragraphs (c) and (d) of "Required Use of American Iron, Steel, and Other Manufactured Goods – Buy American Act – Construction Materials Under Trade Agreements", in the request. If an offeror has not requested a determination regarding the inapplicability of section 1605 of the Recovery Act or the Buy American Act before submitting its offer, or has not received a response to a previous request, the offeror shall include the information and supporting data in the offer.

3. *Evaluation of offers*.
   a. If NREL determines that an exception based on unreasonable cost of domestic construction material applies, NREL will evaluate an offer requesting exception to the requirements of section 1605 of the Recovery Act or the Buy American Act by adding to the offered price of the subcontract— (i.) 25 percent of the offered price of the subcontract, if foreign iron, steel, or other manufactured goods are used as construction material based on unreasonable cost of comparable manufactured domestic construction material; and (ii.) 6 percent of the cost of foreign unmanufactured construction material included in the offer based on unreasonable cost of comparable domestic unmanufactured construction material.
   b. If two or more offers are equal in price, the NREL Subcontract Administrator will give preference to an offer that does not include foreign construction material excepted at the request of the offeror on the basis of unreasonable cost.

4. *Alternate offers*.
   a. When an offer includes foreign construction material, other than Recovery Act designated country construction material, that is not listed by NREL in this solicitation

in paragraph (b)(3) of , "Required Use of American Iron, Steel, and Other Manufactured Goods – Buy American Act – Construction Materials Under Trade Agreements", the offeror also may submit an alternate offer based on use of equivalent domestic or Recovery Act designated country construction material.

b. If an alternate offer is submitted, the offeror shall submit a separate proposal for the alternate offer and a separate cost comparison table prepared in accordance with paragraphs (c) and (d) of" Required Use of American Iron, Steel, and Other Manufactured Goods – Buy American Act – Construction Materials Under Trade Agreements", for the offer that is based on the use of any foreign construction material for which NREL has not yet determined an exception applies.

c. If NREL determines that a particular exception requested in accordance with paragraph (c) of "Required Use of American Iron, Steel, and Other Manufactured Goods – Buy American Act – Construction Materials Under Trade Agreements", does not apply, NREL will evaluate only those offers based on use of the equivalent domestic or Recovery Act designated country construction material, and the offeror shall be required to furnish such domestic or Recovery Act designated country construction material. An offer based on use of the foreign construction material for which an exception was requested—
   (i) Will be rejected as nonresponsive if this acquisition is conducted by sealed bidding; or
   (ii) May be accepted if revised during negotiations.

H. Information Regarding Performance and Payment Bonds

1. **Performance Bond**

A performance bond secures performance and fulfillment of the subcontractor's obligations under the subcontract. A performance bond is required in connection with this subcontract in accordance with FAR 28.102-2. The subcontractor shall submit the performance bond to the Subcontract Administrator prior to award of Phase II of the work. The penal sum of the Performance Bond shall be one hundred percent (100%) of the original subcontract price. If the subcontract price is increased during the performance of the subcontract, the subcontractor shall obtain additional performance bond protection equal to one hundred percent (100%) of the increase in subcontract price.

2. **Payment Bond**

A payment bond assures payments as required by law to all persons supplying labor or material in the prosecution of the work provided for in the subcontract. A payment bond is required in connection with this subcontract's requirement in accordance with FAR 28.102-2. The subcontractor shall submit the payment bond to the Subcontract Administrator prior to the award of Phase II work. The penal sum of the Payment Bond shall be one hundred percent (100%) of the original subcontract price. If the subcontract price is increased during the performance of the subcontract, the subcontractor shall obtain additional payment bond protection equal to one hundred percent (100%) of the increase in subcontract price.

I. Information Regarding Insurance Requirements

1. The Offeror shall be required to provide, maintain, and verify coverage of at least the kinds and minimum amounts of insurance required in any resultant subcontract. Specifically, the Offeror's team will be required to provide Workers' Compensation Employer's Liability, Commercial General Liability, Automobile Liability; Architect/Engineer Professional Liability and Errors and Omissions, and "All Risk" Builder's Risk insurance coverage in at least the amounts specified in the Appendix B-10 clause titled "Insurance - Work on a Government Installation."

2. Certificates of Insurance shall list the Alliance for Sustainable Energy, LLC and the U.S. Department of Energy as additional insured's and contain an endorsement that any cancellation or material change in the coverage adversely affecting NREL's and the Government's interest shall not be effective unless the insurer or the subcontractor gives written notice of cancellation or change with 30 days advance written notice to the NREL Subcontract Administrator.

J. Davis-Bacon Wage Determination

1. Pursuant to the provisions of the Davis-Bacon Act, 40 U.S.C. 276 (a)-276(a)-7, as amended, the Secretary of Labor has determined that rates of wages and fringe benefits listed in the enclosure entitled "Davis-Bacon Wage Determination", are those prevailing for the specified classifications in the locality of the work covered by this RFP's specifications. Such rates of wages and fringe benefits listed in the Davis-Bacon Wage Determination shall be the minimum rates per hour to be paid for the work covered by this RFP's specifications. Refer to the clause entitled "Davis-Bacon Act" of the Appendix B-10 Standard Terms and Conditions for Construction Subcontracts for additional requirements.

2. The latest wage rate determination made by the Secretary of Labor for Jefferson County, Colorado, is included herein. The complete Davis-Bacon Wage Determination is incorporated in this RFP and shall be incorporated into any subsequent subcontract, regardless of whether the offeror / Subcontractor will employ all the classifications of laborers and mechanics listed in the Davis-Bacon Wage Determination.

3. Based on a preliminary assessment of the scope of the work, the following wage decisions will apply, as follows:

Parking Structure(s) and Site Entrance Building	Decision CO100007, Building
Infrastructure & On Site Roads	Decision CO100012, Heavy
Add Alternate No. 1	Decision CO100014, Highway

The successful Offeror will be responsible for categorizing work segments by wage decision, segregating categories of the work in accordance with provisions of the Davis-Bacon Act, paying not less than the prevailing wages applicable for each category of work, and for submitting certified payroll and related reports for each category of the work.

K. Responsibilities for Completion Delay and Safety or Environmental Occurrences

The subcontract will include an article delineating the Subcontractor's responsibilities for completion delay, environmental, safety and health violations. Please refer to the article "Allocation of Liability and Responsibility for Violations of Safety and Environmental Requirements" in the subcontract schedule.

L. Solicitation Provisions—full text provided

1. Withdrawal of offers is discouraged

Withdrawal of offers is discouraged. Notwithstanding, offers may be withdrawn by written notice received at any time before award. Offers may be withdrawn in person by an offeror or an authorized representative, if the representative's identity is made known and the representative signs a receipt for the offer before award.

2. Restrictions on disclosure and use of data

Offerors who include in their proposals data that they do not want disclosed to the public for any purpose or used by the government or NREL, except for evaluation purposes shall—

a. Mark the title page with the following legend:

"This offer includes data that shall not be disclosed outside the government or the NREL and shall not be used or disclosed—in whole or in part—for any purpose other than to evaluate this offer. If, however, a subcontract is awarded to this offeror as a result of—or in connection with—the submission of this data, the government or NREL shall have the right to duplicate, use, or disclose the data to the extent provided in the resulting subcontract. This restriction does not limit the government or NREL's right to use information contained in this data if obtained from another source without restriction. The data subject to this restriction are contained on pages [insert page and line numbers or other identification of pages] of this offer"; and

b. Mark each page of data it wishes to restrict with the following legend:
"Use or disclosure of data contained on this page is subject to the restriction on the title page of this offer."

3. Disclaimer

NEITHER THE UNITED STATES; NOR THE DEPARTMENT OF ENERGY; NOR ALLIANCE FOR SUSTAINABLE ENERGY, LLC; NOR ANY OF THEIR CONTRACTORS, SUBCONTRACTORS, OR THEIR EMPLOYEES MAKE ANY WARRANTY, EXPRESS OR IMPLIED, OR ASSUME ANY LEGAL LIABILITY OR RESPONSIBILITY FOR THE ACCURACY, COMPLETENESS, OR USEFULNESS FOR ANY PURPOSE OF ANY OF THE TECHNICAL INFORMATION OR DATA ATTACHED OR OTHERWISE PROVIDED HEREIN AS REFERENCE MATERIAL.

4. Solicitation disputes

The General Accounting Office and the Department of Energy do not accept or rule on disputes for solicitations for Requests for Proposals issued by Management and Operating

Contractors for the Department of Energy (operators of Department of Energy National Laboratories). Should an offeror have any concerns regarding NREL's solicitation process or selection determination, the offeror may contact Mark Barela, Advocate for Commercial Practices, at (303) 384-7559. NREL will address each concern received from an offeror on an individual basis.

M. Notice of Requirement for Affirmative Action to Ensure Equal Employment Opportunity for Construction (derived from FAR 52-222-23, Feb 1999)

1. The offeror's attention is called to the Equal Opportunity clause and the Affirmative Action Compliance Requirements for Construction clause in Appendix B-10.
2. The goals for minority and female participation, expressed in percentage terms for the Subcontractor's aggregate workforce in each trade on all construction work in the covered area, are as follows:

Goals for Minority Participation for Each Trade	Goals for Female Participation for Each Trade
6%	5%

These goals are applicable to all of the Subcontractor's construction work performed in the covered area. If the Subcontractor performs construction work in a geographical area located outside of the covered area, the Subcontractor shall apply the goals established for the geographical area where the work is actually performed. Goals are published periodically in the Federal Register in notice form, and these notices may be obtained from any Office of Federal Contract Compliance Programs office.

3. The Subcontractor's compliance with Executive Order 11246, as amended, and the regulations in 41 CFR 60-4 shall be based on: (1) its implementation of the Equal Opportunity clause, (2) specific affirmative action obligations required by the clause entitled "Affirmative Action Compliance Requirements for Construction,'' and (3) its efforts to meet the goals. The hours of minority and female employment and training must be substantially uniform throughout the length of the subcontract, and in each trade. The Subcontractor shall make a good faith effort to employ minorities and women evenly on each of its projects. The transfer of minority or female employees or trainees from Subcontractor to Subcontractor, or from project to project, for the sole purpose of meeting the Subcontractor's goals shall be a violation of the subcontract, Executive Order 11246, as amended, and the regulations in 41 CFR 60-4. Compliance with the goals will be measured against the total work hours performed.

4. The Subcontractor shall provide written notification to the Deputy Assistant Secretary for Federal Contract Compliance, U.S. Department of Labor, within ten (10) working days following award of any construction lower-tier subcontract in excess of $10,000 (at any tier) for construction work under the subcontract resulting from this solicitation. The notification shall list the --
   a. Name, address, and telephone number of the lower-tier subcontractor;
   b. Employer's identification number of the lower-tier subcontractor;

c. Estimated dollar amount of the lower-tier subcontract;
d. Estimated starting and completion dates of the lower-tier subcontract; and
e. Geographical area in which the lower-tier subcontract is to be performed.

5. As used in this Notice, and in any subcontract resulting from this solicitation, the "covered area" is in Jefferson County, State of Colorado.

N. (Lower-Tier) Small Business Subcontracting Plan

Upon issuance of a Notice of Award to the successful offeror, the successful offeror shall provide a lower-tier subcontracting plan, within 30 calendar days after subcontract award that separately addresses lower-tier subcontracting with small business, small disadvantaged business, and women-owned small business concerns. If the offeror is submitting an individual subcontract plan, the plan must separately address lower-tier subcontracting with small business, small disadvantaged business, and women-owned small business concerns, with a separate part for the basic subcontract and separate parts for each option (if any). The plan shall be included in and made a part of the resultant subcontract. The lower-tier subcontracting plan shall be negotiated within the time specified by the NREL Subcontract Administrator. Failure to submit and negotiate a lower-tier subcontracting plan shall make the offeror ineligible for award of a subcontract. (See NREL website)

Special Note Regarding Add Alternate No. 1. In the event NREL exercises its option to incorporate Add Alternate No. 1 into the subcontract, upon issuance of a Change Order incorporating the Add Alternate work, the subcontractor shall provide a lower-tier subcontracting plan, within 30 calendar days after award of the Change Order. This plan will be separate from the plan established for the base scope of work, and will apply only to work performed under the Add Alternate No. 1. The plan will shall be incorporated in and made a part of the subcontract and will demonstrate the subcontractor's ability to award 100% of all lower tier subcontracted Add Alternate No. 1 work to small business concerns.

O. Solicitation Provisions—Incorporated by Reference—general access

This solicitation incorporates one or more solicitation provisions by reference with the same force and effect as if they were given in full text. The following documents can be downloaded from the NREL **general access** website at http://www.nrel.gov/business_opportunities/related_docs.html or the NREL RFP Contact (see item 2) will make full text available upon request.

1. NREL Standard Terms and Conditions:
   - "**Addendum to Representations and Certifications for Subcontracts"** form applicable to Subcontracts and Purchase Orders funded in whole or in part under American Recovery and Reinvestment Act of 2009
   -Appendix B-10, "**Standard Terms and Conditions for Firm Fixed-Price Subcontracts for Design/Build**", dated January 18, 2010

2. NREL Intellectual Property Provisions:
   -Appendix C-3 (10/22/98)

3. NREL Terms and Conditions for Subcontracts in excess of $500,000.00
   -Appendix D-1 (05/10/10)

4. NREL Representations and Certifications for Subcontracts (5/10/07)

5. NREL Addendum to Representations and Certifications for Subcontracts form applicable to Subcontracts and Purchase Orders funded in whole or in part under American Recovery and Reinvestment Act of 2002

6. NREL Small Business (Lower-tier) Subcontracting Plan Requirements (10/02/08)

7. American Recovery and Reinvestment Act (ARRA) Reporting Requirements with attachment: American Recovery and Reinvestment Act (Recovery Act) Subcontractor Jobs Report.

P. This Competitive Procurement is Open to Large and Small Businesses

1. The North American Industry Classification System (NAICS) code [formerly standard industrial classification (SIC)] for this solicitation is 236220, General Contractors;
2. The small business size standard for 236220 is $33,500,000.00 in annual receipts (Annual receipts of a concern means the annual average gross revenue for the last three fiscal years.)

Q. Information on Add Alternate No. 1

In order to accommodate the anticipated significant growth of the NREL South Table Mountain (STM) site population a new access road is needed to access the STM site. The need for an additional access road to support the increased site population was identified in traffic surveys conducted in 2007, 2008 and most recently in 2009. Alternative access routes were analyzed in Supplement II of the Site Wide Environmental Assessment (SWEA) and on November 6, 2009, the DOE issued a Finding of No Significant Impact (FONSI) for the SWEA. In the FONSI, a preferred access corridor was identified as an extension of Moss Street north to the South Table Mountain campus property line, called the Moss Street Extension.

To facilitate establishment of the Moss Street Extension, Jefferson County, Colorado has agreed to assist with the negotiations for acquisition of the right-of-way and property rights necessary for the construction and use of the new access road. In support of this process, design work on the Moss Street Extension has been performed outside of the scope of work in this RFP. The design work includes or will include engineering plans, drawings, drainage studies, and surveys necessary to demonstrate compliance with the County roadway design requirements. In addition, it is expected that environmental investigations and permitting will also be substantially completed with the exception of those requirements pertaining to construction. As a result, the design of the Moss Street Extension and associated improvements are expected to be substantially developed in conjunction with the right-of-way acquisition process. There will be no flexibility to alter the design.

At the point when the right-of-way and property rights have been obtained, the design of the Moss Street Extension will be substantially complete. The design can then be issued for pricing and negotiation based on the unit pricing provided. It is strongly desired to have the Moss Street Extension operable at the same time the parking structure(s) is ready for use.

1. **Scope of Work**

   This Add Alternate for the South Access Road provides for the construction of the Moss Street Extension. The subcontractor is expected to provide the labor, material, equipment, services, and supplies to complete the work necessary, within the period of performance negotiated, to construct the roadway and associated improvements described in the Moss Street Extension design (to come).

   The Moss Street extension will ultimately be a public roadway maintained by Jefferson County, Colorado (the County). Therefore the construction will comply with the "Jefferson County Roadway Design & Construction Manual", latest version. The Subcontractor will provide a warranty period for one year after completion of the Moss Street Extension.

   Pursuant to NREL's agreement with the County, the Subcontractor will have the right to enter upon Country property for purposes of constructing the Moss Street Extension subject to compliance with all County regulations relating to road closures and other activities affecting the existing right-of-way along South Golden Road.

   The County will consult and provide guidance on the Add Alternate No. 1 project. Upon completion of construction of the Moss Street Extension, the County will complete the process of final acceptance of the right-of-way. According to County policies and procedures, the County will wait one-year after completion of the project (i.e. the "Warranty Period") before accepting the road for County maintenance, as more particularly set forth in Section 33 of the Jefferson County Zoning Resolution. For purposes of clarity, after final acceptance of the Moss Street Extension, the County will provide only snow plowing services at no additional cost, but the County will delay acceptance of all other County maintenance service obligations until after the Warranty Period has expired.

2. **General Requirements**

   The terms and conditions of any subcontract resulting from this solicitation will remain in force for Add Alternate No. 1. In addition the "Jefferson County Roadway Design & Construction Manual", latest version is applicable to the design and construction of these improvements. Additional requirements, such as those resulting from the permitting process, environmental investigations, and acquisition of property rights will be provided with the design documentation.

3. **Schedule**

   The work shall be completed within eight (8) months or less after execution of this alternate. It is the desire of NREL to have the Moss Street Extension completed at the same time or before the parking structure(s) is completed. Schedule milestone dates will be negotiated upon execution of the contract modification.

4. **Unit Pricing**

   The units selected are based on the current conceptual design which is subject to change. The current conceptual design envisions a two-lane curbed collector street 40 feet wide extending from the existing Moss Street/South Golden Road intersection to the southern border of the South Table Mountain campus terminating in the vicinity of the existing surface parking lot. Sidewalks/bike paths are expected to be included with the Moss Street Extension. The street

and sidewalks/bike paths will be situated in a 60 foot wide right-of-way with an additional 20 foot wide temporary construction easement to one side. Additional drainage, slope, bridge and other easements may be obtained as necessary. The South Golden Road intersection is envisioned to be a modified two lane roundabout with improvements to the existing intersecting streets as necessary to accommodate the roundabout.

The unit prices as shown in Proposal Form Attachment #3, "Table of Unit Prices – Add Alternate No. 1" will be used as the bases for negotiation of the price/cost of this add alternate.

NREL, at its sole discretion, may elect to add this alternate to the scope of work any time within the first 200 calendar days of the subcontract period of performance. Offerors are cautioned that there is a specific 100% small business set aside for all lower tier subcontractors performing work on the Add Alternate No. 1 work, as more fully explained in the Small Business Subcontracting Plan information, above.

PROPOSAL FORM ATTACHMENT #1
PROJECT PRIORITIES CHECKLIST

This Checklist is to be submitted as Attachment #1 to the Proposal Form and will be considered in the evaluation process. Objectives noted as "Highly Desirable" or "If Possible" will be evaluated as part of the Best Value Selection process. Write either "Included" or "Not Included" in the space corresponding to each objective your proposal will or will not achieve. As part of the Management Plan narrative, provide an explanation of how your proposal achieves the included objectives.

MISSION CRITICAL	INCLUDED?
1,500 net additional parking spaces for automobiles	
Comply with NREL requirements	
Site Entrance Building – Achieve LEED™ Gold	
Parking Structure(s) - maximize LEED™ points	
Meet the budget	
Promote ease of mobility and campus circulation	
Integrate campus security	
Substantial completion no later than November 2011	

HIGHLY DESIRABLE	INCLUDED?
Minimize Existing Community Impact	
1,800 maximum parking spaces for automobiles	
Substantial Completion not later than September 2011	
Achieve energy goals for parking structure(s) and site entrance building	
Minimize structure height	
Maximize PV capacity capability	
Life cycle cost efficiency (maximize)	
Shuttle "stop" is weather protected	
Promote car pooling & preferential, dedicated, HOV parking for a minimum 5% of spaces	
Incorporate "recycling" drop-off collection point	
Site Entrance Building – Achieve LEED™ Platinum	
Provided covered bicycle parking	
Provide industry supported Electric Vehicle Supply Equipment (EVSE) for 2% of spaces immediately available on opening day	
Minimize O&M for snow/ice removal	

IF POSSIBLE	INCLUDED?
Substantial Completion not later than August 2011	
Provide infrastructure support to expand the industry supported Electric Vehicle Supply Equipment (EVSE) to accommodate up to 20% of the spaces without the need to upgrade or modify the electrical distribution system.	

Parking management technology	
Net Zero Energy for the Site Entrance Building	
Motorcycle parking	

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APPENDICES:

APPENDIX A	STATEMENT OF WORK – CONCEPTUAL DOCUMENTS
ADDENDUM TO APPENDIX B	STANDARD TERMS AND CONDITIONS APPLICABLE TO SUBCONTRACTS AND PURCHASE ORDERS FUNDED IN WHOLE UNDER AMERICAN RECOVERY AND REINVESTMENT ACT OF 2009
APPENDIX B-10	STANDARD TERMS AND CONDITIONS
APPENDIX C-3	INTELLECTUAL PROPERTY PROVISIONS
APPENDIX D-1	CLAUSES FOR SUBCONTRACTS IN EXCESS OF $500,000
APPENDIX E	INTENTIONALLY LEFT BLANK
APPENDIX F	SMALL BUSINESS (LOWER TIER) SUBCONTRACTING PLAN
APPENDIX G	GENERAL WAGE DECISION NO. *****, MODIFICATION No. ** BUILDING, DATED **/**/**, AND GENERAL WAGE DECISION NO. *****, MODIFICATION No. ** HEAVY, DATED **/**/**
APPENDIX H	PERFORMANCE AWARD FEE PROGRAM EVALUATION FORMS

SUBCONTRACT NO. AGH-0-40752-01

BETWEEN

ALLIANCE FOR SUSTAINABLE ENERGY, LLC

AND

*****

SCHEDULE

INTRODUCTION

THIS SUBCONTRACT is effective upon execution by the Alliance for Sustainable Energy, LLC and is between the Alliance for Sustainable Energy, LLC (hereinafter called "NREL or "Alliance/NREL") and *** (hereinafter called "Subcontractor"), whose principal offices are located in ***,***.

Alliance for Sustainable Energy, LLC has entered into Contract No. DE-AC36-08GO28308 (hereinafter called "Prime Contract") with the Department of Energy (hereinafter called "DOE"), an agency of the U.S. Government (hereinafter called "Government"), for the operation and management of the National Renewable Energy Laboratory. All references to "NREL" or "Alliance NREL" in this subcontract shall mean the Alliance for Sustainable Energy, LLC.

THIS SUBCONTRACT IS FUNDED IN WHOLE WITH AMERICAN RECOVERY AND REINVESTMENT ACT (Recovery Act) FUNDS.

This subcontract is entered into in furtherance of the performance of the work provided for in the Prime Contract.

AGREEMENT

NOW THEREFORE, the parties hereto agree to the following terms and conditions:

ARTICLE 1 – THE WORK TO BE PERFORMED (FEB 2008)

A. The Subcontractor shall perform the work generally described as "South Table Mountain Ingress/Egress and Traffic Capacity Upgrades" Phase I (Preliminary Design) and specifically provided for in Appendix A, Conceptual Documents, attached hereto and made a part hereof, pursuant to the provisions of this subcontract.
B. Specific deliverables, quantities, due dates, reporting requirements, and addresses are set forth in Appendix A hereto.
C. This Subcontract includes the design development and construction (Phase II) of the South Table Mountain Ingress/Egress and Traffic Capacity Upgrades (INEG) and Add Alternate No. 1 outlined as follows:

1. Phase II: Design Development and Construction of the INEG. Upon completion of the preliminary design, NREL may at its discretion enter into negotiations for the design development and construction of the INEG with the Subcontractor. Upon successful negotiations for the design development and construction of the INEG, a modification to this Subcontract will be issued.

2. Add Alternate No. 1: Moss Street Extension. NREL may include the scope of the Moss Street Extension, or any portion of that scope into this subcontract. Upon successful negotiation for the Moss Street Extension scope, a modification may be issued to incorporate this Add Alternate No. 1 into the Subcontract.

ARTICLE 2 – COMMENCEMENT, PROSECUTION, AND COMPLETION OF WORK (FEB 2008)

A. Phase I of this Subcontract (preliminary design):

The period of performance for Phase I under this subcontract shall commence upon the execution date of this subcontract and shall be completed ***** (***) calendar days after such date; provided, however that this period may be extended for an additional period by mutual written agreement of the parties. NREL will make a decision, based on its sole judgment, whether or not to continue and fund Phase II, prior to the completion date of Phase I. If the decision is not to continue and fund Phase II, this subcontract shall be considered complete upon submittal of the preliminary design with comments specified by NREL, if any.

B. Phase II of this Subcontract (design development and construction):

1. The Subcontractor shall be required to (a) commence work under this subcontract within ten (10) calendar days of NREL's execution of the modification, which execution constitutes NREL's formal notice to proceed, (b) prosecute the work diligently, and (c) complete the entire work to achieve substantial completion not later than **** (***) calendar days after such execution date. Such prosecution and completion are subject to the provisions of the Article 22 "NEPA Compliance as a Condition Precedent to Work Performance" herein. The time for completion shall include final cleanup of the premises.
2. NREL will not execute the Subcontract modification until the Subcontract Administrator has received all of the following documents:
    a. An executed version of the subcontract modification with original signatures of the subcontractor;
    b. Certificate(s) of insurance evidencing that required coverage and limits of insurance are in full force and effect.
3. Subcontractor shall submit Performance and Payment bonds and a site specific safety plan to NREL for acceptance prior to commencement of any Phase II work.
4. The Subcontractor shall achieve Substantial Completion within *** calendar days after execution of the subcontract for Phase I scope as outlined in Article 1 above, and shall achieve Final Completion of the entire work within *** calendar days after receipt of the execution of the subcontract. Such Substantial Completion and Final Completion are subject to the provisions of the Article 22 "NEPA Compliance as a Condition Precedent to Work Performance" herein.

a. Substantial Completion is defined as "when the work or designated portion thereof is sufficiently complete, in accordance with the subcontract documents, so NREL may occupy the work or designated portion thereof for the use for which it is intended". Additional prerequisites to Substantial Completion are listed in Appendix A, Conceptual Documents.
b. Final Completion is defined as "when all work reasonably inferable from the subcontract documents has been completed, approved and accepted by NREL, including the final cleanup of the premises, completion of all final inspection punch list items, and submission of all required documents including warranties". Additional prerequisites to Final Completion are listed in Appendix A, Conceptual Documents.
c. Warranty Period is defined as "one year post substantial completion". Warranty Period for re-vegetation/landscaping begins one year from final completion.

ARTICLE 3 – PRICE, PAYMENTS, AND INVOICES (FEB 2008)

A. In full consideration of the Subcontractor's performance of preliminary design (Phase I) of this design-build project covered by this subcontract, NREL shall pay the Subcontractor the firm fixed price of **** Dollars ($ *,***.**) in accordance with this Article, the clause entitled "Payments Under Fixed Price Construction Subcontracts" of Appendix B-10, and other provisions of this subcontract. NREL may, at its sole discretion, offer an Award Fee incentive payment.

B. The Subcontractor is hereby authorized to use the NREL tax exempt number 98-19771-0000 for any use or sales tax which would otherwise apply for the acquisition of any materials or equipment that is required in the performance and delivery under this subcontract.

C. To facilitate processing and payment each invoice must reference the subcontract number which appears on the cover sheet of this subcontract. Payments under this subcontract shall be made to the Subcontractor's remittance name and address shown on the cover sheet of this subcontract.

D. The payment terms of this subcontract shall mean net days from the date of receipt of an acceptable invoice (including appropriate certification(s) and payroll records). Final payment by NREL shall be contingent upon inspection and acceptance of the work effort required by this subcontract, and receipt by NREL of an appropriately signed "Release of Claims" form from the Subcontractor.

E. Any payments made under this subcontract shall not be deemed to prejudice any rights that NREL may have by law or under other provisions of this subcontract.

F. Invoices for work accomplished under this subcontract shall be submitted in an original and two copies, in a form satisfactory to the Subcontract Administrator, accompanied by the "Certificate for Payment" to:

National Renewable Energy Laboratory
Attn: *** ***, Subcontract Associate
1617 Cole Boulevard MS 1533
Golden, CO 80401-3393

An authorized representative of the Subcontractor shall sign the following certification on each invoice submitted for payment:

For invoices for work effort supported by Recovery Act funds, the following certification should be included and signed on each invoice submitted for payment:

"RECOVERY ACT FUNDED WORK EFFORT

I hereby certify, to the best of my knowledge and belief that, (1) the amounts requested are only for performance in accordance with the specifications, terms and conditions of the subcontract; (2) payments to lower-tier subcontractors and suppliers have been made from previous payments received under this subcontract, and timely payments will be made from the proceeds of the payment covered by this certification, in accordance with lower-tier subcontract agreements and the requirements of Chapter 39 of Title 31, United States Code; (3) this request for progress payments does not include any amounts which the Subcontractor intends to withhold or retain from a lower-tier subcontractor or supplier in accordance with the terms and conditions of the lower-tier subcontract; and, (4) this invoice is correct and proper for payment, and reimbursement for this amount has not and will not be received under any other Government contract or TOA or other source of Government funds.

_____ _____
Authorized Official Date"

ARTICLE 4 – PHASE I MILESTONE AND NREL RIGHT OF TERMINATION FOR CONVENIENCE (SPECIAL) (MAY 2008)

A. Upon NREL and the Subcontractor's mutual determination of the satisfactory completion of the Phase I Preliminary Project Performance Baseline milestone review, the Subcontractor shall be entitled to 100% payment of the percent of work completed that meets the standards of quality established under the subcontract, minus monthly progress payments paid to date, not to exceed a total of 75% of the firm fixed price of Phase I. Upon NREL and the Subcontractor's mutual determination of the satisfactory completion of Phase I and NREL and the Subcontractor's successful negotiation of the Phase II modification, the Subcontractor shall be entitled to payment of the remaining balance of the percent of work completed that meets the standards of quality established under the subcontract, minus monthly progress payments paid to date, not to exceed a total of 100% of the firm fixed price of Phase I.

B. In the event that NREL and the Subcontractor mutually determine that the Subcontractor has not achieved satisfactory completion of the Phase I Preliminary Project Performance Baseline milestone review, the Subcontractor shall be entitled to 75% payment of the percent of work completed that meets the standards of quality established under the subcontract, minus monthly progress

payments paid to date, not to exceed a total of 75% of the firm fixed price of Phase I and the subcontract shall be completed. In the event that NREL and the Subcontractor mutually determine that the Subcontractor has not achieved satisfactory completion of Phase I, the Subcontractor shall be entitled to 100% payment of the percent of work completed that meets the standards of quality established under the subcontract, minus monthly progress payments paid to date, not to exceed 75% of the firm fixed price of Phase I and the subcontract shall be completed.

C. Notwithstanding Paragraphs A and B above, the Subcontractor shall be entitled to payment upon completion and acceptance by NREL of the geotechnical services in accordance with the article titled Price, Payments, and Invoices of the Subcontract Schedule and the clause titled Payments Under Fixed-Price Construction Subcontracts of Appendix B. NREL shall not retain or withhold payment or any portion of payment for geotechnical services accepted by NREL.

D. The Termination for Convenience clause shall be applicable in the event that NREL unilaterally terminates the subcontract.

ARTICLE 5 - AWARD FEE INCENTIVE STRUCTURE (FEB 2008)

NREL has established an award fee pool in a not-to-exceed amount of $ 1,000,000.00 to promote excellent performance by the design-build team.

A. NREL may, at its sole discretion, offer an Award Fee incentive payment for work performed under this subcontract. If exercised, such Award Fee incentive program shall be incorporated by modification to this subcontract. This subcontract provides the opportunity to achieve Award Fee incentives in the following categories:

1. Safety
2. Design Effort and Objectives
3. Workmanship – Quality of All Work
4. Responsiveness – Problem Solving
5. Cooperation
6. Communication (including information provided for and disseminated to the existing community) and Professionalism
7. Timeliness of Completion

B. In addition to the categories above, the following items will also be evaluated as part of the Award Fee incentive in the fifth stage (completion of Closeout) under this subcontract:

1. Issuance by NREL of a Certificate of Substantial Completion for the work under this subcontract and return of a signed copy of the Certificate by the subcontractor;
2. Final Completion of the work within 45 calendar days of Substantial Completion;
3. Compliance with all requirements of the subcontract documents;
4. Final inspection and acceptance of the work by NREL, and NREL approval of the subcontractor's final payment request including the subcontractor's Release of Claims, no later than 75 calendar days after the date of Substantial Completion for the subcontract.

C. The award and payment of any portion of the Award Fee shall be at the sole discretion of NREL and is not subject to the disputes clause of this subcontract.

D. Any Award Fee awarded to the subcontractor shall be incorporated by modification into the subcontract. Payment will be contingent upon the submission by the subcontractor of a properly prepared invoice. Award Fee shall be tracked and billed separately from progress payments.

E. Evaluation stages are contemplated to be at the conclusion of the following stages:

1. Completion of Preliminary Design Milestone
2. Completion of Design Development Milestone
3. Completion of Construction Document Milestone
4. Completion of Construction Milestone
5. Completion of Closeout Milestone
6. 12 month post occupancy

F. Percentage of Award Fee available at each evaluation stage is contemplated as follows:

1. First evaluation – not more than 20% of Award Fee
2. Second evaluation – not more than 15% of Award Fee
3. Third evaluation – not more than 15% of Award Fee
4. Fourth evaluation – not more than 30% of Award Fee
5. Fifth evaluation – not more than 15% of Award Fee
6. Final evaluation – not more than the balance of the Award Fee

G. NREL reserves the right to "rollover" any unearned Award Fee to the next evaluation stage.

ARTICLE 6– DESIGN-BUILD – SUBCONTRACTOR'S FIRM-FIXED PRICE (JUN 2008)

A. The Subcontractor shall, in accordance with the terms and conditions of this subcontract, provide the personnel, materials, supplies, and services (except as may be expressly set forth in this subcontract as furnished by NREL) and otherwise do all things necessary and incident to designing and constructing the South Table Mountain Ingress/Egress and Traffic Capacity Upgrades (INEG), as described in Appendix A, Conceptual Documents.

B. If the Subcontractor is part of a consortium, joint venture, and/or other teaming arrangement, the team shall share in the firm fixed price of this subcontract and no separate additional "subcontractor fee" for teaming partners will be paid under the subcontract. If the Subcontractor, supplier, or lower-tier subcontractor is wholly owned, majority owned, or an affiliate of any team member, any fee or profit earned by such entity will be paid under this subcontract.

C. The Subcontractor guarantees that the total price of the Phase I work to be performed under this subcontract is a firm-fixed price of **** Dollars ($ *,***.**). The subcontract shall be subject to full compliance with requirements defined in the Appendix A, Conceptual Documents, and as subsequently amended from time to time during the performance of this subcontract through mutual, good faith negotiations and subsequent written agreement between NREL and the Subcontractor.

D. Except for costs exceeding the Subcontractor's firm-fixed price that directly stem from an NREL-directed subcontract modification, the Subcontractor assumes the risk for all costs exceeding the firm-fixed price necessary to meet NREL's inspection and acceptance of the design-build effort; such inspection and acceptance shall not be unreasonably withheld by NREL.

E. Phase II work shall be incorporated into this Article upon successful negotiation and execution of the Phase II modification.

ARTICLE 7 – NEGOTIATED RATES AND FACTORS FOR CHANGE (SPECIAL) (JUN 2008)

A. For the purpose of expediting negotiation of equitable adjustments for subcontract modifications that may occur, the following rates and factors will be applied as and when appropriate for the entire period of performance:

Constructor:

Description	Percentage
Overhead Rate	**.**%
G & A Rate	**.**%
Profit Rate	**.**%
Handling Fee on Materials	**.**%
Handling Fee on Lower Tier Subcontractors	**.**%

Designer:

Description	Total Multiplier On Base Labor
***	$***.**
***	$***.**

Construction Cost Factors are located in Appendix A, Conceptual Documents, Section 4.

B. The following fully burdened hourly rates will apply to modifications for the entire period of performance:

Constructor:

Position	Fully Burdened Rate
***	$***.**
***	$***.**

Architect/Engineer:

Discipline	Fully Burdened Rate
***	$***.**
***	$***.**

C. The Subcontractor's rates incorporated into this subcontract are based on adequate price competition and will be applied for the entire period of performance of this subcontract and any subsequent modifications.

ARTICLE 8 – APPLICABLE DOCUMENTATION (OCT 2007)

In addition to the terms and conditions contained in this Schedule, the following documents are attached hereto and made a part of this subcontract:

A. Appendix A, entitled "Concept Documents, Design-Build of the South Table Mountain Ingress/Egress Upgrades", Revision 0, dated 06/02/10;

B. "Addendum" to Appendix B – Standard Terms and Conditions, applicable to Subcontracts and Purchase Orders funded in whole under American Recovery and Reinvestment Act of 2009, dated 09/03/09.

C. Appendix B-10, entitled "Standard Terms and Conditions" dated 01/18/10;

D. Appendix C-3, entitled "Intellectual Property Provisions" dated 10/22/98;

E. Appendix D-1, entitled "Clauses for Subcontract in Excess of $500,000" dated 05/10/10;

F. Appendix E – Intentionally Left Blank

G. Appendix F, entitled "Small Business (Lower Tier) Subcontracting Plan" dated **/**/**(to be submitted to NREL for acceptance within 30 calendar days of subcontract award);

H. Appendix G, entitled "General Wage Decision No. ***, Modification No. ** Building, dated **/**/** and General Wage Decision No. ***, Modification No. ** Heavy, dated **/**/**;

I. Appendix H, entitled "Performance Award Fee Program Scoring Evaluation Forms";

J. Other provisions of this subcontract whether incorporated by reference or otherwise; and

K. Subcontractor's technical proposal dated **/**/** together with any revisions, is hereby incorporated by reference. In the event there is a conflict between the Subcontractor's technical proposal and any other provisions of this subcontract, the latter shall prevail.

ARTICLE 9 – ORDER OF PRECEDENCE (OCT 2007)

Any inconsistency in this subcontract shall be resolved by giving precedence in the following order:

A. This Schedule;

B. Statement of Work , Conceptual Documents (Appendix A);

C. Addendum to Appendix B – Standard Terms and Conditions, applicable to Subcontracts and Purchase Orders funded in whole under American Recovery and Reinvestment Act of 2009;

D. Standard Terms and Conditions (Appendix B-10);

E. Intellectual Property Provisions (Appendix C-3);

F. Clauses for Subcontracts in Excess of $500,000 (Appendix D-1);

G. Small Business (Lower Tier) Subcontracting Plan (Appendix F);

H. General Wage Decision Number ***, Modification No. **, Building, dated **/**/**, and Decision Number ***, Modification No. **, Heavy, dated **/**/** (Appendix G);

I. Performance Award Fee Program Scoring Evaluation Forms (Appendix H)

J. Other provisions of this subcontract whether incorporated by reference or otherwise;

K. The Subcontractor's technical proposal, if incorporated in this subcontract by reference or otherwise.

ARTICLE 10 - SUBCONTRACT ADMINISTRATION RESPONSIBILITIES (SUBCONTRACT FOR DESIGN-BUILD, CONSTRUCTION, A&E SERVICES, AND SERVICES – SITE OPERATIONS) (SEP 2007)

A. Signature Authority:

This Subcontract may only be modified or changed by a binding direction signed by an authorized official of the NREL.

B. Subcontract Administration Responsibilities:

1. The authorized official of NREL has designated Steven McCormick as the Subcontract Administrator for this Subcontract with the responsibilities for administering the subcontract and directing binding modifications and changes to this subcontract. The Subcontract Administrator's telephone number is (303) 275-3764.
2. The Subcontract Administrator is the only individual authorized to direct to the Subcontractor binding modifications and changes under this Subcontract and such authority shall remain solely with the Subcontract Administrator regardless of any other provisions of this Subcontract. With Project Manager's concurrence, the Subcontract Administrator shall direct such binding modifications and changes in writing to the Subcontractor. The Subcontractor shall address all contractual and administrative correspondence directly to the Subcontract Administrator.
3. Except for changes resulting from an emergency described in subparagraph 4 below, no written or verbal statement from the Project Manager or any other individual shall be construed to be a binding direction unless or until the Subcontract Administrator directs to the Subcontractor a written modification or change to this Subcontract. The Subcontractor assumes the risk and sole expense of any such unauthorized changes and hereby waives all rights to costs and time extensions that stem directly from changes made without prior written direction from the

Subcontract Administrator. NREL shall make no adjustment to the subcontract price and/or performance period for changes made by the Subcontractor without the binding direction of the Subcontract Administrator.

4. In the event of an emergency, the Project Manager or any individual may direct the Subcontractor to make a change necessitated by such emergency. Except for unsafe work conditions as set forth in the Article "Worker Safety and Health Requirements," in the event that the Subcontractor is directed by the Project Manager or any individual to make a change resulting from an emergency that requires the Subcontractor to take immediate action, the Subcontractor shall be entitled to an equitable adjustment in subcontract price and performance period (if any) covering only that period up to and no later than the second working day after the date on which the change resulting from such emergency occurred.

C. Project Management Responsibilities:

1. The authorized official of NREL has designated *** *** as the Project Manager for this Subcontract with the accountability for stewardship of the Subcontractor's technical project performance with respect to the scope, schedule, and budget under this Subcontract. The Project Manager's telephone number is (***) ***-****. The Subcontractor shall address all technical project performance correspondence to the Project Manager, with an informational copy sent to the Subcontract Administrator.
2. The Project Manager is accountable for stewardship of the Subcontractor's technical project performance, but is not authorized to direct to the Subcontractor binding modifications and changes to the Subcontractor's technical project performance, including scope of work, schedule, budget, performance period, or terms and conditions under this Subcontract.
3. Except for changes resulting from an emergency that requires the Subcontractor to take immediate action, any change made by the Subcontractor based on a statement from the Project Manager shall be at the risk and sole expense of the Subcontractor. The Subcontractor shall immediately refer all such changes to the Subcontract Administrator designated in Paragraph B above.

ARTICLE 11 – KEY PERSONNEL AND LOWER TIER SUBCONTRACTORS (SPECIAL-INEG)(MAY 2010)

The key personnel listed below, or other personnel approved by the Subcontract Administrator as persons of substantially equal abilities and qualifications, are necessary and key to the successful performance of this subcontract. The Subcontractor agrees to assign such employees or persons to the performance of the work under this subcontract, and shall not reassign or remove any of them without prior written approval of the Subcontract Administrator. If, for any reason not the fault of the Subcontractor, one or more of these individuals are unavailable to work under this subcontract, the Subcontractor shall, with the approval of the Subcontract Administrator, replace such employee with an individual of substantially equal abilities and qualifications.

Constructor

Name	Title	Telephone No.
*** ***	***	(***) ***-****
*** ***	***	(***) ***-****

Designer

Name	Title	Telephone No.
*** ***	***	(***) ***-****
*** ***	***	(***) ***-****

Lower Tier Subcontractors

Name	Title	Telephone No.
*** ***	***	(***) ***-****
*** ***	***	(***) ***-****

ARTICLE 12 – SUBCONTRACTOR'S SAFETY MANAGER (OCT 2007)

The Subcontractor shall have a competent full-time Safety Manager, who is satisfactory to the Subcontract Administrator and has authority to act for the Subcontractor, on site at all times during the construction phase of this subcontract. The Subcontractor's Safety Manager must be an employee of the Subcontractor.

ARTICLE 13 – PARTNERING (OCT 2007)

The term "partnering" and "partnership" used in conjunction with this subcontract shall mean a relationship of open communication and close cooperation that involves both NREL and Subcontractor personnel working together for the purpose of establishing a mutually beneficial, proactive, cooperative environment within which to achieve subcontract objectives, resolve issues, and implement actions as required. Such relationship shall in no event be deemed to modify the subcontract between the Subcontractor and NREL, nor shall it be deemed to create a contractual relationship between NREL and any "partner".

Partnering is expected to disclose the intentions of NREL, the Subcontractor, lower-tier subcontractors and the design-build team as each understands its contractual obligations to other "partners", but is not intended to change any of the contractual obligations of the "partners". Sustained commitment to the design-build process is essential to assure success of the relationship. This partnership will be structured to draw on the strengths of each organization to identify and achieve mutual objectives. The objectives are intended to complete the subcontract requirements at the firm-fixed amount and on schedule.

ARTICLE 14 – PERFORMANCE OF CONSTRUCTION WORK BY THE SUBCONTRACTOR (OCT 2007)

The Subcontractor shall perform on the site, and with its own organization, construction work equivalent to at least twenty (20) percent of the total amount of work to be performed under the subcontract. This percentage may be reduced by a modification to this subcontract if, during performing the work, the Subcontractor requests a reduction and the NREL Subcontract Administrator determines that the reduction would be to the advantage of NREL.

ARTICLE 15 – SUBCONTRACT DELIVERABLES (SPECIAL) (JUN 2008)

The Subcontractor shall submit the following deliverables for the Subcontract Administrator's approval, as listed or as further defined in the subcontract documents for each Phase of the subcontract work as follows:

Phase I (Preliminary Design)

Item No.	Deliverable	Due Date/Requirement
1.	Insurance Certificate	All but All-Risk (Appendix B-10)
2.	Release of Claims and Certificate of Final Payment	Prior to submitting a final invoice for subcontract
3.	Small Business Subcontracting Plan	Within 30 calendar days of subcontract award
4.	Revised Small Business Subcontracting Plan	As Applicable
5.	American Recovery and Reinvestment Act Reporting Requirements	Monthly throughout the Period of Performance in accordance with Article 35
6.	Progress Documentation and Situational Documentation	As required in Section 2, Conceptual Documents
7.	Substantiation Documentation	At the completion of Preliminary Design
8.	Project Management Deliverables	As specified in Article 16 "Schedules, Breakdowns, Lower-tier Subcontracts, and Payments" and Section 2, Conceptual Documents
9.	Quality Assurance Plan	Within 21 calendar days after Subcontract Award
10.	Preliminary Project Performance Baseline Milestone Requirements	Within 57 calendar days after award of Phase I and 42 calendar days prior to the end of Phase I work

Phase II (Design Development and Construction)

Item No.	Deliverable	Due Date/Requirement
1.	Performance and Payment Bonds	Prior to award of Phase II work
2.	Monthly Man-hours Report	Within 5 calendar days after the end of each month
3.	Insurance Certificate	All required Insurance prior to Phase II work
4.	Release of Claims and Certificate of Final Payment	Prior to submitting a final invoice for subcontract
5.	Certified Payrolls	Weekly
6.	Standard Form 1413	For each lower tier subcontractor – due at least 10 calendar days prior to start of on site work
7.	NREL Subcontract Risk Evaluation Worksheet (EMR)	For subcontractor and all lower tier subcontractors – due at least 10 calendar days prior to start of on site work
8.	American Recovery and Reinvestment Act Reporting Requirements	Monthly throughout the Period of Performance in accordance with Article 35

9.	Small Business Subcontracting Reports	As Applicable
10.	Revised Small Business Subcontract Plan	As Applicable
11.	Project Record Documents	At Completion of Construction
12.	Progress Documentation and Situational Documentation	As required in Section 2 – Conceptual Documents
13.	Project Management Deliverables	As specified in Article 16 "Schedules, Breakdowns, Lower-tier Subcontracts, and Payments" and Section 2– Conceptual Documents
14.	Environmental, Health and Safety Deliverables	As specified in NREL Procedure 6-4.12 "Construction Environment, Health, and Safety"
15.	Commissioning Plan	30 days after Award for Phase II
16.	Commissioning Reports	7 calendar days after completion of the commissioning activity
17.	Substantiation Documentation	At the completion of each project phase: Design Development, Construction Documents, Construction, Substantial Completion and Closeout.
18.	Closeout Submittals	As required in Section 2 – Conceptual Documents; prior to project closeout.

ARTICLE 16 – SCHEDULES, BREAKDOWNS, LOWER-TIER SUBCONTRACTS, AND PAYMENTS (SPECIAL-INEG) (MAY 2010)

A. Description
   1. The Subcontractor shall develop a Detailed Cost Loaded schedule using Critical Path Method (CPM) demonstrating complete fulfillment of all subcontract requirements, shall keep the CPM network up to date in accordance with the requirements of this section and shall utilize the CPM in planning, coordinating, performing and reporting the work under this subcontract, including all activities of lower-tier subcontractors, equipment vendors, and suppliers, and in assisting the Subcontract Administrator and Project Manager in monitoring the progress of the work.
   2. The principles and definition of CPM in terms used herein shall comprise a graphic description of the preliminary design, design development, construction documents, commissioning, and closeout plan, showing the sequential steps needed to reach the completion of the work from Subcontract Award to the subcontract completion date. The CPM schedule shall be comprehensive and shall include all interdependencies and interactions required to perform the work of the project. There shall be no constrained activities and all activities should have a predecessors or successors except the beginning and ending network nodes. Logic relationships should be Finish-to-Start with a lag of 0 days whenever possible (At least 80% of all activities, preferably more shall have no lag.) Discrete (non-Level of Effort – Hammock or Summary) activity durations should be no greater than 1 month in duration whenever possible. Activities shall have budgeted costs applied and shall provide the basis of the monthly progress payments.

B. Submittals
   1. An update within ten (10) calendar days following receipt of Subcontract Award for Phase I and prior to engaging a new consultant or commencing performance of the work specified in this article with its own forces, the Subcontractor shall submit to the Subcontract Administrator:

   a. The name and the address of the proposed consultant.
   b. Information sufficient to show that the proposed consultant or the Subcontractor's own organization has staff and computer facilities meeting the requirements herein.
   c. A list of projects for which the proposed consultant or the Subcontractor's own organization or staff thereof has performed services similar to those required for this subcontract.
2. The preliminary Detailed Cost Loaded Schedule for Phase I work scope shall be submitted within 14 calendar days after Subcontract Award for Phase I work and within 21 calendar days after Subcontract Award for Phase II work. The Subcontractor shall use Primavera P6 software program to develop aforesaid schedule.
3. Within thirty (30) calendar days of acceptance of the preliminary cost loaded schedule, for each Phase, the Subcontractor shall submit a final Detailed Cost Loaded Schedule.
4. Before final acceptance of the work, the Subcontractor shall submit a final As-Built Schedule.
5. The Subcontractor shall submit all other required reports referenced herein when required by this provision.
6. The Subcontractor shall submit one (1) reproducible and six (6) blue-line prints of each required schedule and reports to the Subcontract Administrator, including required revisions thereof. The Subcontractor shall also submit to the Subcontract Administrator in electronic format the computer data used to produce hard copy submittals. Electronic submittals shall be in a Primavera P6 format compatible with the Subcontract Administrator's scheduling software.
7. The Subcontractor shall submit the monthly updated Detailed Cost Loaded Schedules, for each Phase and reports referenced herein concurrently in a single package.
8. Schedule Changes:
   a. Submit updated schedule(s) whenever adjustments that change the subcontract times and/or milestones are realized.
   b. Updates shall be submitted within 7 calendar days after discovery of required changes.
   c. Submitted adjusted schedules are subject to approved by NREL if the originally submitted schedule being updated was required to be approved by NREL, or is a part of the technical proposal by the Subcontractor.

C. Breakdown of Schedule of Values. Within fourteen (14) calendar days after receipt of the Subcontract Award for each Phase of this subcontract, and prior to payment of any invoices by NREL, the Subcontractor shall submit a breakdown of Schedule of Values (in the form, detailed and numbered prescribed by the Subcontract Administrator), totaling the subcontract price, to the Subcontract Administrator for approval.
   1. The breakdown (hereinafter referred to as the "Schedule of Values") shall correspond to the phases or items indicated in the Detailed Subcontract Schedule showing separate amounts for labor, materials and equipment necessary to complete the work, including quantities and unit prices as requested by the Subcontract Administrator.
   2. Overhead, general and administrative, and other approved markups on labor, materials or equipment shall be included in each of the several items to which they are applicable and will not be stated as separate items. The cost of bonds, however, should be stated in a separate line item.
   3. The Subcontract Administrator shall have the right to revise the Schedule of Values submitted, prior to the Subcontract Administrator's approval, if, in the Subcontract Administrator's opinion the items indicated do not conform to their true value. The breakdown shall be revised at the same time revisions become necessary in the Detail Subcontract Schedule.

4. The Subcontractor shall submit a Project-Level Cash Flow Curve based on the Schedule of Values along with the Schedule of Values submittal. The curve shall show the cumulative planned expenditures in dollar, time-scaled in calendar months from Subcontract Award to the Subcontract completion date. The Subcontractor shall submit one (1) reproducible and six (6) blue-line prints of each required Cash Flow Curve to the Subcontract Administrator, including required revisions thereof and monthly payment requests. The Subcontractor shall also submit to the Subcontract Administrator in electronic format the computer data used to produce hard copy submittals. Electronic submittals shall be in Excel format.

D. Lower-tier Subcontracts
   1. Within fourteen (14) calendar days from execution of modification for Phase II work, or no less than fourteen (14) calendar days before Subcontractor's execution of any lower-tier subcontract not previously submitted, the Subcontractor shall submit the names of all lower-tier subcontractors involving on-site labor, together with a summary of the extent, character, and dollar amount of the work to be done by each lower-tier subcontractor. Upon request, the Subcontractor shall also furnish the Subcontract Administrator with copies of all lower-tier subcontracts for performance of the work under this subcontract.
   2. Immediately after issuance of the Subcontract Award, and any time thereafter the Subcontract Administrator may request submittal of purchase orders or lower-tier subcontracts for materials or equipment (including those issued by lower-tier subcontractors). The submittal to the Subcontract Administrator shall be made immediately after the Subcontractor has received confirmation of the various items. The promised date(s) of shipment, point(s) of delivery, quantity and name of items to be furnished and unit prices will be clearly indicated. The date each purchase order or lower-tier subcontract is placed will be furnished to the Subcontract Administrator.
   3. The Subcontractor shall provide to the Subcontract Administrator monthly Man-hours Reports for lower-tier subcontractors monthly.

E. Changes Affecting Delivery. The Subcontractor shall notify the Subcontract Administrator immediately of any changes or circumstances which would affect timely delivery of any item.

F. Basis for Payment
   1. Progress payment shall be computed on a basis of the percentage of completion of the work in place, multiplied by the lump-sum subcontract price, the percentage of completion representing the ratio of the value of that portion of the work completed to the total price, as determined by the application of prices shown in the approved schedule of values.
   2. No payment(s) will be made to the Subcontractor until a schedule of values and progress schedule revised to reflect all changes in Subcontract work have been submitted to and approved by the Subcontract Administrator. Updated Project-Level Cash flow curves shall also be provided with notations describing differences from the last monthly submission to aid the Subcontract Administrator in structuring their internal payment system.

G. Approvals
   1. Acceptance of the Detailed Cost Loaded Schedule, Schedule of Values and Cash Flow Curve will be a condition precedent to the making of any progress payment for work performed beyond sixty (60) calendar days from receipt of Subcontract Award.

2. Monthly updating of all particulars, including status of the Detailed Cost Loaded Schedule and reports shall be an integral part, and basic element of the estimate upon which progress payments will be made. Submittal, review and approval by the Subcontract Administrator of these items shall be a condition precedent to the making of progress payments. If, in the judgment of the Subcontract Administrator, the Subcontractor fails or refuses to provide a complete updated Detailed Cost Loaded Schedule or reports, as specified, the Subcontractor will be deemed to have not provided the required estimate upon which progress payments may be made, and shall not be entitled to such progress payments unless or until it has furnished the aforesaid schedules.

H. Baseline Schedule and Closeout Plan
   1. Once approved by the Subcontract Administrator, the Subcontractor's Detailed Cost Loaded Schedule shall be known as the Baseline Schedule and shall be used by the Subcontractor for executing the work of the subcontract including planning, organizing and directing the work and reporting its progress until subsequently revised.
   2. As a condition precedent to final acceptance of the project, the Subcontractor shall submit to the Subcontract Administrator a final As-Built Schedule and all final reports which accurately reflect the manner in which the project was executed and include actual start and completion dates for all work activities on the Baseline Schedule.

ARTICLE 17 – SCHEDULES FOR SUBCONTRACTS (SPECIAL-INEG) (MAY 2010)

A. The Subcontractor shall, within fourteen (14) calendar days after Subcontract Award for Phase I, and twenty-one (21) calendar days after Subcontract Modification Award for Phase II, for the subcontract or another period of time determined by the NREL Subcontract Administrator, prepare and submit to the NREL Subcontract Administrator for approval three copies of a Detailed Cost Loaded Schedule showing the order in which the Subcontractor proposes to perform the work, and the dates on which the Subcontractor contemplates starting and completing the several salient features of the work (including acquiring materials, plant, and equipment). The detailed cost loaded schedule shall be in the form of a progress chart of suitable scale to indicate appropriately the percentage of work scheduled for completion by any given date during the period. If the Subcontractor fails to submit a Detailed Cost Loaded Schedule within the time prescribed, the NREL Subcontract Administrator may withhold approval of progress payments until the Subcontractor submits the required schedule.

B. The Subcontractor shall enter the actual progress on the detailed cost loaded schedule as directed by the NREL Subcontract Administrator, and upon doing so shall immediately deliver three copies of the annotated schedule to the NREL Subcontract Administrator. If, in the opinion of the NREL Subcontract Administrator, the Subcontractor falls behind the approved schedule, the Subcontractor shall take steps necessary to improve its progress, including those that may be required by the NREL Subcontract Administrator, without additional cost to NREL. In this circumstance, the NREL Subcontract Administrator may require the Subcontractor to increase the number of shifts, overtime operations, calendar days of work, and/or the amount of construction equipment, and to submit for approval any supplementary schedule or schedules in chart form as the NREL Subcontract Administrator deems necessary to demonstrate how the approved rate of progress will be regained.

C. Failure of the Subcontractor to comply with the requirements of the NREL Subcontract Administrator under this clause shall be grounds for a determination by the NREL Subcontract Administrator that the Subcontractor is not prosecuting the work with sufficient diligence to ensure completion within the time specified in the subcontract. Upon making this determination, the NREL Subcontract Administrator may terminate the Subcontractor's right to proceed with the work, or any separable part of it, in accordance with the default terms of this subcontract.

ARTICLE 18 – COORDINATION OF WORK WITH LABORATORY SCHEDULE AND AVERAGE ADVERSE WEATHER DAYS (NOV 2009)

A. Unless otherwise approved in writing by the Subcontract Administrator, the Subcontractor's work shall be performed during NREL work days. In addition, the Subcontractor shall plan its work in recognition of the historic average of adverse weather days experienced in Golden, Colorado, kept by the National Oceanic and Atmospheric Administration (NOAA).

B. A NREL work day means Monday through Friday, 7 a.m. through 4:30 p.m., of each week, except as specified below:
   1. The days designated as NREL holidays (i.e., New Year's Day, Presidents' Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, and Christmas Day) are not NREL work days;
   2. If a NREL holiday falls on a Saturday or Sunday, the preceding Friday or the following Monday may not be a NREL work day;
   3. The Friday after Thanksgiving is not a NREL work day;
   4. Any day that NREL closes unexpectedly will not be an NREL work day.

C. The recorded historic average of adverse weather days experienced in Golden, Colorado each month is as follows:

January	1 days	July	2 days
February	2 days	August	2 days
March	2 days	September	2 days
April	3 days	October	2 days
May	3 days	November	2 days
June	2 days	December	1 days

D. The Subcontractor's progress schedule should reflect these anticipated adverse weather days in all weather dependent activities. In order for NREL to award a non-compensable time extension due to adverse weather: (1) the number of actual adverse weather days experienced at the project site during the entire subcontract period must exceed the cumulative total of the anticipated adverse weather days during the entire subcontract period; and (2) the actual adverse weather days must prevent work on critical activities for more than 50% of the Subcontractor's work day.

E. In the event the Subcontractor believes that a weather event may be considered as a non-compensable time extension for weather delays, they shall report such occurrences to the Subcontract Administrator within 30 calendar days of the adverse weather event.

ARTICLE 19 – LAYOUT OF WORK (OCT 2007)

The Subcontractor shall lay out its work from established base lines and bench marks indicated on the drawings, and shall be responsible for all measurements in connection with the layout. The Subcontractor shall furnish, at its own expense, all stakes, templates, platforms, equipment, tools, materials and labor required to lay out any part of the work. The Subcontractor shall be responsible for executing the work to the lines and grades that may be established or indicated by NREL. The Subcontractor shall also be responsible for maintaining and preserving all stakes and other marks established by NREL until authorized to remove them. If such marks are destroyed by the Subcontractor or through its negligence before their removal is authorized, NREL may replace them and deduct the expense of the replacement from any amounts due or to become due to the Subcontractor.

ARTICLE 20 – PERFORMANCE AND PAYMENT BONDS – CONSTRUCTION

A. Definitions. As used in this clause.
   1. "Original contract price" means the award price of the subcontract; or, for requirements contracts, the price payable for the estimated total quantity; or, for indefinite-quantity contracts, and the price payable for the specified minimum quantity. Original subcontract price does not include the price of any options, except those options exercised at the time of subcontract award.

B. Amount of required bonds. Unless the resulting subcontract price is $30,000 or less, the successful offeror shall furnish performance and payment bonds to the Subcontract Administrator as follows:
   1. Performance Bonds. The penal amount of performance bonds at the time of subcontract award shall be 100 percent of the subcontract amount.
   2. Payment Bonds. The penal amount of payment bonds at the time of subcontract award shall be 100 percent of the subcontract amount.
   3. Additional bond protection
      a. NREL may require additional performance and payment bond protection if the subcontract price is increased. The increase in protection generally will equal 100 percent of the increase in subcontract price.
      b. NREL may secure the additional protection by directing the Subcontractor to increase the penal amount of the existing bond or to obtain an additional bond.

C. Furnishing executed bonds. The Subcontractor shall furnish all executed bonds, including any necessary reinsurance agreements, to the NREL Subcontract Administrator, before starting Phase II work under this subcontract.

D. Surety or other security for bonds. The bonds shall be in the form of a firm commitment, supported by corporate sureties whose names appear on the list contained in Treasury Department Circular 570, individual sureties, or by other acceptable security such as postal money order, certified check, cashier's check, irrevocable letter of credit, or, in accordance with Treasury Department regulations, certain bonds or notes of the United States. Treasury Circular 570 is published in the Federal Register or may be obtained from the:

   U.S. Department of Treasury
   Financial Management Service
   Surety Bond Branch

401 14th Street, NW, 2nd Floor, West Wing
Washington, DC 20227

E. Notice of lower-tier subcontractor waiver or protection (40 U.S.C. 270b(c). Any waiver of the right to sue on the payment bond is void unless it is in writing, signed by the person whose right is waived, and executed after such person has first furnished labor or material for use in the performance of the subcontract.

ARTICLE 21 – PROGRESS MEETINGS AND REPORTS (APR 2004)

A. Preconstruction Meeting: A meeting shall be conducted prior to the start of construction activities. The Subcontractor and its principal lower-tier subcontractors, if any, shall attend this meeting. The purpose of the meeting is to coordinate all aspects of the construction phase including the construction schedule and the special requirements for environmental, safety and security associated with performance of the construction project on a Government-owned or leased facility.

B. Daily Log Reports: The Subcontractor shall prepare, and require its lower-tier subcontractors to prepare, daily reports to be kept on file until subcontract closeout, recording all construction activities at the construction project site including any safety issues or concerns. The NREL Subcontract Administrator or the NREL Project Manager may review these daily log reports, as requested, and may require the Subcontractor to submit two (2) copies of any daily log report to NREL (One copy for the Subcontract Administrator and one copy for the Project Manager).

C. Verbal Reports: The Subcontractor shall provide verbal reports to the NREL Project Manager, as requested, to ensure that NREL is informed of all progress made and any problems that might cause a delay in the completion of this construction project. These verbal reports will ensure that NREL is afforded the opportunity to take appropriate action to avoid or mitigate any problems as they arise under the construction project.

ARTICLE 22 – NEPA COMPLIANCE AS CONDITION PRECEDENT TO WORK PERFORMANCE (OCT 2007)

The Subcontractor shall not commence, and shall not authorize its lower-tier subcontractors to commence, any construction work under this Subcontract without written notification from the NREL Subcontract Administrator authorizing commencement of construction work determined by the U.S. Department of Energy to be compliant with National Environmental Policy Act requirements.

ARTICLE 23 – LIQUIDATED DAMAGES (SPECIAL) (MAR 2009)

A. If the Subcontractor fails to substantially complete the work within the time specified in the subcontract, or any extension, the Subcontractor shall, in place of actual damages, pay to NREL liquidated damages in the following specified number of calendar days of delay. For day 1 through 30, the Subcontractor shall pay the amount of Five Thousand Six Hundred dollars and no cents ($5,600.00) for each calendar day of delay; and for each day after 30 days, the Subcontractor shall pay Nineteen Thousand, Four Hundred dollars and no cents ($ 19,400.00) for each calendar day of delay.

B. If NREL terminates for cause the Subcontractor's right to proceed, the resulting damage will consist of liquidated damages, in place of actual damages, in the amount of Five Thousand Six Hundred Dollars ($5,600.00) calculated as set forth below. Such liquidated damages shall be calculated from the date of substantial completion specified in the subcontract at the time of termination until such reasonable time as may be required for substantial completion of the work by a successor subcontractor or performance bond surety.

C. If NREL terminates for cause the Subcontractor's right to proceed, in addition to the liquidated damages set forth in Paragraph B above the Subcontractor shall be liable for any increased costs in completing the work by a successor subcontractor or performance bond surety.

ARTICLE 24 – RESPONSIBILITY FOR RISK OF LOSS OR DAMAGE (CONSTRUCTION) (JAN 2008)

A. Except as otherwise provided in this subcontract, the risk of loss of or damage to supplies or materials delivered and work performed under this subcontract shall remain with the Subcontractor until completion, inspection, and acceptance of the construction project or completion, inspection, and acceptance of any segregable unit of the construction project.

B. Under paragraph (A) above, the Subcontractor shall not be liable for loss of or damage to supplies or materials caused by the negligence of NREL or the Government's officers, agents, or employees.

ARTICLE 25 – ALLOCATION OF LIABILITY AND RESPONSIBILITY FOR VIOLATIONS OF SAFETY AND ENVIRONMENTAL REQUIREMENTS (CONSTRUCTION) (JAN 2008)

A. NREL and the Subcontractor commit to full cooperation with regard to safety and environmental requirements applicable to the performance of work under this subcontract. This article allocates the liability and responsibility for violations of safety and environmental requirements applicable to the performance of work under this subcontract. For purposes of this subcontract, the term "safety requirements" means requirements imposed by the Department of Energy's "Worker Safety and Health" rule codified at 10 CFR 851 and "environmental requirements" means requirements imposed by applicable Federal, State, and local environmental laws and regulations, including without limitation, statutes, ordinances, regulations, court orders, consent decrees, administrative orders, compliance agreements, permits and licenses.

B. Liability and responsibility for civil fines or penalties arising from or related to violations of safety or environmental requirements shall be borne by the party causing the violation. In the event that the Subcontractor causes a violation of safety or environmental requirements, the Subcontractor shall not be entitled to reimbursement or equitable adjustment from NREL, Alliance for Sustainable Energy LLC or the Government for civil fines or penalties associated with such violation.

C. Liability and responsibility for civil fines or penalties shall be borne by the causing party irrespective of the fact that the cognizant regulatory authority may assess any such fine or penalty upon either party or both parties (or the Government) without regard to the allocation of responsibility or liability under this subcontract. This allocation of liability and responsibility for any such fine or penalty is effective regardless of which party signs permit application's manifests, reports or other required documents, is a permitee, or is the named subject of an enforcement action or assessment of a fine or penalty.

D. In the event that the Subcontractor is deemed to be the primary party causing the violation, then the Subcontractor shall be afforded the opportunity to participate in negotiations to settle or mitigate the fines and penalties with the regulatory authority. If the Subcontractor is the sole party of the enforcement action, the Subcontractor shall take the lead role in the negotiations and NREL shall have sole discretion regarding its participation in such negotiations.

ARTICLE 26 – EXISTING SERVICES AND UTILITIES - (CONSTRUCTION) (FEB 2008)

A. The term "services and utilities" as used here is defined as including, but not limited to, roads, ditches, electrical, phone/data, sewer, water, fencing, natural gas, etc.

B. If applicable to the performance of work under this subcontract, the locations of existing underground services and utilities as indicated on the drawings are approximate, and a utility locate may be required.

C. The Subcontractor shall be responsible for the actual necessary connection(s) to any existing service or utility required in the performance of this subcontract.

D. The Subcontractor is hereby notified that all underground electrical systems and other systems covered by the lockout/tagout program shall be de-energized and locked out during excavations within 5 feet of those systems. Exceptions to this requirement must be approved in writing by the NREL Subcontract Administrator, after concurrence by the NREL Project Manager and NREL ES&H representative. Such outage shall be coordinated with NREL's Project Manager in accordance with Paragraph (E) below.

E. No planned outage will be permitted without prior consent of the NREL Project Manager. The Subcontractor shall coordinate with NREL's Project Manager fourteen (14) full NREL normal working days prior to any approved planned interruption of existing services and utilities required for performance of this subcontract. Interruption of existing services and utilities includes, but is not limited to, existing equipment, piping, electrical service or other utilities, which must be disconnected, shut off, relocated or otherwise modified. The Subcontractor shall be responsible for reconnecting and restoring to the original operating conditions any equipment that was disconnected or put out of service as a result of any interruption (planned or otherwise), unless specified under this subcontract. If significant fire protection system(s) will be impaired longer than eight (8) hours, specific approval shall be obtained from the NREL Project Manager, who shall coordinate with the NREL ES&H representative. The Subcontractor shall attach a safety tag to the device which de-energizes the service (breakers, etc.) and lock or otherwise secure the device in the "off" position so as to prevent accidental reactivation. All utilities tie-in costs and premium time, if any, shall be included in the total subcontract price.

ARTICLE 27 - TEMPORARY STRUCTURES, OFFICES AND WORK AREAS (OCT 2007)

A. The Subcontractor shall be responsible for providing at its own expense, all temporary structures, utilities, and services required by it for use as offices, warehouses, shops, etc. The location and type of any temporary structure shall be approved and coordinated with the NREL Project Manager. Such temporary structures shall be removed by the Subcontractor at its own expense upon the

completion of the construction effort. The Subcontractor shall hold and save NREL and the Government, their officers, employees, and agents free and harmless from liability of any nature associated herewith.

B. Only materials, appliances, and plans to be used for the performance of the subcontract work may be stored in stockpile areas or in warehouses and shop facilities (whether erected by the Subcontractor or not) located on the NREL site. If the Subcontractor abandons the performance of the subcontract work or if the Subcontractor's right to proceed is terminated pursuant to the clause entitled "Default (Fixed Price Construction)," the Subcontractor shall hold and save NREL and the Government and their officers and agents free and harmless from any liability of any nature or kind, arising from NREL's or the Government's entry into such stockpile areas, warehouses, or shop facilities and from NREL's or the Government's taking possession of and utilizing such materials, appliances, and plant in completing the subcontract work.

C. All operations of the Subcontractor, including storage of construction materials and equipment, upon the NREL site shall be confined to areas authorized or approved by NREL. No unauthorized or unwarranted entry upon or passage through, or storage or disposal of materials shall be made upon the NREL site. The Subcontractor shall hold and save NREL and the Government, its officers and agents free and harmless from liability of any nature or kind arising from any use, trespass, or damage occasioned by its operations on premises of third persons.

D. The Subcontractor shall use only established roadways or construct and use such temporary roadways as may be authorized by NREL. Where materials are transported in the prosecution of the work, vehicles shall not be loaded beyond the loading capacity recommended by the manufacturer of the vehicles or prescribed by an applicable Federal, state, or local law or regulation. When it is necessary to cross curbings or sidewalks or to operate heavily loaded vehicles on surfaced streets, sidewalks or developed areas, protection against damage shall be provided by the Subcontractor, and any damaged roads, curbings, sidewalks or developed areas shall be repaired by, or at the expense of the Subcontractor.

E. The Subcontractor shall provide and maintain during the entire period covered by this subcontract a weather-tight bulletin board approximately 7 feet high by 8 feet long. It shall be mounted in a conspicuous place, as approved by the Project Manager, accessible to all employees of the Subcontractor and lower-tier subcontractors. The bulletin board will remain the property of the Subcontractor. All NREL or Government posters or notices, the subcontract's Davis-Bacon Wage Rate decision, Subcontractor's safety programs, and any publications in the interest of workmen shall be displayed on this bulletin board.

ARTICLE 28 – WASTE DISPOSAL

In accordance with the clause entitled “Cleaning Up” of Appendix B-10 the Subcontractor shall be responsible for maintaining a clean and neat construction site and for removing and disposing of all scrap and waste from the construction site in accordance with all applicable laws or regulations at no additional cost to NREL. The Subcontractor shall be responsible for disposing of all excess soil or waste material from excavations and concrete work made by the Subcontractor, unless otherwise specified in this subcontract. The disposal of toxic or hazardous waste is to be coordinated with NREL.

ARTICLE 29 – RIGHTS TO PROPOSAL DATA

Except for technical data contained on pages (none) of the subcontractor's proposal dated *** **, **** which are asserted by the Subcontractor as being proprietary data, it is agreed that, as a condition of the award of this subcontract, and notwithstanding the provisions of any notice appearing on the proposal, the Government and NREL shall have the right to use, duplicate, disclose and have others do so for any purpose whatsoever, the technical data contained in the proposal upon which this subcontract is based.

ARTICLE 30 – PUBLICITY RELEASE AND PUBLIC AFFAIRS

A. Publicity release of any nature in connection with this subcontract shall be coordinated as provided in the "Public Affairs" clause of Appendix B-10. The Subcontractor shall not make without prior review and approval of the NREL Subcontract Administrator, any publicity release of any nature of general, non-technical information in connection with this subcontract. For purposes of this subcontract, general, non-technical information means any information concerning the existence of the subcontract, the identity of the parties, and the scope and general character of the research or technical activity. As used in this Article, "publicity release" does not include a lawful inspection of the Subcontractor's records conducted pursuant to Federal or State public records access statutes. The Subcontractor may report specifics regarding the formation and execution of this subcontract in its internal publications without prior review and approval of the NREL Subcontract Administrator.

B. Data rights are set forth in Appendix C-3 hereof. The Subcontractor should particularly note that all papers and documents that are required for submittal and distribution for patent clearance under this subcontract should first be submitted to the Department of Energy, Intellectual Property law Division, Chicago Operations Office, 9800 South Cass Avenue, Argonne, Illinois 60439 prior to distribution to the public. This requirement of patent clearance prior to publication of all Subcontractor's reports is specifically required and set forth in Appendix C hereof.

ARTICLE 31 – SMALL BUSINESS (Lower-Tier) SUBCONTRACTING PLAN (FEB 2007)(To Be Submitted to NREL For Acceptance Within 30 Calendar Days of Subcontract Award)

The Subcontractor's Small Business (Lower-tier) Subcontracting Plan dated **/**/** is incorporated as Appendix F in this subcontract. The Subcontractor shall electronically submit the "Individual Subcontract Report" (ISR) semi-annually during subcontract performance for the periods ended March 31st and September 30th, based on the Government's fiscal year (October 1 through September 30). The ISR is due on or before the twenty-fifth (25th) day of the month following the close of the applicable period. The Subcontractor shall also electronically submit the "Summary Subcontract Report" (SSR) annually for the twelve months ended September 30th, at the close of each Government fiscal year. The ISR and SSR submissions shall be made electronically through the Electronic Subcontracting Reporting System (eSRS) at www.esrs.gov.

Additional instructions can be found at http://www.nrel.gov/business_opportunities/related_docs.html, under the document entitled "Instructions for Submitting Small Business Subcontracting Reports through the Electronic Subcontracting Reporting System (eSRS)".

ARTICLE 32 – SUBCONTRACTOR'S OBLIGATION REGARDING SOFTWARE (SPECIAL-INEG)(MAY 2010)

To the extent not currently owned and licensed by NREL, within one week of substantial completion, the Subcontractor shall deliver at no additional cost to NREL, one copy and concomitant one-year license for any commercially available software product utilized by the Subcontractor in the performance of this Subcontract and determined by NREL to be necessary to the transition and future management and operation of the work performed under the subcontract. NREL, at its sole discretion may waive the Subcontractor's obligation under this Article if NREL can purchase such software and license at a cost lower than the cost reasonably available to Subcontractor.

ARTICLE 33 – SUBCONTRACTOR'S COOPERATION AND COORDINATION WITH MITIGATION AND REMEDIATION ACTIVITIES (SPECIAL-INEG)(MAY 2010)

A. The Subcontractor is advised that recent excavations in the general vicinity of the proposed INEG construction site has revealed the presence of old, spent ordnance. NREL, working through subject matter experts, is taking steps to mitigate risk and to remediate the affected areas.

B. As determined by the NREL Project Manager, the Subcontractor shall cooperate and coordinate its construction activities with those of the NREL subject matter experts and shall suspend, modify, or confine its construction activities to allow NREL to accomplish a safe and thorough remediation of old, spent ordnance from the INEG construction site.

C. To the extent reasonably possible, the Subcontractor shall manage such cooperation and coordination with the NREL subject matter experts to avoid an increase or decrease in the Subcontractor's cost of, or the time required for, performing any part of the work under this subcontract.

ARTICLE 34 - SUBCONTRACTOR'S COOPERATION AND COORDINATION REGARDING EXISTING COMMUNITY IMPACT MITIGATION (SPECIAL-INEG)(JUNE 2010)

A. Subcontractor acknowledges that the scope of work under this subcontract includes design and construction of facilities that will be located in close proximity to the existing community. To the maximum extent practicable and consistent with the project priorities, the Subcontractor shall mitigate adverse impact to the existing community resulting from the design and construction of such facilities.

B. When directed by the NREL Project Manager, the Subcontractor shall support and participate in meetings, presentations, feedback sessions, or public forums that may include participants from the existing community to provide information and updates regarding existing community impact mitigation under this subcontract. The Subcontractor shall manage such cooperation and coordination to avoid an increase in the Subcontractor's cost of, or time required for, performance of work under this subcontract.

ARTICLE 35 – ALTERATIONS TO TERMS AND CONDITIONS

Appendix C-3, Intellectual Property Provisions for Large and Small Business, Nonprofit Organizations, Educational Institutions and Others (Non Research and Development) is modified to delete Clause 4. Rights in Data – General and replace it with the following:

CLAUSE 4 – RIGHTS IN DATA – SPECIAL WORKS

A. Definitions.
"Data," as used in this clause, means recorded information regardless of form or the medium on which it may be recorded. The term includes technical data and computer software. The term does not include information incidental to subcontract administration, such as financial, administrative, cost or pricing or management information.
"Unlimited rights," as used in this clause, means the right of NREL/Government to use, disclose, reproduce, prepare derivative works, distribute copies to the public, and perform publicly and display publicly, in any manner and for any purpose whatsoever, and to have or permit others to do so.

B. Allocation of Rights.
1. The Government shall have --
   (i) Unlimited rights in all data delivered under this Subcontract, and in all data first produced in the performance of this Subcontract, except as provided in paragraph C of this clause for copyright.
   (ii) The right to limit exercise of claim to copyright in data first produced in the performance of this Subcontract, and to obtain assignment of copyright in such data, in accordance with subparagraph C (1) of this clause.
   (iii) The right to limit the release and use of certain data in accordance with paragraph D of this clause.
2. The Subcontractor shall have, to the extent permission is granted in accordance with subparagraph C (1) of this clause, the right to establish claim to copyright subsisting in data first produced in the performance of this Subcontract.

C. Copyright –
1. Data first produced in the performance of this Subcontract.
   (i) The Subcontractor agrees not to assert, establish, or authorize others to assert or establish, any claim to copyright subsisting in any data first produced in the performance of this Subcontract without prior written permission of the DOE Contracting Officer. When claim to copyright is made, the Subcontractor shall affix the appropriate copyright notice of 17 U.S.C. 401 or 402 and acknowledgment of NREL/Government sponsorship (including Subcontract number) to such data when delivered to NREL/Government, as well as when the data are published or deposited for registration as a published work in the U.S. Copyright Office. The Subcontractor grants to NREL/Government, and others acting on its behalf, a paid-up nonexclusive, irrevocable, worldwide license for all such data to reproduce, prepare derivative works, distribute copies to the public, and perform publicly and display publicly, by or on behalf of the Government.
   (ii) If the Government desires to obtain copyright in data first produced in the performance of this Subcontract and permission has not been granted as set forth in subdivision C (1)(i) of

this clause, the DOE Contracting Officer may direct the Subcontractor to establish, or authorize the establishment of, claim to copyright in such data and to assign, or obtain the assignment of, such copyright to the Government or its designated assignee.

2. Data not first produced in the performance of this Subcontract. The Subcontractor shall not, without prior written permission of the DOE Contracting Officer, incorporate in data delivered under this Subcontract any data not first produced in the performance of this Subcontract and which contain the copyright notice of 17 U.S.C. 401 or 402, unless the Subcontractor identifies such data and grants to the Government, or acquires on its behalf, a license of the same scope as set forth in subparagraph C (1) of this clause.

D. Release and use restrictions. Except as otherwise specifically provided for in this Subcontract, Subcontractor shall not release, reproduce, distribute, or publish any data first produced in the performance of this Subcontract, nor authorize others to do so, without written permission of the DOE Contracting Officer.

E. Indemnity. The Subcontractor shall indemnify NREL and the Government and its officers, agents, and employees acting for NREL or the Government against any liability, including costs and expenses, incurred as the result of the violation of trade secrets, copyrights, or right of privacy or publicity, arising out of the creation, delivery, publication, or use of any data furnished under this Subcontract; or any libelous or other unlawful matter contained in such data. The provisions of this paragraph do not apply unless NREL/Government provides notice to the Subcontractor as soon as practicable of any claim or suit, affords the Subcontractor an opportunity under applicable laws, rules, or regulations to participate in the defense thereof, and obtains the Subcontractor's consent to the settlement of any suit or claim other than as required by final decree of a court of competent jurisdiction; nor do these provisions apply to material furnished to the Subcontractor by the NREL/Government and incorporated in data to which this clause applies."

ARTICLE 36 – AMERICAN RECOVERY AND REINVESTMENT ACT OF 2009 – REPORTING REQUIREMENTS

This subcontract is funded in whole or in part, with American Recovery and Reinvestment Act (Recovery Act) funds. As such, the subcontractor is required to complete the reporting requirements as contained in the document "AMERICAN RECOVERY AND REINVESTMENT ACT OF 2009 – REPORTING REQUIREMENTS." The document located on the following link:
http://www.nrel.gov/business_opportunities/related_docs.html,
titled "Recovery Act – Subcontract Jobs Report" must be completed and submitted monthly through the period of performance of the subcontract.

ARTICLE 37 – INTEGRATION

This subcontract contains the entire understanding between the parties, and there are no understandings or representations except those set forth or incorporated by reference herein. No subsequent modifications of this subcontract shall be of any force or effect unless in writing signed by a duly authorized official of NREL.

IN WITNESS WHEREOF, the parties hereto have executed this subcontract as of the date fully signed below:

ACCEPTED ***		AUTHORIZED Alliance for Sustainable Energy, LLC	
By:	_____	By:	_____
Name:	_____	Name:	_____
Title:	_____	Title:	_____
Date:	_____	Date:	_____

Section 2
CONCEPTUAL DOCUMENTS

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PART 1
DESIGN & CONSTRUCTION PROCEDURES
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DESIGN AND CONSTRUCTION DEFINITIONS

A. APPLICABILITY: These definitions are integral to the Subcontract.

B. DOCUMENTS

1. Conceptual Documents include the following:
   a. Part 1 - Design & Construction Procedures
   b. Part 2 - Program
   c. Part 3 - Performance Criteria

2. Program: NREL's requirements for size, arrangement, organization, location of functional spaces, description of space functions, identification of fittings, equipment, furnishings and description of the physical and environmental requirements for each space.

3. Performance Criteria: NREL's requirements for performance of project components, systems, assemblies, and measurable characteristics. Specific Product requirements are referenced.

C. DESIGN TO PRICE/COST AND SCHEDULE

1. Performance-Based Conceptual Documents: The Conceptual Documents are not prescriptive, and do not direct the design or construction. Decisions which establish the solution are determined by the Subcontractor in accordance with the price/cost, schedule, and other constraints of the Subcontract.

2. Design-to-Price/Schedule: The Conceptual Documents do not prescribe what elements must be (unless otherwise prescribed as Products), rather what elements must do. All performance criteria included in the Conceptual Documents must be met to satisfy the Subcontract constraints and requirements. The Subcontractor is responsible to adapt, change, and revise the design(s) until all requirements of the Subcontract are satisfied (including price/cost and schedule requirements).

3. Proposal: The Proposal Form and Exhibits, which compile the information prepared by the offeror to demonstrate their method of complying with the Conceptual Documents.
   a. The Proposal period is the time frame during which prospective Offerors prepare their Proposals.
   b. Substantiation submittals specified to occur during the Proposal period are intended to accompany the Proposal and have been included in the proposal evaluation submittal requirements. Proposal Submittals will be used to satisfy NREL's evaluation process, and will not be considered a substitute for or replacement of the Subcontract Conceptual Documents.

D. DESIGN AND CONSTRUCTION PHASES OR STAGES

1. Preliminary Design (Phase I of Design): The process of preparing and finalizing preliminary drawings and written descriptions to illustrate the Subcontractor's proposed design solution, intended construction, and management plan(s) for NREL.
   a. The end of the Preliminary Design period is a Milestone as referenced in the Proposal.
2. Design Development (Phase II of Design): The process of determining the systems, assemblies, form, arrangement, size, and materials of the Subcontractor's solution, intended construction, and management plan(s) for NREL.
   a. The end of Design Development (and Phase I of Design) occurs before the beginning of preparation of Construction Documents.

b. The end of Design Development for the project as a whole is a Milestone as referenced in the Conceptual Documents.

3. Construction Documents (Phase II of Design): The process of preparing working drawings, prescriptive specifications, and other documents describing the work or a portion of the work in sufficient detail to allow accurate and complete substantiation of all Subcontract requirements (including those of the Conceptual Documents), and to complete construction of the project.
   a. The end of Construction Documents for the project as a whole is a Milestone as referenced in the Conceptual Documents.
   b. The end of Construction Documents is the time at which all portions of the Construction Documents are complete.

4. Construction:
   a. The Construction period is the time from the beginning of construction activities on the project site until final payment as defined in the Subcontract.
   b. The end of the Construction period is a Milestone.

5. Substantial Completion: As defined in the Subcontract; prerequisites include (but not limited to):
   a. Subcontractor's complete punchlist of items to be completed.
   b. NREL's complete punchlist of items to be completed.
   c. Compliance with requirements of governing authorities, for submittals, inspections, and permits.
   d. Compliance with NREL's requirements for access to areas occupied by the NREL.
   e. Final Clean Complete.
   f. Maintenance manuals delivered to NREL.
   g. Warranties.
   h. Project record documents.
   i. Final site survey.

6. Closeout: The process of completing all details of both construction and commissioning.
   a. The Closeout period is the time from the Date of Substantial Completion until Final Completion (and may be concurrent with the Construction Period).
   b. Before and during the Closeout period, the NREL will ascertain whether the completed project complies with the Subcontract Documents.
   c. Training of NREL's personnel in operation and maintenance occurs during Closeout, unless specifically indicated otherwise for certain items.

7. Beneficial Occupancy: The period during which the project is occupied for its intended purpose.
   a. The Beneficial Occupancy period begins at the Date of Substantial Completion as defined by the Subcontract.

8. Correction Period: Function and time frame as defined by the Conditions of the subcontract.

ATTACHMENTS

A. The following information is provided as attachments to this RFP, to assist in the preparation of proposals and will not be incorporated into the subcontract. The successful subcontractor will be required to verify information through site investigations or measurements during Phase I, Preliminary Design.

- NREL 2009 South Table Mountain Campus Master Plan, dated October 29, 2009
- NREL Drawings, As Follows:
  Drawing PERM-000-X002, "Abbreviations, Legends and Symbols", Rev. 2, dated 12/1/99
  Drawing PERM-000-C004, "Topographic Site Plan, Sheet 3", Rev. 4, dated 07/08/09
  Drawing PERM-000-C005, "Topographic Site Plan, Sheet 4", Rev 3, dated 07/08/09
  Drawing PERM-000-C013, "Topographic Site Plan, Sheet 12", Rev. 3, dated 070/08/09
  Drawing PERM-000-C014, "Topographic Site Plan, Sheet 13", Rev. 3, dated 07/08/09
  Drawing PERM-000-C124, "Composite Utilities, Sheet 3", Rev. 1, dated 05/24/00
  Drawing PERM-000-C125, "Composite Utilities, Sheet 4", Rev. 1, dated 11/19/08
  Drawing PERM-000-C133, "Composite Utilities, Sheet 12", Rev. 0, dated 11/05/99
  Drawing PERM-000-C134, "Composite Utilities, Sheet 13, Rev. 0, dated 11/05/99
- Ingress/Egress Energy Target Definitions, Guard House and Parking Garage, Updated 03/15/2010
- Ground Engineering, Inc. "Subsurface Exploration Program, Geotechnical Recommendations, National Renewable Energy Laboratory Proposed Southern Addition, Golden, CO", dated 09/05/08

B. The following information is provided as attachments to this RFP. Offerors should expect that the requirements of these attachments will be incorporated into the subcontract

- Site Utilization Plan (1 sheet), undated
- West Metro Fire Rescue Supplemental Rules and Regulations**,** National Renewable Energy Laboratory, 1617 Cole Boulevard Golden, CO 80401, Undated
- NREL Site Operations Computer Aided Design Manual, Rev. 4, dated July, 2007
- National Renewable Energy Laboratory (NREL) Security & Emergency Preparedness (Security) Project Design Requirements
- Laboratory Level Procedures – Construction, Environment, Health and Safety, No. 6-4.12, dated 10/14/09

MANAGEMENT AND COORDINATION

A. Access to and Use of Site: Referenced NREL standards will be made available in this solicitation and in the Subcontract Documents.

1. The Subcontractor shall follow all standards for Safety & Security as required by NREL for any and all operations on the Campus.

2. Reference "Site Use Plan" for details related to site use by the Subcontractor.

B. Coordination with Campus Occupants:

1. Adjacent Buildings, Roadways, and Grounds: Improvements and facilities throughout the NREL STM Campus will be occupied and operated during the entire Subcontract period.

2. Existing Utility, Life Safety, and Fire Safety System Elements:
   a. No disruptions of services to areas while they are occupied. All disruptions need to be arranged at least 48 hours in advance with NREL.
   b. Prevent accidental disruptions to facilities outside the project limits by investigation of existing utilities and protection during construction. Accidental disruptions will be remedied at no cost to NREL.
   c. All work outside the limits of the 'Site Use Plan' must be approved by NREL at least 48 hours in advance.

3. Construction of the Project: NREL intends to occupy completed portions of the project as early as possible for beneficial occupancy. This phased occupancy by NREL will take place only in accordance with the Subcontract requirements.

C. Coordination with Integrated Project Team (IPT):

1. Subcontractor to provide minimum six (6) working days notice for any meetings requiring attendance by NREL IPT members.

2. Conduct weekly progress meetings as necessary to demonstrate compliance with the Conceptual Documents.

D. Campus Operations:

1. Emergency Routes and Exits Required by NREL Campus Operations: Maintained open during construction period, unless alternate means of egress acceptable to local authorities are provided. Local authorities include NREL.
2. Current Campus Operations: Maintained open during construction period; protected from Subcontractor activities, kept clear of construction debris and stored materials, and with safe walking and vehicular surfaces.

3. Use of Spaces for Storage: Not allowed unless otherwise so indicated on the 'Site-Use-Plan'.

E. Schedule Control/Progress Tracking and Reporting: As specified in the Subcontract and as follows:
1. Schedule and Cost load all activities required for the project.
   a. Substantiation Milestone periods (start date and completion date).
   b. Substantiation Milestone Submission Dates (Baseline plus float).
   c. The Subcontractor will develop a detailed cost loaded schedule that will complete their milestones/deliverables to NREL. The Subcontractor shall be responsible for

planning and scheduling all work and is expected to provide all services in a timely manner as required for the orderly progress of the work.

d. The schedule will be developed using the Critical Path Method.
e. All activities in the schedule (except Milestones) will be cost loaded.

2. Document/Schedule all activities requiring DOE/NREL management coordination, including but not limited to:
    a. Dates for all design and construction activities requiring DOE/NREL input and integration. All activities will list the specific DOE/NREL resource group(s) and/or participants.
    b. Phased Occupancy dates (if applicable), and DOE/NREL prerequisite activities required for phased occupancy.
    c. Dates for all DOE/NREL prerequisite activities and/or submissions to support the project.
    d. Dates for any additional activities for which the Design-Builder requires DOE/NREL integration or participation.

3. Complete a Monthly Project Status Report by the 15th of Each Month. Including, but not limited to the following information:
    a. Narrative highlights of the month
    b. Summary of completed issues
    c. Status of drawings
    d. Percentage completion, overall, and by discipline
    e. Open issues and assignments
    f. Budget status
    g. Schedule status
    h. Milestone status
    i. Problems/Open issues
    j. Recovery plan/schedule if any Milestones have slipped beyond the baseline (subcontract) schedule.

4. Monthly Review of Design-Builder's invoices to ensure compliance with the subcontract terms and conditions and verification of actual progress.

5. Submit updated schedule (including Schedule Control/Progress Tracking and Reporting) whenever adjustments that change the Subcontract Duration, Subcontract Cost or Control Milestones are approved.

F. Progress Documentation for NREL Information:

1. During Preliminary Design, Design Development, and Construction Documents Periods: Graphic displays, plans, and diagrams sufficiently detailed to allow individual NREL IPT Members to identify the status of the solution for programmed spaces, adjacencies, capacities, and other related design and performance criteria.

G. Progress Documentation for NREL's Project Record:

1. Prior to Construction: Digital photographic record documenting pre-construction conditions in the vicinity of the work which could be altered by construction operations.
2. During Construction: Weekly digital photographic record of each portion of the work, taken from consistent locations, distances, and angles.
3. During Closeout: Detailed digital photographic record of each interior room and space, each exterior elevation, the roof, all site areas, and each parking levels showing 100% of parking spaces.
4. Photographs and Videos: Include the date taken, a short title of the view, and the compass orientation in each view; data must be encoded with the actual photograph in a manner to provide reliability of information.

QUALITY REQUIREMENTS

A. Design Kick-Off Activities: Prior to initiating the post award design phase, the Subcontractor shall schedule and conduct activities that, at a minimum include:

1. Presentation of the design process outlining the milestones, activities, and coordination including in the plan.

2. Identification of the project designer(s) of record and their role(s) in the design process and the quality assurance process.

B. Design Criteria: During Preliminary Design (Phase I), the design and performance criteria must be refined, finalized, and documented to establish any variation from the design and performance criteria (Part 2-Program & Part 3-Performance Criteria) that is acceptable by NREL as a part of a "Criteria Tradeoff" process.

1. Criteria Tradeoff: NREL will consider adjusting design and performance criteria (Part 2-Program & Part 3-Performance Criteria) proposed by the Subcontractor during Phase I of design for the Project. Tradeoffs will follow Best Practices of the Design-Build Institute of America for “Performance Based Design-Build'”, and as follows:
   a. Tradeoffs Defined: Tradeoffs are adjustments to Part 2-Program or Part 3-Performance Criteria of the Conceptual Documents that result in an increase of value (increase of benefit to the fixed price of the subcontract) to the project's outcome. The benefit must result in an advantage to the facilities' function, aesthetic, life & safety, durability, comfort, ease of operation or maintenance, energy efficiency, warranty period, or service life-span.
   b. Tradeoff of any design or performance criteria must be supported by demonstration of cost effectiveness, and be documented, approved and accepted in writing by NREL.

2. Upon execution of the Subcontract, and to provide the Subcontractor a better understanding of the Project's unique needs to be considered in the Subcontractor’s Solution, NREL will appoint representatives of the following departments or groups to provide details of functional needs review Preliminary Design, Conceptual Design, and Construction Document Milestones and offer insight to the design and functionality of the facility:
   a. Security, Safety & Emergency Preparedness staff
   b. Site Operations Maintenance and Engineering staff
   c. NREL's Design-Build Support Services Consultant
   d. NREL Project Management
   e. Design Documentation: Record all design and performance criteria that will be of use during occupancy and operation of the project, including all items specified for maintenance manuals, below.
      1) Design Criteria Documentation Included in Construction Documents: Organized logically (from the point of view of operations staff) and placed in a prominent location in drawing sets.
      2) In addition, shop drawings must be used to accomplish design documentation.
      3) Drawings: (See NREL Site Operations Computer Aided Design Manual).
      4) Mock-Ups: Where necessary to clarify design intent and demonstrate compliance with the Conceptual Documents, construct full-scale mock-ups.

C. Substantiation Requirements: See Part 3-Performance Criteria for definitions and basic requirements; see other Sections for specific items of substantiation requirements.

1. Substantiation Submittal Procedures:

   a. Time Frames: As specified. If there is a conflict between the degree of detail or completion specified and the progress of the design or construction, obtain a clarification before submitting.

   b. Recipient: The NREL Subcontract Administrator.

   c. Number of Copies: 3 hard copies and 1 electronic copy for NREL's use and records; NREL will return not more than one additional copy.

   d. For time periods that constitute Milestones, all substantiation submittals required during that period must be complete and accepted before the Milestone can be considered achieved.

   e. Substantiation Submittals are the primary means for NREL to measure and understand the design and construction intent of the subcontractor. Absence of properly submitted substantiation (as identified and required by the RFP Documents) will be a basis for NREL to measure non-compliance of the subcontract requirements of the subcontractor.

   f. Submit complete sets of documents containing all substantiation at end of the following periods:
      1) Proposal stage.
      2) Preliminary Design stage.
      3) Design Development stage.
      4) Construction Documents stage.
      5) Closeout period.

   g. Resubmissions: Clearly identified as such, with all changes made since the original submittal clearly marked.

2. NREL's Review of Substantiation: Unless otherwise indicated, NREL will make formal acceptance of substantiation submittals.

   a. If a submittal is not acceptable NREL will notify Subcontractor within 15 working days.

3. Substantiation Schedule: Prepare and maintain a complete schedule of substantiation items, displaying the following:

   a. Contents, for each item:
      1) Item description, including Section, paragraph number, and drawing identification (if any).
      2) Anticipated submittal date, or time period(s) during which submittal is required.
      3) Actual submittal date.
      4) Action taken or other status.
      5) Identification of future re-submission requirement, if any.

   b. Schedule shall be incorporated into overall progress schedule, provided substantiation data must be reported separately from other progress information.

   c. Schedule of Substantiation Submission: To NREL, within 30 days after award of Phase II work.

   d. Format: Computer database format for NREL's use in tracking submittals; database structured so NREL's added information will not be overwritten or deleted by incorporation

of updated data from Subcontractor.

e. Updates: To NREL, monthly hard copy. Updates required irrespective of any changes to the schedule.

D. Field Testing and Inspection: Perform all testing and inspection required by code and as specified.

1. Exception: Tests and inspections indicated in this subcontract to be performed by NREL or its agent(s).

2. Qualifications of Testing/Inspection Agencies:
   a. Qualified and equipped to perform applicable tests/inspection.
   b. Regularly engaged in testing and inspection activities on a commercial basis.
   c. Independent of Subcontractor and his contractors' organizations.
   d. Authorized to operate in Colorado.
   e. Acceptable to NREL.
   f. Substantiation: Submittal of qualifications, based on ASTM E 329 and ASTM E 548.

3. Reports: Written report of each test/inspection; including complete details of conditions, methods, and results, signed by responsible individual.

E. Quality Assurance Plan: The Subcontractor shall prepare a formal Quality Assurance Plan that shall be submitted to NREL for approval within 21 calendar days after subcontract award. The Subcontractor shall utilize the plan and defined processes and procedures to meet the project objectives and guard NREL against errors and omissions in design, as well as defects in material, equipment, and workmanship during construction.

1. At a minimum, the Quality Assurance Plan shall address the following:

   a. Criteria used for applying a graded approach to quality assurance and quality control activities during design and construction.

   b. Process for evaluating whether all architectural and engineering designs are consistent and interconnected between the various disciplines and lower-tier subcontractors.

   c. A list of the quality control checkpoints and criteria.

   d. Design review, approval, and submittal processes and authorities.

   e. Design development and evaluation checklists.

   f. Processes for reviewing, inspecting, testing, and accepting construction.

   g. Process for validating operating requirements for equipment used during construction activities.

   h. Process for validating workmanship. Include sampling plans as appropriate.

   i. Minimum professional qualifications for each level of design and construction in all applicable disciplines.

   j. Process for verifying professional qualifications and maintaining the records.

   k. Processes for analyzing and verifying updates to documents. This includes planning documents, requirements documents, and design documents.

   l. Process for managing records and data.

m. Process and criteria for evaluating and selecting vendors and lower-tier subcontractors.

n. Process for evaluating whether design, construction, and NREL requirements are flowed down to suppliers and subcontractors.

o. Process for validating delivered equipment and supplies, including inspection and testing. Include sampling plans as appropriate. Also include any special activities associated with identifying suspect and counterfeit items.

p. Formal assessments performed during design and construction to verify compliance with requirements and processes.

q. Process for managing issues and corrective actions identified during assessments, reviews, and inspections.

2. At each milestone of the design, the Subcontractor shall submit a record of the quality control checkpoints met and the disposition of all outstanding exceptions or variances. Unless otherwise directed, the Subcontractor shall ensure that all construction inspections that would be required under the local permitting authorities are performed. The Subcontractor shall ensure that all work submitted for use in construction of the project is stamped or otherwise approved by an Architect or Engineer registered in the state of Colorado.

F. Reference Standards: Where products or workmanship is specified by reference to a document not included in the Subcontract Documents, comply with the requirements of the document, except where more stringent requirements are specified.

1. Date of Issue: Latest edition published as of date of subcontract documents except where a specific date is specified herein or established by code.

2. Copies on Site: Keep copies of referenced standards on site until completion of the Subcontract.

G. Project Record Documents: During construction maintain on site one set of all documents forming the subcontract, including drawings, recording all changes made by addenda, by formal modifications, and in performing the work, for reference.

1. Storage: Separately from documents used for construction, in location where they can be kept clean and safe from fire and damage.

TEMPORARY FACILITIES AND CONTROLS FOR CONSTRUCTION ACTIVITIES

A. NREL will provide the following:

1. Electrical power and potable water, consisting of utility access as indicated on the "Site Use Plan".

B. New permanent facilities may not, and shall not, be used during construction.

C. Provide the following for the use of the NREL:

1. Lockable field office on site (80 sf minimum).

2. Telephone/Internet connectivity in field office on site.

D. Vehicular Access and Parking: Comply with NREL regulations relating to use of parking lots, roadways, streets and sidewalks, access to emergency facilities, and access for emergency vehicles.

1. Parking for Construction Workers: Provided by Subcontractor including offsite parking if necessary.

2. Do not allow vehicle parking on existing pavements other than as allowed by the Site Use Plan.

3. Provide 2 parking spaces reserved for use of NREL.

E. Traffic Controls: Provide all traffic controls necessary to conduct safe operations and in accordance with NREL Site Operations regulations. Submit Traffic Control Plan for approval by NREL prior to any site activities.

F. Security: The Subcontractor shall provide protection of the work, existing facilities, site improvements, and NREL's operations from unauthorized entry, vandalism, and theft.

G. Erosion and Sediment Control: See Part 3-Performance Criteria.

H. Dust Control:

1. Exterior: Minimize raising dust, preventing dispersal of air-borne dust into atmosphere and over adjacent property (see Execution section E.3).

I. Noise Control:

1. At All Times: Excessively noisy tools and operations will not be tolerated on any part of the site that cause disturbance to existing NREL operations and adjacent neighbors ; excessively noisy includes jackhammers, pile drivers, pneumatic hammers, and diesel engines.

2. Outdoors: Limit conduct of especially noisy exterior work to hours as coordinated with NREL Project Management.

J. Waste Control: Provide waste storage and removal as required to maintain site in clean and orderly condition.

K. Pest and Rodent Control:

1. Pest Control Service: Weekly treatments.

L. Pollution Control: Comply with federal, State, and local regulations.

M. Project Identification Sign and Site Use Signage: By Subcontractor to NREL's design requirements.

1. No other signs allowed on site without NREL's permission except those required by law.

N. Removal of Temporary Facilities, Utilities, and Controls: Prior to Substantial Completion; including clean up, restoration of existing facilities used to original condition, restoration of permanent facilities used to specified condition, and repair of damage.

PRODUCT REQUIREMENTS

A. See Part 3-Performance Criteria for general requirements for product options and substitutions.

B. NREL-Furnished Products: NREL will arrange for and deliver shop drawings and other submittals, arrange and pay for delivery to site, perform joint inspection after delivery, submit claims for transportation damage, replace items damaged prior to delivery, replace defective items, and arrange for manufacturer inspections, service, and warranties, for fixtures, furnishings, and equipment identified in Part 2-Program as Owner Supplied (OS).

EXECUTION

A. Pre-Construction Survey: To be prepared by Subcontractor for use by NREL; control and reference points shall be indicated on the Survey. Control and Reference Points shall be as directed by NREL.

B. Work by NREL: NREL will perform the following work, with their forces or using other subcontractors:

1. Installation of items identified as Owner Supplied and Owner Installed (OSOI) in the Program (Part 2); prepare spaces and provide applicable utility connections as necessary to assure proper installation by NREL.
   a. NREL will supply product and manufacturer's data as requested by the Subcontractor.

C. Do not enter, cross, infringe upon, or limit access to adjacent properties without first obtaining written permission from the property owner through a coordinated effort with NREL. All contact with adjacent property owners must be coordinated with NREL in advance prior to contacting such owners.

D. Health and Safety:

1. Use of explosives is not permitted.

2. Construction operations will comply with NFPA 241-2000, including applicable recommendations in Appendix A.

3. Construction operations must comply with all NREL Safety procedures as indentified in the Subcontract Documents and as follows:

   a. The NREL safety culture begins with Zero incidents as an expectation and promotes continuous improvement in safety performance. Zero incidents mean error-free, incident-free project execution: no injuries, illnesses, property damage, or adverse community or environmental impacts. Performance at this level does not happen by chance - it is achieved through the integration of safety into all management systems, the project process, and by individual effort. NREL believes that all incidents are preventable.

      1) Health and safety programs, plans, and procedures define the applicable safety requirements and clearly specify the performance and behavior expected from each NREL Subcontractor employee. Training is provided and/or required to ensure an understanding of the requirements. Communications, awareness, and recognition reinforce the training effort and provide motivation for the achievement of safety excellence. Monitoring and evaluation of Subcontractor safety performance provides feedback on the effectiveness of the overall safety program and results in continuous safety program improvement through implementation of lessons learned. This programmatic approach to safety establishes a work environment in which safety is a prerequisite and employee work practices reflect the NREL safety culture.

      2) NREL Subcontractors (including lower-tier subcontractors) shall implement and maintain a safety program on-site consistent with 10 CFR 851 DOE Worker Safety and Health program and compliant with NREL procedure 6-4.12 “Construction Environment Safety and Health” (see Available Information) It is recognized that safety programs which go beyond mere compliance with industry standards achieve better safety performance and fewer worker injuries or illnesses, and save money. The health and safety management system is required by Subcontract and is

intended to fulfill DOE standards. Specifically, NREL Subcontractor safety programs shall, at a minimum, include the elements described below:

i. Management Commitment: On-site management, supervisors, and foremen show proactive, visible leadership for the safety program. This includes active involvement in safety meetings and safety inspections, including safety concern in the planning, budgeting, and scheduling process, and recognizing or rewarding employees for participation in safety programs and practicing safe work behaviors.

ii. Employee Involvement: Employees should be involved with all levels of the safety process. This includes, at a minimum, involvement in:

(1) Safety meetings (daily or periodic, and the monthly subcontractor safety meeting)

(2) Safety inspections (periodic, weekly, and/or monthly)

(3) Exercising the worker's right to stop work.

(4) Raising and reporting safety concerns.

(5) Reporting incidents including near misses.

3) Additional avenues for employee involvement are encouraged, such as employee development or review of the task-specific Health and Safety Plan (HASP) and Activity Hazard Analyses (AHAs), participation in incident reporting and investigation, development and presentation of safety training, and participation in project or department safety committees.

4) The Subcontractor will be required to include and present NREL's Environmental Protection Policy and requirements during initial worker site briefing/safety orientation. Availability for participation in occasional environmental audits/assessments is expected of the subcontractor.

5) Worksite Analysis: A worksite analysis program shall be developed and maintained, including safety inspections, participation in periodic health and safety reviews, and assessments, worksite monitoring (physical, chemical, and biological hazards), tracking, and trending of incidents and corrective actions, and provision of adequate, qualified health and safety resources

6) Hazard Prevention and Control: A worksite free of recognized hazards must be maintained. Work shall be planned to prevent or eliminate hazards where feasible. Adequate resources must be provided to control hazards using the following hierarchy; engineering controls, work practice or administrative controls and, lastly, Personal Protective Equipment (PPE). Adequate resources must be available to abate potential hazards in a timely manner.

7) Safety and Health Training: A complete safety and health training program shall be implemented and maintained to meet regulatory requirements and ensure that employees are adequately trained to perform work safely. Employees shall be trained to applicable plans and procedures and be aware of the health and safety hazards of the work, signs, and symptoms of overexposure, and ways to protect themselves from workplace hazards. Additionally, employees shall be apprised of

their rights and responsibilities under the 10 CFR 851 DOE 851 Worker Safety and Health Program.

8) Health and Safety Plan: A written Health and Safety plan per the requirements or NREL procedure 6-4.12 "Construction Environment Safety and Health." NREL places significant emphasis on:

i. Full compliance with 10 CFR 851 to include medical surveillance.

ii. Competent safety staff on the job site at all times during operations.

iii. Effective safety orientations for all personnel entering the site.

iv. Effective documented safety training (e.g. fall protection, hearing conservation, ladder).

v. Documented safety meetings daily POD, weekly tool box.

vi. Activity Hazard Analysis (AHA) development for all definable features of work (e.g. mobilization, clearing and grubbing, foundation, steel erection).

vii. Pre-phase planning of all definable features of work.

viii. Competent person identification for work involving cranes, excavation, electrical.

ix. Supervision to craft ratio.

x. Time in the field. Do not under estimate the administrative requirements for supervision, safety, and quality personnel who are needed in the field. Additional administrative support for those personnel is strongly encouraged.

4. Substantiation:
   a. Proposal: Demonstrate integration of safety and security into the design of the project.
   b. Design Development (Phase I): Identification of hazards (or hazardous conditions) in existing structures or improvements, and on site, with preliminary plan for abatement.

E. Environmental Requirements (Construction):

1. National Environmental Policy Act (NEPA): A Provisional NEPA review has been completed. Once the details of the project have been described in the Preliminary Design, but before initiation of construction activities, additional environmental review may be required. Depending on the nature and scope of the activity, the environmental review process could take a few days to several weeks.

2. Stormwater Discharge: Stormwater discharges associated with construction activities at NREL's STM site is regulated by the Environmental Protection Agency (EPA) via the EPA General Construction Permit. The Subcontractor is responsible for obtaining coverage under the EPA's Construction General Permit. This requires filing a Notice of Intent with the EPA and preparation of a Stormwater Pollution Prevention Plan (SWPPP). NREL will also apply for coverage under the EPA permit for areas of disturbance greater than one acre under a separate Notice of Intent. Subcontractors are required to utilize a template provided to them by NREL Environmental Health and Safety (EH&S) for preparation of the SWPPP. The NREL EH&S Office must review and approve the subcontractor SWPPP in advance of applying for EPA coverage and before beginning construction activities.

Areas of disturbance of less than one acre in size do not require coverage under the EPA Construction General Permit. However, the subcontractor must prepare an erosion control plan that must be accepted by NREL Environment, Health & Safety (EH&S) before construction activities can begin.

Other stormwater requirements include the following:

a. General

i. Subcontractor will be required to complete, document, and provide NREL with a copy of the weekly stormwater inspections.

ii. The SWPPP shall incorporate provisions addressing NREL's fugitive dust permit.

iii. Revegetation requirements are identified in NREL's Stormwater Pollution Prevention Plan.

iv. Subcontractor must notify NREL EH&S personnel immediately upon arrival at an NREL site of any representative of a local, state or federal jurisdiction. Such representatives are not permitted on NREL sites without an NREL host.

v. All communications with regulatory agencies must be documented and provided to NREL EH&S.

vi. SWPPP plans must indicate phasing of Best Management Practices (BMP) for initial, interim and final phases of construction. This information must also be included in design and construction documents.

b. A site logistics plan that includes laydown areas, access and egress routes, material storage areas, concrete washout locations, and other potential sources of impacts to stormwater area to be addressed in the subcontractor's stormwater plan.

c. Stockpiling of soil is not permitted unless approved by NREL EH&S.

3. Air Emissions

a. Fugitive Dust: Subcontractor must adhere to NREL's Particulate Emissions Control Plan for Construction Activities (State air permit 08JE0889L and NWTC permit 04JE1442L).

b. Vehicular Emissions: Construction vehicles, equipment, and subcontractor's personal vehicles shall be operated to minimize emissions. Unnecessary idling of vehicles and equipment is prohibited. Idling of vehicles for occupant heating/cooling comfort is prohibited.

4. Pipe Flushing: Because NREL is a federal facility, flushing of new water lines, storm and sanitary sewer lines, or fire line flushing is not regulated by the Colorado Department of Public Health and Environment (CDPHE) at NREL. However, for such activities NREL requires preparation and approval by NREL EH&S of a plan that describes the location and nature of activity to be performed, description of the discharge (duration, anticipated volume and rate, source of the water, potential pollutants in the water used), and the BMPs to be used to prevent potential pollutants from reaching a stream, drainage channel, ditch or groundwater. NREL prohibits discharges to grassed or otherwise vegetated areas.

5. Trash, Construction Debris and Sanitary Waste: Provide waste storage and removal as required to maintain site in clean and orderly condition with periodic disposal of waste off-site.

Open free-fall chutes and containers without lids are prohibited. Trash and debris is prohibited from migrating outside the construction area. All trash and debris is to be collected daily.

6. Wastewater: NREL limits wastewater discharges to sewer or septic systems. NREL does not permit other direct wastewater discharges to the environment, including land and surface water. NREL complies with Pleasant View Water and Sanitation District (Pleasant View) and Metro Wastewater Reclamation District (Metro) prohibitions, criteria, restrictions, and notification requirements for wastewater discharges. Discharges of large volumes of wastewater (25,000 gallons per day or greater) require a special permit from the wastewater districts. Contact the NREL EH&S Office if such a volume is planned on a route, periodic, or occasional basic.

7. Hazardous Waste: NREL holds the necessary Resource Conservation and Recovery Act (RCRA) generator identification numbers to conduct waste generation and collection activities. NREL prohibits treating (evaporation, neutralization, dilution, or reduction of volume or toxicity) or disposing of hazardous waste on site. Subcontractor must contact the NREL EH&S Office prior to any construction activity that will generate hazardous or chemical waste. Special handling, storage, and labeling requirements may apply depending upon the type and quantity of chemical waste.

8. Asbestos: The use of Asbestos Containing Material (ACM) is not anticipated and is not authorized. However it is possible that unidentified ACM may be discovered during excavation activities. Should ACM be discovered, the Subcontractor shall stop the affected work and notify the NREL Project Manager.

9. Noise: Per State of Colorado Noise Statute, construction projects are limited to permit conditions or 80 dBA for the period within which the construction is to be completed or a reasonable amount of time.

10. Pesticide and Herbicide Use: All pesticide and herbicide use must be approved by the NREL EH&S prior to application.

11. Vegetation: Project design shall attempt to minimize the elimination of existing trees/shrubs, which provide habitat, reduce cooling needs in summer by providing shade, and remove carbon dioxide from the air, thus contributing to a reduction of greenhouse gases generated at NREL. Those trees/shrubs that must be eliminated as a result of construction shall be tagged/otherwise marked and noted on construction drawings. Removal of existing trees/shrubs may require replacement. The IPT together with NREL EH&S will determine replacement strategies (types of trees, number to be replaced, etc).

12. Natural Resources - Wildlife: Natural resource protection at NREL is guided by NEPA, the Migratory Bird Treaty Act, the Colorado Division of Wildlife Recommended Buffer Zones and Seasonal Restrictions for Colorado Raptors, the Threatened and Endangered Species Act, the National Historic Preservation Act, and other applicable state and federal wildlife guidelines. The following topics represent areas that may impact individual project costs and schedules:

    a. Nesting birds: In general, for any construction-related activities (grading/clearing, heavy equipment use, demolition activities, etc) that occur between mid-March to mid-September, NREL EH&S must conduct a nesting bird survey. NREL EH&S must be notified at least 14 days prior to the start of construction, to ensure the availability of staff to conduct the survey. Surveys must be completed from three to seven days before construction, depending on local and species-specific breeding activities. Project delays of

a few days to several weeks may occur if an active nest is found in the construction area. Active nests may occur on the ground, in shrubs or trees, in onsite nest boxes, or in building entryways or open areas. If raptor (hawks, owls, falcons) nests are found, buffer zones from 200 yards to ¼ mile must be kept free of construction activities until the young leave the nest. Early coordination with NREL EH&S can help mitigate issues before they arise. Note: Walking in ground-nesting habitat is permitted. If a bird is spotted flying from the ground, avoid the area by 20 feet, as a nest may be occupied or under construction.

b. Snakes: NREL employees and subcontractors must not pursue, capture, harass, harm, or kill wildlife, including snakes, encountered onsite. Minimal project delays (less than one hour) may occur if a snake is discovered in a project area. When a snake is discovered in an area frequented by workers or visitors, the observer must call security at 303-384-6811 or 303-275-1234 to report its location. NREL EH&S Office or Security and Emergency Preparedness Office workers must relocate the snake to an uninhabited area of the site.

c. Other wildlife species: NREL workers, project managers, and subcontractors must avoid adverse impacts to other wildlife species, including coyotes, deer, salamanders, bats, small rodents, rabbits, squirrels, swarms of bees, and any other form of wildlife encountered. Concrete washout areas shall be constructed and operated in a manner to preclude entrapment and drowning of wildlife.

d. Wildlife Corridor: A wildlife corridor at the South Table Mountain (STM) campus has been designated along the Middle Drainage. Construction that involves roadways, bridges, pedestrian trails and other features must be designed to facilitate wildlife movement through the corridor. NREL EH&S must approve such designs.

13. Preservation of Historical Resources: In the event potential archeological items are unearthed or discovered during construction, work in the area must stop. NREL will make a determination within 24 to 48 hours if work can continue. Potential archeological items may not be moved or stockpiled upon discovery.

14. Wetlands and Drainage Areas: Work within jurisdictional wetlands requires permitting under Section 404 of the Clean Water Act. At this time, no jurisdictional wetlands have been identified at STM. Work within non-jurisdictional wetlands requires approval from NREL EH&S.

COMMISSIONING

A. Commissioning: Placing the project into full and proper operation, including starting and adjusting equipment and systems, functional performance testing, otherwise demonstrating compliance with Subcontract Documents (including all Performance Criteria), correcting defects, and obtaining permits.

1. Follow the recommendations of:
   a. ASHRAE Guideline 1 - The HVAC Commissioning Process.
   b. PECI Model Commissioning Plan and Model Commissioning Guide Specifications.
2. Prerequisites: Design criteria documentation and recording of all changes to Subcontract Documents.
3. As indicated, Subcontractor is responsible for all commissioning activities. NREL will provide CxA Quality Assurance oversight, including all approvals as defined by the Subcontract Documents.
4. Commissioning activities may take place at any time after completion of the element to be commissioned.
5. All commissioning activities must be complete before the end of Closeout, unless specifically accepted.
6. Maintenance Manuals: Ready for use during applicable commissioning activities.

B. Functional Performance Testing: Test all functions of system, all components of system, and interfaces between systems, including all modes of operation, conditional controls, and reactions to emergency conditions.

1. Description in Commissioning Plan: Each function to be tested described separately.
2. Systems Composed of More Than One Item of Equipment: Individual components tested for proper operation and interconnection before beginning system testing (e.g. "point-to-point" testing).
3. See substantiation requirements in other Sections for specific items to be tested and tests required.
4. Testing Agency Qualifications: As specified in this section under Quality Requirements.
5. NREL will witness tests and prepare defect reports.
6. Detailed test reports are to be by Subcontractor, showing test criteria, methods, and results.

C. Demonstration: For each equipment item or system for which functional performance testing by Subcontractor is not specified, demonstrate all operational modes to NREL at time acceptable to NREL; if defects occur during demonstration, demonstration must be rescheduled for a time acceptable to NREL.

D. Commissioning Plan: Prepare complete plan and schedule of all commissioning activities, including those by NREL and other authorities; include all field tests and inspections, functional performance tests, demonstrations, and permit inspections and tests.

1. Contents: For each commissioning activity indicate:
   a. Entity performing activity.

b. Prerequisites, such as type of design information required, prior testing, etc.; identify in schedule as separate tasks.
c. Functions to be tested or inspected.
d. Methods of test or inspection, conditions required, and other procedures; if methods are not specified, identify methods that will demonstrate compliance with Subcontract Documents with satisfactory repeatability by others.
e. Equipment required.
f. Results required.

2. Schedule commissioning activities at the optimum time, to avoid unnecessary uncovering of work, retesting due to inadequate preparation, and duplication of effort.

3. If desired, schedule may be incorporated into overall progress schedule or substantiation schedule, provided commissioning tasks can be reported separately from other progress information.

4. Submission: To NREL; within 30 calendar days after notice award of Phase II of this subcontract.

5. Form: Computer database format for NREL's use in tracking submittals; database structured so NREL's added information will not be overwritten or deleted by incorporation of updated data from Subcontractor.

6. Updates: To NREL monthly in hard copy.

E. Commissioning Reports: Submit a report for each commissioning activity that involves inspection, observation, or testing of construction, on a standard form that identifies the project.

1. Timing: Submitted within 7 calendar days after completion of the activity; for activities that are prerequisites for other activities to be witnessed by NREL, satisfactory report submitted prior to start of witnessed activity.

2. Contents:
a. Identification of activity, including element/system involved, date/time.
b. Entity performing activity; other persons present.
c. Prerequisites required and accomplished.
d. Procedures or methods of testing.
e. Results required and results achieved.

F. NREL-Conducted Commissioning Activities:

1. NREL will assign a staff member to manage the commissioning process beginning during Preliminary Design and to perform the following commissioning activities:
a. Review of design criteria documentation for completeness.
b. Review of Subcontractor's commissioning plan and specifications.

2. NREL, NREL's staff, or consultants will perform the following commissioning activities:
a. Inspection just prior to Substantial Completion, including preparation of NREL's punchlist.
b. Inspection prior to final payment.

CLOSEOUT SUBMITTALS

A. Maintenance Manuals: Assemble system design information, operation and maintenance data, and copies of warranties into manuals, organized by functional system (e.g. plumbing, HVAC, etc.) or material type (e.g. flooring, wall finishes, etc.) as appropriate using specification numbers where applicable.

1. Binders: 3-ring, D-ring, with hard cover, project title on spine, Table of Contents in each volume, and stiff dividers with labeled tabs; contents divided into logical binders not more than 3 inches thick.
2. Directory: Names, addresses, telephone numbers, of all design and construction entities, including subcontractors and suppliers, with names of products supplied.
3. Software-Operated Systems and Equipment: Detailed program documentation, a general review of the programming approach, description of use on this project, and description of possible user-modifications.
4. Drawings: Bound into manuals, folded to size of binder.
5. Product Listing: Manufacturer's brand name for each major product actually installed, in alphabetical order by generic product name, cross-referenced to specification numbers and Table of Contents of manuals.
6. Warranties: Photocopies of originals.
7. Videotapes of training sessions.
8. See other sections for additional requirements for contents of operation and maintenance data.

B. Project Record Documents: Provide one set of all documents forming the subcontract and deliverables, including drawings, recording all changes made by addenda, by formal modifications, and in performing the work, for NREL's future reference.

1. Changes to be Recorded Include:
   a. Actual measured locations and ends of existing and abandoned below grade utilities.
   b. Actual measured locations (horizontal and vertical) of foundations and concealed utilities and appurtenances, referenced to visible permanent appurtenances.
   c. Field changes of dimension and detail and details not on original documents.
   d. Actual products used, in specification, with brand name or model number.
2. Submittal Copy of Drawings: All marks copied to a clean set of prints.
   a. Provide one copy of the BIM model in a format acceptable to NREL.
   b. As-built drawings must be incorporated into AutoCAD drawing files in accordance with NREL CAD standards.

C. Final Site Survey: Pre-construction survey updated after completion of finished site work, verifying location and level of permanent benchmarks and control points, utility access points, and principal improvements.

DEMONSTRATION AND TRAINING

A. Training: Perform training of NREL's personnel in operation and maintenance of equipment, consisting of:

1. Training is required for all software-operated systems, HVAC systems and equipment, plumbing equipment, electrical systems and equipment, conveying systems, other electrically-operated equipment, and security and safety equipment.
   a. Provide supplemental training within 6 months for operations that are seasonal in nature.
2. Instruction in operation, control, adjustment, shut-down, servicing, troubleshooting, and maintenance, for each equipment item for which training is specified.
3. Instruction in care, cleaning, maintenance, and repair of materials, for:
   a. Each item for which training is specified.
   b. Roofing, waterproofing, other weather-exposed or moisture protection products.
   c. Finishes, including flooring.
   d. Fixtures and fittings.
   e. Items as specified in other Sections.
4. Systems: Training by manufacturer's certified instructor(s), on-site: for minimum of 6 NREL staff members, with all training materials.
5. Training Documentation: If not otherwise specified, conduct training on-site, with videotapes made for future use.
6. Minimum Qualifications of Trainers: Knowledgeable about the project and the equipment and trained by the manufacturers.
7. Maintenance Manuals: Ready for use in training.

OPERATION AND MAINTENANCE

A. Operation and Maintenance: Subcontractor is responsible for the following:

1. Preparation of maintenance plan for NREL's use, including description of maintenance activities, tools, and supplies required. Reference Part 3-Performance Criteria (Facility Performance) for additional details related to Operations and Maintenance requirements.

B. Post-Occupancy Survey: Conducted by NREL, of actual occupants after minimum of 1 month of full occupancy and operation, and again after 6 months.

1. See Subcontract for provisions relating to results of post-occupancy survey.

2. Purpose of Survey: Subjective evaluation of function and quality of project as a whole. Survey questions will include:
   a. Were the final design and features communicated to you before construction began?
   b. Have the functional needs you identified as important been provided?
   c. Was the progress of construction of the new facility communicated to you on a regular basis?
   d. Is the room temperature of your work area comfortable? Is the performance of the heating/air conditioning system acceptable?
   e. Does the amount of direct lighting in your work area meet your needs and expectations?
   f. Does the amount of outside natural light into your work area meet your expectations based on the design and location of your work area?
   g. Is noise from other work areas or outside sources not objectionable in your work area?
   h. Does the performance of the equipment you use in your work area meet your expectations? (Excluding owner-provided equipment)
   i. Does the appearance of the building and structures both inside and outside convey the appropriate image to the community and our visitors?
   j. Is the building and improvements user-friendly? Have features been placed where they are convenient and readily accessible?
   k. Does the quality of construction meet your expectations? Do finishes, trim, and craftsmanship demonstrate the expected level of quality?
   l. Were you provided with an appropriate level of orientation regarding the features of the new building and parking structure before 'move-in'?
   m. Is the number of corrective repairs or warranty claims up to this point of occupancy less or more than you would expect with a major new facility?
   n. How would you rate the new Project, overall, on a scale of 1 to 10 (lowest to highest), realizing that it would be impossible to completely please everyone?

REFERENCE DOCUMENTS

A. Applicability:
   1. The documents referenced in the RFP (and those which may be listed herein, but are not found in the RFP) are a part of the Proposal and govern the design and construction.
   2. Unless otherwise indicated, follow version of reference documents in effect at time of subcontract award.

B. Government Regulations and Publications:
   1. CFR - Code of Federal Regulations, United States Government:
      a. 10 CFR 851 - Worker Safety and Health.
      b. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials; Consumer Product Safety Commission; current edition.
      c. 28 CFR 36 - Nondiscrimination by Public Accommodations and in Commercial Facilities; Final Rule; Department of Justice; current edition.
      d. 29 CFR 1904 - Recordkeeping Reporting; current edition.
      e. 29 CFR 1910 - Occupational Safety and Health Standards; Occupational Safety and Health Administration; current edition.
      f. 29 CFR 1926 - Safety and Health Regulations for Construction; Occupational Safety and Health Administration; current edition.
      g. 36 CFR 1191 - Americans with Disabilities Act Accessibility Guidelines for Buildings and Facilities; Final Guidelines and Amendment to Final Guidelines (ADAAG); Architectural and Transportation Barriers Compliance Board; current edition; reprinted compiling all revisions, September 1994.
      h. 36 CFR 1192 - Americans with Disabilities Act Accessibility Guidelines for Transportation Vehicles; Final Guidelines; Architectural and Transportation Barriers Compliance Board; current edition.
      i. 40 CFR 122 - NPDES General Permit for Stormwater Discharges from Construction Activities (issued by the EPA).

C. Model Code Organizations:
   1. 2006 International Building Code.
   2. 2006 International Fire Code.
   3. 2006 International Plumbing Code.
   4. 2006 International Mechanical Code.
   5. 2006 International Fuel Gas Code.
   6. 2006 International Energy Conservation Code.
   7. 2006 ICC Electrical Code - Administrative Provisions.

D. U.S. Government Standards:
   1. FHWA FLP-94-005 - Best Management Practices for Erosion and Sediment Control; Federal Highway Administration; 1995.
   2. National Priority Project Criteria (Energy Policy Act 2005), Section 1405.
   3. FED-STD-795 - Uniform Federal Accessibility Standards; April 1, 1988 (UFAS).

E. Non-Governmental Standards Developing Organizations:
   1. AAMA - American Architectural Manufacturers Association.
      a. AAMA 1503 - Voluntary Test Method for Thermal Transmission and Condensation Resistance of Windows, Doors, and Glazed Wall Sections; 2009.
      b. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels; 2005.

c. AAMA 2505 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels; 2005.

2. AASHTO - American Association of State Highway and Transportation Officials:

   a. AASHTO GDPS - Guide for Design of Pavement Structures, Volume 1; 1993 with 1998 supplement.

   b. AASHTO GDPSV2-3 - Guide for Design of Pavement Structures, Volume 2; 1986.

   c. AASHTO GDHS - A Policy on Geometric Design of Highways and Streets; 2004.

3. ACI - American Concrete Institute International:

   a. ACI 201.2R - Guide to Durable Concrete; 2001.

   b. ACI 302.1R - Guide for Concrete Floor and Slab Construction; 2004 (Errata 2007).

4. ASCE - American Society of Civil Engineers:

   a. ASCE 7 - Minimum Design Loads for Buildings and Other Structures; 2005.

5. ASHRAE - American Society of Heating, Refrigerating and Air-Conditioning Engineers:

   a. ASHRAE (HVACA) - ASHRAE Handbook - HVAC Applications; 2007.

   b. ASHRAE Guideline 1 - The HVAC Commissioning Process; 1996.

   c. ANSI/ASHRAE Std 62.1 - Ventilation for Acceptable Indoor Air Quality; 2007 (errata 2008).

6. ASTM - ASTM International:

   a. ASTM C 755 - Standard Practice for Selection of Vapor Retarders for Thermal Insulation; 2003.

   b. ASTM C 1199 - Standard Test Method for Measuring the Steady State Thermal Transmittance of Fenestration Systems Using Hot Box Methods; 2000.

   c. ASTM C 1363 - Standard Test Method for the Thermal Performance of Building Assemblies by Means of a Hot Box Apparatus; 2005.

   d. ASTM D 2047 - Standard Test Method for Static Coefficient of Friction of Polish-Coated Floor Surfaces as Measured by the James Machine; 2004.

   e. ASTM D 2244 - Standard Practice for Calculation of Color Differences From Instrumentally Measured Color Coordinates; 2007.

   f. ASTM E 72 - Standard Test Methods of Conducting Strength Tests of Panels for Building Construction; 2005.

   g. ASTM E 96/E 96M - Standard Test Methods for Water Vapor Transmission of Materials; 2005.

   h. ASTM E 283 - Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 2004.

   i. ASTM E 330 - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference; 2002.

j. ASTM E 695 - Standard Method for Measuring Relative Resistance of Wall, Floor, and Roof Construction to Impact Loading; 2003.

k. ASTM E 1155 - Standard Test Method for Determining F (F) Floor Flatness and F (L) Floor Levelness Numbers; 1996 (Re-approved 2008); or ASTM E 1155M; 1996 (Re-approved 2008).

l. ASTM E 1300 - Standard Practice for Determining Load Resistance of Glass in Buildings; 2007.

m. ASTM E 1477 - Standard Test Method for Luminous Reflectance Factor of Acoustical Materials by Use of Integrating-Sphere Reflectometers; 1998a (Re-approved 2003).

n. ASTM E 1677 - Standard Specification for Air Barrier (AB) Material or System for Low-Rise Framed Building Walls; 2005.

o. ASTM F 793 - Standard Classification of Wall Covering by Use Characteristics; 2007.

7. BOMA - Building Owners and Managers Association:

   a. ANSI/BOMA Z65.1 - Standard Method for Measuring Floor Area in Office Buildings; 1996.

8. IEEE - The Institute of Electrical and Electronics Engineers:

   a. IEEE 1100 - IEEE Recommended Practice for Powering and Grounding Sensitive Electronic Equipment; 2005.

9. IESNA - Illuminating Engineering Society of North America:

   a. IESNA (LH) - Lighting Handbook; 2000.

   b. IESNA RP-5 - Recommended Practice of Daylighting; 1999.

10. NAAMM - National Association of Architectural Metal Manufacturers:

    a. NAAMM FP 1001 - Guide Specifications for Design Loads of Metal Flagpoles; 1997.

11. NEC – National Electric Code 1999

    a. Article 625 – Electric Vehicle Charging System

    b. Article 690 – Photo Voltaic Systems

12. NEMA - National Electrical Manufacturers Association:

    a. NEMA 250 - Enclosures for Electrical Equipment; 2003

13. NFPA - National Fire Protection Association:

    a. NFPA 10 - Standard for Portable Fire Extinguishers; 2007.

    b. NFPA 13 - Standard for the Installation of Sprinkler Systems; 2007.

    c. NFPA 14 - Standard for the Installation of Standpipe, Private Hydrant, and Hose Systems; 2007.

    d. NFPA 25 - Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems; 2008.

    e. NFPA 70 - National Electrical Code; 2008.

f. NFPA 72 - National Fire Alarm Code; 2007.

g. NFPA 241 - Standard for Safeguarding Construction, Alternation, and Demolition Operations; 2004.

h. NFPA 1144 - Standard for Reducing Structure Ignition Hazards from Wildland Fire; 2008.

14. PECI - Portland Energy Conservation, Inc.:

a. PECI (MCGS) - Model Commissioning Guide Specifications; Portland Energy Conservation, Inc.; located at http://www.peci.org/library/mcpgs.htm; current edition.

b. PECI (MCP) - Model Commissioning Plan; Portland Energy Conservation, Inc.; located at http://www.peci.org/library/mcpgs.htm; current edition.

15. SMACNA - Sheet Metal and Air Conditioning Contractors' National Association, Inc.:

a. SMACNA (ASMM) - Architectural Sheet Metal Manual; 2003.

16. USGBC - U. S. Green Buildings Council, www.usgbc.org

a. USGBC LEED-NC - LEED Green Building Rating System For New Construction & Major Renovations; 2009.

F. Private Evaluation Organizations

1. NFRC - National Fenestration Rating Council

2. UL - Underwriters Laboratories Inc.:

a. ANSI/UL 972 - Burglary Resisting Glazing Material; 2006.

G. Additional Requirements: In addition to the Reference Documents, comply with the following “laws and regulations” to which all work at NREL facilities must comply:

1. Code of Federal Regulations (CFR)

a. 10 CFR 8.4 - Interpretation by the General Counsel: AEC Jurisdiction

b. 10 CFR 835 - Occupational Radiation Protection (Except Sections 101 (c), ALARA Plans and Measures, 402 (h), DOE Laboratory Accreditation Program for Personal Dosimetry, 901, General Employee Training, and 902, Radiological Workers Training)

c. 10 CFR 851 - Worker Safety and Health Program

d. 10 CFR 1021 - DOE NEPA Implementing Regulations, Subtitle B - DOE Decision making

e. 10 CFR 1021 - DOE NEPA Implementing Regulations, Subtitle D - Typical Classes of Actions (Including ref. Appendices A-D)

f. 051-1 Act of 1970, Section 5 (a) (1) - General Duty Clause

g. 29 CFR 1904 - OS1-3A Recordkeeping and Reporting Occupational Injuries and Illness

h. 29 CFR 1926 - Occupational Safety and Health Standards for the Construction Industry

i. 33 CFR 320 - General Regulatory Policies

j. 33 CFR 323 - Permits for Discharges of Dredged or Fill Material into Waters of the United States

k. 33 CFR 325 - Processing of Department of the Army Permits

l. 33 CFR 328 - Definition of Waters of the United States

m. 33 CFR 330 - Nationwide Permits

n. 36 CFR 63 - Determination of Eligibility for Inclusion in the National Register of Historic Places

o. 36 CFR 65 - National Historic Landmarks Program

p. 36 CFR.78 - Waiver of Federal agency responsibilities under section 110 of the National Historic Preservation Act

q. 36 CFR 79 - Curation of Federally-Owned and Administered Archaeological Collections.

r. 36 CFR 800 - Protection of Historic and Cultural Properties

s. 40 CFR 50 - National Primary and Secondary Ambient Air Quality Standards

t. 40 CFR 61 - National Emission Standards for hazardous Air Pollutants

u. 40 CFR 66 - Assessment and Collection of Noncompliance Penalties by EPA

v. 40 CFR 79 - Registration of Fuels and Fuel Additives

w. 40 CFR 82 - Protection of Stratospheric Ozone

x. 40 CFR 88 - Clean Vehicles

y. 40 CFR 110 - Discharge of Oil

z. 40 CFR 112 - Oil Pollution Prevention

aa. 40 CFR 113 - Liability Limits for Small 01/Share Storage Facilities

bb. 40 CFR. 116 - Designation of Hazardous Substances

cc. 40 CPR 117 - Determination of Reportable Quantities for Hazardous Substances

dd. 40 CFR 122 - EPA Administered Permit Programs: The National Pollutant Discharge Elimination System (NPDES)

ee. 40 CFR 131 - Water Quality Standards

ff. 40 CFR 141 - National Primary Drinking Water Regulations

gg. 40 CFR 142 - National Primary Drinking Water Regulations Implementation

hh. 40 CFR 166 - Exemption of Federal and State Agencies for use of Pesticides under Emergency Conditions

ii. 40 CFR 171 - Certification of Pesticide Applicators

jj. 40 CFR 260-270 - Resource Conservation and Recovery Act (RCRA)

kk. 40 CFR 261 - Identification and Listing of Hazardous Waste

ll. 40 CFR 262 - Standards Applicable to Generators of Hazardous Waste

mm. 40 CPR 268 - Land Disposal Restrictions

nn. 40 CFR 273 - Standards for Universal Waste Management

oo. 40 C.FR. 279 - Standards for the Management of Used Oil

pp. 40 CFR 302 - Designation, Reportable Quantities, and Notification (CERCLA)

qq. 40 CFR 355 - Emergency Planning and Notification (CERCLA)

rr. 40 CFR 370 - Hazardous Chemical Reporting: Community Right -To-Know

ss. 40 CFR 401 - General Provisions - Effluent Guideline and Standards

tt. 40 CFR 403 - General Pretreatment Regulations for Existing and New Sources of Pollution

uu. 40 CFR 763 - Subpart G - Asbestos Abatement Projects

vv. 49 CFR 107-199 Transportation - Hazardous Materials Regulations

ww. 49 CFR. 382-399Transportation - Federal Motor Carrier Safety Regulations

xx. 50 CFR 17 - Endangered and Threatened Wildlife and Plants

yy. 50 CFR 402 - Interagency Cooperation - Endangered Species Act of 1973

zz. 50 CFR 424 - Listing Endangered and Threatened Species and Designating Critical Habitat

aaa. 50 CFR 450 - General Provisions - Endangered Species Exemption Process

bbb. 50 CFR 451 - Application Process

2. United States Code (USC)

   a. 7 USC 136 et seq. - Environmental Pesticide Control Act

   b. 7 USC 136 et seq. - Federal Insecticide, Fungicide, and Rodenticide Act .

   c. 7 USC 7701 Plant Protection Act 2000 (as amended by the Noxious Weed Control and Eradication Act 2004)

   d. 15 USC 2601 et seq.- Toxic Substances Control Act, Title 11 (Asbestos Hazard Emergency Response)

   e. 16 USC 431 et seq. - Antiquities Act of 1906

   f. 16 USC 470 et seq. - Archaeological Resources Protection Act of .1979 (ARPA)

   g. 16 USC 470 et seq. - National Historic Preservation Act of 1966 (NIIPA)

   h. 16 I,ISC 661 et seq. - Fish and Wildlife Coordination Act

   i. 16 USC 668 et seq. - Bald and Golden Eagle Protection Act

   j. 16 USC 703 et seq. - Migratory Bird Treaty Act

   k. 16 USC 1531 et seq_ - Endangered Species Act of 1973

   l. 33 USC 1251, et seq. - Clean Water Act

   m. 33 USC 1321 - Oil and Hazardous Substances Liability (Clean Water Act, Section 311)

   n. 42 USC Sec. 300f et seq. - Safe Drinking Water Act, and 42 USC 201 - Safe Drinking Water Act Amendments of 1996

o. 42 USC 6901 et seq. - Resource Conservation and Recovery Act (RCRA)

p. 42 USC 7401 et seq. - Clean Air Act & Amendments

q. 42 USC 9602 - CERCLA, Title 1, Section 102 - Reportable Quantities and Additional Designations

r. 42 USC 9603 - CERCLA, Title 1, Section 103 - Notices, Penalties

s. 42 USC 11000-11050 , Emergency Planning and Community Right-to-Know Act of 1986 (EPCRA)

t. 42 USC 13101-13109 - Pollution Prevention Act of 1990

3. Executive Order (EO)

a. EO 11593 - Protection and Enhancement of Cultural Environment 1971

b. EO 11738 - Providing for Administration of the Clean Air Act and the Federal Water Pollution Control Act with Respect to Federal Contracts, Grants or Loans

c. EO 11988 - Floodplain Management

d. EO 11990 - Protection of Wetlands

e. EO 12114 - Environmental Effects Abroad of Major Federal Actions

f. EO 12843 - Procurement Requirements and Policies for Federal Agencies for Ozone-Depleting Substances

g. EO 12856 - Federal Compliance with Right-to-Know Laws and Pollution Prevention Requirements

h. EO 12898 - Federal Actions to Address Environmental Solstice in Minority Populations and Low Income Populations

i. EO 13112 - Invasive Species 1999

j. EO 13423, Strengthening Federal Environment, Energy and Transportation Management

k. EO 13514, Federal Leadership in Environmental, Energy and Economic Performance

l. EO 13186 - Responsibilities of Federal Agencies to Protect Migratory Birds

4. Other Federal Standards

a. EPA Air Quality Standards

5. Department of Energy

a. DOE O 430.2B, Renewable Energy and Transportation Management

b. DOE M 470.4-1, Safeguards and Security Program Planning and Management

c. DOE P 456.1 - Secretarial Policy Statement on Nanoscale Safety (dated 09/15105)

d. DOE 414.1C - Quality Assurance

e. CRD – Contract Required Documents as incorporated in DOE Orders made applicable under Prime Contract No. DE-AC36-08GO28308 with the Alliance for Sustainable Energy, LLC. Referenced DOE Orders can be found at Section J – “List of Documents, Exhibits and

Other Attachments", Attachment 5 – "Operating and Administrative Requirements", located on the following URL:

http://www.eere.energy.gov/golden/PDFs/ReadingRoom/PrimeContract/Mod_M195/Modification_No._195.pdf

The full text of referenced DOE Orders can be located at the following URL:

http://www.directives.doe.gov/

6. National Renewable Energy Laboratory Standards
   a. Stormwater Pollution Prevention for Construction Activities: South Table Mountain Site (6-2.15)
   b. Stormwater Pollution Prevention for Construction Activities: NWTC (6-2.16)
   c. Environmental Permitting and Notification (6-2.1)
   d. National Environmental Policy Act Implementation (6-2.2)
   e. Drinking Water Program (6-2.3)
   f. Above Ground Storage Tank Management (6-2.7)
   g. Waste Management and Minimization (6-2.8)
   h. Particulate Emission Control for Construction (6-2.14)
   i. Sustainable Landscape Design and Management Program (6-2.19)
7. Code of Colorado Regulations (CCR)
   a. 2 CCR 402-2 - Water Well Construction
   b. 2 CCR 402-4 - Rules for Small Capacity Well Permits in Designated Ground Water Basins
   c. 2 CCR 406-8 - Chapter 10, Article 2 and 3 Non-Game Wildlife
   d. 5 CCR 10011-20 - Colorado Department of Public Health & Environment, Air Quality Control Commission Regulations
   e. 5 CCR 1001-5, Regulation 3, Section II.D.1.j – Air Emissions Construction Permit for Overlot Grading and Associated Construction Activities
   f. 5 CCR. 1001-10 Regulation No 8 - Control of Hazardous Air Pollutants
   g. 5 CCR 1001-19 - Control of Emission of Ozone Depleting Compounds
   h. 5 CC.R. 1002-31 - Basic Standards and Methodologies for Surface Water
   i. 5 CCR 100241 - The Basic Standards for Groundwater
   j. 5 CCR 1002-42 - Site-Specific Water Quality Classifications and Standards for Ground Water (Rocky Flats Area)
   k. 5 CCR 1002-61 - Colorado Discharge Permit System Regulations
   l. 5 CCR 1002-62 - Regulations for Effluent Limits
   m. 5 CCR 1002-63 - Pretreatment Regulations

n. 5 CCR 1002-65 - Regulations Controlling Discharges to Storm Sewers

o. 5 CCR 1003 -1 - Primary Drinking Water Regulations

p. 5 CCR 1003-6 - Guidelines on Individual Sewage Disposal Systems

q. 6 CCR 1007-1 - Part 1 - General Provisions

r. 6 CCR 1007-1 - Part 2 - Registration of Radiation Producing Machines

s. 6 CCR 1007-1 - Part 3, Sections 1-7 - Exempt and General License Material

t. 6 CCR 1007-1 - Part 4 - Standards for Protection Against Radiation

u. 6 CCR 1007-1 - Part 8 - Radiation Safety Requirements for Analytical X-Ray Equipment

v. 6 CCR 1007-1 - Part 10 - Notices, Instructions, and Reports to Workers; Inspections

w. 6 CCR 1007-1 - Part 17 - Transportation of Radioactive Material

x. 6 CCR 1007-3 - Colorado Hazardous Waste Regulations

y. 7 CCR 1101-14 - Underground Storage Tanks and Aboveground Storage Tanks

z. 8 CCR 1507-1 - Colorado Operation of Commercial Vehicles and Transportation of Hazardous Materials

aa. 8 CCR 1507-7 - Colorado Hazardous Materials Route Designation

bb. 8 CCR 1507-8 - Colorado Hazardous Materials Transportation Reporting

cc. 8 CCR 1507-9 - Colorado Transporting and Shipping of Hazardous Materials

dd. Rules and Regulations Pertaining to the Administration and Enforcement of the Colorado Weed Management Act (Colorado State Weed List - No citation available yet.)

ee. State of Colorado Noise Statue, CCR 25-12-101 to 109.

8. Colorado Revised Statutes (CRS)

a. 8 CRS 20.5 - Parts 1-3 - Petroleum Storage Tanks

b. 25 CRS 7 - Air Quality Control

c. 25 CRS 8 - Colorado Water Quality Control Act

d. 25 CRS 10 - Individual Sewage Disposal Systems Act

e. 25 CRS 15 - Part 1, Part 3 - State Hazardous Waste Management Program

f. 25 CRS15 - Part 1, Part 4 - Infectious Waste

g. 29 CRS 22 - Hazardous Substances Incidents

h. 33 CRS 2 - Nongame and Endangered Species Conservation

i. 33 CRS 6 - Law Enforcement and Penalties

j. 35 CRS 5 - Pest Control Districts

k. 35 CRS 5.5 - Colorado Weed Management Act

l. 35 CRS 9 - Pesticide Act

m. 35 CRS 10 - Pesticide Applicators Act

n. 37 CRS 90-101, et seq. - Colorado Ground Water Management Act

9. American Conference of Governmental Industrial Hygienists (ACGIH)

   a. ACGIII Threshold Limit Values for Chemical Substances and Physical Agents (Latest Edition)

10. American National Standards Institute (ANSI)

    a. ANSI Z126.1 - Safe Use of Lasers (Latest Version)

    b. ANSI Z88.2 - American National Standard for Respiratory Protection

    c. ANSI Z49.1:2005 - Safety in Welding, Cutting and Allied Processes

11. National Institute of Health (N-11-1)

    a. NM - Guidelines for Research Involving Recombinant DNA Molecules (Latest Edition) Excluding

    b. Section IV-B-2-a (3): Annual reporting to N11-1 including the roster of Institutional Biosafety Committee (IBC).

    c. Section W-B-2-a (6): Open IBC meetings to the public, when possible.

    d. Section TV-13-2-a (7): All IBC meeting minutes will be made available to the public for review and comment. Public comments and the Track response is to he forwarded to NTH.

12. OTHER LOCAL STANDARDS

    a. Consolidated Mutual Water Company Rules

    b. Jefferson County Dept. of Health and Environment, Individual Sewage Disposal Sys. Reg.

    c. Metro Wastewater Reclamation District Rules and Regulations

    d. Pleasant View Water and Sanitation District Rules and Regulations

    e. West Metro Fire Rescue Amendments to the international Fire Code

    f. Jefferson County Zoning Regulations – Section 11 Lighting

END OF PART 1-DESIGN & CONSTRUCTION PROCEDURES

PART 2
PROGRAM
TABLE OF CONTENTS

PROGRAM OVERVIEW

A. NARRATIVE

The Program contains the traditional programmatic needs of NREL including: spatial metrics and capacities, spatial relationship requirements, furnishings / fixtures / equipment requirements, special ambient and environmental requirements, and any particular specific aesthetic requirements not addressed in Part 3-Performance Criteria.

In addition, the Program contains a 'Risk Analysis Report' (RAR). The RAR is NREL's analysis of the impact to project cost, quality, and schedule that would result based on known conditions and assumptions unique to this project. The RAR is an essential tool used by NREL to establish many evaluation components used in the selection of the Subcontractor as detailed in the Procedures section.

B. OBJECTIVES:

The South Table Mountain (STM) site population is currently approximately 650 staff. However, this population will grow to 1,450 during 2010 when approximately 800 staff (currently housed off campus) are moved to the STM site to occupy new facilities. An additional 500-600 staff will be relocated to STM in 2012 when additional new campus facilities are complete, increasing the site population beyond 2,500.

The South Table Mountain Ingress/Egress and Traffic Capacity Upgrades project is required to provide parking for a minimum of 1,500 vehicles with the potential to provide parking for up to 1,800 vehicles or more. Also included in the project is the design and construction of up to 4,000 lineal feet of South Table Mountain campus roadways and the relocation and expansion of the campus utilities (water, natural gas, sewers, electric, telecom/data, etc). Add Alternate No. 1 is planned for an additional access road from the south to improve traffic flow and safety response. As a result of the new site access the project includes a new site entrance building with systems and hardware for campus access and security that integrate with the new parking structure.

The scope of the Ingress & Egress Upgrades project is to provide the following:

1. Build multi-level parking structure(s) on the STM site for a minimum of 1,500 vehicles to support a coordinated site circulation pattern and, in the process, free up low density surface parking lots for future high-value development;
2. Provide Security and Access Control of the STM site via a future public roadway by means of Site Entrance Building;
3. Relocate and improve existing on-site roadways, utilities, and drainages necessary to accommodate the new site traffic patterns (including Campus Shuttle Services) and future STM site development as envisioned in the Campus Master Plan;
4. Plan for an additional access road from off-site to the STM campus from the south to improve traffic flow capacity and safety response (construction is addressed in Add Alternate No. 1); and
5. Further meet the vision of the "Campus Master Plan".

C. PROGRAM COMPONENTS

The Program is essentially three major scopes-of-work: Security Operations, Parking Structure, and Site Improvements; together they comprise the STM Ingress/Egress and Traffic Capacity Upgrades project. Following is an outline describing each component, and highlighting some of the project's key goals, objectives, and requirements.

1. Security Operations

   Provide a Site Entrance Building (SEB) in accordance with the Program. SEB functions may be integrated with the parking structure or provided as a stand-alone building. The SEB provides secure access control for all employee and visitors entering the STM Campus from the south

access point (re: Campus Master Plan). SEB facility is approximately 1,000 SF (as further defined in the Program).
As the SEB is a facility of "first impression", the aesthetic appeal and image should reinforce the mission of NREL; project a sense of "campus security"; and be appropriate for a federal facility. Materials and massing shall be contextual to the larger campus.

2. Parking Structure
   Provide structured parking for a minimum of 1500 automobiles (as further defined in the Program). Proven technologies such as cast-in-place facilities using epoxy coated reinforcement and highly durable concrete mix designs (such as silica-fume) may assist in maximizing service lifespan.
   As the facility must achieve a high level of energy efficiency consistent with NREL's mission; the energy systems must use a maximum of 175 kBTU per parking space per year. Integration of natural lighting and ventilation systems are valued to the extent they support the energy efficiency requirements.
   As the parking facility will be a 24/7 operation, safe environmental design (such as Crime Prevention Through Environmental Design (CPTEDP)) is essential for user comfort and a sense of personal security. Balancing energy consumption with a safe and secure environment will likely make use of motion-sensing lighting systems, or other energy saving designs that assure personal security.
3. Site Improvements
   Provide site improvements, such as vehicular and pedestrian circulation routes, utility extensions, walks, roadways and drives, automated access control gates, signage, and other amenities that are driven by the design-builder's solution, the NREL Campus Master Plan, design best-practices, and consistent with elements further identified in the Program.
   Site geometrics shall be consistent with ASHTO Guidelines. Utility and site improvements shall achieve the requirements of the NREL Campus Master Plan; coordinate with existing campus improvements; support employee/visitor vehicular circulation, campus shuttle circulation, and campus storm water management concepts.

RISK ANALYSIS REPORT

A. NARRATIVE

The following report lists the project goals and objectives along with associated project risks identified by the IPT. The primary Mission Critical project goals are those that, if not achieved, would prevent the project from advancing or render the project unsuccessful. The Project Risks identify the challenge or constraints which have the potential to increase the likelihood that the project goals will not be achieved. The Risk Chart attempts to assign a subjective rating for each risk related to each project goal. Note that not all risk/goal combinations are related and therefore not each combination is assigned a rating.

The report serves to educate both NREL and the Subcontractor as to the issues that may impact the project's cost, quality, and schedule, and as such may be greatly mitigated by unique designs and pro-active project management.

Most importantly, the Risk Analysis Report identifies the goals of the project as established by NREL.

B. MISSION CRITICAL PROJECT GOALS

1. 1,500 Net Additional Parking Spaces: The project site currently has a surface parking lot with 300 parking spaces. The project is required to add a minimum of 1,500 additional stalls. Note that existing surface parking stalls may be eliminated if replaced within the project solution. Also note that the existing spaces may not be eliminated until the replacement is complete and useable by the NREL.
2. Comply with NREL requirements: The facility will be located on the South Table Mountain Campus which is land owned by the Federal government. As such, it will be required to meet all DOE and NREL requirements. It will also be subject to federal executive orders, state codes, and NREL established best practices and procedures. However, the Owner and Subcontractor must be aware of the order of precedence for the code requirements. At the time of the Risk Analysis publication, the list of code organizations and the order of precedence had yet to be established. Among the requirements noted:
    a. Meet DOE reporting requirements, including ARRA requirements: Without knowledge of the jurisdictional hierarchy of established codes, the Owner and Subcontractor will be at risk until the codes have been identified and established.
    b. Meet NREL established requirements: NREL does not maintain independent building codes and will reference national, state, and local code. NREL holds safety to the highest standard and exceeds many safety requirements throughout design, construction and operations.
    c. South Table Mountain Campus Master Plan: While not a code and not considered a design guide, the Campus Master Plan provides guidance and direction based on the vision presented. The Subcontractor will apply professional knowledge and experience as to the application of the Campus Master Plan.
    d. Roadway and Utility requirements: Included in the NREL requirements will be reference to standards that guide the design and construction of the vehicular and pedestrian circulation along with site and building utilities. The subcontractor will apply professional knowledge and experience as to the application of these requirements and will lead the IPT through the application.
3. Maximize LEED™ points: The Owner maintains a goal of sustainable design and construction through maximizing the application of the USGBC LEED rating system. Included in the goal of maximizing LEED™ are minimizing energy use while maximizing day lighting and natural ventilation.

4. Meet the Budget: The program and performance criteria will provide a prioritized list including the mission critical elements. The project budget is fixed and the subcontractor will be required to achieve the project goals within the stated budget for the approved project scope.
5. Promote Ease of Mobility: The project site is strategically located to provide parking on the perimeter of the campus. The successful design-build team will thoughtfully address the movement of people via various modes while integrating pedestrians, bicycles, shuttles, personal vehicles, and delivery vehicles. The Campus Master Plan remains a guiding document but the application requires specific knowledge and experience.
6. Integrate Campus Security: This project shall include the space to house the staff required to meet the security requirements for employees, delivery vehicles and disoriented visitors who will use the new access road. Integration of the new South Table Mountain access road requires the design and construction of this project to be coordinated with work scope that is not yet designed.
7. Substantial Completion No Later than November, 2011: The mission critical schedule requires substantial completion no later than November, 2011. This substantial completion date includes a 3 month period anticipated for the DOE Critical Decision (CD) 2/3 approval process prior to the award of Phase II of this subcontract for Design Development and Construction.

C. PROJECT RISKS

A. Proximity to the property boundary
B. Do not exceed a 65 foot height restriction
C. Maintain safety during construction
D. Maintain safety during operations
E. Do not exceed the budget
F. Slow access road (ROW acquisition) integration
G. Meet NREL requirements (approvals, standards etc)
H. Legacy military waste/unforeseen conditions
I. Unacceptable aesthetics (design advisory board)
J. Does not provide additional parking capacity by December 2011
K. Select inexperienced DB subcontractor
L. “NREL security” knowledge of DB subcontractor
M. Protracted DOE approval schedule
N. Not spending construction funds by March 2011
O. Not achieving LEED
P. Not achieving energy goal
Q. EPA regulations
R. Communication from the DBT to IPT
S. Mechanical ventilation required in the parking structure

D. RISK CHART

PROBABILITY	IMPACT 1	2	3	4	5
1			7A		6A
2	1F 2F 4L 5F 5D	1L 1T 2I 3I 6F 6L	1P 3P 3Q 6I 6P 6Q	1I 3E 4I 4P 5L	1G 2L 2P 4R
3	1M 2G 2S	2E 3S 5R	1E 1H 4K 4M 4S	1Q 1S 2Q 3R 4H 5D 1K 2K	2C 2D 3K
4	2N	1R 2M 4C 4D	4A 5O 5Q 6O	1A	1N 2R
5	1J 1O 2A 2J 3C 3D	3A 5K	1B 3B 4B 4J 4O		1C 1D

PROGRAM INFORMATION

A. SPACE CODE SUMMARY

The Space Code Summary defines all of the space code listing used in the Space Criteria Sheets. This provides the Space Code, the Space Name and a general overview of the space. Each type is color-coded to match the Space Criteria Summary and the Net Diagram for easy reference.

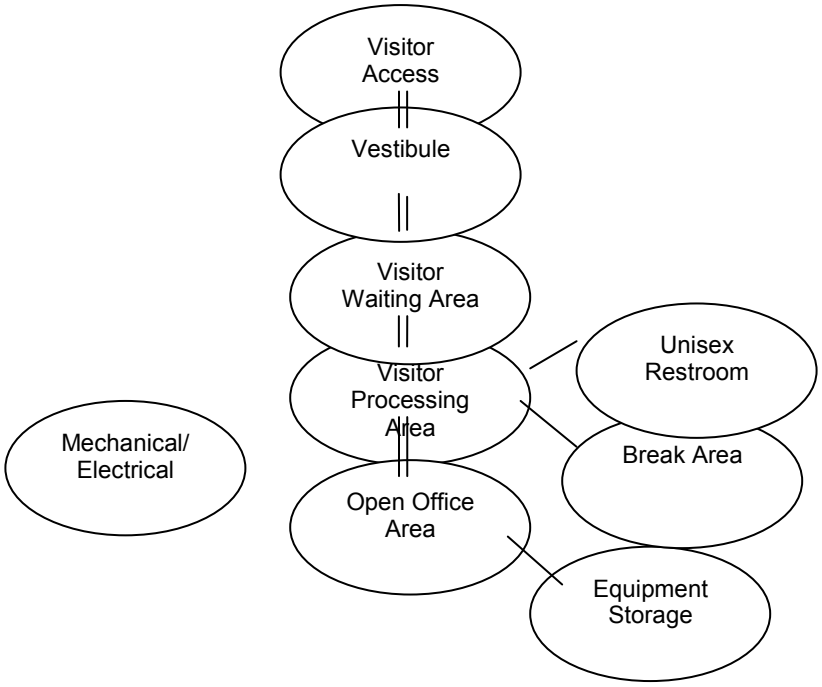
Space Type		Space Code	Space Name	Description of the Space
	Personnel	SP1	Visitor Contact	Spaces where the occupants meet the public or their customers, including reception & security desks.
		SP2	Occupant Work	Spaces intended primarily for NREL workers, including security offices and open-office cubicles
		SP3	Equipment Utilization	Spaces where more than one person may use common equipment.
	Resident	SR	Occupant Services	Spaces for toilets, showers, changing and dressing.
	Storage	SS	Storage	Rooms devoted to storage, including closets, storage rooms.
	Circulation	SC	Circulation	Spaces functioning as corridors, lobbies, waiting areas, vestibules, stairs, and ramps.
	Utility	SU1	Building Services	Spaces for service sinks, maintenance equipment, recycling and trash collection.
		SU2	Utility Equipment	Spaces for mechanical equipment, heating equipment, electrical equipment, communications equipment, and elevator equipment.
		SV1	Indoor Automotive	Space for parking vehicles including automobiles, motorcycles, and securing bicycles.
		SV2	Automotive	Space for parking vehicles, roadways, drives, access gates, and loading and unloading areas.

B. ADJACENCY DIAGRAM

The Adjacency Diagram (also known as a net diagram) identifies adjacencies between the spaces outlined in the Space Criteria Sheets. The spaces are color coded to correspond with the Space Code Summary and the Space Criteria Summary. Please note: not all spaces are identified on the adjacency diagrams.

The adjacencies are defined as follows:

1. ═══ Direct Adjacency – Spaces should be "next to" each other
2. ——— Indirect Adjacency – Spaces should be "close" to each other, they can be separated but should be easily accessible to each other
3. No Adjacency – No adjacency is required
4. Required Separation – Spaces should be separated for visual, acoustical, olfactory or other reasons.



C. SPACE CRITERIA SUMMARY

The Space Criteria Summary is a summary table of the defined spaces on the site. Each space is color-coded to correspond with the Space Code Summary and the Net Diagram. Please note: "Net Square Footage" is defined as the area from the inside face of wall to inside face of wall. The net square footage does not include a "grossing" factor." (I.e. walls, building circulation, mechanical and equipment support areas, utilities, etc.). The table also indicates what spaces require environmental conditioning (thermal control).

Enclosed Space						
Space Type		**Description**		**Space Code**	**Net Square Footage**	**Conditioned Vs. Un-conditioned**
Security Operations (SEB)	Personnel	Visitor Processing Area		SP1	100	C
		Open Office Area	2 Security Employee Workstations	SP2	250	C
			Drive-Up Window Operations	SP2	75	
			Process Equipment	SP3	80	
	Resident	Unisex Restroom		SR	2 @ 50	C
	Storage	Equipment Storage		SS	100	C
	Circulation	Vestibule (Air Lock)		SC	70	C
		Visitor Waiting Area		SC	100	C
	Utility	Mechanical / Electrical		SU2	Equipment Driven	C

Semi-Enclosed Space					
Space Type		**Description**	**Space Code**	**Capacity**	**Conditioned Vs. Un-conditioned**
Parking Structure		Automobile Parking	SV1	1500 (min)	U
		Motorcycle Parking	SV1	20 (min)	U
		Bicycle Parking	SV1	20 (min)	U

Site					
Space Type		**Description**	**Space Code**	**Capacity**	**Conditioned Vs. Un-conditioned**
Site	Utility	Shuttle Waiting Area	SV2	40 persons	U
		Trash/Recycling Area	SU1	16 yard	U
		Circulation Roads/Drives	SV2	Design Driven	U
		Shuttle Roads	SV2	Design Driven	U
		Security Checkpoints	SV2	Design Driven	U

D. SPACE CRITERIA SHEETS: The purpose of the Space Criteria Sheet is to establish and summarize minimum design criteria for each required space for the project.
   1. Characteristics: Each criteria sheet describes the following characteristics.
      a. Space Name: The name of the space (or program element)
      b. Security Zone: The secured access requirements of the space (see Part 3-Performance Criteria)
      c. Goal/Activities: The specific functional goals and activities of the space and/or its desired influence on other spaces or program elements
      d. Technologies: Requirements for ambient conditions, technologies, etc
      e. Equipment: The required equipment for the space. This notes the quantity and supplier and installer of such equipment
      f. Notes: General commentary on other requirements of the space
   2. Use: The Space Criteria Sheets used in conjunction with the Adjacency Diagram comprises the minimum program criteria for the project.
   3. Abbreviations used:
      a. NA: No exceptions to the performance specifications defined in Section 111-Facility Performance (Part 3-Performance Criteria).
      b. sf: square foot

Space:	Visitor Processing Area	**Space Code:**	SP1
Goals/ Activities:	Space to allow the 'security' processing of visitors and other persons seeking access to NREL Campus Facilities including: paperwork processing, ID check, information exchange, and badge distribution. This space is intended to accommodate groups being processed, announcement to groups by security personnel, etc.		
Quantity:	1		

General Characteristics			
Net Area:	100 SF	Ceiling Height:	Proportionate to area
Occupant Number:	Up to 8	Door Size:	Code
Security Zone:	Reception		

Data/Communications & Connections		**HVAC (Heating, Ventilation & Air Conditioning)**	
Telecom:	2 connections	Temperature Range:	RE: Part 3-Performance
Data:	2 connections	# Air Changes /Hour:	Code
Acoustics:	RE: Part 3-Performance	Outside Air:	Code
A/V:	1 Connection for Display Monitor		

Electrical Power		**Lighting**	
Power Receptacle:	Equipment driven	General:	RE: Part 3-Performance
Special Receptacle:	NA	Accent:	RE: Part 3-Performance to support activities
Un-interrupted Power:	NA	Other:	

Equipment Description	**Owner Supplied**	**Owner Installed**	**DB Supplied**	**DB Installed**
LCD Display Monitor – 36" 1080i	X	X		
Graphic Display substrate (32 sf of tackable surface)			X	X
46 sf of countertop space to support processing activities. Divides the 'visitor processing area' from the employee zone. Provides storage of materials.			X	X

Notes	
1	

Space:	Open Office Area	**Space Code:**	SP2/3
Goals/ Activities:	Space to support/accommodate 2 Security Employee workstations, Drive-Up Window operations/activities, accommodate processing equipment including, security ID equipment and general office equipment. This space is intended to support all typical work activities of security personnel.		
Quantity:	1		

General Characteristics			
Net Area:	250 sf (security workstations) 75 sf Drive-up window ops 80 sf Processing equipment	Ceiling Height:	Proportionate to area
Occupant Number:	Up to 3	Door Size:	Code
Security Zone:	Operations		

Data/Communications & Connections		**HVAC (Heating, Ventilation & Air Conditioning)**	
Telecom:	4 connections	Temperature Range:	RE: Part 3-Performance
Data:	8 connections	# Air Changes /Hour:	Code
Acoustics:	RE: Part 3-Performance	Outside Air:	Code
A/V:	NA		
TV:	Conduit and structural support for roof/wall mounted 18” satellite dish	Other:	Direct view to Processing Area, Waiting Area, Vestibule, and outdoors

Electrical Power		**Lighting**	
Power Receptacle:	Code+ 8 @ 120v	General:	RE: Part 3-Performance
Special Receptacle:	8 @ 120v for process equipment	Accent:	Task to support activities
Un-interrupted Power:	All	Other:	

Equipment Description	**Owner Supplied**	**Owner Installed**	**DB Supplied**	**DB Installed**
5 - computer workstations	X	X		
2 – 6’x8’ ‘systems furniture’ workstations (design and configuration by Subcontractor). Includes 10 linear feet of work surface, 6 liner feet of overhead storage, 2 under-top pedestals, and keyboard/mouse tray.			X	X
2 – Workstation chairs			X	X
8 linear feet of countertop work surface @ Drive-up window			X	X
Process Equipment & supporting furniture			X	X
Satellite Dish and connections	X	X		

Notes	
1	

Space:	Break Area	**Space Code:**	SP2/3
Goals/ Activities:	Space to provide lockers for personal belongings and a small area for food preparation.		
Quantity:	1		

General Characteristics			
Net Area:		Ceiling Height:	Proportionate to area
Occupant Number:	Up to 3	Door Size:	Code
Security Zone:	Operations		

Data/Communications & Connections		**HVAC (Heating, Ventilation & Air Conditioning)**	
Telecom:		Temperature Range:	RE: Part 3-Performance
Data:		# Air Changes /Hour:	Code
Acoustics:	RE: Part 3-Performance	Outside Air:	Code
A/V:	NA		
		Other:	

Electrical Power		**Lighting**	
Power Receptacle:		General:	RE: Part 3-Performance
Special Receptacle:		Accent:	Task to support activities
Un-interrupted Power:	All	Other:	

Equipment Description	**Owner Supplied**	**Owner Installed**	**DB Supplied**	**DB Installed**
Refrigerator (full size)			X	X
Microwave oven			X	X
Sink			X	X
6 linear feet of countertop work surface			X	X
Coffeepot	X	X		
12 vented lockers (3'x12"x22")			X	X

Notes	
1	

Space:	Unisex Restroom	**Space Code:**	SR
Goals/ Activities:	To support hygienic needs of employees and visitors.		
Quantity:	2		

General Characteristics			
Net Area:	2 @ 50 sf	Ceiling Height:	Proportionate to area
Occupant Number:	1 each	Door Size:	Code + (both ADA accessible)
Security Zone:	Reception		

Data/Communications & Connections		**HVAC (Heating, Ventilation & Air Conditioning)**	
Telecom:	NA	Temperature Range:	RE: Part 3-Performance
Data:	NA	# Air Changes /Hour:	Code
Acoustics:	Isolated, RE: Part 3-Performance	Outside Air:	Code
A/V:	NA		

Electrical Power		**Lighting**	
Power Receptacle:	Code	General:	RE: Part 3-Performance
Special Receptacle:	NA	Accent:	RE: Part 3-Performance
Un-interrupted Power:	Code	Other:	

Equipment Description	**Owner Supplied**	**Owner Installed**	**DB Supplied**	**DB Installed**
2 toilets (1 each restroom)			X	X
1 urinal (1 restroom only)			X	X
Accessory fixtures			RE: Part 3-Performance	RE: Part 3-Performance

Notes	
1	

Space:	Equipment Storage	**Space Code:**	SS
Goals/ Activities:	To store and maintain security equipment such as radios, clothing, and misc. equipment.		
Quantity:	1		

General Characteristics			
Net Area:	100 sf	Ceiling Height:	Proportionate to area
Occupant Number:	Up to 8	Door Size:	Code + support largest equipment item stored
Security Zone:	Secure		

Data/Communications & Connections		**HVAC (Heating, Ventilation & Air Conditioning)**	
Telecom:	NA	Temperature Range:	RE: Part 3-Performance
Data:	NA	# Air Changes /Hour:	Code
Acoustics:	RE: Part 3-Performance	Outside Air:	Code
A/V:	NA		

Electrical Power		**Lighting**	
Power Receptacle:	8 @ 120v (for recharge of equipment)	General:	RE: Part 3-Performance
Special Receptacle:	NA	Accent:	NA
Un-interrupted Power:	All	Other:	

Equipment Description	**Owner Supplied**	**Owner Installed**	**DB Supplied**	**DB Installed**
20 liner feet of full height (96”) modular shelving 24” deep to support 20 lbs/sf.			X	X

Notes	
1	

Space:	Vestibule	**Space Code:**	SC
Goals/ Activities:	Provide airlock to protect interior ambient condition.		
Quantity:	1		

General Characteristics			
Net Area:	70 sf min.	Ceiling Height:	Proportionate to area
Occupant Number:	NA	Door Size:	Code
Security Zone:	Public		

Data/Communications & Connections		**HVAC (Heating, Ventilation & Air Conditioning)**	
Telecom:	1 Intercom to security	Temperature Range:	RE: Part 3-Performance
Data:	NA	# Air Changes /Hour:	Code
Acoustics:	RE: Part 3-Performance	Outside Air:	Code
A/V:	1 Security Camera		

Electrical Power		**Lighting**	
Power Receptacle:	To support equipment	General:	Code
Special Receptacle:	NA	Accent:	To support equipment
Un-interrupted Power:	All	Other:	

Equipment Description	**Owner Supplied**	**Owner Installed**	**DB Supplied**	**DB Installed**
1 Security surveillance camera			X	X
1 intercom station (to security network)			X	X
1 electronic access control at inner doorway (remote operation by security in security Open Office Area).			X	X

Notes	
1	

Space:	Visitor Waiting Area	**Space Code:**	SC
Goals/ Activities:	Space to allow up to 8 visitors to wait seated for processing. Space shall support typical 'waiting lounge activities' including the support of conversations without disturbance to other adjacent spaces, reading, etc.		
Quantity:	1		

General Characteristics			
Net Area:	100 sf	Ceiling Height:	Proportionate to area
Occupant Number:	Up to 8	Door Size:	Code
Security Zone:			

Data/Communications & Connections		**HVAC (Heating, Ventilation & Air Conditioning)**	
Telecom:	2 phone ports	Temperature Range:	RE: Part 3-Performance
Data:	2 connections	# Air Changes /Hour:	Code
Acoustics:	RE: Part 3-Performance	Outside Air:	Code
A/V:	1 Connection for Display Monitor or shared view with "Processing Area" Monitor	Other:	View to Processing Area, outdoors, and Vestibule

Electrical Power		**Lighting**	
Power Receptacle:	For Monitor	General:	RE: Part 3-Performance
Special Receptacle:	NA	Accent:	RE: Part 3-Performance
Un-interrupted Power:	NA	Other:	

Equipment Description	**Owner Supplied**	**Owner Installed**	**DB Supplied**	**DB Installed**
LCD Display Monitor – 36" 1080i	X	X		
Seating for 8 visitors			X	X
8 sf of end-table(s) top surface			X	X
32 sf of lock-able display (tackable surface)			X	X

Notes	
1	

Space:	Mechanical/Electrical	**Space Code:**	SU2
Goals/ Activities:	House mechanical and electrical equipment required to support security Site Entrance Building (SEB) operations.		
Quantity:	1		

General Characteristics			
Net Area:	Equipment driven	Ceiling Height:	Proportionate to area
Occupant Number:	NA	Door Size:	Code + support largest piece of equipment
Security Zone:	S		

Data/Communications & Connections		**HVAC (Heating, Ventilation & Air Conditioning)**	
Telecom:	Equipment driven	Temperature Range:	RE: Part 3-Performance
Data:	Equipment driven	# Air Changes /Hour:	Code
Acoustics:	RE: Part 3-Performance	Outside Air:	Code
A/V:			

Electrical Power		**Lighting**	
Supply	RE: Part 3-Performance	General:	RE: Part 3-Performance
Un-interrupted Power:	Provide and house all UPS equipment to support Program: reference Part 3-Performance for additional requirements	Accent:	RE: Part 3-Performance
Emergency Operations Generated Power	Provide emergency back-up generator	Total Electrical System:	SEB activities: not more than 9300 kwh per year (under normal operations -not emergency operations)

Equipment Description	**Owner Supplied**	**Owner Installed**	**DB Supplied**	**DB Installed**
General Power, Panels, etc (RE: Part 3-Performance)			X	X
UPS Power supply and interface (RE: Part 3-Performance)			X	X
Mechanical Systems (RE: Part 3-Performance)			X	X
Generated Power connectivity			X	X
Other MEP Equipment (RE: Part 3-Performance)			X	X
Emergency back-up generator			X	X

Notes	
1	SEB activities include all power inside the building, plus exterior building lighting and flag lighting.

Space:	Security Checkpoints	**Space Code:**	SV2
Goals/ Activities:	Support site security function, separate staff and visitor/vendor traffic, isolate vehicle inspection, and provide turn around space for disallowed vehicles.		
Guidelines:	AASHTO requirements for circulation.		
Quantity:	1 (located adjacent to or to support function from SEB)		

General Characteristics			
Net Area:	As required	Vehicle Inspection:	150 lf
Visitor Parking:	5 spaces	Vehicle Turnaround	Code + Design driven
Security Vehicles:	3 spaces		

Data/Communications & Connections		**HVAC (Heating, Ventilation & Air Conditioning)**	
Telecom:	NA	Temperature Range:	Unconditioned
Data:	NA	# Air Changes /Hour:	NA
Acoustics:	NA	Outside Air:	NA
A/V:	NA		

Electrical Power		**Lighting**	
Power Receptacle:	To support security activities	General:	RE: Part 3-Performance
Special Receptacle:	NA	Accent:	To support vehicle inspections
Un-interrupted Power:	NA	Other:	

Equipment Description	**Owner Supplied**	**Owner Installed**	**DB Supplied**	**DB Installed**
West Metro Fire Rescue Knox Box			X	X

Notes	
1	

Space:	Parking Structure	**Space Code:**	SV1
Goals/ Activities:	Support parking, circulation (vehicular and pedestrian), and Photovoltaic Superstructure of NREL Supplied and Installed PV System.		
Guidelines:	RE: NREL Master plan for data related to roadways, drives, site requirements, and other design information. Minimum Level of Service: Level C as defined by *"Parking Structures: Planning, Design, Maintenance, and Repair"* (M. Smith, Chapman & Hall, 1996)		
Quantity:	See below		

General Characteristics			
Automobile: Motorcycle: Bicycle:	1500 (minimum) 20 (minimum) 20 (minimum)	Ceiling Height:	8'–4" at all vehicular parking and routes
Occupant Number:	NA	Door Size:	Code + Design driven
Security Zone:	Operations	DC/AC Conversion Equipment:	Provide space to house the future PV power conversion equipment and connection to campus distribution system

Data/Communications & Connections		**HVAC (Heating, Ventilation & Air Conditioning)**	
Telecom:	Emergency call boxes (maximum distance between stations shall be no more than 150' path of travel)	Temperature Range:	Un-conditioned
Data:	NA	# Air Changes /Hour:	Code
Acoustics:	NA	Outside Air:	Code
A/V:	RE: Part 3-Performance		

Electrical Power		**Lighting**	
Power Receptacle:	NA	General:	RE: Part 3-Performance
Special Receptacle:	NA	Accent:	RE: Part 3-Performance
Total Electrical System	Not more than 175 kBTU per parking space per year		
PV Power:	Provide concealed conduit to convey PV power from rooftop arrays to conversion equipment and from conversion equipment to campus distribution system		

Equipment Description	**Owner Supplied**	**Owner Installed**	**DB Supplied**	**DB Installed**
RE: Part 3-Performance			X	X
Talk-a-Phone (emergency call boxes)			X	X
Security & Surveillance			X	X
Emergency Equipment			X	X
Fire Suppression			X	X
Other Fixtures & Equipment, RE: Part 3-Performance			X	X
Bicycle parking racks - rack space for 20. Rack shall be inverted "U" or vertical with 2 points of contact			X	X
20 lockers (1/2 size)			X	X
Bench - 6 ft floor mounted			X	X

Notes	
1	

Space:	Trash / Recycling Area	**Space Code:**	SU1
Goals/ Activities:	Provide trash collection area, and area for the collection of recyclables such as glass, paper, and plastic. Trash and recycling receptacles shall be located so as to provide convenient access by the campus. All collection area and containers shall be accessible by Service Contractors and their Vehicular Equipment.		
Quantity:	1 central location (near pedestrian route to Shuttle Area)		

General Characteristics			
Net Area:	NA	Ceiling Height:	Proportionate to area
Occupant Number:	NA	Door Size:	Code
Security Zone:	Operations		

Data/Communications & Connections		**HVAC (Heating, Ventilation & Air Conditioning)**	
Telecom:	NA	Temperature Range:	RE: Part 3-Performance
Data:	NA	# Air Changes /Hour:	Code
Acoustics:	NA	Outside Air:	Code
A/V:	NA		

Electrical Power		**Lighting**	
Power Receptacle:	NA	General:	RE: Part 3-Performance
Special Receptacle:	NA	Accent:	RE: Part 3-Performance
Un-interrupted Power:	NA	Other:	

Equipment Description	**Owner Supplied**	**Owner Installed**	**DB Supplied**	**DB Installed**
Containers- 16 yards total (divided by trash and individual recyclables)	X	X		

Notes	
1	

Space:	Shuttle Area	**Space Code:**	SV2
Goals/ Activities:	Area to support up to 40 people waiting for NREL Campus Shuttle Service. Activities including standing and setting.		
Quantity:	1 area		

General Characteristics			
Net Area:	Design driven	Ceiling Height:	Proportionate

Occupant Number:	Up to 40	Openings Size:	Code
Security Zone:	Operations		

Data/Communications & Connections		**HVAC (Heating, Ventilation & Air Conditioning)**	
Telecom:	Emergency call boxes (maximum distance between stations shall be no more than 150' path of travel)	Temperature Range:	Unconditioned
Data:	NA	# Air Changes /Hour:	NA
Acoustics:	NA	Outside Air:	NA
A/V:	NA		

Electrical Power		**Lighting**	
Power Receptacle:	To support maintenance activities	General:	RE: Part 3-Performance
Special Receptacle:	NA	Accent:	Design Driven
Un-interrupted Power:	NA	Other:	

Equipment Description	**Owner Supplied**	**Owner Installed**	**DB Supplied**	**DB Installed**
Seating for 20 persons			X	X
1 trash receptacle			X	X
1 recycling receptacle			X	X
Waiting shelter for 40 persons to provide protection from wind and rain			X	X
Talk-a-Phone (emergency call boxes)			X	X

Notes	
1	

END OF PART 2-PROGRAM

PART 3
PERFORMANCE CRITERIA
TABLE OF CONTENTS

111 - FACILITY PERFORMANCE

PERFORMANCE

A. Basic Function:

1. Provide built elements and site modifications as required to fulfill needs described in Part 2-Program and other subcontract documents.

2. The complete project comprises the following elements:
   a. Substructure: Elements below grade and in contact with the ground.
   b. Shell: The superstructure, exterior enclosure, and the roofing.
   c. Interiors: Interior construction, stairs, finishes, and fixtures, except fixtures associated with services and specialized equipment.
   d. Services: Mechanized, artificial, automatic, and unattended means of supply, distribution, transport, removal, disposal, protection, control, and communication.
   e. Equipment and Furnishings: Fixed and movable elements operated or used by occupants in the functioning of the project.
   f. Demolition: Removal of unneeded and undesirable existing elements.
   g. Sitework: Modifications to the site, site improvements, and utilities.

3. Code: Make all portions of the project comply with the code. The code referred to herein consists of all applicable local, State, and federal regulations, including those listed in Part 1-Design & Construction Procedures, Reference Documents.

4. Environmentally Responsible Design: In addition to other requirements, provide design and construction that minimizes adverse effects on the exterior environment, mitigates concerns of the existing community, enhances the quality of the indoor environment, and minimizes consumption of energy, water, construction materials, and other resources.
   a. LEED Ratings: The primary structures for this project are separated into manned structures and uninhabited structures. Each type of structure has different LEED goals.
      1) Manned Structures (Site Entrance Building) are required to be designed and constructed in a manner that achieves a minimum number of points for a LEED Gold building, according to the USGBC rating system. NREL has not established whether or not the building will be submitted to the USGBC for the rating.
      2) Uninhabited Structures (Parking Structures) are required to be designed and constructed as to maximize the number of LEED points according to the USGBC.
   b. Achieve as many points as possible (unless otherwise identified in the Project Priorities Checklist to achieve a Certified Rating) in accordance with U.S. Green Buildings Council LEED-NC Green Building Rating System; selection of specific credits to achieve is the responsibility of Subcontractor unless otherwise indicated; comply with criteria specified in current Rating System documentation as well as related criteria specified in other Sections.
   c. Sitework:
      1) Bicycle and cyclist facilities: Required.
      2) Alternative-fuel refueling station(s): Required.
      3) Preferred parking for car pools and van pool, with minimum parking capacity: Required.
      4) Preferred parking for fuel-efficient and low emission vehicles, comprising not less than five percent (5%) of total parking: Required.
      5) Restoration of degraded site areas: Desirable.

6) Sediment and erosion control: Required.
7) Capture of rain water for landscape maintenance: If possible.
8) Reduction of heat islands created by impervious paving and roofs: Desirable.
9) Light pollution reduction: Required.

d. Water Conservation:
1) Landscaping requiring no potable water for maintenance: Desirable.

e. Energy Conservation:
1) Minimum energy efficiency: Required.
2) Improvement of efficiency through basic building commissioning: Required.
3) No use of CFC-based refrigerants: Required.

f. Conservation of Materials and Resources:
1) Central location for collection and storage of recyclables: Required.
2) Use of salvaged or refurbished materials: Desirable.
3) Use of materials containing recycled content: Desirable.
4) Use of local/regional materials: Desirable.
5) Construction Waste management: Desirable.

g. Indoor Environmental Quality:
1) Smoking will be prohibited in the building.
2) Minimum ventilation performance: Required.
3) Construction procedures that reduce impact on interior air quality during and after construction: Required.
4) Control of sources of indoor pollutants: Required.
5) Thermal comfort conditions: As specified.
6) Provision of daylighting: As specified.

h. Substantiation:
1) Proposal Stage: LEED Checklist annotated to show specific credits to be achieved with brief description of how they will be achieved.
2) Preliminary Design (Phase I) and Construction Documents (Phase II):
a) LEED Checklist annotated to show specific credits status of design related to specific credits to be achieved.
b) Comprehensive checklist of certification documentation specified in LEED Reference Guide, annotated to show which forms of documentation have been submitted.
c) The documentation specified in LEED Reference Guide that is relevant to the degree of completion of the design; at subsequent design stages it will not be necessary to repeat submissions of the same documentation unless the design has changed.
3) At Completion (if LEED Certification is offered): LEED Certification, by U.S. Green Buildings Council (USGBC).
a) Subcontractor shall submit application and pay applicable fees.
b) Subcontractor shall provide all certification documentation and install certification plaque.
c) Subcontractor shall provide NREL a complete duplicate of certification documentation.

B. Amenity and Comfort:

1. Thermal Performance: Design and construct to provide comfortable interior environment for Occupant Spaces as indicated in Part 2-Program, and in accordance with the code and the

following:

a. Summer Interior Design Conditions:
   1) Daytime Setpoint: 72 deg F, plus or minus 2 deg F except as specified in the program or in Section D3-HVAC.
   2) Night Setback: 78 deg F.
   3) Interior Relative Humidity: 50 percent, maximum.

b. Winter Interior Design Conditions:
   1) Daytime Setpoint: 68 deg F, plus or minus 2 deg F except as specified in the program or in Section D3-HVAC.
   2) Interior Relative Humidity: 10 percent, minimum.

c. Outside Air Design Conditions:
   1) Summer Outside Air Design Temperature: 0.4 percent cooling design condition listed in the ASHRAE Fundamentals Handbook-2005.
   2) Winter Outside Air Design Temperature: 99.6 percent heating design condition listed in the 1997 ASHRAE Fundamentals Handbook.

d. Energy Design Wind Speed: 25 mph.

C. Health and Safety:

1. Fire Resistance: Provide appropriate Type construction in accordance with ICC International Code.

2. Environmental Requirements:

   a. National Environmental Policy Act: Federal agencies are required to evaluate the potential impacts of its actions as part of the planning process for an activity. Environmental reviews are usually completed prior to award of a subcontract or during the design phase. For design-build projects, a provisional NEPA approval may be given without delay to allow preliminary design to move forward. The NREL NEPA Coordinator must be provided the preliminary design for review and comment, and a more detailed NEPA review will be required. Unanticipated conditions or other circumstances may also required additional environmental review. Depending on the nature and scope of the activity, the environmental review process could take a few days to a few weeks. Contact the NREL EH&S Office for additional guidance.

   b. Air Emissions:

      1) Site-wide fugitive dust: Subcontractor activities shall be in accordance with the site-wide particulate emissions control plan, NREL procedure 6-2.14 “Particulate Emissions Control for Construction” and CDPHE permits 08JE0889L (STM) and 04JE1442L (NWTC).

      2) Stationary Sources: All air emission sources must be evaluated for CDPHE permitting applicability. Permits must be obtained prior to system construction or equipment procurement. The State of Colorado permitting process may take up to 160 days. Subcontractor must provide NREL EH&S Office the make, model, maximum input rating (in Btu/hr), pollution control devices, and manufacturer’s emission data. Permitting activities will be completed by NREL.

      3) Laboratory ventilation exhaust stacks

         i. Ventilation exhaust stacks must meet State of Colorado Noise Statute

requirements (CRS 25-12-101 through CRS 25-12-109) which establishes standards for noise level limits for various time periods and areas. The most stringent permissible noise levels apply to residential zones, where the maximum permissible daytime (7 am to 7 pm) noise level is 55 dBA measured at a distance of 8 meters (25 feet) from the property line.

ii. Exhaust stacks must be visually appealing to the surrounding community.

iii. Air dispersion modeling is required for new or modified air emission sources to determine offsite impacts and re-entrainment of exhaust into onsite buildings.

iv. Exhaust stacks must have sufficient height to preclude health impacts to workers who access building rooftops.

4) Ozone-Depleting Substances: All refrigeration and air conditioning equipment that contains and uses an ozone-depleting compound shall be registered with the CDPHE. Contact NREL EH&S prior to procuring such equipment.

5) Odors: Emissions of odorous air contaminants shall meet State of Colorado Air Quality Commission Odor Emission Regulation 2 (5 CCR 1001-4). For residential or commercial areas, it is a violation if odors are detected after odorous air has been diluted with seven (7) or more volumes of odor free air.

c. Wastewater:

1) Floor Drains:

i. All drains that have the potential to accept chemicals must be normally closed (cap, plug, collar, valve) to preclude inadvertent discharges.

ii. Floor drains are not recommended in laboratories unless normally closed or user requirements have identified an exception or specific need that must be approved by NREL.

iii. Boiler blow-down drains may be normally open.

iv. Restroom drains may be normally open.

v. Janitor closet floor drains shall be normally closed.

vi. Floor drains are not required for safety shower/eyewashes.

2) Sink Drains: Cup sinks and chemical fume hood sinks must have a raised lip around the sink (typically 3/8” to 1/2” lip); these sinks will drain to the laboratory waste system.

3) Trench Drains: Trench drains in the vicinity of chemical handling areas and areas where pollutants might enter the stormwater system (such as the unloading dock and trash compactor) shall have a normally closed valve.

4) Other Drains:

i. Only lavatory wastes from lavatory sinks, toilets and lavatory showers will be connected to the sanitary sewer system.

ii. Only drains that carry stormwater from perimeter drains, roof drains and other stormwater collection facilities will be connected to the storm drain system.

5) Bench-top Sinks: May be flush with bench-top; a raised lip is preferred. Bench-top sinks will drain to the lavatory waste system.

6) Wastewater sampling:

i. Control manholes must be of sufficient size to accept industry standard self-contained sampling equipment.

iii. Control manholes must accept all wastewater (drains) prior to connection with the sanitary sewer.

7) Elevator:

i. Elevator design must include a provision for a secondary catchment basin, oil/water separator, oil-sensing pump, or other means to preclude inappropriate discharges.

ii. Elevator sumps must not discharge to a drain or to the ground.

iii. Oil/water separate is required for automatic discharge to the sanitary sewer.

iv. Liquid level detector with manual discharge to the sanitary sewer is acceptable.

v. The maximum discharge limit with the Metro Wastewater Reclamation District for oil and grease is 75 ppm.

d. Stormwater: NREL has prepared a stormwater master plan to address stormwater on the South Table Mountain campus. Included in the stormwater master plan is a stormwater storage structure, which is identified on the Site Use Plan.

1) A project specific drainage study must be conducted to identify impacts to the existing storm drain infrastructure. A preconstruction and post-construction analysis is required. If the project results in impacts to the existing onsite or offsite infrastructure, impacts must be mitigated. The Subcontractor is required to convey stormwater, as determined by their study, to a storage area. If the Subcontractor chooses to convey stormwater to the storage structure identified in the stormwater master plan, the Subcontractor is <u>not</u> required to construct the storage structure. This requirement stems from NREL's obligations under NEPA.

2) Use Lower Impact Development (LID) techniques to maintain the pre-development hydrologic regime as much as possible, utilizing vegetated parking lot islands (when trees are included, heat island effect is also reduced) and diversion of runoff from roof drains, parking, and other paved areas to swales (grassed or aesthetically designed combination of rockscapes and arid/semi-arid vegetation).

3) Vegetated roofs may be considered.

4) Where detention basins are required (refer to Denver Urban Drainage and Flood Control District [UDFCD] requirements), construct in aesthetically pleasing way utilizing where possible a sediment forebay, micropool, irregular pond perimeter design, and contoured basin bottom and side slopes that incorporate vegetation that can withstand periodic inundation and drought. Use of biologs and other vegetated slope stabilizing techniques are encouraged.

5) Design detention basins and other stormwater infrastructure in such a way as to

blend into the environment and be compatible with wildlife usage.

6) Follow UDFCD detention basin criteria for detaining the water quality volume and larger storm events and the criteria for releasing those stormwater flows.

7) Avoid complex filtration systems (e.g. sand/media filters) that require significant cleanout/maintenance.

8) Use vegetative growth as a stormwater filter as much as possible.

9) Use of porous pavement/concrete shall be considered where traffic use and maintenance costs are appropriate.

10) Eliminate curb and gutter so as not to concentrate flow; concentrated flow is harder to manage than sheet flow because it is more erosive.

11) Under Colorado State water law, any interference with stormwater flow that causes depletion, whether by evaporation or infiltration, can become a water rights issue if downstream higher priority water users file a grievance. Non-standard stormwater quality treatment practices may require a legal evaluation prior to implementation.

e. Drinking Water: Drinking water shall be supplied to the facility by a Public Water System. In addition to any code-required cross-connection or backflow prevention, all janitor closet faucets and hose bibs shall incorporate additional backflow prevention. This can generally be accomplished by the use of an air-gap or vacuum breaker, unless a more complex device is warranted.

f. Landscaping and Irrigation:

1) Landscaping should be designed consistent with existing site facilities, enhance the workplace for employees, mitigate impacts to existing community, and provide opportunities for energy efficiency, resource conservation, and environmental stewardship.

2) Landscaping shall incorporate xeriscape concepts to reduce water consumption to the maximum extent practicable.

3) Irrigation shall be provided for initial establishment of native grasses, shrubs, plants and trees. An in-ground drip-type irrigation system is to be considered for periodic irrigation to provide limited water to keep vegetation viable during droughts.

4) Seed mixes for re-vegetation are identified in the NREL Stormwater Pollution Prevention Plan (NREL Procedures 6-2.15 and 6-2.16).

5) Other plantings may be considered with NREL approval.

6) Soils analysis for determination of appropriate soil amendments needed for revegetation is required.

g. Aboveground Storage Tanks:

1) Any tank larger than 660 gallons will require review and approval by the State Oil Inspection Section prior to installation.

2) The NREL standard for ASTs is the State Oil Inspection Section's Storage Tank Regulations, 7CCR 1101-14. Additional requirements are as follows:

i. Normal vent shall be 12 feet in the clear with a spark arrestor.

ii. Double-walled tank shall have an interstitial monitor/alarm with a test capability (pop-up indicator is not acceptable).

iii. Fill cap shall be secured either with a lockable cap or locked generator enclosure.

iv. The fill pipe shall incorporate means to collect drips, spills, and overfills from the fuel nozzle (such as an integral containment basin around the fill pipe).

v. Tank and genset must be separately grounded (not bonded together).

vi. Written specifications, operating, and maintenance documentation, including expected air emissions data is required for the tank, and tank systems (liquid level sensor, interstitial monitor, etc).

vii. A fenced area is not required provided all equipment openings and controls are inaccessible to unauthorized personnel.

3) Underground storage tanks are prohibited.

h. Lighting:

1) Ensure all lighting devices utilize low-mercury and low-lead bulbs, such as Phillips Alto, GE Ecolux, Sylvania Ecologic, or equivalent.

2) Minimize the use of CFLs and HIDs to the extent practicable.

3) All exterior site lighting shall meet the requirements set forth in Jefferson County Zoning Regulation, Section 11-Lighting. These include shielding all lamps over 2,800 lumens (approximately equivalent to a 200-watt incandescent bulb). In addition, the illumination level at the property boundary shall not exceed 0.3 foot candles at the property boundary.

4) All exterior lighting shall be controllable by the building control system to allow for operational sequence, including light level (i.e. off, low, high) changes by NREL.

5) A photometric sheet shall be included in the design drawing set to substantiate that the project meets the illumination level at the property boundary.

6) All lighting must be consistent with NREL security requirements.

3. Prevention of Accidental Injury: As required by code and as follows:
   a. Safety Glazing: As defined by 16 CFR 1201; provide in locations required by code, glazed areas subject to human impact, glazed areas at grade, and doors.
   b. Other requirements as specified in other Sections.
   c. Substantiation:
      1) Preliminary Design: Identification of building elements that require special accident prevention measures.
      2) Design Development: Identification of safety measures taken, detailed description of design criteria, and structural analysis of load-resisting elements prepared by licensed structural engineer.
      3) Construction Documents: For load-resisting elements, structural design calculations and drawings sealed by licensed structural engineer.

4. NREL Safety requirements: NREL regularly requires installations that exceed standard regulatory controls.

    a. NREL's STM wind loading standard is 120 mph for a 3 second gust. This is higher than the local authority having jurisdiction (AHJ). At NREL's National Wind Technology Center (NWTC), the requirement is 140 mph.

    b. The facility and activities need to be evaluated for tolerance of ventilation set-back during off, or unoccupied hours.

    c. Controls for overriding the ventilation set-back shall be incorporated in the facility design. This should include visual indication of the ventilation status.

    d. Throughout the facility, elevated areas required regular maintenance shall be accessible. Piping, conduit and other utilities shall be arranged to allow a worker to access all utilities that require regular maintenance.

    e. Facility lighting will be designed to be maintainable without extraordinary measures such as manlifts, scaffolding, etc. If such measures are required, they shall be specified on the drawings, or in some other way, communicated to NREL.

    f. Roof areas that are accessible by personnel and/or contain installations and equipment that require periodic maintenance shall have roof edges equipped with a 42-inch high roof parapet or perimeter handrail/guardrail system.

    g. When design specifications are inconsistent between sections and documents, the actual input by NREL scientists, engineers, and ES&H personnel, provided in writing through the Subcontract Administrator, shall supersede all other references.

    h. Accoutrements for the facility, such as first aid kits, fire extinguishers, Automated External Defibrillators (AED), hazardous waste spill carts, room numbers, room name signage, directional signs, and emergency egress signs/maps shall be considered during the design phase. The Project Manager shall be responsible for verifying that required equipment is specified according to user requirements, obtained and installed.

    i. An effort should be made to design control panels with covered or protected power sources. Or, the control cabinet should only include low voltage control wiring. This will reduce the exposure of control circuit workers to sources of hazardous energy.

5. Lightning Hazard: Prevent damage to occupants, structure, services, and contents due to lightning strikes.

    a. Provide protection equivalent to that specified in NFPA 780.

    b. Ground Resistance Measurement Methods: As described in NFPA 780, Appendix I, or IEEE 81-1983.

    c. Substantiation:

        1) Design Development: Diagrams showing locations of strike (air) terminals and zones of protection; identification of internal components that require bonding to equalize potential.

        2) Construction Documents: Engineering analysis of equalization of potential to metal bodies within the structure.

3) Construction Documents: Drawings showing locations and sizes of conductors, bonding of metal bodies, and components; detailed installation specifications.

4) Commissioning: Continuity tests for grounding conductors, equipotential bonding of other systems, and ground terminals; ground resistance test for each ground terminal, or equivalent taking into account related grounding systems.

5) Commissioning: Certification of system complying with UL Master Label or Lightning Protection Institute Certified System requirements.

6) Closeout: Maintenance and inspection procedures.

7) Closeout: Project record data; location of ground terminals, ground resistance and soil conditions at time of test.

6. Health Hazards:
   a. Design to prevent growth of fungus, mold, and bacteria on surfaces and in concealed spaces.
   b. Hazardous Construction Materials: Design and construct to comply with the requirements of the code.
   c. Indoor Air Quality: Design and construct to comply with other Sections and the code.

7. Physical Security: In addition to any provisions that may be required by law or code, design and construct both exterior and interior spaces to incorporate accepted principles of crime prevention through environmental design (CPTED), using natural (as opposed to technological) methods of providing surveillance, access control, and territorial reinforcement wherever possible.
   a. Definition of Elements at Ground Level: For purposes of physical security, any element within 20 feet of the ground, floor, deck, grade, or adjacent paving.
   b. Security Zones:
      1) Public Access Spaces (P): That area to which the public has free access, as identified in Part 2-Program.
      2) Reception Spaces (R): The area to which the general public has access but beyond which access is restricted at all times.
      3) Operation Spaces (O): The area to which only employees and visitors accompanied by an employee have access.
      4) Secure Spaces (S): The area to which access is always controlled and which is monitored continuously.

8. Electrically-Operated Equipment and Appliances: UL listed for application or purpose to which they are put; suitable for wet locations listing for exterior use.

D. Structure:

1. Substantiation:
   a. Proposal: Identification of major structural materials and systems.
   b. Preliminary Design: Detailed listing of design criteria and preliminary analysis, prepared by a licensed structural engineer.
   c. Construction Documents: Detailed design analysis by licensed structural engineer.

E. Durability:

1. Expected Service Life Span: Expected functional service life of the built portions of this project

is 50 years.

a. Service life spans of individual elements that differ from the overall project life span are defined in other Sections.
b. Additional requirements for elements not required to have life span equal to that of the project as a whole are specified below under "Operation and Maintenance."
c. Substantiation: Since actual service life cannot be proven, substantiation of actual service life is not required; however, the following are reasonable indicators of anticipatable service life:
    1) Preliminary Design or Design Development: Service life expectancy analysis, for each element for which life span is specified; including:
        a) Length of effective service life, and aesthetic service life if specified, with action required at end; e.g. complete replacement, partial replacement, refurbishment.
        b) Basis of confidence in time estimates; e.g. similarity of present application to proven-in-use application.
        c) Conditions under which estimate will be valid; e.g. expected uses, inspection frequency, maintenance frequency, etc.
    2) Design Development: Replacement cost, in today's dollars, for each major element that has a service life expectancy less than that of the project; include both material and labor cost, but not overhead or profit; base costs on installing in existing building, not as a new installation.
    3) Design Development: Life cycle cost of project, over the specified project service life, excluding operating staff costs; include costs of:
        a) Replacement of each element not expected to last the life of the project; identify the frequency of replacement.
        b) Energy for operation of equipment and systems, from energy analysis specified under "Operation and Maintenance".
        c) Routine maintenance of operating equipment, including replacement of worn parts before failure; identify frequency of maintenance.
        d) Routine cleaning of exposed materials; identify type of cleaning and frequency.
        e) Calculate costs in today's dollars, disregarding the time value of money, inflation, taxes, and insurance.

2. Biological Factors:
    a. Animals: Do not use materials that are attractive to or edible by animals or birds.
    b. Insects: Do not use materials that are edible by insects, unless access by insects is prevented.

F. Operation and Maintenance:

1. Space Efficiency: Minimize floor area required while providing specified spaces and space relationships, plus circulation and services areas required for maximizing programmatic functions.
    a. Substantiation: Areas and ratios measured and calculated in accordance with ANSI/BOMA Z65.1-1996.
        1) Proposal: Calculation of Gross and Net Building Area for all spaces intended for human occupancy, Parking Spaces by type, and net area for all ancillary spaces identified in Part 2-Program or otherwise required for proper function of the entire project.

2) Preliminary Design and Design Development: Update calculation of Gross and Net Building Area for all spaces intended for human occupancy, Parking Spaces by type, and net area for all ancillary spaces identified in Part 2-Program or otherwise required for proper function of the entire project.
3) Construction Document: Update calculation of Gross and Net Building Area for all spaces intended for human occupancy, Parking Spaces by type, and net area for all ancillary spaces identified in Part 2-Program or otherwise required for proper function of the entire project.

2. Energy Efficiency: Minimize energy consumption while providing function, amenity, and comfort specified. The NREL Ingress/Egress Energy Target Definitions (included in Section III-Attachments - NREL Provided Information) define the design requirements for both the Site Entrance Building and the Parking Structure.
   a. Substantiation:
      1) Proposal: Identification of method of calculation of energy efficiency to be employed.
      2) Preliminary Design: Preliminary energy analysis documenting how the energy goals for the parking structure and site entrance building will be met.
      2) Design Development: Detailed listing of design criteria and design analysis showing compliance, prepared by a licensed mechanical engineer.
      3) Design Development: Energy cost of all energy-consuming equipment and systems over the first year of operation; include analysis of probable change in annual cost over time due to aging but disregarding inflation and rate changes.
      4) Construction Documents: Energy cost of all energy-consuming equipment and systems over the first year of operation; include analysis of probable change in annual cost over time due to aging but disregarding inflation and rate changes.

3. Water Consumption: Minimize water consumption.

4. Ease of Operation: Provide facility, equipment, and systems that are easily operated by personnel with a reasonable level of training for similar activities.
   a. Minimize the need for specialized training in operation of specific equipment or systems; identify all equipment and systems for which the manufacturer recommends or provides training programs.
   b. Train NREL's personnel in operation of all equipment and systems.
   c. Substantiation:
      1) Design Development: Operating impact analysis, including identification of type and quantity of staff, tools, and supplies required; estimate of impact that aging materials will have on operating requirements; no cost calculations required; identify source of data.
      2) Construction Documents: Updated operating impact analysis, based on actual product selections.

5. Ease of Maintenance: Minimize the amount of maintenance required.
   a. Substantiation:
      1) Design Development: Maintenance impact analysis, including identification of maintenance effort (type of staff, time required, and frequency), tools, and supplies required, over expected functional and aesthetic service life of project; including preventive maintenance, replacement of parts, and cleaning, but not energy for operation or replacement at end of service life; identify source of data.

2) Construction Documents: Updated maintenance impact analysis, based on final product selections.

6. Ease of Repair: Elements that do not meet the specified requirements for ease of repair may be used, provided they meet the specified requirements for ease of replacement of elements not required to have service life span equal to that specified for the project as a whole; the service life expectancy analysis and life cycle cost substantiation specified for service life are provided; and with NREL's concurrence.

7. Ease of Replacement:
   a. Elements Not Required to have the Expected Service Life Span Equal to that Specified for the Project as a Whole: Make provisions for replacement without disruption of normal building(s) operation.

ELEMENTS AND PRODUCTS

A. In addition to requirements specified in other Sections, provide products and elements that comply with the following.

B. Where "no substitutions" is indicated, use only the product (or one of the products) specified.

C. Elements Made Up of More Than One Product:

1. Where an element is specified by performance criteria, use construction either proven-in-use or proven-by-mock-up, unless otherwise indicated.
   a. Proven-In-Use: Proven to comply by having actually been built to the same or very similar design with the same materials as proposed and functioning as specified.
   b. Proven-by-Mock-Up: Compliance reasonably predictable by having been tested in full-scale mock-up using the same materials and design as proposed and functioning as specified. Testing need not have been accomplished specifically for this project; when published listings of independent agencies include details of testing and results, citation of test by listing number is sufficient (submittal of all test details is not required).
   c. The Subcontractor may choose whether to use elements proven-in-use or proven-by-mock-up, unless either option is indicated as specifically required.
   d. Where test methods accompany performance requirements, use those test methods to test the mock-up.
   e. Exception: Where a design analysis is specified, or allowed by the NREL, substantiation of proven-in-use or proven-by-mock up construction is not required.

2. Where a type of product is specified, without performance criteria specifically applicable to the element, use the type of product specified.

3. Where more than one type of product is specified, without performance criteria specifically applicable to the element, use one of the types of products specified.

4. Where a type of product is specified, with applicable performance criteria, use either the type of product specified or another type of product that meets the performance criteria as proven-in-use or proven-by-mock-up.

5. Where more than one type of product is specified, with applicable performance criteria, use either one of the types of products specified or another type of product that meets the performance criteria as proven-in-use or proven-by-mock-up.

6. Where neither types of products nor performance criteria are specified, use products that will

perform well within the specified life span of the building.

D. Products:

1. Where a product is specified only by a manufacturer name and model number/brand name, use only that model/brand product.

2. Where the properties of a product are specified by description and/or with performance criteria, use products that comply with the description and/or performance criteria.

3. Where manufacturers are listed for a particular product, use a product made by one of those manufacturers that also complies with other requirements.

SUBSTANTIATION

A. Definition: Substantiation is any form of reliable evidence (consistent with the Conceptual Documents) produced and/or documented by the Subcontractor that can be used to predict whether the design will comply with the requirements or to verify that the resulting construction based on the design actually does comply with all requirements of the Subcontract.

1. During Preliminary Design, Design Development, and Construction Documents, requirements to submit substantiation are primarily intended to forestall the use of designs or constructions that will not comply.

2. At any time before Substantial Completion of the Project, substantiation is presumed to be only a prediction and may subsequently be invalidated by actual results.

3. All elements, systems, products, materials, and components making up the design or construction of the Project are subject to substantiation by the Subcontractor.

4. Regardless of whether substantiation is specified or not, the actual construction must comply with the specified requirements and may, at the NREL's discretion, be examined, inspected, or tested to determine compliance.

5. The Subcontractor's Substantiation submittals will not be approved or accepted, except to the extent that they are part of documents required to be approved or accepted in order to proceed to the next stage of design or construction. However, approval or acceptance of substantiation WILL NOT constitute approval or acceptance of deviations from the specified requirements unless those deviations are specifically identified as such on the submittal from the Subcontractor and formally incorporated into the Subcontract (consistent with the Subcontract requirements).

6. NREL accepts the responsibility to review substantiation submittals in a timely manner and to respond if they are inconsistent with the Subcontract requirements.

B. In addition to the requirements stated in other Sections, provide the following substantiation of compliance at each stage of the project:

1. If a substantiation requirement is specified without an indication of when it is to be submitted, submit or execute it before the end of Construction Documents.

2. See also other Sections of the Subcontract for submittal requirements.

C. Previous Construction: Where elements proven-in-use are used to comply with performance requirements:

1. In the Proposal, identify which elements will be accomplished using proven-in-use elements.

2. During Design Development, identify proven-in-use elements proposed for use, including building name, location, date of construction, owner contact, and description of design and materials in sufficient detail to enable reproduction in this project.

D. Mock-Up Testing: Where elements proven-by-mock-up are used to comply with performance requirements:

1. In the Proposal, identify which elements will be accomplished using proven-by-mock-up elements.

2. During Design Development, identify proven-by-mock-up elements proposed for use, with test report including date and location of test, name of testing agency, and description of test and mock-up.
3. Mock-up testing need not have been performed specifically for this project, provided the mock-up is substantially similar in design and construction to the element proposed and is acceptable to NREL.

E. Design Analyses (including Engineering Calculations):

1. Where a design analysis or calculation is specified without identifying a particular method, perform analysis in accordance with accepted engineering or scientific principles to show compliance with specified requirements, and submit report that includes analysis methods used and the name, signature, and professional seal of the licensed designer.

2. Where engineering design is allowed to be completed after commencement of construction, substantiation may be in the form of shop drawings or other data signed by the designer/engineer-of-record.

3. Submit design analyses at the end of Design Development unless otherwise indicated.

4. Where design analysis is specified to be performed by licensed design professional, use a design professional licensed in Colorado.

F. Products: Where actual brand name products are not identified by NREL, identify the products to be used.

1. In the Proposal:
   a. Identify one or more product types for each system, assembly, or element.
   b. For each product type, provide brief descriptive or performance specifications.
   c. For major manufactured products that are commonly purchased by brand name, and any other products so indicated, identify at least one manufacturer that will be used.

2. During Preliminary Design or Design Development:
   a. Where more than one product type is identified for a particular system, assembly, or element, identify exactly which type will be used.
   b. For each product type, provide descriptive or performance specifications; early submittals may be brief specifications, but complete specifications are required prior to completion of construction documents.
   c. For each product type, identify at least one manufacturer that will be used.
   d. For major manufactured products that are commonly purchased by brand name, and any other products so indicated, provide manufacturer's product literature on at least one actual brand name product that meets the specifications, including performance data and sample warranty.

3. During Construction:
   a. Identify actual brand name products used for every product, except commodity products specified by performance or description.
   b. Where a product is specified by performance requirements with test methods, and if so specified, provide test reports showing compliance.
   c. Provide manufacturer's product literature for each brand name product.
   d. Provide the manufacturer's certification that the product used on the project complies with the subcontract documents.

4. Before End of Closeout:
   a. Provide copies of all manufacturer warranties, including all that extend for more than one year after completion.

END OF SECTION 111

A - SUBSTRUCTURE

PERFORMANCE

A. Basic Function:

1. Provide substructure as required to support the completed and occupied buildings and improvements safely and without uncontrolled subsidence or other movement.

2. Substructure comprises the following elements:
   a. Foundations: Structures responsible for transferring dead loads, live loads, and environmental loads of completed building to the earth in such a way that the building is supported evenly and without movement.
   b. Basements (and below grade spaces): Space-enclosing or partially enclosing elements below grade, including necessary excavation, structural walls and floors, and other elements of enclosure such as waterproofing and thermal insulation.

3. Where substructure is integral with elements defined within another element group, meet requirements of both element groups.

4. In addition to the requirements of this section, comply with all applicable requirements of Section 111-Facility Performance.

B. Amenity and Comfort:

1. Thermal Performance: Provide thermal resistance as necessary to maintain interior comfort levels specified and in accordance with code and the following:
   a. Energy Efficiency: As specified in Section 111-Facility Performance.
   b. Average Thermal Transmittance: U-value of 0.15 IP, maximum, for portions of substructure in contact with earth and enclosing conditioned space.
   c. Condensation: None on interior surfaces under normal interior temperature and relative humidity conditions, during 97-1/2 percent of the days in the coldest 3 months of the year.
   d. Substantiation:
      1) Design Development: Detailed listing of design criteria and design analysis, prepared by licensed mechanical engineer.
      2) Construction Documents: Product data on thermal materials and details of continuous thermal barrier.

2. Water Penetration: Prevent ground water penetration into the interior of the building, under any circumstances.
   a. Substantiation:
      1) Preliminary Design: Identification of major water resistant assemblies and drainage features.
      2) Construction Documents: Details of proven-in-use or proven-by-mock-up design.

3. Water Accumulation: Prevent accumulation of water in open areas adjacent to substructure.

4. Acoustical Performance: Limit sound transmission through substructure as follows:
   a. Vibration Control: Use substructure elements that will not resonate at frequencies that are characteristic of ambient underground sound and vibration sources at the project site.

C. Health and Safety:

1. Fire Resistance: Design and select materials to provide fire resistance in accordance with code.
   a. Substantiation:
      1) Design Development: Identification of assemblies required to have fire resistance rating and method to be used to achieve rating.
      2) Construction Documents: Identifying numbers on the construction drawings.

2. Substance Exclusion: Prevent accumulation of harmful chemicals and gases such as radon, methane, and carbon monoxide in spaces below substructure and subsequent penetration into occupied spaces.
   a. Substantiation:
      1) Preliminary Design: Identification of major radon resistant assemblies, chemical resistant assemblies, and ventilation features.
      2) Construction Documents: Details of proven-in-use or proven-by-mock-up design.
      3) Occupancy: Field testing to verify the absence of significant levels of harmful gases and chemicals.

3. Vermin Protection: Provide permanent protection against infestation of construction by ground dwelling termites and other vermin.
   a. Substantiation:
      1) Preliminary Design: Identification of major termite resistant assemblies intended for protection against termites and other vermin.

D. Structure:

1. Capacity: Provide loadbearing substructure members as required by code and designed to distribute dead loads, live loads, and environmental loads so that bearing capacity of soil is not exceeded.
   a. Extend bearing portions of substructure to levels below frostline at project location; not less than 3 ft below grade.

2. Dead Loads: Accommodate loads from weights of building materials, construction itself, and all fixed service equipment.

3. Live Loads: Accommodate loads from use and occupancy of the building, either uniformly distributed loads as prescribed by code or concentrated loads, whichever are more demanding structurally.

4. Environmental Loads: Accommodate loads from all environmental forces in accordance with code and the following:
   a. Lateral Soil Loads: Lateral pressure of soil adjacent to vertical substructure elements, including potential surcharge from fixed or moving loads and potential hydrostatic pressure.
      1) Increase lateral pressure assumptions if expansive soils have been identified by a geotechnical investigation, unless expansive soils are excluded from backfill.
   b. Vertical Soil Loads: Full hydrostatic pressure applied over entire substructure area.
      1) Increase vertical pressure assumptions if expansive soils have been identified by a geotechnical investigation, unless expansive soils removed and replaced by nonexpansive soils to a minimum depth of 24 in below horizontal substructure elements.
   c. Earthquake: In accordance with requirements of Section 111-Facility Performance.

d. Wind: Overturning forces attributable to design wind speed at project location applied to full building height.

5. Substantiation:
   a. Proposal: Basis for design of foundation elements based on information provided.
   b. Preliminary Design: Soil investigation report, detailed listing of design criteria, and preliminary analysis, prepared by a licensed structural engineer.
   c. Construction Documents: Detailed design analysis by licensed structural engineer.

E. Durability:

1. Corrosion Prevention: Provide supplementary protection for underground metal elements, sufficient to prevent corrosion completely for the service life of the element without maintenance.
   a. 4 inches of concrete cover is considered to be permanent protection.
   b. Provide cathodic protection if any of the following is true; coatings or wrappings will not be considered sufficient protection for elements falling under these criteria:
      1) Metal elements are buried in a soil environment known to cause corrosion on similar nearby structures.
      2) Metal elements are buried in a soil environment in which stray DC electrical currents are present.

F. Operation and Maintenance:

1. Provide substructure elements that will endure for the lifetime of the building with no maintenance.

PRODUCTS

A. Use one of the following:

1. Reinforced concrete.

2. Precast, prestressed concrete.

B. Do not use any of the following:

1. Reinforced masonry.

2. Structural steel.

3. Treated wood.

4. Foam plastic insulation below grade.

END OF SECTION A

A1 - FOUNDATIONS

PERFORMANCE

A. Basic Function:

1. Provide foundations as required to support the completed and occupied building safely and without uncontrolled subsidence or other movement.

2. Foundations comprise the following elements:
   a. Standard Foundations: Includes spread footings below columns, linear spread footings below loadbearing walls, foundation walls not part of basements, caisson (pier) caps, and pile caps.
   b. Floors on Grade: All elements necessary for slab foundations, including trenches, pits, and sumps, equipment bases, slab moisture protection, and subdrainage system.

3. Where foundations are integral with elements defined within another element group, meet requirements of both element groups.

4. In addition to the requirements of this section, comply with all applicable requirements of Section 111-Facility Performance and Section A-Substructure.

B. Amenity and Comfort:

1. Thermal Performance:
   a. Minimum thermal performance values for individual foundation elements are also specified in other Sections.

2. Water Protection:
   a. Waterproofing: Provide permanent waterproofing at portions of foundation that extend below water table and enclose habitable space.
   b. Drainage: Provide method of collecting and draining water from below portions of foundation that enclose or bound habitable space.

3. Acoustical Performance:
   a. Vibration Control: Use foundation elements that are designed to avoid sympathetic vibration at frequencies within the audible range of 500-4000 Hz.

C. Structure:

1. Capacity: Provide loadbearing foundation members as required by Section A-Substructure.
   a. Minimum Wall Thickness: Not less than thickness of superstructure walls supported by foundation walls.

END OF SECTION A1

A13 – FLOORS ON GRADE

PERFORMANCE

A. Basic Function:

1. Provide floors (including slabs) on grade as required to create usable spaces and support interior or exterior functions without subsidence, structural cracking, or other uncontrolled movement.

2. Floors on grade comprise slabs, structural slabs and individual pavers that are installed over fill or at excavated and compacted grade, including all depressions in the floor, such as trenches, pits, and sumps. Slabs and Floors on grade also include equipment bases, under floor and perimeter drainage, thermal insulation at floor edge, and moisture barriers installed integrally with floor system.

3. Where floors on grade are integral with elements defined within another element group, meet requirements of both element groups.

4. In addition to the requirements of this section, comply with all applicable requirements of Section 111-Facility Performance, Section A-Substructure, and Section A1-Foundations.

B. Amenity and Comfort:

1. Thermal Performance: Provide thermal properties at edges of floors on grade as necessary to maintain interior comfort levels specified and in accordance with code.
   a. Thermal Insulation: Provide R-value of 5.0 IP, minimum, for portions of floors on grade within 24 in of exposed building exterior.
   b. Floor Edge Heating: Maintain temperature of floor surface within 24 in of exposed building exterior at not less than 68 deg F under winter design conditions.
   c. Substantiation:
      1) Design Development: Design criteria and design analysis, prepared by licensed mechanical engineer.
      2) Construction Documents: Product data on thermal materials and details of construction to achieve required thermal performance.

2. Waterproofing: Provide permanent waterproofing for floors on grade that could potentially come into contact with ground water. Acceptable method:
   a. Permanent, waterproof barrier beneath floor construction, protected against damage from floor installation.
   b. Substantiation:
      1) Design Development: Subsurface investigation to identify location of water table and identification of areas requiring waterproofing systems.
      2) Construction Documents: Product data on waterproofing and details of construction to achieve permanent waterproofing.

C. Durability:

1. Water-Cement Ratio: For concrete slabs that are partly or completely exposed to freezing conditions, limit water-cementitious materials ratio as recommended by ACI 302.1R-2004.
   a. Exposure Subject to Deicing Chemicals: Maximum 0.45.

2. Air Content: For concrete slabs on grade that are partly or completely exposed to freezing conditions, provide air content in accordance with recommendations of ACI 201.2R-2001.

END OF SECTION A13

B - SHELL

PERFORMANCE

A. Basic Function:

1. Provide permanently enclosed and semi-enclosed, conditioned and unconditioned, spaces for all functional areas shown in the program, unless otherwise indicated. Provide a physical enclosure/semi-enclosure that keeps out unwanted weather, unwelcome people, animals, and insects without requiring specific action by occupants, while providing convenient circulation and movement of occupants and vehicles between inside and outside, desirable natural light, required thermal comfort, and views from inside to outside. Provide level floor areas (appropriately sloped in parking structure), comfortable ceiling heights, and essentially vertical walls.

2. The elements forming space(s) and separating or delineating that space from the external environment comprise the shell, and consist of:
   a. Superstructure: All elements forming floors and roofs above grade and within basements, and the elements required for their support, insulation, fireproofing, and firestopping.
   b. Exterior Enclosure: All essentially vertical elements forming the separation between exterior and interior conditioned and unconditioned space, including exterior skin, components supporting weather barriers, and jointing and interfacing components; not including the interior skin unless an integral part of the enclosure.
   c. Roofing: All elements forming weather and thermal barriers at horizontal and sloped roofs and decks, and roof fixtures.
   d. Photovoltaic Superstructure: All elements forming a support structure for NREL supplied PV Panel system, not including secondary attachment systems specific to the PV panels.

3. Exterior Surfaces Exposed to View: Surfaces visible from street or ground level, plus surfaces visible from windows or openings of same building or structure, and adjacent existing buildings.

4. Where shell elements also function as elements defined within another element group, meet requirements of both groups.

5. In addition to the requirements of this section, comply with all applicable requirements of Section 111-Facility Performance, and Section G21-Site Pavements and Surfacing related to Parking requirements.

B. Amenity and Comfort:

1. Thermal Performance: Provide construction that will have thermal resistance as necessary to maintain interior comfort levels specified and in accordance with code and the following:
   a. Average Thermal Transmittance: U-value of.035 IP, maximum, for entire shell enclosing occupant spaces.
   b. Condensation: None on interior surfaces under normal interior temperature and relative humidity conditions, during 98 percent of the days in the coldest 3 months of the year.
   c. Components That Have Surfaces Facing Both Interior and Exterior Environment: Condensation Resistance Factor (CRF) as required to meet requirement above, when tested in accordance with AAMA 1503-1998.
   d. Substantiation:
      1) Preliminary Design: Identification of major thermal resistant materials and systems.

2) Design Development: Detailed listing of design criteria and design analysis, prepared by licensed mechanical engineer.
3) Construction Documents: Product data on thermal materials and details of continuous thermal barrier.

2. Air Infiltration: Maximum of 0.06 cfm per square foot of exterior surface area, measured in accordance with ASTM E 283-2004 at differential pressure of 6.24 psf.
   a. Use supplementary air barrier if necessary to maintain performance over entire shell.
   b. Use method of sealing joints between elements that will be effective given available construction practices.

3. Water Penetration: Design and select materials to prevent water penetration into the interior of the building, under conditions of rain driven by 50 mph wind.
   a. Substantiation:
      1) Preliminary Design: Identification of major water resistant assemblies.
      2) Design Development: Details of proven-in-use or proven-by-mock-up design.

4. Natural Light: Provide fenestration in shell as required to meet requirements for natural light as specified in Section C-Interiors and in accordance with code.

5. Natural Ventilation: Design and construct shell to provide natural ventilation in accordance with code and the following:
   a. Minimum Ventilation Opening Area: 10 percent of total floor area for each habitable room; not required for toilet compartments, closets, or storage and utility spaces.
   b. Design ventilation to provide cross ventilation where possible.
   c. Substantiation:
      1) Design Development: Drawings showing natural ventilation location, ventilation opening areas, and floor areas being served.

6. Acoustical Performance: Design and construct the shell to limit sound transmission as follows:
   a. Vibration Control: Use shell elements that will not resonate at frequencies that are characteristic of ambient exterior sound sources at the project site.

7. Cleanliness of Exterior Surfaces: Design and select materials to:
   a. Prevent attraction and adherence of dust and air-borne dirt and soot, and minimize appearance of settled dust and dirt.
   b. Be washed reasonably clean by normal precipitation.
   c. Prevent precipitation from washing settled dust and dirt over surfaces exposed to view.

8. Appearance: Design and select materials to provide exterior appearance with characteristics as follows:
   a. Compatible with adjacent buildings on same campus.
   b. Concealing rooftop mechanical equipment, plumbing equipment, electrical equipment, and piping, conduit, and ducts from view from the street, windows in adjacent buildings that overlook the roof, and adjacent neighborhoods.
   c. Substantiation:
      1) Proposal: Concept renderings of proposed solution indicating overall building configuration, massing, scale, materials, and relationship to surrounding buildings.
      2) Preliminary Design: Drawings showing facade treatment for principal elevations identifying visible materials.
      3) Design Development: Drawings and renderings showing all building elements that are part of the shell with sizes and locations to scale.

4) Construction Documents: Details of building shell, annotated to show compliance with performance requirements.

C. Health and Safety:

1. Fire Resistance: Design and select materials to provide fire resistance in accordance with code.
2. Accidental Injury: Design and select materials to protect pedestrians and building occupants in accordance with code and the following:
   a. Prevent ice and snow from falling off building elements onto pedestrians, building occupants, and vehicles.
   b. Protect pedestrians, building occupants, and vehicles from objects accidentally dropped from elevated plazas, or decks.
   c. Substantiation: As specified in Section 111-Facility Performance.
3. Ventilation of Special Spaces: Design and construct shell to provide outside air movement through enclosed shell volumes in accordance with code.
   a. Substantiation:
      1) Proposal: Identification of volumes relying on natural ventilation with description of ventilation concept and required building elements.
      2) Design Development: Drawings showing natural ventilation location, ventilation opening areas, and volumes being served.

D. Structure:

1. Structural Performance: Design and select materials to support all loads without damage due to loads, in accordance with code.
   a. Special Loads: In addition to loads defined by code, design for loads from Owner Supplied and Installed (OSOI) Photovoltaic system (reference Part 2-Program).
   b. Special Components: If design method is not specifically prescribed by code, design in accordance with ASCE 7-2005.
   c. Design and provide shell elements to resist loosening or detachment in winds equivalent to the code design wind speed.
   d. Shell elements engineered by their manufacturer or fabricator, rather than by the engineer-of-record, shall comply with the following additional requirements:
      1) Manufacturer/fabricator employs licensed structural engineer to accomplish design of structural elements.
   e. Elements engineered by their manufacturer or fabricator, rather than by the engineer-of-record, are not acceptable for superstructure.
   f. Substantiation:
      1) Proposal: Identification of major structural materials and systems.
      2) Preliminary Design: Detailed listing of design criteria and preliminary analysis, prepared by a licensed structural engineer.
      3) Construction Documents: Detailed design analysis by licensed structural engineer (for structures engineered by their manufacturer or fabricator, engineer-of-record may provide detailed design criteria, with design analysis postponed until construction stage).
      4) Construction: For structures engineered by their manufacturer or fabricator, detailed design analysis prepared by and shop drawings stamped by a licensed structural engineer, with approval of engineer-of-record recorded.

2. Construction Loads and Erection Stresses: Accommodate temporary construction loads and erection stresses during construction.

E. Durability:

1. Service Life Span: Same as building service life, except as follows:
   a. Load-Bearing Structural Members: Minimum of 100 years.
      1) No anticipated deterioration when protected as specified.
      2) Protective Elements: Minimum 25 years.
   b. Wall Primary Weather-Barrier Elements: Minimum 50 years functional and aesthetic service life, excluding joint sealers.
   c. Transparent Elements (Glazing): Same as other wall primary weather-barrier elements, except accidental breakage is considered normal wear-and-tear.
   d. Joint Sealers: Minimum 20 years before replacement.
   e. Surfaces Exposed to View: Minimum 20 years aesthetic service life; in addition, deterioration includes color fading, crazing, and delamination of applied coatings.
   f. Roof Covering Weather-Barriers: Minimum 20 years, fully functional.
   g. Substantiation: As specified in Section 111-Facility Performance, including service life analysis and life cycle cost analysis.

2. Water Penetration: Design and select materials to prevent water penetration into the interior of shell assemblies, under conditions of rain driven by 70 mph wind.
   a. Exception: Controlled water penetration is allowed if materials will not be damaged by presence of water or freezing and thawing, if continuous drainage paths to the exterior are provided, and water passage to the building interior is prevented.
   b. Substantiation: In addition to requirements specified for proven-in-use and proven-by-mock-up construction, drawings showing paths of water movement, with particular attention to changes in direction or orientation and joints between different assemblies.

3. Weather Resistance: Design and select materials to minimize deterioration due to precipitation, sunlight, ozone, normal temperature changes, and atmospheric pollutants.
   a. Deterioration includes corrosion, shrinking, cracking, spalling, delamination, abnormal oxidation, decay and rot.
   b. Surfaces Exposed to View: Deterioration adversely affecting aesthetic life span includes color fading, crazing, and delamination of applied coatings.
      1) Field Applied Coated Finishes: Do not use coated finishes on the exterior.
      2) Coating Performance: AAMA 2605-2005, minimum.
   c. Joint Components and Penetration Seals: Capable of resisting expected thermal expansion and contraction; use overlapping joints that shed water wherever possible.
   d. Transparent Elements (Glazing): No haze, loss of light transmission, or color change, during entire expected service life.
   e. Service Temperature: Low temperature equal to historically-recorded low; high temperature equal to that expected due to any combination of air temperature and heat gain from solar and other sources.
   f. Freeze-Thaw Resistance: Adequate for climate of project.
   g. Corrosion Resistance: In locations exposed to the outdoor air or in potential contact with moisture inside shell assemblies, use only corrosion-resistant metals as defined in this section.
   h. Ozone Resistance: Do not use materials that are adversely affected by ozone.
   i. Substantiation:

1) Proposal: Identification of weather-exposed elements and proposed materials.
2) Design Development: Details of proven-in-use materials and test reports.

4. Impact Resistance: Design and select materials to resist damage due to impact in accordance with code and the following:
   a. Minimize damage from windborne debris propelled at up to 35 mph.
   b. Provide Impact Protection for building fixtures from vehicles moving up to 5 mph.
   c. Design and select materials to resist damage from hail of size up to 1/2 inch.
   d. Minimize damage due to potential vandalism.
   e. Natural Hazards: Design to resist damage from perching, nesting, and feeding birds.
   f. Substantiation:
      1) Design Development: Identification of building elements required to resist impact damage, quantification of impact criteria, materials to be used, and methods of substantiation.

5. Moisture Vapor Transmission: Design to prevent deterioration of materials due to condensation of moisture vapor inside assemblies.
   a. Use supplementary vapor retarder if necessary to meet requirements.
   b. Substantiation:
      1) Design: Identification of building elements providing moisture barrier, materials to be used, and data showing performance.

6. Wear Resistance: Design and select materials to provide resistance to normal wear-and-tear in accordance with code and the following:
   a. Elements Within Reach of Pedestrians: Minimize degradation from rubbing and scratching caused by pedestrians.
   b. Substantiation:
      1) Design Development: Identification of building elements required to resist wear, quantification of wear criteria, materials to be used, and methods of substantiation.

PRODUCTS

A. Corrosion-Resistant Metals:

1. Hot-dipped galvanized steel, with minimum zinc coating of 0.90 oz/sq ft total all exposed sides.
2. Cadmium-plated steel, with minimum coating of 12 micrometers.
3. Aluminum.

B. Coated Finishes:

1. Do not use paint or other field applied coatings.

C. Do not use:

1. Pre-engineered metal building.
2. Air-supported structure.
3. Different metals subject to galvanic action in direct contact with each other.
4. Aluminum in direct contact with concrete or cementitious materials.
5. Materials and products that require field finishing on surfaces exposed to the weather.

END OF SECTION B

B1 - SUPERSTRUCTURE

PERFORMANCE

A. Basic Function:

1. Provide structural elements, above grade and within basements, capable of supporting all anticipated loads without failure or damage.
2. Do not use any electrically-operated or fuel-powered construction for support of floor or roof members.
3. The superstructure comprises:
   a. Elevated Floors: Floor construction above grade, including parking decks, ramp floors, floors elevated for access, stair construction if part of the structure, and roof decks intended for occupant live load; and the elements required for their support, insulation, fireproofing, and firestopping.
   b. Roofs: Roof construction, including canopies, and elements required for their support, insulation, fireproofing, and firestopping.
4. Where superstructure elements also must function as elements defined within another element group, meet requirements of both element groups.
5. In addition to the requirements of this section, comply with all applicable requirements of Section 111-Facility Performance and Section B-Shell.

B. Health and Safety:

1. Fire: Provide members with combustibility, flame spread, and smoke generation characteristics not greater than allowed by code.
2. Fire Resistance: Design and select materials to provide fire resistance in accordance with code.
3. Grounding: When grounding of electrical systems is accomplished using structural members, design to prevent shock to occupants.

C. Structure:

1. Capacity: Design and provide load-bearing structural members of capacities required by code.
2. Dead Loads: Design to resist loads from weights of materials, construction, and fixed service equipment.
3. Live Loads:
   a. Floors: Resist uniformly distributed, concentrated, and impact loads without live load reductions.
   b. Roofs: Resist uniformly distributed, concentrated, and impact loads.
4. Structural Design: In addition to the requirements of the code, design to comply with ASCE 7-2005.
5. Structural Serviceability: Comply with requirements and recommended design procedures of ASCE 7-2005.

D. Durability:

1. Moisture Resistance of Load-Bearing Members: Use materials that are not damaged by

contact with water or moisture vapor.

a. Materials that will corrode in the presence of water may not be used.

2. Impact Resistance of Load-Bearing Members: Use materials that are not easily damaged by common hand tools.

3. Portions of Superstructure Exposed on Exterior: Comply with requirements of Section B-Shell for water penetration, weather resistance, impact resistance, wear resistance, and appearance.

PRODUCTS

A. Superstructure: Use elements specified in Section B11-Elevated Floors and B12-Roofs.

END OF SECTION B1

B11 - ELEVATED FLOORS

PERFORMANCE

A. Basic Function:

1. Provide all floor construction above grade and within basements, including balcony, mezzanine, and ramp floors, floors elevated for access, stair construction if part of the structure, and roof decks intended for occupant live load; and the elements required for their support, insulation, fireproofing, and firestopping, as well as finishing, if an integral part of the floor construction.
    a. Floor Flatness (FF): Provide suspended floors that are engineered and constructed to achieve degree of flatness as follows, when measured in accordance with ASTM E 1155-1996(R01):
        1) Specified Overall Value (SOV) at vehicular parking areas: 20.
        2) Minimum Localized Value (MLV) at vehicular parking areas: 13.
        3) Specified Overall Value (SOV) at any non-vehicular parking areas: 30.
        4) Minimum Localized Value (MLV) at any non-vehicular parking areas: 24.
    b. Floor Levelness (FL): Provide suspended floors that are engineered and constructed to achieve degree of levelness (not otherwise intended to be sloped by design) as follows, when measured in accordance with ASTM E 1155-1996(R01):
        1) Specified Overall Value (SOV) at vehicular parking areas: 15.
        2) Minimum Localized Value (MLV) at vehicular parking areas: 10.
        3) Specified Overall Value (SOV) at any non-vehicular parking areas: 20.
        4) Minimum Localized Value (MLV) at any non-vehicular parking areas: 13.
2. Where floor elements also must function as elements defined within another element group, meet requirements of both element groups.
3. In addition to the requirements of this section, comply with all applicable requirements of Section 111-Facility Performance, Section B-Shell, and Section B1-Superstructure.

B. Amenity and Comfort:

1. Impact Sound Transmission and Insulation for Occupant Spaces: See Section C-Interiors for requirements.

C. Health and Safety:

1. Slip Resistance:
    a. Exposed Structural Floors: Same as specified for floor finishes in Section C-Interiors and related Sub-Sections.

D. Durability:

1. Exposed Interior Structural Floor Surfaces: Comply with requirements for floor finishes specified in Section C-Interiors.
2. Exposed Exterior Structural Floor Surfaces: Comply with requirements for pavement finishes.

PRODUCTS

A. Structure Supporting Floors:

1. Use one or more of the following:

a. Cast-in-place reinforced concrete beams, columns, walls, girders, and joists.
b. Precast concrete beams, columns, tees, and hollow slabs.

2. Do not use:
   a. Wood structural members.
   b. Non-reinforced load-bearing masonry.

B. Elevated Floors:

1. Use one or more of the following:
   a. Cast-in-place reinforced concrete slabs.
      1) Steel reinforcement for parking structure components: use epoxy-coated or equal corrosion resistance reinforcement.
   b. Precast concrete tees or hollow core slabs covered with minimum 2 inches concrete.
      1) Steel reinforcement for parking structure components: use epoxy-coated or equal corrosion resistance reinforcement.

2. Do not use:
   a. Wood structural members.

C. Ramp Floors:

1. Use the following:
   a. Same construction as other floors.

D. Stairs and Stair Landings: See Section C15-Stairs.

E. Interior Exposed Structural Floor Finish:

1. Use the following:
   a. Any finish specified in or meeting performance requirements of Section C16-Interior Finishes and allowed for interior space usage.

2. Do not use:
   a. Concrete without at least an applied cure-sealer-dustproofer.

END OF SECTION B11

B12 - ROOFS

PERFORMANCE

A. Basic Function:

1. Provide all roof construction, including canopies, and elements required for their support, insulation, fireproofing, and firestopping.
2. Where roof elements also must function as elements defined within another element group, meet requirements of both element groups.
3. In addition to the requirements of this section, comply with all applicable requirements of Section 111-Facility Performance, Section B-Shell, and Section B1-Superstructure.

B. Health and Safety:

1. Slip Resistance: Where roof structure is the finished roof weather surface, also comply with requirements of Section B3-Roofing for roofing.

C. Durability:

1. Exposed Roof Deck Surfaces: Comply with requirements for roofing weather barrier specified in Section B31-Roof Coverings.
2. Vapor Retarder Under Deck: Continuous separate membrane located on the warm side of the winter dew point.
   a. Vapor Permeance: 1 perm, maximum when tested in accordance with ASTM E 96/E 96M-2005.
   b. Design and select materials in accordance with ASTM E 1677-2005, including appendices, and ASTM C 755-2003.

PRODUCTS

A. Structure Supporting Roofs:

1. Do not use:
   a. Wood structural members.

B. Roof Decks:

1. Do not use:
   a. Wood structural members.

END OF SECTION B12

B2 - EXTERIOR ENCLOSURE

PERFORMANCE

A. Basic Function:

1. Provide an essentially vertical separation between exterior and interior conditioned spaces, that keeps out weather, uninvited people, and animals and insects, without unusual action by occupants, while providing convenient movement of occupants between inside and outside, desirable natural light, and views from inside to outside.

2. The elements forming the vertical separation comprise the exterior enclosure and consist of:
   a. Exterior Walls.
   b. Exterior Windows and Other Openings.
   c. Exterior Doors.
   d. Exterior Fixtures.

3. Where exterior enclosure elements also must function as elements defined within another element group, meet requirements of both element groups.

4. In addition to the requirements of this section, comply with all applicable requirements of Section 111-Facility Performance and Section B-Shell.

B. Amenity and Comfort:

1. Water Penetration: As specified in Section B-Shell.

2. Glazing Appearance:
   a. Tint and Reflectivity: Use matching or similar tint and reflectivity as existing Campus Site Entrance Building.

C. Durability:

1. Ambient Temperature Change: Allow for daily expansion and contraction within and between elements caused by temperature range from most extreme low temperature to 50 deg F greater than the most extreme high temperature, in any year, without causing detrimental effect to components and anchorage.

2. Water Penetration: As specified in Section B-Shell.

3. Impact Resistance:
   a. Elements Adjacent to Traffic Lanes, Roadways, and Drive Isles: Resist damage from accidental vehicular impact at 5 mph maximum velocity.
      1) Provide barriers and protective devices to minimize damage to Exterior Enclosure elements.

4. Glass:
   a. Type and thickness in accordance with ASTM E 1300-2004 combined with other applicable factors; minimum thickness 6 mm for each light.

END OF SECTION B2

B21 - EXTERIOR WALLS

PERFORMANCE

A. Basic Function:

1. Provide physical separation between exterior and interior conditioned space that keeps out weather, uninvited people, and animals and insects.

2. Provide physical separation between exterior and interior of parking structure areas that minimizes the effects of weather such as drifting of snow, and controls vehicular and pedestrian circulation.

3. The elements forming the physical separation comprise the exterior walls and consist of the supporting structure, the exterior skin. Additionally: separation between exterior and interior conditioned spaces consisting of vapor retarders, air barriers, and insulation, the interior skin if an integral part of the wall, exterior screens and railings, balcony walls and parapets, exterior soffits unless they do not form a weather barrier, firestopping and draftstopping within wall and between wall and floors, and other exterior wall elements.

4. Where exterior wall elements also must function as elements defined within another element group, meet requirements of both element groups.

5. In addition to the requirements of this section, comply with all applicable requirements of Section 111-Facility Performance, Section B-Shell, and Section B2-Exterior Enclosure.

B. Amenity and Comfort:

1. Thermal Performance: Not applicable to parapets or balcony walls.
   a. Average Thermal Transmittance of Vertical Walls: U-value of.05 IP, maximum.
   b. Provide continuous insulation over entire enclosure of conditioned spaces.
   c. Exterior Soffits and Ceilings: Same requirements as exterior walls.

C. Structure:

1. Wind Design: No damage when tested in accordance with ASTM E 330-2002 at 1.5 times positive and negative design wind loads using 10 second duration of maximum load.
   a. Deflection: 1/180 of span, maximum, unless otherwise indicated.
   b. Unit Masonry: Maximum deflection of 1/360 of span.
   c. Unit Masonry Veneer: Maximum deflection of 1/720 of span.
   d. Members Supporting Glass: Maximum deflection of flexure limit of glass; with full recovery of glazing materials.

2. Railing Assemblies: Resistant to required forces in accordance with ASCE 7-2005.

D. Durability:

1. Water Penetration: Drain water, moisture, and condensation entering assembly to the exterior.

2. Joint Sealers in Exterior Skin: Life span expectancy equal to that specified for primary weather barriers.
   a. Exception: Lesser life span, with minimum of 20 years, is acceptable providing the joint surface does not exceed 1 percent of the face surface of the jointed area and the joint design provides secondary water-shedding design.

3. Vapor Retarder: Continuous separate membrane over entire exterior enclosure of conditioned space, located on the warm side of the winter dew point.
   a. Vapor Permeance: 1 perm, maximum when tested in accordance with ASTM E 96/E 96M-2005.
   b. Design and select materials in accordance with ASTM E 1677-2005, including appendixes, and ASTM C 755-2003.

4. Impact Resistance:
   a. Precast Concrete, Metal Siding, and Masonry: Resistant to permanent damage to supporting structure and exterior skin when tested in accordance with ASTM E 695-2003 with functionally appropriate test weight.

PRODUCTS

A. Exterior Skin of Exterior Walls:

1. Do not use:
   a. Exterior insulation and finish system.

B. Joint Sealers in Exterior Skin:

1. Do not use:
   a. Silicone sealant.
   b. Hollow neoprene gaskets.

C. Exterior Railings:

1. Use one of the following:
   a. Construction similar to exterior walls.

2. Do not use:
   a. Wood.
   b. Plastic.
   c. Field applied coatings on any components.

D. Exterior Ceilings and Soffits:

1. Use one of the following:
   a. Construction similar to exterior walls .

2. Do not use:
   a. Exterior insulation and finish system (EIFS).
   b. Portland cement plaster or stucco.

E. Glazing: Glass.

1. Do not use:
   a. Patterned glass.
   b. Polycarbonate sheet.
   c. Acrylic sheet,
   d. Reflective plastic films.
   e. Heat absorbing coatings.

END OF SECTION B21

B22 - EXTERIOR WINDOWS AND OTHER OPENINGS

PERFORMANCE

A. Basic Function:

1. Fill, cover, close, or otherwise protect all openings in the exterior walls including conditioned spaces (other than doors) so that the entire exterior enclosure functions as specified, using windows and other opening elements as specified, without using components that must be installed at changes of season.

2. The elements comprising exterior windows and other openings include windows, fixed glazing other than glazed walls, ventilation openings, protection devices for openings, and elements that form or complete the openings, unless an integral part of another element.

3. Where exterior window and other opening elements also must function as elements defined in another element group, meet requirements of both element groups.

4. In addition to the requirements of this section, comply with all applicable requirements of Section 111-Facility Performance, Section B-Shell, and Section B2-Exterior Enclosure.

B. Amenity and Comfort:

1. Thermal Performance of Elements Forming Exterior/Interior Separation:
   a. Maximum Thermal Transmittance of Any Individual Component: U-value of 0.50 Btu/sq ft/hr/deg F when tested in accordance with ASTM C 1363-2005 or ASTM C 1199-2000.

2. Air Infiltration:
   a. Operable Openings Intended to be Normally Closed: Maximum of 0.3 cfm/sq ft, measured in accordance with ASTM E 283-2004 at differential pressure of 6.24 psf.
   b. Mechanical Ventilation Openings: Automatically closed when ventilation is not required. Unless ducted, maximum of 0.3 cfm/sq ft of crack when closed, measured in accordance with ASTM E 283-2004 at differential pressure of 1.57 psf.
   c. Substantiation:
      1) Construction: For standard manufactured fenestration products, certification of specified properties by NFRC or other testing agency acceptable to NREL; for other elements, test reports.

3. Appearance:
   a. Sight Lines of Glazed Areas: Provide maximum glazing area with minimum interruption by framing members.

C. Health and Safety:

1. Ventilation Openings: Equipped with means of keeping insects, birds, and animals out.

D. Durability:

1. Air Intake and Exhaust Openings: Minimize rainwater penetration and protect adjacent interior spaces from damage from water.

2. Water Penetration: Design openings and components of openings to positively drain water to exterior of the building.
   a. Top of Openings: If wall construction does not provide its own methods of drainage, use separate flashing to prevent water from entering opening components or the interior of

enclosed space.

b. Bottom of Openings: Integral or separate sill or flashing to prevent water running over or draining out of opening components from entering the wall construction below or the interior of enclosed space.

E. Operation and Maintenance:

1. Cleanability: Design glazed openings (operable windows) to permit the exterior surface to be cleaned from inside without removing window sash.

2. Operating Components: Remaining operable for 10 years under normal exposure conditions for the project site.

3. Mechanical Ventilation Openings: No moving parts on exterior of building or where accessible to occupants.

PRODUCTS

A. Windows (Operable and Fixed):

1. Window Operation: Use the following:
   a. Horizontal sliding windows at visitor drive-up openings.

2. Glazing: Double pane insulated units.

3. Use the following:
   a. Aluminum windows at all locations.

4. Do not use:
   a. Wood windows.
   b. Metal-clad wood windows.
   c. Plastic-clad wood windows.
   d. Tubular plastic windows.
   e. Composite windows.

B. Fixed Glazing:

1. Use one of the following:
   a. Windows matching operable windows, but without operating sash (at conditioned spaces only).
   b. Storefront or curtainwall glazing systems at parking structure stair location.

2. Do not use:
   a. Wood windows.
   b. Metal-clad wood windows.
   c. Plastic-clad wood windows.
   d. Tubular plastic fixed windows.
   e. Composite windows.

C. Glazing:

1. Do not use:
   a. Patterned glass.
   b. Polycarbonate sheet.
   c. Acrylic sheet.

D. Other Exterior Opening Elements: All components required to complete the opening.

E. Concealed Flashings:

1. Use one of the following:
   a. Aluminum flashing.
   b. Flexible flashing.
   c. Stainless steel edged flashing at masonry opening locations.
   d. Copper flashing.

END OF SECTION B22

B23 - EXTERIOR DOORS

PERFORMANCE

A. Basic Function:

1. Secure all openings in the exterior wall that function to allow the entrance and exit of people, vehicles, and goods, so that the entire exterior enclosure functions as specified, using doors as specified, without using components that must be installed at changes of season.
2. The elements comprising exterior doors include doors of all sizes and uses, gates, and elements that form or complete the openings, unless an integral part of another element.
3. Where exterior door elements also must function as elements defined within another element group, meet requirements of both element groups.
4. In addition to the requirements of this section, comply with all applicable requirements of Section 111-Facility Performance, Section B-Shell, and Section B2-Exterior Enclosure.

B. Amenity and Comfort:

1. Thermal Performance for Conditioned Spaces:
   a. Maximum Thermal Transmittance of Any Individual Component: U-value of.09 Btu/sq ft/hr/deg F when tested in accordance with ASTM C 1363-2005.
   b. Provide thermal performance without using supplementary storm doors.
2. Air Infiltration: Maximum of 0.20 cfm/ft of crack length, measured in accordance with ASTM E 283-2004 at differential pressure of 1.57 psf.
   a. Substantiation:
      1) Design Development: Details of method of weather sealing; test reports on door/frame assemblies.
3. Water Penetration: If so desired, provide justification for exemption of door openings from water penetration requirements of Section B-Shell and B2-Exterior Enclosure.
   a. Substantiation:
      1) Design Development: Details of method of weather sealing; test reports on door/frame assemblies.
4. Convenience and Accessibility:
   a. Door Handles and Knobs: As required by code; where code and other requirements allow an option exit devices are preferred.
   b. Mode of Operation: Self-closing, with manual hold-open, unless otherwise indicated.
   c. Operated Door Control:
      1) Access Control System: As specified in Section D92-Surveillance and Security Controls.
5. Appearance:
   a. Doors at Building Entrances: Match windows and window framing.

C. Health and Safety:

1. Physical Security:
   a. Doors non-removable from outside without use of key.
   b. Secure each exterior door using a "fail-secure" method that allows entrance plus exit from inside using only one motion.

1) Keys: Type as required to minimize unauthorized entry.
   a) Keying: Key to the existing NREL keying system.
2) Lock Functions: Appropriate to the location and function unless otherwise specified.

D. Structure:

1. Lintels: Constructed to span door openings and support loads imposed by exterior wall with maximum deflection vertically and horizontally of 1/360 of span.

2. Door Frames: Constructed to span door opening with maximum deflection vertically and horizontally of 1/360 of span.

E. Durability:

1. Water Penetration: Design openings and components of openings to positively drain water to exterior of the building.
   a. Top of Openings: If wall construction does not provide its own methods of drainage, use separate flashing to prevent water from entering opening components or the interior of the building.
   b. Bottom of Openings: Integral or separate sill or flashing to prevent water running over or draining out of opening components from entering the wall construction below or the interior of the building.

2. Wear Resistance:
   a. Door Surfaces: Scuff-resistant in areas where foot impact is likely; highly scratch-resistant in areas where hand contact is likely.
   b. Door Handles and Knobs: Highly scratch-resistant and of finish that will minimize appearance changes due to wear; satin or brushed finish and no plated or coated finishes.

3. Flexible Seal Materials: Minimize deterioration due to operation of doors, aging, and weather.

4. Swinging Doors: Control door swing to prevent damage due to impact, to either door or element impacted.

F. Operation and Maintenance:

1. Service Life Span of Operating Components: Remaining operable for 10 years under normal exposure conditions for the project site.

2. Ease of Use and Repair: Provide doors that will be easy to use by occupants, easy to repair or service, and with operating components easy to replace.

PRODUCTS

A. Site Entrance Building Main Entrance Door and Doors to Conditioned Space:

1. Use one of the following:
   a. Glazed aluminum doors.
   b. Glazed prefinished metal doors.
   c. Glazed stainless steel doors.

2. Do not use:
   a. Balanced doors.
   b. Revolving doors.
   c. Sliding doors.

d. Wood doors.

B. Doors and Frames:

1. Use one of the following:
   a. Prefinished metal.
   b. Stainless Steel

C. Hardware for Swinging Doors:

1. Use satin, stainless steel, brass, or bronze finish.
2. Hinges: Ball-bearing butt hinges.
3. Exit Devices: Unless specifically indicated as one type, mortise type or exposed vertical rod type.
4. Locksets: Unless specifically indicated as one type, mortise or interconnected lockset and deadbolt.
5. Door Closers: Unless specifically indicated as one type, surface overhead frame-mounted type or concealed overhead frame-mounted type.
   a. Do not use floor mounted type or spring hinges.
6. Door Stops: Unless specifically indicated as one type, wall-mounted type or overhead door/frame mounted type.
   a. Do not use floor-mounted type.
7. Door Hold-Opens: Unless specifically indicated as one type, wall-mounted type or overhead door/frame mounted type.
   a. Do not use floor-mounted type.

D. Do not use:

1. Different metals subject to galvanic action in direct contact with each other.
2. Aluminum in direct contact with concrete or cementitious materials.

END OF SECTION B23

B24 - EXTERIOR WALL FIXTURES

PERFORMANCE

A. Basic Function:

1. Exterior wall fixtures include all elements attached to the outside of the exterior walls, unless consisting of equipment or services fixtures. Fixtures required are those made necessary by the design and the following:
   a. Main Building Identification Sign: Mounted on ground or main elevation of Site Entrance Building, for visibility from approach zone; provide a minimum of one.
   b. Flagpole: For US and NREL flag(s). Minimum flag size: 5 by 8 feet.
      1) See Section G22-Site Fixtures and Equipment for ground-mounted flagpoles.
2. Where exterior wall fixtures also have a function defined in another element group, design such elements as specified for that element group, in addition to the requirements specified in this section.
3. In addition to the requirements of this section, comply with all applicable requirements of Section 111-Facility Performance, Section B-Shell, and Section B2-Exterior Enclosure.

B. Amenity and Comfort:

1. Noise Reduction:
   a. Signs Noise Level: Not detectable by pedestrian or building occupants 20 feet from the sign.
   b. Flagpoles: Limit noise from wind blown halyards and flagsnaps contacting flagpoles so noise is not detectable by building occupants 25 feet from the flagpole.
2. Appearance:
   a. Signs: Legible during daylight and nighttime hours by pedestrians, and motorists from 50 yards.
   b. Flagpoles: Flag(s) to be visible during daylight and nighttime hours by pedestrians, and motorists.
   c. Conceal ballasts and wiring from view.
3. Convenience: Flag raised and lowered using internal halyard, manually-operated.

C. Structure:

1. Flagpoles: Design in accordance with NAAMM FP 1001-1997 to resist the combined wind loads on pole and flag(s) at code design wind load, assuming that flag(s) will be removed during winds of over 50 mph.
2. Anchorage: If 'building mounted', Design wall fixtures to be supported from building structural frame rather than from exterior wall.

D. Durability:

1. Water Penetration Resistance:
   a. Maintain integrity of exterior wall water penetration resistance at points of wall fixture attachment to supporting structure.
2. Weather:
   a. Surface Finish: Minimum service life of 10 years without color deterioration, except for

flags.

b. Flagpoles: Protect flagpole finish from damage caused by wind blown halyards and flagsnaps.

3. Impact Resistance:
   a. Signs: For signs located at grade and the first floor of the building, constructed to resist damage from vandalism.

PRODUCTS

A. Signs:

1. Match existing sign designs on campus

2. Do not use:
   a. Signs painted on the face of the exterior wall.
   b. Signs constructed of the same material as the exterior skin of the exterior wall.

B. Flagpoles: Type as required, outrigger type, vertical building-mounted type, or site mounted (re: Section G-Sitework).

1. Provide sheathed metallic flagsnaps.

2. Use one of the following:
   a. Aluminum flagpoles.
   b. Stainless steel flagpoles.
   c. Prefinished fiberglass flagpoles.

END OF SECTION B24

B3 - ROOFING

PERFORMANCE

A. Basic Function:

1. Provide a weather-proof enclosure over the entire "top-side" of building that also excludes unwelcome people, animals, and insects without requiring specific action by occupants, while shedding water and preventing uncontrolled water infiltration, withstanding anticipated loading conditions, providing required access, and permitting the entry of desirable natural light.
2. Provide all fixtures needed on the roof due to the design.
3. Roofing comprises the following elements:
   a. Roof Coverings: Weather barriers, vapor retarders, insulation, wearing surfaces, water collectors and conductors; including coverings over plaza decks, balconies, and other exposed floors.
   b. Roof Openings: Skylights, ventilation openings, access openings, and other roof opening elements.
   c. Roof Fixtures: All elements attached to the roof, unless equipment or services.
4. Where roofing elements also must function as elements defined within another element group, meet requirements of both element groups.
5. In addition to the requirements of this section, comply with all applicable requirements of Section 111-Facility Performance and Section B-Shell.
6. Substantiation:
   a. Post-Construction: Roof inspection conducted in the first spring after completion of roofing, after chance of snow has passed.

B. Amenity and Comfort:

1. Run-Off: Direct water run-off to storm drains without splashing or dripping.
2. Noise of Precipitation: Design and select materials that dampen the sound of precipitation on the roof to maintain interior ambient sound levels as required by Section B-Shell.
3. Appearance:
   a. Concealment of Services and Equipment: Provide permanent concealment of rooftop items using substantial construction other than screens.
   b. Cleanliness: In addition to requirements of Section B-Shell for cleanliness of exterior surfaces, if roofing surfaces are exposed to view, use surface materials that will conceal or resist the build-up of dirt.
   c. Ponding: Arrange drainage of roof so no ponding will occur, regardless of whether roofing material will withstand ponding of water or not.

C. Health and Safety:

1. Roof Worker Safety: Design to provide safe design and safety measures as required by code and the following:
   a. Provide permanent access to all areas of the roof requiring routine maintenance or operation in the form of stairs.
   b. Provide permanently installed supports for equipment used for cleaning windows and

other glazed areas of the shell.

2. Physical Security: Consider the roof area and all roof openings unsupervised.

D. Structure:

1. Rainwater Load: As required by code plus 15%.

2. Roof Component Wind Resistance:
   a. Uplift: Same pressure as specified in code for structural members.
   b. Substantiation:
      1) Design Development: Identification of assemblies or methods used.
      2) Post-Construction: Reports of windstorms involving wind gusts of over 50 mph within one year after completion of each roofing element, including wind speed, direction, duration, and results of inspection of roofing.

3. Snow Load:
   a. Roof Opening Elements: Exceed code requirements by 15 percent.

E. Durability:

1. Weather Resistance: Provide weather-exposed roof coverings and other components that comply with weather resistance specified in Section B-Shell and the following:
   a. Minimization of Deterioration Due to Weather: For weather-barrier materials, minimization means no deterioration that adversely affects water penetration resistance at any time during the specified service life span.
   b. Substantiation:
      1) Design Development: As specified for service life span in Section 111-Facility Performance, including service life analysis and life cycle cost analysis.

2. Water Penetration: None, under conditions of rain driven at 50 mph, unless water paths are completely accessible.
   a. Substantiation:
      1) Construction: Water flood tests of roof areas that can accumulate rainwater if primary drains are blocked, up to depth for which structure is designed.
      2) Construction: Reports of first 3 significant rainfalls after completion of each roofing element, including rainfall amount and intensity, wind speed and direction, and results of inspection of roof and underside.

3. Minimum Slope:
   a. Field of Roof: 1/2 inch per foot.

4. Grease, Chemical Resistance: Wherever there is a possibility of the introduction of grease, oils, or chemicals onto the roof, provide materials that are not damaged by such leakage.

5. Ice: Design to avoid damage due to ice formation and buildup on roofing and in water conductors.

6. Wear Resistance:
   a. Surfaces Subject Only to Maintenance Foot Traffic: Not punctured by ordinary materials or tools when stepped on.
   b. Substantiation:
      1) Design Development: Proven-in-use products, or demonstration using tests appropriate to materials used, over same type of substrates as will be used in

construction.

F. Operation and Maintenance:

1. Ease of Service:
   a. All components of roofing (not just roof covering) easily accessible by maintenance persons on foot without the use of portable ladders or other portable devices.
   b. Rooftop fixtures serviceable by simple replacement of parts, minimizing time required on roof, and eliminating need for repair work in the weather.

2. Ease of Repair:
   a. Water Barrier Subject to Foot Traffic: Easily accessible for repair; if covered, covering must be removable by one person without the use of tools other than shovel and broom, with original covering materials replaceable to the same degree of coverage using the same tools.

END OF SECTION B3

B31 - ROOF COVERINGS

PERFORMANCE

A. Basic Function:

1. Provide a weather-resistive covering over the top side of the roof superstructure and any exposed floor superstructure.
2. Roof covering comprises all weather-resistive components, including the primary weather barrier, vapor retarders, insulation, water collectors and conductors, wearing surfaces, trim and accessories, but not including roof opening elements or roof fixtures.
3. Where roof covering elements also must function as elements defined within another element group, meet requirements of both element groups.
4. In addition to the requirements of this section, comply with all applicable requirements of Section 111-Facility Performance, Section B-Shell, and Section B3-Roofing.

B. Amenity and Comfort:

1. Air Infiltration: If a jointless or completely sealed-seam or welded-seam membrane-type water barrier is not used, provide auxiliary method of complying with air infiltration requirements of Section B-Shell.

C. Structure:

1. Roof Covering Substrate: Sufficiently rigid or dense to support water barrier in a manner that prevents puncture due to traffic on roof.
2. Wind Uplift: Where roof covering has a lower air transmission rate than the roof superstructure, provide means of preventing blow-off or ballooning due to low negative pressure over roof.

D. Durability:

1. Life Span: As specified in Section B-Shell, and the following:
   a. Aesthetic Life Span: Significant degradation of appearance during the functional life span is not acceptable.
   b. Manufacturer Approval of Design: Where roof covering manufacturer recommends or requires certain design features for satisfactory performance or for warranty, with manufacturer's requirements.
   c. Manufacturer Warranty:
      1) Materials: 20 years, minimum.
      2) Installation and Workmanship: 10 years, minimum.
   d. Substantiation:
      1) Preliminary Design: Material type, expected functional life span, and manufacturer warranty available.
      2) Design Development: Material type and specification, expected functional life span, and manufacturer warranty available.
      3) Construction Documents: Quality assurance program to be implemented to ensure complete and correct installation of weather-barrier elements.
      4) Construction: Actual manufacturer warranty.
2. Water Penetration:

a. Water Barrier Type: Use a water barrier that is lapped for positive run-off, a monolithic jointless membrane, or a membrane with sealed joints.
b. Fasteners Penetrating Water Barrier: Prohibited, unless fasteners are located under overlapping material.

E. Operation and Maintenance:

1. Water Conductor Capacity: As required by code or SMACNA Architectural Sheet Metal Manual (ASMM), 2003, whichever is greater, based on 100 year 1 hour intensity.
   a. Substantiation:
      1) Design Development: Calculations of capacity.
      2) Construction: Water tests.

PRODUCTS

A. Essentially Flat Roofs:

1. Use the following:
   a. Elastomeric roofing membrane.
      1) Made of EPDM or PVC.
      2) Installed over insulation and mechanically attached, or fully-adhered.
2. Do not use:
   a. Pitch pans or pockets.
   b. Fluid-applied roofing or waterproofing membrane.
   c. Loose-laid roofing membrane.
   d. Inverted roof membrane assembly (insulation over membrane).

B. Sloped Roofs:

1. Use the following:
   a. Metal roofing of copper, aluminum, or factory-finished hot-dipped galvanized steel.
2. Do not use:
   a. Asphalt shingles.
   b. Wood shingles.
   c. Slate shingles.
   d. Mineral fiber-cement tiles.

C. Water Collectors and Conductors:

1. Use one of the following:
   a. Metal piping.
   b. Stainless steel sheet metal.
   c. Factory-finished galvanized steel sheet metal.

D. Flashing, Trim, and Accessories: Sheet metal.

1. Use one of the following:
   a. Copper sheet metal.
   b. Stainless steel sheet metal.
   c. Factory-finished galvanized sheet metal.

END OF SECTION B31

B9 - PHOTOVOLTAIC SUPERSTRUCTURE

PERFORMANCE

A. Basic Function:

1. Provide a Structural Mounting/Support System (MSS) to affix and operate Photovoltaic Panels supplied and installed by NREL.
2. The Structural (MSS) shall be sized to maximize the usable square feet of PV panels, and to cover the top level of structured parking.
3. The Structural (MSS) comprises the following elements:
   a. Space-frame, or comparable structure, providing connections to the footings and foundations and for the connection/mounting of the Owner supplied and installed PV panels.
4. In addition to the requirements of this Section, meet other requirements of Part 3-Performance Criteria, specifically Sections - B1-Substructure and B-Shell.

B. Amenity and Comfort:

1. Eliminate the functional interruption of parking spaces and roadways caused by the placement of the MMS.
2. Vibration Control: Use MMS elements that will not resonate at frequencies that are characteristic of ambient exterior conditions (such as wind) at the project site.
3. Provide a MMS that is aesthetically compatible with the surrounding buildings architectural details, materials, massing and scale.
   a. Substantiation:
      1) Proposal: Identification of structural system to be used, and boundaries of structure in context with the parking area.
      2) Preliminary Design: Identification of materials and finishes of MMS components.
4. Cleanliness of Exterior Surfaces: Design and select materials to:
   a. Prevent attraction and adherence of dust and air-borne dirt and soot, and minimize appearance of settled dust and dirt.
   b. Be washed reasonably clean by normal precipitation.
   c. Prevent precipitation from washing settled dust and dirt over surfaces exposed to view.

C. Health and Safety:

1. Vermin Protection: Minimize the effect of nesting or perching birds and climbing animals due to droppings or organic debris buildup.
2. The MMS shall not cause visual or physical impairment of the safe operation of vehicles within the parking area.

D. Structure:

1. The MMS shall meet the Structure requirements of Section- Shell.

E. Durability:

1. Service Life Span: Same as the Service Life Span of the Facility.

2. Corrosion Prevention: Provide supplementary protection for underground metal elements, sufficient to prevent corrosion completely for the service life of the element without maintenance.
   a. 3 inches (150 mm) of concrete cover is considered to be permanent protection.
3. Weather Resistance: Design and select materials to minimize deterioration due to precipitation, sunlight, ozone, normal temperature changes and atmospheric pollutants.
4. Impact Resistance: Design and select materials to resist damage due to impact by vehicular traffic traveling at expected speeds.

F. Operation and Maintenance:

1. Provide substructure elements that will endure for the lifetime of the MMS with no maintenance.
2.

PRODUCTS

A. Corrosion-Resistant Metals:

1. Hot-dipped galvanized steel, with minimum zinc coating of 0.90 oz/sq ft (275 gm/sq m) total both sides.
2. Stainless steel, Type 304 or 316.
3. Cadmium-plated steel, with minimum coating of 12 micrometers.
4. Aluminum.

B. Coated Finishes:

1. Use one of the following:
   a. Fluoropolymer coating (70 percent Kynar 500 (tm) or Hylar 5000(tm)), minimum two coats.
   b. Factory Applied Coatings providing adequate Service Life Span
2. Do not use:
   a. Paint or other field applied coatings.

END OF SECTION B9

C - INTERIORS

PERFORMANCE

A. Basic Function:

1. Provide appropriately finished interiors for all spaces indicated in the program, equipped with interior fixtures as required to function properly for specific occupancies.

2. Interiors comprise the following assemblies:
   a. Interior Construction: All elements necessary to subdivide and finish conditioned space enclosed within the shell, including applied interior surfaces of the exterior enclosure.
   b. Interior Parking Structure Construction: All elements necessary to finish parking spaces enclosed or semi-enclosed within the shell, including applied interior treatments of the exterior enclosure.
   c. Interior Fixtures: All elements attached to interior construction that add functionality to enclosed spaces, except for elements classified as equipment or services fixtures.

3. Provide physical separation between spaces, constructed to achieve fire ratings required by code, appropriate security between adjacent spaces, and visual, acoustical, olfactory, and atmospheric isolation as necessary to maintain desirable conditions in each space.

4. Provide finishes for interior surfaces that are appropriate for the functions of each space.

5. Provide interior fixtures that are necessary for the proper functioning of each space.

6. Where interior elements also must function as elements defined within another element group, meet requirements of both element groups.

7. In addition to the requirements of this section, comply with all applicable requirements of Section 111-Facility Performance.

B. Amenity and Comfort:

1. Natural Ventilation: Design and construct interiors to permit air movement between exterior openings positioned to enhance warm weather thermal comfort of occupants in all major spaces, or as required to meet code requirements for ventilation of SV (Parking).
   a. SR1 (Sanitary Facilities), SS (Storage), and SU (Utility, Building Services) spaces are exempt from natural ventilation requirements.
   b. Substantiation:
      1) Proposal: Information on overall building configuration that will permit natural ventilation of all major spaces.
      2) Design Development: Engineering calculations for representative spaces, predicting anticipated air movement under weather conditions typical for project site.

2. Access: Provide access to all primary interior spaces from Circulation spaces (SC Spaces) (no access to any primary interior space exclusively through another primary interior space).

3. View: Provide views to the building exterior from virtually all locations within primary interior conditioned spaces.
   a. View spaces include the following types:
      1) Customer Contact (SP1 Spaces).
      2) Occupant Work (SP2 Spaces).
      3) Equipment Utilization (SP3 Spaces).

4. Natural Light:
   a. Daylighting: Provide ambient natural lighting in primary spaces that is of intensity adequate for essential tasks when measured on a typical overcast winter day in midafternoon.
      1) Spaces for daylighting include the following types:
         a) Customer Contact (SP1 Spaces).
         b) Occupant Work (SP2 Spaces).
         c) Equipment Utilization (SP3 Spaces).
         d) Parking Structure (SV Spaces)
      2) Light Levels: Provide minimum light levels not less than those recommended in IESNA Lighting Handbook, 2000, for the types of tasks to be anticipated in each category of space.
         a) For light levels related to Parking Structure reference Section G-Sitework.
   b. Visual Comfort: Provide ambient natural light in primary spaces that is free of excessive direct or reflected glare, as defined in IESNA RP-5, 1999, Recommended Practice of Daylighting.
   c. Daylight Control: Provide local devices to enable occupants to control brightness and glare from direct daylighting in conditioned spaces.
   d. Substantiation:
      1) Proposal: Information on overall building configuration that will permit daylighting to levels specified.
      2) Design Development: Engineering calculations for representative spaces, predicting anticipated daylighting levels under specified conditions.
      3) Construction Documents: Details of lighting control mechanisms.
      4) Construction: Field test of lighting levels verifying compliance with performance requirements.

5. Acoustical Performance:
   a. Background Noise: Provide interiors that maintain ambient sound levels within primary spaces at levels recommended in ASHRAE HVAC Applications Handbook, 2003, when adjacent spaces are occupied and are being used normally.

6. Odor Control: Prevent unpleasant or noxious odors generated within a space from affecting occupants of adjacent spaces, by providing physical isolation of the spaces, separate ventilation, or a combination of isolation and ventilation.
   a. Control odors from spaces of the following types:
      1) Toilet rooms.
      2) Parking structure.

7. Appearance: Provide interiors that are pleasing in appearance and do not detract from the primary functions performed in each space.

8. Texture: Provide interior elements and surfaces that are textured appropriately for primary functions to be accommodated within each space.
   a. For surfaces that are within normal reach of occupants, provide textures that are safe for occupants and require minimum maintenance.
   b. For surfaces that are not within normal reach of occupants, design may provide textures that are generally of a coarser scale than those permitted within normal reach.

C. Health and Safety:

1. Egress: Provide egress from all interior spaces in accordance with code.

2. Fire Resistance: Design and select materials to provide fire resistance in accordance with code.
   a. For all elements required to have a fire resistive rating and which are not made of materials and systems specified as acceptable by the code, use proven-by-mock-up construction.
   b. For proven-by-mock-up construction, acceptable testing agencies are Underwriters Laboratories Inc. and Factory Mutual
   c. Minimum performance values for individual interior elements are also specified in other Sections.
   d. Substantiation:
      1) Design Development: Identification of assemblies required to have fire resistance rating and method to be used to achieve rating.
      2) Construction Documents: Identifying numbers placed on the construction drawings.

D. Structure:

1. Structural Performance: Provide interior construction and fixtures to support without damage all loads required by code.
   a. Special Loads: In addition to loads defined by code, provide for adequate support of wall-mounted or ceiling-mounted furnishings and equipment in spaces where such equipment is identified by program or is likely to be installed after construction because of intended function.
      1) Adequate support is defined as the ability to sustain 150 percent of design loads without damage to building or equipment.
   b. Substantiation:
      1) Construction Documents: Detailed design analysis by licensed structural engineer.

E. Durability:

1. Service Life Span: Same as building service life, except as follows:
   a. Interior Doors and Other Operable Elements: Minimum 20 years functional and aesthetic service life.
   b. Interior Ceiling Finishes: Minimum 20 years functional and aesthetic service life; including suspended ceilings.
   c. Interior Wall and Floor Finishes: Minimum 15 years functional and aesthetic service life.
   d. Other Interior Construction: Minimum 20 years functional and aesthetic service life.
   e. Substantiation: As specified in Section 111-Facility Performance, including service life analysis and life cycle cost analysis.

2. Wear Resistance: Provide interior construction and fixtures that are suitable in durability for the degree and type of traffic to be anticipated in each space.

3. Ultraviolet Resistance: In interior spaces exposed to direct sunlight, provide interior construction and fixtures that are inherently resistant to fading and discoloration.

4. Vandal Resistance: In spaces accessible to the public and not subject to continuous surveillance, provide interior construction and fixtures that are inherently vandal resistant or designed to be difficult to access or damage.

F. Operation and Maintenance:

1. Cleaning: Provide interior construction and fixtures that will not be damaged by ordinary

cleaning and maintenance operations.

END OF SECTION C

C1 - INTERIOR CONSTRUCTION

PERFORMANCE

A. Basic Function:

1. Provide physical separation between spaces required by the program, constructed to achieve fire ratings required by code, create delineation between adjacent spaces, appropriate security between adjacent spaces, and visual, acoustical, olfactory, and atmospheric isolation as necessary to maintain desirable conditions in each space.

2. Provide appropriately finished interiors for all spaces required by the program. Finishes shall meet requirements for amenity, comfort, health and safety, structural capacity, durability, and operation and maintenance.

3. Interior construction comprises the following elements:
   a. Partitions: All types of space dividers, including demountable and operable partitions.
   b. Interior Doors: All interior doors, including hardware and frames, except for elevator doors.
   c. Interior Windows: All interior fixed and operable windows, including frames and casings.
   d. Other Interior Openings: Interior utility openings such as hatches and access panels, louvers and vents.
   e. Stairs and Ramps: Those interior and exterior stair and ramp elements not a part of superstructure or integral with the exterior enclosure.
   f. Interior Finishes: All functional and decorative applied interior finishes, including secondary support structures.

4. Where interior construction elements also must function as elements defined within another element group, meet requirements of both element groups.

5. In addition to the requirements of this section, comply with all applicable requirements of Section 111-Facility Performance and Section C-Interiors.

B. Amenity and Comfort:

1. Cross Ventilation: Provide interior construction to facilitate natural cross ventilation required in Section B-Shell and by the code.

C. Health and Safety:

1. Fire Resistance: Design and provide interior construction to achieve fire resistance required by code.
   a. For all elements required to have a fire resistive rating, that are not made of materials and systems specified in the code, use proven-by-mock-up construction.
   b. For proven-by mock-up construction, acceptable testing agencies are Underwriters Laboratories Inc..
   c. Substantiation:
      1) Design Development: Identification of assemblies required to have fire resistance rating and method to be used to achieve rating.
      2) Construction Documents: Identifying numbers on the construction drawings.

2. Safety: Design and provide interior construction to protect building occupants in accordance with code and the following:
   a. Heights: Protect building occupants from falling from elevated decks of any type.

b. Tripping: Protect building occupants from tripping hazards due to uneven floor surfaces or abrupt changes in floor elevation of more than 1/8 inch.

D. Operation and Maintenance:

1. Cleaning: At toilet rooms, provide interior construction that will allow harsh chemical cleaning without damage.

END OF SECTION C1

C11 - PARTITIONS

PERFORMANCE

A. Basic Function:

1. Provide physical separation between spaces included in the program, constructed to achieve fire ratings required by code, appropriate security between adjacent spaces, and visual, acoustical, olfactory, and atmospheric isolation as necessary to maintain desirable conditions in each space.

2. Partitions comprise the following elements:
   a. Fixed Partitions: Solid, stationary space dividers that are opaque and extend full height.
   b. Partial Height Partitions: Fixed, solid, opaque visual barriers, including toilet compartments.
   c. Fixed, Open Protection and Control Devices: Barriers include interior railings and mesh partitions.

3. Where partition elements also must function as elements defined within another element group, meet requirements of both element groups.

4. In addition to requirements specified in this section, comply with all applicable requirements of Section 111-Facility Performance, Section C-Interiors, and Section C1-Interior Construction.

B. Amenity and Comfort:

1. Thermal Performance: Where adjacent spaces have different ambient temperatures in excess of 10 degrees F, provide minimum U-value of.05 Btu/sq ft/hr/deg F.

2. Light: Provide transparent or translucent fixed partitions or interior windows where required to meet natural lighting objectives specified in Section C-Interiors.

3. Exterior View: At primary interior spaces without access to exterior windows, provide transparent fixed partitions or transparent interior windows that permit occupants to borrow light and view from adjoining spaces.

4. Visual Privacy: Provide partial height partitions in rest rooms that afford visual privacy between adjacent stalls.

5. Acoustical Isolation:
   a. Fixed Partitions: Provide acoustic partition treatments at toilet rooms that isolate ambient sounds generated in toilet room from adjacent occupant spaces.

6. Appearance:
   a. Provide partitions that are smooth in texture at all circulation routes (SC spaces).

C. Structure:

1. Lintels: Constructed to span openings in partitions and support imposed loads with maximum deflection vertically and horizontally of 1/360 of span.

2. Vertical Loads: Provide partitions with sufficient strength to withstand anticipated vertical loads for wall-mounted handrails, equipment, and furnishings without excessive deflection or structural damage.
   a. Partial Height Partitions: Withstand point load of 200 lbf applied every 2 feet to top of partition.

3. Horizontal Loads: Provide partitions with sufficient strength and rigidity to withstand anticipated horizontal loading conditions without excessive deflection or structural damage.
   a. Fixed Partitions: Withstand loading of 5 psf with maximum deflection of L/360, per ASTM E 72-2005.
   b. Elevator Shaft Wall Partitions: Withstand intermittent air pressure loads of 10 psf with maximum deflection of L/360, per ASTM E 72-2005.
   c. Partial Height Partitions: Withstand concentrated load of 200 lbf applied over not more than 10 sq in anywhere on partition surface.
4. Railings: Provide railings with sufficient strength and rigidity to withstand the following loads:
   a. Concentrated load of 200 lbf applied in any direction.
   b. Uniform load of 50 lbf/ft applied in any direction.

PRODUCTS

A. Fixed Partitions:

1. Design and construct partitions using one of the following:
   a. Cast-in-place concrete.
   b. Brick.
   c. Concrete masonry units.
   d. Glass unit masonry.
   e. Gypsum board (with appropriate finish) on metal framing.
2. Do not use:
   a. Gypsum plaster on metal lath over wood framing.
   b. Solid gypsum plaster on steel framing.
   c. Portland cement plaster on metal lath over metal framing .
   d. Gypsum board on wood framing and furring.
   e. Wood paneling on wood framing and furring.

B. Partial Height Partitions:

1. Design and construct partitions using one the following:
   a. Cast-in-place concrete.
   b. Brick.
   c. Concrete masonry units.
   d. Glass unit masonry.
   e. Gypsum board (with appropriate finish) on metal framing.
   f. Manufactured solid plastic toilet compartments and screens.
2. Do not use:
   a. Gypsum plaster on gypsum lath over wood framing.
   b. Solid gypsum plaster on steel framing.
   c. Portland cement plaster on metal lath over metal framing .
   d. Gypsum board on wood framing and furring.
   e. Wood paneling on wood framing and furring.

C. Interior Railings:

1. Use one of the following:
   a. Railing systems of stainless steel.
   b. Railing systems of G90 galvanzied steel

c. Railing systems of aluminum.

2. Do not use:
   a. Field finished pipe and tube railings of steel
   b. Galvanized railing systems requiring field welding
   c. Glass-supported railings.

D. Fixed, Open Screens:

1. Use one of the following:
   a. Ornamental metal screens of prefinished steel.
   b. Ornamental metal screens of stainless steel.
   c. Ornamental metal screens of aluminum.

END OF SECTION C11

C12 - INTERIOR DOORS

PERFORMANCE

A. Basic Function:

1. Equip all openings in partitions that function to allow passage of people, vehicles, and goods, so that openings can be closed and secured when not in use, using components as indicated.
2. The elements comprising interior doors include doors of all sizes and uses, gates, and elements that form or complete the openings, unless an integral part of another element.
3. Where interior door elements also must function as elements defined within another element group, meet requirements of both element groups; interior doors function as partition elements when doors are closed.
4. In addition to the requirements of this section, comply with all applicable requirements of Section 111-Facility Performance, Section C-Interiors, and Section C1-Interior Construction.

B. Amenity and Comfort:

1. Convenience:
   a. Dimensions: Provide interior doors that are sized appropriately for maintenance activities, people, vehicles, goods, and equipment likely to move between adjacent spaces.
   b. Height: Not less than 84 inches in height.
   c. Closing Devices: Required on all doors; smooth closing motion, with slower latching speed than closing speed (no slamming).
2. Appearance:
   a. Provide interior doors coordinated with adjacent wall surfaces, using aesthetically and functionally appropriate materials, colors, and textures.

C. Health and Safety:

1. Fire Safety: Protect door openings in fire-rated walls and partitions in accordance with the code.
   a. Closers: Sufficient closing force to close and latch door despite drafts and typical wind, but not more than that specified by code.
2. Emergency Egress: Where doors must be latched or locked, comply with the code.
   a. Locking Devices Requiring a Key for Egress: Not allowed.
3. Physical Security:
   a. Locks: Secure each room door using a keyed lockset that allows exit from inside using only one motion.
      1) Exceptions:
         a) The following must not have any locking feature at all:
            (1) Doors into stairwells.
            (2) Doors to restrooms, unless single-occupant; use privacy locks without keys.
         b) See Section D92-Surveillance and Security Controls for remote unlocking requirements related to access/entry control functions.
      2) Keys: As specified in Section B23-Exterior Doors.
         a) Keymaking Restrictions: Key blanks and keymaking restricted to owner.

3) Locking Functions: Appropriate to the space location and function.

D. Structure:

1. Door Frames: Constructed to span door opening with maximum deflection vertically and horizontally of 1/360 of span.

E. Durability:

1. Wear Resistance:
   a. Door Surfaces: Scuff-resistant in areas where foot impact is likely; highly scratch-resistant in areas where hand contact is likely; applied protective surfaces for vulnerable areas are acceptable.
   b. Door Handles and Knobs: Highly scratch-resistant and of finish that will minimize appearance changes due to wear; satin or brushed finish and no plated or coated finishes.
2. Flexible Seal Materials: Minimize deterioration due to operation of doors and aging.
3. Swinging Doors: Control door swing to prevent damage due to impact, to either door or element impacted.

F. Operation and Maintenance:

1. Ease of Use and Repair: Provide doors that will be easy to use by occupants, easy to repair or service, and with operating components easy to replace.
2. Life Span of Operating Components: Remaining operable for 20 years under normal exposure conditions for the project site.

PRODUCTS

A. Interior Pedestrian Doors:

1. Use one of the following:
   a. Hollow prefinished steel doors and frames at un-conditioned spaces
   b. Hollow stainless steel doors and frames at un-conditioned spaces
   c. Hollow steel frames and flush wood doors at conditioned spaces.
2. Do not use:
   a. Hollow steel doors and frames.
   b. Stile-and-rail wood doors.

B. Glazing in Doors: Glass.

1. Use one of the following:
   a. Fully tempered glass.
   b. Laminated glass.
2. Do not use:
   a. Plain float or sheet glass.
   b. Heat-strengthened glass.
   c. Acrylic sheet.
   d. Polycarbonate sheet.
   e. Wired glass, except in fire-rated doors.

C. Door Louvers:.

1. Louvers in Metal Doors: Same material as doors.
2. Use fire rated louvers on fire rated doors.
3. Louver in Wood Doors: Use one of the following:
   a. Prefinished steel louvers.
   b. Aluminum louvers.
   c. Stainless steel louvers.
   d. Wood louvers.

D. Hardware for Swinging Doors:

1. Hinges: Ball-bearing butt hinges or offset hinges at toilet partitions.
2. Exit Devices: Unless specifically indicated as one type, mortise type or exposed vertical rod type.
3. Locksets: Unless specifically indicated as one type, mortise.
4. Door Closers: Unless specifically indicated as one type, surface overhead frame-mounted type or concealed overhead frame-mounted type.
   a. Do not use floor mounted type or spring hinges.
5. Door Stops: Unless specifically indicated as one type, wall-mounted type or overhead door/frame mounted type.
   a. Do not use floor-mounted type.
6. Door Hold-Opens: Unless specifically indicated as one type, wall-mounted type or overhead door/frame mounted type.

E. Do not use:

1. Different metals subject to galvanic action in direct contact with each other.
2. Aluminum in direct contact with concrete or cementitious materials.

END OF SECTION C12

C13 - INTERIOR WINDOWS

PERFORMANCE

A. Basic Function:

1. Provide interior windows between adjacent spaces where required by the program or where proper functioning of adjacent spaces requires limited visual or physical connection between them.

2. Interior windows comprise the following elements:
   a. Operable windows.
   b. Fixed windows, but excluding glazed partitions.
   c. Window openings without glazing, including finished sills, head, and jambs.

3. Where interior windows are integral with elements defined within another element group, meet requirements of both element groups. Fixed interior windows and operable interior windows, when closed, function as partition elements and cannot degrade performance of partitions below the levels specified.

4. In addition to requirements specified in this section, comply with all applicable requirements of Section 111-Facility Performance, Section C-Interiors, and Section C1-Interior Construction.

B. Amenity and Comfort:

1. Thermal Performance: Where adjacent spaces have differential required temperatures in excess of 10 degrees F, provide minimum U-value of 0.61 IP.

2. Light: Provide interior windows or fixed partitions that are transparent where required to meet natural lighting objectives specified in Section C-Interiors.

3. Exterior View: At primary interior spaces without access to exterior windows, provide interior windows or transparent fixed partitions that permit occupants to borrow light and view from adjoining spaces.

4. Interior View: At interior conditioned spaces adjacent to public vestibules, lobbies, and waiting areas, provide interior windows or transparent fixed partitions to permit views of the public.

5. Convenience:
   a. Dimensions: Provide operable interior windows (as required by the design to satisfy the program) that are sized appropriately for objects, materials, and services likely to be transferred between adjacent spaces.

6. Appearance:
   a. Compatibility: Provide interior windows that are compatible in appearance with exterior windows in the same space, employing similar materials, colors, and textures.
   b. Sight Lines: Provide maximum glazing area with minimum interruption by framing members.
   c. Frames: Designed and constructed to give a flush appearance with minimal shadow lines.
   d. Muntins: No muntins employed to subdivide interior windows.

C. Durability:

1. Physical Endurance: At operable interior windows, design and select materials and window operation that will withstand not less than 15 years of normal operation without requiring

replacement of any parts.

2. Hardware at Operable Interior Windows: Highly scratch-resistant and of finish that will minimize appearance changes due to wear; satin or brushed finish and no plated or coated finishes.

D. Operation and Maintenance:

1. Ease of Use: Provide operable interior windows that can be opened and closed easily by hand, without requiring special tools or equipment.

2. Ease of Use: Provide operable interior windows that can be opened and closed by exertion of not more than 10 lbf.

PRODUCTS

A. Interior Windows (Operable and Fixed):

1. Glazing: Double pane insulated units.

2. Do not use:
   a. Wood windows.
   b. Metal-clad wood windows.
   c. Plastic-clad wood windows.
   d. Tubular plastic windows.
   e. Composite windows.

B. Glazing:

1. Do not use:
   a. Tinted glass.
   b. Heat absorbing glass.
   c. Patterned glass.
   d. Wired glass.
   e. Ceramic glass.
   f. Polycarbonate sheet.
   g. Acrylic sheet.

END OF SECTION C13

C15 - STAIRS

PERFORMANCE

A. Basic Function:
   1. Provide interior stairs, ramps, and fire escapes as necessary for access to and egress from all occupied spaces required by the program, in compliance with code and as follows:
      a. Wider Stairs: Provide stairs that are 50 percent wider than required by code.
   2. Provide not less than one stair to all mechanical spaces and equipment locations.
   3. Stairs comprise the following elements:
      a. Structure supporting stairs, unless an integral part of superstructure.
      b. Tread and riser construction, unless an integral part of superstructure.
      c. Railings for interior stairs.
      d. Integral stair finishes.
   4. Where stairs are integral with elements defined within another element group, meet requirements of both element groups.
   5. In addition to requirements of this section, comply with all applicable requirements of Section 111-Facility Performance, Section C-Interiors, and Section C1-Interior Construction.

B. Amenity and Comfort:
   1. Stair Comfort:
      a. Landings: Provide stairs with maximum rise of not more than 10 ft between landings.
   2. Ramp Comfort:
      a. Landings: Provide ramps with landings of not less than 8 ft in length.

C. Health and Safety:
   1. Safety of Stairs:
      a. Slip Resistance: Design and construct exterior stairs so that treads have a minimum static coefficient of friction of 0.80, measured in accordance with ASTM D 2047-2004.
      b. Winders: Design and construct stairs without winders, even if permitted by code.
      c. Spiral Stairs: Do not employ spiral stairs, even if permitted by code.
      d. Circular Stairs: Do not employ circular stairs, even if permitted by code.

D. Structural:
   1. Handrails and Guardrails: Provide handrail and guardrail assemblies capable of resisting forces in excess of those required by code, as follows:
      a. Uniform Load: Minimum 100 lb/ft applied in any direction at the top.
      b. Concentrated Load: Minimum 250 pounds applied in any direction at any point along the top.
      c. Normal Load to Intermediate Rails or Guard: Minimum 100 pounds horizontally applied to area of not more than 1 foot square.

PRODUCTS

A. Design and construct stairs using the following materials and systems:
   1. Poured-in-place concrete stairs.
   2. Precast concrete stairs.
   3. Custom fabricated prefinished metal stairs.
   4. Prefinished metal railing systems.
   5. Stainless steel railing systems
   6. G90 Galvanized metal railings systems with no field welding for assembly.

B. Do not use:
   1. Tempered glass railing assemblies.
   2. Field finished metal stairs
   3. Wood stairs

4. Railing systems requiring field welding

END OF SECTION C15

C16 - INTERIOR FINISHES

PERFORMANCE

A. Basic Function:

1. Provide appropriately finished interiors for all spaces required by the program.
2. Interior finishes comprise the following elements:
   a. Wall finishes, including those applied to the interior face of exterior walls and to the vertical faces of superstructure elements.
   b. Floor finishes.
   c. Suspended ceilings and soffits.
   d. Applied ceiling finishes.
   e. Stair finishes in conditioned spaces.
   f. Finishes applied to other interior surfaces.
3. Where interior finishes are integral with elements defined within another element group, meet requirements of both element groups.
4. In addition to the requirements of this section, comply with all applicable requirements of Section 111-Facility Performance, Section C-Interiors, and Section C1-Interior Construction.

B. Amenity and Comfort:

1. Thermal Performance:
   a. Interior Wall Finishes at Exterior Walls: Provide vapor permeance of 1 perm maximum when tested in accordance with ASTM E 96/E 96M-2005.
   b. Interior Ceiling Finishes at Roof Level: Provide vapor permeance of 1 perm maximum when tested in accordance with ASTM E 96/E 96M-2005.
2. Reflectivity:
   a. Glare: Provide interior finishes that will not result in discomfort glare due to excessive contrast with light sources.
      1) Ceiling Surfaces: Not less than 80 percent reflectivity, when measured in accordance with ASTM E 1477-1998a (Reapproved 2003).
      2) Wall Surfaces: Not less than 50 percent reflectivity.
      3) Floor Surfaces: Not less than 30 percent reflectivity.
   b. Specular Reflections: Provide interior finishes that will minimize specular reflections.
3. Cleanliness:
   a. For spaces such as toilet rooms and maintenance rooms, provide wall, ceiling, and floor surfaces that are inherently resistant to moisture and that can be cleaned by caustic agents without damage.

C. Health and Safety:

1. Slip Resistance: For spaces subject to floor wetting, including entry lobbies, provide floor finishes with inherent slip resistance under wet conditions.
   a. At building entries, provide means for reducing or minimizing moisture and debris on shoe soles.
2. Slip Resistance: At stairs and corridors, provide floor finishes with minimum static coefficient of friction of 0.60, measured in accordance with ASTM D 2047-2004.

3. Slip Resistance: At ramps and sloped floor surfaces, provide floor finishes with minimum static coefficient of friction of 0.80, measured in accordance with ASTM D 2047-2004.

4. Tactile Warning Surfaces: Provide floor surfaces that comply with ADAAG-1994 detectable warning requirements at potentially hazardous locations, including (but not limited to) top and bottom of stairs and top and bottom of ramps.

D. Structure:

1. Floor Loading: Provide floor finishes that are capable of withstanding static loading of 125 psi without permanent deformation.

E. Durability:

1. Wall Finishes: Provide integral or applied wall surfaces that are appropriate for anticipated usage and traffic, offering durability not less than would be provided by applied wall coverings as follows, classified in accordance with ASTM F 793-2007:
   a. SP1 Customer Contact: Category III- Decorative with High Serviceability.
   b. SP2 Occupant Work: Category IV- Type I Commercial Serviceability.
   c. SP3 Equipment Utilization: Category V- Type II Commercial Serviceability.
   d. SP6 Meeting and Instruction: Category V- Type II Commercial Serviceability.
   e. SR1 Sanitary Facilities: Category V- Type II Commercial Serviceability.
   f. SS1 Closets: Category 1-Decorative Only.
   g. SC1 Corridors: Category VI- Type III Commercial Serviceability.SC2 Lobbies:
   h. SC3 Waiting Areas: Category V- Type II Commercial Serviceability.

2. Interior Wall Finishes at Exterior Walls: Provide surfaces that will not be damaged by incidental condensation from windows.

3. Wall, Fixture, and Equipment Protection: In parking areas, provide impact resistant guards at fixtures, equipment, and other protrusions including conduits and piping, and wall surfaces that are inherently resistant to impact damage due to vehicular traffic to 5 MPH..

4. Opening Protection: At partition openings intended to accommodate pedestrian or vehicular traffic, provide protection of opening edges in the form of door frames (cased openings), corner guards, or bollards.

5. Flooring: Provide floor finishes in conditioned spaces that are appropriate for anticipated usage and traffic in each area, based on a 20 year replacement cycle.
   a. Flooring: Provide floor finishes in parking spaces that are appropriate for anticipated vehicular usage and traffic based on the Service Life of the facility.
   b. Substantiation:
      1) Design Development: In addition to items of proven-in-use substantiation specified in Section 111-Facility Performance, provide, for minimum of 3 existing applications, date of installation of floor covering or floor treatment; maintenance, repair, and replacement history; recommended inspection and maintenance program; detailed evaluation of similarities and differences of historical application from proposed application; estimated life span of similar assembly if constructed today.

END OF SECTION C16

C2 - INTERIOR FIXTURES

PERFORMANCE

A. Basic Function:

1. Provide elements fixed to interior construction that are necessary for complete and proper functioning of spaces required by the program.

2. Interior fixtures are functional items that are permanently attached to interior walls, ceilings, and floors, except for equipment items and items that are integral components of service systems, and comprise the following elements:
   a. Identifying Devices: Informational accessories, including signage and directories.
   b. Storage Fixtures: Non-furniture items intended primarily for storing or securing objects, materials, and supplies, including casework, closet fixtures, and lockers.
   c. Window Treatment: Non-furnishing accessories for control of light, solar heat gain, and view at interior and exterior windows, including blinds, and shutters.
   d. Accessory Fixtures: Specialty items intended to provide service or amenity to building interiors, including toilet and bath accessories and visual display surfaces.

3. Where interior fixtures are integral with elements defined within another element group, meet requirements of both element groups.

4. In addition to the requirements of this section, comply with all applicable requirements of Section 111-Facility Performance and Section C-Interiors.

B. Amenity and Comfort:

1. Accessibility: Provide interior fixtures that are easily usable by disabled persons without outside assistance.

2. Light and Glare: Provide interior fixtures that are not a source of direct or reflected glare.
   a. Written and Graphic Information on Interior Fixtures: Clearly legible from typical viewing distances by occupants with normal eyesight.
   b. Surfaces Containing Written or Graphic Information: Matte finished to reduce the incidence of veiling reflections.

3. Convenience: Provide interior fixtures with fittings and controls that are manageable without special instruction or the need for excessive force.

4. Appearance: Provide interior fixtures that are coordinated in design with other elements of interior construction, using compatible materials, colors, textures, and design features.

5. Texture: Provide durable, low maintenance exposed surfaces for interior fixtures that are within reach of occupants engaged in activities normal for the particular space in which they are installed.
   a. Flat, Exposed Metal Surfaces: Finishes that are satin, that is, non-reflective rather than smooth polished surfaces.
   b. Flat Metal Surfaces: Coatings not permitted.
   c. Hardware and Other Rounded Metal Surfaces: Coatings not permitted.

C. Structure:

1. Live Loads: Provide suspended interior fixtures or portions of fixtures designed for storage or support of persons or objects that have been engineered and installed to withstand 1.5 times

the anticipated live loads without excessive deflection or permanent distortion.

D. Operation and Maintenance:

1. Ease of Use:
   a. Language of Identifying Devices: All text in English.
   b. Interior Fixtures with Movable Components: Easy to use without special instruction and designed to prevent misuse.
   c. Hinges and Latches: Heavy duty hardware, easily adjustable, providing minimum anticipated service life of 20 years.
   d. Mechanical Controls: Movable cranks and levers designed for trouble-free operation over a minimum anticipated service life of 20 years.
   e. Substantiation:
      1) Design Development: Product data on hardware and other movable components of interior fixtures.
2. Ease of Repair: Provide interior fixtures at all locations that are designed to permit repair or replacement of individual components without removal of fixture.
3. Ease of Replacement: Provide interior fixtures at all locations that are detachable from substrate without damage to fixtures.
4. Theft Resistance: Provide interior fixtures at all locations that are attached to substrates with concealed, tamper-resistant, or tamperproof fasteners to minimize theft and vandalism.

END OF SECTION C2

C21 - IDENTIFYING DEVICES

PERFORMANCE

A. Basic Function:

1. Provide identifying devices fixed to interior construction that are necessary for direction to and identification of functions and spaces as required by the program.
   a. Room Label Signs: Provide room label signs for all spaces.
   b. Directional Signs: Provide directional signs at all building/structure entrances and exits and interior pedestrian and vehicular routes.
   c. Building Directories: Provide adequately sized directories at all lobbies, including elevator lobbies, and pedestrian exits from parking structure leading to the 'campus'.
2. Identifying devices comprise the following elements:
   a. Room or function labels applied to doors or walls immediately adjacent to doorways.
   b. Signs that provide guidance to, or information about, building functions or spaces, other campus facilities and routes, including directional signs, locator maps, and logotypes.
   c. Architectural signs, including three dimensional graphics and illuminated lettering.
   d. Building directories with update-able data and information.
3. Text/Content of Identifying Devices: Some content will be provided by NREL; remainder to be provided by Subcontractor for NREL's approval.
4. Where identifying devices are integral with elements defined within another element group, meet requirements of both element groups.
5. In addition to the requirements of this section, comply with all applicable requirements of Section 111-Facility Performance, Section C-Interiors, and Section C2-Interior Fixtures.

B. Amenity and Comfort:

1. Accessibility:
   a. Provide identification devices that comply with ADAAG-1994.
   b. Function Labels: Graphic and Braille signs for the following building services and functions:
      1) Stairways.
      2) Escalators.
      3) Elevators.
      4) Toilets.
      5) Hazardous areas.
   c. Directional Signs: Accessible graphic and Braille signs in addition to any that are mounted above head height, other than vehicular direction signage.
2. Visibility:
   a. Illumination Levels: Provide ambient lighting or equivalent backlighting of identifying devices adequate to provide clear visibility for normally sighted persons at typical viewing distances.
      1) Wall-Mounted Corridor Signs or Signs Intended for Viewing at Less Than 5 feet: Minimum of 10 fc.
      2) Signs Mounted Above Head Height or Intended for Viewing at More Than 10 feet: Minimum of 30 fc.
   b. Character Size: Provide signs with characters of adequate size to be seen comfortably by

normally sighted persons at typical viewing distances.

1) Wall-Mounted Corridor Signs or Signs Intended for Viewing at Less Than 5 feet: Minimum character height of 5/8 inch and maximum of 2 inch.
2) Signs Mounted Above Head Height or Intended for Viewing at More Than 10 feet: Minimum character height of 3 inches.
3) Signs Mounted Above Head Height or Intended for Viewing by persons operating vehicles: Based on ASHTO Guidelines for speed and distance with a minimum character height of 3 inches.

c. Reflectivity: Provide signs with matte surface measuring 11-19 degree gloss on 60 degree glossimeter.
d. Fonts and Style: Provide mockups for all signage for approval by NREL. Fonts and styles to be consistent with the NREL Campus Standard.
e. Contrast: Provide signs with contrast between characters and background of not less than 70 percent.

3. Appearance:
   a. Provide signage for entire project that is consistent in design with other interior features and coordinated with overall color scheme.

C. Health and Safety:

1. Safety Signs: In addition to signs required by code, provide danger signs with bright background color at the following locations:
   a. Steps at Changes of Floor Level: Wall-or floor mounted warning signs immediately adjacent to tops and bottoms of unenclosed flights of steps.
   b. Crosswalks: Wall- or floor-mounted hazard signs at pedestrian crosswalks or any other circulation intersections, for both pedestrians and vehicles.

D. Operation and Maintenance:

1. Vandalism Resistance: For signs in public areas that are within reach, provide signs that are positively attached to substrate by concealed mechanical devices and not by double-sided tape, sealant, or adhesive.
   a. Do not use suspended or hanging signage (signage not firmly attached to walls or posts) below 10 feet above floor level or grade.

2. Ease of Replacement: For building directories, provide system with message strips that are easily replaceable by NREL's personnel.

END OF SECTION C21

C22 - STORAGE FIXTURES

PERFORMANCE

A. Basic Function:

1. Provide storage fixtures attached to interior construction that are necessary for proper functioning of spaces required by the program.

2. Storage fixtures comprise the following elements:
   a. Closed Material Storage and Service Counters: Provide modular storage cabinets and countertops with capacity adequate to accommodate required functions in spaces as follows: (re: Part 2-Program for requirement details)
      1) SP1 (Customer contact).
      2) SP2 (Occupant work).
      3) SP3 (Equipment utilization).
      4) SR (Occupant) sanitary facilities.
   b. Display Storage: Provide cases with capacity adequate for intended uses in spaces as follows:
      1) SP1 (Customer contact).
   c. Miscellaneous Storage Fixtures: Provide shelves with capacity adequate for anticipated occupancy in spaces as follows:
      1) SS (Storage).

3. Where storage fixtures are integral with elements defined within another element group, meet requirements of both element groups.

4. In addition to the requirements of this section, comply with all applicable requirements of Section 111-Facility Performance, Section C-Interiors, and Section C2-Interior Fixtures.

B. Amenity and Comfort:

1. Accessibility:
   a. Countertops: Where work surfaces or countertops over storage fixtures are required, provide wheelchair access to not less than 10 percent of surface at maximum height of 34 inches from the floor.

2. Noise Control: Provide closed storage fixtures equipped with hardware or fittings that minimize the sound generated by door slamming.

3. Convenience:
   a. Closed Material and Utensil Storage: Provide floor-mounted cabinets equipped with full-extension drawers and doors that open a full 180 degrees.

4. Appearance:
   a. Countertops and Work Surfaces: Provide light-colored surfaces that are seamless.
   b. Casework: For casework intended for display of objects, provide fixtures with clear glazing and surface finishes that are metallic.

PRODUCTS

A. Built-In Cabinetry and Casework:

1. Use the following:
   a. Manufactured plastic laminate clad cabinets.

b. Solid Surface countertops at all locations.

2. Do not use:
   a. Laminate coutertops.

B. Utility Storage Shelving:

1. Use the following:
   a. Metal frame and panel shelving with baked enamel finish.

2. Do not use:
   a. Wood shelving with plastic laminate finish.

END OF SECTION C22

C23 - WINDOW TREATMENT

PERFORMANCE

A. Basic Function:

1. Provide window treatments attached to interior construction that are necessary for adequate control of light, glare, privacy, and views for spaces with interior and exterior windows.
2. Where window treatments are integral with elements defined within another element group, meet requirements of both element groups.
3. In addition to the requirements of this section, comply with all applicable requirements of Section 111-Facility Performance, Section C-Interiors, and Section C2-Interior Fixtures.

B. Amenity and Comfort:

1. Condensation Resistance: Provide window treatment throughout project that is water-resistant and made of non-corrosive materials that will not be damaged by contact with condensation on window surface.
2. Accessibility: Comply with ADA Accessibility Guidelines.
3. Light and Glare Control: Provide window treatment throughout project that will allow control of light transmitted through window assembly.
4. Light and Glare Control with View: Provide window treatment throughout project that will allow control of light, glare, and solar heat gain in closed position while retaining some level of view to exterior.
5. Convenience: Provide window treatment throughout project with controls that are conveniently located and easily operated.
    a. Vertical Movement by Manual Controls: Maximum weight of window treatment of 20 lb.
6. Appearance: Provide window treatment throughout project that is coordinated with window modules and does not conflict with expression of architectural elements of interior construction.

C. Durability:

1. Colorfastness: Provide window treatment throughout project that is resistant to degradation from exposure to ultraviolet light.
    a. Painted Aluminum: Maximum of 5 Delta E units (Hunter) color change as calculated in accordance with ASTM D 2244-2005 after 5 years of exposure in accordance with AAMA 2604-2005.

PRODUCTS

A. Window Blinds:

1. Use the following:
    a. Horizontal aluminum blinds.

END OF SECTION C23

C24 - ACCESSORY FIXTURES

PERFORMANCE

A. Basic Function:

1. Provide accessory fixtures as required to accomplish the design as required by code, as indicated in the program, and as follows:
   a. Mirrors:
      1) One for each lavatory.
      2) Full length mirror on back of each bathroom door.
   b. Grab Bars: Wherever required for safety and assistance in use of toilet and bath fixtures, and at toilets designed for the disabled.
   c. Waste receptacles.
      1) One on each exit route from toilet room.
   d. Baby Changing Station: One in one of the 2 restrooms.
   e. Holders and dispensers for toilet and sink supplies furnished by NREL.
      1) Toilet Paper: Roll, consumer-size; one dispenser per toilet.
      2) Towels: Paper, C-fold; one dispenser per 1 lavatory.
      3) Toilet Seat Covers: Paper; one dispenser per toilet.
      4) Hand Soap: Liquid, one dispenser for each lavatory.
   f. Hooks for temporary storage of occupants' property; one in each toilet compartment.
   g. Holders and dispensers for cleaning supplies, utensils, and tools furnished by NREL.
      1) Mops and Brooms: 3 items to be hung up in Equipment Storage Room.
   h. Visual Display Fixtures: Configuration and surface area as indicated in the program.
      1) Tackable surfaces, which are identified in the program as tackable surface, for standard push pin use.
         a) Where indicated as "secured" or "enclosed" and in lobbies and corridors, prevent removal of applied items while allowing full visibility.

2. Where accessory fixtures also must function as elements defined within another element group, meet the requirements of both element groups.

3. In addition to the requirements of this section, comply with all applicable requirements of Section 111-Facility Performance, Section C-Interiors, and Section C2-Interior Fixtures.

B. Amenity and Comfort:

1. Convenience of Visual Display Surfaces:
   a. Except as otherwise indicated, required surface area must be accomplished within the "usable" areas as follows, although additional area is not objectionable:
      1) Tackable Surfaces: Not less than 36 inches above floor; not more than 72 inches above floor.

2. Appearance of Visual Display Surfaces:
   a. Tackable Surfaces: Self-healing material or surface finish that minimizes visibility of ordinary thumbtack holes.
   b. Flatness: Permanently flat, without warp or bow.

C. Health and Safety:

1. Slip Resistance:
   a. Fixtures Expected to Support or Assist in the Support of Persons: Touchable surfaces

having slip resistance of 0.50, measured in accordance with ASTM D 2047-2004, using wet conditions.

2. Broken Glass Hazard: Provide only fully tempered float glass for glass in fixtures.

D. Structure:

1. Grab Bars: Strength, design, anchorage, and support as required to withstand 250 pounds-force applied vertically at the center between supports and 250 pounds-force tension applied at any support; supports of sufficient rigidity to prevent rotation of bars under load.

E. Durability:

1. Service Life Span:
   a. Operating Components of displays: Minimum of 10 years under normal use conditions.
2. Indoor Units: Materials and finish complying with specified requirements for equivalent environments specified in Section C-Interiors
3. Wear Resistance:
   a. Visual Display Surfaces: Comply with requirements of Section C16-Interior Finishes for wall finishes for the building spaces in which installed, as a minimum.
   b. Tackable Surfaces: Tackable material and surface finish durability not less than would be provided by applied wall coverings complying with ASTM F 793-2007 Category II-Decorative with Medium Serviceability.
4. Moisture Resistance:
   a. Mirrors: Silvered surfaces protected from degradation due to presence of moisture.

F. Operation and Maintenance:

1. Frequency of Servicing: NREL expects that refilling/emptying will occur at the following intervals; provide capacity appropriate to servicing interval and expected use, based on project occupancy:
   a. Paper Towel Dispensers: Weekly.
   b. Toilet Paper Dispensers: Weekly.
   c. Toilet Seat Cover Dispensers: Weekly.
   d. Hand Soap Dispensers: Weekly.
   e. Waste Receptacles: Daily.
2. Ease of Cleaning:
   a. Waste Receptacles: Disposable liners or bags.
3. Ease of Repair:
   a. Mirrors: Breakable glazing replaceable without disassembly of frame.

PRODUCTS

A. Reflective Surfaces of Mirrors: (10800)

1. Use the following:
   a. Glass.

B. Toilet Accessories:

1. Use the following:

a. Stainless steel accessories.

END OF SECTION C24

D - SERVICES

PERFORMANCE

A. Basic Function:

1. Provide the following services:
   a. Conveying Systems: Mechanized means of conveying people and goods.
   b. Water and Drainage: Means of delivery of water to points of utilization; automatic heating and conditioning of domestic water; and unattended removal of water, rainwater, and liquid waste.
   c. HVAC: Artificial means of maintaining interior space comfort in condition spaces and air quality in all spaces, including heating, cooling, ventilation, and energy supply.
   d. Electrical Power: Energy to operate all electrically-operated devices, including those included under other services and those provided separately by the NREL.
   e. Artificial Lighting: Means of illuminating spaces and tasks, both interior and exterior, independent of reliance on natural light.
   f. Telecommunications: Services that include voice and data transmission, sound reinforcement, and television distribution.

2. Utility Sources and Outlets:
   a. Water Source: Existing public utility.
   b. Sewage Disposal: Connect building sewer to the existing public sewage system.
   c. Rain Water Drainage Outlet: See Section G-Sitework.
   d. Electrical Power Source: Existing public utility.

3. Equipment That is Not Part of Services Systems: Specified in the program and in Sections E-Equipment and Furnishings.

4. Where services elements must also function as elements defined within another element group, meet the requirements of both element groups.
   a. Where services elements are located outside the building in the site area, meet applicable requirements of Sections G3 and subsections

5. In addition to the requirements of this section, comply with all applicable requirements of Section 111-Facility Performance.

B. Amenity and Comfort:

1. Artificial Illumination: Provide illumination for all interior spaces that is adequate in level and quality for comfortable performance of tasks typical for each space, regardless of the availability of natural light.
   a. Light Levels: See Section D6-Artificial Lighting.
   b. Accent Lighting: In addition to general and task illumination, provide lighting on architectural features, displays, and signage in focal areas to produce luminances that are within the range of 5:1 with respect to ambient background.
   c. Substantiation:
      1) Design Development: Overall lighting scheme, including types of luminaires and lamps for primary spaces.
      2) Construction Documents: Calculations of illuminance levels for representative spaces, prepared by a registered electrical engineer.
      3) Construction: Measurements of luminance and illuminance levels for representative

spaces throughout the project, with a report setting forth results after correcting for maintenance factors keyed to luminaire design and lamp types.

2. Equipment Producing By-Product Heat: Ventilate housings and cabinets as required by equipment manufacturer and rooms and spaces as required to maintain specified environmental conditions.

3. Moisture: Prevent condensation from forming on service elements.

4. Airborne Sound:
   a. Maintain the sound transmission characteristics of assemblies through which services must pass; comply with requirements of the section where penetrated assembly is specified.
   b. Prohibited Plumbing Noises: All sounds of flushing and of liquid running through pipes ("bathroom sounds") are prohibited outside of the rooms housing toilets with the exception of when doors to those rooms are open.
   c. Equipment Noises: Noise level below that which will be objectionable, based on occupancy of spaces.

5. Structure-Borne Sound and Vibration: Prevent transmission of perceptible sound and vibration from services equipment that rotates, vibrates, or generates sound, by isolating such equipment from superstructure or by isolating equipment support foundations from building foundations.
   a. Substantiation:
      1) Preliminary Design: Identification of sound- and vibration-generating equipment and method of isolation.

6. Cleanliness: Prevent accumulation of debris and dirt at floor mounted equipment by one or more of the following methods.
   a. Provide 4 inch thick, concrete housekeeping pads.
   b. Provide corrosion-resistant equipment stands.

7. Odors: Eliminate, isolate, or exhaust odors produced by occupant functions and building services.

8. Appearance:
   a. Conceal services elements from view to greatest extent possible.
      1) Exception: Exposed portions are acceptable in SU1, SV1, and SV2 areas.
      2) Where exposed portions are acceptable, do not obstruct or diminish clear dimensions of doorways, windows, other operable openings, access panels and cabinet doors, or passageways, stairs, and other exitways.
      3) Where exposed piping is acceptable, install it close to walls and overhead structure, parallel and square to finished construction, plumb and nominally horizontal (except where required to slope for drainage).
   b. Cover annular spaces around pipes, ducts, and conduits, where they pass through walls, ceilings, and floors with escutcheons or cover plates.
      1) Exception: Escutcheons not required in SU1 and SV1 areas, provided annular spaces are fitted tightly.

C. Health and Safety:

1. Fire Safety:
   a. Maintain fire resistance of walls, floors, ceilings, and other fire-rated assemblies that

services must pass through, in accordance with requirements of the section in which the fire-rated assembly is specified.

b. Provide fire-rated separations between equipment rooms and other spaces where required, and as specified by the code.
c. Substantiation for Combustible Materials, Where Allowed: UL listed or labeled, with flame spread and smoke developed ratings printed on product.
d. Provide products which are fire rated for the specific locations where they are installed.

2. Excess Pressure: Design pressurized components to withstand operational pressures without failure and to relieve or reduce excessive pressure to prevent failure.

3. Misuse: Minimize misuse that could result in damage to property, injury, or loss of life.

4. Electric Shock: Provide equipment which protects personnel from electrical shock.

5. Toxic Materials:
   a. Lead: Do not use lead or lead-containing materials in potable water systems.

6. Vermin Resistance: Use components that are resistant to the entry of rodents and insects.

D. Structure:

1. Supports for Piping, Conduit, Ducts, and Components: Attached to, and supported by, the superstructure, not to or by non-structural construction or sheet metal elements, so that they do not move or sag, using the following:
   a. Supports that allow movement of the rigid linear elements (pipe, etc.) without undue stress on the piping, tubes, fittings, components, or the superstructure.
   b. Intermediate supports mounted between structural members to limit distance between supports.
   c. Supports capable of handling seismic forces in accordance with the code.
   d. Mounting frames, bases, or pads, designed for ease of anchorage or mounting.
   e. Rigid sway bracing at changes in direction of more than one-half of a right-angle, for all pipes.
   f. Substantiation:
      1) Design Development: Details of supports, including engineering analysis.

2. Structural Design of Components and Their Supports: In accordance with code.
   a. Safety Factor for Component Structural Elements: Two; based on weight of component.
   b. Anchors: Securely and positively attach all services components to superstructure.

3. Concealed or Buried Components: Design cover or concealment so that components are not subjected to damaging stresses due to applied loads.

E. Durability:

1. Expected Service Life Span: Same as the service life of the building, except as follows:
   a. Ducts, Piping, and Wiring in All Services: Same as the service life of the building.
   b. All Components Permanently Installed Underground or Encased in Concrete: Same as service life of building.
   c. Conveying Systems: Minimum 25 years.
   d. Plumbing:
      1) Shut-Off Valves and Similar Components: Same as service life of building.
      2) Electrically-Operated Equipment: Minimum 20 years.
      3) Plumbing Fixtures: Same as building service life.

4) Sink Faucets, But Not Other Fittings: Minimum 10 years.

e. HVAC:
   1) Dampers, Louvers, Registers, Grilles: Same as service life of building.
   2) Main Heat Generation and Cooling Equipment: Minimum 20 years.
   3) Control Components, Except Wiring: Minimum 20 years.

f. Fire Protection:
   1) Sprinkler Heads, Valves, and Other Inlet and Outlet Components: Same as building service life.

g. Electrical:
   1) Power Distribution Equipment: Same as building service life.
   2) All Components of Life Safety-Related Systems: Minimum 20 years.
   3) Control Components, Except Wiring (same as building service life span): Minimum 10 years.

h. Lighting Fixtures: Minimum 15 years.

i. Security and Surveillance Controls: Minimum 15 years.

j. Software and Firmware Integral to Operation of Services Equipment: Minimum 20 years functional life without reprogramming required.

2. Weather Resistance:
   a. All components exposed to outdoor environment must comply with the requirements of Section B-Shell and Section B2-Exterior Enclosure; equipment enclosures are considered the equivalent of the exterior enclosure.
   b. Buried Water Piping: Minimum of 12 inches below lowest recorded level at which the ground freezes.
   c. Services Passing From Inside to Outside: Openings through shell sealed as required to meet performance specified, and using materials specified, in Section B-Shell, Section B2-Exterior Enclosure.

3. Condensation: Provide insulated drain pans and piping to remove condensation from cooling coils.

4. Moisture Resistance: Where components are mounted to surfaces that are required to be moisture-resistant, seal mounting surface of components to finish surface so that moisture cannot penetrate under or behind component, using material that is not affected by presence of water, that is mildew-growth resistant, and that has a minimum service life of 10 years.

5. Temperature and Humidity Endurance: Design equipment to endure temperature and humidity that will be encountered and to resist damage due to thermal expansion and contraction.

6. Corrosion Resistance: Prevent corrosion by using corrosion-resistant materials, by preventing galvanic action, by preventing contact between metals and concrete and masonry, and by preventing condensation on metals.
   a. Metals Considered Corrosion-Resistant: Aluminum, stainless steel, brass, bronze, cast iron, ductile iron, malleable iron, hot-dipped galvanized steel, chrome-plated steel, cadmium-plated steel, and steel coated with high-build epoxy or coal tar-based paint.
   b. Piping Connections for Piping of Dissimilar Metals: Dielectric adapters.
   c. Underground Elements: Provide supplementary protection for underground metal pipes and conduits, sufficient to prevent corrosion completely, for the service life of the element without maintenance.

1) 3 inches of un-jointed concrete cover is considered to be permanent protection.
2) Bituminous or other waterproof coating or wrapping is considered permanent protection unless cathodic protection is required and unless underground element is subject to movement due to structural loads or thermal expansion or contraction.
3) Provide cathodic protection if any of the following is true; coatings or wrappings will not be considered sufficient protection for elements falling under these criteria:
   a) Metal elements are submerged or buried in a soil environment known to cause corrosion on similar nearby structures.
   b) Metal elements are submerged and buried in a soil environment in which stray DC electrical currents are present.

7. Accidental Water Leakage: Locate components that would be damaged by water leakage from pipes or through foundations or roof out of likely paths of water and at least 4 inches above floor level.

8. Abuse Resistance:
   a. Buried Components: Minimum of 12 inches below surface of ground.
   b. Underground Piping and Conduit: Watertight and rootproof.
   c. Finishes on Exposed Components Subject to Touching by Occupants: Durable enough to withstand regular scrubbing using ordinary methods.

9. Accidental Damage: Protect equipment and piping from accidental damage.

10. Underground Piping Accidental Damage: Protect piping from accidental damage with a warning tape buried 12 inches above the pipe.

F. Operation and Maintenance:

1. Capacity:
   a. Conveying Systems: As required, based on design to adequately support pedestrian traffic, minimizing waiting time of occupants.
   b. Water and Drainage: As required by code and as specified in Section D2-Water and Drainage.
   c. Heating, Cooling, and Ventilating: Maintain interior environment within ranges specified in Section 111-Facility Performance.
   d. Fire Suppression: As required by code.
   e. Electrical: As required by code.
      1) Power: Non-interruptible power supply as indicated in Part 2-Program.
   f. Substantiation:
      1) Proposal: Description of systems required, sources, input-side capacities, and means of distribution.
      2) Design Development: Engineering calculations showing input- and output-side capacities and loads and sizes of distribution elements.
      3) Construction Documents: Complete system details.
      4) Construction and Closeout: Functional performance testing.

2. Efficiency:
   a. Energy efficiency as specified in Section 111-Facility Performance and Part 2-Program
   b. Water consumption as specified in Section 111-Facility Performance.
   c. Substantiation: As specified in Section 111-Facility Performance.

3. Ease of Use:

a. Access: All mechanical and electrical equipment located to allow easy access. Provide access doors for equipment accessed through walls, partitions, or fixed ceilings.
b. Space Around Components: Working clearances and access routes as required by code and as recommended by component manufacturer.
c. Testing: After completion of installation, prepare services for starting-up by testing appropriately for proper operation.
d. Commissioning: Prepare services for use by eliminating operational anomalies, adjusting control systems for optimum operation, and demonstrating proper functioning, as specified in Part 1-Design & Construction Procedures.
    1) Substantiation:
        a) Proposal: General outline of commissioning procedures and responsibilities of the parties.
        b) Design Development: Identification of systems and equipment to be tested and method of test.
        c) Construction Documents: Complete commissioning plan.
        d) Construction and Closeout: Commissioning reports.

4. Ease of Cleaning: Where not otherwise specified, design equipment mountings to allow easy cleaning around, and under, equipment, if applicable, without crevices, cracks, and concealed spaces where dirt and grease can accumulate and with raised, closed bases for equipment mounted on the floor.
    a. Provide equipment with removable access panels to allow cleaning.

5. Ease of Maintenance and Repair:
    a. Piping Other Than Gravity Drains: Provide means of isolating convenient portions of piping system, so that small portions may be shut down leaving the remainder in operation and so that drainage of the entire system is not required to enable repair of a portion of it.
    b. Above Ground Piping (all piping types): Labeled to identify contents and direction of flow, each shut-off valve, each piece of equipment, each branch take off, and at 20 ft maximum spacing on exposed straight pipe runs.
    c. Equipment in Piping Systems: Each unit provided with a union or flanged connector at each pipe connection to allow easy removal.
        1) Substantiation:
            a) Design Development: Outline of system showing zones and sections of system to be isolated for ease of repair and maintenance.

6. Ease of Equipment Service: As specified in Section 111-Facility Performance and the following:
    a. Lighting: Adequate for locating and operating equipment; emergency (battery backup) lighting for critical components.
    b. Do not locate any equipment requiring maintenance on the roof, in attics, in crawl spaces, where access must be through attics or crawl spaces, or where access is not possible using removable panels or doors.
    c. Parts Having Service Life Less Than That of the Building: Easily replaceable, without de-installation or de-mounting of the entire element, component, or equipment item.
    d. Valves: Easily replaceable internal parts, eliminating necessity of removal of entire valve for repair.
    e. Parts: Readily available from stocking distributors within 50 miles of project location.
    f. Substantiation:

1) Construction Documents: Identification of parts normally replaced during routine maintenance and parts replaced only when damaged or unexpectedly worn out; location of stocking distributors.

7. Ease of Equipment Removal: Provide doors and corridors large enough for removal of major pieces of equipment, such as, fans, coils, transformers, switchgear, and water heaters.
   a. Substantiation:
      1) Preliminary Design: Identify locations of major pieces of equipment.
      2) Design: Submit the measurements of the major pieces of equipment and the path for removal from the building. Verify that routes, doors and corridors provide adequate clearance for removal of equipment.

END OF SECTION D

D1 - CONVEYING SYSTEMS

PERFORMANCE

A. Basic Function:

1. Provide conveying systems required by the program or necessary to fulfill basic project functions.

2. Conveying systems are devices that move people between levels and comprise the following elements:
   a. Elevators: All components for passenger elevators, including items such as shaft rails, pit ladders, exhaust louvers, and car and hoistway doors; see Section C16-Interior Finishes for requirements for car finishes.

3. Provide conveying systems for moving people when any of the following conditions occur:
   a. Parking Structure is more than 2 levels tall and movement of people between floors is required.
   b. Movement of occupants must meet requirements of ADA or any other mobility requirements.

4. Where conveying systems are integral with elements defined within another element group, meet requirements of both element groups.

5. In addition to the requirements of this section, comply with all applicable requirements of Section 111-Facility Performance and Section D-Services.

B. Amenity and Comfort:

1. Accessibility: Provide at least one accessible passenger elevator complying with code that serves every habitable level when multiple levels are provided.

2. Appearance: Provide conveying systems that present as light and open an appearance as possible. To the degree possible, provide transparency and minimum apparent visual mass.

C. Durability:

1. Expected Service Life Span: Provide conveying systems with functional service life the same as specified for the project, assuming that they will have continuing professional maintenance and periodic replacement of wearing parts.
   a. Substantiation:
      1) Preliminary Design: Service life expectancy analysis for proposed conveying systems, including basis for time estimates; e.g. proven-in-use applications.
      2) Design Development: Life cycle cost analysis, including replacement cost and frequency of replacement for major components, energy costs for operation of equipment and systems, costs for routine maintenance, and anticipated cost escalation factors.

D. Operation and Maintenance:

1. Ease of Use: Provide conveying systems that operate automatically or in response to passenger input, without intervention by operators.

2. Minimization of Misuse: Provide conveying systems with features and mechanisms that will prevent or minimize unsafe conditions or inconvenience attributable to vandalism, pranks, or

deliberate sabotage.

3. System Maintenance: Provide conveying systems designed to require minimum maintenance.
   a. Substantiation:
      1) Preliminary Design: Maintenance impact analysis, including scope of maintenance effort anticipated during expected functional and aesthetic service life of project.
      2) Construction Documents: Proposed maintenance contract, for NREL's review.

END OF SECTION D1

D2 - WATER AND DRAINAGE

PERFORMANCE

A. Basic Function:

1. Provide delivery of hot and cold domestic water to points of utilization and the removal of water, rainwater, and liquid waste.

2. Water and drainage elements comprise the following:
   a. Water Supply: Water sources and storage.
   b. Plumbing Fixtures: All fixtures necessary for sanitation, occupancy, and use that are connected to water supply or drainage; not including water heating or conditioning equipment or kitchen appliances.
   c. Domestic Water: All elements required to distribute water to fixtures, including piping and equipment for water cooling, heating and storage.
   d. Sanitary Waste: All elements required for removal of sanitary waste, including piping, venting, discharge and disposal, and equipment.
   e. Rain Water Drainage: All elements required for drainage of rain water from building areas in which it may accumulate and drainage of clear wastes from building services; not including gutters and downspouts (B31) or subdrainage (A).

3. Where plumbing elements also must function as elements defined within another element group, meet the requirements of both element groups.

4. In addition to the requirements of this section, comply with requirements specified in Section 111-Facility Performance and Section D-Services.

B. Amenity and Comfort:

1. Noise:
   a. Design to prevent noise due to air trapped in piping systems.

2. Convenience:
   a. Fixture Heights: As specified in code.
   b. Fixture Configurations: As specified in code.
   c. Water Connections: Hot water on the left side of fixtures and cold water on the right side of fixtures.

3. Odors:
   a. Do not locate sanitary waste vent openings where odors are noticeable by occupants or by occupants of adjacent properties or where odor-bearing air may enter building spaces.
   b. Connect fixtures to prevent entry of sewer gases into occupied spaces.

C. Health and Safety:

1. Health: Provide potable water.
   a. Public utility water can be considered to be potable.

2. Waste Disposal: Connect each fixture to sanitary drainage system for proper disposal of waste and harmful materials.

3. Pressure Control: Control pressures to protect the building, fixtures, equipment, and occupants from harm.
   a. Maximum Water Distribution Working Pressure: 80 psi.

b. Air Removal: Remove air trapped in water distribution system.

4. Prevention of Sewer Gas Leaks:
   a. Provide waste system vents as required by code to avoid trap siphonage or compression.

5. Protection of Potable Water Supply: As required by code.

6. Hazard Labeling: Clearly label domestic hot water, domestic cold water, rain water drainage, and sanitary waste and vent systems indicating the nature of contents and direction of flow.

7. Hazardous Material Drainage: Prevent damage to public utility drainage systems by removing or neutralizing hazardous materials before discharging.

D. Structure:

1. Insulated Pipes: Prevent compression of insulation by using pipe shields or saddles or dense insulation inserts.

E. Durability:

1. Electrical Component Protection:
   a. Do not route piping through electrical rooms and elevator equipment rooms.

2. Equipment Protection:
   a. Domestic Water Distribution System: Provide a filtration device upstream of equipment which may be damaged by debris in the distribution system.

F. Operation and Maintenance:

1. Capacity of Water Service: Provide adequate water flow and pressure to supply peak demand requirements. Comply with requirements specified in the code.
   a. Water Delivery: If the water source has insufficient flow or pressure, provide means of increasing to required level.
   b. Substantiation:
      1) Preliminary Design: Analysis and documentation of water supply source and flow conditions.
      2) Design Development: Piping design calculations and entrance locations.
      3) Design Development: Cut-sheets for all manufacturer-recommended chemical additives to boilers, process water, heating/cooling loops, etc are to be provided to NREL for review and approval.
      4) Construction: Functional tests of fixtures and equipment.
      5) Occupancy: Observation of function during full occupancy simulating extreme conditions.

2. Waste Pipe Sizing:
   a. Size piping as required by code.
   b. Building Drain: 4 inches diameter, minimum.
   c. Substantiation:
      1) Preliminary Design: Analysis and documentation of sewer discharge method and locations.
      2) Construction: Air and water pressure tests of piping systems; functional tests of drains and equipment under simulated full occupancy loads.
      3) Occupancy: Observation of function during full occupancy simulating extreme conditions.

3. Rain Water Drainage Capacity: As specified in the code and as follows:
   a. Secondary Drainage: Required for roofs and exterior structural decks that do not drain naturally. Provide secondary roof drains connected to a secondary drainage system.
   b. Substantiation:
      1) Preliminary Design: Analysis and documentation of rain water discharge methods and locations.
      2) Design Development: Drainage design calculations and documentation of piping outlets.
      3) Occupancy: Field observation of performance during at least two storms.

4. Ease of Maintenance and Repair:
   a. Isolation of Piping Segments and Equipment: Provide a means of isolating the following:
      1) Building from main water service. Provide a shut-off valve located inside a valve box whose removable access cover is at grade level.
      2) Water meter from building piping.
      3) Each vertical riser from piping below.
      4) Each water branch to fixtures or equipment from main vertical riser.
      5) Piping lower than the supply, to prevent unnecessary draining in the case of disconnection.
      6) Each plumbing fixture, storage tank, and item of equipment, so that removal of one will not necessitate shutdown of others.
      7) Individual fixtures and equipment. Provide an isolation device within 3 feet of pipe connection to item.
   b. Provision for Drainage of Water Distribution Piping:
      1) Provide a system drain at the lowest point in the system.
      2) Provide an adequately sized method of drainage for the volume of water inside the distribution system.
      3) Drain valve (or fixture shut-off valve) located at each low point.
   c. Provision for Cleaning of Drainage Piping: Provide a cleanout as required by code and as follows:
      1) At the upstream end of each horizontal sanitary drainage pipe, for cleaning in direction of flow.
      2) At the dead end of each dead-end pipe.
      3) Pipe 3 inches and Smaller: At intervals of 50 foot, maximum.
      4) Pipe 4 inches to 6 inches: At intervals of 80 foot, maximum.
      5) Pipe 8 inches and Larger: At intervals of 100 foot, maximum.
      6) Clearance: As required by code to allow for cleaning and rodding of pipe.

PRODUCTS

A. Do not use:

1. Plastic piping of any type.

2. Steel piping, for any purpose.

3. Pro-press or compression fittings.

END OF SECTION D2

D3 - HVAC - HEATING, VENTILATING, AND AIR CONDITIONING

PERFORMANCE

A. Basic Function:

1. Provide artificial means of controlling temperature, relative humidity, velocity, and direction of air motion in the interior conditioned spaces enclosed by the shell, and reduction of airborne odors, particulates, and contaminant gases.

2. Provide artificial means of controlling air velocity and direction in semi-enclosed unconditioned spaces (i.e. Parking Structure) to meet ventilation requirements if required by code.

3. The HVAC system consists of the following elements:
   a. Energy Supply: Elements which provide energy used to maintain building comfort.
   b. Heat Generation: Elements required to heat building to maintain space comfort.
   c. Refrigeration: Elements necessary to generate the cooling required to maintain building comfort.
   d. Air Distribution: Elements required to distribute air to maintain building comfort and occupant safety.
   e. Hydronic and Steam Distribution: Elements required to distribute chilled water and steam to maintain building comfort.

4. Where HVAC elements also must function as elements defined within another element group, meet the requirements of both element groups.

5. In addition to the requirements of this section, comply with all applicable requirements of Section 111-Facility Performance and Section D-Services.

B. Amenity and Comfort: Reference Section 111 for setpoint requirements.

1. Relative Humidity Range: As specified in Section 111-Facility Performance and as follows:
   a. All spaces: 50% maximum.

2. Substantiation:
   a. Closeout: Measurement of temperature and humidity in spaces with unacceptable temperature fluctuations.
      1) One measurement in the summer (outdoor air temperature above 85 degrees F) and one measurement in the winter (outdoor air temperature below 30 degrees F), within first year of occupancy.

C. Health and Safety:

1. Emergency Power: Provide emergency power in accordance with code.
   a. In addition to the code, provide uninterrupted power and emergency power as indicated in Part 2-Program.

2. Electrical Shock Prevention:
   a. Provide a means of disconnecting power at each piece of equipment.

3. Indoor Air Quality of Conditioned Space: Provide sufficient ventilation to obtain acceptable indoor quality, determined using the Ventilation Rate Procedure of ANSI/ASHRAE 62.1-2004 .

PRODUCTS

A. HVAC System Type:

1. Use one or more of the following:
   a. Stand-Alone HVAC Systems:
      1) Air to Air Heat Pump systems with minimum 17 SEER rating.
      2) Ground Source Heat Pump systems with 17+ SEER rating.
   b. HVAC Air Distribution:
      1) Use designs, materials, and components in accordance with the heating/cooling equipment manufacturers recommendations.
   c. HVAC Controls:
      1) Local controls, 2 zones, with remote (DDC) digital monitoring tied to Campus DDC System.

END OF SECTION D3

D4 - FIRE PROTECTION

PERFORMANCE

A. Basic Function:

1. Provide services systems to protect life and property.
2. Fire protection comprises the following elements:
   a. Fire Sprinkler and Extinguishing Systems: Elements which automatically extinguish fires.
   b. Standpipe and Hose Systems: Elements that deliver adequate supplies of water to locations in the building for manual fire-fighting.
   c. Fire Detection and Alarm: Elements required to detect fires and communicate fire location to building occupants, building management, and public fire fighting agencies.
   d. Fire Protection Specialties: Elements required for manual fire-fighting by occupants.
3. Provide automatic fire suppression to Security Operations, even if not required by code. Provide all other spaces as required by the code.
4. Water Use:
   a. Provide standpipes without permanent water connection, unless otherwise required by code.
5. Where fire protection elements also must function as elements defined within another element group, meet the requirements of both element groups.
6. In addition to the requirements of this section, comply with all applicable requirements of Section 111-Facility Performance and Section D-Services.

B. Amenity and Comfort:

1. Leakage: Provide systems that are leak-free.
2. Accessibility: Provide clearances around system components for service and use.
3. Sound: Provide audible alarm system to signal building occupants of fire hazard.
4. Convenience: Provide an automatic system to signal building occupants of fire, fight the fire, and signal the fire station that a fire has started.
5. Hazards: Provide systems which minimize risk of injury and damage to property.
6. Substantiation:
   a. Preliminary Design: Fire protection areas identified.
   b. Design Development: Fire protection zones indicated on the drawings with riser locations identified.
   c. Construction: Functional performance testing in accordance with code.

C. Health and Safety:

1. Path of Egress: Provide systems which safeguard path of egress.
2. Fire Source: Provide system materials which do not contribute to the spread of the fire.

D. Structural:

1. Seismic Design: Provide support systems which sustain static (dead) loads twice the wet weight of the system.

E. Durability:
   1. Corrosion Resistance: Use corrosion resistant materials; ferrous metal is not considered corrosion resistant unless it is hot dipped galvanized, chrome plated, or coated with rust inhibitive paint.
   2. Vandalism: Provide systems which are tamper-resistant.

F. Operation and Maintenance:
   1. Ease of Use: Provide easy access to and working clearances around system components.
   2. Unauthorized Use: Provide systems which minimize activation and use by unauthorized persons.
   3. Substantiation:
      a. Preliminary Design: System layout indicating operator interface locations.
      b. Design Development: System equipment locations indicated on the drawings and manufacturer's product data indicating products to be used.

END OF SECTION D4

D41 - FIRE SPRINKLER AND EXTINGUISHING SYSTEMS

PERFORMANCE

A. Basic Function:

1. Provide fire sprinkler or fire extinguishing systems for all conditioned interior spaces, and spaces required by the code.
2. Provide code-required coverage if the coverage specified above is less than required by code.
3. Fire Sprinklers: Design and construction in accordance with code and NFPA 13-2007.
4. Where fire sprinkler and extinguishing elements also must function as elements defined within another element group, meet the requirements of both element groups.
5. In addition to the requirements of this section, comply with all applicable requirements of Section 111-Facility Performance, Section D-Services, and Section D4-Fire Protection.

B. Amenity and Comfort:

1. Accessibility:
   a. Provide fire department connections as required by code.
2. Appearance:
   a. All spaces: Pendant sprinklers, except as follows:
      1) "Conditioned" Personnel, Resident, and Circulation spaces: Concealed sprinklers
   b. Fire system piping painted red for identification.

C. Health and Safety:

1. Sprinkler Head Performance: As required by code and NFPA 13-2007.
2. Water Demand Requirements:
   a. Determine minimum water supply requirements for each sprinkler system using the hydraulic calculation method defined by NFPA 13-2007.
   b. Substantiation:
      1) Preliminary Design: Identification of water source.
      2) Design Development: Water supply for sprinkler systems shown on the drawings.
      3) Construction: Tests of each sprinkler system in accordance with the requirements of the design standard.

D. Durability:

1. Expected Service Life Span: Provide a sprinkler system which will be viable for the life of building when maintained as specified in NFPA 25-2002.
   a. Substantiation:
      1) Preliminary Design: Identification of the system type to be installed.

E. Operation and Maintenance:

1. Ease of Service:
   a. Spare Sprinkler Heads: Provide additional sprinkler heads as required by code to service the system.

PRODUCTS

A. Pipe:

1. Use the following:
   a. Materials permitted by code.

B. Fittings:

1. Use the following:
   a. Materials permitted by code.

END OF SECTION D41

D42 - STANDPIPE AND HOSE SYSTEMS

PERFORMANCE

A. Basic Function:

1. Provide a standpipe system to protect life and property.
2. Standpipe Design and Installation: Provide a standpipe system as required by code and NFPA 14-2007.
3. Where standpipe and hose system elements also must function as elements defined within another element group, meet the requirements of both element groups.
4. In addition to the requirements of this section, comply with all applicable requirements of Section 111-Facility Performance, Section D-Services, and Section D4-Fire Protection.

B. Amenity and Comfort:

1. Accessibility:
   a. Provide fire department connections as required by code and the local Fire Department.
2. Appearance:
   a. Hose Cabinets: Bright-chrome finish and glass window in the door.
   b. Valves: Bright-chrome finish.
   c. Fire Department Connections: As directed by the local Fire Department.
3. Convenience: Provide fire department connections for each standpipe as required by code and the local Fire Department.

C. Health and Safety:

1. Fire Spread: Provide a standpipe system to assist firefighters in preventing the spread of fire.
   a. Substantiation:
      1) Preliminary Design: Identification of locations of each standpipe, coordinated with Fire Department authorities.
      2) Design Development: Indication of standpipe locations on the drawings, coordinated with Fire Department authorities
      3) Construction: Tests of each standpipe system.

D. Durability:

1. Expected Service Life Span: Provide standpipes which will be viable for the life of building.

E. Operation and Maintenance:

1. Provide standpipe maintenance in accordance with NFPA 25-2002.
2. Ease of Use: Provide standpipes which comply with the acceptance requirements of NFPA 14-2007.

PRODUCTS

A. Pipe:

1. Use the following:
   a. Materials permitted by code and local Fire Department.

B. Fittings:

1. Use the following:
   a. Materials permitted by code and local Fire Department.

END OF SECTION D42

D43 - FIRE DETECTION AND ALARM

PERFORMANCE

A. Basic Function:

1. Provide automatic fire detection and automatic alarm systems as required by code and as follows:
2. In addition to protected premises system(s), provide a new on-premises supervising station in Security Offices with connection between protected premises and supervising station by same method currently used for other buildings.
3. Connect the protected premises system(s) to public fire department via connection to the NREL STM campus system.
4. Integrated systems performing all functions are preferred, subject to requirements of code for separated, independent systems.
5. Where fire detection and alarm elements also must function as elements defined within another element group, meet the requirements of both element groups.
6. In addition to the requirements of this section, comply with all applicable requirements of Section 111-Facility Performance, Section D-Services, and Section D4-Fire Protection.
7. Substantiation:
   a. Preliminary Design: Outline description of systems, inter-system interfaces, and functions provided.
   b. Design Development: Details of each type of input and output device; capacities of systems; manufacturer data.
   c. Construction Documents: Detailed layout of input and output device locations.
   d. Closeout: Complete functional performance testing as specified in Part 1-Design & Construction Procedures, under Commissioning.

B. Amenity and Comfort:

1. Accessibility: Comply will requirements of local authorities for facilities for the disabled.

C. Health and Safety:

1. Detection, Alarm, Notification Methods: In accordance with NFPA 72-2007.
2. Detection:
   a. Air Handling Units Over 2,000 cfm: Minimum of one detector in both supply and return.
   b. Upon detection of fire or smoke condition, automatic notification of occupants, building operations staff, owner's central emergency staff, and applicable public emergency authorities.
3. Alarms:
   a. Means for occupants to communicate same types of alarm as automatic system does.
   b. Manual stations at minimum of 150 feet intervals along means of egress paths, minimum of one on each level of egress.
   c. Audible Alarms: Minimum of 15 dB over ambient noise, audible throughout common areas and means of egress.
   d. Visual alarms, in locations required by code and corridors and restrooms.

4. Fire Protection Controls:
   a. Provide connections between alarm and detection system and fire suppression system activation sensors.
5. Audible and visual trouble notification of operations staff, for alarm zone failures, annunciator zone failures, ground faults, backup power failure, water supply equipment failures.
6. Error and Failure Prevention: Hard wired system; "tamper" sensors at sensitive points; products of only one manufacturer or certified by manufacturer as compatible.
7. Substantiation:
   a. Construction or Closeout: Functional performance tests.

D. Operation and Maintenance:

1. Power Supplies:
   a. Dedicated Battery Backup Power: For:
      1) Fire safety systems, 90 minutes.
      2) Emergency communications, 90 minutes.
2. Ease of Use:
   a. Minimum of one centralized monitoring display for all systems is preferred; locate in security office.
3. NREL Personnel Training:
   a. Operational: Minimum of 8 hours, for 2 persons, for each separate system.
   b. Maintenance: Minimum of 8 hours, for 2 persons, for each separate system.

END OF SECTION D43

D45 - FIRE PROTECTION SPECIALTIES

PERFORMANCE

A. Basic Function:

1. Provide equipment and fixtures to facilitate manual fire-fighting in accordance with the code.
2. Fire protection specialties comprise the following elements:
   a. Fire extinguishers.
   b. Cabinets for storage.
3. Provide portable fire extinguishers throughout the facility, of the type and size and in the locations required by NFPA 10-2007 and the code.
4. Where fire protection specialty elements also must function as elements defined within another element group, meet the requirements of both element groups.
5. In addition to the requirements of this section, comply with all applicable requirements of Section 111-Facility Performance, Section D-Services, and Section D4-Fire Protection.
6. Substantiation:
   a. Design Development: Types, locations, and calculations of travel distances.

B. Health and Safety:

1. Accident Prevention:
   a. Locate extinguishers and cabinets so that means of egress is not impeded, in accordance with code.
2. Fire Safety: Mount extinguishers in permanent location using mounting fixtures that will inhibit casual removal but allow ready use in case of fire.

C. Durability:

1. Expected Service Life Span: Same as life span of building.
2. Durability: As specified for interior fixtures in Section C-Interiors.

D. Operation and Maintenance:

1. By-Products: Select extinguishing agent to minimize adverse effects of use on building equipment and finishes.
2. Ease of Use: For extinguishers intended for the use of occupants other than trained fire brigade members, weight of extinguisher may not exceed 12 pounds.

END OF SECTION D45

D5 - ELECTRICAL POWER

PERFORMANCE

A. Basic Function:

1. Provide electrical power with the appropriate characteristics to operate all electrically operated devices, including those in other services.

2. The electrical system comprises the following elements:
   a. Electrical Energy Generation: Utility power sources, engine-generator systems, battery power systems, uninterruptible power supply systems and unit power conditioners.
   b. Service and Distribution: Service entrance equipment, distribution equipment, transformers, motor control equipment, service and feeder wiring (conductors and raceways), monitoring, safety and control equipment, and other elements required for a complete functional system.
   c. Branch Circuits: Branch circuit wiring and receptacles and other branch circuit wiring systems.

3. Where electrical power elements also must function as elements defined within another element group, meet the requirements of both element groups.

4. In addition to the requirements of this section, comply with all applicable requirements of Section 111-Facility Performance and Section D-Services.

5. Substantiation:
   a. Construction: Continuity test of wiring systems prior to functional performance test. Functional performance test of wiring systems.

B. Amenity and Comfort:

1. Convenience:
   a. Locate metering in a single location.

C. Health and Safety:

1. Electrical Hazards: Design in accordance with all NFPA standards that apply to the occupancy, application, and design.
   a. Control access to spaces housing electrical components and allow access only by qualified personnel.
   b. Provide electrical distribution equipment with locking cabinets, doors, panels and appropriate signage when it is located in public areas.

2. Emergency Systems: Provide emergency power when normal power is interrupted, for the following:
   a. Systems and areas as required by code.
   b. Computers. See Section D51-Electrical Energy Generation for requirements.
   c. Interior Lighting. See Section D61-Interior Lighting for requirements.

D. Durability:

1. Moisture Resistance: Water-resistant equipment includes transformers, raceways, enclosures, panelboards, and switchgear.

2. Enclosures: As required to protect equipment from environment in which it is installed,

complying with NEMA 250-2003 and:

a. Areas to be Hosed-Down, or Equivalent, Exterior or Interior: Type 4.
b. Exterior, Exposed to Weather and Wind: Type 3S.
c. Exterior, Other Locations: Type 3R.
d. Interior, Other Locations: Type 1.

E. Operation and Maintenance:

1. Capacity: Calculated in accordance with NFPA 70-2002.

2. Power Consumption and Efficiency:
   a. Parking Structure: 175 kBTU/year per parking space
   b. Security Site Entrance Building (SEB): 9300 kwh/year (non-emergency condition)
   c. Private Metering: Provide meters to measure power consumption of lights, receptacles, HVAC systems, water heaters, elevators, and loads greater than 20 kW.

3. Load Characteristics:
   a. Maximum Harmonic Current Distortion: Plus or minus 2 percent of design current.
   b. Transient Suppression: Limit voltage transients below damage curve of the electrical system and connected equipment.

4. Protection Against Disturbances:
   a. Provide circuits which serve sensitive electronic equipment with electrical characteristics within the ranges defined in IEEE Standard 1100-2005.
      1) Substantiation:
         a) Preliminary Design: Identification of design strategies to minimize electrical disturbances.
         b) Design Documents: Identification of circuits which require power conditioning equipment and which serve sensitive electronic equipment.
         c) Construction: Functional performance testing.
         d) Occupancy:
            (1) If equipment is damaged or malfunctions within one year after completion, reporting of the cause of equipment damage or malfunctions.
            (2) Corrective Action: Provide corrective measures necessary to eliminate electrical disturbances which caused equipment damage and malfunctions.
            (3) Retest Report: Identification of electrical characteristics after corrective equipment has been installed and all equipment is operating properly and without damage.
   b. Noise Protection: Limit frequency excursions between 90 to 110 percent of design frequency.
      1) Protect the following:
         a) Receptacles serving personal computer terminals.
         b) Power supply to fire alarm panel.
         c) Power supply to Security and Surveillance Equipment.
      2) Substantiation:
         a) Preliminary Design: Identification of circuits that require noise protection.
         b) Design Development: Description of noise protection devices to be used.
   c. Surge Protection: Voltage excursion limit of 2 times design voltage.
      1) Provide protection of the following:
         a) Receptacles serving personal computer terminals.

b) Power supply to fire alarm panel.
c) Power supply to Security and Surveillance Equipment.

2) Substantiation:
a) Preliminary Design: Identification of circuits that require surge protection.
b) Design Development: Description of surge protection devices to be used.
c) Construction: Measurement of voltage excursions on protected circuits.

5. General Receptacle System Voltage: 120 volts/3-phase/60 Hz.

6. Industry Supported Electrical Vehicle Supply System: Installed in accordance with National Electric Code Article 625.

7. Ease of Use:
a. Configuration: Design wiring and protective devices so that outages caused by local overloads do not affect unrelated areas or systems.
b. Main Switchboard: Provide only one, located in Security Offices.
c. Monitoring: Provide local and remote monitoring coordinated with the NREL existing DDC System.

8. Availability: Provide an electrical system which is available to deliver power at least 99 percent of the time.

9. Allowance for Change and Expansion:
a. Spare Capacity - System Wide:
1) Load: 20 percent, minimum.
2) Rated Capacity: 20 percent, minimum.
3) Number of Additional Circuits: 30 percent, minimum.

END OF SECTION D5

D51 - ELECTRICAL ENERGY GENERATION

PERFORMANCE

A. Basic Function:

1. Provide electrical energy for emergency and standby power systems.
   a. Provide emergency power as required by code including the following:
      1) Emergency Lighting: Duration as required by code.
      2) Warning Lights: Duration as required by code.
      3) Fire Detection and Alarm System: Duration of 24 hours.
      4) Public Address System: Duration of 1.5 hours.
   b. Provide uninterruptible power supply (UPS) system as follows:
      1) NREL Supplied Telephone System: Transfer time of 0.0167 seconds (1 cycle).
         a) Duration of 1.5 hours.
      2) Computer Systems and Auxiliary Equipment: Transfer time of 0 seconds.
         a) Duration of 1.5 hours.
      3) Gate Access and Card Reader Systems: Transfer time of 0 seconds.
         a) Duration of 1.5 hours.
2. Electrical Energy Generation Capacity
   a. Provide 10 watts per square foot for Security Offices (Site Entrance Building) only.
3. Photovoltaic Support
   a. Provide space to house the future PV power conversion equipment assuming roof support structure is fully utilized for photovoltaic array.
   b. Provide concealed conduit to convey PV power from rooftop arrays to conversion equipment and from conversion equipment to campus distribution system.
4. Where electrical energy generation elements must also function as elements defined within another element group, meet the requirements of both groups.
5. In addition to the requirements of this section, comply with all applicable requirements of Section 111-Facility Performance, Section D-Services, and Section D5-Electrical.

B. Amenity and Comfort:

1. Sound and Noise:
   a. Provide uninterruptible power supply system's noise generation of no more than 69 dBA measured at 5 feet.

C. Health and Safety:

1. Protection from Damage: Locate electrical energy generation equipment away from high traffic areas, building occupants, and vehicular traffic.
2. Emergency Generators: Located out-of-doors.

D. Structural:

1. Seismic Design:
   a. Provide a electrical energy generation elements with flexible joints where differential movement is anticipated.

E. Durability:

1. Expected Service Life Span: Provide UPS systems which will last a minimum of 20 years in service without major repairs or operating expense.
2. Moisture Resistance: Provide electrical energy generation equipment which is resistant to moisture.
3. Corrosion Resistance: Provide electrical energy generation equipment which is resistant to corrosion.
4. Impact Resistance: Provide electrical energy generation equipment with a protective housing.

F. Operation and Maintenance:

1. Uninterruptible Power Supply (UPS) Configuration: Parallel redundant with automatic transfer from UPS power to normal power.
   a. Maintenance Bypass: Provide a maintenance switch to transfer UPS loads to the emergency generator.
   b. Substantiation:
      1) Preliminary Design: Listing of input/output voltage, types of load covered, and generic equipment characteristics.
      2) Design Development: Single-line drawings, power supply equipment sizes and types, equipment room sizes.
      3) Construction Documents: Riser diagrams, calculations, equipment operating parameters.
2. Uninterruptible Power Supply Systems: Performance parameters not less than base electrical distribution system.
3. Generator Characteristics:
   a. Electrical Characteristics: 120 volts/single phase/60 Hz.
   b. Generator Fuel Supply: Natural gas or bio-diesel preferred, diesel acceptable.
   c. Generator Reliability: 100 percent.
   d. Power Quality: Compatible voltage, wave shape, and frequency with the primary power source.
   e. Spare capacity: 20% over total load at altitude..
   e. Run Time: 4 hours at 100 percent load.
4. Photovoltaic Systems: Install per NEC 690, metered, and capable of utility interactive service.

END OF SECTION D51

D6 - ARTIFICIAL LIGHTING

PERFORMANCE

A. Basic Function:

1. Provide artificial means of lighting interior and exterior spaces.
2. Artificial lighting comprises the following elements:
   a. Interior Lighting: General room lighting, emergency lighting, and accent lighting.
   b. Exterior Area Lighting: General lighting of exterior spaces including roadways, driveways, walkways, and parking areas.
3. Portable lamps (not permanently attached to the building or other building furnishings) may not be used to accomplish required artificial lighting.
4. Where artificial lighting elements also must function as elements defined within another element group, meet the requirements of both element groups.
5. In addition to the requirements of this section, comply with all applicable requirements of Section 111-Facility Performance and Section D-Services.

B. Amenity and Comfort:

1. Interior Light Levels: Provide maintained ambient illuminance values for various activities that are within the ranges specified in the IESNA Lighting Handbook-2000, except for the following:
   a. Interior areas and spaces noted in Section D61-Interior Lighting.
   b. Parking Deck Areas: See D62-Exterior Area Lighting.
2. Light Quality: Provide luminous environment in each space that is designed to complement the functions and the character of the space.
   a. Distribution: In keeping with geometry of space and location of visual tasks.
   b. Color of Light: Appropriate for functions accommodated in space and characteristics of interior finishes.
   c. Character of Fixtures: Coordinated with architecture and other building systems and appropriate to finish level.

C. Health and Safety:

1. Emergency Systems: Provide backup lighting for periods of normal power interruption, for the following:
   a. Systems and areas as required by code.

D. Durability:

1. Moisture Resistance: Regardless of whether exposure to moisture is likely or not, design lighting equipment to be resistant to moisture.

E. Operation and Maintenance:

1. Capacity: Design lighting to deliver required illumination while operating within intended ratings.
2. Power Consumption and Efficiency as defined in Section D-Services.

PRODUCTS

A. All lamps shall be of low mercury and low lead construction, such as Phillips alto or equivalent. Provide 10% spare lamps and ballasts at the completion of the project.

B. Minimize the use of CFL's and HID's to the extent practical.

C. The construction will not use:

   1. Reflector halogen or tungsten halogen.

END OF SECTION D6

D61 - INTERIOR LIGHTING

PERFORMANCE

A. Basic Function:

1. Provide artificial lighting for all interior spaces that is adequate in quality and distribution for the performance of tasks typical for the type of space and the characteristics of the intended population, regardless of the availability of natural light.

2. Interior lighting comprises the following elements:
   a. Luminaires for general illumination.
   b. Accent lighting.
   c. Emergency lighting.
   d. Illuminated exit signs.

3. Where artificial lighting is integral with elements defined within another element group, meet requirements of both element groups.

4. In addition to the requirements of this section, comply with all applicable requirements of Section 111-Facility Performance, Section D-Services, and Section D6-Artificial Lighting.

B. Amenity and Comfort:

1. Accessibility: Comply with ADA Accessibility Guidelines.

2. Light Levels: Provide maintained average illuminance values for all spaces that are based on the primary visual tasks to be accommodated and are not less than the following, when measured at task height:
   a. SP2 Occupant Work Spaces:
      1) Open Office Cubicle: 30 fc.
   b. SP3 Equipment Utilization Spaces:
      1) Process Equipment: 50 fc.
   c. SR Resident or Occupant Service Spaces:
      1) Toilet Rooms: 10 fc.
   d. SC Circulation Spaces:
      1) Waiting Room: 10 fc.
   e. Local Lighting: In spaces where local task lighting is used to achieve maintained luminance levels, maintain balance with ambient illumination such that general lighting for space provides not less than 20 percent of local lighting level.
   f. Substantiation:
      1) Construction Documents: Calculations of illuminance levels for representative spaces, prepared by a registered electrical engineer.
      2) Construction: Measurements of illuminance levels for representative spaces throughout the project, with a report setting forth results after correcting for maintenance factors keyed to luminaire design and lamp types.

3. Light Quality:
   a. Color: Provide light sources throughout project with Color Rendering Index of not less than 90.
      1) Exception: SVI Automotive Interior.
      2) Exception: SU1 Maintenance Facilities.
   b. Substantiation:

1) Construction Documents: Calculations for representative spaces, and product data for lamps and luminaires.

C. Health and Safety:

1. Emergency Lighting: Provide emergency lighting that complies with code.

D. Operation and Maintenance:

1. Power Consumption and Efficiency: Comply with requirements of Section D6-Artificial Lighting and the following:

a. Lighting Controls: Provide level of control of lighting appropriate to type of space and NREL's requirements for energy conservation.

b. Daylighting Controls: Provide separate lighting circuits for spaces or zones adjacent to fenestration.

1) Controls: Daylight sensing controls, multiple-step dimming to daylighting OFF throughout project.

2) All conference rooms shall have separate controls for ambient lighting, task lighting, dimmable lighting for presentations, and capable of turning off lighting near the project screen.

c. Occupancy Controls: Provide lighting controls for private offices that do not require action by occupants.

1) Controls: Occupancy sensor and programmable timing control throughout project.

2) Occupancy sensors shall include manual on/off control of lighting with photocell override such that the occupant can select 'on' or 'off' but the system will override the 'on' setting and turn lights off if the system detects no occupants.

d. Light Sources: Provide lamps with average lamp efficacy rating not less than the following:

1) Compact Fluorescent Lamps: 55 lumens/watt.

2) Full Size Fluorescent Lamps: 90 lumens/watt.

3) Metal Halide Lamps: 95 lumens/watt.

e. Ballasts: Provide electronic or energy efficient ballasts with fluorescent lamps. Ballasts used in daylight areas shall be dimming or step dimming type.

f. Provide daylight to all spaces having windows providing 100% of light in spaces between the hours of 10:00 am and 2:00 pm.

2. Ease of Maintenance: Provide luminaires that do not collect dirt rapidly and are readily cleanable.

a. Luminaire Categories: Provide luminaires of IESNA Category I, II, or V, for minimum dirt accumulation and LDD factors.

END OF SECTION D61

D62 - EXTERIOR AREA LIGHTING

PERFORMANCE

A. Basic Function:

1. Provide artificial lighting for exterior spaces, as required by the program, that is adequate in quantity, quality, and distribution for the performance of tasks typical for the type of outdoor space and the characteristics of the intended user population.
2. Exterior area lighting comprises the following elements: Exterior luminaires, poles, standards, or other means of mounting the luminaires, power supply, and controls.
3. Where exterior area lighting is integral with elements defined within another element group, meet requirements of both element groups.
4. In addition to the requirements of this section, comply with all applicable requirements of Section 111-Facility Performance, Section D-Services, and Section D6-Artificial Lighting.

B. Amenity and Comfort:

1. Light Levels: Provide maintained average illuminance values for exterior spaces that are based on the primary visual tasks to be accommodated and are not less than the following, when measured at grade:
   a. Parking Decks: 1.5 fc, maximum uniformity ratio (average to minimum) of 4:1.
   b. Parking Lots (with no structure above): 0.6 fc, maximum uniformity ratio (average to minimum) of 4:1.
   c. Building Entrance Areas: 4 fc, maximum uniformity ratio (average to minimum) of 4:1.
   d. Bikeways: 0.75 fc, maximum uniformity ratio (average to minimum) of 10:1.
   e. Pedestrian Areas:
      1) Sidewalks: 0.75 fc, maximum uniformity ratio (average to minimum) of 4:1.
      2) Pedestrian Tunnels: 2.5 fc, maximum uniformity ratio (average to minimum) of 4:1.
      3) Stairways: 0.75 fc, maximum uniformity ratio (average to minimum) of 10:1.
   f. Substantiation:
      1) Design Development: Overall exterior lighting scheme, including types of luminaires and lamps.
      2) Construction Documents: Calculations of illuminance levels and uniformity ratios for representative exterior areas, prepared by a registered electrical engineer.
      3) Construction: Measurements of illuminance levels and uniformity ratios for representative exterior areas, with a report setting forth results after correcting for maintenance factors keyed to luminaire design and lamp types.
2. Light Quality:
   a. Glare Minimization: Provide exterior area lighting that minimizes the incidence of discomfort glare and avoids disability glare under all normal conditions of use, in accordance with IESNA recommendations.
   b. Color: Provide light sources throughout project that render automobile colors with reasonable accuracy.
3. Appearance of Lighting Installation:
   a. Provide exterior area lighting that is compatible with overall project appearance and coordinated with site layout and building organization.
      1) Luminaire Mounting:

a) Installation on poles, wall mounting brackets, or architectural fixtures:
b) Style compatible with Campus Standards.
c) Material and finish compatible with Campus Standards.

4. Lighting Cutoff:
   a. Configure exterior area lighting to avoid spill light on adjacent property and streets.

C. Structure:

1. Provide poles for parking lot area lighting that are located to avoid damage by automobiles or mounted to bases that are structurally capable of withstanding moderate impact.

2. Substantiation:
   a. Construction Documents: Strength calculations for representative installations, prepared by a registered structural engineer.

D. Durability:

1. Expected Service Life Span: Provide a system which will last a minimum of 25 years in service without major repairs.

2. Vandal Resistance:
   a. Luminaires mounted at minimum height of 12 ft above grade.

E. Operation and Maintenance:

1. Minimum Outdoor Operating Temperature: Provide lighting systems that operate at temperatures as low as -10 degrees F.

2. Power Consumption and Efficiency: Comply with requirements of Section D6-Artificial Lighting.
   a. Lighting Controls: Provide daylight sensing controls, on-off switches, programmable timing, and motion activation switching to assure Project Energy Efficiency.
      1) Substantiation:
         a) Preliminary Design: Provide design of special switching and light controls that will assure energy efficiency of entire Project.
         b) Design Development: Details of controls with manufacturer product information for all lighting control system components.
         c) Commissioning: Functional performance testing for all conditions and configurations that immulate actual operatingdemands.

3. Maintenance Efficiency: Provide luminaires that do not collect dirt rapidly and are readily cleanable.

4. Luminaire Categories: Provide luminaires of IESNA Category I, for minimum dirt accumulation and LDD factors.

5. Ease of Relamping: Provide luminaires designed for easy relamping without special tools or equipment.

END OF SECTION D62

D7-TELECOMMUNICATIONS

PERFORMANCE

A. Basic Function:

1. Provide the following telecommunications services:
   a. Voice and Data: Infrastructure for voice and data transmission and telephone equipment.
   b. Sound Reinforcement: Public address system.
2. Where telecommunications elements also must function as elements defined within another element group, meet the requirements of both element groups.
3. Emergency telephones (dials internal emergency number automatically) and outside phone lines as a backup to Voice Over Internet Protocol (VOIP) phone system are required.
4. Emergency Telephones and signage must be placed every 100 ft. throughout areas determined by Security requiring emergency reporting capabilities in areas of higher hazards.
   a. In all new construction, an outside phone line service must be available at centralized locations determined by security.
   b. Emergency Telephones in elevators must have the ability to be used immediately once a call has ended (immediate disconnect) there can be no delay before the next call made.
5. Digital Signage/Video Displays
   a. Provide LCD monitors in lobby.
6. In addition to the requirements of this section, comply with all applicable requirements of Section 111-Facility Performance and Section D-Services.

B. Amenity and Comfort:

1. Accessibility: Systems shall comply with requirements of local authorities for facilities for the disabled.

C. Health and Safety:

1. Electrical hazards: the construction will be in compliance with all nfpa standards that apply to the occupancy, application, and design.
   a. Provide controlled access to spaces housing electrical components and allow access only by qualified personnel.
   b. Comply with NFPA 70 (most recent adopted) requirements for hazardous locations applications.
2. Emergency Systems: Provide backup power when normal power is interrupted, for the following:
   a. Systems and areas as required by code.

B. Durability:

1. Enclosures: As required to protect equipment from environment in which it is installed, complying with NEMA 250 (most recent adopted) and:
   a. Areas to be Hosed-Down, or Equivalent, Exterior or Interior: Type 4.
   b. Exterior, Exposed to Weather and Wind: Type 3S.
   c. Interior, Other Locations: Type 1.

C. Operation and Maintenance:

1. Capacity: Provide systems to deliver required performance while operating within their intended ratings.
   a. Substantiation:
      1) Construction: Testing of wiring systems for continuity, prior to functional performance testing; functional performance testing as per latest TIA/EIA/BICSI standards.

2. Power Consumption and Efficiency:
   a. Comply with requirements for energy efficiency of electrical equipment in ASHRAE 90.1-2007.

3. Ease of Use:
   a. Zoning: Arrange wiring and protective devices so that outages caused by local faults do not affect unrelated areas or systems.
   b. Main Telecommunications Panel: Provide one main telecommunications room.
   c. Telecommunications Room:
      1) Provide as necessary to provide 100% building coverage with no cable run exceeding 225 feet. Each level shall have a minimum of one telecommunications room.

4. Allowance for Change and Expansion:
   a. Spare Distribution Capacity: 20 percent, minimum.
   b. Future Distribution Capacity: 40 percent, minimum.

END OF SECTION D7

D9 - OTHER SERVICES

PERFORMANCE

A. Basic Function:

1. Other services include:
   a. Surveillance and Security Controls: Elements for intrusion detection, access control, and visual and auditory monitoring.
   b. Special Grounding Systems: Elements for lighting protection.
   c. Cathodic Protection: Elements for supplementary corrosion protection using cathodic protection.

B. Where services elements also must function as elements defined within another element group, meet requirements of both element groups.

1. In addition to the requirements of this section, comply with all applicable requirements of Section 111-Facility Performance and Section D-Services.

END OF SECTION D9

D92 - SURVEILLANCE AND SECURITY CONTROLS

PERFORMANCE

A. Basic Function:

1. Provide remote surveillance of specified areas, intrusion detection, and automatic and remote control of access to Project areas, as required by the code, the Program, and as follows.
    a. All operable windows (within 18 ft) from the ground must be sealed or alarmed. Operable windows shall meet requirements set forth in DOE M 470.4-2. A variance to the DOE security requirement can be sought but approval is not guaranteed. The requirement can be found in DOE O470.4-2.
    b. Security and Emergency Management system wires must be in conduit (except public address system). Use fiber optic cable where appropriate.
    c. Exterior data cable including Outside Plant (OSP) access must be secured (locked).
    d. Doors with electronic access door equipment (card readers) require the ability to secure if back-up power fails (electric strike or handset).
2. Integrated systems performing all functions are preferred, subject to requirements of code for separated, independent systems.
3. Data Communications Functions: As required to accomplish security functions.
    a. Connection between campus central system and building system.
4. Visual Communications Functions:
    a. Point-to-Point Video Communication:
        1) Visual monitoring, for access/entry control.
        2) Two-way visual communication between Site Entrance Building security office and points of access/entry control.
5. Access/Entry Control and Intrusion Detection Functions: See definition of security zones in Section 111-Facility Performance.
    a. Public Access Interaction Points: Remote visual monitoring and continuous visual recording, for drive-in entrances.
    b. Approaches to Reception Zone from Outside: Remote visual monitoring and recording.
    c. Doors Between Public Access Zone and Reception Zone: remote visual monitoring, door status monitoring, keyless entry for occupants, and remote locking/unlocking.
    d. Operations Zone Vehicular Parking: Access limited by gate controls.
        1) Entrances: control gate, remote visual monitoring, and automatic "lot full" computation and sign.
        2) Exits: Control gate and remote visual monitoring.
    e. Operations Zone Entrances: remote visual monitoring, door status monitoring, and keyless entry for occupants.
    f. Inside Operations Zone: Remote visual monitoring, at all locations (100% coverage).
    g. Secure Zone Entrances: door status monitoring and keyless entry for occupants.
    h. Motion Detection: Provide motion detection inside the SEB for spaces identified as Operations or Secure security zones.
    i. Recording of door/gate status changes and proper and improper access attempts for all controlled entry points.

j. Real-time status display of all controlled and monitored points; display located in security office.
k. Furnished by NREL:
1) Employee Cards for activation of all keyless operations, all other components by Subcontractor.
a) Match existing NREL security system or NREL approved compatible manufacturer.

6. Where surveillance and security control elements also must function as elements defined within another element group, meet the requirements of both element groups.

7. In addition to the requirements of this section, comply with all applicable requirements of Section 111-Facility Performance, Section D-Services, and Section D9-Other Services, and the NREL Security & Emergency Preparedness Project Design Requirements (included in Section III-Attachments - NREL Provided Information).

8. Substantiation:
a. Proposal: Outline description of systems, inter-system interfaces, and functions provided.
b. Preliminary Design: Update of outline description of systems, inter-system interfaces, and functions provided.
c. Design Development: Details of each type of input and output device; capacities of systems; manufacturer data.
d. Construction Documents: Detailed layout of input and output device locations, riser diagram, interfaces, rack configurations, installation details, and grounding connection locations.
e. Closeout: Complete functional performance testing as specified in Part 1-Design & Construction Procedures, under Commissioning.

B. Amenity and Comfort:

1. Accessibility: Comply will requirements of federal authorities for facilities for the disabled.

2. Visual Image Quality:
a. Television Monitors: Minimum 36 inch diagonal, color.

C. Durability:

1. Moisture Resistance and Thermal Compatibility: Materials that will resist degradation and failure of signals under ambient conditions expected.

D. Operation and Maintenance:

1. Power Supplies:
a. Building power with power line conditioner for all systems.
b. Dedicated Battery Backup Power: For:
1) Access/entry controls; fail-secure, 90 minutes.
2) Intrusion detection, 90 minutes.
3) Video surveillance, 90 minutes.

2. Transmission Capacity: Reference NREL Standards

3. Data Storage Capacity:
a. Keyless Entry Devices: Minimum of 100,000 unique combinations, with minimum of 4 levels of access authorization.

4. Ease of Operation:
   a. Time/date displays centrally synchronized and adjustable.
   b. Minimum of one centralized monitoring display for all systems is preferred; locate in security office.
   c. Keyless Entry Devices: Reprogrammable from central control location.
5. NREL Personnel Training:
   a. Operational: Minimum of 8 hours, for 4 staff, for each separate system.
   b. Maintenance: Minimum of 8 hours, for 4 staff, for each separate system.

PRODUCTS

A. Control Systems for All Applications:

1. Use the following:
   a. Components fully compatible with the existing Software House C-Cure 800 System (CCM80-20S) (C-Cure 9000 System if existing C-Cure 800 System will be replaced prior to construction) without alternation and be Software House factory approved for compatibility.

B. Keyless Entry Devices:

1. Use the following:
   a. HID model ProProx with keypad 5355 AGS - black.

C. Access/Entry/Intrusion Status Monitoring Devices:

1. Use the following:
   a. Strike monitors.

D. Remotely Operated Locks:

1. Use one of the following:
   a. Electric strikes.
   b. Magnetic locks.

E. Roadway and Parking Access Control Detection:

1. Use one of the following:
   a. Proximity card reader plus keypad for visitors.

END OF SECTION D92

D93-SPECIAL GROUNDING SYSTEMS

PERFORMANCE

A. Basic Function:

1. Provide grounding systems that:
   a. Provide protection from lightning strikes; scope and design of protection as defined in Section 111-Facility Performance.
   b. Reduce static electricity and transient and induced current in raised access flooring and electronic equipment cabinets, racks, and supports.
   c. Comply with applicable recommendations of IEEE 142-1991 and IEEE 1100-2005.
2. Where special grounding systems and elements must also function as elements defined within another element group, the construction will meet requirements of both element groups.
3. In addition to the requirements of this section, the construction will comply with all applicable requirements of Section 111-Facility Performance, Section D-Services, and Section D9-Other Services.

B. Amenity and Comfort:

1. Appearance: Concealed grounding conductors and ground terminals wherever possible.

C. Health and Safety:

1. Lightning Protection System Minimum Capacity:
   a. Maximum Ground Resistance: 10 ohms, between any individual down conductor and ground.
   b. Main and Bonding Conductors: Solid and braided copper as required by code.
   c. Substantiation: As specified in Section 111-Facility Performance.

D. Durability:

1. Expected Service Life Span of All Grounding Systems: Life of the building without requiring any more maintenance than annual inspection and minor repairs not more frequently than annually.
   a. Substantiation:
      1) Design Development: Maintenance analysis.
      2) Closeout: Maintenance schedule and instructions.
2. Lightning Protection Elements: Minimum quality demonstrated by listing or labeling by UL.
3. Lightning Protection Strike (Air) Terminals: Sheet metal elements less than 3/16 inch (4.8 mm) thick are likely to be damaged (punctured) by direct lightning strikes and may not be used as strike (air) terminals.

END OF SECTION D93

D94-CATHODIC PROTECTION

PERFORMANCE

A. Basic Function:

1. Cathodic protection will be provided for the following elements:
   a. Submerged metal pipes, ducts, conduits, tanks, and structural elements.
   b. Buried metal piping carrying petroleum products or other hazardous or toxic materials, where installed without means of visual observation of entire exterior surface of piping.
   c. Other buried metal pipes, ducts, conduits, tanks, and structural elements outside the building.
   d. Other buried metal elements, if post-occupancy tests determine AC or DC electrical currents to be present in the ground.
2. In addition to the requirements of this section, the construction will comply with all applicable requirements of Section 111-Facility Performance, Section D-Services, and Section D9-Other Services.

B. Amenity and Comfort:

1. Appearance: All portions of cathodic protection systems will be concealed.

C. Durability:

1. Corrosion Prevention by Cathodic Protection: Designed and constructed in accordance with NACE RP0169-1996(R2002) and NACE RP0285-2002; either galvanic anode or impressed current system.
   a. Design of Protected Elements: In addition to requirements specified elsewhere, as specified in NACE RP0169-1996(R2002) and NACE RP0285-2002, including coatings.
   b. Measurement Techniques: As specified in NACE TM0497-2002.
   c. Substantiation:
      1) Commissioning: Tests to verify achievement of cathodic potential or polarization required by design; documentation of operating parameters in accordance with applicable NACE standard.
      2) Closeout: Maintenance instructions; include copy of applicable NACE design standards.
      3) Occupancy: After one month of full occupancy and activation of all services and again at the end of one year, tests to determine if AC or DC currents or potentials exist between buried metal elements and the ground; addition, replacement, or enhancement of cathodic protection as necessary to achieve protective effect.

D. Operation and Maintenance:

1. Ease of Maintenance:
   a. Anodes: Located for ease of replacement; locations recorded in project record documents.
   b. Test Stations: Permanent testing stations and test equipment for periodic measuring of cathodic potential, as specified in NACE RP0169-1996(R2002) and NACE RP0285-2002 and at minimum of 2 locations.
   c. Impressed Current Type: Monitoring panel for electrical equipment located in a utility room, with separate readouts for each current source, display of last inspection date, and storage for maintenance records.

END OF SECTION D94

E-EQUIPMENT AND FURNISHINGS

PERFORMANCE

A. Basic Function:

1. Design the facility to accommodate the equipment and furnishings required by the Owner, which are specified in the project program.

2. Equipment and furnishings comprise the following elements:
   a. Equipment: Mechanized, plumbed, and electrical devices, other than equipment that is part of a service system (HVAC, electrical, etc.), and permanently installed fixtures not covered by another Section.
   b. Furnishings: Systems furniture (wired), modular furniture (including desks, storage cabinets, casework, and storage systems), movable (loose) furniture and fittings, without electrical or plumbing connections identified in the Project Program as Subcontractor supplied and installed.

3. The following equipment and furnishings are to be provided by the Subcontractor:
   a. All permanently installed equipment and furnishings.
   b. Electrically-operated equipment with a permanently wired connection.
   c. Items requiring a water supply or drainage connection.
   d. Items requiring an air distribution or exhaust connection.
   e. Items requiring a special services connection.
   f. Items required by the code.
   g. Industry supported electric vehicle supply equipment

4. Where equipment or furnishings elements also must function as elements defined within another element group, meet requirements of both element groups.

5. In addition to the requirements of this section, comply with all applicable requirements of Facility Performance (Part 3-Performance Criteria).

B. Amenity and Comfort:

1. Appearance:
   a. Services Connections to Equipment: Concealed behind or under items or their housings.

C. Health and Safety:

1. Accident Prevention:
   a. Comply will the requirements of 29 CFR 1910, regulations of Occupational Safety and Health Administration.
   b. Prevent accidental pinching, crushing, and cutting of operator limbs, fingers, and toes in or by moving parts of equipment by using intelligent design or guards or other protection, without reliance on self-protective operation by operator.

D. Durability:

1. Service Life Span: 30 years.
   a. Substantiation:
      1) Proposal: Identification of proven-in-use assemblies of the same type, for inspection by Owner.
      2) Preliminary Design: Identification of proven-in-use assemblies of the same type, for

inspection by Owner.

3) Design Development: Identification of actual products to be used.

2. Weather Resistance: Items located outdoors must comply with requirements of Section B-Shell.

3. Vandal Resistance: Parts not easily removed without the use of tools.

E. Operation and Maintenance:

1. Ease of Maintenance: Not requiring any routine measures to maintain operation or finishes, other than washing with soap and water.

2. Ease of Repair: Serviceable parts and access panels easily removable with common tools.

3. Ease of Equipment Service: As specified in Facility Performance (Part 3-Performance Criteria) and the following:
   a. Parts Having Service Life Less Than That Specified for Element: Easily replaceable, without de-installation or de-mounting of the entire element, component, or equipment item.
   b. Valves: Easily replaceable internal parts, eliminating necessity of removal of entire valve for repair.
   c. Parts: Readily available from stocking distributors within 50 miles (80 km) of project location.
   d. Substantiation:
      1) Construction Documents: Identification of parts normally replaced during routine maintenance and parts replaced only when damaged or unexpectedly worn out; location of stocking distributors.

END OF SECTION E

F - DEMOLITION

PERFORMANCE

A. Scope of Work:

1. Remove existing construction and utilities that are required to support the design and satisfy the Program.
   a. The following existing elements may remain in place provided they are concealed in the final work:
      1) Underground piping, provided it is completely marked, recorded on final survey, and drained and capped, except petroleum products piping.
2. Relocate existing construction and utilities as required for the design.
3. Where requirements of another element group also apply to demolition or relocation operations, meet the requirements of that element group as well.
4. In addition to the requirements of this section, comply with all applicable requirements of Section 111-Facility Performance, Section G-Sitework, and Section G1-Site Preparation.

B. Amenity and Comfort:

1. See Part 1-Design & Construction Procedures for noise control and dust control.
2. Public Amenity: Conduct operations so as to cause minimum annoyance of the public and adjacent property owners.
   a. Where existing structures on the site continue to be occupied (such as the surface parking area), provide alternate means of access with physical barriers and directional signs acceptable to NREL.
   b. Substantiation:
      1) Construction Documents: Detailed demolition plan, including daily schedule.
3. Use physical barriers to protect existing elements to remain.

C. Health and Safety:

1. Health Hazards:
   a. Whenever construction operations could result in worker contact with hazardous materials, follow recommendations of an American Board of Industrial Hygiene Certified Industrial Hygienist (CIH) employed by Subcontractor.

D. Structure:

1. Prevent movement or settlement of structures that are to remain.
2. Cease operations immediately if structures that are to remain appear to be in danger; do not resume operations until danger has been removed or remedied.
3. Coordinate demolition with grading so that final grades do not subside within one year after completion.

E. Durability:

1. Maintain temporary and permanent erosion and sediment controls during demolition and relocation operations or replace as soon as demolition or relocation is complete.

F. Operation and Maintenance:

1. Comply with requirements of utility providers.

2. Locations of Existing and Abandoned Utilities: Recorded or marked in such a manner that they can be easily located during and after completion of construction.

END OF SECTION F

G - SITEWORK

PERFORMANCE

A. Basic Function:

1. Provide all modifications to the site and site improvements and utilities required for proper functioning of the project and as indicated in the program.
2. Some requirements of this section and subsections will apply to semi-enclosed un-conditioned spaces as identified in Part 2-Program (i.e. Parking Structure)
3. Sitework comprises the following elements:
   a. Site Preparation: All modifications to the site and grades required for construction of new work and for proper functioning of the project.
   b. Site Improvements: All elements required to provide finished and durable site surfaces and outdoor improvements described in the program.
   c. Site Services: All outdoor and underground elements required to complete the design of services defined in Section D-Services.
   d. Other Site Construction: Miscellaneous site elements.
4. Where site elements also must function as elements defined within another element group, meet the requirements of both element groups.
5. In addition to the requirements of this section, comply with all applicable requirements of Section 111-Facility Performance.

B. Amenity and Comfort:

1. Weather:
   a. Provide shelter from weather for:
      1) Persons waiting at the NREL Shuttle bus stop.
2. Heat/Cold: Design to minimize heat gain in summer and maximize heat gain in winter.
3. Wind: Design to shield entrances from wind in all seasons.
4. Cleanliness: Provide above grade elements, fixtures, and equipment that:
   a. Prevent attraction and adherence of dust and air-borne dirt and soot, and minimize appearance of settled dust and dirt.
   b. Are washed reasonably clean by normal precipitation.
5. Comfort:
   a. Provide outdoor seating as described in the program.
6. Appearance:
   a. Preserve:
      1) Trees, shrubs, and other vegetation that need not be removed to accomplish the design.
      2) Natural waterways: "The Arroyo" indicated on the Site Use Plan.
   b. Fit the new activities on site to the topography, soils, and existing vegetation as much as possible.
   c. Finished Surfaces:
      1) Make finished surfaces smooth and uniform in appearance, without depressions that collect water.

2) Do not leave soil surfaces exposed in finished work; minimize the amount of time soil surfaces are left exposed.
3) If, after consideration of other performance requirements, options remain as to methods of finishing soil surfaces, the NREL prefers:
   a) Landscaping, rather than paving.
   b) Perennial shrubbery and ground covers, rather than lawns.
   c) Water-pervious paving, such as unit pavers on pervious bed, rather than monolithic pavement.

d. Conceal unsightly site elements from view from the streets.
e. Substantiation:

C. Health and Safety:

1. Safety:
   a. Prevent:
      1) The intentional passage of people across controlled access highways, except at intended roadway crossings.
      2) The intentional driving of vehicles from adjacent public rights-of-way onto the site, except at intended roadway accesses.
      3) The intentional driving of vehicles from roadways and parking areas onto pedestrian walkways and open site areas.

2. Maximum Slopes:
   a. Slopes with Smooth Pavement: 1:10, unless restricted to vehicular use.
   b. Slopes Covered with Grass: 1:5, unless less than 3 feet in height.
   c. Slopes with Pedestrian-Inhibiting Vegetation: 1:1, unless less than 5 feet in height.
   d. Slopes With No Access From Top: Limited only by structural stability and resistance to erosion.

3. Fire Sources: Design to minimize the danger of wildfires spreading to the site, by complying with NFPA 1144-2002.
   a. Substantiation:
      1) Design Development: Identification of measures taken; review by NREL and authorities having jurisdiction.

4. Vermin/Animal Control:
   a. Prevent and eliminate standing water that could become stagnant.

5. Physical Security:
   a. Provide fixed mountings for securing of bicycles against theft.
      1) Bicycle owner to provide lock and chain.

6. Vehicular Safety: Comply with the code.
   a. Provide visual barriers at extreme changes in elevation near roadways.
   b. Provide tactile warnings where pedestrian walkways cross or run adjacent to roadways.

D. Structure:

1. Earthwork: Provide structural design in accordance with ASCE 7-2005 if not otherwise required by code.
   a. Bearing Capacity: Under substructure, paving, and site structural elements, maintain natural bearing capacity or achieve or correct compaction as required to prevent

uncontrolled subsidence or other movement.

b. Substantiation:
   1) Design Development: Engineering design of any structural fills required.

2. Site Fixtures, Equipment, and Services:
   a. Provide foundations or other mountings as required to support the completed and operational element permanently and safely and without uncontrolled subsidence or other movement.
   b. Design structural elements in accordance with code and requirements specified in Section B-Shell.
   c. Miscellaneous Site Structures with Floors or Roofs: Designed to comply with same requirements as building superstructure.
   d. Substantiation: Same as required for superstructure.

E. Durability:

1. Weather Resistance of Built Elements: Comply with requirements of Section B-Shell.

2. Weather Resistance of Plants and Turf: Use plants that will withstand extremes of weather likely to occur in any 5 years without supplementary irrigation and without seasonal protection other than mulch.
   a. NREL agrees that maintenance to the level specified by the Subcontractor will be necessary to assure survival of the plants.
   b. Exception: Supplementary irrigation is expected during new plant establishment period.

3. Soil Erosion Resistance: Comply with the code and the following:
   a. Maintain the existing site features that contribute to erosion resistance to the greatest extent possible.
   b. The present natural resistance to erosion is insufficient; take measures to improve the resistance to erosion.
   c. Design to minimize soil erosion.
   d. If erosion occurs during construction and within one year after completion, relocation or replacement of eroded soil and repair of eroded areas shall be performed by the Subcontractor at no cost to the NREL.
   e. If erosion occurs within one year after completion, provide improved erosion control measures within one week after notification by NREL.

4. Traffic Resistance: Provide finished site surfaces that are permanently resistant to the type of traffic to be expected, under all weather conditions.
   a. Where vegetated surfaces will not withstand the anticipated traffic, provide pavement or other surfacing.
   b. If vegetated surfaces are damaged due to traffic within one year after completion, replacement of vegetation with more durable materials shall be performed by the Subcontractor at no cost to the NREL.
   c. Vegetation and fencing may be used to discourage pedestrian traffic, if other functional requirements can be met.
   d. Substantiation, Paving and Hard Surfacing:
      1) Preliminary Design: Identification of types and thicknesses of paving and surfacing for various functions.
      2) Design Development: Proven-in-use documentation of paving and surfacing consistent with types of traffic anticipated; manufacturer's data may be submitted

for modular paving units.

3) Construction Documents: Engineering calculations, based on anticipated weights and intensity of traffic.

5. Stormwater:
   a. Control storm water runoff as required to prevent damage to project elements, including vegetation, and to prevent damage to neighboring sites, including vegetation.
   b. Prevent storm water runoff into public utilities in excess of actual capacity or amount allowed by public agencies, whichever is less, under conditions of the most extreme rainfall that might occur in 50 years.
   c. Substantiation:
      1) Design Development: Engineering design of site drainage, including drainage volume calculations.

6. Vehicular Collision: Design to minimize the probability of vehicular impact on site fixtures and accidental driving on lawns and landscaped areas.

F. Operation and Maintenance:

1. Utilities: See Section D-Services and other applicable chapters in that section for design parameters.

2. Water Conservation: Minimize water use as required by law.

3. Ease of Maintenance:
   a. Snow Removal: Design to facilitate removal of snow from all vehicular and pedestrian trafficways using mechanized equipment or automatic means wherever possible; where not possible, design to minimize the effort required to use manual snow removal methods.

4. Substantiation:
   a. Preliminary Design: Identification of treatments that minimize or eliminate the collection of snow at vehicular and pedestrian traffic surfaces and anticipated methods of snow removal.
   b. Design Development: Identification of vehicular and pedestrian traffic surfaces and anticipated methods of snow removal.

5. Theft Deterrence:
   a. Provide fixtures that are either anchored securely to the ground using fastenings not easily removable or that are too heavy for one person to carry, and that are made of materials with no intrinsic or salvage value.

END OF SECTION G

G1 - SITE PREPARATION

PERFORMANCE

A. Basic Function:

1. Provide all modifications to the site required for proper functioning of the project and as indicated in the program.

2. Site preparation is comprised of the following elements:
   a. Clearing: Removal of trash, existing built elements, and vegetation that is not needed, and temporary erosion control.
   b. Earthwork: Changing of grade levels, removal of soil and rock, modifying existing soils in preparation for construction, and temporary and permanent erosion and sediment control structures made of soil or rock.

3. Where site preparation elements also must function as elements defined within another element group, meet the requirements of both element groups.

4. In addition to the requirements of this section, comply with all applicable requirements of Section 111-Facility Performance and Section G-Sitework.

B. Durability:

1. Soil Erosion Resistance: As specified in Section G-Sitework and as follows:
   a. During construction, take whatever measures are required to minimize the amount of eroded soil that is transported off the site or into waterways under the most extreme short term and 24-hour rainfall events that might occur in 25 years.
   b. In the design and constructed elements, take whatever measures are required to minimize soil erosion under the most extreme short term and 24-hour rainfall events that might occur in 25 years, and to prevent eroded soil from being transported off the site or into waterways.
   c. Design erosion control measures in accordance with "Best Management Practices (BMPs)" and design procedures prescribed by law.
      1) State of Colorado Erosion and Sediment Control Manual.
      2) Federal Highway Administration FLP-94-005, Best Management Practices for Erosion and Sediment Control,1995.
   d. Limit continuous slopes to maximum of 30 feet measured vertically, unless intermediate terraces with drainage swales are provided.
   e. Replace temporary measures with permanent measures unless made unnecessary by constructed site elements, final topography, or permanent vegetation.
   f. Substantiation:
      1) Preliminary Design: Preliminary site plan identifying soils and vegetation, existing erosion problems, and areas vulnerable to erosion due to topography, soils, vegetation, or drainage.
      2) Design Development: Site plan showing grading and new improvements, probable causes of erosion during construction, proposed methods of prevention and remediation, and maintenance requirements for permanent erosion control measures;
      3) Design Development: Where extensive areas of soil will be disturbed, storm water flow and volume calculations, with soil loss predictions.
      4) Construction Documents: Complete erosion and sediment control plan, including

scheduling of temporary and permanent measures and construction.

5) Construction: Daily inspection and repair of erosion control measures; cleanout of sediment control structures as required.
6) Closeout: Removal of temporary measures, cleanout of permanent measures, and repair of damage; submittal of written maintenance procedures.
7) Occupancy: Weekly inspection of site and repair of damage.

C. Operation and Maintenance:

1. Ease of Maintenance:
   a. Design and construct earthwork elements so that they are permanent, not requiring periodic maintenance to maintain stability or appearance.
      1) Exceptions: Periodic inspection and minor repairs are expected to be required for permanent waterway channel stabilization.

END OF SECTION G1

G2 - SITE IMPROVEMENTS

PERFORMANCE

A. Basic Function:

1. Provide all elements required for finished and durable site surfaces, indoor plantings, and outdoor improvements described in the program.

2. Site improvements comprise the following elements:
   a. Pavements and Surfacing: Finished surfaces for vehicular and pedestrian, other than turf.
   b. Site Fixtures and Equipment: Fixtures, equipment, and miscellaneous structures located out-of-doors, except those located on the roof or mounted on walls of buildings.
   c. Landscaping: Outdoor plants and elements supporting plants.

3. Where site improvements elements also must function as elements defined within another element group, meet the requirements of both element groups.

4. In addition to the requirements of this section, comply with all applicable requirements of Section 111-Facility Performance and Section G-Sitework.

B. Appearance:

1. Plants:
   a. Outdoor: Provide an attractively landscaped site, compatible with the existing community, that looks tidy during non-growing seasons at the Site Entrance Building approach.
   b. Substantiation:
      1) Design Development: Identification of types of plants to be used, with any seasonal variations in appearance.

2. Pavements and Surfacing: Provide rigid surfaces that are smooth, consistent in color and finish, sloped and drained to avoid ponding, appropriate to the function, and neatly finished at edges.
   a. Vehicular Areas: Marked neatly to denote traffic lanes and parking spaces.
   b. Pedestrian Areas: Designed to contrast visually with vehicular areas.

C. Durability:

1. Weather Resistance of Plants: Provide connections to a manual irrigation system for all plantings that are not required to survive normal weather extremes without supplementary irrigation.

2. Pavements and Surfacing: Provide systems that are designed and engineered to withstand the types and intensity of traffic anticipated for the facility size and type.

END OF SECTION G2

G21 - PAVEMENTS AND SURFACING

PERFORMANCE

A. Basic Function:

1. Provide exterior pavements and surfacing, as required by the program and by code, that are adequate in extent and sufficiently durable to accommodate without damage the types of traffic that can be reasonably anticipated for the facility type and intended user population.

2. Pavements and surfacing comprise the following elements:
   a. Exterior paved or surfaced areas such as roadways, driveways, parking lots, and walkways.
   b. Exterior steps and ramps not connected to buildings, including handrails and stair nosings.
   c. Appurtenances for roadways and driveways, including curbs, gutters, guardrails, and pavement markings.
   d. Signs, including "stop," "yield, directional signs, and parking space marking and identification, and wayfinding signage.

3. Roadways and Driveways: Provide paved surfaces as required for vehicular access to the project site and to various functional areas requiring vehicular access, including main entrance, parking areas, loading and unloading zones, and drive-up service windows.
   a. Comply with recommendations of AASHTO "A Policy on Geometric Design of Highways and Streets", 2004.
   b. Minimum Widths: Traffic lanes not less than 11 ft wide.
   c. Maximum Slopes: 1:10.
   d. Curbs: Minimum 4 inch barrier curbs at all roadways and driveways.
   e. Traffic Lanes and Directional Markings: Permanent and highly visible, minimum width of 4 in.

4. Parking Areas: Provide paved surfaces as required for surface vehicular parking.
   a. Minimum Width of Automobile Parking Spaces: 114 in.
   b. Minimum Width of Motorcycle Parking Spaces: 52 in.
   c. Space Markings: Permanent and highly visible, minimum width of 4 in.
   d. Parking Signage: As required by code and program.

5. Walkways, Pedestrian Ramps, and Exterior Stairs: Provide paved surfaces as required for pedestrian movement on the site without damage to landscaping.
   a. Minimum Widths: Sized to permit 3 persons walking abreast
      1) Secondary Entrances and Emergency Exits: 48 in.
      2) Major Routes: 60 in.
   b. Handrails, Railings, or Protective Walls: Required when pedestrian surfaces are more than 12 in above adjacent grade.

6. Where pavements and surfacing are integral with elements defined within another element group, meet requirements of both element groups.

7. In addition to the requirements of this section, comply with all applicable requirements of Section 111-Facility Performance, Section G-Sitework and Section G2-Site Improvements and Sections A-Substructure and Section B-Shell.

B. Amenity and Comfort:

1. Accessibility:

a. Comply with ADAAG-1994.
b. Parking: Provide not fewer than 3 accessible parking spaces in addition to the number required under ADAAG-1994 in each parking area.
c. Van Accessibility: Provide not fewer than 1 van accessible parking space in addition to the number required under ADAAG-1994 in each parking area and on each level of the Parking Structure.
d. Pedestrian Ramps: Limit slope to maximum of 1:16 and rise to maximum of 24 in in any run.

2. Stair Comfort:
   a. Steepness: Provide exterior stairs with risers of not more than 6.5 inches and treads sized so that twice the riser height plus the tread depth totals 24 to 25 inches.

3. Appearance:
   a. Vehicular Paving: Design and construct paving to achieve plain, utilitarian appearance.
   b. Pedestrian Walkways at crosswalks: Provide pedestrian walking surfaces that contrast with vehicular paving and achieve smooth, consistent appearance.
   c. Curbs and Gutters: Provide smooth, rounded shapes that contrast with roadway, and walkway surfaces for maximum visibility.
   d. Handrails, Guardrails, and Protective Walls: Provide materials and finishes that are consistent with building exterior in appearance.

C. Health and Safety:

1. Safety of Pedestrian Surfaces:
   a. Slip Resistance: Provide walking surfaces of exterior stairs, ramps, and walkways with a minimum static coefficient of friction of 0.80, measured in accordance with ASTM D 2047-2004.

2. Safety of Vehicular Areas:
   a. Traffic Signs and Signals: Provide highly visible signs and signals as required to regulate traffic for safety and convenience.
      1) Comply with requirements of NREL Standards for placement and design.

D. Structural:

1. Exterior Stairs, Ramps, and Elevated Walkways: Capable of supporting loads in excess of those required by code, as follows:

   a. Live Load: Minimum 150 psf (72 kPa).

   b. Concentrated Load: Minimum 400 pounds (1779 N) at any point.

2. Exterior Handrails, Guards, and Guardrails: Capable of resisting forces in excess of those required by code, as follows:

   a. Uniform Load: Minimum 50 lb/ft (0.73 kN/m) applied in any direction at the top.

   b. Concentrated Load: Minimum 200 pounds (890 N) applied in any direction at any point along the top.

   c. Normal Load to Intermediate Rails or Guard: Minimum 50 pounds (222 N) horizontally applied to area of not more than 1 foot square (305 mm square).

3. Substantiation:

a. Construction Documents: Engineering calculations, stamped by a registered structural engineer.

E. Durability:

1. Service Life Span of exterior (exclusive of Parking Structure) Paved Surfaces: 20 years, under normally anticipatable usage. Reference Section A-Substructure, A1-Foundations, A13-Floors On Grade B-Shell, B1-Superstructure, and B11-Elevated Floors for additional requirements.

2. Traffic Resistance: Design and construct pavement to accommodate traffic as follows, based on procedures in AASHTO GDPS-1993(supp98) and GDPS3-V2-1986, Guide for Design of Pavement Structures:
   a. Category A: Parking areas and access lanes for automobiles and motorcycles.
   b. Category B: Truck access lanes for average daily truck traffic of 15 vehicles with 6 wheels or more.
   c. Category D: Site and Parking entrances and traffic lanes for heavy trucks, with average daily traffic of up to 5 vehicles.

3. Substantiation:
   a. Proposal: Basis for design of pavement section based on information provided.
   b. Design Development: Identification of proven-in-use surfaces of the same type, for inspection by NREL.
   c. Design Development: Identification of erosion controls. Indicate phasing of BMPs for initial, interim and final phases of construction.
   d. Construction Documents: Computations to establish pavement strength and thickness, stamped by a registered civil or structural engineer.

END OF SECTION G21

G22 - SITE FIXTURES AND EQUIPMENT

PERFORMANCE

A. Basic Function:

1. Provide all fixtures, equipment (other than that associated with services), and miscellaneous structures located out-of-doors that are required by the program and that are required as a result of these and other requirements.

2. Site fixtures and equipment that are required include:
   a. Site furnishings, including:
      1) Outdoor seating.
      2) Waste receptacles.
      3) Bicycle racks: Weather Protected (May be located in Parking Structure)
      4) Flagpole at Site Entrance Building Entry.
   b. Outdoor signs, including:
      1) Vehicular and Pedestrian Wayfinding throughout the project.
   c. Minor site structures, including:
      1) Bus stop shelter at Shuttle Bus Pickup/Dropoff.

3. Where site fixtures and equipment elements also must function as elements defined within another element group, meet the requirements of both element groups.

4. In addition to the requirements of this section, comply with all applicable requirements of Section 111-Facility Performance, Section G-Sitework, and Section G2-Site Improvements.

B. Health and Safety:

C. Structure:

1. Covered (weather protected) Bicycle Racks: Constructed of materials strong enough to resist forces generated by attempted forcible removal of bicycle.

D. Durability:

1. Service Life:
   a. Minor Site Structures: Same as for equivalent building elements.
   b. Other Fixed Site Improvements: 25 years under normal use and weather.
   c. Substantiation:
      1) Construction Documents: Proven-in-use data.

2. Weather Resistance: Same as specified for components of exterior shell in Section B-Shell.

PRODUCTS

A. Permanent Site Fixtures:

1. Use products made of one of the following:
   a. Cast-in-place concrete.
   b. Precast concrete.
   c. Aluminum.
   d. Bronze.
   e. Stainless steel.

B. Site Furnishings:

1. Use products made of one of the following:
    a. Cast-in-place concrete.
    b. Precast concrete.
    c. Aluminum.
    d. Bronze.
    e. Stainless steel.
    f. Masonry.

C. Signs:

1. Match existing signs on Campus.

2. Do not use:
    a. Signs painted on the face of the exterior wall.

D. Flagpoles (10350): Type as required, fixed.

END OF SECTION G22

G23 - LANDSCAPING

PERFORMANCE

A. Basic Function:

1. Provide landscaping over all areas of the site not finished with paving, surfacing, or buildings.
2. Landscape planting features that are required are:
   a. Turf for ornamental or erosion-control purposes.
   b. Improvement of appearance of natural and functional features including the following:
      1) Site Entrance Building approach.
3. Subcontractor shall provide non-permanent irrigation equipment as required to accomplish NREL's maintenance activities.
4. Where landscaping elements also must function as elements defined within another element group, meet the requirements of both element groups.
5. In addition to the requirements of this section, comply with all applicable requirements of Section 111-Facility Performance, Section G-Sitework, and Section G2-Site Improvements.

B. Durability:

1. Service Life: It is understood that ultimate survival of plants will depend on weather conditions as well as maintenance; however, the Subcontractor is responsible for providing plants that will survive under the specified conditions when maintained according to both the procedures specified and the procedures furnished by the Subcontractor at closeout.
   a. Soil: Suitable for growing the plants provided, with adequate nutrients for the first year of growth, based on recommendations of established authorities.
   b. The Subcontractor shall provide maintenance of all plants, including irrigation, during the initial establishment period, as follows:
      1) Trees and Shrubs: 6 months.
      2) Seeded Turf: 120 days.
      3) Sodded Turf: 120 days.
      4) Other Plants: 30 days.
   c. At the end of one year after completion, if any plants are dead, dying, or wilting, the Subcontractor shall replace them with other plants of better weather resistance, care for the replacement plants during their establishment period, and furnish maintenance data to the NREL.
2. Weather Resistance:
   a. Trees and Woody Shrubs: Sustainable without supplemental irrigation.
   b. Mulch: Where soil would otherwise be exposed around individual plants, cover soil with mulch that allows penetration of precipitation but minimizes evaporation; type of mulch coordinated with erosion resistance requirements.
3. Accidental Damage:
   a. Plants in Beds: Where planting beds adjoin turf areas, edge of turf shaped for ease of mowing with motorized equipment without damage to plants in beds.
4. Insect and Disease Resistance: Avoid the use of plants and turf that are known to be subject to insect damage or disease.

C. Operation and Maintenance:

1. Irrigation Water Source: Same as building supply.

2. Ease of Maintenance:
   a. Turf: Do not use areas of turf that cannot be mowed with motorized equipment.
   b. Plants: Arranged for ease of access for weeding, mulching, and watering.
   c. Shrubs and Woody Plants: Do not use plants that require routine annual or seasonal pruning.
   d. Non-Woody Plants: Do not use plants that are not perennial.

END OF SECTION G23

G3 - SITE SERVICES

PERFORMANCE

A. Basic Function:

1. See Section D-Services for basic requirements for services.
2. Provide the following site services:
   a. Water Supply: Means of supplying and distributing water for all purposes required in buildings and on site. See Section D2-Water and Drainage for additional requirements.
   b. Sanitary Sewer: Means of removing liquid waste generated in buildings on site. See Section D2-Water and Drainage for additional requirements.
   c. Storm Sewer: Means of removing and controlling rainwater runoff from buildings and site areas. See Section D2-Water and Drainage for additional requirements.
   d. Electrical Power: Adequate supply of power for project functions. See Section D5-Electrical Power for additional requirements.
      1) Provide underground electrical distribution system for all improvements on site.
   e. Site Elements of Artificial Lighting: See Section D6-Artificial Lighting and D62-Exterior Area Lighting.
   f. Site Elements of Surveillance and Security Controls: See Section D9-Other Services and D92-Surveillance and Security Controls.
3. Where site services elements must also function as elements defined within another element group, meet requirements of both element groups.
4. In addition to the requirements of this section, comply with all applicable requirements of Section 111-Facility Performance, Section D-Services, and Section G-Site Work.

B. Amenity and Comfort:

1. Leakage: Provide distribution systems which are leak-free.
2. Accessibility: Provide clearances around components that are adequate for service and use.

C. Health and Safety:

1. Safety Hazards: Avoid safety hazards wherever possible; where services must involve flammable materials or hazardous operations, comply with code.
2. Unauthorized Access: Provide locking devices to stop unauthorized access.
3. Excess Pressure: Design pressurized components to withstand operational pressures without failure and to relieve or reduce excessive pressure to prevent failure.
4. Electrical Shock: Isolate electrical conductors from personnel.
5. Misuse: Minimize misuse that could result in damage to property, injury, or loss of life.
6. Hazardous Materials: Piping carrying potentially hazard creating materials clearly labeled.
7. Vermin Resistance: Use components that are resistant to the entry of rodents and insects.

D. Structure:

1. Concealed or Buried Piping and Components: Design cover or concealment so that they are not subjected to damaging stresses due to applied loads.

2. Supports for Piping and Components: Support piping and components using the following:
   a. Supports that allow movement of the pipe without undue stress on the piping, tubes, fittings, components, or foundations.
   b. Substantiation:
      1) Design Development: Details of supports, concealments, and buring, including engineering analysis.

3. Structural Design of Components and Their Supports: In accordance with code.
   a. Safety Factor for Component Structural Elements: Two; based on weight of component.
   b. Anchors: Securely and positively attach piping to supports.

E. Durability:

1. Service Life Span: Same as the service life of the building, except as follows:
   a. Piping: Same as service life of building.
   b. Piping and Components Permanently Installed Underground or Encased in Concrete: Same as service life of building.
   c. Shut-Off Valves and Similar Components: Same as service life of building.
   d. Hydrants: Same as building service life.
   e. Electrical Equipment: Minimum of 25 without failure.

2. Weather Resistance:
   a. Burial Depth of Piping: NREL standard depth for water NEC or NREL standard for Electrical.
   b. Electrical Equipment: Provide equipment which is waterproof.

3. Corrosion Resistance: Prevent corrosion by using corrosion-resistant materials, by preventing galvanic action, by preventing contact between metals and concrete and masonry, and by preventing condensation on metals.
   a. Metals Considered Corrosion-Resistant: Aluminum, stainless steel, brass, bronze, cast iron, ductile iron, malleable iron, hot-dipped galvanized steel, chrome-plated steel, cadmium-plated steel, and steel coated with high-build epoxy or coal tar-based paint.
   b. Underground Elements: Provide supplementary protection for underground metal pipes and tanks, sufficient to prevent corrosion completely, for the service life of the element without maintenance.
      1) 3 inches of seamless concrete cover is considered to be permanent protection.
      2) Bituminous or other waterproof coating or wrapping is considered permanent protection unless cathodic protection is required and unless underground element is subject to movement due to structural loads or thermal expansion or contraction.
      3) Provide cathodic protection if any of the following is true; coatings or wrappings will not be considered sufficient protection for elements falling under these criteria:
         a) Metal elements are submerged or buried in a soil environment known to cause corrosion on similar nearby structures.
         b) Metal elements are submerged and buried in a soil environment in which stray DC electrical currents are present.

4. Resistance to Accidental Damage and Abuse:
   a. Provide barriers or protected locations for services, to prevent damage due to vehicular traffic.
   b. Buried Components: Minimum of 18 inches below surface of ground.
   c. Underground Piping: Watertight and rootproof.

F. Operation and Maintenance:

1. Capacity:
   a. Water and Drainage: As required by code and as specified in Section D2-Water and Drainage.
   b. Fire Protection: As required by code and as specified in Section D4-Fire Protection.
   c. Substantiation:
      1) Preliminary Design: Description of systems required, sources, input-side capacities, and means of distribution.
      2) Design Development: Engineering calculations showing input- and output-side capacities and loads and sizes of distribution elements.
      3) Construction Documents: Complete system details.
      4) Construction and Closeout: Functional performance testing, as specified in Part 1-Design & Construction Procedures.

2. Ease of Maintenance:
   a. Piping: Provide means of isolating portions of piping system, so that small portions may be shut down leaving the remainder in operation, by using isolation valves located so that drainage of the entire system is not required for repair.

3. Provision for Change and Future Capacity:
   a. Provide electrical equipment which can be modified to increase service capacity in the future.

END OF SECTION G3

Energy Appendix

Merged from separate file

Ingress/Egress Energy Target Definitions

Guard House and Parking Garage

Updated: 3/5/2010

Guard House

9300 kWh Annual Goal. This goal is intended to serve as a mechanism to create a building that uses less than this energy intensity annually within its own footprint. The goal is a demand-side goal to be achieved through energy efficiency strategies. Supply-side renewable generation options such as PV, biomass, wind, or renewable energy credits do not count toward the 9300 kWh goal. The intent is to use the goal as a tool to develop a comprehensive program of efficiency measures and building operational strategies and policies to reduce energy use in the building as the first priority, rather than encouraging the use of supply side renewable options coupled with a less efficient building where all energy efficiency options have not been first fully exploited.

- The whole building energy use will be measured at the building footprint. It includes all loads in the building for lighting, HVAC, plug loads, and other miscellaneous equipment connected through the building, such as transformers and control systems. It also includes any façade lighting.
- All losses from transformers and inverters are considered part of this energy calculation.
- Under this definition, PV on or through the building will be considered a supply side technology, and not count toward the 9300 kWh goal.
- Daylighting, natural ventilation, transpired collectors, Trombe walls, solar hot water, and other such technologies are considered demand side technologies.
- Plug loads will be included in the demand side calculation.
    - Equipment included in the annual energy goal derivation:
        - One Dell Latitude E6400 Laptop, and docking station per occupant
        - Two Dell 24” G2410h LCD Monitors per occupant
        - One all-in-one machine
        - One LED task light per occupant
        - One VOIP phone per occupant
        - One refrigerator
        - One coffee pot/maker
        - One microwave
        - One visitor badge printer
        - One visitor badge camera, scanner and signature pad
        - Four flashlight chargers
        - One radio battery charger
        - Unspecified miscellaneous load of 0.1 W/ft^2
        - Whole building HVAC load of 7 kBtu/ft^2
        - Whole building Lighting load of 4 kBtu/ft^2
        - One Samsung 55” UN55C6500VF LED TV

The goal 9300 kWh annually was derivation an assumption of 5 people total, three people during the day and two people during the night in two shifts, in a 1000 ft^2 building. A base energy use intensity (EUI) of 32 kBtu/ft^2 was calculated based on campus energy standards for new construction and plug load measurements of the existing Site Entrance Building.

ZEB Goal. Once the building has achieved the energy efficiency goal, it is possible to capture renewable energy sources to offset the consumption of the building. It is desired to use a Site and Source ZEB

building as defined by Torcellini and Pless in “Zero Energy Buildings: A Critical Look at the Definition”[1]. Possible renewable energy generation options include electricity generation from PV on the building, new PV generation at NREL’s site and solar hot water collectors.

This means that a Zero Energy Building would have zero (or less) source or site energy use, as defined in equation 1 and 2:

Equation 1:

Net Source Use (kWh) =

Whole building electricity use (not including PV) * 2.894

– new PV generation on NREL site * 2.75

– PV generation connected through the building * 2.894

Equation 2:

Net Site Use (kWh) =

Whole building electricity use (not including PV)

– PV generation connected through the building

Notes:

• All energy units measured or determined in kWh.

• PV generated on the building is valued slightly higher (5%) than PV energy generated on the site due to no transmission, distribution, or transformer losses.

• Electricity site to source multiplier of 2.894 based on Deru and Torcellini[2] .

1 Torcellini, P., Pless, S., Deru, M. Crawley, D.; (2006). Zero *Energy Buildings: A Critical Look at the Definition.* Paper #417, Proceedings (CD-ROM), ACEEE Summer Study on Energy Efficiency in Buildings, August 13−18, 2006, Pacific Grove, CA. National Renewable Energy Laboratory, Golden, CO. 12 pp. http://www.nrel.gov/docs/fy06osti/39833.pdf (PDF 477 KB).

2 Deru, M.; Torcellini, P. (2006). *Source Energy and Emission Factors for Energy Use in Buildings*. Technical Report NREL/TP-550-38617. Golden, CO: National Renewable Energy Lab. http://www.nrel.gov/docs/fy06osti/38617.pdf.

Parking Garage

175 kBtu per Parking Space Annual Goal. This goal is intended to serve as a mechanism to create a building that uses less than this energy intensity annually within its own footprint. The goal is a demand-side goal to be achieved through energy efficiency strategies. Supply-side renewable generation options such as PV, wind, or renewable energy credits do not count toward the 175 kBtu per parking space goal. The intent is to use the goal as a tool to develop a comprehensive program of efficiency measures and building operational strategies and policies to reduce energy use in the building as the first priority, rather than encouraging the use of supply side renewable options coupled with a less efficient building where all energy efficiency options have not been first fully exploited.

• The whole building energy use will be measured at the building footprint. It includes all loads in the building: lighting, security cameras and other miscellaneous equipment connected through the building, such as transformers and control systems.

• All losses from transformers and inverters are considered part of this energy calculation. Use of direct current lighting that can use the 100,000 kWh PV allotment for the garage will be considered for a to-be-determined credit.

• Under this definition, PV on or through the building will be considered a supply side technology, and not count toward the 9300 kWh goal.

• Daylighting and natural ventilation are considered demand side technologies.

• Based on NREL occupancy data and a typical parking structure daylighting study, the EUI recommendation of 175 kBtu/parking space/year is based on:

- 0.05 W/ft2 LPD
- 25% hours of operation for daytime hours (75% reduction on maximum LPD)
- 25% hours of operation for nighttime hours (75% reduction on maximum LPD)
- Full annual operating schedule
- Approximately 0.10 kBtu/ft^2/year controls allowance
- 8.5’ x 19.5’ parking space
- Transition area equals one and a half times and parking space area

With 1,500 or 1,800 spaces, the design will fit within the 100,000 kWh PV allotment for the structure.

Excluded loads from the energy goal include:

- Power for recharging stations
- Power for intermittent plug loads such as those incurred by power washing structure surfaces

Continuous load due to transformers required for the plug loads should be included when calculating the annual energy goal.