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65% Submittal by RESPEC to Southcentral Foundation (SCF) for:

VNPCC Expansion Commissioning Requirements

Document includes:

65% Cx Specs (019113; 01911.43; 210800; 220800; 230800; and 260800)
65% Cx MEL
65% Cx Plan
65% OPR

SECTION 01 91 13

GENERAL COMMISSIONING REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. General requirements for coordinating and scheduling commissioning.
2. Commissioning meetings.
3. Commissioning reports.
4. Use of test equipment, instrumentation, and tools for commissioning.
5. PreFunctional checklist, including, but not limited to, installation checks, startup, performance tests, and performance test demonstration.
6. Functional performance tests and Functional Performance Test demonstration.
7. Adjusting, verifying, and documenting identified systems and assemblies.
8. Integrated System functional performance test guidelines.

B. Related Requirements:

1. Section 013000 "Administrative Requirements" for Administrative requirements including submittal procedures requirements for commissioning.
2. Section 017000 "Execution and Closeout Requirements" for certificate of Construction Phase Commissioning Completion submittal requirements.
3. Section 019119.43 “Exterior Enclosure Commissioning” for technical commissioning requirements for the exterior enclosure.
4. Section 210800 "Commissioning of Fire Suppression" for technical commissioning requirements for fire suppression.
5. Section 220800 "Commissioning of Plumbing" for technical commissioning requirements for plumbing.
6. Section 230800 "Commissioning of HVAC" for technical commissioning requirements for HVAC.
7. Section 260800 "Commissioning of Electrical Systems" for technical commissioning requirements for electrical systems.

1.2 DEFINITIONS

A. Acceptance Criteria: Threshold of acceptable work quality or performance specified for a commissioning activity, including, but not limited to, prefunctional

checklist, performance tests, performance test demonstrations, Functional performance tests and Functional performance test demonstrations.

B. Basis-of-Design Document: A document prepared by the Architect that records concepts, calculations, decisions, and product selections used to comply with Owner's Project Requirements and to suit applicable regulatory requirements, standards, and guidelines.

C. Commissioning Authority: An entity engaged by Owner, and identified in Section 011000 "Summary of Work," to evaluate Commissioning-Process Work.

D. Commissioning Plan: A document, prepared by Commissioning Authority, that outlines the organization, schedule, allocation of resources, and documentation requirements of commissioning.

E. Commissioning: A quality-focused process for verifying and documenting that the facility and all of its systems and assemblies are planned, designed, installed, and tested to comply with Owner's Project Requirements. The requirements specified here are limited to the construction phase commissioning activities. The scope of commissioning is defined in Section 011000 "Summary of Work."

F. Construction Phase Commissioning Completion: The stage of completion and acceptance of commissioning when resolution of deficient conditions and issues discovered during commissioning and retesting until acceptable results are obtained has been accomplished. Owner will establish in writing the date Construction Phase Commissioning Completion is achieved. See Section 017000 "Execution and Closeout Procedures" for certificate of Construction Phase Commissioning Completion submittal requirements.

1. Commissioning is complete when the work specified in this Section and related Sections has been completed and accepted, including, but not limited to, the following:

    a. Completion of tests and acceptance of test results.
    b. Resolution of issues, as verified by retests performed and documented with acceptance of retest results.
    c. Comply with requirements in Section 017900 "Demonstration and Training."
    d. Completion and acceptance of submittals and reports.

G. Owner's Project Requirements: A document written by Owner, Architect, or Commissioning Authority that details the functional requirements of a project and the expectations of how it will be used and operated, including Project goals, measurable performance criteria, cost considerations, benchmarks, success criteria, and supporting information.

H. Owner's Witness: Commissioning Authority, Owner's Project Manager, or Architect-designated witness authorized to authenticate test demonstration data and to sign completed test data forms.

I. "Systems," "Assemblies," "Subsystems," "Equipment," and "Components": Where these terms are used together or separately, they shall mean "as-built" systems, assemblies, subsystems, equipment, and components.

J. Test: Performance tests, performance test demonstrations, Functional performance tests, and Functional performance test demonstrations.

K. Sampling Procedures and Tables for Inspection by Attributes: As defined in ASQ Z1.4.

1.3 COMPENSATION

A. Should Architect, Commissioning Authority, other Owner's witness, or Owner's staff perform additional services or incur additional expenses due to actions of Contractor listed below, compensate Owner for such additional services and expenses.

1. Failure to provide timely notice of commissioning activities schedule changes.
2. Failure to meet acceptance criteria for test demonstrations.

B. Contractor shall compensate Owner for such additional services and expenses at the professional's billing rate per labor hour plus travel expenses plus per diem allowances for meals and lodging according to current U.S. General Services Administration (GSA) Per Diem Rates.

1.4 COMMISSIONING TEAM

A. Members Appointed by Contractor(s):

1. Commissioning Coordinator: A person or entity employed by Contractor to manage, schedule, and coordinate commissioning.
2. Project superintendent and other employees that Contractor may deem appropriate for a particular portion of the commissioning.
3. Subcontractors, installers, suppliers, and specialists that Contractor may deem appropriate for a particular portion of the commissioning.
4. Appointed team members shall have the authority to act on behalf of the entity they represent.

B. Members Appointed by Owner:

1. Commissioning authority, plus consultants that Commissioning Authority may deem appropriate for a particular portion of the commissioning.
2. Owner representative(s), facility operations and maintenance personnel, plus other employees, separate contractors, and consultants that Owner may deem appropriate for a particular portion of the commissioning.
3. Architect, plus employees and consultants that Architect may deem appropriate for a particular portion of the commissioning.

1.5 SUBMITTALS

A. Comply with requirements in Section 013000 "Administrative Procedures" for submittal procedures general requirements for commissioning.

B. INFORMATIONAL SUBMITTALS
   1. Commissioning Plan Information:
      a. List of Contractor-appointed commissioning team members to include specific personnel and subcontractors to the performance of the various commissioning requirements.
      b. Schedule of commissioning activities, integrated with the construction schedule. Comply with requirements in Section 013100 "Project Management and Coordination" for construction schedule general requirements for commissioning.
      c. Contractor personnel and subcontractors to participate in each test.
      d. List of instrumentation required for each test to include identification of parties that will provide instrumentation for each test.
   2. Commissioning schedule.
   3. Two-week look-ahead schedules.
   4. Commissioning Coordinator Letter of Authority
   5. Commissioning Coordinator Qualification Data:
   6. List test instrumentation, equipment, and monitoring devices. Include the following information:
      a. Make, model, serial number, and application for each instrument, equipment, and monitoring device.
      b. Brief description of intended use.
      c. Calibration record showing the following:
         1) Calibration agency, including name and contact information.
         2) Last date of calibration.
         3) Range of values for which calibration is valid.
         4) Certification of accuracy.
         5) N.I.S.T. traceability certification for calibration equipment.
         6) Due date of the next calibration.
   7. Test Reports:
      a. Pre-Startup Report: Prior to start up of equipment or a system, submit signed, completed prefunctional checklist.
      b. Test Data Reports: At the end of each day in which tests are conducted, submit test data for tests performed.

c. Commissioning Issues Reports: Daily, at the end of each day in which tests are conducted, submit commissioning issue reports for tests for which acceptable results were not achieved.
d. Weekly Progress Report: Weekly, at the end of each week in which tests are conducted, submit a progress report.
e. Data Trend Logs: Submit data trend logs at the end of the trend log period.
f. System Alarm Logs: Daily, at the start of days following a day in which tests were performed, submit print-out of log of alarms that occurred since the last log was printed.

8. Prefunctional Checklist:
   a. Material checks.
   b. Installation checks.
   c. Startup procedures, where required.

C. CLOSEOUT SUBMITTALS
1. Commissioning Report:
   a. At Construction Phase Commissioning Completion, include the following:
      1) Pre-startup reports.
      2) Approved test procedures.
      3) Test data forms, completed and signed.
      4) Progress reports.
      5) Commissioning issues report log.
      6) Commissioning issues reports showing resolution of issues.
      7) Correspondence or other documents related to resolution of issues.
      8) Other reports required by commissioning.
      9) List unresolved issues and reasons they remain unresolved and should be exempted from the requirements for Construction Phase Commissioning Completion.
      10) Report shall include commissioning work of Contractor.
2. Request for Certificate of Construction Phase Commissioning Completion.
3. Operation and Maintenance Data. For proprietary test equipment, instrumentation, and tools to include in operation and maintenance manuals.

1.6 QUALITY ASSURANCE

A. Commissioning Coordinator Qualifications:

1. Documented experience commissioning systems of similar complexity to those contained in these documents on at least [**three**] <**Insert number**> projects of similar scope and complexity.

2. Certification of commissioning process expertise. The following certifications are acceptable. Owner reserves the right to accept or reject certifications as evidence of qualification.

    a. Certified Commissioning Professional, by Building Commissioning Association.
    b. Commissioning Process Management Professional, by American Society of Heating, Refrigerating and Air-Conditioning Engineers.
    c. Accredited Commissioning Process Authority Professional, by University of Wisconsin.
    d. Accredited Commissioning Process Manager, by University of Wisconsin.
    e. Accredited Green Commissioning Process Provider, by University of Wisconsin.

B. Calibration Agency Qualifications: Certified by The American Association of Laboratory Accreditation that the calibration agency complies with minimum requirements of ISO/IEC 17025.

1.7 COMMISSIONING AUTHORITY'S RESPONSIBILITIES

A. Commissioning Authority Responsibilities: Comply with requirements in Section 011000 "Summary of Work."

PART 2 - PRODUCTS

2.1 TEST EQUIPMENT, INSTRUMENTATION, AND TOOLS

A. Test equipment and instrumentation required to perform the commissioning shall remain the property of Contractor unless otherwise indicated.

B. Test equipment and instrumentation required to perform commissioning shall comply with the following criteria:

1. Be manufactured for the purpose of testing and measuring tests for which they are being used and have an accuracy to test and measure system performance within the tolerances required to determine acceptable performance.
2. Calibrated and certified.

    a. Calibration performed and documented by a qualified calibration agency according to national standards applicable to the tools and instrumentation being calibrated. Calibration shall be current according to national standards or within test equipment and instrumentation manufacturer's recommended intervals, whichever is

more frequent, but not less than within six months of initial use on Project. Calibration tags permanently affixed.

b. Repair and recalibrate test equipment and instrumentation if dismantled, dropped, or damaged since last calibrated.

3. Maintain test equipment and instrumentation.
4. Use test equipment and instrumentation only for testing or monitoring Work for which they are designed.

2.2 PROPRIETARY TEST EQUIPMENT, INSTRUMENTATION, AND TOOLS

A. Proprietary test equipment, instrumentation, and tools are those manufactured or prescribed by tested equipment manufacturer and required for work on its equipment as a condition of equipment warranty, or as otherwise required to service, repair, adjust, calibrate or perform work on its equipment.

1. Identify proprietary test equipment, instrumentation, and tools required in the test equipment identification list submittal.
2. Proprietary test equipment, instrumentation, and tools shall become the property of Owner at Substantial Completion.

2.3 REPORT FORMAT AND ORGANIZATION

A. General Format and Organization:
1. Electronic Data: Portable document format (PDF); a single file with outline-organized bookmarks for major and minor tabs and tab contents itemized for specific reports.

B. The Commissioning Authority shall compile and prepare a Commissioning Report containing:

1. Include a table of contents and an index to each test.
2. Include major tabs for each Specification Section.
3. Include minor tabs for each test.
4. Within each minor tab, include the following:

a. Test specification.
b. Pre-startup reports.
c. Approved test procedures.
d. Test data forms, completed and signed.
e. Commissioning issue reports, showing resolution of issues, and documentation related to resolution of issues pertaining to a single test. Group data forms, commissioning issue reports showing resolution of issues, and documentation related to resolution of issues for each test repetition together within the minor tab, in reverse chronological order (most recent on top).

PART 3 - EXECUTION

3.1 PREPARATION

A. Review preliminary Prefunctional Checklist and preliminary test procedures and data forms.

3.2 PREFUNCTIONAL CHECKLIST

A. Prefunctional checklist cannot modify or conflict with the Contract Documents.

B. The Commissioning Agent will create prefunctional checklist based on actual systems and equipment to be included in Project.

C. Material Checks: Compare specified characteristics and approved submittals with materials as received. Include factory tests and other evaluations, adjustments, and tests performed prior to shipment, if applicable.

1. Services connection requirements, including configuration, size, location, and other pertinent characteristics.
2. Included optional features.
3. Delivery Receipt Check: Inspect and record physical condition of materials and equipment on delivery to Project site, including agreement with approved submittals, cleanliness and lack of damage.

D. Installation Checks:
1. Location according to Drawings and approved Shop Drawings.
2. Configuration.
3. Compliance with manufacturers' written installation instructions.
4. Attachment to structure.
5. Access clearance to allow for maintenance, service, repair, removal, and replacement without the need to disassemble or remove other equipment or building elements. Access coordinated with other building elements and equipment, including, but not limited to, ceiling and wall access panels, in a manner consistent with OSHA fall-protection regulations and safe work practices.
6. Utility connections are of the correct characteristics, as applicable.
7. Correct labeling and identification.

E. Startup Checks: Verify readiness of equipment to be energized. Include manufacturer's standard startup procedures and forms.

F. Startup: Perform and document initial operation of equipment to prove that it is installed properly and operates as intended according to manufacturer's standard startup procedures, minimum.

G. Performance Tests:

1. Static Tests: As specified elsewhere, including, but not limited to, duct and pipe leakage tests, insulation-resistance tests, and water-penetration tests.
2. Component Performance Tests: Tests evaluate the performance of an input or output of components under a full range of operating conditions.
3. Equipment and Assembly Performance Tests: Test and evaluate performance of equipment and assemblies under a full range of operating conditions and loads.
4. System Performance Tests: Test and evaluate performance of systems under a full range of operating conditions and loads.
5. Intersystem Performance Tests: Test and evaluate the interface of different systems under a full range of operating conditions and loads.

H. Deferred PreFunctional Checklist: Obtain Owner approval of proposed deferral of prefunctional checklist, including proposed schedule of completion of each deferred prefunctional checklist, before submitting request for Certificate of Construction Phase Commissioning Completion. When approved, deferred prefunctional checklist may be completed after date of Construction Phase Commissioning Completion. Include the following in request for Certificate of Construction Phase Commissioning Completion:

1. Identify deferred prefunctional checklist by number and title.
2. Provide a target schedule for completion of deferred prefunctional checklist.
3. Written approval of proposed deferred prefunctional checklist, including approved schedule of completion of each deferred construction checklist.

I. Delayed PreFunctional checklist: Obtain Owner approval of proposed delayed PreFunctional checklist, including proposed schedule of completion of each delayed construction checklist, before submitting request for Certificate of Construction Phase Commissioning Completion. When approved, delayed prefunctional checklist may be completed after date of Construction Phase Commissioning Completion. Include the following in request for Certificate of Construction Phase Commissioning Completion:

1. Identify delayed prefunctional checklist by number and title.
2. Provide a target schedule for completion of delayed prefunctional checklist.
3. Written approval of proposed delayed prefunctional checklist, including approved schedule of completion of each delayed construction checklist.

3.3 GENERAL EXECUTION REQUIREMENTS

A. Schedule and coordinate commissioning with the construction schedule.

B. Perform activities identified in prefunctional checklist, including tests, and document results of actions as construction proceeds.

C. Perform test demonstrations for Owner's witness. Unless otherwise indicated, demonstrate tests for 100 percent of work to which the test applies. In some instances, demonstration of a random sample of other than 100 percent of the results of a test is specified.

1. Where sampling is specified, the sampling plan and procedure for the test demonstration shall be determined using ASQ Z1.4.

a. General Inspection: [**Level I**] [**Level II**] [**Level III**] <**Insert level**>.
b. Special Inspection: [**Level S-1**] [**Level S-2**] [**Level S-3**] [**Level S-4**] <**Insert level**>.
c. Acceptance Quality Limit (AQL) of [**1.5**] <**Insert AQL**>.

2. The "lot size" in ASQ Z1.4 is the sum of the number of items to which the test demonstration applies, as described in the scope subparagraph of each test.
3. On determination of the sample size, the samples shall be selected randomly by Owner's witness at the time of the test demonstration.
4. Include in the Commissioning Plan a detailed list of the test demonstrations with lot and sample quantities for each test.

D. Report test data and commissioning issue resolutions.

E. Schedule personnel to participate in and perform Commissioning-Process Work.

F. Installing contractors' commissioning responsibilities include, but are not limited to, the following:

1. Operating the equipment and systems they install during tests.
2. In addition, installing contractors may be required to assist in tests of equipment and systems with which their work interfaces.

3.4 CONTRACTOR'S RESPONSIBILITIES

A. Management and Coordination: Manage, schedule, and coordinate commissioning, including, but not limited to, the following:

1. Coordinate with subcontractors on their commissioning responsibilities and activities.
2. Obtain, assemble, and submit commissioning documentation.
3. Attend periodic on-site commissioning meetings. Comply with requirements in Section 013100 "Project Management and Coordination."

4. Develop and maintain the commissioning schedule. Integrate commissioning schedule into the construction schedule. Update schedule at specified intervals.
5. Review and comment on preliminary test procedures and data forms.
6. Report inconsistencies and issues in system operations.
7. Verify that tests have been completed and results comply with acceptance criteria, and that equipment and systems are ready before scheduling test demonstrations.
8. Direct and coordinate test demonstrations.
9. Coordinate witnessing of test demonstrations by Owner's witness.
10. Coordinate and manage training. Be present during training sessions to direct video recording, present training and direct the training presentations of others. Comply with requirements in Section 017900 "Demonstration and Training."
11. Provide the documentation to the Commissioning Authority for the preparation and submission of specified commissioning reports.
12. Track commissioning issues until resolution and retesting is successfully completed.
13. Retain original records of Commissioning-Process Work, organized as required for the commissioning report. Provide access by Owner to these records on request.
14. Provide documentation to the Commissioning Authority for the assembly and submission of the commissioning report.

3.5 FUNCTIONAL PERFORMANCE TESTING

A. Quality Control: PreFunctional checklist, including tests, are quality-control tools designed to improve the functional quality of Project. Test demonstrations evaluate the effectiveness of Contractor's quality-control process.

B. Owner's witness will be present to witness commissioning work requiring the signature of an owner's witness, including, but not limited to, test demonstrations. Owner's project manager will coordinate attendance by Owner's witness with Contractor's published commissioning schedule. Owner's witness will provide no labor or materials in the commissioning work. The only function of Owner's witness will be to observe and comment on the progress and results of commissioning.

C. PreFunctional Checklist:

1. Complete prefunctional checklist as Work is completed.
2. Distribute prefunctional checklist to installing contractors before they start work.
3. Installers:

a. Verify installation using approved prefunctional checklist as Work proceeds.
b. Complete and sign prefunctional checklist [**daily**] [**weekly**] <**Insert frequency**> for work performed during the preceding [**day**] [**week**] <**Insert time period**>.

4. Provide Commissioning Authority access to prefunctional checklist.

D. Installation Compliance Issues: Record as an installation compliance issue Work found to be incomplete, inaccessible, at variance with the Contract Documents, nonfunctional, or that does not comply with prefunctional checklist. Record installation compliance issues on the construction checklist at the time they are identified. Record corrective action and how future Work should be modified before signing off the construction checklist.

E. Pre-Startup Audit: Prior to executing startup procedures, review completed installation checks to determine readiness for startup and operation. Report conditions, which, if left uncorrected, adversely impact the ability of systems or equipment to operate satisfactorily or to comply with acceptance criteria. Prepare pre-startup report for each system.

F. Test Procedures and Test Data Forms:

1. Test procedures shall define the step-by-step procedures to be used to execute tests and test demonstrations.
2. Test procedures shall be specific to the make, model, and application of the equipment and systems being tested.
3. Completed test data forms are the official records of the results of tests.
4. Commissioning Authority will provide to Contractor preliminary test procedures and test data forms for performance tests and Functional performance tests after approval of Product Data, Shop Drawings, and preliminary operation and maintenance manual.
5. Review preliminary test procedures and test data forms and provide comments within 14 days of receipt from Commissioning Authority. Review shall address the following:

a. Equipment protection and warranty issues, including, but not limited to, manufacturers' installation and startup recommendations, and operation and maintenance instructions.
b. Applicability of the procedure to the specific software, equipment, and systems approved for installation.

6. After Contractor has reviewed and commented on the preliminary test procedures and test data forms, Commissioning Authority will revise and reissue the approved revised test procedures and test data forms marked "Approved for Testing."

7. Use only approved test procedures and test data forms marked "Approved for Testing" to perform and document tests and test demonstrations.

G. Performance of Tests:

1. The sampling rate for tests is 100 percent. The sampling rate for test demonstrations is 100 percent unless otherwise indicated.
2. Perform and complete each step of the approved test procedures in the order listed.
3. Record data observed during performance of tests on approved data forms at the time of test performance and when the results are observed.
4. Record test results that are not within the range of acceptable results on commissioning issue report forms in addition to recording the results on approved test procedures and data forms according to the "Commissioning Compliance Issues" Paragraph in this Article.
5. On completion of a test, sign the completed test procedure and data form. Tests for which test procedures and data forms are incomplete, not signed, or which indicate performance that does not comply with acceptance criteria will be rejected. Tests for which test procedures and data forms are rejected shall be repeated and results resubmitted.

H. Performance of Test Demonstration:

1. Perform test demonstrations on a sample of tests after test data submittals are approved. The sampling rate for test demonstrations shall be 100 percent unless otherwise indicated in the individual test specification.
2. Notify Owner's witness at least [**three days**] <**Insert alternative time**> in advance of each test demonstration.
3. Perform and complete each step of the approved test procedures in the order listed.
4. Record data observed during performance of test demonstrations on approved data forms at the time of demonstration and when the results are observed.
5. Provide full access to Owner's witness to directly observe the performance of all aspects of system response during the test demonstration. On completion of a test demonstration, sign the completed data form and obtain signature of Owner's witness at the time of the test to authenticate the reported results.
6. Test demonstration data forms not signed by Contractor and Owner's witness at the time of the completion of the procedure will be rejected. Test demonstrations for which data forms are rejected shall be repeated and results shall be resubmitted.

    a. Exception for Failure of Owner's Witness to Attend: Failure of Owner's witness to be present for agreed-on schedule of test demonstration shall not delay Contractor. If Owner's witness fails to attend a scheduled test, Contractor shall proceed with the scheduled

test. On completion, Contractor shall sign the data form for Contractor and for Owner's witness, and shall note the absence of Owner's witness at the scheduled time and place.

7. False load test requirements are specified in related sections.

    a. Where false load testing is specified, provide temporary equipment, power, controls, wiring, piping, valves, and other necessary equipment and connections required to apply the specified load to the system. False load system shall be capable of steady-state operation and modulation at the level of load specified. Equipment and systems permanently installed in this work shall not be used to create the false load without Architect's written approval.

I. Deferred Tests:

1. Deferred Tests List: Identify, in the request for Certificate of Construction Phase Commissioning Completion, proposed deferred tests or other tests approved for deferral until specified seasonal or other conditions are available. When approved, deferred tests may be completed after the date of Construction Phase Commissioning Completion. Identify proposed deferred tests in the request for Certificate of Construction Phase Commissioning Completion as follows:

    a. Identify deferred tests by number and title.
    b. Provide a target schedule for completion of deferred tests.

2. Schedule and coordinate deferred tests. Schedule deferred tests when specified conditions are available. Notify Architect and Commissioning Authority at least [**three working days**] <**Insert alternative time**> (minimum) in advance of tests.
3. Where deferred tests are specified, coordinate participation of necessary personnel and of Architect, Commissioning Authority, and Owner's witness. Schedule deferred tests to minimize occupant and facility impact. Obtain Architect's approval of the proposed schedule.

J. Delayed Tests:

1. Delayed Tests List: Identify, in the request for Certificate of Construction Phase Commissioning Completion, proposed delayed tests. Obtain Owner approval of proposed delayed tests, including proposed schedule of completion of each delayed test, before submitting request for Certificate of Construction Phase Commissioning Completion. Include the following in the request for Certificate of Construction Phase Commissioning Completion:

    a. Identify delayed tests by test number and title.

b. Written approval of proposed delayed tests, including approved schedule of completion of delayed tests.

2. Schedule and coordinate delayed tests. Schedule delayed tests when conditions that caused the delay have been rectified. Notify Architect and Commissioning Authority at least [**three working days**] <**Insert alternative time**> (minimum) in advance of tests.
3. Where delayed tests are approved, coordinate participation of necessary personnel and of Architect, Commissioning Authority, and Owner's witness. Schedule delayed tests to minimize occupant and facility impact. Obtain Architect's approval of the proposed schedule.

K. Commissioning Compliance Issues:

1. Test results that are not within the range of acceptable results are commissioning compliance issues.
2. Track and report commissioning compliance issues until resolution and retesting are successfully completed.
3. If a test demonstration fails, determine the cause of failure. Direct timely resolution of issue and then repeat the demonstration. If a test demonstration must be repeated due to failure caused by Contractor work or materials, reimburse Owner for billed costs for the participation in the repeated demonstration.
4. Test Results: If a test demonstration fails to meet the acceptance criteria, perform the following:

    a. Complete a commissioning compliance issue report form promptly on discovery of test results that do not comply with acceptance criteria.
    b. Submit commissioning compliance issue report form within [**24 hours**] <**Insert alternative time**> of the test.
    c. Determine the cause of the failure.
    d. Establish responsibility for corrective action if the failure is due to conditions found to be Contractor's responsibility.

5. Commissioning Compliance Issue Report: Provide a commissioning compliance issue report for each issue. Do not report multiple issues on the same commissioning compliance issue report.

    a. Exception: If an entire class of devices is determined to exhibit the identical issue, they may be reported on a single commissioning compliance issue report. (For example, if all return-air damper actuators that are specified to fail to the open position are found to fail to the closed position, they may be reported on a single commissioning issue report. If a single commissioning issue report is used for multiple commissioning compliance issues, each device

shall be identified in the report, and the total number of devices at issue shall be identified.

b. Complete and submit Part 1 of the commissioning compliance issue report immediately when the condition is observed.
c. Record the commissioning compliance issue report number and describe the deficient condition on the data form.
d. Resolve commissioning compliance issues promptly. Complete and submit Part 2 of the commissioning compliance issue report when issues are resolved.

6. Diagnose and correct failed test demonstrations as follows:

    a. Perform diagnostic tests and activities required to determine the fundamental cause of issues observed.
    b. Record each step of the diagnostic procedure prior to performing the procedure. Update written procedure as changes become necessary.
    c. Record the results of each step of the diagnostic procedure.
    d. Record the conclusion of the diagnostic procedure on the fundamental cause of the issue.
    e. Determine and record corrective measures.
    f. Include diagnosis of fundamental cause of issues in commissioning compliance issue report.

7. Retest:

    a. Schedule and repeat the complete test procedure for each test demonstration for which acceptable results are not achieved. Obtain signature of Owner's witness on retest data forms. Repeat test demonstration until acceptable results are achieved. Except for issues that are determined to result from design errors or omissions, or other conditions beyond Contractor's responsibility, compensate Owner for direct costs incurred as the result of repeated test demonstrations to achieve acceptable results.
    b. For each repeated test demonstration, submit a new test data form, marked "Retest."

8. Do not correct commissioning compliance issues during test demonstrations.

    a. Exceptions will be allowed if the cause of the issue is obvious and resolution can be completed in less than [**five**] <**Insert number**> minutes. If corrections are made under this exception, note the deficient conditions on the test data form and issue a commissioning compliance issue report. A new test data form, marked "Retest," shall be initiated after the resolution has been completed.

3.6 COMMISSIONING MEETINGS

A. Commissioning Authority will schedule and conduct commissioning meetings. Comply with requirements in Section 013100 "Project Management and Coordination."

3.7 SEQUENCING

A. Sequencing of Commissioning Verification Activities: For a particular material, item of equipment, assembly, or system, perform the following in the order listed unless otherwise indicated:

1. PreFunctional Checklist:

    a. Material checks.
    b. Installation checks.
    c. Start up, as appropriate. Some startup may depend on component performance. Such startup may follow component performance tests on which the startup depends.
    d. Performance Tests as appropriate.

2. Functional performance tests.
    a. Static tests, as appropriate.
    b. Component performance tests. Some component performance tests may depend on completion of startup. Such component performance tests may follow startup.
    c. Equipment and assembly performance tests.
    d. System performance tests.
    e. Intersystem performance tests.

B. Before performing Functional performance tests, verify that materials, equipment, assemblies, and systems are delivered, installed, started, and adjusted to perform according to prefunctional checklist.

C. Verify readiness of materials, equipment, assemblies, and systems by performing tests prior to performing test demonstrations. Notify Architect if acceptable results cannot be achieved due to conditions beyond Contractor's control or responsibility.

D. Commence tests as soon as installation checks for materials, equipment, assemblies, or systems are satisfactorily completed. Tests of a particular system may proceed prior to completion of other systems, provided the incomplete work does not interfere with successful execution of test.

3.8 SCHEDULING

A. Commence commissioning as early in the construction period as possible.

B. Commissioning Schedule: Integrate commissioning into Contractor's construction schedule.

1. Include detailed commissioning activities in monthly updated Contractor's construction schedule and short interval schedule submittals.
2. Schedule the start date and duration for the following commissioning activities:

    a. Submittals.
    b. Preliminary operation and maintenance manual submittals.
    c. Installation checks.
    d. Startup, where required.
    e. Performance tests.
    f. Performance test demonstrations.
    g. Functional performance tests.
    h. Functional performance test demonstrations.

3. Schedule shall include a line item for each installation check, startup, and test activity specific to the equipment or systems involved.
4. Determine milestones and prerequisites for commissioning. Show commissioning milestones, prerequisites, and dependencies in monthly updated critical-path-method construction schedule and short interval schedule submittals.

C. Two-Week Look-Ahead Commissioning Schedule:

1. Two weeks prior to the beginning of tests, submit a detailed two-week look-ahead schedule. Thereafter, submit updated two-week look-ahead schedules weekly for the duration of commissioning.
2. Two-week look-ahead schedules shall identify the date, time, beginning location, Contractor personnel required, and anticipated duration for each startup or test activity.
3. Use two-week look-ahead schedules to notify and coordinate participation of Owner's witnesses.

D. Owner's Witness Coordination:

1. Coordinate Owner's witness participation via Architect.
2. Notify Architect of commissioning schedule changes at least [**two**] <**Insert number**> work days in advance for activities requiring the participation of Owner's witness.

3.9 COMMISSIONING REPORTS

A. Test Reports:

1. Pre-startup reports include observations of the conditions of installation, organized into the following sections:

    a. Equipment Model Verification: Compare contract requirements, approved submittals, and provided equipment. Note inconsistencies.
    b. Preinstallation Physical Condition Checks: Observe physical condition of equipment prior to installation. Note conditions including, but not limited to, physical damage, corrosion, water damage, or other contamination or dirt.
    c. Preinstallation Component Verification Checks: Verify components supplied with the equipment, preinstalled or field installed, are correctly installed and functional. Verify external components required for proper operation of equipment correctly installed and functional. Note missing, improperly configured, improperly installed, or nonfunctional components.
    d. Summary of Installation Compliance Issues and Corrective Actions: Identify installation compliance issues and the corrective actions for each. Verify that issues noted have been corrected.
    e. Evaluation of System Readiness for Startup: For each item of equipment for each system for which startup is anticipated, document in summary form acceptable to Owner completion of equipment model verification, preinstallation physical condition checks, preinstallation component verification checks, and completion of corrective actions for installation compliance issues.

2. Test data reports include the following:

    a. "As-tested" system configuration. Complete record of conditions under which the test was performed, including, but not limited to, the status of equipment, systems, and assemblies; temporary adjustments and settings; and ambient conditions.
    b. Data and observations, including, but not limited to, data trend logs, recorded during the tests.
    c. Signatures of individuals performing and witnessing tests.
    d. Data trend logs accumulated overnight from the previous day of testing.

3. Commissioning Compliance Issues Reports: Report as commissioning compliance issues results of tests and test demonstrations that do not comply with acceptance criteria. Report only one issue per commissioning compliance issue report. Use sequentially numbered facsimiles of commissioning compliance issue report form included in this Section, or other form approved by Owner. Distribute commissioning compliance

issue reports to parties responsible for taking corrective action. Identify the following:

a. Commissioning compliance issue report number. Assign unique, sequential numbers to individual commissioning compliance issue reports when they are created, to be used for tracking.
b. Action distribution list.
c. Report date.
d. Test number and description.
e. Equipment identification and location.
f. Briefly describe observations about the performance associated with failure to achieve acceptable results. Identify the cause of failure if apparent.
g. Diagnostic procedure or plan to determine the cause (include in initial submittal).
h. Diagnosis of fundamental cause of issues as specified below (include in resubmittal).
i. Fundamental cause of unacceptable performance as determined by diagnostic tests and activities.
j. When issues have been resolved, update and resubmit the commissioning issue report forms by completing Part 2. Identify resolution taken and the dates and initials of the persons making the entries.
k. Schedule for retesting.

4. Weekly progress reports include information for tests conducted since the preceding report and the following:

a. Completed data forms.
b. Equipment or system tested, including test number, system or equipment tag number and location, and notation about the apparent acceptability of results.
c. Activities scheduled but not conducted per schedule.
d. Commissioning compliance issue report log.
e. Schedule changes for remaining Commissioning-Process Work, if any.

5. Data trend logs shall be initiated and running prior to the time scheduled for the test demonstration.

a. Trend log data format shall be multiple data series graphs. Where multiple data series are trend logged concurrently, present the data on a common horizontal time axis. Individual data series may be presented on a segmented vertical axis to avoid interference of one data series with another, and to accommodate different axis scale values. Graphs shall be sufficiently clear to interpret data within the accuracy required by the acceptance criteria.

b. Attach to the data form printed trend log data collected during the test or test demonstration.
c. Record, print out, and attach to the data form operator activity during the time the trend log is running. During the time the trend log is running, operator intervention not directed by the test procedure invalidates the test results.

6. System Alarm Logs: Record and print out a log of alarms that occurred since the last log was printed. Evaluate alarms to determine if the previous day's work resulted in any conditions that are not considered "normal operation."

    a. Conditions that are not considered "normal operation" shall be reported on a commissioning issue report attached to the alarm log. Resolve as necessary. The intent of this requirement is to discover control system points or sequences left in manual or disabled conditions, equipment left disconnected, set points left with abnormal values, or similar conditions that may have resulted from failure to fully restore systems to normal, automatic control after test completion.

3.10 CERTIFICATE OF CONSTRUCTION PHASE COMMISSIONING COMPLETION

A. When Contractor considers that construction phase commissioning, or a portion thereof which Owner agrees to accept separately, is complete, Contractor shall prepare and submit to Owner and Commissioning Authority through Architect a comprehensive list of items to be completed or corrected. Failure to include an item on such list does not alter Contractor's responsibility to compete commissioning.

B. On receipt of Contractor's list, Commissioning Authority will make an inspection to determine whether the construction phase commissioning or designated portion thereof is complete. If Commissioning Authority's inspection discloses items, whether included on Contractor's list, which is not sufficiently complete as defined in "Construction Phase Commissioning Completion" Paragraph in the "Definitions" Article, Contractor shall, before issuance of the Certificate of Construction Phase Completion, complete or correct such items on notification by Commissioning Authority. In such case, Contractor shall then submit a request for another inspection by Commissioning Authority to determine construction phase commissioning completion.

C. Contractor shall promptly correct deficient conditions and issues discovered during commissioning. Costs of correcting such deficient conditions and issues, including additional testing and inspections, the cost of uncovering and replacement, and compensation for Architect's and Commissioning Authority's

services and expenses made necessary thereby, shall be at Contractor's expense.

D. When construction phase commissioning or designated portion is complete, Commissioning Authority will prepare a Certificate of Construction Phase Commissioning that shall establish the date of completion of construction phase commissioning. Certificate of Construction Phase Commissioning Completion shall be submitted prior to requesting inspection for determining date of Substantial Completion.

END OF SECTION 019113

SECTION 019119.43

EXTERIOR ENCLOSURE COMMISSIONING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes building enclosure Cx process requirements for the above- and below-grade systems and assemblies:

1. Opaque walls.
2. Roofs.
3. Openings.
4. Interfaces.

B. Related Requirements:

1. Section 019113 "General Commissioning Requirements" for general requirements for Cx processes including definitions, Cx team membership, Owner's responsibilities, Contractor's responsibilities, and CxA's responsibilities.

1.3 DEFINITIONS

A. Building Enclosure: Materials, components, systems, and assemblies intended to provide shelter and environmental separation between interior and exterior, or between two or more environmentally distinct interior spaces in a building or structure. The building enclosure includes, but is not limited to, exterior walls, above and below grade, and roof assemblies.

B. Cx: Commissioning, as defined in Section 019113 "General Commissioning Requirements."

C. CxA: Commissioning Authority, as defined in Section 019113 "General Commissioning Requirements."

D. "Systems," "Assemblies," "Subsystems," "Equipment," and "Components": Where these terms are used together or separately, they shall mean "as-built" systems, assemblies, subsystems, equipment, and components.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Prefunctional Checklists: Draft Prefunctional Checklists will be created by CxA for Contractor review.

C. Cx Process Submittals:

1. Test Reports: Prepared by a qualified testing agency for the test.
2. Record Drawings: As-built drawings of mockups showing changes made during testing.

D. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For building envelope systems and components to include in operation and maintenance manuals.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 CONSTRUCTION CHECKLIST REVIEW

A. Review and provide written comments on draft Construction Checklists. CxA will create required draft Construction Checklists and provide them to Contractor.

B. Return draft Construction Checklist review comments within [**10**] <**Insert number**> days of receipt.

C. When review comments have been resolved, CxA will provide final Construction Checklists, marked "Approved for Use, (date)."

D. Use only Construction Checklists, marked "Approved for Use, (date)."

3.2 GENERAL TESTING REQUIREMENTS

A. If tests cannot be completed because of a deficiency outside the scope of the building enclosure systems, document the deficiency and report it to Owner. After deficiencies are resolved, reschedule tests.

B. If seasonal testing is specified, complete appropriate initial performance tests and documentation and schedule seasonal tests.

C. Coordinate schedule with, and perform Cx activities at the direction of the CxA.

3.3 BUILDING ENCLOSURE TESTING

A. Building Enclosure Testing: Perform testing before installation of interior finishes unless otherwise indicated.

B. Testing Agency: [**Owner will engage**] [**Engage**] a qualified testing agency to perform tests and inspections.

C. Expansion Building Enclosure Testing: Perform the following tests in the following order:

1. Whole Building Air Leakage Rate by Fan Pressurization: ASTM E 779.

    a. Maximum Air Leakage Rate: <**Insert value**>.

2. Whole Building Air Tightness Using an Orifice Blower Door: ASTM E 1827.

    a. Maximum Air Leakage Rate: <**Insert value**>.

END OF SECTION 019119.43

SECTION 21 08 00

COMMISSIONING OF FIRE SUPPRESSION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes Cx process requirements for the following fire-suppression systems, assemblies, and equipment:

1. Water-based fire-suppression systems.
2. Fire-extinguishing systems.
3. Fire pumps.

B. Related Requirements:

1. Section 019113 "General Commissioning Requirements" for general Cx process requirements and CxA responsibilities.
2. For Prefunctional checklists, comply with requirements in various Division 21 Sections specifying fire-suppression systems, system components, equipment, and products.

1.2 DEFINITIONS

A. Cx: Commissioning, as defined in Section 019113 "General Commissioning Requirements."

B. CxA: Commissioning Authority, as defined in Section 019113 "General Commissioning Requirements."

C. "Systems," "Assemblies," "Subsystems," "Equipment," and "Components": Where these terms are used together or separately, they shall mean "as-built" systems, assemblies, subsystems, equipment, and components.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For fire-suppression testing technician.

B. Prefunctional checklists: Draft prefunctional checklists will be created by CxA for Contractor review.

1.4 QUALITY ASSURANCE

A. Fire-Suppression Testing Technician Qualifications: Technicians to perform fire-suppression Prefunctional checklist verification tests, Prefunctional checklist verification test demonstrations, Cx tests, and Cx test demonstrations shall have the following minimum qualifications:

1. Journey level or equivalent skill level with knowledge of fire-suppression system, electrical concepts, and building operations.
2. Minimum [**three years'**] <**Insert time**> experience installing, servicing, and operating systems manufactured by approved manufacturer.

B. Clean-Agent Fire-Suppression Systems Testing Technician Qualifications: Technicians to perform clean-agent fire-suppression system Prefunctional checklist verification tests, Prefunctional checklist verification test demonstrations, Cx tests, and Cx test demonstrations shall have the following minimum qualifications:

1. Journey level or equivalent skill level. Vocational school four-year-program graduate or an Associate's degree in mechanical systems, fire-suppression systems, or similar field. Degree may be offset by three years' experience in servicing fire-suppression systems in the clean-agent fire-suppression systems industry. Generally, required knowledge includes clean-agent fire-suppression systems, electrical concepts, building operations, and application and use of tools and instrumentation to measure performance of fire-suppression system equipment, assemblies, and systems.
2. Minimum [**three years'**] <**Insert time**> experience installing, servicing, and operating systems manufactured by approved manufacturer.

C. Testing Equipment and Instrumentation Quality and Calibration:

1. Capable of testing and measuring performance within the specified acceptance criteria.
2. Be calibrated at manufacturer's recommended intervals with current calibration tags permanently affixed to the instrument being used.
3. Be maintained in good repair and operating condition throughout duration of use on Project.
4. Be recalibrated/repaired if dropped or damaged in any way since last calibrated.

D. Proprietary Test Instrumentation and Tools:

1. Equipment Manufacturer's Proprietary Instrumentation and Tools: For installed equipment included in the Cx process, test instrumentation and tools manufactured or prescribed by equipment manufacturer to service,

calibrate, adjust, repair, or otherwise work on its equipment or required as a condition of equipment warranty, shall comply with the following:

a. Be calibrated by manufacturer with current calibration tags permanently affixed.
b. Include a separate list of proprietary test instrumentation and tools in operation and maintenance manuals.
c. Fire-suppression system proprietary test instrumentation and tools become property of Owner at the time of Substantial Completion.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 PREFUNCTIONAL CHECKLIST REVIEW

A. Review and provide written comments on draft Prefunctional checklists. CxA will create required draft Prefunctional checklists and provide them to Contractor.

B. Return draft Prefunctional checklist review comments within [**10**] <**Insert number**> days of receipt.

C. When review comments have been resolved, the CxA will provide final Prefunctional checklists, marked "Approved for Use, (date)."

D. Use only Prefunctional checklists, marked "Approved for Use, (date)."

3.2 Cx TESTING PREPARATION

A. Certify that fire-suppression systems, subsystems, and equipment have been installed, calibrated, and started and that they are operating according to the Contract Documents and approved submittals.

B. Certify that fire-suppression systems instrumentation and control systems have been completed and calibrated, that they are operating according to the Contract Documents and approved submittals, and that pretest set points have been recorded.

C. Set systems, subsystems, and equipment into operating mode to be tested according to approved test procedures (for example, normal shutdown, normal auto position, normal manual position, unoccupied cycle, emergency power, and alarm conditions).

3.3 Cx TEST CONDITIONS

A. Perform tests using design conditions, whenever possible.

1. Simulated conditions may, with approval of Architect, be imposed using an artificial load when it is impractical to test under design conditions. Before simulating conditions, calibrate testing instruments. Provide equipment to simulate loads. Set simulated conditions as directed by CxA and document simulated conditions and methods of simulation. After tests, return configurations and settings to normal operating conditions.
2. Cx test procedures may direct that set points be altered when simulating conditions is impractical.
3. Cx test procedures may direct that sensor values be altered with a signal generator when design or simulating conditions and altering set points are impractical.

B. If tests cannot be completed because of a deficiency outside the scope of the fire-suppression system, document the deficiency and report it to Architect. After deficiencies are resolved, reschedule tests.

C. If seasonal testing is specified, complete appropriate initial performance tests and documentation and schedule seasonal tests.

3.4 Cx TESTS COMMON TO FIRE-SUPPRESSION SYSTEMS

A. Measure capacities and effectiveness of systems, assemblies, subsystems, equipment, and components, including operational and control functions, to verify compliance with acceptance criteria.

B. Test systems, assemblies, subsystems, equipment, and components operating modes, interlocks, control responses, responses to abnormal or emergency conditions, and response according to acceptance criteria.

C. Coordinate schedule with, and perform Cx activities at the direction of, CxA.

D. Comply with Prefunctional checklist requirements, including material verification, installation checks, startup, and performance tests requirements specified in Division 21 Sections specifying fire-suppression systems and equipment.

E. Provide technicians, instrumentation, tools, and equipment to perform and document the following:

1. Prefunctional checklist verification tests.
2. Prefunctional checklist verification test demonstrations.
3. Cx tests.
4. Cx test demonstrations.

F. Vibration Isolation in Fire-Suppression Systems:

1. Prerequisites: Acceptance of results of Prefunctional checklists for vibration[**and seismic**] control devices specified in [**Section 210548 "Vibration and Seismic Controls for Fire-Suppression Piping and Equipment."**] [**Section 210548.13 "Vibration Controls for Fire-Suppression Piping and Equipment."**]
2. Components to Be Tested:

    a. Vibration isolation[**and seismic**] control devices in water-based fire-suppression systems.
    b. Structural systems.

3. Test Purpose: Evaluate effectiveness of vibration isolation[**and seismic**] control devices.
4. Test Conditions: Measure vibration of the facility structure at [**three**] <**Insert number**> locations designated by Owner's witness while the isolated equipment operates.
5. Test Conditions: Measure vibration of the facility structure at [**three**] <**Insert number**> locations designated by Owner's witness at the following operating conditions:

    a. Maximum speed.
    b. Minimum speed.
    c. Critical speed.

6. Acceptance Criteria: Structure-borne vibration not to exceed specified performance.

G. Supervision of Fire-Protection Valves in Water-Based Fire-Suppression Systems:

1. Prerequisites: Acceptance of results of Prefunctional checklists for valves specified in the Sections listed below:

    a. Section 210500 "Common Work Results for Fire Suppression”
    b. Section 213000 "Fire Pumps
    c. Section 284600"Fire Detection and Alarm"

2. Equipment and Systems to Be Tested:

    a. Supervised valves in water-based fire-suppression systems.
    b. Division 28 fire-detection and -alarm systems.

3. Test Purpose: Verify generation of supervisory alarm at the fire-alarm control panel in response to activation of valve supervision device or tamper switch.
4. Test Conditions:

a. Fire-alarm system operating in normal, automatic mode.
b. Activate valve supervision devices and tamper switches, one at a time.

5. Acceptance Criteria: Activation of valve supervision device or tamper switch generates supervisory alarm at fire-alarm control panel.

H. Heat Tracing in Water-Based Fire-Suppression Systems:

1. Prerequisites: Acceptance of results of Prefunctional checklists for heat tracing specified in water-based fire-suppression systems.

2. Equipment and Systems to Be Tested:

a. Self-regulating, parallel-resistance heating cables.
b. Heater trace circuit controller.
c. Interface with fire-alarm control panel.

3. Test Purpose:

a. Evaluate response to ambient temperature below freeze-protection set point.
b. Evaluate heating cable fault alarm.

4. Test Conditions:

a. Subject temperature sensor to temperature approximately [**3 deg F**] <**Insert value**> above freeze-protection set point (initial set point [**41 deg F**] <**Insert value**>). Monitor sensed temperature with a calibration-grade thermometer. Gradually change set point or sensed temperature until freeze-protection circuit is energized.
b. Subject temperature sensor to temperature approximately [**3 deg F**] <**Insert value**> below freeze-protection set point (initial set point [**41 deg F**] <**Insert value**>). Monitor sensed temperature with a calibration-grade thermometer. Gradually change set point or sensed temperature until freeze-protection circuit is de-energized.
c. Simulate an electrical fault on the heating cable.

5. Acceptance Criteria:

a. Freeze-protection circuit is energized at set-point temperature minus 2 deg F.
b. Freeze-protection circuit is de-energized at set-point temperature plus 2 deg F.
c. Heater trace circuit controller initiates an alarm of cable fault. Alarm is correctly reported at the fire-alarm control panel.

3.5 Cx TESTS FOR DRY-PIPE SPRINKLER PIPING, FITTINGS, SPRINKLERS, AND SPECIALTIES.

A. Air Compressor Run Time:

1. Prerequisites: Acceptance of results of Prefunctional checklists specified in Section 211316 "Dry-Piping Sprinkler Systems."
2. Systems and Equipment to Be Tested:

    a. Air compressors in fire-suppression systems.
    b. Associated compressed air piping, valves, and appurtenances.
    c. Associated air pressure controllers.

3. Test Purpose: Evaluate air compressor run time and number of compressor starts.
4. Test Conditions:

    a. Keep compressed air and associated sprinkler piping openings closed during test.
    b. For systems with multiple compressors, lock out compressor motors on all but one compressor. Repeat test for each compressor in turn.
    c. Record number of air compressor motor starts during a 14-day period.
    d. Record air compressor motor run time during the same 14-day period.

5. Acceptance Criteria:

    a. Number of compressor motor starts during test period shall not exceed [**20**] <**Insert number**>.
    b. Compressor motor run time during test period shall not exceed [**60 minutes**] <**Insert time**>.

END OF SECTION 210800

SECTION 22 08 00

COMMISSIONING OF PLUMBING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes Cx process requirements for the following plumbing systems, assemblies, and equipment:

1. Domestic hot- and cold-water piping.
2. Sanitary waste and vent piping.
3. Storm drainage piping.
4. Plumbing pumps.
5. General-service compressed air piping and equipment.
6. Plumbing equipment.
7. Vacuum piping and equipment for laboratory and healthcare facilities.
8. Medical gases piping, equipment, and alarms.
9. Chemical waste systems for laboratory and healthcare facilities.
10. Processed water systems for laboratory and healthcare facilities.

B. Related Requirements:

1. Section 019113 "General Commissioning Requirements" for general Cx process requirements and CxA responsibilities.
2. For prefunctional checklists, comply with requirements in various Division 22 Sections specifying plumbing systems, system components, equipment, and products.

1.2 DEFINITIONS

A. Cx: Commissioning, as defined in Section 019113 "General Commissioning Requirements."

B. CxA: Commissioning Authority, as defined in Section 019113 "General Commissioning Requirements."

C. "Systems," "Assemblies," "Subsystems," "Equipment," and "Components": Where these terms are used together or separately, they shall mean "as-built" systems, assemblies, subsystems, equipment, and components.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For plumbing testing technician.

B. Prefunctional checklists: Draft prefunctional checklists will be created by CxA for Contractor review.

C. Test equipment and instrumentation list, identifying the following:

1. Equipment/instrument identification number.
2. Planned Cx application or use.
3. Manufacturer, make, model, and serial number.
4. Calibration history, including certificates from agencies that calibrate the equipment and instrumentation.
5. Equipment manufacturers' proprietary instrumentation and tools. For each instrument or tool, identify the following:

    a. Instrument or tool identification number.
    b. Equipment schedule designation of equipment for which the instrument or tool is required.
    c. Manufacturer, make, model, and serial number.
    d. Calibration history, including certificates from agencies that calibrate the instrument or tool, where appropriate.

1.4 QUALITY ASSURANCE

A. Plumbing Testing Technician Qualifications: Technicians to perform plumbing prefunctional checklist verification tests, prefunctional checklist verification test demonstrations, Cx tests, and Cx test demonstrations shall have the following minimum qualifications:

1. Journey level or equivalent skill level with knowledge of plumbing system, electrical concepts, and building operations.
2. Minimum [**three years'**] <**Insert time**> experience installing, servicing, and operating systems manufactured by approved manufacturer.

B. Medical Gas Piping Systems Testing Technician Qualifications: Technicians to perform medical compressed-air, vacuum, and medical gas piping for laboratory and healthcare facilities system prefunctional checklist verification tests, prefunctional checklist verification test demonstrations, Cx tests, and Cx test demonstrations shall have the following minimum qualifications:

1. Journey level or equivalent skill level. Vocational school four-year-program graduate or an Associate's degree in mechanical systems, plumbing systems, or similar field. Degree may be offset by three years' experience in servicing plumbing systems in the gas piping for laboratory and healthcare facilities plumbing systems industry. Generally, required

knowledge includes gas piping for laboratory and healthcare facilities systems, electrical concepts, building operations, and application and use of tools and instrumentation to measure performance of plumbing system equipment, assemblies, and systems.

2. Minimum [**three years'**] <**Insert time**> experience installing, servicing, and operating systems manufactured by approved manufacturer.

C. Testing Equipment and Instrumentation Quality and Calibration:

1. Capable of testing and measuring performance within the specified acceptance criteria.
2. Be calibrated at manufacturer's recommended intervals with current calibration tags permanently affixed to the instrument being used.
3. Be maintained in good repair and operating condition throughout duration of use on Project.
4. Be recalibrated/repaired if dropped or damaged in any way since last calibrated.

D. Proprietary Test Instrumentation and Tools:

1. Equipment Manufacturer's Proprietary Instrumentation and Tools: For installed equipment included in the Cx process, test instrumentation and tools manufactured or prescribed by equipment manufacturer to service, calibrate, adjust, repair, or otherwise work on its equipment or required as a condition of equipment warranty, shall comply with the following:

a. Be calibrated by manufacturer with current calibration tags permanently affixed.
b. Include a separate list of proprietary test instrumentation and tools in operation and maintenance manuals.
c. Plumbing system proprietary test instrumentation and tools become property of Owner at the time of Substantial Completion.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 PREFUNCTIONAL CHECKLIST REVIEW

A. Review and provide written comments on draft prefunctional checklists. CxA will create required draft prefunctional checklists and provide them to Contractor.

B. Return draft prefunctional checklist review comments within [**10**] <**Insert number**> days of receipt.

C. When review comments have been resolved, the CxA will provide final prefunctional checklists, marked "Approved for Use, (date)."

D. Use only prefunctional checklists, marked "Approved for Use, (date)."

3.2 Cx TESTING PREPARATION

A. Certify that plumbing systems, subsystems, and equipment have been installed, calibrated, and started and that they are operating according to the Contract Documents and approved submittals.

B. Certify that plumbing systems instrumentation and control systems have been completed and calibrated, that they are operating according to the Contract Documents and approved submittals, and that pretest set points have been recorded.

C. Set systems, subsystems, and equipment into operating mode to be tested according to approved test procedures (for example, normal shutdown, normal auto position, normal manual position, unoccupied cycle, emergency power, and alarm conditions).

3.3 Cx TEST CONDITIONS

A. Perform tests using design conditions, whenever possible.

1. Simulated conditions may, with approval of Architect, be imposed using an artificial load when it is impractical to test under design conditions. Before simulating conditions, calibrate testing instruments. Provide equipment to simulate loads. Set simulated conditions as directed by CxA and document simulated conditions and methods of simulation. After tests, return configurations and settings to normal operating conditions.
2. Cx test procedures may direct that set points be altered when simulating conditions is impractical.
3. Cx test procedures may direct that sensor values be altered with a signal generator when design or simulating conditions and altering set points are impractical.

B. If tests cannot be completed because of a deficiency outside the scope of the plumbing system, document the deficiency and report it to Architect. After deficiencies are resolved, reschedule tests.

C. If seasonal testing is specified, complete appropriate initial performance tests and documentation and schedule seasonal tests.

3.4 Cx TESTS COMMON TO PLUMBING

A. Measure capacities and effectiveness of systems, assemblies, subsystems, equipment, and components, including operational and control functions, to verify compliance with acceptance criteria.

B. Test systems, assemblies, subsystems, equipment, and components operating modes, interlocks, control responses, responses to abnormal or emergency conditions, and response according to acceptance criteria.

C. Coordinate schedule with, and perform Cx activities at the direction of, CxA.

D. Comply with prefunctional checklist requirements, including material verification, installation checks, startup, and performance tests requirements specified in Division 22 Sections specifying plumbing systems and equipment.

E. Provide technicians, instrumentation, tools, and equipment to perform and document the following:

1. Prefunctional checklist verification tests.
2. Prefunctional checklist verification test demonstrations.
3. Cx tests.
4. Cx test demonstrations.

F. Vibration Isolation in Plumbing Systems:

1. Prerequisites: Acceptance of results of prefunctional checklists for vibration and seismic control devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."
2. Components to Be Tested:

    a. Vibration isolation and seismic control devices in plumbing systems.
    b. Structural systems.

3. Test Purpose: Evaluate effectiveness of vibration isolation and seismic control devices.
4. Test Conditions: Measure vibration of the facility structure at [**three**] <**Insert number**> locations designated by Owner's witness while the isolated equipment operates.
5. Test Conditions: Measure vibration of the facility structure at [**three**] <**Insert number**> locations designated by Owner's witness at the following operating conditions:

    a. Maximum speed.
    b. Minimum speed.
    c. Critical speed.

6. Acceptance Criteria: Structure-borne vibration not to exceed specified performance.

G. Supervision of Alarms in Plumbing Systems:

1. Prerequisites: Acceptance of results of prefunctional checklists for plumbing systems specified in the Sections listed below:

a. Section 221113 "Facility Water Distribution Piping."
b. Section 226313 "Gas Piping for Laboratory and Healthcare Facilities."
c. Section 226400 "Medical Gas Alarms."

2. Scope:

a. [**Supervised**] [**Monitored**] plumbing system alarms.

3. Purpose:

a. Verify reporting of [**supervised**] [**monitored**] plumbing alarm at [**building management system**] [**security monitoring service**] [**alarm monitoring service**] [**other alarm monitoring system**] <**Insert system**>.

4. Conditions of the Test:

a. Alarm monitoring systems operating in normal, automatic mode.
b. Activate [**supervised**] [**monitored**] plumbing alarms, one at a time.

5. Acceptance Criteria:

a. Activation of [**supervised**] [**monitored**] plumbing alarm generates alarm at [**building management system**] [**security monitoring service**] [**alarm monitoring service**] [**other alarm monitoring system**] <**Insert system**> control panel.

H. Plumbing Meter Reporting:

1. Prerequisites: Acceptance of results of prefunctional checklists for plumbing systems specified in the Sections listed below:

a. Section 221113 "Facility Water Distribution Piping."
b. Section 221119 "Domestic Water Piping Specialties."
c. Section 223100 "Domestic Water Softeners."

2. Scope:

a. [**Supervised**] [**Monitored**] plumbing system water meters.

3. Purpose:

    a. Verify accuracy of reporting of [**supervised**] [**monitored**] plumbing system water meters at [**building management system**] [**utility management service**] [**other utility consumption management system**] <**Insert system**>.

4. Conditions of the Test:

    a. Plumbing system water meter recording systems operating in normal, automatic mode.
    b. Compare cumulative consumption data at plumbing system water meter recording systems with independent, calibrated flow-measuring instrumentation under the following conditions:

        1) Low Flow: [**1**] <**Insert number**> percent of maximum design flow rate for a period of [**four hours**] <**Insert value**>.
        2) High Flow: [**80**] <**Insert number**> percent of maximum design flow rate for a period of [**20 minutes**] <**Insert value**>.

    c. Activate [**supervised**] [**monitored**] plumbing alarms, one at a time.

5. Acceptance Criteria:

    a. Cumulative flow reported for low-flow condition is within [**5**] <**Insert number**> percent flow recorded by calibrated flow-measuring instrumentation.
    b. Cumulative flow reported for high-flow condition is within [**1**] <**Insert number**> percent flow recorded by calibrated flow-measuring instrumentation.

I. Heat Tracing in Plumbing Systems:

1. Prerequisites: Acceptance of results of prefunctional checklists for heat tracing specified in heat-tracing systems. Comply with requirements listed in Section 220533 "Heat Tracing for Plumbing Piping."
2. Equipment and Systems to Be Tested:

    a. Self-regulating, parallel-resistance heating cables.
    b. Heater trace circuit controller.

3. Test Purpose:

    a. Evaluate response to ambient temperature below freeze-protection set point.
    b. Evaluate heating cable fault alarm.

4. Test Conditions:

a. Subject temperature sensor to temperature approximately [**3 deg F**] <**Insert value**> above freeze-protection set point (initial set point [**41 deg F**] <**Insert value**>). Monitor sensed temperature with a calibration-grade thermometer. Gradually change set point or sensed temperature until freeze-protection circuit is energized.
b. Subject temperature sensor to temperature approximately [**3 deg F**] <**Insert value**> below freeze-protection set point (initial set point [**41 deg F**] <**Insert value**>). Monitor sensed temperature with a calibration-grade thermometer. Gradually change set point or sensed temperature until freeze-protection circuit is de-energized.
c. Simulate an electrical fault on the heating cable.

5. Acceptance Criteria:

a. Freeze-protection circuit is energized at set-point temperature minus 2 deg F.
b. Freeze-protection circuit is de-energized at set-point temperature plus 2 deg F.
c. Heater trace circuit controller initiates an alarm of cable fault. Alarm is correctly reported at the fire-alarm control panel.

3.5 Cx TESTS FOR COMPRESSED AIR SYSTEMS

A. Air Compressor Run Time:

1. Prerequisites:

a. Acceptance of results of prefunctional checklists specified in the following:

1) Section 221519 "General-Service Packaged Air Compressors and Receivers."

2. Scope:

a. Air compressors in plumbing systems.
b. Associated compressed air piping, valves, and appurtenances.
c. Associated air pressure controllers.

3. Purpose: Evaluate air compressor run time and number of compressor starts.
4. Conditions of the Test:

a. Keep compressed air openings closed during test.
b. For systems with multiple compressors, lock out compressor motors on all but one compressor. Repeat test for each compressor in turn.

c. Record number of air compressor motor starts during a 14-day period.
d. Record air compressor motor run time during the same 14-day period.

5. Acceptance Criteria:

a. Number of compressor motor starts during test period shall not exceed [**20**] <**Insert number**>.
b. Compressor motor run time during test period shall not exceed [**60 minutes**] <**Insert time**>.

3.6 Cx TESTS FOR VACUUM SYSTEMS

A. Vacuum Pump Run Time:

1. Prerequisites:

a. Acceptance of results of prefunctional checklists for vacuum equipment for laboratory and healthcare facilities.

2. Scope:

a. Vacuum pumps in plumbing systems.
b. Associated vacuum piping, valves, and appurtenances.
c. Associated vacuum pressure controllers.

3. Purpose:

a. Evaluate vacuum pump run time and number of vacuum pump starts.

4. Conditions of the Test:

a. Keep vacuum piping openings closed during test.
b. For systems with multiple vacuum pumps, lock out vacuum pump motors on all but one pump. Repeat test for each vacuum pump in turn.
c. Record number of vacuum pump motor starts during a 14-day period.
d. Record vacuum pump motor run time during the same 14-day period.

5. Acceptance Criteria:

a. Number of vacuum pump motor starts during test period shall not exceed [**20**] <**Insert number**>.

b. Vacuum pump motor run time during test period shall not exceed [**60 minutes**] <**Insert time**>.

3.7 Cx TESTS FOR PROCESSED WATER SYSTEMS

A. Processed Water Filtration Quality:

1. Prerequisites: Acceptance of results of prefunctional checklists specified for processed-water systems. Comply with requirements in Section 226700 "Processed Water Systems for Laboratory and Healthcare Facilities."
2. Scope:

    a. Processed water equipment in plumbing systems.
    b. Associated processed water piping, valves, and appurtenances.
    c. Processed water point-of-use fixtures.

3. Purpose: Evaluate processed water quality at points-of-use.
4. Conditions of the Test:

    a. Operate water processing equipment and circulation pumps in normal automatic mode for seven days prior to the test.
    b. Collect process water samples from points-of-use.
    c. Collect and handle water samples according to analytical laboratory recommendations.
    d. Document that the following parameters meet minimum standards required for the specified grade of process water, as applicable:

        1) Resistivity.
        2) pH.
        3) Total organic carbon (TOC).
        4) Sodium.
        5) Chloride.
        6) Total silica.
        7) Microbial.
        8) Endotoxin.
        9) Bacteria.

5. Acceptance Criteria:

    a. Measured process water parameters shall meet the following criteria:

        1) Resistivity: [**10**] <**Insert value**> megohms.
        2) pH: [**6**] <**Insert value**> units.
        3) TOC: [**500**] <**Insert value**> ppb.
        4) Sodium: [**5**] <**Insert value**> ug/L.
        5) Chloride: [**5**] <**Insert value**> ug/L.

6) Total Silica: [**3**] <**Insert value**> ug/L.
7) Microbial: [**10**] <**Insert value**> CFU/mL.
8) Endotoxin: [**0.01**] <**Insert value**> EU/mL.
9) Bacteria: [**10 CFU/100 mL**] <**Insert values**>.

END OF SECTION 220800

SECTION 23 08 00

COMMISSIONING OF HVAC

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes Cx process requirements for the following HVAC systems, assemblies, and equipment:

1. Energy supply systems.
2. Heat generation systems.
3. Cooling generation systems.
4. Central-station air-handling systems.
5. Air, and hydronic distribution systems.
6. Heating and cooling terminal and unitary equipment.
7. HVAC controls.
8. TAB verification.

B. Related Requirements:

1. Section 019113 "General Commissioning Requirements" for general Cx process requirements and CxA responsibilities.
2. For prefunctional checklists, comply with requirements in various Division 23 Sections specifying HVAC systems, system components, equipment, and products.

1.2 DEFINITIONS

A. Cx: Commissioning, as defined in Section 019113 "General Commissioning Requirements."

B. CxA: Commissioning Authority, as defined in Section 019113 "General Commissioning Requirements."

C. DDC: Direct digital controls.

D. HVAC: Heating, ventilating, and air conditioning.

E. "Systems," "Assemblies," "Subsystems," "Equipment," and "Components": Where these terms are used together or separately, they shall mean "as-built" systems, assemblies, subsystems, equipment, and components.

F. TAB: Testing, adjusting, and balancing.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 CONSTRUCTION CHECKLIST REVIEW

A. Review and provide written comments on draft prefunctional checklists. CxA will create required draft prefunctional checklists and provide them to Contractor.

B. Return draft prefunctional checklist review comments within [**10**] <**Insert number**> days of receipt.

C. When review comments have been resolved, the CxA will provide final prefunctional checklists, marked "Approved for Use, (date)."

D. Use only prefunctional checklists, marked "Approved for Use, (date)."

3.2 Cx TESTING PREPARATION

A. Certify that HVAC systems, subsystems, and equipment have been installed, calibrated, and started and that they are operating according to the Contract Documents and approved submittals.

B. Certify that HVAC instrumentation and control systems have been completed and calibrated, that they are operating according to the Contract Documents and approved submittals, and that pretest set points have been recorded.

C. Certify that TAB procedures have been completed and that TAB reports have been submitted, discrepancies corrected, and corrective work approved.

D. Set systems, subsystems, and equipment into operating mode to be tested according to approved test procedures (for example, normal shutdown, normal auto position, normal manual position, unoccupied cycle, emergency power, and alarm conditions).

3.3 Cx TEST CONDITIONS

A. Perform tests using design conditions, whenever possible.

1. Simulated conditions may, with approval of Architect, be imposed using an artificial load when it is impractical to test under design conditions. Before simulating conditions, calibrate testing instruments. Provide equipment to simulate loads. Set simulated conditions as directed by CxA and document simulated conditions and methods of simulation. After tests, return configurations and settings to normal operating conditions.

2. Cx test procedures may direct that set points be altered when simulating conditions is impractical.
3. Cx test procedures may direct that sensor values be altered with a signal generator when design or simulating conditions and altering set points are impractical.

B. If tests cannot be completed because of a deficiency outside the scope of the HVAC system, document the deficiency and report it to Architect. After deficiencies are resolved, reschedule tests.

C. If seasonal testing is specified, complete appropriate initial performance tests and documentation and schedule seasonal tests.

3.4 Cx TESTS COMMON TO HVAC SYSTEMS

A. Measure capacities and effectiveness of systems, assemblies, subsystems, equipment, and components, including operational and control functions, to verify compliance with acceptance criteria.

B. Test systems, assemblies, subsystems, equipment, and components operating modes, interlocks, control responses, responses to abnormal or emergency conditions, and response according to acceptance criteria.

C. Coordinate schedule with, and perform Cx activities at the direction of, CxA.

D. Comply with prefunctional checklist requirements, including material verification, installation checks, startup, and performance tests requirements specified in Division 23 Sections specifying HVAC systems and equipment.

E. Provide technicians, instrumentation, tools, and equipment to perform and document the following:

1. Prefunctional checklist verification tests.
2. Prefunctional checklist verification test demonstrations.
3. Cx tests.
4. Cx test demonstrations.

F. Vibration Isolation in HVAC Systems:

1. Prerequisites: Acceptance of results of prefunctional checklists for vibration and seismic control devices specified in Section 230548 "Vibration and Seismic Controls for HVAC Piping and Equipment."
2. Components to Be Tested:

    a. Vibration isolation and seismic control devices in HVAC systems.
    b. Structural systems.

3. Test Purpose: Evaluate effectiveness of vibration isolation and seismic control devices.
4. Test Conditions: Measure vibration of the facility structure at [**three**] <**Insert number**> locations designated by Owner's witness while the isolated equipment operates.
5. Test Conditions: Measure vibration of the facility structure at [**three**] <**Insert number**> locations designated by Owner's witness at the following operating conditions:

    a. Maximum speed.
    b. Minimum speed.
    c. Critical speed.

6. Acceptance Criteria: Structure-borne vibration not to exceed specified performance.

G. Heat Tracing in HVAC Systems:

1. Prerequisites: Acceptance of results of prefunctional checklists for heat tracing specified in HVAC systems. Comply with requirements listed in Section 230533 "Heat Tracing for HVAC Piping."
2. Equipment and Systems to Be Tested:

    a. Self-regulating, parallel-resistance heating cables.
    b. Heater trace circuit controller.

3. Test Purpose:

    a. Evaluate response to ambient temperature below freeze-protection set point.
    b. Evaluate heating cable fault alarm.

4. Test Conditions:

    a. Subject temperature sensor to temperature approximately [**3 deg F**] <**Insert value**> above freeze-protection set point (initial set point [**41 deg F**] <**Insert value**>). Monitor sensed temperature with a calibration-grade thermometer. Gradually change set point or sensed temperature until freeze-protection circuit is energized.
    b. Subject temperature sensor to temperature approximately [**3 deg F**] <**Insert value**> below freeze-protection set point (initial set point [**41 deg F**] <**Insert value**>). Monitor sensed temperature with a calibration-grade thermometer. Gradually change set point or sensed temperature until freeze-protection circuit is de-energized.
    c. Simulate an electrical fault on the heating cable.

5. Acceptance Criteria:

a. Freeze-protection circuit is energized at set-point temperature minus 2 deg F.
b. Freeze-protection circuit is de-energized at set-point temperature plus 2 deg F.
c. Heater trace circuit controller initiates an alarm of cable fault. Alarm is correctly reported at the fire-alarm control panel.

3.5 TAB VERIFICATION

A. Prerequisites: Completion of "Examination" Article requirements and correction of deficiencies, as specified in Section 230593 "Testing, Adjusting, and Balancing for HVAC."

B. Completion of "Preparation" Article requirements for preparation of a TAB plan that includes strategies and step-by-step procedures, and system-readiness checks and reports, as specified in Section 230593 "Testing, Adjusting, and Balancing for HVAC."

C. Scope: HVAC air systems and hydronic piping systems.

D. Purpose: Differential flow relationships intended to maintain air pressurization differentials between the various areas of Project.

E. Conditions of the Test:

1. Cx Test Demonstration Sampling Rate: As specified in "Inspections" Article in Section 230593 "Testing, Adjusting, and Balancing for HVAC."
2. Systems operating in full heating mode[**with minimum outside-air volume**].
3. Systems operating in full cooling mode[**with minimum outside-air volume**].
4. For measurements at air-handling units with economizer controls; systems operating in economizer mode with 100 percent outside air.

F. Acceptance Criteria:

1. Under all conditions, rechecked measurements comply with "Inspections" Article in Section 230593 "Testing, Adjusting, and Balancing for HVAC."
2. Additionally, no rechecked measurement shall differ from measurements documented in the final report by more than two times the tolerances allowed.
3. Under all conditions, where the Contract Documents indicate a differential in airflow between supply and exhaust and/or return in a space, the differential relationship shall be maintained.

3.6 BUILDING HEATING CONTROL SYSTEM Cx TESTS

A. Heating-Water Supply Temperature Control:

1. Prerequisites: Installation verification of the following:

    a. Startup of boilers B2-1 and B2-2.
    b. Startup of heating-water pump(s) <**Insert pump designation(s)**>.
    c. TAB of heating-water flow and pressure.
    d. Input Device: Heating-water supply temperature; [**thermostat**] [**thermistor temperature sensor**] [**resistance temperature sensor**] <**Insert device designation**>.
    e. Output Device: Control valve <**Insert device designation**>.
    f. Display the following at the operator's workstation:

        1) Heating-water supply temperature.
        2) Heating-water supply temperature set point.
        3) Control-valve position.

2. Scope: Heating-water system.
3. Purpose: Control of heating-water supply temperature at input device <**Insert device designation**>.
4. Conditions of the Test:

    a. Minimum heating-water flow.
    b. Midrange Heating-Water Flow: [**50 to 60**] <**Insert number(s)**> percent of maximum.
    c. Maximum heating-water flow.

5. Acceptance Criteria: Under all conditions, heating-water supply temperature is within plus or minus [**2.0 deg F**] <**Insert temperature**> of set point.

B. Heating-Water Supply Temperature Reset:

1. Prerequisites: Installation verification of the following:

    a. Startup of Boilers B2-1 and B2-2.
    b. Startup of heating-water pump(s) <**Insert pump designation(s)**>.
    c. TAB of heating-water flow and pressure.
    d. Input Device: Heating-water supply temperature; [**thermostat**] [**thermistor temperature sensor**] [**resistance temperature sensor**] <**Insert device designation**>.
    e. Input Device: Outdoor-air temperature; [**electric, outdoor-air-reset controller**] [**outdoor-air sensor**].
    f. Output Device: Control valve <**Insert device designation**>.
    g. Display the following at the operator's workstation:

1) Outdoor-air temperature.
2) Heating-water supply temperature.
3) Heating-water supply temperature set point.
4) Control-valve position.

2. Scope: Heating-water system.
3. Purpose: Control of heating-water supply temperature at heating-water supply temperature input device <**Insert device designation**> in response to variable outdoor-air temperature input; [**electric, outdoor-air-reset controller**] [**outdoor-air sensor**].
4. Conditions of the Test: Outdoor-air temperature input value may be overridden for this test.

    a. Low Temperature: Outdoor-air temperature between [**minus 30 and 0 deg F**] <**Insert temperature range**>.
    b. Midrange Temperature: Outdoor-air temperature between [**30 and 45 deg F**] <**Insert temperature range**>.
    c. High Temperature: Outdoor-air temperature above [**65 deg F**] <**Insert temperature**>.

5. Acceptance Criteria: Heating-water supply temperature resets in straight-line relationship with outdoor-air temperature for the following reset schedule. Under all conditions, heating-water supply temperature is within [**2.0 deg F**] <**Insert temperature**> of set point.

    a. [**195 deg F**] <**Insert temperature**> heating water when outdoor-air temperature is [**minus 30 deg F**] <**Insert temperature**>.
    b. [**130 deg F**] <**Insert temperature**> heating water when outdoor-air temperature is [**65 deg F**] <**Insert temperature**>.
    c. Under all conditions, heating-water supply temperature is within plus or minus [**2.0 deg F**] <**Insert temperature**> of set point.

C. Control Primary Circulating Pump(s):

1. Prerequisites: Installation verification of the following:

    a. Startup of heating-water pump(s) <**Insert pump designation(s)**>.
    b. Input Device: Outdoor-air temperature; [**electric, outdoor-air-reset controller**] [**outdoor-air sensor**].
    c. Output Device: Heating-water pump; [**starter**] [**DDC system command to starter**] relay.
    d. Display the following at the operator's workstation:

        1) Outdoor-air temperature.
        2) Operating status of primary circulating pump(s).

2. Scope: Heating-water pump(s) <**Insert pump designation(s)**> and associated controls.

3. Purpose: On-off control of heating-water pump(s) in response to variable outdoor-air temperature input; [**electric, outdoor-air-reset controller**] [**outdoor-air sensor**].
4. Conditions of the Test:

    a. High Temperature: Outdoor-air temperature above [**65 deg F**] <**Insert temperature**>.
    b. Low Temperature: Outdoor-air temperature below [**65 deg F**] <**Insert temperature**>.

5. Acceptance Criteria:

    a. High Temperature: Pump(s) are off when outside-air temperature is above [**65 deg F**] <**Insert temperature**>.
    b. Low Temperature: Pump(s) are on when outside-air temperature is below [**65 deg F**] <**Insert temperature**>.

3.7 SNOWMELT HEATING CONTROL SYSTEM Cx TESTS

A. Snowmelt Heating-Water Supply Temperature Control:

1. Prerequisites: Installation verification of the following:

    a. Startup of boiler B2-3 and B2-4.
    b. Startup of heating-water pump(s) SMCP2-1A and SMCP2-1B.
    c. TAB of heating-water flow and pressure.
    d. Input Device: Heating-water supply temperature; [**thermostat**] [**thermistor temperature sensor**] [**resistance temperature sensor**] <**Insert device designation**>.
    e. Output Device: Control valve <**Insert device designation**>.
    f. Display the following at the operator's workstation:

        1) Heating-water supply temperature.
        2) Heating-water supply temperature set point.
        3) Control-valve position.

2. Scope: Heating-water system.
3. Purpose: Control of heating-water supply temperature at input device <**Insert device designation**>.
4. Conditions of the Test:

    a. Minimum heating-water flow.
    b. Midrange Heating-Water Flow: [**50 to 60**] <**Insert number(s)**> percent of maximum.
    c. Maximum heating-water flow.

5. Acceptance Criteria: Under all conditions, heating-water supply temperature is within plus or minus [**2.0 deg F**] <**Insert temperature**> of set point.

B. Snowmelt Heating-Water Supply Temperature Reset:

1. Prerequisites: Installation verification of the following:

    a. Startup of boilers B2-3 and B2-4.
    b. Startup of heating-water pump(s) SMCP2-1A and SMCP2-1B.
    c. TAB of heating-water flow and pressure.
    d. Input Device: Heating-water supply temperature; [**thermostat**] [**thermistor temperature sensor**] [**resistance temperature sensor**] <**Insert device designation**>.
    e. Input Device: Outdoor-air temperature; [**electric, outdoor-air-reset controller**] [**outdoor-air sensor**].
    f. Output Device: Control valve <**Insert device designation**>.
    g. Display the following at the operator's workstation:

        1) Outdoor-air temperature.
        2) Heating-water supply temperature.
        3) Heating-water supply temperature set point.
        4) Control-valve position.

2. Scope: Heating-water system.
3. Purpose: Control of heating-water supply temperature at heating-water supply temperature input device <**Insert device designation**> in response to variable outdoor-air temperature input; [**electric, outdoor-air-reset controller**] [**outdoor-air sensor**].
4. Conditions of the Test: Outdoor-air temperature input value may be overridden for this test.

    a. Low Temperature: Outdoor-air temperature between [**minus 30 and 0 deg F**] <**Insert temperature range**>.
    b. Midrange Temperature: Outdoor-air temperature between [**30 and 45 deg F**] <**Insert temperature range**>.
    c. High Temperature: Outdoor-air temperature above [**65 deg F**] <**Insert temperature**>.

5. Acceptance Criteria: Heating-water supply temperature resets in straight-line relationship with outdoor-air temperature for the following reset schedule. Under all conditions, heating-water supply temperature is within [**2.0 deg F**] <**Insert temperature**> of set point.

    a. [**195 deg F**] <**Insert temperature**> heating water when outdoor-air temperature is [**minus 30 deg F**] <**Insert temperature**>.
    b. [**130 deg F**] <**Insert temperature**> heating water when outdoor-air temperature is [**65 deg F**] <**Insert temperature**>.

c. Under all conditions, heating-water supply temperature is within plus or minus [**2.0 deg F**] <**Insert temperature**> of set point.

C. Control Primary Circulating Pump(s):

1. Prerequisites: Installation verification of the following:

a. Startup of heating-water pump(s) <**Insert pump designation(s)**>.
b. Input Device: Outdoor-air temperature; [**electric, outdoor-air-reset controller**] [**outdoor-air sensor**].
c. Output Device: Heating-water pump; [**starter**] [**DDC system command to starter**] relay.
d. Display the following at the operator's workstation:

1) Outdoor-air temperature.
2) Operating status of primary circulating pump(s).

2. Scope: Heating-water pump(s) <**Insert pump designation(s)**> and associated controls.
3. Purpose: On-off control of heating-water pump(s) in response to variable outdoor-air temperature input; [**electric, outdoor-air-reset controller**] [**outdoor-air sensor**].
4. Conditions of the Test:

a. High Temperature: Outdoor-air temperature above [**65 deg F**] <**Insert temperature**>.
b. Low Temperature: Outdoor-air temperature below [**65 deg F**] <**Insert temperature**>.

5. Acceptance Criteria:

a. High Temperature: Pump(s) are off when outside-air temperature is above [**65 deg F**] <**Insert temperature**>.
b. Low Temperature: Pump(s) are on when outside-air temperature is below [**65 deg F**] <**Insert temperature**>.

3.8 CENTRAL REFRIGERATION SYSTEM Cx TESTS

A. Start and Stop Condenser-Water Pump(s):

1. Prerequisites: Installation verification of the following:

a. Startup of condenser-water pump(s) <**Insert pump designation(s)**>.
b. Startup of cooling tower <**Insert cooling tower designation**>.
c. Input Device: Water pressure transducer <**Insert device designation**>.

d. Input Device: [**Space thermostat**] [**DDC system outdoor-air temperature**] <**Insert device designation**>.
e. Input Device: [**Time clock**] [**DDC system time schedule**] <**Insert device designation**>.
f. Output Device: Hard wired through motor starter; [**DDC system binary output**] <**Insert device designation**>.
g. Output Device: [**Time clock**] [**Binary output**] <**Insert device designation**>.
h. Display the following at the operator's workstation:

1) Low-level cooling-tower sump alarm.
2) Outdoor-air temperature.
3) Cooling (software) demand indication.
4) Time and time schedule.
5) Condenser-water pump(s) on-off status.
6) Condenser-water pump(s) on-off indication.
7) Condenser-water flow indication.

2. Scope:

a. Condenser-water system, including condenser-water pump(s), cooling towers, and associated controls.

3. Purpose:

a. Condenser-water pump(s) lockout.
b. Condenser-water pump(s) start.
c. Condenser-water pump(s) shutdown.
d. Low-level cooling-tower sump alarm.
e. Condenser-water pump(s) time-of-day schedule.

4. Conditions of the Test:

a. Verify Lockout: Start with condenser-water pump enable-input devices in the "disable" state to prevent pump start. One by one, place the enable-input devices in the "enable" state, and then return each to the "disable" state before placing the next enable-input device to the "enable" state.
b. Verify Start: Start with condenser-water pump enable-input devices in the "disable" state to prevent pump start. One by one, place the enable-input devices in the "enable" state.
c. Verify Shutdown: Place all enable-input devices in the "enable" state to allow the pump(s) to start. One by one, place the enable-input devices in the "disable" state, and then return each to the "enable" state before placing the next enable-input device to the "disable" state.

d. Verify Schedule: Compare condenser-water pump start and stop schedule times with Owner-approved time-of-day schedule.

5. Acceptance Criteria:

a. Lockout: No single enable-input device starts the pump(s) when released to the "enable" state.
b. Start: Condenser-water pump(s) start when, and only when, all enable-input devices are in the "enable" state.
c. Shutdown: Each enable-input device stops the condenser-water pump(s) when placed in the "disable" state, regardless of the state of other enable-input devices.
d. Schedule: Condenser-water pump start and stop schedule times agree with Owner-approved time-of-day schedule.

B. Start and Stop Chilled-Water Pump(s):

1. Prerequisites: Installation verification of the following:

a. Startup of chilled-water pump(s) <**Insert pump designation(s)**>.
b. Startup of condenser-water pump(s) <**Insert pump designation(s)**>.
c. Startup of cooling tower <**Insert cooling tower designation**>.
d. Input Device: Flow switch in condenser-water circuit<**Insert device designation**>.
e. Output Device: [**Starter**] [**DDC system command to starter**] relay.
f. Display of the following at the operator's workstation:

1) Chilled-water flow indication.
2) Condenser-water flow indication.
3) Chilled-water pump(s) on-off status.
4) Chilled-water pump(s) on-off indication.

2. Scope: Chilled-water system, including chilled-water pump(s), associated controls, and condenser-water system controls.
3. Purpose:

a. Chilled-water pump(s) start.
b. Chilled-water pump(s) shutdown.

4. Conditions of the Test:

a. Verify Start: Start with chilled-water pump enable-input device in the "disable" state to prevent pump start. Place the enable-input device in the "enable" state.
b. Verify Shutdown: Start with the enable-input device in the "enable" state to allow the pump(s) to run. Then place the enable-input device in the "disable" state.

5. Acceptance Criteria:

    a. Start: Chilled-water pump(s) start when, and only when, the enable-input device is in the "enable" state.
    b. Shutdown: The enable-input device stops the chilled-water pump(s) when placed in the "disable" state.

C. Alternative Chiller(s):

1. Prerequisites: Installation verification of the following:

    a. Input Device: [**Electric alternator**] [**DDC system software**] <**Insert device designation**>.
    b. Output Device: [**Chiller**] [**DDC system command to chiller**] <**Insert device designation**> terminal strip.
    c. Display:

        1) Chiller(s) on-off indication.
        2) Chiller failure alarm.

2. Scope:

    a. Chilled-water system and associated controls.
    b. Condenser-water system and associated controls.

3. Purpose:

    a. Lead-lag rotation of chillers.
    b. Replacement of failed chiller in rotation.
    c. Adding and dropping chillers as follows: <**Insert sequence and parameters**>.
    d. Replacement of failed chiller in add/drop sequence.
    e. Chiller failure alarm initiation.

4. Conditions of the Test:

    a. Lead-Lag Rotation - Chiller Start: Create a number of chilled-water system start-stop cycles equal to the number of chillers plus one.
    b. Lead-Lag Rotation - Lead Chiller Fail: Disable the lead chiller while it is running.
    c. Lead-Lag Rotation - Lag Chiller Fail: Disable a lag chiller while it is running.
    d. Lead-Lag Rotation - Chiller Start Fail: Disable a chiller while it is in standby mode. Initiate a lead-lag rotation call for the disabled chiller to start.
    e. Add/Drop Sequence - Increasing Demand: Increase chilled-water demand incrementally to observe the corresponding addition of chillers. Increase demand gradually as the load approaches the set

point for adding the next chiller, to permit observation of the actual load at the time the next chiller is enabled.

f. Add/Drop Sequence - Decreasing Demand: Decrease chilled-water demand incrementally to observe the corresponding dropping of chillers. Decrease demand gradually as the load approaches the set point for dropping the next chiller, to permit observation of the actual load at the time the next chiller is disabled.

5. Acceptance Criteria:

a. Lead-Lag Rotation - Chiller Start: On each chilled-water system start event, the [**other**] [**next**] chiller in rotation starts as the lead chiller, and the previous lead chiller is designated as the [**last**]lag chiller.
b. Lead-Lag Rotation - Lead Chiller Fail: When the lead chiller fails, the [**other**] [**next**] chiller in rotation starts as the lead chiller, and a chiller failure alarm is initiated for the failed chiller.
c. Lead-Lag Rotation - Lag Chiller Fail: When the lag chiller fails, [**the next chiller in rotation starts as the lead chiller, and**]a chiller failure alarm is initiated for the failed chiller.
d. Lead-Lag Rotation - Chiller Start Fail: When a chiller fails to start, [**the next chiller in rotation starts in its place, and**]a chiller failure alarm is initiated for the failed chiller.
e. Add/Drop Sequence - Increasing Demand: Chillers are added at the specified load set point, plus or minus [**5**] <**Insert number**> percent. Chilled-water supply temperature remains stable within plus or minus [**2.0 deg F**] <**Insert temperature**> of set point.
f. Add/Drop Sequence - Decreasing Demand: Chillers are dropped at the specified load set point, plus or minus [**5**] <**Insert number**> percent. Chilled-water supply temperature remains stable within plus or minus [**2.0 deg F**] <**Insert temperature**> of set point.
g. Add/Drop Sequence - Operating Chiller Fail: When an operating chiller fails, the next chiller in sequence starts and a chiller failure alarm is initiated for the failed chiller.
h. Add/Drop Sequence - Chiller Start Fail: When a chiller fails to start, the next chiller in sequence starts in its place and a chiller failure alarm is initiated for the failed chiller.

3.9 TERMINAL UNIT EQUIPMENT Cx TESTS

A. VAV Terminal Air Units with Coils:

1. Prerequisites: Installation verification of the following:

a. Occupancy Input Device: Occupancy sensor.
b. Occupancy Output Device: DDC system binary output.

c. Room Temperature Input Device: [**Room thermostat**] [**Electronic temperature sensor**].
d. Room Temperature Output Device: [**Pneumatic**] [**Electronic**] damper actuators and control-valve operators.
e. Display the following at the operator's workstation:

1) Room/area served.
2) Room occupied/unoccupied.
3) Room temperature indication.
4) Room temperature set point.
5) Room temperature set point, occupied.
6) Room temperature set point, unoccupied.
7) Air-damper position as percentage open.
8) Control-valve position as percentage open.

2. Scope: VAV terminal air units with hydronic coils in supply-air systems, and associated controls.
3. Purpose:

a. Occupancy-dependent room temperature set-point reset.
b. Room temperature control.

4. Conditions of the Test:

a. Cx Test Demonstration Sampling Rate: [**10**] <**Insert number**> percent of each model/size unit.
b. Temperature Control - Occupied: Start with the room unoccupied. Occupy the room and observe the change to occupied status. Observe temperature control until room temperature is stable at occupied set point, plus or minus [**1.0 deg F**] <**Insert temperature**>.
c. Temperature Control - Unoccupied: Start with the room occupied. Vacate the room and observe the change to unoccupied status. Observe temperature control until room temperature is stable at unoccupied set point, plus or minus [**1.0 deg F**] <**Insert temperature**>.

5. Acceptance Criteria:

a. Temperature Control - Occupied:

1) Control system status changes from "occupied" to "unoccupied" after the specified time.
2) Room temperature is stable at occupied set point, plus or minus [**1.0 deg F**] <**Insert temperature**> within [**10**] <**Insert number**> minutes of occupancy. Room temperature does not overshoot or undershoot set point by more than [**2.0 deg F**] <**Insert temperature**> during transition.

b. Temperature Control - Unoccupied:

1) Control system status changes from "unoccupied" to "occupied" [**immediately**] [**after five minutes of continuous occupancy**].
2) Room temperature is stable at unoccupied set point, plus or minus [**1.0 deg F**] <**Insert temperature**> within [**30**] <**Insert number**> minutes of occupancy.

B. Finned Tube

C. Radiant Panel

3.10 AIR-HANDLING SYSTEM Cx TESTS

A. Supply Fan(s) Variable-Volume Control:

1. Prerequisites: Installation verification of the following:

a. Volume Control Input Device: [**Static-pressure transmitter**] [**Differential-pressure switch**] sensing supply-duct static pressure referenced to conditioned-space static pressure.
b. Volume Control Output Device: [**Receiver controller**] [**DDC system analog output**] [**DDC system analog output to digital-to-pneumatic transducer**] to modulating damper actuator. Set inlet guide vanes to [**minimum**] [**closed**] position when fan is stopped.
c. Volume Control Input Device: [**Static-pressure transmitter**] [**Differential-pressure switch**] sensing supply-duct static pressure referenced to conditioned-space static pressure.
d. Volume Control Output Device: [**Receiver controller**] [**DDC system analog output**] to motor speed controller. Set variable-speed drive to minimum speed when fan is stopped.
e. High-Pressure Input Device: Static-pressure transmitter sensing supply-duct static pressure referenced to static pressure outside the duct.
f. High-Pressure Output Device: [**Receiver controller**] [**DDC system binary output**] to [**alarm panel**] [**motor starter**].
g. Display the following at the operator's workstation:

1) Supply-fan-discharge static-pressure indication.
2) Supply-fan-discharge static-pressure set point.
3) Supply-fan airflow rate.
4) Supply-fan [**inlet vane position**] [**speed**].

2. Scope: VAV supply fan units and associated controls.
3. Purpose:

a. Supply-air discharge static pressure control.

b. Response to excess supply-air discharge static pressure condition.

4. Conditions of the Test:

a. Minimum supply-air flow.
b. Midrange Supply-Air Flow: [**50 to 60**] <**Insert number(s)**> percent of maximum.
c. Maximum supply-air flow.
d. Excess supply-air discharge static pressure.

5. Acceptance Criteria:

a. At all supply-air flow rates, and during changes in supply-air flow, discharge air static pressure is at set point plus or minus [**2**] <**Insert number**> percent.
b. Fan stops and an alarm is initiated at the operator's workstation when supply-air discharge static pressure is at the excess static pressure, plus or minus [**2**] <**Insert number**> percent.

B. Air-Handler Mixed-Air Control:

1. Prerequisites: Installation verification of the following:

a. Minimum Position Input Device: [**Time clock**] [**DDC system time schedule**].
b. Output Device: [**Receiver controller**] [**DDC system analog output**] [**DDC system analog output to digital-to-pneumatic transducer**] to modulating damper actuator(s).
c. Heating Reset Input Device: [**Room thermostat**] [**DDC system software**].
d. [**Supply**] [**Mixed**]-Air Temperature Input Device: [**Duct-mounted thermostat**] [**Electronic temperature sensor**].
e. Cooling Reset Input Device: Outdoor- and return-air, duct-mounted [**thermostats**] [**electronic temperature sensors**].
f. Display the following at the operator's workstation:

1) Mixed-air-temperature indication.
2) Mixed-air-temperature set point.
3) Mixed-air damper position.

2. Scope: Air handler with mixed-air control and associated controls.
3. Purpose:

a. Occupied time control.
b. Minimum damper position control.
c. Heating reset control.
d. [**Supply**] [**Mixed**]-air temperature control.
e. Cooling reset control.

f. Unoccupied time control.

4. Conditions of the Test:

   a. Occupied Time Control: Start in unoccupied schedule. Advance to occupied schedule time.
   b. Minimum Damper Position Control: Command system to mode in which minimum damper position is required.
   c. Heating Reset Control: Create a call for heating.
   d. [**Supply**] [**Mixed**]-Air Temperature Control: Override [**supply**] [**mixed**]-air temperature set point to a value [**2.0 deg F**] <**Insert temperature**> above current [**supply**] [**mixed**]-air temperature.
   e. Cooling Reset Control: Override outdoor-air [**temperature to a value that exceeds return-air temperature**] [**enthalpy to a value that exceeds return-air enthalpy**].
   f. Unoccupied Time Control: Advance to unoccupied schedule time.
   g. Control Data Trend Log: Set up a data trend log of the following input device values and output device commands. Record data at [**hourly**] <**Insert alternative recording frequency**> intervals. Submit trend data for [**24-hour**] <**Insert time**> periods in which natural conditions require heating reset control, [**supply**] [**mixed**]-air temperature control, and cooling reset control.

      1) Minimum position input device.
      2) Heating reset input device.
      3) [**Supply**] [**Mixed**]-air temperature input device.
      4) Cooling reset input device.

5. Acceptance Criteria:

   a. Occupied Time Control: Mixed-air control is active in occupied mode.
   b. Minimum Damper Position Control: Controller [**opens minimum outdoor-air dampers**] [**positions outdoor-air dampers to minimum position**].
   c. Heating Reset Control: Controller [**closes minimum outdoor-air dampers**] [**sets outdoor-air dampers to minimum position**].
   d. [**Supply**] [**Mixed**]-Air Temperature Control: Controller modulates outdoor-, return-, and relief-air dampers to maintain temporary [**supply**] [**mixed**]-air temperature set point, plus or minus [**1.0 deg F**] <**Insert temperature**>.
   e. Cooling Reset Control: Controller sets outdoor-air dampers to minimum position when outdoor-air [**temperature exceeds return-air temperature**] [**enthalpy exceeds return-air enthalpy**].
   f. Unoccupied Time Control: Controller positions outdoor- and relief-air dampers closed and return-air dampers open.
   g. Control Data Trend Log: Data verify control according to sequence of control.

END OF SECTION 230800

SECTION 26 08 00

COMMISSIONING OF ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes Cx process requirements for the following electrical components, systems, assemblies, and equipment:
   1. Electrical equipment connected to Normal power systems, including the following:
      a. Motor-control centers.
      b. Transformers.
      c. Primary and secondary service electrical systems.
      d. Distribution and branch-circuit panelboards.
      e. Lightning protection systems.
      f. Grounding systems.

   2. Electrical equipment connected to Essential power systems that provide an alternative source of power in the absence of power from the Normal power system.
      a. Motor-control centers.
      b. Primary and secondary service electrical systems.
      c. Distribution and branch-circuit panelboards.
      d. Lighting protection systems.
      e. Grounding systems.
      f. Generators.
      g. UPS.

   3. Controls and instrumentation.
      a. Equipment monitoring systems.
      b. Energy monitoring and control systems.
      c. Electrical metering and metering system.
      d. Demand response systems.
      e. Lighting control systems.
      f. Security systems.
      g. Fire-alarm systems.
      h. Security systems.
      i. Communications.
      j. <Insert systems>.

4. Systems testing and verification, including [Normal] [and] [Essential] power systems[, and transitions from Normal to Essential power systems and back].
5. <Insert electrical systems>.

B. Related Requirements:
1. Section 019113 "General Commissioning Requirements" for general Cx process requirements and CxA responsibilities.

1.2 DEFINITIONS

A. BoD: Basis-of-Design Document, as defined in Section 019113 "General Commissioning Requirements."

B. Cx: Commissioning, as defined in Section 019113 "General Commissioning Requirements."

C. CxA: Commissioning Authority, as defined in Section 019113 "General Commissioning Requirements."

D. Essential Power Systems: A power system that a facility transitions to in the absence of Normal power. This power includes all systems classified as "standby" or "emergency," including "legally required."

E. Low Voltage: 600 V and below.

F. Medium Voltage: 601 V and above.

G. Normal Power Systems: A power system that provides primary power to a facility.

H. OPR: Owner's Project Requirements, as defined in Section 019113 "General Commissioning Requirements."

I. "Systems," "Assemblies," "Subsystems," "Equipment," and "Components": Where these terms are used together or separately, they shall mean "as-built" systems, assemblies, subsystems, equipment, and components.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For [BAS] [and] [electrical] testing technician.

B. Prefunctional checklists: Draft prefunctional checklists will be created by CxA for Contractor review.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For electrical systems and components to include in operation and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Electrical Testing Technician Qualifications: Technicians to perform electrical prefunctional checklist verification tests, prefunctional checklist verification test demonstrations, Cx tests, and Cx test demonstrations shall have the following minimum qualifications:
   1. Journey level or equivalent skill level. Vocational school four-year-program graduate or an Associate's degree in electrical systems, or similar field.
   2. Minimum **[three years']** <**Insert time**> experience installing, servicing, and operating systems manufactured by approved manufacturer.

B. Testing Equipment and Instrumentation Quality and Calibration: For test equipment and instrumentation required to perform electrical Cx work, perform the following:
   1. Submit test equipment and instrumentation list. For each equipment or instrument, identify the following:
      a. Equipment/instrument identification number.
      b. Planned Cx application or use.
      c. Manufacturer, make, model, and serial number.
      d. Calibration history, including certificates from agencies that calibrate the equipment and instrumentation.
   2. Test equipment and instrumentation shall meet the following criteria:
      a. Capable of testing and measuring performance within the specified acceptance criteria.
      b. Be calibrated at manufacturer's recommended intervals with current calibration tags permanently affixed to the instrument being used.
      c. Be maintained in good repair and operating condition throughout duration of use on Project.
      d. Be recalibrated/repaired if dropped or damaged in any way since last calibrated.

C. Proprietary Test Instrumentation and Tools:
   1. Equipment Manufacturer's Proprietary Instrumentation and Tools: For installed equipment included in the Cx process, test instrumentation and tools manufactured or prescribed by equipment manufacturer to service, calibrate, adjust, repair, or otherwise work on its equipment or required as a condition of equipment warranty, perform the following:
      a. Submit proprietary instrumentation and tools list. For each instrument or tool, identify the following:

1) Instrument or tool identification number.
2) Equipment schedule designation of equipment for which the instrument or tool is required.
3) Manufacturer, make, model, and serial number.
4) Calibration history, including certificates from agencies that calibrate the instrument or tool, where appropriate.

b. Include a separate list of proprietary test instrumentation and tools in operation and maintenance manuals.

c. Electrical proprietary test instrumentation and tools become property of Owner at the time of Substantial Completion.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 CONSTRUCTION CHECKLIST REVIEW

A. Review and provide written comments on draft prefunctional checklists. CxA will create required draft prefunctional checklists and provide them to Contractor.

B. Return draft prefunctional checklist review comments within [10] <Insert number> days of receipt.

C. When review comments have been resolved, CxA will provide final prefunctional checklists, marked "Approved for Use, (date)."

D. Use only prefunctional checklists, marked "Approved for Use, (date)."

3.2 GENERAL TESTING REQUIREMENTS

A. Certify that electrical systems, subsystems, and equipment have been installed, calibrated, and started and that they are operating according to the Contract Documents and approved Shop Drawings and submittals.

B. Certify that electrical instrumentation and control systems have been completed and calibrated, that they are operating according to the Contract Documents and approved Shop Drawings and submittals, and that pretest set points have been recorded.

C. Set systems, subsystems, and equipment into operating mode to be tested according to approved test procedures (for example, normal shutdown, normal auto position, normal manual position, unoccupied cycle, emergency power, and alarm conditions).

D. Measure capacities and effectiveness of systems, assemblies, subsystems, equipment, and components, including operational and control functions to verify compliance with acceptance criteria.

E. Test systems, assemblies, subsystems, equipment, and components operating modes, interlocks, control responses, and responses to abnormal or emergency conditions, and response according to acceptance criteria.

F. Prefunctional checklists: Prepare and submit detailed prefunctional checklists for electrical systems, subsystems, equipment, and components.

G. Perform tests using design conditions, whenever possible.

H. If tests cannot be completed because of a deficiency outside the scope of the electrical system, document the deficiency and report it to Owner. After deficiencies are resolved, reschedule tests.

I. If seasonal testing is specified, complete appropriate initial performance tests and documentation and schedule seasonal tests.

J. Coordinate schedule with, and perform Cx activities at the direction of the CxA.

K. Comply with prefunctional checklist requirements, including material verification, installation checks, startup, and performance tests requirements specified in Sections specifying electrical systems and equipment.

L. Provide technicians, instrumentation, tools, and equipment to complete and document the following:
   1. Performance tests.
   2. Demonstration of a sample of performance tests.
   3. Cx tests.
   4. Cx test demonstrations.

3.3 Cx TESTS FOR ELECTRICAL SYSTEMS

A. Verification of Normal Power System Operation:
   1. Prerequisites: Acceptance of results for prefunctional checklists for Division 26 electrical components associated with Normal power system.
   2. Equipment and Systems to Be Tested: Division 26 electrical equipment.
   3. Test Purpose: Verify operation of Normal power system.
   4. Test Conditions: Energize components of Normal power system, one at a time.
   5. Acceptance Criteria: Proper operation of Normal power system over a [24] [48] <Insert number>-hour period.

B. Verification of Essential Power System Operation:
   1. Prerequisites:

a. Acceptance of results for prefunctional checklists for Division 26 electrical components associated with Essential power system.
b. Completion of "Verification of Normal Power System Operation" tests.

2. Equipment and Systems to Be Tested: Division 26 electrical equipment.
3. Test Purpose: Verify operation of Essential power system.
4. Test Conditions:
   a. Energize components of Normal power system.
   b. Simulate a failure of Normal power system.
5. Acceptance Criteria: Transfer of power from Normal to Essential power system within OPR.

C. Verification of Control and Instrumentation:
   1. Prerequisites: Acceptance of results for prefunctional checklists.

D. Test Purpose: Verify operation of control and monitoring systems for Normal and Essential power systems.

E. Test Conditions:
   1. Energize components of Normal power system.
   2. Test operation of equipment.

F. Acceptance Criteria: Operation of equipment according to OPR.

END OF SECTION 260800

RESPEC

To be verified
UD = No Defined Specification Section
N/A = Not Applicable Or in Multiple Systems
Calculated Value
Not Approved/Not Received
NOT PROVIDED IN DDC DRAWINGS

Project:	VNPCC Expansion
Project #:	
Title:	Cx Equipment List
CxA:	RSW
Input Date:	10/9/2024

GENERAL DATA														COMMISSIONING FORMS								COMMISSIONING ACTIVITIES									
EQUIPMENT									SECTION REF.					PRE-FUNCTIONAL CHECKLIST			FUNCTIONAL PERFORMANCE TEST			TRAINING SYLLABUS	PFC COMPLETED				FPT COMPLETED		TRAINING OUTLINE		TRAINING COMPLETED
CC Form No.	FPT Form No.	SYSTEM/EQUIPMENT TAG	SYSTEM/EQUIPMENT DESCRIPTION	MFR	MODEL	BUILDING	ROOM NAME	ROOM NUMBER	SPEC	PARAGRAPH	SUBMITTAL APPROVED	I/O&M APPROVED	LETTER / WAIVER RECEIVED	SERIAL NUM.	DRAFT COMPLETE DATE	FINAL COMPLETE DATE	APPROVED DATE	DRAFT COMPLETE DATE	FINAL COMPLETE DATE	APPROVED DATE	APPROVED DATE	RECEIVED	REVISION	APPROVED	DATE	INITIAL	DATE	INITIALS	DATE	DATE
01 00 00 - OWNER FURNISHED EQUIPMENT																															
xx xx xx - Medical Equipment Power Supply System																															
			CT-Scanner																												
PFC-01-XX	#N/A	XX																#N/A	#N/A	#N/A						#N/A	#N/A				
			X-Ray and MRI Equipment																												
PFC-01-XX	#N/A	XX																#N/A	#N/A	#N/A						#N/A	#N/A				
			UPS																												
PFC-01-XX	#N/A	XX																#N/A	#N/A	#N/A						#N/A	#N/A				
08 00 00 - DOORS AND FRAMES																															
xx xx xx - Doors with Frames Fire Rating																															
			Fired Rated Doors																												
PFC-21-FRD	#N/A	FRD																#N/A	#N/A	#N/A						#N/A	#N/A				
21 00 00 - FIRE SUPPRESSION																															
21 05 00 - Common Work Results for Fire Suppression																															
			Water-Based Fire-Suppression Systems																												
PFC-21-FSS	#N/A	FSS	Water-Based Fire-Suppression Systems Piping	--	--	--		Throughout										#N/A	#N/A	#N/A						#N/A	#N/A				
21 30 00 - Fire Pumps																															
			Fire Pumps																												
PFC-21-FP-1	#N/A	FP-1	Fire Pump	Aurora	--	Sector F	Fire Pump/Sprinkler	463										#N/A	#N/A	#N/A						#N/A	#N/A				
PFC-21-JP-1	#N/A	JP-1	Jockey Pump	Goulds	1SV	Sector F	Fire Pump/Sprinkler	463										#N/A	#N/A	#N/A						#N/A	#N/A				
22 00 00 - PLUMBING																															
22 10 00 - Plumbing Piping																															
			Facility Water Distribution																												
PFC-22-DCW	#N/A	DCW	Domestic Cold Water System	--	--	--		--										#N/A	#N/A	#N/A						#N/A	#N/A				
PFC-22-DHW	#N/A	DHW	Domestic Hot Water System	--	--	--		--										#N/A	#N/A	#N/A						#N/A	#N/A				
PFC-22-HWC	#N/A	HWC	Domestic Hot Water Circ	--	--	--		--										#N/A	#N/A	#N/A						#N/A	#N/A				
			Facility Sanitary Sewerage																												
PFC-22-SW	#N/A	SW	Sanitary Waste System	--	--	--		--										#N/A	#N/A	#N/A						#N/A	#N/A				
PFC-22-SV	#N/A	SV	Sanitary Vent System	--	--	--		--										#N/A	#N/A	#N/A						#N/A	#N/A				
22 11 19 - Domestic Water Piping Specialties																															
			Expansion Tanks																												
PFC-22-PET2-1	#N/A	PET2-1	DHW Expansion Tank	Taco	CA215-125		Fire Pump/Sprinkler	1913										#N/A	#N/A	#N/A						#N/A	#N/A				
PFC-22-PET2-2	#N/A	PET2-2	Domestic Water Pressure Tank	Taco	CA215-125		Fire Pump/Sprinkler	1913										#N/A	#N/A	#N/A						#N/A	#N/A				
																										#N/A	#N/A				
			Tempering Valves																												
PFC-22-TV2-1	#N/A	TV2-1	Tempering Valves	PVI	V135-ABFSNP		Fire Pump/Sprinkler	1913																							
			Water Hammer Arrestors																												
PFC-22-WHA-A	#N/A	WHA-A	PDI Size 'A'	--	--	--		Throughout																							
PFC-22-WHA-B	#N/A	WHA-B	PDI Size 'B'	--	--	--		Throughout																							
PFC-22-WHA-C	#N/A	WHA-C	PDI Size 'C'	--	--	--		Throughout																							
PFC-22-WHA-D	#N/A	WHA-D	PDI Size 'D'	--	--	--		Throughout																							
PFC-22-WHA-E	#N/A	WHA-E	PDI Size 'E'	--	--	--		Throughout																							
PFC-22-WHA-F	#N/A	WHA-F	PDI Size 'F'	--	--	--		Throughout																							
22 60 00 - Gas and Vacuum Systems for Laboratory and Healthcare Facilities																															
			Compressed-Air Systems for Laboratory and Healthcare Facilities																												
PFC-22-CA	#N/A	CA	Compressed-Air System	--	--	--		Throughout	22 16 13									#N/A	#N/A	#N/A						#N/A	#N/A				
			Dental Vacuum Piping																												
PFC-22-DAS	#N/A	DAS	Dental Air System						22 61 13.74									#N/A	#N/A	#N/A						#N/A	#N/A				
PFC-22-DVS	#N/A	DVS	Dental Vacuum System						22 62 13.74									#N/A	#N/A	#N/A						#N/A	#N/A				
			Dental Vacuum and Evacuation Equipment																												
PFC-22-XX	#N/A	XX																#N/A	#N/A	#N/A						#N/A	#N/A				
			Gas Systems for Laboratory and Healthcare Facilities																												
PFC-22-O2	#N/A	O2	Medical Oxygen System	--	--	--		Throughout	22 63 13									#N/A	#N/A	#N/A						#N/A	#N/A				
PFC-22-N2O	#N/A	N2O	Nitrous Oxide System	--	--	--		Throughout	22 63 13									#N/A	#N/A	#N/A						#N/A	#N/A				
PFC-22-MAS	#N/A	MAS	Medical Air System	--	--	--		Throughout	22 63 13									#N/A	#N/A	#N/A						#N/A	#N/A				
			Medical Gas Equipment																												
PFC-22-XX	#N/A	XX																#N/A	#N/A	#N/A						#N/A	#N/A				
			Chemical-Waste Systems for Laboratory and Healthcare Facilities																												
PFC-22-XX	#N/A	XX		--	--	--		--	22 66 00									#N/A	#N/A	#N/A						#N/A	#N/A				
22 34 00 - Fuel-Fired, Domestic-Water Heaters																															
			Commercial Gas-Fired Water Heaters																												
PFC-21-WH2-1	#N/A	WH2-1	Domestic Hot Water / Gas-Fired Condensing	PVI	30 L 100A-GCL		Fire Pump/Sprinkler	1913	22 34 36									#N/A	#N/A	#N/A						#N/A	#N/A				
PFC-21-WH2-2	#N/A	WH2-2	Domestic Hot Water / Gas-Fired Condensing	PVI	30 L 100A-GCL		Fire Pump/Sprinkler	1913	22 34 36									#N/A	#N/A	#N/A						#N/A	#N/A				
22 11 23 - Domestic Water Pumps																															
			Booster Pumps																												
PFC-21-DBP2-1	#N/A	DBP2-1	Domestic Water Booster Pump	Grundfos	Hydro Multi-E 2 CRE 15-2		Fire Pump/Sprinkler	1913	22 11 23.13									#N/A	#N/A	#N/A						#N/A	#N/A				
			Circulating Pumps																												
PFC-21-PCP2-1A	#N/A	PCP2-1A	Domestic Hot Water Circulation Pump	Grundfos	UPS 32-160F B		Fire Pump/Sprinkler	1913	22 11 23.23									#N/A	#N/A	#N/A						#N/A	#N/A				
PFC-21-PCP2-1B	#N/A	PCP2-1B	Domestic Hot Water Circulation Pump	Grundfos	UPS 32-160F B		Fire Pump/Sprinkler	1913	22 11 23.23									#N/A	#N/A	#N/A						#N/A	#N/A				
22 31 16 - Commercial Domestic Water Softeners																															
			Water Softener																												
PFC-21-WS2-1	#N/A	WS2-1	Domestic Water Softener	WATTS	M4614WWTI-NH			Fire Pumps/Sprinkler & Boiler Room 1913										#N/A	#N/A	#N/A						#N/A	#N/A				

23 00 00 - HEATING, VENTILATING, AND AIR CONDITIONING (HVAC)																															
23 31 00 - HVAC Ducts and Casings																															
			HVAC Ductwork Systems																												
PFC-23-OSA	#N/A	OSA	Outside Air Ductwork System															#N/A	#N/A	#N/A						#N/A	#N/A				
PFC-23-SA	#N/A	SA	Supply Air Ductwork System															#N/A	#N/A	#N/A						#N/A	#N/A				
PFC-23-RA	#N/A	RA	Return Air Ductwork System															#N/A	#N/A	#N/A						#N/A	#N/A				
PFC-23-EA	#N/A	EA	Exhaust Air Ductwork System															#N/A	#N/A	#N/A						#N/A	#N/A				
xx xx xx - Facility Fuel Systems																															
			Facility Fuel Piping																												
PFC-23-FFS	#N/A	FFS																#N/A	#N/A	#N/A						#N/A	#N/A				
			Facility Fuel Pumps																												
PFC-23-FP	#N/A	FP																#N/A	#N/A	#N/A						#N/A	#N/A				
23 11 23 - Facility Natural-Gas Piping																															
			Natural Gas Piping System																												
PFC-23-NGP-1	#N/A	NGP-1	Natural Gas Piping System															#N/A	#N/A	#N/A						#N/A	#N/A				
23 21 16 - Hydronic Piping Specialties																															
			Expansion Tanks																												
PFC-23-ET-1A	#N/A	ET-1A	Heating Water	Taco	CA700-125													#N/A	#N/A	#N/A						#N/A	#N/A				
PFC-23-ET-1B	#N/A	ET-1B	Heating Water	Taco	CA700-125													#N/A	#N/A	#N/A						#N/A	#N/A				
PFC-23-ET-2	#N/A	ET-2	Drycooler Expansion Tank	Taco	CA90-125													#N/A	#N/A	#N/A						#N/A	#N/A				
PFC-23-ET-4	#N/A	ET-4	Snow Melt System Expansion Tank	Taco	CA90-125													#N/A	#N/A	#N/A						#N/A	#N/A				
PFC-23-ET-5	#N/A	ET-5	Chilled Glycol Expansion Tank	Taco	CA90-125													#N/A	#N/A	#N/A						#N/A	#N/A				
			Air Separator																												
PFC-23-AS2-1	#N/A	AS2-1	Buildling Heating System Air Separator	Spirotherm	VDN 600 FA													#N/A	#N/A	#N/A						#N/A	#N/A				
PFC-23-AS2-2	#N/A	AS2-2	Snowmelt System Air Separator	Spirotherm	VDN 800 FA													#N/A	#N/A	#N/A						#N/A	#N/A				
PFC-23-AS2-3	#N/A	AS2-3	Drycooler System Air Separator	Spirotherm	VDN 300 FA													#N/A	#N/A	#N/A						#N/A	#N/A				
PFC-23-AS2-4	#N/A	AS2-4	Chilled Glycol Air Separator	Spirotherm	VDN 800 FA													#N/A	#N/A	#N/A						#N/A	#N/A				
			Glycol Makeup Tank																												
PFC-23-GT2-1	#N/A	GT2-1	Glycol Makeup Tank	Axiom	SF 100													#N/A	#N/A	#N/A						#N/A	#N/A				
PFC-23-GT2-2	#N/A	GT2-2	Glycol Makeup Tank	Axiom	DMF 300													#N/A	#N/A	#N/A						#N/A	#N/A				
			Buffer Tank																												
PFC-23-BT2-1	#N/A	BT2-1	Hydronic Buffer Tank	Taco	MPT0450F06-125N1AN																										
			Chemical Feeder																												
PFC-23-PF2-1	#N/A	PF2-1	Chemical Feeder	J.L. Wingert	DB-12HD		Fire Pump/Sprinkler	1913																							
23 21 13 - HVAC Piping																															
			HVAC Piping Systems																												
PFC-23-CWS	#N/A	CWS	Chilled Water System															#N/A	#N/A	#N/A						#N/A	#N/A				
PFC-23-HHW	#N/A	HHW	Hydronic Hot Water Heating System															#N/A	#N/A	#N/A						#N/A	#N/A				
23 21 23 - HVAC Pumps																															
			HVAC PUMPS																												
PFC-23-HCP2-1A	#N/A	HCP2-1A	Hydronic Circulation Pump	Taco	3011D		Fire Pump/Sprinkler	1913										#N/A	#N/A	#N/A						#N/A	#N/A				
PFC-23-HCP2-1B	#N/A	HCP2-1B	Hydronic Circulation Pump	Taco	3011D		Fire Pump/Sprinkler	1913										#N/A	#N/A	#N/A						#N/A	#N/A				
PFC-23-HCCP-1A	#N/A	HCCP-1A		Grundfos														#N/A	#N/A	#N/A						#N/A	#N/A				
PFC-23-HCCP-1B	#N/A	HCCP-1B		Grundfos														#N/A	#N/A	#N/A						#N/A	#N/A				
PFC-23-SMCP-1A	#N/A	SMCP-1A	Snow Melt Circulation Pump	Taco	3007D		Fire Pump/Sprinkler	1913										#N/A	#N/A	#N/A						#N/A	#N/A				
PFC-23-SMCP-1B	#N/A	SMCP-1B	Snow Melt Circulation Pump	Taco	3007D		Fire Pump/Sprinkler	1913										#N/A	#N/A	#N/A						#N/A	#N/A				
PFC-23-CWP2-1	#N/A	CWP2-1		Taco	4009D																										
PFC-23-CWP2-2	#N/A	CWP2-2		Taco	4009D																										
PFC-23-CWP2-3A	#N/A	CWP2-3A		Taco	4009D																										
PFC-23-CWP2-3B	#N/A	CWP2-3B		Taco	4009D																										
PFC-23-CWP2-4A	#N/A	CWP2-4A		Taco																											
PFC-23-CWP2-4B	#N/A	CWP2-4B		Taco																											
23 31 00 - HVAC Ducts and Casings																															
			HVAC Ductwork Systems																												
PFC-23-OSA	#N/A	OSA	Outside Air Ductwork System															#N/A	#N/A	#N/A						#N/A	#N/A				
PFC-23-SA	#N/A	SA	Supply Air Ductwork System															#N/A	#N/A	#N/A						#N/A	#N/A				
PFC-23-RA	#N/A	RA	Return Air Ductwork System															#N/A	#N/A	#N/A						#N/A	#N/A				
PFC-23-EA	#N/A	EA	Exhaust Air Ductwork System															#N/A	#N/A	#N/A						#N/A	#N/A				
23 33 00 -Air Duct Accessories																															
			Exhaust Air Valve																												
PFC-23-EAV1-1	#N/A	EAV1-1	Phoenix Controls Exhaust Air Valve	Phoenix Controls	ACCEL II		Receiving	540																							
PFC-23-EAV1-2	#N/A	EAV1-2	Phoenix Controls Exhaust Air Valve	Phoenix Controls	ACCEL II		Receiving	540										#N/A	#N/A	#N/A						#N/A	#N/A				
			Fire Smoke Dampers																												
23 34 00 -HVAC Fans																															
			Exhaust Air Valve																												
PFC-23-EF1-9	#N/A	EF1-9	Centrifugal Fume Exhaust	Greenheck	VEKTOR-H-12																										
PFC-23-EF1-10	#N/A	EF1-10	Belt Driven Downblast Exhaust Fan	Greenheck	GB-131													#N/A	#N/A	#N/A						#N/A	#N/A				
PFC-23-EF1-11	#N/A	EF1-11	Direct Drive Downblast Exhaust Fan	Greenheck	G-098-VG																										
PFC-23-EF1-12	#N/A	EF1-12	Direct Drive Downblast Exhaust Fan	Greenheck	G-095-_																										
23 36 00 - Air Terminal Units																															
			Variable Air Volume Unit	Titus	DESV																										
PFC-23-VAV-101	#N/A	VAV-101	Variable Air Volume Unit	Titus	DESV																										
PFC-23-VAV-102	#N/A	VAV-102	Variable Air Volume Unit	Titus	DESV																										
PFC-23-VAV-103	#N/A	VAV-103	Variable Air Volume Unit	Titus	DESV																										
PFC-23-VAV-104	#N/A	VAV-104	Variable Air Volume Unit	Titus	DESV																										
PFC-23-VAV-105	#N/A	VAV-105	Variable Air Volume Unit	Titus	DESV																										
PFC-23-VAV-106	#N/A	VAV-106	Variable Air Volume Unit	Titus	DESV																										
PFC-23-VAV-107	#N/A	VAV-107	Variable Air Volume Unit	Titus	DESV																										
PFC-23-VAV-108	#N/A	VAV-108	Variable Air Volume Unit	Titus	DESV																										
PFC-23-VAV-109	#N/A	VAV-109	Variable Air Volume Unit	Titus	DESV																										
PFC-23-VAV-110	#N/A	VAV-110	Variable Air Volume Unit	Titus	DESV																										
PFC-23-VAV-111	#N/A	VAV-111	Variable Air Volume Unit	Titus	DESV																										
PFC-23-VAV-112	#N/A	VAV-112	Variable Air Volume Unit	Titus	DESV																										
PFC-23-VAV-113	#N/A	VAV-113	Variable Air Volume Unit	Titus	DESV																										
PFC-23-VAV-114	#N/A	VAV-114	Variable Air Volume Unit	Titus	DESV																										
PFC-23-VAV-115	#N/A	VAV-115	Variable Air Volume Unit	Titus	DESV																										
PFC-23-VAV-116	#N/A	VAV-116	Variable Air Volume Unit	Titus	DESV																										

FC-23-VAV-11	#N/A	VAV-117	Variable Air Volume Unit	Titus	DESV																									
FC-23-VAV-11	#N/A	VAV-118	Variable Air Volume Unit	Titus	DESV																									
FC-23-VAV-11	#N/A	VAV-119	Variable Air Volume Unit	Titus	DESV																									
FC-23-VAV-12	#N/A	VAV-120	Variable Air Volume Unit	Titus	DESV																									
FC-23-VAV-12	#N/A	VAV-121	Variable Air Volume Unit	Titus	DESV																									
FC-23-VAV-12	#N/A	VAV-122	Variable Air Volume Unit	Titus	DESV																									
FC-23-VAV-12	#N/A	VAV-123	Variable Air Volume Unit	Titus	DESV																									
FC-23-VAV-12	#N/A	VAV-124	Variable Air Volume Unit	Titus	DESV																									
FC-23-VAV-12	#N/A	VAV-125	Variable Air Volume Unit	Titus	DESV																									
FC-23-VAV-12	#N/A	VAV-126	Variable Air Volume Unit	Titus	DESV																									
FC-23-VAV-12	#N/A	VAV-127	Variable Air Volume Unit	Titus	DESV																									
FC-23-VAV-12	#N/A	VAV-128	Variable Air Volume Unit	Titus	DESV																									
FC-23-VAV-12	#N/A	VAV-129	Variable Air Volume Unit	Titus	DESV																									
FC-23-VAV-13	#N/A	VAV-130	Variable Air Volume Unit	Titus	DESV																									
FC-23-VAV-13	#N/A	VAV-131	Variable Air Volume Unit	Titus	DESV																									
FC-23-VAV-13	#N/A	VAV-132	Variable Air Volume Unit	Titus	DESV																									
FC-23-VAV-13	#N/A	VAV-133	Variable Air Volume Unit	Titus	DESV																									
FC-23-VAV-13	#N/A	VAV-134	Variable Air Volume Unit	Titus	DESV																									
FC-23-VAV-13	#N/A	VAV-135	Variable Air Volume Unit	Titus	DESV																									
FC-23-VAV-13	#N/A	VAV-136	Variable Air Volume Unit	Titus	DESV																									
FC-23-VAV-13	#N/A	VAV-137	Variable Air Volume Unit	Titus	DESV																									
FC-23-VAV-13	#N/A	VAV-138	Variable Air Volume Unit	Titus	DESV																									
FC-23-VAV-13	#N/A	VAV-139	Variable Air Volume Unit	Titus	DESV																									
FC-23-VAV-14	#N/A	VAV-140	Variable Air Volume Unit	Titus	DESV																									
FC-23-VAV-14	#N/A	VAV-141	Variable Air Volume Unit	Titus	DESV																									
FC-23-VAV-14	#N/A	VAV-142	Variable Air Volume Unit	Titus	DESV																									
FC-23-VAV-14	#N/A	VAV-143	Variable Air Volume Unit	Titus	DESV																									
FC-23-VAV-14	#N/A	VAV-144	Variable Air Volume Unit	Titus	DESV																									
FC-23-VAV-14	#N/A	VAV-145	Variable Air Volume Unit	Titus	DESV																									
FC-23-VAV-14	#N/A	VAV-146	Variable Air Volume Unit	Titus	DESV																									
FC-23-VAV-14	#N/A	VAV-147	Variable Air Volume Unit	Titus	DESV																									
FC-23-VAV-14	#N/A	VAV-148	Variable Air Volume Unit	Titus	DESV																									
FC-23-VAV-14	#N/A	VAV-149	Variable Air Volume Unit	Titus	DESV																									
FC-23-VAV-15	#N/A	VAV-150	Variable Air Volume Unit	Titus	DESV																									
FC-23-VAV-15	#N/A	VAV-151	Variable Air Volume Unit	Titus	DESV																									
FC-23-VAV-15	#N/A	VAV-152	Variable Air Volume Unit	Titus	DESV																									
FC-23-VAV-15	#N/A	VAV-153	Variable Air Volume Unit	Titus	DESV																									
FC-23-VAV-15	#N/A	VAV-154	Variable Air Volume Unit	Titus	DESV																									
FC-23-VAV-15	#N/A	VAV-155	Variable Air Volume Unit	Titus	DESV																									
FC-23-VAV-15	#N/A	VAV-156	Variable Air Volume Unit	Titus	DESV																									
FC-23-VAV-15	#N/A	VAV-157	Variable Air Volume Unit	Titus	DESV																									
FC-23-VAV-15	#N/A	VAV-158	Variable Air Volume Unit	Titus	DESV																									
FC-23-VAV-15	#N/A	VAV-159	Variable Air Volume Unit	Titus	DESV																									
FC-23-VAV-16	#N/A	VAV-160	Variable Air Volume Unit	Titus	DESV																									
FC-23-VAV-16	#N/A	VAV-161	Variable Air Volume Unit	Titus	DESV																									
FC-23-VAV-16	#N/A	VAV-162	Variable Air Volume Unit	Titus	DESV																									
FC-23-VAV-16	#N/A	VAV-163	Variable Air Volume Unit	Titus	DESV																									
FC-23-VAV-16	#N/A	VAV-164	Variable Air Volume Unit	Titus	DESV																									
FC-23-VAV-16	#N/A	VAV-165	Variable Air Volume Unit	Titus	DESV																									
FC-23-VAV-16	#N/A	VAV-166	Variable Air Volume Unit	Titus	DESV																									
FC-23-VAV-16	#N/A	VAV-167	Variable Air Volume Unit	Titus	DESV																									
FC-23-VAV-16	#N/A	VAV-168	Variable Air Volume Unit	Titus	DESV																									
FC-23-VAV-16	#N/A	VAV-169	Variable Air Volume Unit	Titus	DESV																									
FC-23-VAV-17	#N/A	VAV-170	Variable Air Volume Unit	Titus	DESV																									
FC-23-VAV-17	#N/A	VAV-171	Variable Air Volume Unit	Titus	DESV																									
FC-23-VAV-17	#N/A	VAV-172	Variable Air Volume Unit	Titus	DESV																									
FC-23-VAV-17	#N/A	VAV-173	Variable Air Volume Unit	Titus	DESV																									
FC-23-VAV-17	#N/A	VAV-174	Variable Air Volume Unit	Titus	DESV																									
FC-23-VAV-17	#N/A	VAV-175	Variable Air Volume Unit	Titus	DESV																									
FC-23-VAV-17	#N/A	VAV-176	Variable Air Volume Unit	Titus	DESV																									
FC-23-VAV-17	#N/A	VAV-177	Variable Air Volume Unit	Titus	DESV																									
FC-23-VAV-17	#N/A	VAV-178	Variable Air Volume Unit	Titus	DESV																									
FC-23-VAV-17	#N/A	VAV-179	Variable Air Volume Unit	Titus	DESV																									
FC-23-VAV-18	#N/A	VAV-180	Variable Air Volume Unit	Titus	DESV																									
FC-23-VAV-18	#N/A	VAV-181	Variable Air Volume Unit	Titus	DESV																									
FC-23-VAV-18	#N/A	VAV-182	Variable Air Volume Unit	Titus	DESV																									
FC-23-VAV-18	#N/A	VAV-183	Variable Air Volume Unit	Titus	DESV																									
FC-23-VAV-18	#N/A	VAV-184	Variable Air Volume Unit	Titus	DESV																									
FC-23-VAV-18	#N/A	VAV-185	Variable Air Volume Unit	Titus	DESV																									
FC-23-VAV-18	#N/A	VAV-186	Variable Air Volume Unit	Titus	DESV																									
FC-23-VAV-18	#N/A	VAV-187	Variable Air Volume Unit	Titus	DESV																									
FC-23-VAV-18	#N/A	VAV-188	Variable Air Volume Unit	Titus	DESV																									
FC-23-VAV-18	#N/A	VAV-189	Variable Air Volume Unit	Titus	DESV																									
FC-23-VAV-19	#N/A	VAV-190	Variable Air Volume Unit	Titus	DESV																									
FC-23-VAV-19	#N/A	VAV-191	Variable Air Volume Unit	Titus	DESV																									
FC-23-VAV-19	#N/A	VAV-192	Variable Air Volume Unit	Titus	DESV																									
FC-23-VAV-19	#N/A	VAV-193	Variable Air Volume Unit	Titus	DESV																									
FC-23-VAV-19	#N/A	VAV-194	Variable Air Volume Unit	Titus	DESV																									
FC-23-VAV-19	#N/A	VAV-195	Variable Air Volume Unit	Titus	DESV																									
FC-23-VAV-20	#N/A	VAV-201	Variable Air Volume Unit	Titus	DESV																									
FC-23-VAV-20	#N/A	VAV-202	Variable Air Volume Unit	Titus	DESV																									
FC-23-VAV-20	#N/A	VAV-203	Variable Air Volume Unit	Titus	DESV																									
FC-23-VAV-20	#N/A	VAV-204	Variable Air Volume Unit	Titus	DESV																									
FC-23-VAV-20	#N/A	VAV-205	Variable Air Volume Unit	Titus	DESV																									
FC-23-VAV-20	#N/A	VAV-206	Variable Air Volume Unit	Titus	DESV																									
FC-23-VAV-20	#N/A	VAV-207	Variable Air Volume Unit	Titus	DESV																									
FC-23-VAV-20	#N/A	VAV-208	Variable Air Volume Unit	Titus	DESV																									
FC-23-VAV-20	#N/A	VAV-209	Variable Air Volume Unit	Titus	DESV																									
FC-23-VAV-21	#N/A	VAV-210	Variable Air Volume Unit	Titus	DESV																									
FC-23-VAV-21	#N/A	VAV-211	Variable Air Volume Unit	Titus	DESV																									
FC-23-VAV-21	#N/A	VAV-212	Variable Air Volume Unit	Titus	DESV																									
FC-23-VAV-21	#N/A	VAV-213	Variable Air Volume Unit	Titus	DESV																									
FC-23-VAV-21	#N/A	VAV-214	Variable Air Volume Unit	Titus	DESV																									
FC-23-VAV-21	#N/A	VAV-215	Variable Air Volume Unit	Titus	DESV																									
FC-23-VAV-21	#N/A	VAV-216	Variable Air Volume Unit	Titus	DESV																									
FC-23-VAV-21	#N/A	VAV-217	Variable Air Volume Unit	Titus	DESV																									
FC-23-VAV-21	#N/A	VAV-218	Variable Air Volume Unit	Titus	DESV																									
FC-23-VAV-21	#N/A	VAV-219	Variable Air Volume Unit	Titus	DESV																									
FC-23-VAV-22	#N/A	VAV-220	Variable Air Volume Unit	Titus	DESV																									
FC-23-VAV-22	#N/A	VAV-221	Variable Air Volume Unit	Titus	DESV																									
FC-23-VAV-22	#N/A	VAV-222	Variable Air Volume Unit	Titus	DESV																									
FC-23-VAV-22	#N/A	VAV-223	Variable Air Volume Unit	Titus	DESV																									
FC-23-VAV-22	#N/A	VAV-224	Variable Air Volume Unit	Titus	DESV																									

PFC-23-VAV-225	#N/A	VAV-225	Variable Air Volume Unit	Titus	DESV																									
PFC-23-VAV-226	#N/A	VAV-226	Variable Air Volume Unit	Titus	DESV																									
PFC-23-VAV-227	#N/A	VAV-227	Variable Air Volume Unit	Titus	DESV																									
PFC-23-VAV-228	#N/A	VAV-228	Variable Air Volume Unit	Titus	DESV																									
PFC-23-VAV-229	#N/A	VAV-229	Variable Air Volume Unit	Titus	DESV																									
PFC-23-VAV-230	#N/A	VAV-230	Variable Air Volume Unit	Titus	DESV																									
PFC-23-VAV-231	#N/A	VAV-231	Variable Air Volume Unit	Titus	DESV																									
PFC-23-VAV-232	#N/A	VAV-232	Variable Air Volume Unit	Titus	DESV																									
PFC-23-VAV-233	#N/A	VAV-233	Variable Air Volume Unit	Titus	DESV																									
PFC-23-VAV-234	#N/A	VAV-234	Variable Air Volume Unit	Titus	DESV																									
PFC-23-VAV-235	#N/A	VAV-235	Variable Air Volume Unit	Titus	DESV																									
PFC-23-VAV-236	#N/A	VAV-236	Variable Air Volume Unit	Titus	DESV																									
PFC-23-VAV-237	#N/A	VAV-237	Variable Air Volume Unit	Titus	DESV																									
PFC-23-VAV-238	#N/A	VAV-238	Variable Air Volume Unit	Titus	DESV																									
PFC-23-VAV-239	#N/A	VAV-239	Variable Air Volume Unit	Titus	DESV																									
PFC-23-VAV-240	#N/A	VAV-240	Variable Air Volume Unit	Titus	DESV																									
PFC-23-VAV-241	#N/A	VAV-241	Variable Air Volume Unit	Titus	DESV																									
PFC-23-VAV-242	#N/A	VAV-242	Variable Air Volume Unit	Titus	DESV																									
PFC-23-VAV-243	#N/A	VAV-243	Variable Air Volume Unit	Titus	DESV																									
PFC-23-VAV-244	#N/A	VAV-244	Variable Air Volume Unit	Titus	DESV																									
PFC-23-VAV-245	#N/A	VAV-245	Variable Air Volume Unit	Titus	DESV																									
PFC-23-VAV-246	#N/A	VAV-246	Variable Air Volume Unit	Titus	DESV																									
PFC-23-VAV-247	#N/A	VAV-247	Variable Air Volume Unit	Titus	DESV																									
PFC-23-VAV-248	#N/A	VAV-248	Variable Air Volume Unit	Titus	DESV																									
PFC-23-VAV-249	#N/A	VAV-249	Variable Air Volume Unit	Titus	DESV																									
PFC-23-VAV-250	#N/A	VAV-250	Variable Air Volume Unit	Titus	DESV																									
PFC-23-VAV-251	#N/A	VAV-251	Variable Air Volume Unit	Titus	DESV																									
PFC-23-VAV-252	#N/A	VAV-252	Variable Air Volume Unit	Titus	DESV																									
PFC-23-VAV-253	#N/A	VAV-253	Variable Air Volume Unit	Titus	DESV																									
PFC-23-VAV-254	#N/A	VAV-254	Variable Air Volume Unit	Titus	DESV																									
PFC-23-VAV-255	#N/A	VAV-255	Variable Air Volume Unit	Titus	DESV																									
PFC-23-VAV-256	#N/A	VAV-256	Variable Air Volume Unit	Titus	DESV																									
PFC-23-VAV-257	#N/A	VAV-257	Variable Air Volume Unit	Titus	DESV																									
PFC-23-VAV-258	#N/A	VAV-258	Variable Air Volume Unit	Titus	DESV																									
PFC-23-VAV-259	#N/A	VAV-259	Variable Air Volume Unit	Titus	DESV																									
PFC-23-VAV-260	#N/A	VAV-260	Variable Air Volume Unit	Titus	DESV																									
PFC-23-VAV-261	#N/A	VAV-261	Variable Air Volume Unit	Titus	DESV																									
PFC-23-VAV-262	#N/A	VAV-262	Variable Air Volume Unit	Titus	DESV																									
PFC-23-VAV-263	#N/A	VAV-263	Variable Air Volume Unit	Titus	DESV																									
PFC-23-VAV-264	#N/A	VAV-264	Variable Air Volume Unit	Titus	DESV																									
PFC-23-VAV-265	#N/A	VAV-265	Variable Air Volume Unit	Titus	DESV																									
PFC-23-VAV-266	#N/A	VAV-266	Variable Air Volume Unit	Titus	DESV																									
PFC-23-VAV-267	#N/A	VAV-267	Variable Air Volume Unit	Titus	DESV																									
PFC-23-VAV-268	#N/A	VAV-268	Variable Air Volume Unit	Titus	DESV																									
PFC-23-VAV-269	#N/A	VAV-269	Variable Air Volume Unit	Titus	DESV																									
PFC-23-VAV-270	#N/A	VAV-270	Variable Air Volume Unit	Titus	DESV																									
PFC-23-VAV-271	#N/A	VAV-271	Variable Air Volume Unit	Titus	DESV																									
PFC-23-VAV-272	#N/A	VAV-272	Variable Air Volume Unit	Titus	DESV																									
PFC-23-VAV-273	#N/A	VAV-273	Variable Air Volume Unit	Titus	DESV																									
PFC-23-VAV-274	#N/A	VAV-274	Variable Air Volume Unit	Titus	DESV																									
PFC-23-VAV-275	#N/A	VAV-275	Variable Air Volume Unit	Titus	DESV																									
PFC-23-VAV-276	#N/A	VAV-276	Variable Air Volume Unit	Titus	DESV																									
PFC-23-VAV-277	#N/A	VAV-277	Variable Air Volume Unit	Titus	DESV																									
PFC-23-VAV-278	#N/A	VAV-278	Variable Air Volume Unit	Titus	DESV																									
PFC-23-VAV-279	#N/A	VAV-279	Variable Air Volume Unit	Titus	DESV																									
PFC-23-VAV-280	#N/A	VAV-280	Variable Air Volume Unit	Titus	DESV																									
PFC-23-VAV-281	#N/A	VAV-281	Variable Air Volume Unit	Titus	DESV																									
PFC-23-VAV-282	#N/A	VAV-282	Variable Air Volume Unit	Titus	DESV																									
PFC-23-VAV-283	#N/A	VAV-283	Variable Air Volume Unit	Titus	DESV																									
PFC-23-VAV-284	#N/A	VAV-284	Variable Air Volume Unit	Titus	DESV																									
PFC-23-VAV-285	#N/A	VAV-285	Variable Air Volume Unit	Titus	DESV																									
PFC-23-VAV-286	#N/A	VAV-286	Variable Air Volume Unit	Titus	DESV																									
23 37 00 - Air Outlets and Inlets																														
			Grilles, Registers, and Diffusers																											
PFC-23-GRDs	#N/A	GRDs																#N/A	#N/A	#N/A						#N/A	#N/A			
23 52 16 - Condensing Boilers																														
			Gas-Fired Condensing Boilers																											
PFC-23-B2-1	#N/A	B2-1	Heating Water Modular Condensing Boiler	Riello	4000													#N/A	#N/A	#N/A						#N/A	#N/A			
PFC-23-B2-2	#N/A	B2-2	Heating Water Modular Condensing Boiler	Riello	4000													#N/A	#N/A	#N/A						#N/A	#N/A			
PFC-23-B2-3	#N/A	B2-3	Snow Melt Modular Condensing Boiler	Riello	4000													#N/A	#N/A	#N/A						#N/A	#N/A			
PFC-23-B2-4	#N/A	B2-4	Snow Melt Modular Condensing Boiler	Riello	4000													#N/A	#N/A	#N/A						#N/A	#N/A			
23 57 00 - Heat Exchangers for HVAC																														
			Plate and Frame																											
PFC-23-HX2-1	#N/A	HX2-1	Glycol System Heat Exchanger	Taco														#N/A	#N/A	#N/A						#N/A	#N/A			
23 63 00 - Refrigerant Condensers																														
			Dry Coolers																											
PFC-23-DC2-1	#N/A	DC2-1	Year-Round Cooling															#N/A	#N/A	#N/A						#N/A	#N/A			
PFC-23-DC2-2	#N/A	DC2-2	Year-Round Cooling															#N/A	#N/A	#N/A						#N/A	#N/A			
23 64 00 - Packaged Water Chillers																														
			Chillers																											
PFC-23-CH2-1	#N/A	CH2-1	Air Cooled Scroll Chiller	York	YLAA0139HJ46XFB																									
PFC-23-CH2-2	#N/A	CH2-2	Air Cooled Scroll Chiller	York	YLAA0139HJ46XFB																									
23 72 00 - Air-to-Air Energy Recovery Equipment																														
			Heat Recovery Ventilators																											
PFC-23-HRV2-1	#N/A	HRV2-1	Fixed Plate	VTS	AVS230		Mech Penthouse											#N/A	#N/A	#N/A						#N/A	#N/A			
PFC-23-HRV2-2	#N/A	HRV2-2	Fixed Plate	VTS	AVS100		Mech Penthouse											#N/A	#N/A	#N/A						#N/A	#N/A			
23 73 00 - Indoor Central-Station Air-Handling Units																														
			Indoor Air-Handlers																											
PFC-23-AHU-1	#N/A	AHU-1	Indoor Air-Handler	Haakon														#N/A	#N/A	#N/A						#N/A	#N/A			
PFC-23-AHU-2	#N/A	AHU-2	Indoor Air-Handler	Haakon														#N/A	#N/A	#N/A						#N/A	#N/A			
23 81 23 -Computer-Room Air-Conditioners																														
			Computer Room Air Conditioner																											
PFC-23-CRAC1-1	#N/A	CRAC1-1	Computer Room Air Conditioner	Above Air Technologies	MCG-018S-3-00HRH-EC-FE-UR0-1A		Mech	554																						
PFC-23-CRAC1-2	#N/A	CRAC1-2	Computer Room Air Conditioner	Above Air Technologies	MCG-018S-3-00HRH-EC-FE-UR0-1A		Mech	554																						
PFC-23-CRAC1-3	#N/A	CRAC1-3	Computer Room Air Conditioner	Above Air Technologies	MCG-018S-3-00HRH-EC-FE-UR0-1A		Mech	554																						

FC-23-CRAC1-	#N/A	CRAC1-4	Computer Room Air Conditioner	Above Air Technologies	WCH-007S-S-00ERH-EC-A		Elec/Comm	461																					
FC-23-CRAC2-	#N/A	CRAC2-1	Computer Room Air Conditioner	Above Air Technologies	WCH-007S-3-00EFH-EC-A		Main Comms	1756																					
FC-23-CRAC2-	#N/A	CRAC2-2	Computer Room Air Conditioner	Above Air Technologies	WCH-007S-3-00EFH-EC-A		SAT. Comms	1894																					
FC-23-CRAC2-	#N/A	CRAC2-3	Computer Room Air Conditioner	Above Air Technologies	WCH-007S-3-00EFH-EC-A		Main Comms (2nd F	1756																					
FC-23-CRAC2-	#N/A	CRAC2-4	Computer Room Air Conditioner	Above Air Technologies	MCG-018S-3-00HRH-ECFE-UR0-1A		IT Rack	1299																					
			Refrigerant Cooling Unit																										
PFC-23-RCU1-1	#N/A	RCU1-1	Refrigerant Cooling Unit	Above Air Technologies	CGU-007S-3-00-00-S		Storage	457																					
PFC-23-RCU2-1	#N/A	RCU2-1	Refrigerant Cooling Unit	Above Air Technologies	CGU-007S-3-00-00-S		Stor.	1757																					
PFC-23-RCU2-2	#N/A	RCU2-2	Refrigerant Cooling Unit	Above Air Technologies	CGU-007S-3-00-00-S																								
PFC-23-RCU2-3	#N/A	RCU2-3	Refrigerant Cooling Unit	Above Air Technologies	CGU-007S-3-00-00-S		Waiting Room	758																					
23 82 00 -Convection Heating and Cooling Units																													
			Finned Tube																										
PFC-23-FT2-1	#N/A	FT2-1	Finned Tube	Modine	S 018																								
PFC-23-FT2-2	#N/A	FT2-2	Finned Tube	JAGA	Clima Canal 10																								
PFC-23-FT2-3	#N/A	FT2-3	Finned Tube	JAGA	Clima Canal 10																								
PFC-23-FT2-4	#N/A	FT2-4	Finned Tube	JAGA	Clima Canal 10																								
			Cabinet Unit Heaters																										
PFC-23-CUH-1	#N/A	CUH-1	Ceiling Recessed Mounted Cabinet Unit Heater	Modine	CW 004		Vestibule	1108																					
PFC-23-CUH-1	#N/A	CUH-1	Ceiling Recessed Mounted Cabinet Unit Heater	Modine	CW 004		Vestibule	1108																					
PFC-23-CUH-2	#N/A	CUH-2	Ceiling Recessed Mounted Cabinet Unit Heater	Modine	CW 004																								
PFC-23-CUH-3	#N/A	CUH-3	Ceiling Recessed Mounted Cabinet Unit Heater	Modine	CW 004		Vestubule	513																					
PFC-23-CUH-3	#N/A	CUH-3	Ceiling Recessed Mounted Cabinet Unit Heater	Modine	CW 004		Vestubule	1089																					
PFC-23-CUH-4	#N/A	CUH-4	Ceiling Recessed Mounted Cabinet Unit Heater	Modine	CW 004																								
PFC-23-CUH-5	#N/A	CUH-5	Wall Surface Mounted Cabinet Unit Heater	Modine	CW 004		Stair 2	1093																					
PFC-23-CUH-6	#N/A	CUH-6	Wall Surface Mounted Cabinet Unit Heater	Modine	CW 004		Stair 2	1093																					
			Unit Heater																										
PFC-23-UH-1	#N/A	UH-1	Unit Heater	Modine	HC-63		Material Handling	476																					
PFC-23-UH-1	#N/A	UH-1	Unit Heater	Modine	HC-63		Material Handling	476																					
PFC-23-UH-1	#N/A	UH-1	Unit Heater	Modine	HC-63		Mail Room																						
PFC-23-UH-1	#N/A	UH-1	Unit Heater	Modine	HC-63		Fire Pump/Sprinkler	1913																					
PFC-23-UH-1	#N/A	UH-1	Unit Heater	Modine	HC-63		Fire Pump/Sprinkler	1913																					
PFC-23-UH-1	#N/A	UH-1	Unit Heater	Modine	HC-63		Fire Pump/Sprinkler	463																					
PFC-23-UH-1	#N/A	UH-1	Unit Heater	Modine	HC-63		Main Ele. Rm	1621																					
PFC-23-UH-2	#N/A	UH-2	Unit Heater	Modine	V 95L		Mechanical Penthouse																						
PFC-23-UH-2	#N/A	UH-2	Unit Heater	Modine	V 95L		Mechanical Penthouse																						
PFC-23-UH-2	#N/A	UH-2	Unit Heater	Modine	V 95L		Mechanical Penthouse																						
PFC-23-UH-2	#N/A	UH-2	Unit Heater	Modine	V 95L		Mechanical Penthouse																						
PFC-23-UH-2	#N/A	UH-2	Unit Heater	Modine	V 95L		Mechanical Penthouse																						
PFC-23-UH-2	#N/A	UH-2	Unit Heater	Modine	V 95L		Mechanical Penthouse																						
PFC-23-UH-2	#N/A	UH-2	Unit Heater	Modine	V 95L		Mechanical Penthouse																						
23 83 00 -Radiant Heating and Cooling Units																													
			Radiant Panels																										
PFC-23-RP2-1	#N/A	RP2-1	Radiant Ceiling Panels																										
26 00 00 - ELECTRICAL																													
26 52 00 - Safety Lighting																													
			Exit Light Fixtures																										
PFC-26-EXL	#N/A	EXL																#N/A	#N/A	#N/A						#N/A	#N/A		
			Emergency Lighting																										
PFC-26-EML	#N/A	EML																#N/A	#N/A	#N/A						#N/A	#N/A		
xx xx xx - Low-Voltage Switchgear																													
			<<NAME>>																										
PFC-26-MVSG	#N/A	MVSG																#N/A	#N/A	#N/A						#N/A	#N/A		
26 22 00 - Low-Voltage Transformers																													
			<<NAME>>																										
PFC-26-MVT	#N/A	MVT																#N/A	#N/A	#N/A						#N/A	#N/A		
26 24 13 - Switchboards																													
			<<NAME>>																										
PFC-26-SB	#N/A	SB																#N/A	#N/A	#N/A						#N/A	#N/A		
26 24 16 - Panelboards																													
			<<NAME>>																										
PFC-26-PB	#N/A	PB																#N/A	#N/A	#N/A						#N/A	#N/A		
26 36 23 - Automatic Transfer Switches																													
			<<NAME>>																										
PFC-26-ATS	#N/A	ATS																#N/A	#N/A	#N/A						#N/A	#N/A		
26 32 00 - Packaged Engine-Generator Assemblies																													
			<<NAME>>																										
PFC-26-EG	#N/A	EG																#N/A	#N/A	#N/A						#N/A	#N/A		
xx xx xx - Short Circuit Studies																													
			<<NAME>>																										
PFC-26-XX	#N/A	XX																#N/A	#N/A	#N/A						#N/A	#N/A		
xx xx xx - Facility Lightning Protection																													
			<<NAME>>																										
PFC-26-FLP	#N/A	FLP																#N/A	#N/A	#N/A						#N/A	#N/A		
26 43 00 - Surge Protective Devices																													
			<<NAME>>																										
PFC-26-XX	#N/A	XX																#N/A	#N/A	#N/A						#N/A	#N/A		
xx xx xx - Low Voltage Metering																													
			<<NAME>>																										
PFC-26-LVM	#N/A	LVM																#N/A	#N/A	#N/A						#N/A	#N/A		
xx xx xx - Instrumentation and Control for Electrical Systems																													
			Buidling Lighting Control System																										
PFC-26-CC	FPT-23-XXX	CC																								-	-		
			Transient Voltage Surge Suppression System (TVSS)																										
PFC-26-TVSS	#N/A	TVSS																#N/A	#N/A	#N/A						#N/A	#N/A		

xx xx xx - Low Voltage Electrical Distribution																												
			<<NAME>>																									
PFC-26-XX	#N/A	XX															#N/A	#N/A	#N/A					#N/A	#N/A			
27 00 00 - COMMUNICATIONS																												
27 10 00 - Structured Cabling																												
			<<NAME>>																									
PFC-26-XX	#N/A	XX															#N/A	#N/A	#N/A					#N/A	#N/A			
xx xx xx - Nurse Call/Code Blue Systems																												
			<<NAME>>																									
PFC-26-NCS	#N/A	NCS															#N/A	#N/A	#N/A					#N/A	#N/A			
27 51 23 - Intercommunications and Program Systems																												
			Public Address System																									
PFC-26-PAS	#N/A	PAS															#N/A	#N/A	#N/A					#N/A	#N/A			
xx xx xx - Infant Protection and Alarm System																												
			<<NAME>>																									
PFC-26-IFP	#N/A	IFP															#N/A	#N/A	#N/A					#N/A	#N/A			
28 00 00 - ELECTRONIC SAFETY AND SECURITY																												
28 10 00 - Electronic Safety and Security																												
			Security System																									
PFC-26-ESS	#N/A	ESS															#N/A	#N/A	#N/A					#N/A	#N/A			
28 46 00 - Fire Detection and Alarm																												
			Fire Alarm Control Panel and Annunciator Panel																									
PFC-26-FDA	#N/A	FDA															#N/A	#N/A	#N/A					#N/A	#N/A			
			Smoke Detectors and Sensors																									
PFC-26-XX	#N/A	XX															#N/A	#N/A	#N/A					#N/A	#N/A			
			Fire Alarm Horns and Strobes																									
PFC-26-FAD	#N/A	FAD															#N/A	#N/A	#N/A					#N/A	#N/A			
			Fire Alarm Flow Switches																									
PFC-26-FFS	#N/A	FFS															#N/A	#N/A	#N/A					#N/A	#N/A			
			Fire Alarm Pull Stations																									
PFC-26-MPS	#N/A	MPS															#N/A	#N/A	#N/A					#N/A	#N/A			

COMMISSIONING PLAN

BENTEH NUUTAH VALLEY NATIVE PRIMARY CARE CENTER EXPANSION

DRAFT

Oct. 9, 2024

Prepared by:

Randall S. Williams PE

RESPEC

Table of Contents:

OVERVIEW

The fundamental objectives of the Commissioning Process are to:

a) *Clearly document Owner's Project Requirements;*
b) *Provide documentation and tools to improve the quality of deliverables;*
c) *Verify and document that systems and assemblies perform according to the Owner's Project Requirements;*
d) *Verify that adequate and accurate system and assembly documentation is provided to the Owner;*
e) *Verify that operation and maintenance personnel and occupants are properly trained;*
f) *Provide a uniform and effective process for delivery of construction projects;*
g) *Deliver buildings and construction projects that meet the Owner's needs, at the time of completion;*
h) *Utilize quality-based sampling techniques to detect systemic problems, as such sampling provides high value, efficient verification, accurate results, and reduced project costs; and*
i) *Verify proper coordination among systems and assemblies, and among all contractors, subcontractors, vendors, and manufacturers of furnished equipment and assemblies.*

PURPOSE OF THE COMMISSIONING PLAN

This plan provides a summary of activities needed to successfully start up and commission systems that support the new medical facility expansion adjoining the existing Benteh Nuutah Valley Native Primary Care Center (VNPCC). The Commissioning Agent (CxA) will ensure that all equipment and systems perform interactively according to the design intent and the Owner's operational needs.

This plan summarizes the requirements included in 01 91 13 General Commissioning Requirements, and the technical and commissioning specifications for the individual equipment components. This document does not replace the technical specifications or change or eliminate requirements of the technical specifications. Specification Section 01 91 13 provides standard form templates for the start-up of the individual system components.

The purpose of the commissioning plan is to:

1. Provide direction for the development of the Commissioning (Cx) specifications, developed during the latter part of the design phase.
2. Provide direction for the Testing, Start-up, and Commissioning process during construction, particularly providing resolution for issues and providing details that cannot be, or were not, fully developed during design, such as:
    a. Scheduling
    b. Participation of various parties of this project
    c. Actual lines of reporting and approvals
    d. Coordination
    e. Etc.

This plan does not provide a detailed explanation of required testing procedures. Those can be found in individual discipline commissioning specifications, and in the functional test forms. Additionally, this plan does not provide extensive narrative on all commissioning concepts, as may be provided in other commissioning guides and standards such as ASHRAE Guideline 0 - The Commissioning Process, ASHRAE Standard 202 – Commissioning Process for Buildings and Systems, and ASHE Health Facility Commissioning Guidelines.

The Commissioning Plan is a living document. The document is to be continually modified during the design and construction process based on Owner input, changes in the design, field conditions, and the normal progression and scheduling of the construction process.

MAIN PROJECT COMPONENTS

The completed Work will provide the Owner with a new, operational medical facility encompassing approximately 130,000 square feet. Commissioning will verify functionality of the following systems:

1. Air Handling System
2. Major Mechanical Systems
3. Major Electrical System
4. Lighting System
5. Life Safety System

6. Building Security and Communications System
7. Building Automation System and Control Strategies
8. Backflow Preventer
9. Medical Gas and Dental Vacuum System
10. Standby Generator Fuel Gas System
11. Medical Equipment Power Supply System
12. Telecommunications and Television Cable System
13. Building Security System
14. Medical Waste Disposal System

Commissioning is a methodical process of confirming that equipment, systems, and assemblies perform interactively according to the design intent and the Owner's operational needs. This is achieved by beginning in the design phase and documenting design and operating intent and continuing through construction and acceptance with verification of performance. The Owner's requirements are documented in Appendix A –Owner's Project Requirements (OPR), and the design intent is found in Appendix B – Basis of Design (BoD). The OPR was developed by Owner Representatives. The BoD is developed by the AE Team.

Commissioning during construction is intended to achieve the following specific objectives:

- Verify and document that equipment is installed and started per manufacturer's recommendations, industry accepted minimum standards, and the Contract Documents.
- Confirm that applicable equipment and systems are installed properly and receive adequate operational checkout by installing contractors.
- Verify and document proper performance of equipment and systems.
- Verify systems spanning multiple disciplines are functioning properly with all the individual components. (Integrated System Testing)
- Confirm that O&M documentation is complete.
- Confirm that the Owner's operating personnel are adequately trained.

PROJECT DELIVERY

Division 01 Specification Section 01 91 13 General Commissioning Requirements covers:

1. General requirements for coordinating and scheduling commissioning.
2. Commissioning meetings.
3. Commissioning reports.
4. Use of test equipment, instrumentation, and tools for commissioning.
5. PreFunctional checklist guidelines, including, but not limited to, installation checks, start-up, performance tests, and performance test demonstration. [note: technical req's for each checklist are found in each associated technical spec]
6. Adjusting, verifying, and documenting identified systems and assemblies.
7. Commissioning (functional performance) test guidelines.
8. Integrated System functional performance test guidelines.

Technical Cx Specs cover (by discipline):

1. Technical requirements for PreFunctional Checklists, including, but not limited to, installation checks, start-up, performance tests, and performance test demonstration.
2. Technical requirements for Commissioning tests and commissioning test demonstration.
3. List of Systems and Assemblies to be Functionally Tested
4. List of Tests and Acceptance Criteria for Each System

CxA duties are contracted separately from AE Design Team, and happen in parallel.

ABBREVIATIONS AND DEFINITIONS

The following are common abbreviations used in this document. Definitions are found in Specifications. Refer to Appendix D for names of people in the roles listed below.

AE PM	Architect and Design Engineer team Project Manager	FPT	Functional Performance Test / Testing / Checklist
BoD	Basis of Design	GC	General Contractor
CxA	Commissioning Authority	MC	Mechanical Contractor
CC	Controls Contractor	Mfr	Manufacturer
CCC	Contractor's Commissioning Coordinator	O&M	Operation & Maintenance
CP	Construction Package	PFC	PreFunctional Checklist
Cx	Commissioning	CM	Construction Manager
Cx Plan	Commissioning Plan	Subs	Subcontractors to General
DOR	Designer of Record	SI	Systems Integrator
EC	Electrical Contractor	TAB	Test and Balance Contractor
OPR	Owner's Project Requirements		

TEAM MEMBERS

General descriptions of key commissioning roles are as follows:

CxA: Facilitates the Cx process. Reviews and approves test plans and signs off on performance.

Prepares the administrative and technical Cx portions of the construction documents for bid.

Coordinates the Cx process during construction, writes test forms, and observes performance tests.

GC: Facilitates the Cx process, ensures that Subcontractors perform their responsibilities and integrates Cx into the construction process and schedule.

CCC: Schedules and coordinates all aspects of the Contractor's Cx duties, and documents Cx using provided forms.

CC: Programs all BMS/BAS systems; provides testing, guidance and support for process control systems.

Subs: Performs tests, demonstrates proper system performance, assists CxA in test verification.

AE PM: Provides construction observation, observes performance tests, approves submittals and O&M manuals and assists in resolving discrepancies.

Mfr: The equipment manufacturers and vendors provide documentation to facilitate the commissioning work and perform contracted start-up.

For this project, the Owner will hire the CxA. The General Contractor will hire a CCC to coordinate all their Cx activities during Construction. The CxA and CCC roles are closely related and the two will work in tandem to accomplish the Cx Process. Refer to Figure 1 illustrating the contractual relationships.

Refer to Appendix D – Communication Structures, and Appendix E – Roles and Responsibilities, for identification of team members, contact information, and expanded description of assigned roles.

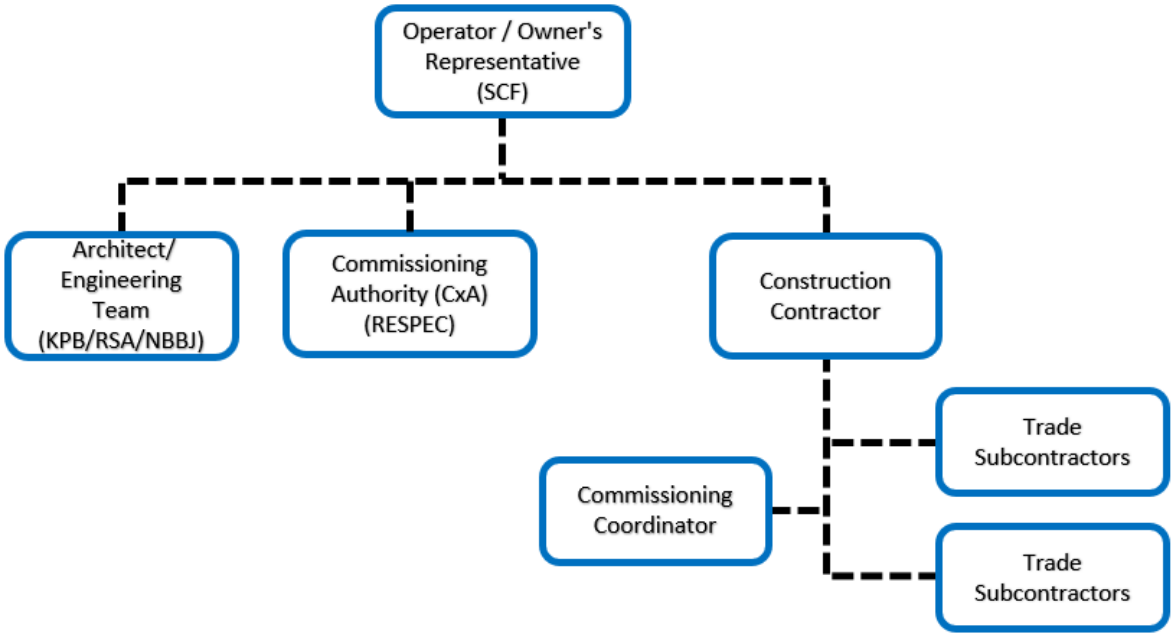

Figure 1 – Contractual Relationship Diagram

REFERENCE DOCUMENTS USED IN CREATION OF THIS PLAN

1. ASHRAE:
   a. Guideline 0-2019 – The Commissioning Process
   b. Guideline 0.2-2015 – Cx Process for Existing Systems and Assemblies
   c. Guideline 1.1-2007 – HVACR Technical Requirements for the Cx Process
   d. Guideline 1.2-2019 – Technical Requirements for the Commissioning Process for Existing HVAC&R Systems and Assemblies
   e. Guideline 1.4-2019 – Preparing Systems Manuals for Facilities
   f. Standard 202-2018 – Commissioning Process for Buildings and Systems
   g. ASHE Health Facility Commissioning Guidelines

2. MasterSpecs:

a. 01 91 13 General Commissioning Requirements
b. 01 91 13.43 Exterior Enclosure Commissioning
c. 08 08 00 Commissioning of Openings
d. 21 08 00 Commissioning of Fire Suppression
e. 22 0800 Commissioning of Plumbing systems
f. 23 0800 Commissioning of HVAC
g. 26 0800 Commissioning of Electrical Systems

COMMISSIONING PROCESS DESCRIPTION

Commissioning spans from pre-design into post occupancy and is meant to help provide some continuity of performance and knowledge, in addition to verification of compliance with the Owner's Project Requirements.

The Contractor may be required to provide continued commissioning activities beyond the Beneficial Occupancy date, due to the nature of the Cx process.

Issues based on occupancy type are not illustrated in this Cx Plan but must be considered in detail when developing the Commissioning Schedule and integrating it into the master construction schedule.

The following sequential priorities are followed during Design:

1. CxA produces Draft Cx Plan (this document) for review at each deliverable.
2. The AE Team, DORs produce the Basis of Design document for review at each deliverable.
3. The DORs review the Draft Cx Plan and incorporate it into each construction package.
4. The CxA reviews the Basis of Design and coordinates with the OPR.
5. At each deliverable, the CxA holds a design review meeting with the Owner and Owner's O&M staff. Review comments are forwarded to the AE Team for implementation and response.
6. As the design proceeds, the Cx Team updates the Cx Plan to address review comments, and to add more detailed information as it is developed by the AE Team.
7. An updated Cx Plan and a coordinated Division 1 Cx specification is produced by the CxA prior to the 95% deliverables. Templates for the technical division Cx specifications are also provided to the AE Team DORs.
8. The AE Team DORs tailor copies of the spec templates for each discipline for delivery with the 95%.
9. The CxA produces a draft of the Cx Plan for the 95% deliverable, which includes Construction Phase Activities.
10. After incorporating review comments from the 95% deliverable, the Plan is ready to pass to the Construction Phase.

The following sequential priorities are followed during Construction:

1. Continue to update the Cx Plan by adding information to the Appendices as it is completed.
2. Equipment IOM manuals are submitted to AE Team, reviewed and approved.

3. CxA submits PFC Forms. The forms are reviewed and approved by the Owner, AE Team, and Contractors. The CxA addresses review comments and approves the forms for use.
4. Weekly Cx progress reports begin at start of FPT.
5. CC & sub-contractors to submit their installation and start-up plan to CxA. CxA to review and approve the installation and start-up plan.
6. Sub-contractors fill out PFC forms during installation of equipment, assemblies, and systems. PFC forms are completed and delivered to CxA for review. The contractor address CxA comments and provides updated forms. The CxA recommends acceptance of the forms to the Owner.
7. Sub-contractors submit shop and controls drawings to CxA. Shop and controls drawings to be reviewed and approved by CxA and AE.
8. Equipment should not be "temporarily" started, until PFC items and all manufacturers' pre-start procedures are completed.
9. Start-up and checkout initiated by sub-contractors. CC performs controls start-up, initials and dates sequence of operation. Deficiencies discovered are to be documented and provided to CxA.
10. CxA writes FPT forms. FPT forms are reviewed and approved by Owner, AE DOR, and controls sub.
11. TAB is not performed until the HVAC controls system has been sufficiently functionally tested and approved by the CxA for TAB work, TAB process is outlined, and the envelope of the building is completely enclosed.
12. CC and Sub-contractors perform a "dry run" of Functional Performance Tests prior to FPT witnessed by CxA. Any deficiencies discovered are to be documented and provided to CxA.
13. FPT is not begun until PFCs, controls start-up, "dry runs" of FPT, and TAB (where applicable) are substantially completed for a given system (this does not preclude a phased approach).
14. Integrated Systems FPT occurs after FPT of all related sub-systems for each Integrated System.
15. The CxA is notified that the previous deficiencies have been corrected, and that systems operate per the FPTs. CxA witness FPT procedures and denotes deficiencies or recommends acceptance of systems to the Owner.
16. Any deficiencies discovered during FPT are corrected and the CxA is notified. The CxA verifies systems operate per the FPTs and recommends acceptance of systems to the Owner.
17. The Training Syllabus is prepared and delivered to the Owner and CxA prior to Owner Training. CxA to review and approve the Training Syllabus.
18. Owner Training occurs after completion of formal FPT.
19. Commissioning Report (minus seasonal testing where applicable) is produced by the CxA and delivered to Cx Team.
20. Turnover to Owner.
21. Final Commissioning Report is produced by the CxA and delivered to Cx Team.

The following sequential priorities are followed during Post-Occupancy and Warranty:

1. Seasonal FPT (where applicable)

   a. Cooling Systems: June 15 – July 31
   b. Heating Systems: Dec 15 – Jan 31
2. Any deficiencies discovered during Seasonal FPT are corrected and the CxA is notified. The CxA verifies systems operate per the FPTs and recommends acceptance of systems to the Owner.
3. The CxA is to work with the Facility Manager to determine the facility's actual Energy Performance. Should the Energy Performance differ from the Project Energy Efficiency Goals, the CxA shall work with the Facility Manager, AE Team and Contractor to troubleshoot and implement corrective action.
4. The CxA is to assist the Facility Manager with development of an energy efficiency scorecard which is to be published each month.
5. Near the end of the warranty phase, a comprehensive review of the project is to be held with the CxA, Owner, AE Team and Contractors. The review should identify outstanding construction deficiencies and deficiencies discovered by the O&M Staff. CxA is to assist the other members of the project team with correction of deficiencies.
6. CxA to hold a Lessons Learned Meeting with the Owner, AE Team and Contractors. CxA is to produce a Lessons Learned Report.
7. Final Commissioning Report is produced by the CxA and delivered to Cx Team.

PREDESIGN ACTIVITIES

DEVELOP OWNER'S PROJECT REQUIREMENTS

Refer to Appendix A for the current Owner's Project Requirements documentation.

DEVELOP INITIAL COMMISSIONING PLAN

The predesign section of this Cx Plan is based on, and uses information from, the *RFP-23-1099-VNPCC-Commissioning-Addendum-1-final* document dated for May 19, 2023, the *Pre-Design Programming Draft* dated for May 26, 2023 and the *Sustainability Charrette Report* dated for June 8th, 2023 . The Preliminary Cx Plan was prepared by RESPEC.

COMMISSIONING PROCESS ISSUES

STEP 1: IDENTIFY SYSTEMS AND ASSEMBLIES TO BE COMMISSIONED

EQUIPMENT LIST

The following is a list of equipment that was expected to be commissioned as of the RFP, Pre-Design Documentation, and Sustainability Charrette Report. Refer to Appendix F for the current list of Commissioned Systems.

Location / Category	**Equipment**
Life Safety System	
	Fire Alarm Control Panel and Annunciator Panel
	Fire Pump with Jockey Pump
	Flow Switch
	Fire Sprinklers
	Doors with Fire Rated Frames
	Exit Light Fixtures
	Emergency Lighting
	Smoke Detectors and Sensors
	Fire and Smoke Dampers
	Horn/Strobe Lights for Fire Alarm
	Manual Pull Stations
Building Security and Communication System	
	Nurse Call System
	Infant Protection and Alarm System
	Security System
	Public Address System
Building Automation System with Control Strategies	
	Direct Digital Control (DDC) or Building Automation System (BAS)
	Energy Management Control System (EMCS)
	Electrical or Pneumatic Controls
Air Handling Unit System	
	Air Handling Unit including Supply and Return (or Relief) Fans (Including Air Pressure Adjacency Validation)
	Exhaust Air Fans
	Terminal Units
	Diffusers/Grilles (Supply, Return, Exhaust)
	Ductwork (Supply, Return, Exhaust)
	Chilled and Hot Water Pumping System
Major Mechanical Systems	
	Chilled Water System including Chiller, Cooling Tower and Pumps
	Heating Hot Water System including Boiler, Fuel System and Pumps
	Process System (Steam for Sterilizers, Humidifier, etc.)
Major Electrical Systems	
	Main Switchgear and all Electrical Panel Boards
	Emergency & Standby Generators with ATS
	Arc Flash Hazard Warning Signs on Electrical Panels
	Coordination and Short Circuit Study information

Location / Category	Equipment
	Lighting Protection with Building Grounding System
	Transient Voltage Surge Suppression (TVSS) System
	Advanced Metering System
	Renewable Energy System
	Building Lighting Control System
	Regular and K-Type Transformers
Backflow Preventer	
	Potable Water, Fire Sprinkler System, Chiller, Cooling Tower, and Boiler Water Supply
Medical Gas and Dental Vacuum System	
	Oxygen System, Nitrous Oxide System, Medical Air System, Dental Air System, Dental Vacuum System, Laboratory Gas System, Air Compressor, Medical Gas System Equipment
Standby Generator Fuel Gas System	
Medical Equipment Power Supply System	
	CT-Scanner, X-Ray and MRI Equipment, UPS Requirements to Protect Equipment
Telecommunication and Television Cable System	
Building Security System	
Medical Waste Disposal System	

PRE-START-UP ACTIVITIES

The following activities must be completed prior to start-up. These activities need to be completed prior to the arrival of equipment vendors and the commissioning team.

Pre-Start-up Activity	Details
Pipe pressure/leak testing	As required in Section 40 80 01
Pipe disinfection and bacteriological sampling	As required in Section 33 13 00
All electrical connections complete	"bump" motors to ensure connection and proper rotation
All controls connections complete	Includes verification of correct I/O landing points in control panels and on control devices
	Includes all loop status report forms
	Includes confirmation of alarm dialer functionality

Pre-Start-up Activity	Details
All vendor provided IOM manuals reviewed, approved, and on site	
All instruments calibrated	
Manufacturer's certificates of proper installation submitted and approved and all manufacturer's training complete.	
Any vendor provided pre-start-up checklists are complete	
All required testing equipment is on site	
PFCs provided reviewed, approved for use, and on site.	
Start-up Plan reviewed and approved	
For all controls connections, complete the following items:	
	• Instrument tags in place
	• Wire tags in place
	• Wiring inspected and connections verified including grounding
	• Instrument block and drain valves installed
	• Instrument factory calibration sheets delivered to project
	• Loop status report forms must include verification of the
	• measurement at the transmitter display, PLC, HMI.
Instruments	Manufacturer and shipping stops removed
	Installation orientation correct and per engineering drawings (straight runs/pockets/rotation/etc.)

PERFORMANCE TESTING

The following activities are required for performing the individual system component checks. Performance testing demonstrates the functionality of the individual system components prior to operating the full facility.

Unit Process	Performance Test Details
<<Eqpt Name>> Pump	
	Dynamic balancing of rotating components
	3-hour operation without malfunction, document performance criteria from
	specification.
	Motor test data (Section 26 20 00)
	Hydraulic institute standard tests
	Local/remote controls per loop specifications and control narrative
	Alarms work per control narratives

<<Eqpt/Assem/Sys Name>>	<<Insert Eqpt, Assem, and Sys as they become available>>
HVAC System	
	Check operation in relation to setpoints
	New steam traps function properly
	HVAC testing and balancing
	Alarms work per control narratives
Controls	
	Performance test reports for each loop (forms generated by control contractor) Test each alarm and interlock during loop check. Positioners must be verified at a minimum of the following settings (0%, 25%, 50%, 75%, 100%) This verification needs to be confirmed at the HMI, PLC, Instrument, and Instrument display as applicable
	Alarms work per control narratives
	Deliverables must include as left configuration files and programming software utilized for the installation

FACILITY DEMONSTRATION TESTING

The following activities will constitute the Facility Demonstration Test. This testing shows that the facility as a whole will operate as designed as well as withstand the normal operational challenges that may be encountered. Included in this test is verification of the automatic and manual controls for the entire facility.

Test Description	**Demonstration Test Details**
Normal Operation – 2 days	Uninterrupted Operation, monitoring:
	Alarms work as programmed
	Pumps adjust speed to maintain pressure and level as designed
	Real time system trends and recording
Challenge Testing – 1.5 day	Power failure (include complete power failure simulation (UPS's turned off) so entire system is black)
	Power recovery
	Duty pump failure
	Control signal failures
	100% facility backup, 36 hours of generator runtime.

STEP 2: RECORD ISSUES, SCHEDULES, BUDGETS, AND EXPECTATIONS.

None identified during Pre-Design phase. Items will be tracked as needed during subsequent phases.

STEP 3: PROVIDE DOCUMENTATION AND TRAINING REQUIREMENTS

Following demonstration testing, provide final report. Final report should have no remaining deficiencies.

DESIGN ACTIVITIES

The following general tasks comprise the commissioning work during:

Concept Design:

0%- to 15%

1. Coordinate and Review Basis of Design (BOD)
2. Update Commissioning Plan
3. Update Owner Project Requirements (OPR)
4. Update Master Equipment List (MEL)
5. Develop Commissioning Process
6. Develop Contracting Documents
7. Develop, Coordinate, and Review Project Specifications
8. Perform Concept Design Review
9. Set Project Energy Efficiency Goals

Schematic Design:

15% to 35%:

1. Update:
    a. Commissioning Plan
    b. OPR
    c. MEL
    d. Commissioning Process
    e. Contracting Documents
    f. Commissioning Specifications
2. Review Schematic Design Documents
3. Develop Prefunctional Checklist (PFC)
4. Develop Functional Performance Test (FPT) Forms
5. Develop Draft Submittal Manual

Design Development:

35% to 65%:

1. Update:
    a. Commissioning Plan
    b. OPR
    c. MEL
    d. Commissioning Process
    e. Contracting Documents
    f. Commissioning Specifications
    g. PFC
    h. FPT Forms
2. Perform a Review of Design Development Documents
3. Develop Systems Manual

Construction Documents:

65%-95%

1. Update:
    a. Commissioning Plan
    b. OPR
    c. MEL
    d. Commissioning Process
    e. Contracting Documents
    f. PFC
    g. FPT Forms
    h. Systems Manual
2. Perform a Review of the Construction Documents
3. Perform a Review and Coordination of BoD
4. Review HVAC Sequence of Operations

Final Construction Documents:

95% to 100%

1. Finalize Design Phase Commissioning Plan
2. Perform a Review and Coordination of the Final BoD
3. Update:
    a. Commissioning Plan
    b. OPR
    c. MEL
    d. Commissioning Process
    e. Contracting Documents

DEVELOP AND UPDATE BASIS OF DESIGN

As the AE team develops the project documents, they will update the BoD. The CxA reviews the BoD for compliance with the OPR at each milestone deliverable. Appendix B has the current version of the BoD.

UPDATE COMMISSIONING PLAN

The Commissioning Authority makes necessary clarifications and changes to the draft Commissioning Plan developed during pre-design phase. This updated plan guides the commissioning work during design. All AE team members receive a copy of the plan.

The CxA develops an Interim Cx Plan, to be used for the Commissioning Scoping Meeting at the beginning of Construction. The Interim Cx Plan explains the Cx Process during Construction as specified in the contract documents and provides further details where they are known during

Design. The Interim Plan will be updated during construction by the CxA to become the Final Cx Plan.

DEVELOP COMMISSIONING PROCESS

The CxA will be the coordinator of the commissioning activities during Design, per the designations in Appendix E. The beginning of this task consists of holding a commissioning kick-off meeting with the AE team at the beginning of Construction Documents Phase (after 65% is complete). This meeting is held after the Cx Plan has been created, and ideally after it has been reviewed and updated. The meeting includes reviewing the process and outlining each party's responsibilities.

The CxA will ensure that commissioning issues are part of AE team meeting agendas and will ensure that the Leads for each task understand their responsibilities and execute them. The CxA makes any necessary changes to the Design phase Cx Plan. The CxA reports to the Project Manager.

DEVELOP AND REVIEW PROJECT SPECIFICATIONS

Commissioning specifications for inclusion in the construction bid documents are developed by the CxA and AE Team DOR. Commissioning-related specifications are included in Appendix C after completion.

PURPOSE

The specifications provide detail so that those bidding on the project can clearly understand how the commissioning process works and specifically what role they have in the process. They provide the requirements and process for properly executing the commissioning work.

SPECIFICATION CONTENT

The commissioning specifications provide the bidders a clear description of the extent of the verification testing required, including what components and systems will be tested and the documentation, reporting and scheduling requirements. Details of the extent of testing and who is responsible for writing tests, executing tests, witnessing and signing-off on tests are included. The relationship between and requirements for start-up, Prefunctional checklists, manual functional performance tests, control system trend logs and stand-alone data logging are also given. Example tests are provided. The specifications detail the operator training and the O&M documentation and O&M plan requirements.

Division 01 has specification 01 91 13 General Commissioning Requirements, which covers administration, procedure and roles, what will be commissioned, etc. This includes discussion of management of the Cx process. Specification 01 91 13 also has definitions of Cx terminology. Finally, this specification covers Cx of Integrated Systems, which span across multiple disciplines and contractors, requiring General Level oversight by the CxA and CCC. The scope of 01 91 13 includes:

1. General requirements for coordinating and scheduling commissioning.
2. Commissioning meetings.
3. Commissioning reports.
4. Use of test equipment, instrumentation, and tools for commissioning.
5. PreFunctional checklists creation, including, but not limited to, installation checks, start-up, performance tests, and performance test demonstration.
6. Commissioning test creation (Functional Tests).
7. Integrated Systems test creation
8. Adjusting, verifying, and documenting identified systems and assemblies.

Related Division 01 Specs:

1. 01 30 00 ADMINISTRATIVE REQUIREMENTS
2. 01 40 00 QUALITY REQUIREMENTS
3. 01 40 10.01 INFECTION CONTROL RISK ASSESSMENT CONSTRUCTION PERMIT
4. 01 45 00 QUALITY CONTROL
5. 01 60 00 PRODUCT REQUIREMENTS
6. 01 70 00 EXECUTION AND CLOSEOUT REQUIREMENTS

Technical Commissioning Specifications:

1. 08 08 00 COMMISSIONING OF OPENINGS
2. 21 08 00 COMMISSIONING OF FIRE SUPPRESSION
3. 22 08 00 COMMISSIONING OF PIPING
4. 23 08 00 COMMISSIONING OF HVAC
5. 26 08 01 COMMISSIONING OF ELECTRICAL SYSTEMS

Technical Cx Specs cover (by discipline):

1. List of Systems and Assemblies to be Commissioned and Functionally Tested
2. List of Tests and Acceptance Criteria for Each System

GUIDE SPECIFICATIONS

Commissioning specifications documents in Appendix C were developed by the CxA from the specification guide templates for inclusion in the construction bid, adapted for this construction package, and reviewed by AE Team members as part of the commissioning process.

COORDINATION AND REVIEW

The CxA is responsible for developing the general Cx specification, and coordinating the development of sections of the commissioning specifications. Each AE Team DOR develops the applicable technical Cx spec for their systems, and provides feedback to the CxA, who edits the general specifications according to the feedback.

ACCOMPLISH DESIGN REVIEWS

15% CONCEPTUAL DESIGN REVIEW

At the end of the Conceptual Design (15%), the CxA reviews the design along with the other AE Team members.

In the Conceptual Design phase the CxA ensures the design documents aligns with the BoD and that those documents align with the Owners intent in the OPR. The CxA team will review and suggest alternative designs that might lower project cost without negatively impacting performance and that could lower the life cycle costs without undue increase in construction cost. Though the CxA may review the areas mentioned above, they are not responsible for the design concept, design criteria, or compliance with codes.

35% SCHEMATIC DESIGN REVIEW

At the end of the Schematic Design (35%), the CxA reviews the design along with the other AE Team members.

The CxA ensures the proposed design documents align with the BoD and those align with the Owners intent as identified in the OPR, and conforms to best practice. The CxA team will also review the documents with the O&M staff and document their comments and concerns. CxA will prepare both CxA and O&M comments and deliver them to the Owner and the AE Team. While the CxA may review the content below, they are not responsible for the design concept, design criteria, or compliance with codes.

CxA 35% Schematic Design Review	
Design Area	**Review Description**
___ Owner's Requirements	Compliance with OPR.
___ Completeness	Ensure design documents are complete and contain the information required for construction, maintenance and operation
___ Commissionability	Input regarding making the building easier to commission, see Commissioning Facilitation
___ Cost Effective	Identify alternative designs that maintain performance at a lower cost.
___ Coordination of Trades	Ensure information is consistent between disciplines, without gaps or overlaps
___ Energy Efficiency	Identify energy reducing alternative designs.

65% DESIGN DEVELOPMENT REVIEW

At the end of Design Development (65%), the CxA reviews the design along with the AE Team members.

The CxA compares the proposed design aligns with the BoD, and that the design documents align with the interests and needs of the Owner as identified in the OPR. The commissioning authority also identifies any improvements that can be made in areas below. Though the CxA

may review the areas checked below, they are not responsible for design concept, design criteria or compliance with codes.

CxA 65% Design Development Review	
Design Area	**Review Description**
___ Owner's Requirements	Compliance with OPR.
___ Reliability	Ensure maximum reliability of mission-critical systems (N+1)
___ Commissioning facilitation	Input regarding making the building easier to commission, see Commissioning Facilitation
___ Functionality for Users / Mission	How the design can be changed to improve functionality for the success of the mission, and assess general equipment adequacy
___ Energy Efficiency	General efficiency of building shell, building layout, HVAC system types, lighting system type, etc.
___ Operation and Maintenance (O&M).	How building O&M can be made easier (accessibility, layouts, maintainability, and system control, etc.)
___ Indoor Environmental Quality (IEQ)	How thermal, visual, acoustical comfort or air quality can be improved (1)
___ Environmental Sustainability	How the building materials and systems and landscaping can create less of an impact on the environment
___ Life Cycle Costs	Life cycle assessment of options relative to energy efficiency, O&M, IEQ or functionality
___ Communication	Ensure CxA and Owner comments have been addressed

(1) Indoor air quality (IAQ) commissioning does not ensure that indoor air quality will be adequate or without deficiency at building turnover or during occupancy, unless the Owner has specifically specified that actual air quality testing is performed. Commissioning indoor air quality entails performing tasks that minimize the potential for IAQ problems, but it does not eliminate their possibility.

95% CONSTRUCTION DOCUMENTS

The CxA, along with the AE Team members, review the full set of Construction Documents and specifications at the 95% deliverable stage. Parts of this review dealing with commissioning specifications will have been completed during Commissioning Specification Development. The AE PM provides the necessary documents to the CxA.

The CxA compares the design with the BoD, and ensures compliance with the Owners interests and needs as identified in the OPR and the design areas in the table below. The CxA also identifies improvements that can be made in areas that do comply with or are not specifically mentioned in the OPR in areas checked in the table. The rigor of the review can be prescribed or determined based on the complexity of the project.

Though the CxA may review the areas checked below, they are not *responsible* for design concept, design criteria, or compliance with codes. The CxA does not *verify* the designers' calculations or proof schematics or layouts in detail. Constructability review is performed by another party. The CxA will use their expertise to provide input into the areas checked in the table. For example, the CxA does not verify appropriate pipe or duct sizing but may provide comments on unusually tight or restrictive duct layouts and bends or a poor location of a static pressure sensor.

CxA 95% Design Development Review	
Design Area	**Review Description**
___ Commissioning facilitation	Input regarding making the building easier to commission (see Commissioning Facilitation section below)
___ Component energy efficiency	Review for adequacy of the efficiency of bldg. shell components, HVAC systems and lighting systems.
___ Control system & control strategies	Review ___HVAC, ___lighting, ___fire control, ___security control system, strategies and sequences of operation for adequacy and efficiency.
___ Operation and maintenance	Review for effects of specified systems and layout toward facilitating O&M (equipment accessibility, system control, etc.).
___Indoor environmental quality	Review to ensure that systems relating to ___thermal, ___visual, ___acoustical, ___air quality comfort, ___air distribution are in accordance with the design intent.
___Environmental sustainability	Review to ensure that the ___building materials, ___landscaping, ___use of water resources, ___waste management are in accordance with the design intent.
___Facility performance and design intent	Identify oversights or insufficient detail in the design, relevant to being able to reasonably meet the design intent
___Functionality for tenants	Review to ensure that the design meets the functionality needs of the tenants.
___ Life cycle costs	Perform a ___qualitative, ___quantitative lifecycle assessment of the primary competing systems relative to ___energy efficiency, ___O&M, ___IEQ, ___functionality.
___O&M documentation	Verify that building O&M plan and documentation requirements specified are adequate
___Training	Verify that operator training requirements specified are adequate.
___ Commissioning specifications	Verify that bid documents adequately specify building commissioning and that there are adequate monitoring and control points specified to facilitate commissioning and O&M (trending capabilities, test ports, control points, gages and thermometers).
___Review of engineering assumptions	Review the engineering assumptions relating to equipment sizing, energy efficiency decisions and HVAC cost-benefit calculations

CxA 95% Design Development Review	
Design Area	**Review Description**
___Owner's design guide or standard	Verify that the design complies with the Owner's own design standard or guideline.

COMMISSIONING FACILITATION

One of the primary reasons for reviewing the design documents is to facilitate commissioning during construction. Many of the features that facilitate commissioning will also enhance ease of building and systems operation. The CxA will review for the following items during Design phase reviews. The CxA will make recommendations to the AE Team as to which items are needed.

1. Clear and rigorous design documentation, including detailed and complete sequences of operation.
2. An HVAC fire and emergency power response matrix that lists all equipment and components (air handlers, dampers, valves, etc.) with their status and action during all operating conditions. See Appendix B – Basis of Design.
3. Access for reading gages, entering doors and panels, observing and replacing filters, coils, etc.
4. Required isolation valves, dampers, interlocks, piping, etc. to allow for manual overrides, simulating failures, seasons and other testing conditions.
5. Sufficient monitoring points in the control systems, even beyond that necessary to control the systems, to facilitate performance verification and O&M.
6. Adequate trending and reporting features in the BAS.
7. Pressure and temperature (P/T) plugs close to controlling sensors for verifying their calibration.
8. Pressure gages, thermometers and flow meters in strategic areas for verifying system performance and ongoing O&M.
9. Pressure and temperature (P/T) plugs at less critical areas or on smaller equipment where gages and thermometers do not add value or clarity to the operation.
10. Specification of the location and criteria for static pressure sensors and differential pressure sensors for systems such as VAV ducting, chilled water piping, cooling water, heating water, heat recovery piping, potable water, etc.
11. Adequate balancing valves, flow metering and control stations and control system functions to facilitate and verify reliable test and balance.
12. Control strategy for integrated systems.
13. Clear and complete commissioning specifications for the construction phase.
14. Complete O&M documentation requirements in the specifications.
15. Complete training requirements in the specifications.
16. Review entire document and building information management plan from design through construction and turnover to ensure adequacy and compliance with the Owner's program.

PRE-BID MEETING

Bidders learn important project details affecting their bids by attending the pre-bid meeting. The agenda for the meeting includes discussion of the Cx effort required so the successful bidder will have adequate provision in their bids for executing the work. The CxA will attend the meeting and provide support in answering questions related to the Cx Process..

CONSTRUCTION ACTIVITIES

CONDUCT PRECONSTRUCTION MEETING

COMMISSIONING SCOPING MEETING (CONSTRUCTION KICK-OFF MEETING)

A Construction Kick-Off meeting is planned and conducted by the CxA after construction contract award. In attendance are the CxA, GC, AE Team, and Owner. At the meeting, the CxA is introduced and the following is discussed: Cx Plan, Cx process questions, management and reporting lines of communication, flow of documents and submittal data, general list of each party's responsibilities, and the proposed commissioning schedule.
The outcome of the meeting is to increase familiarity of the Cx process with all project stakeholders and ensure understanding of roles and responsibilities. The meeting also provides the CxA with additional information needed to update the Cx Plan, including the commissioning schedule.

FINAL COMMISSIONING PLAN

The CxA updates the Interim Cx Plan using the information gathered from the Construction Kick-Off Meeting. As necessary and recommended, the revisions will include re-commissioning, testing, balancing of equipment systems in the existing building, and project specific pre-functional checklists and functional performance test procedures. The initial commissioning schedule is updated for construction, and is actively updated as construction progresses. Prior to start-up of the primary equipment, the CxA meets with the following stakeholder gather to develop a detailed Cx Schedule: CCC and Owner. The schedule is included in the Cx Plan and the Construction Cx Plan is approved by the Owner / Owner's Representative.

SITE OBSERVATION

The CxA will make 16 periodic visits, as necessary, to witness equipment and system installations. The CxA will offer facility O&M personnel construction site tours to discuss, and help familiarize, the staff with equipment, assemblies, systems, maintenance requirements, sequences of operation, and other relevant information. The CxA will maintain a list of O&M staff comments and concerns and will work with the AE Team and Contractor to provide coordinated responses.

MEETINGS

CxA will review the meeting minutes of the regular project meetings, and attend selected planning and job-site meetings, to remain informed on construction progress and update parties involved in commissioning. The CCC and GC provides the CxA with information regarding

substitutions, change orders, modifications to the contract documents, and RFIs that may affect commissioning.

Later during construction, dedicated commissioning meetings will be scheduled by the CxA as required. The CxA will oversee these meetings, and they will be held jointly with the CCC. The intent of these meetings will be to verify schedule and document progress of Cx activities.

MANAGEMENT PROTOCOLS

The following protocols will be used on this project:

Management Protocols for Cx Processes	
Issue	**Protocol**
For requests for information (RFIs) or for formal documentation requests:	The CCC communicates through the GC.
For minor or verbal information and clarifications:	The CCC communicates direct to the informed party
For notifying contractors of deficiencies:	The CxA documents deficiencies but may discuss issues with contractors prior to notifying the GC.
For notifying AE of concerns with construction documents:	The CxA documents concerns but may discuss issues with AE prior to notifying the Owner's Representative / PM.
For scheduling Functional Performance Tests or Training:	The CxA may provide input, and do some coordination of training and testing, but does not do any scheduling or participate in all training. Scheduling is accomplished by the CCC.
For scheduling commissioning meetings:	The CxA works with the Owner, GC, PM, and AE Team.
For making a request for significant changes:	The CxA and the CCC has no authority to issue change orders or field directives.
For making small changes in specified sequences of operation:	The CxA will make recommendations to the AE Team. The CxA has no authority to direct changes in sequences of operations without written approval from the AE Team. The CxA may make recommendations to the Subcontractors on ways to implement the sequences of operation.
Subcontractors disagreeing with requests or interpretations by the CxA shall:	Try and resolve with the CxA first. Then work through the CCC and GC who will work with the CxA directly to resolve the situation.

PROGRESS REPORTING AND LOGS

At the beginning of construction, the CCC provides the CxA with commissioning progress reports. Prior to the start-up of the first piece of major equipment, the frequency of progress reports is increased until start-up is completed. Before functional testing of equipment begins, weekly progress reports are required until functional testing and all non-conformance issues are resolved. The CxA may adjust the reporting frequency as needed. The progress reports provide a format for this report. The CxA keeps a log of commissioning-related issues that require current or future attention.

The reports contain: an update of the schedule with list of requested schedule changes and new items added to the schedule, a list of new and outstanding deficiencies, a description of

commissioning progress corresponding to the plan, status of submittals, status of contractor questions, etc.

CCC regularly communicates with all members of the commissioning team, keeping them apprised of commissioning progress and scheduling issues through memos, progress reports, etc.

The CCC will keep all commissioning materials in an electronic file system accessible to the team members. Refer to documentation format requirements elsewhere in this Cx Plan.

CONTRACTOR SUBMITTAL REVIEW

INITIAL SUBMITTALS AND DOCUMENTATION

Submittal tracking and documentation will conform to the format requirements of the project specifications. Submittals will be routed to the appropriate reviewer using the submittal review process. The CxA through the CCC provides subcontractors with commissioning documentation requirements for their respective equipment and systems. These data requests coincide with the normal AE Team submittal process. Submittals received by the GC from trade subcontractors are shared with the CxA. At minimum, this equipment data includes installation and start-up procedures, O&M data, performance data, and control drawings. The CxA will use the information to create the PreFunctional checklists and the Functional Performance Tests.

STANDARD SUBMITTALS

The CxA reviews and approves submissions relative to commissioning issues expressed in the contract documents, not for general contract compliance (which is an AE Team responsibility), unless specifically directed by the Owner to do so. CxA recommendations are provided to the AE Team and Owner as directed.

SPECIAL SUBMITTALS, NOTIFICATIONS AND CLARIFICATIONS

The CCC, Subcontractors, GC or AE Team notify the CxA of any new design intent or operating parameter changes, added control strategies and sequences of operation, or other change orders that may affect commissioned systems. The controls contractors provide the CxA a full points list with details requested by the CxA. Thirty (30) days prior to performing tests, the CCC provides the CxA full details of the procedures. During TAB, daily TAB reports will be issued to the CxA and AE Team, at the completion of TAB the final report will be provided to the CxA with full explanations of approach, methods, results, data table legends, Issues and Resolutions, etc.

These submittals to the CxA do not constitute compliance for submittals for the O&M manuals.

The CxA may request additional design narrative from the AE Team and from the CC to supplement the documentation provided with the bid documents. The CxA may submit written DCVRs to contractors or address them directly for clarifications, as needed.

PREFUNCTIONAL CHECKLISTS

PRE-INSTALLATION CHECKS

Pre-installation checks are not provided by the CxA, but the CxA may request demonstration that the checks were completed properly by a random sampling of equipment. Pre-installation checks are performed by the GC, CCC, or trade subcontractor as necessary to fulfill requirements of the installation, start-up, and PreFunctional checklists. During the installation and start-up checks the CxA will verify that pre-installation checks were performed by the GC or trade subcontractor. Pre-installation checks may include but are not limited to:

1. Manufacturer's pre-installation requirements.
2. Provisions for personal protective equipment, and emergency egress have been made available.
3. Provisions for lockout, tag-out procedures have been made available.
4. Confirmation of permanent utilities (electrical power, fuel gas or fuel oil, water service).
5. Confirmation of level, rigid, and permanent mounting surface or housekeeping pad.
6. Confirmation that vibration isolation and seismic restraint calculations have been received by the GC and trade subcontractors and adequate restraint system sizing has been recommended.
7. Review and discussion of installation procedures between GC and trade subcontractors for conformance with job-site safety procedures and expectations.

INSTALLATION CHECKS

Installation and start-up checks are not provided by the CxA, but the CxA may request demonstration that the checks were completed properly by a random sampling of equipment. Installation and start-up checks may include but are not limited to:

1. Manufacturer's installation and start-up checklists.
2. Trade subcontractor internal checklists.
3. Recommendations suggested by the CM, GC, or CxA, or sequence of operations.
4. Safety isolation devices (electrical disconnect switches, fuel gas or fuel oil isolation valves, water service isolation valves).
5. Installation of vibration isolation and seismic restraint systems.
6. Thermal Insulation for Mechanical Systems.
7. Installation of Direct Digital Control devices for HVAC controls.
8. Chemical Treatment of Water for Mechanical Systems.
9. Hydronic piping air pressure tests.
10. Electric motor rotation confirmation.

PREFUNCTIONAL CHECKLISTS, TESTS AND START-UP

PreFunctional checklists (PFC) are important to ensure that the equipment and systems are hooked up and operational and that functional performance testing may proceed without unnecessary delays. Each piece of equipment receives full PreFunctional checklist checkout by the Contractor and CCC.

No sampling strategies are used by the Contractor. In general, the PreFunctional checklist for a given system must be successfully completed prior to formal functional performance testing of equipment or subsystems of the given system.

PreFunctional checklists are primarily static inspections and procedures to prepare the equipment or system for initial operation (e.g., oil levels OK, fan belt tension, labels affixed, gages in place, sensor calibration, etc.). However, some PreFunctional checklist items entail simple testing of the function of a component, a piece of equipment or system (such as proper fan rotation). The PreFunctional checklists are completed before functional testing. PreFunctional checklists augment and are combined with the manufacturer's start-up checklist.

The technical specifications also include tests required of the work during construction, such as piping pressure tests, structural special inspections, and others. The PreFunctional checklists will include lists of these specified tests for each component and system so that the CCC can include them in the schedule.

Contractors typically already perform some, if not most, of the PreFunctional checklist items the CxA will recommend. This project requires that the checklist items and procedures be signed off by the installing Subcontractors. The CxA does not generally witness the activities on the PreFunctional checklist, except for testing of larger or more critical pieces of equipment and some spot-checking. It is recommended for the CCC to witness PreFunctional checklist activities to provide input to the start-up technician or installing contractor.

DELIVERY PROCESS

Construction Checks will proceed as described in the Technical Commissioning specification sections and Section 01 91 13 GENERAL COMMISSIONING REQUIREMENTS. Draft PreFunctional checklists will be created by the CxA using the materials and equipment submittals specific to the project. The submittal review and documentation process are integral to the production of the PreFunctional checklists.

Draft PreFunctional checklists will be provided by the CxA for review by the GC, CCC, and trade subcontractors prior to creation and distribution of the final PreFunctional checklists. Final versions will incorporate Contractor comments and information on approved submittals.

The GC, CCC, and trade subcontractors provide filled-out and signed-off PreFunctional checklists to CxA for review and recommendation to Owner.

START-UP PLAN

The CxA assists in developing detailed start-up plans for equipment.

The following procedures shall be used for this project:

1. The CxA prepares, the PreFunctional checklists (PFC), and incorporates comments from the subcontractors.
2. The CCC develops the Start-up Plan obtains manufacturer installation, start-up and checkout data, including actual field checkout sheets used by the field technicians.

3. The CCC copies all pages with important instructional data and procedures (not covered in manufacturer field checkout sheets) from the start-up and checkout manuals and adds a signature line in the column by each procedure.
4. For systems that may not have adequate manufacturer start-up and checkout procedures, particularly for components being integrated with other equipment, the Subcontractor should provide the added necessary detail and documenting format to the CxA for approval, prior to execution.
5. The CCC transmits the full Start-up Plan to the CxA for review and approval.
6. The CxA reviews and approves the procedures, noting procedures that need to be added, and conveys to the GC. The GC then transmits the full start-up plan to the Subcontractors for their review and use.

EXECUTION OF CHECKLISTS AND START-UP

Prior to start-up, the CCC schedule start-up and initial checkout with the Owner, GC, and CxA. The start-up and initial checkout are directed and executed by the CCC. The CxA, CC, and Owner observe, at minimum, the procedures for each piece of primary equipment. All equipment and components are processed through PreFunctional checklist activities and start-up procedures. For repetitive components or equipment, (e.g., VAV boxes), the CxA may elect to observe a sampling of these procedures.

To document the process of start-up and checkout, the installing Subcontractor performing the PFC line item task initials and dates each paragraph of procedures in the Start-up Plan and checks off items on the PreFunctional checklist and manufacturer field checkout sheets, as they are completed. Only individuals having direct knowledge of a line item being completed shall check or initial the forms.

The subcontractors and vendors execute the checklists and tests and submit a signed copy of the completed start-up forms and PreFunctional checklists to the CxA. The CxA may review PreFunctional checklists in progress, as necessary.

DEFICIENCIES AND NON-CONFORMANCE

The trade subcontractors clearly list any outstanding items of the initial start-up and PreFunctional checklist procedures that were not completed successfully at the bottom of the procedures form or on an attached sheet. The procedures form and deficiencies are provided to the CxA within two days of test completion.

The CxA works with the Subcontractors and vendors to correct and retest deficiencies or uncompleted items— involving the Owner and others as necessary. The installing Subcontractors or vendors correct all areas that are deficient or incomplete according to the checklists and tests.

TAB

The TAB contractor submits the outline of the TAB plan and approach to the CxA and the controls contractor four weeks prior to starting the TAB. Included in the approach is an

explanation of the intended use of the building control system. The CxA reviews the plan and approach for understanding and coordination issues and may comment but does not approve or disapprove. The controls contractor reviews the feasibility of using the building control system for assistance in the TAB work. The TAB submits daily written reports of discrepancies, contract interpretation requests and lists of completed tests to the CxA during TAB activities. This facilitates quicker resolution of problems and will result in a more complete TAB before functional testing begins. Upon completion of TAB activities, the TAB contractor will submit a final TAB Report to the AE Team and CxA for review.

TAB work will not begin until the PreFunctional checklists are complete and approved by the CxA.

SYSTEM INTEGRATION AND CONTROLS CHECKOUT PLAN

The CC develops and submits a written step-by-step plan to the CxA which describes the process they intend to follow in checking out the systems and the forms on which they will document the process. The CC will also coordinate with the TAB contractor to determine the capabilities of the control system for use in TAB. The CC shall operate the system controls during Cx procedures.

The intent is to have all CxA-required controls PreFunctional checklists, calibrations, start-up and selected functional tests of the system completed and approved by the CxA prior to TAB. The CC shall execute the tests and trend logs assigned to them and remain on site for assistance for mechanical system functional tests as specified in the same sections.

FUNCTIONAL PERFORMANCE TEST CHECKLISTS

DELIVERY PROCESS

Draft functional performance tests (FPT) are created by the CxA and CC using the materials and equipment submittals specific to the project. The submittal review and documentation process are integral to the production of the FPTs.

Draft FPTs are provided by the CxA for review by the CCC, Owner, AE Team**,** GC, CC, and select Subcontractors prior to creation and distribution of the final FPTs. Final versions will incorporate comments and information on approved submittals.

OVERVIEW

Functional performance testing is the dynamic testing of systems (in addition to individual components) under full operation (e.g., pumps operate in sequence to maintain flow and pressure, and valves open and close in sequence to change mode of operation between storage systems).

Systems are tested under various modes, such as during low heating loads, high loads, component failures, unoccupied, varying outside air temperatures, fire alarm, power failure, etc. Unique operating modes and Integrated Systems are also tested, refer to Appendix F – Commissioned Systems. The systems are run through the control system sequences of

operation, and components are verified to respond as the sequences states. The CxA and CC develop the functional test procedures in a sequential written form and witness the testing. The CCC coordinates the actual testing, and the CxA oversees and documents the actual testing—which is typically performed by the CC, installing contractor, or vendor.

DEVELOPMENT PROCESS

Before test procedures are written, the CxA obtains requested documentation and a current list of change orders affecting equipment or systems, including an updated points list, control sequences and setpoints. The CxA develops specific test procedures to verify proper operation of each piece of equipment and system. The CxA obtains clarification, as needed, from contractors and the AE Team regarding sequences and operation to develop these tests. Prior to execution, the CxA provides a copy of the primary equipment tests to the CCC and CC, who reviews the tests for feasibility, safety, warranty, and equipment protection. Blank copies of the procedures are included in the O&M manuals for later use by operations staff.

Functional testing and verification may be achieved by manual testing (persons manipulate the equipment and observe performance) or by monitoring the performance and analyzing the results using the control system trend log capabilities, or by stand-alone data-loggers. The CxA follows the Specifications when given and uses judgment where needed to determine which method is most appropriate. Sampling will not be allowed for Cx unless stated by the Owner and all items in the Master Equipment List will undergo testing and checks unless specifically excluded by specification. To minimize redundancy in testing, the CxA reviews Owner-contracted, factory or required Owner acceptance tests and determines whether further testing may be required to comply with the Specifications. In many cases, a simple line-item checkoff in the CxA documentation is all that is required if other testing is adequate.

FUNCTIONAL PERFORMANCE TESTING

EXECUTION OF FUNCTIONAL TESTING PROCEDURES

Functional Testing procedures are described in the Technical Commissioning specification sections and Section 01 91 13 GENERAL COMMISSIONING REQUIREMENTS. The CCC schedules functional tests in coordination with the CC, CxA, and affected subcontractors. For any given system, prior to performing functional testing, the CCC verifies that the PreFunctional checklist has been submitted with the necessary signatures, confirming that the system is ready for functional testing.

The CCC coordinates attendance dates and time with all individuals and groups required to be present during specific system or equipment functional tests. The CxA will invite building O&M personnel to attend and witness testing; however, they are not required to attend. It is expected that schedule conflicts will occur for specific individuals; however, the CCC will coordinate to ensure each commissioning role is attended by an appropriate representative.

OVERVIEW AND PROCESS

The CCC schedules and the CxA oversees, and documents the functional testing of equipment, assemblies, and systems according to the Specifications and the Cx Plan. The subcontractors execute the tests. The control system is tested before it is used to verify the performance of other components or systems. The air balancing and water balancing is completed and debugged before functional testing of air-related or water-related equipment or systems. Testing proceeds from components to subsystems to systems and finally to interlocks and connections between systems.

The CCC will coordinate with the PM and subcontractors to ensure that the PreFunctional checklists are completed, and the subcontractors run through sequences of operation to verify that the systems operate as designed prior to commencement of the dry run and formal functional testing.

The following sequential priorities are followed:

1. Equipment is not "temporarily" started before PreFunctional checklist items and all manufacturers' start-up procedures are completed.
2. The controls system and the equipment it controls are not functionally tested until all points have been calibrated and PreFunctional checklist is substantially completed.
3. TAB for HVAC is not performed until the envelope of the building is completely enclosed and ceiling substantially complete, unless the return air is ducted.
4. TAB is not performed until the controls system has been sufficiently functionally tested and approved by the CxA for TAB work.
5. Functional testing is not begun until PreFunctional checklists, start-up, and TAB are substantially completed, for a given system (this does not preclude a phased approach). Minor TAB work may be completed after functional testing if equipment is near operating parameters at time of functional testing. TAB must be fully completed before testing can occur in critical areas or areas with clearly defined pressure relationships to adjacent spaces, including, but not limited to, isolation rooms, anterooms, operating rooms, procedure rooms, airborne infection isolation rooms, and protective environment rooms.
6. Integrated System testing is not performed until all related component commissioning and functional tests are complete.

DRY RUN TESTING

The CCC schedules preliminary functional tests through the CC and affected subcontractors. The intent of these tests is to verify the functional test forms and proper operation of systems prior to formal testing with the CxA, CC, AE Team, PM, and Owner.

DEFICIENCIES AND RETESTING

The CxA documents the results of the test. Corrections of minor deficiencies identified are made during the tests at the discretion of the CxA. The CxA records the results of the test on the procedure or test form. Subcontractors correct deficiencies and notify the CxA. The CxA schedules any retesting through the GC. Decisions regarding deficiencies and corrections are made at as low a level as possible, preferably between CxA or Owner and the Subcontractor with possible consultation with the AE Team. For areas in dispute, final authority, besides the PM, resides with the AE Team. The CxA recommends acceptance of each test to the Owner.

Deficiencies resulting from the commissioning process will be added to the project-wide punch list for tracking.

If the CxA is instructed to be on site to witness testing and the equipment, assemblies, or system for witnessing are not substantially ready for functional testing (whether through inadequate documentation or installation), the CxA may elect to fail the system and have the GC and affected Subcontractors redo PFCs and subsequent Cx documentation. This subsequent cost and additional on-site functional testing will be charged to Owner who must bill the Contractor for delay in Cx Schedule.

SEASONAL TESTING

Some systems may not be able to be fully tested due to climactic conditions at the time of the regularly scheduled functional testing. The CCC will coordinate with the CxA, PM, AE Team, and Subcontractors to schedule a time to complete the tests when climactic conditions are more applicable. PreFunctional Checklist are to be completed during the initial construction period.

TRENDS

The CxA will document that specified trends are implemented and operational as required by the commissioning Specifications. Specified trends shall be discussed between the AE Team, CxA, Owner, GC, and related subcontractors prior to trend data collection. Trends shall be reviewed by the CxA to confirm trend data is being accurately recorded and collected.

INTEGRATED SYSTEM TESTING

Integrated System Testing confirms broad-scope control sequence testing which requires the integration of multiple disciplines, systems and controls. Appendix F – Commissioned Systems lists the expected integrated systems testing to be performed.

FACILITY STAFF PARTICIPATION

The Operator's facilities operating staff will be invited to attend and participate in the testing process. The CxA will notify the Owner, Operator, and PM, who will then notify the facility staff when the commissioning events will occur.

The Operators will have the right to require presence of their designated representatives for certain tests.

DOCUMENTATION

Cx documentation shall be provided with the Operation and Maintenance Manuals (O&Ms) for all commissioned equipment in a format similar to and compatible with the O&Ms. Information will be shared and cross-referenced between O&M. Primary deliverable media will be digitally stored PDF documents, organized into files named according to the subject matter. The large amount of information will require a robust navigational aid system, to include bookmarks, indexing, and printable, searchable files.

In addition to the PDFs, copies of the electronic documents used to create the PDFs shall be provided. This may include Microsoft Word, Excel, or other similar formats.

A hard copy of relevant Cx documentation shall be provided for inclusion in the physical O&Ms.

SYSTEMS MANUAL / DESIGN ANALYSIS / O&MS

As construction nears completion, the CxA develops a Systems Manual for inclusion with the O&Ms. The systems manual is based on the Design Analysis information provided at the beginning of construction, and as updated through construction in coordination with the CCC and AE Team DORs.

The commissioning specification 01 91 13 includes a description of the Systems Manual contents. Also, refer to the Design Activities section of this plan for detailed discussion of what is included in the Design Analysis.

The CCC oversees assembly and transmittal of systems manual information to the CxA for review according to the specifications.

For this project, the CxA will prepare a comprehensive Systems Manual encompassing both the work of this contract and the existing systems. The CCC and AE Team DORs will provide information for the work of this contract. Where applicable, the Facility Operators will provide information relating to the existing systems. The CxA will integrate the information into a single document that will serve as the overall facility Systems Manual.

The O&Ms include typical product Installation, Operation, and Maintenance (IO&M) information from manufacturers, in addition to comprehensive documentation and narratives of systems design and operation from the AE Team design analyses, warranty information, etc.

The CxA reviews the O&M manuals, documentation and redline as-builts for systems that were commissioned to verify compliance with the specifications and OPR. The CxA recommends approval and acceptance of O&Ms to the Owner. The CxA also reviews each equipment warranty and verifies that all requirements to keep the warranty valid are clearly stated.

TRAINING

TRAINING AND ORIENTATION OF OWNERS PERSONNEL

Training sessions will be completed by the GC and CCC according to the specifications. The training plan shall include the following items:

1. Level of training for O&M staff, emergency response personnel, and occupants.
2. Outline of instructional topics related to the systems, sub-systems, equipment, and assemblies. These topics shall address the design, construction, operation, and maintenance of specific systems, assemblies, and equipment.
3. Learning objectives and training delivery methods for each instructional topic.

4. The planned location of the training sessions (classroom, on site, and off site) and the minimum duration of each training session, in hours, to be completed as required in the OPR, Cx Plan, or contract documents.
5. Instructor's qualifications.
6. Training materials requirements to be employed during the instructional process.
7. Training report, records, and recording requirements.
8. Overview of the maintenance and operation of each system or piece of equipment. Overview shall include location of equipment, isolation components, and accessories requiring regular access and maintenance.

The CxA will verify that training was accomplished and that it met the standards put forth in the specifications. Archival of instruction, delivery of instruction, and training materials shall be provided as specified in the contract documents and per the OPR. A copy of the training plan, training materials, and records shall be included in the final Systems Manual.

TRAINING VERIFICATION

The GC will provide the training syllabus for review by the CxA prior to each session of Owner Training. The GC will verify that the training adequately covered the operation and maintenance functions of the installed systems and equipment. The CxA will recommend having the training repeated if the training is inadequate.

PRELIMINARY COMMISSIONING REPORT

A preliminary commissioning report will be prepared by the CxA after the construction is substantially complete and prior to occupancy. The preliminary commissioning report will be a thorough summary of commissioning activities and will include but not be limited to:

1. Executive summary, noting a general description of the testing and verification methods implemented on the project and results of the process.
2. List of participants and roles.
3. Brief project scope and system description.
4. Discussion of commissioning and testing scope.
5. Description of testing and verification methods.
6. Commissioning issues logs.

Any outstanding items or significant changes that occurred to the project due to the commissioning process will be highlighted. Copies of the completed PreFunctional checklists and Functional Performance Tests, as well as the training sign-in lists will be included as appendices to the Commissioning Report.

OCCUPANCY/OPERATIONS ACTIVITIES

The following general tasks comprise the commissioning work during Occupancy/Operations:

1. Coordinate the commissioning activities
2. Finalize commissioning plan

3. Perform a review of contractor O&M Manual and provide comments to the GC, Owner, and AE Team
4. Review outline of Ongoing Training activates
5. Seasonal Testing
6. Warranty inspection.
7. Provide Final Cx Report
8. Finalize the Systems Manual

ONGOING TRAINING

Ongoing training will be the responsibility of the Facility Manager and Plant O&M staff. GC training documentation will be provided to the Facility Manager to retain for future use. The CxA will provide the Facility Manager with supplemental training documentation in the Systems Manual.

WARRANTY REVIEW

WARRANTY PERIOD

During the warranty period, seasonal testing and other deferred testing required are completed according to the Specifications. The CxA coordinates this activity. Tests are executed, and deficiencies corrected by the appropriate Subcontractors, witnessed by facilities staff and the CxA.

The CxA will return to the site 10 months into the 12-month warranty period and review with facility staff the current building operation and condition of outstanding issues related to the original seasonal commissioning. The CxA will also interview facility staff and identify their problems or concerns with operating the building as originally intended based on a previously approved BoD documentation and any approved adjustments made to the design.

Any final adjustments to the O&M manuals and as-builts due to the testing are made. Refer to seasonal testing details above for this project.

LESSONS-LEARNED MEETING AND REPORT

To be developed.

The CxA will accomplish a meeting with the Owner, contractors, designers, operators, and occupants coinciding with the post-occupancy visit to identify lessons learned.

FINAL COMMISSIONING REPORT

A final commissioning report will be prepared by the CxA after the construction is substantially complete. The CCC will assist in ensuring all required documentation for the commissioning report has been supplied to the CxA. The preliminary commissioning report will be a thorough summary of commissioning activities and will include but not be limited to:

1. Executive summary, noting a general description of the testing and verification methods implemented on the project and results of the process.
2. List of participants and roles.
3. Brief project scope and system description.
4. Discussion of commissioning and testing scope.
5. Description of testing and verification methods.
6. Commissioning issues logs

Any outstanding items or significant changes that occurred to the project due to the commissioning process will be highlighted. Copies of the completed Functional Performance Tests and Daily Site visit Cx reports will integral or included as appendices to the Commissioning Report.

FINAL SYSTEMS MANUAL

During occupation and operation phase of the facility, and while closeout documents are being submitted, the CxA finalizes a Systems Manual for inclusion with the Operations and Maintenance Manuals (O&Ms). At this stage the Systems Manual forms into a central location for information essential for the building operators to understand, operate, and maintain the systems and assemblies; outlines updating mechanisms for continuous evaluation of the building's function against functional requirements; and outlines the procedures for effective documenting and tracking of modifications to the systems and assemblies by the Process Operators (O&M staff) as they occur during Occupancy and Operations Phase.

CONTACT AND RESPONSIBILITY INFORMATION

Each project has a unique set of personnel providing the various services required for Cx purposes. There is no single person in charge of the commissioning effort. Various teams will accomplish each phase of commissioning, with oversight by the CxA.

Refer to Appendix D for Appendix D- Management and Communication Structures.

SCHEDULE REQUIREMENTS

The CxA provides a detailed description of Cx Process Activities and a schedule of activities. The design milestones should include the Cx Team meetings, OPR development, design reviews, and the completion of the BoD and the Cx specifications, permitting, construction phases, and post occupancy services.

For construction and renovation activities, the CCC produces a similar schedule of activities, where milestones should include the Cx Team meetings, submittals, installation checklists completion, start-up plan start and finish, performance testing, Owner move-in, training, O&M and record drawing completion, deferred seasonal testing, warranty review, and final Cx Process report.

Refer to Appendix G.

APPENDICES

Appendices in this project will state the requirements, responsibilities, and any applicable background information for the required deliverable. The results and documentation for each item will be included in the final Cx report.

It is not necessary to include copies of documents included in the systems manual in the final Cx Report if that Cx Report is included in the systems manual, but the location of the document(s) should be noted.

APPENDIX A-OWNER'S PROJECT REQUIREMENTS

The initial draft of the OPR was developed by the CxA during concept design, and was based on information provided by the Owner's Representative, Project Manager, and Program Manager; additionally, the OPR pulled in information from the Pre-Design and Visioning sessions and Sustainability Charrette Reports produced by the AE Team. Topics from the Pre-Design and Visioning sessions and Sustainability Charrette reports were vetted by the Owner's Representatives during OPR development meetings.

The attachment will be provided when the OPR is finalized after the completion of Construction.

APPENDIX B-BASIS OF DESIGN

The BoD records the major thought processes and assumptions behind design decisions made to meet the OPR. The BoD varies greatly from project to project, but will general include: Specific codes, standards, and guidelines considered during design of the facility and designer interpretations of such requirements; information regarding ambient conditions (climatic, geologic, structural, existing construction) used during design; assumptions regarding use of the facility; expectations regarding system O&M; performance criteria that the system was designed to meet, linked to the OPR; specific design methods, techniques, and software used in design, a narrative statement of design that describes how the designer intends to meet the OPR; a narrative statement of operation that details how the facility is expected to operate under various situations (such as normal operation, extreme event, emergency); and a listing of specific manufacturer makes and models used as the basis for drawings and specifications.

Attachment will be provided after the completion of the 100% Construction Documents.

APPENDIX C-PROJECT SPECIFICATIONS

Attachment will be provided after the completion of the 100% Construction Documents.

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APPENDIX D- MANAGEMENT AND COMMUNICATION STRUCTURES

Role	**Contact Name**	**Contact Phone**	**Contact Email**
Owner			
Tag: **SCF**	Company: **Southcentral Foundation**		Reports To: **SCF**
Owner's Representative (OR)	Krista Phillips	(907) 729-6656	kphillips@southcentralfoundation.com
Owner's Project Manager (OPM)	Shawn Glenn	(907) 729-3378	sglenn@southcentralfoundation.com

Role	**Contact Name**	**Contact Phone**	**Contact Email**
Owner's Program Manager (OPGRM)	Haily Olson	(907) 729-4955	holson@southcentralfoundation.com
Architecture			
Tag: **ARCH**	Company: **KPB**		Reports To: **SCF**
Project Manager/ Principal (ARCH PM)	Jae Shin	(907) 274-7443	jshin@kpbarchitects.com
Planner and Landscape Arch	Tamas Deak	(907) 274-7443	
Design Principal	Andrew Weiss	(907) 274-7443	AWeiss@KPBArchitects.com
Director of Interior Design	Alisha Weiss	(907) 274-7443	
Architect	Troy Nesset	(907) 274-7443	
Architecture-Design			
Tag: **ARCH-D**	Company: **NBBJ**		Reports To: **SCF**
Design Principal	Brian Uyesugi		buyesugi@nbbj.com
Project Manager, Principal	Chuck Kolb		ckolb@nbbj.com
Designer	Deepthi Ganesh		dganesh@nbbj.com
Medical Planner, Principal	Erin Kelly		ekelley@nbbj.com
Senior Designer	Travis Allen		tallen@nbbj.com
Associate, Designer	Yuchi Kuo		ykuo@nbbj.com
Senior Associate	Yusuke Ito		yito@nbbj.com
Medical Planner	Xi Cao		xcao@nbbj.com
Designer of Record (DOR)			
Tag: ***See Below***	Company: **RSA**		Reports To: **ARCH**
Mechanical DOR (ME DOR)	AJ Schirack	(907) 865-0583	aschirack@rsa-ak.com

Role	Contact Name	Contact Phone	Contact Email
Electrical Staff Engineer	Kaylyn Boydston	(907) 276-0521	kboydston@rsa-ak.com
Electrical Engineer	Steven Bassler	(907) 276-0521	sbassler@rsa-ak.com
Electrical DOR (EE DOR)	Xuan Ta	(907) 276-0521	xta@rsa-ak.com
Tag: **ST DOR**	Company: **Reid Middleton, Inc**		Reports To: **ARCH**
Structural DOR	Courtney Willoughby	(907) 562-3439	cwilloughby@reidmiddleton.com
Tag: **C DOR**	Company: **EBSC**		Reports To: **ARCH**
Civil Designer of Record	Luke Mattson		
Tag: **AC DOR**	Company: **Tenor**		Reports To: **ARCH**
Acoustical Engineer	Erik Miller Klein		
Tag: **SW DOR**	Company: **Snow & Wind**		Reports To: **ARCH**
Project Engineer	Chris Oreskovic		
Project Engineer	Jan Dale		
Senior Project Manager	Dan Bacon		
Cost Estimator			
Tag: **CE**	Company: **JMB Consulting**		Reports To: **ARCH**
Cost Estimator	Jon Bayles		
Commissioning Authority			
Tag: **CxA**	Company: **RESPEC**		Reports To: **SCF**
Commissioning Authority	Randall Willams	(907) 743-3200	randall.williams@respec.com

Role	Contact Name	Contact Phone	Contact Email
General Contractor			
Tag: ***See Below***	Company: **TBD**		Reports To: **Owner**
General Contractor (GC)			
GC Project Manager (GC PM)			
Sub-Contractors			
Tag: ***See Below***	Company: **TBD**		Reports To: **GC**
Mechanical Contractor (MC)			
Electrical Contractor (EC)			
Controls Contractor (CC)			

APPENDIX E-ROLES AND RESPONSIBILITIES

TEAM MEMBERS

The members of the commissioning team consist of the CxA, SI, GC, AE DOR (particularly the mechanical and electrical engineers), Owner, Facility O&M staff, the mechanical contractor, electrical contractor, TAB representative, controls contractor, any other installing subcontractors or supplier of equipment that is to be commissioned. Refer to Appendix D for names and contact information.

GENERAL MANAGEMENT PLAN

The CxA is hired directly by the Owner or Owner's Representative to prepare bid documents that accurately reflect the Cx needs for the OPR and as described in the Cx Plan. Practitioners applying the Cx Process should carefully follow applicable Cx process guidance such as ASHRAE Guideline 0, ASHRAE Standard 202, ASHE Health Facility Commissioning Guidelines, and other applicable commissioning technical guidelines tailored to their specific projects.

In general, the CxA coordinates the commissioning activities with the OPM, ARCH PM and GC. The CxA accomplishes creation of PreFunctional Checklists and Functional Testing forms, witnessing of testing procedures, troubleshooting of systems, and resolution of issues on the Cx Log.

The CCC is hired by the GC. The CCC's responsibilities, along with all other contractors' commissioning responsibilities are detailed in the specifications written by the CxA. The Specifications will take precedence over this Cx Plan.

All Cx Team members work together to fulfill their contracted responsibilities and meet the objectives of the Contract Documents. Refer to the Roles and Responsibilities Matrix below.

Understanding and defining the role of each participant is vital to the success of the Cx Process. This appendix provides an example of the responsibilities of each participant in a comprehensive Cx Process. These responsibilities shall be documented in the contracts between the Owner and Contractor(s), Owner and design professionals, and Owner and Cx Specialists. The responsibilities of each participant should be included in the contract documents.

The responsibilities of the Owner, CxA, Design Professionals, Contractors, and Manufacturers are detailed below.

OWNER / OWNER'S REPRESENTATIVES

a. Include a statement regarding design professional commissioning responsibilities and scope in the request for design services.
b. Develop and commit to the Owner Project Requirements (OPR) document for the facility and its use.
c. Assign operations and maintenance (O&M) personnel and schedule them to participate in the various meetings, training sessions, and observations/inspections as follows:

1. Design-Phase coordination meetings
2. Construction-Phase coordination meetings
3. Initial owner-training session at initial placement of major equipment
4. Maintenance orientation and inspection
5. System testing verification meetings
6. Procedures meeting for testing systems
7. Owner's training session
8. Verification demonstrations
9. Systems and assembly tests
10. Final review at acceptance meeting

d. Review and approve any changes made to OPR.
e. Review and approve the construction documents.
f. Provide qualified personnel for videotaping and editing of training sessions.
g. Videotape construction progress.
h. Review and comment on the CxA's Cx Progress Reports.
i. Review and comment on the CxA's verification reports.
j. Review and accept the CxA's Cx Report.

COMMISSIONING AUTHORITY DURING DESIGN (CXA)

a. Organize and lead the CxA Team during design.
b. Facilitate and document the OPR.
c. Verify that the Cx Process Activities are clearly stated in all scopes of work.
d. Integrate the Cx Activities into the project schedule.
e. Prepare a Cx Plan that describes the extent of the Cx Process to meet the Owner's Project Requirements.
f. Update the Cx Plan during each phase of the project to incorporate changes and additional information.
g. Schedule the Pre-Design Cx Process meeting at some convenient location and at a time suitable to the attendees. This meeting will be for reviewing the complete Cx Process and establishing tentative schedules for the Design-Phase commissioning activities.
h. Review and comment on the ability of the design documents to achieve the OPR for the Commissioned systems and assemblies.
i. Prepare the Cx Activities to be included as part of the project specification. Include a list of all individual trade contractor responsibilities for all the Cx Activities (list contractors by name, firm, and trade specialty if known).
j. Execute the Cx through the writing and review of Cx Reports, organization of all CxA Team meetings, tests, demonstrations, and training events described in the contract documents and approved Cx Plan. Organizational responsibilities include preparation of agendas, attendance lists, arrangements for facilities, and timely notification to participants for each Cx Activity. The CxA shall act as chair at all commissioning events and ensure execution of agenda items. The CxA shall prepare minutes of every Cx Activity and send copies to all CxA Team members and attendees.
k. Review the plans and specifications (during the Predesign and Design Phases) with respect to their completeness in all areas relating to the Cx Process. This includes verifying that the OPR has been met, and that there are adequate devices included in the design to properly test the systems and assemblies and to document the performance of each piece of equipment, system, or assembly.
l. Schedule all document review coordination meetings.
m. Develop the initial format to be used for issues and resolution logs throughout and for each phase of the Cx.
n. Prepare contract documents that coordinate required interfaces between Systems and Assemblies.

COMMISSIONING AUTHORITY DURING CONSTRUCTION (CXA)

a. Organize and lead the Cx Team during Construction.
b. Attend the project's Prebid meeting to detail the design professional or contractor Cx requirements.
c. Execute the Cx through the writing and review of Cx Reports, organization of all CxA Team meetings, tests, demonstrations, and training events described in the contract documents and approved Cx

Plan. Organizational responsibilities include preparation of agendas, attendance lists, arrangements for facilities, and timely notification to participants for each Cx Activity. The CxA shall act as chair at all commissioning events and ensure execution of agenda items. The CxA shall prepare minutes of every Cx Activity and send copies to all CxA Team members and attendees.

d. Attend the project's kickoff meeting to detail the design professional Cx Process requirements.
e. Participate in the Cx Process during construction on the Owner's behalf.
f. Update the Cx Plan during each phase of the project to incorporate changes and additional information.
g. Schedule the initial Owner training session so that it will be held immediately before the contractor training. This session will be attended by the Owner's O&M personnel, the design professionals, the contractor, and the CxA. The CxA will review the OPR and the design professional(s) will review the BoD.
h. Review proposed contractor-provided training program to verify that the OPR is met.
i. Attend a portion of the contractor-provided training sessions to verify that the OPR is met.
j. Witness system and assembly testing. Verify the results and include a summary of deficiencies.
k. Periodically review record drawings for accuracy with respect to the installed systems. Request revisions to achieve accuracy.
l. Prepare Cx Process Progress Reports.
m. Prepare Cx Verification Reports.
n. Prepare Cx Process Reports.
o. Recommend acceptance of the individual systems and assemblies to the Owner (in accord with the defined project requirements).
p. Receive and review the systems manual as submitted by the contractor. Verify that it meets the OPR. Insert systems descriptions as provided by the design professional(s) in the systems manual.
q. Supervise the CxA Team members in completion of tests. The test data will be part of the Cx Report.
r. Verify that the Systems Manual and all other design and construction records have been updated to include all modifications made during the Construction Phase.
s. Repeat implementing of tests to accommodate seasonal tests or to correct any performance deficiencies. Revise and resubmit the Cx Report.
t. Prepare the final Cx Report.
u. Assemble the final documentation, which includes the Cx Process Report, the systems manual, and all record documents. Submit this documentation to the Owner for review and acceptance.

CONTRACTOR'S COMMISSIONING COORDINATOR (CCC)

a. Attend the preconstruction Cx Process meeting. This meeting will be for the purpose of reviewing the complete Cx Process and establishing tentative schedules for the Construction-Phase commissioning activities.
b. Execute the Cx Process through the organization of all Cx Team meetings, tests, demonstrations, and training events described in the contract documents and approved Cx Plan.
c. Schedule the initial Owner training session so that it will be held immediately before the contractor training. This session will be attended by the Owner's O&M personnel, the design professionals, the contractor, and the CxA. The CxA will review the OPR and the design professional(s) will review the BoD.
d. Supervise the Cx Team members in completion of tests. The test data will be part of the Cx Process Report.
e. Verify that the systems manual and all other design and construction records have been updated to include all modifications made during the Construction Phase.
f. Repeat implementing of tests to accommodate seasonal tests or to correct any performance deficiencies.

DESIGN PROFESSIONAL / DESIGNER OF RECORD (DOR)

a. Participate and assist in the documentation of the initial OPR.
b. Document revisions to the OPR and obtain approval from the Owner.
c. Document the BoD (Design Analysis).

d. Prepare contract documents, including the integration of the Cx requirements and activities provided by the CxA.
e. Prepare contract documents that coordinate required interfaces between systems and assemblies.
f. Attend the Predesign and Design-Phase coordination and review meetings.
g. Respond to Cx Team design submission review comments and other issues in a timely manner.
h. Attend the Prebid and Pre-Construction meetings**[.][as scheduled by the CCC.]**
i. Specify and verify that the operation and maintenance of the systems and assemblies has been adequately detailed in the construction documents.
j. Review and incorporate as appropriate the CxA's comments from submittal reviews.
k. Participate in the initial operation and maintenance personnel and occupant training session by presenting the project BoD.
l. Participate in other training as detailed in the training program.
m. Review test procedures submitted by the contractor.
n. Review and comment on the CxA's periodic Cx Process Progress Reports and Issues and Resolution Log reports.
o. Review and accept record documents as required by contract documents.
p. Review and comment on the final Cx Process Report.
q. Recommend final acceptance of the systems to the Owner.

CONSTRUCTION MANAGER

a. Include costs for Cx Process Activities in the contract price.
b. Include Cx Process Activities and requirements in all contractors' contracts.
c. Provide adequate accessibility as required to properly operate and maintain the facility.
d. Provide acceptable representation with the means and authority to prepare and coordinate implementation of the Cx Process as detailed in the contract documents.
e. Issue a statement certifying that all work has been completed and that the facility is operational, in accordance with contract documents.
f. Issue the appropriate final reports to the design professionals for review and acceptance.
g. Remedy deficiencies identified by the CxA during verification of the installation or testing.
h. Review and comment on the final Cx Process Report.

CONTRACTOR

a. Include costs for Cx Process Activities in the contract price.
b. Provide services of a qualified, experienced CCC.
c. Include Cx Process Activities and requirements in each purchase order or subcontract written.
d. Obtain cooperation and participation of all subcontractors and manufacturers.
e. Attend the Pre-Construction and Cx Team meetings.
f. Include Cx Process milestones in the project schedule.
g. Implement the training program as detailed in the contract documents.
h. Provide submittals to the Owner, design professionals, and the CxA.
i. Notify the CxA when systems and assemblies are ready for testing.
j. Demonstrate the performance of assemblies and/or operation of systems to the CxA.
k. Complete the PreFunctional checklists as the work is accomplished. Provide the completed PreFunctional checklists to the CxA.
l. Continuously maintain the record drawings and submit as detailed in the contract documents.

CONTROLS CONTRACTOR

a. Develop and provide controls drawings per the contract documents.
b. Review and incorporate as appropriate the CxA's comments from submittal reviews.
c. Develop and verify internal functional acceptance testing procedures.
d. Attend the Pre-Construction meeting.
e. Program all BMS, BAS, and/or SCADA systems.
f. Provide review and comment of CxA written FPTs.
g. Provides testing, guidance, and support.
h. Notify the GC when systems are ready for FPT verifications.

i. Demonstrate operation and performance of the equipment, assemblies, and systems identified for the Cx Process.

MANUFACTURERS

a. Provide all information required for the operation and maintenance of the system or assembly as part of the initial submittal.
b. Provide the requirements to maintain the warranty as part of the initial submittal.
c. Coordinate and accomplish factory tests as detailed in the contract documents.
d. Provide training as detailed in the training program contained in the contract documents.
e. Demonstrate operation and performance of the system or assembly as detailed in the contract documents.

APPENDIX F-COMMISSIONED SYSTEMS

SECTION 01 91 19 – EXTERIOR ENCLOSURE COMMISSIONING

Section includes Cx process requirements for building envelope commissioning:

1. Superstructure.
2. Exterior Enclosure.
3. Roofing.

SECTION 21 08 00 - COMMISSIONING OF FIRE SUPPRESSION

Section includes Cx process requirements for the following fire suppression systems, assemblies, and equipment. See the MEL for specific equipment tags.

1. Water-Based Fire-Suppression System.
2. Fire-Extinguishing System.
3. Pumps
    a. Fire Pump
    b. Jockey Pump
4. Fire-Suppression Water Storage

SECTION 22 08 00 - COMMISSIONING OF PLUMBING

Section includes Cx process requirements for the following piping systems, assemblies, and equipment. See the MEL for specific equipment tags.

1. Domestic hot- and cold-water piping.
2. Sanitary waste and vent piping.
3. Storm drainage piping.
4. Plumbing pumps.
    a. Booster Pumps
    b. Circulating Pumps
5. General-service compressed air piping and equipment.
6. Plumbing equipment.
    a. Water Heaters
    b. Expansion Tanks

    c. Tempering Valves
7. Compressed-air piping and equipment for laboratory and healthcare facilities.
8. Vacuum piping and equipment for laboratory and healthcare facilities.
9. Medical gases piping, equipment, and alarms.
10. Chemical waste systems for laboratory and healthcare facilities.
11. Processed water systems for laboratory and healthcare facilities.

SECTION 23 08 00 - COMMISSIONING OF HVAC

Section includes Cx process requirements for the following HVAC systems, assemblies, and equipment. See the MEL for specific equipment tags.

1. Energy Supply Systems
2. Heat Generation Systems
    a. Boilers
3. Cooling Generation Systems
    a. Chillers
    b. Dry Coolers
4. Central-Station Air-Handling Systems.
    a. Air Handling Units
    b. Heat Recovery Ventilators
5. Air, Steam, and Hydronic Distribution Systems
6. Heating and cooling terminal and unitary equipment.
7. HVAC Equipment
    a. Air Separators
    b. Expansion Tanks
    c. Glycol Make-Up Tanks
    d. Heat Exchangers
    e. Hydraulic Separators
8. HVAC pumps.
    a. Circulating Pumps
9. HVAC controls.
10. TAB verification.
11. Standby Generator Fuel Gas System

SECTION 26 08 00 - COMMISSIONING OF ELECTRICAL SYSTEMS

Section includes Cx process requirements for the following electrical components, systems, assemblies, and equipment:

1. Electrical equipment connected to Normal power systems, including the following:
2. Electrical equipment connected to Essential power systems that provide an alternative source of power in the absence of power from the Normal power system.
3. Controls and instrumentation, including the following:
4. Systems testing and verification, including Normal and Essential power systems, and transitions from Normal to Essential power systems and back.

5. Direct Digital Control (DDC) or Building Automation System (BAS).
6. Exit light fixtures.
7. Emergency lighting.
8. Security Design
9. Fire Detection and Alarm Systems
10. Data Communications

INTEGRATED SYSTEMS

Systems which span multiple disciplines or multiple sub-systems:

1. Operating Modes: switching from mode to mode.
2. Controls: graceful blackout shutdown / restart

APPENDIX G-COMMISSIONING PROCESS SCHEDULE

See attached.

APPENDIX H-PRE-BID MEETING

Pre-Bid meeting documentation will be provided after the Pre-Bid Meeting is completed. This section will include official responses to any bid questions.

APPENDIX I-PRE-CONSTRUCTION MEETING

Pre-Construction meeting documentation will be provided after the Pre-Construction Meeting is completed.

APPENDIX J-SUBMITTAL REVIEW

Submittal reviews will take place during construction and documentation will be provided after the completion and approval of submittals.

APPENDIX K-COMMISSIONING PROCESS ISSUES

Cx Process Issues documentation will be provided as issues emerge throughout the life of the project.

APPENDIX L-PREFUNCTIONAL CHECKLISTS

PFCs are developed throughout the project and documentation will be provided once equipment selections are finalized and dedicated PFCs are Approved for Use.

APPENDIX M-TESTS AND DOCUMENTATION

FPTs are developed once the Control Contractor Drawings are finalize and approved. FPT documentation will be provided once CC Drawings are finalized and FPTs are Approved for Use.

APPENDIX N-SYSTEMS MANUAL ASSEMBLY

The systems manual will be included as a separate document and will be distributed outside of this Cx Plan. The systems manual will include the following parts:

Part 1. Executive Summary

Part 2. Facility Design and Construction

- 2.1 Owner's Project Requirements
- 2.2 Basis of Design Requirement
- 2.3 Facility Design Drawings
- 2.4 Facility and Equipment Specifications
- 2.5 Facility/Project Record Documents (or directions to their location)

Part 3. Building, Systems, and Assemblies Information

- 3.1 Contract Changes
- 3.2 Approved Submittals
- 3.3 Coordination Drawings
- 3.4 Manufacturer's Operations and Maintenance Data
- 3.5 Warranties
- 3.6 3Contractor/Supplier Listing and Contact Information

Part 4. Facility Operations

- 4.1 Facility Guide (including Operating Plan; Facility and Equipment Operating Schedules; Set Points, Ranges, and Limitations; Systems Operation Control Sequences of Operation; and Emergency Procedures)
- 4.2 Maintenance Plans, Procedures, Checklists, and Records
- 4.3 Maintenance Schedules
- 4.4 Ongoing Commissioning Operational and Maintenance Record Keeping
- 4.5 Janitorial and Cleaning Plans and Procedures
- 4.6 Utility Measurement and Reporting

Part 5. Training

- 5.1 Training Plans and Materials
- 5.2 Training Records
- 5.3 System Manual Maintenance and Documentation, including Operator's Ongoing Documentation of Modifications and Adjustments to the Facility Systems and Assemblies

Part 6. Cx Project Report

- 6.1 Executive Summary
- 6.2 Cx Plan(s)
- 6.3 Cx Design and Submittal Review Reports
- 6.4 Testing and Start-Up Reports, Permits, Inspections, Evaluation Checklists, and Testing Check-lists Completed for Commissioned Systems and Assemblies
- 6.5 Cx Progress Reports
- 6.6 Issues and Resolution Logs
- 6.7 Item Resolution Plan for Open Items

APPENDIX O-TRAINING

Copies of training plans and associated materials will be provided in this section. Associated materials documentation will include written descriptions of operating procedures in both normal and emergency modes.

Training documentation will be provided after the final training plan is completed and approved. Associated training materials will be included as they become available.

APPENDIX P-MEETING MINUTES

This section captures meeting minutes as they become available.

APPENDIX Q-CORRESPONDENCE

This section captures relevant correspondence as it becomes available.

APPENDIX R-WARRANTY REVIEW

A warranty review will be conducted 10 months into the 12-month warranty period. The warranty review will identify outstanding construction deficiencies and additional deficiencies discovered by the O&M staff after occupancy. Such deficiencies may include, but are not limited to the following: inadequate or incomplete O&M training, incomplete post occupancy testing, inadequate or incomplete O&M documentation, incomplete or inaccurate record documents, etc. Documentation will be issued in the form of and addenda to the final Cx report, and updated Issues and Resolutions Log (if applicable), and retesting forms with deferred testing results (if applicable).

Warranty review documentation will be provided after the completion of the Warranty Review.

APPENDIX S-OPEN ISSUES

Open issues will be tracked as part of the Issues and Resolutions log. A summary of open issues will be detailed upon completion of commissioning activities.

The final Issues and Resolutions log will be provided after the completion of Commissioning Activities.

APPENDIX T-LESSONS LEARNED

A Lessons Learned Workshop will be held with the Owner, Contractors, Designers, Operators, and Occupants one year after occupancy to identify both positive and constructive lessons learned.

The attachment will be provided after the completion of the Lessons Learned Workshop.

OWNER'S PROJECT REQUIREMENTS

Benteh Nuutah Valley Native Primary Care Center Expansion

DRAFT FOR REVIEW

Oct. 9, 2024

Prepared by:

Randall S. Williams PE

RESPEC

Contents

Introduction

What is an Owner's Project Requirement Document

Owner's Project Requirements are sometimes referred to as "design intent" or "project intent." The OPR documents all decisions and direction regarding design, construction, acceptance, and operational topics. It includes information to help the Project Team properly plan, design, and construct, and the Owner to operate, and maintain systems and assemblies.

The OPR document evolves through each project phase. As decisions are made during the Design Phase, Construction Phase, and Occupancy and Operations Phase, this document is updated to reflect the current project requirements of the Owner. It is the primary tool for benchmarking success and quality at all phases of the project delivery and throughout the life of the facility.

The OPR aligns interpretations of the building requirements and individual responsibilities for the Owner, designer, contractors, and O&M personnel. This helps avoid misunderstandings of the constructed project's needs.

General organization follows this outline:

- **Project Overview**: High-level description of purpose and processes
- **Project Goals**: Concisely worded list of goals defining success
- **Performance Criteria**: Specific, measurable, verifiable benchmarks that demonstrate achievement of Project Goals

Sources for information and goals specific to the VNPCC Expansion are indicated in [Brackets] as follows:

[V]	Visioning & Pre-Programming
[C]	Sustainability Charrette
[U]	User Group (e.g. at design review meetings)
[F]	SCF Facility Planning and Construction Department
[CxA]	Commissioning Authority recommendation
[A/E]	Architect and Engineer Team

Primary Purpose of the Project

Benteh Nuutah Valley Native Primary Care Center provides high quality health care to Customer Owners throughout the region. The current 85,000 SF facility is fully utilized. Growth of the Alaska Native population in the southcentral area of Alaska and increased need for services requires an expansion to the existing primary care center and a remodel to the existing center to allow the care team to meet the needs of the Community.

Space Programming is intended to serve projected needs for 10 years, through 2036, with flexibility to adapt to needs beyond that date. The expansion building infrastructure, its structure, and enclosure is expected to meet the needs of SCF and VNPCC for 50 years, through the year 2075. In addition to providing the means for reorganization, repair, and replacement of systems to continue to meet the communities changing needs throughout the life of the building.

The VNPCC Expansion will have comprehensive energy efficiencies integrated in a holistic building systems approach to reduce carbon dioxide emissions and maximize daylight in ways that are environmentally and socially responsible.

Construction will be in two phases: New Expansion Construction, then Partial Renovation of Existing. Phase 1 will be completed and occupied before Phase 2 construction begins.

Commissioning Process

SCF has adopted the building commissioning process as detailed in the ASHE Health Facility Commissioning Guidelines and recommendations from the 2022 IHS A/E Design Guide as their quality-oriented process for determining, achieving, verifying, and documenting that the performance of the facility, systems, and assemblies meets their defined objectives and criteria as defined in this document.

The focus of the commissioning process is on key systems and assemblies, including:

- Life Safety
- Building Security and Communication (selected systems)
- Building Automation System with Control Strategies
- Air Handling Units
- Major Mechanical
- Major Electrical
- Backflow Preventers
- Medical Gas and Dental Vacuum

Not Included are:

- Telecommunication and Television Cable
- Building Security (systems not selected above)
- Medical Waste Disposal

Refer to Commissioning Program section of this document for more details.

The Owner is utilizing a third-party Commissioning Authority with a direct contract to the Owner. The scope of work to be accomplished by the Commissioning Authority includes the following key activities:

Design (Phase 1 and 2)

- Facilitate development of the OPR (this document)
- Develop and maintain the Commissioning Plan
- Review Design: Basis of Design, SRA review process and participation, Plans & Specifications (schematic, design development, construction documents), HVAC Control Sequences
- Integrate commissioning process into design documents, including specifications, construction checklists, testing procedures, documentation, and impact of non-compliance
- Attend and Participate in Design Review meetings
- Visit Existing Building Site

Construction (Phase 1 - Expansion)

- Pre-construction Cx kickoff meeting
- Commissioning "milestone" meetings
- Project meetings
- Develop and maintain the Commissioning Plan
- Reviews:

    - Submittals, shop drawings, O&M manuals, Start-up Plan, HVAC Controls, Training Program, TAB report, Record Drawings
- Develop Pre Functional Checklist and Functional Performance Test forms
- Execute PFCs in phases: Construction site visits and meetings to verify on-going achievement of OPR by contractor
- Execute FPTs: Testing of HVACR & building systems to document Owner's Project Requirement achievement

Occupancy and Operations (Phase 1 - Expansion)

- Seasonal testing of HVACR systems to document Owner's Project Requirement achievement
- 10-month warranty review
- Lessons-learned meeting

Construction (Phase 2 - Renovation)

- Pre-construction Cx kickoff meeting
- Commissioning "milestone" meetings
- Project meetings
- Develop and maintain the Commissioning Plan
- Reviews:
    - Submittals, shop drawings, O&M manuals, Start-up Plan, HVAC Controls, Training Program, TAB report, Record Drawings
- Develop PFC and FPT forms
- Execute PFCs in phases: Construction site visits and meetings to verify on-going achievement of OPR by contractor
- Execute FPTs: Testing of HVACR & building systems to document Owner's Project Requirement achievement

Occupancy and Operations (Phase 2 - Renovation)

- Seasonal testing of HVACR systems to document Owner's Project Requirement achievement
- 10-month warranty review
- Lessons-learned meeting

Key Owner's Requirements

Several key OPR have been identified on which the Cx Process will focus that are absolutely critical to the success of this project. These Key OPR descriptions are general in nature and encompass performance criteria and detailed OPR contained throughout this document.

- **Provide Space for 10 Years of Projected Needs**
- **Provide Durable and Flexible Building Systems to last 50 years or more**
- **Establish VNPCC as a "Place of Pride"**
- **Demonstrate Respect for Land & People**
- **Control Life Cycle Impact**

General Project Description

The expansion project has been undertaken to meet the needs of the Community and to provide the foundation for the next 10 years of space programming and 50 or more years of growth and change. This project is not only an expansion of the existing facility, but is intended to demonstrate sustainability, maximize employee productivity, and be flexible to meet varying needs throughout the life of the facility.

Size & Scope

The addition is a two-story structure with an enclosed penthouse for mechanical systems. The following departments will be in the new addition: Primary Care, Adult and Pediatric Physical Therapy, Applied Behavioral Analysis Therapy, Behavioral Health, Optometry, Audiology, Complementary Medicine, Traditional Healing, Administration and public space that includes a large multipurpose community space. The renovation scope includes work in the following areas: Pharmacy, Imaging, Café, Health Education, and Laboratory. The building should be 2-3 stories maximum with a grand entry stair, a preference on a smaller footprint, and a tighter envelope to preserve land for the future. With the multiple story design, a service/freight elevator is needed. Additionally, one of the passenger elevators should be large enough to accommodate as a service elevator. A main focus of VNPCC is healing through nature, so green spaces should be prioritized including courtyards, and the maintaining and expanding on walking paths. This access to nature is carried through the utilization of sunlight, daylight harvesting, and building glazing. The use of windows should be maximized while taking into consideration building efficiency, direction of views, and solar shading to reduce solar gain and glare. Additionally, VNPCC is committed to being a center of pride for customer-owners and has the need to maintain and provide improved experiences within the Community Spaces.

Careful consideration should be given to parking with an emphasis on having parking close to the building entrances. The design needs to consider multiple entry points and accessibility for the elderly, those covered under ADA, and those seeking rehabilitation through the VNPCC programs. Due to the location of the facility, snow and wind are major driving forces behind the design. Consideration should be taken on wind driven snow from higher adjacent roofs to lower levels in terms of building up and structural integrity with recent years of record snow falls; as well as the effects of wind on maintaining a safe entry into the facility due to wind blowing away salt and sand.

The Community is proud of the existing facility and its representation of the local culture. The building feels welcoming to the local tribes as well as the broader community of Alaska Native People and American Indians living in Alaska. The new facility and remodel should maintain the same connection to local culture.

Space programming includes as much as 130,000 SF of gross area for the expansion. Projected remodel of the existing VNPCC anticipates 20,000 to 30,000 SF of affected space.

Flexibility in the Project Program

The facility should focus on flexibility within the project programs. Where possible Conference room spaces should be adequate for meetings, Special Project Areas, and dual use for miscellaneous space for employees. [V]

Future Expansion Requirements

Needs were forecasted in the Visioning and Pre-Design programming sessions by looking at historical growth based on demographic projected utilization rates, and building for the right size which includes identifying underutilized devices and missing services for the customer-owners in the region.

Future needs use the same rates of use and the same hours of operation as the existing clinics at the VNPCC for key space drivers as a basis for the calculations, and then modify the calculations based on input concerning changes in practice or care forecast for the future – specific program needs can be found in Program and Services Needs and Capacity for Future Growth. There is a large emphasis on childcare being provided in the future with an adjacent playground area. [V]

Preferred Master Plan Layout Option A is shown below in Figure 2 and Figure 3 as presented in the Programming Document from June 2023. Placement of Phase II Expansion building, parking, and access elements in this project must allow for future Phases as envisioned.

This plan has been modified in the Schematic Design project drawings. The 35% Schematic Design site plan is below Figure 1, prior to the Master Plan Layout Option A.

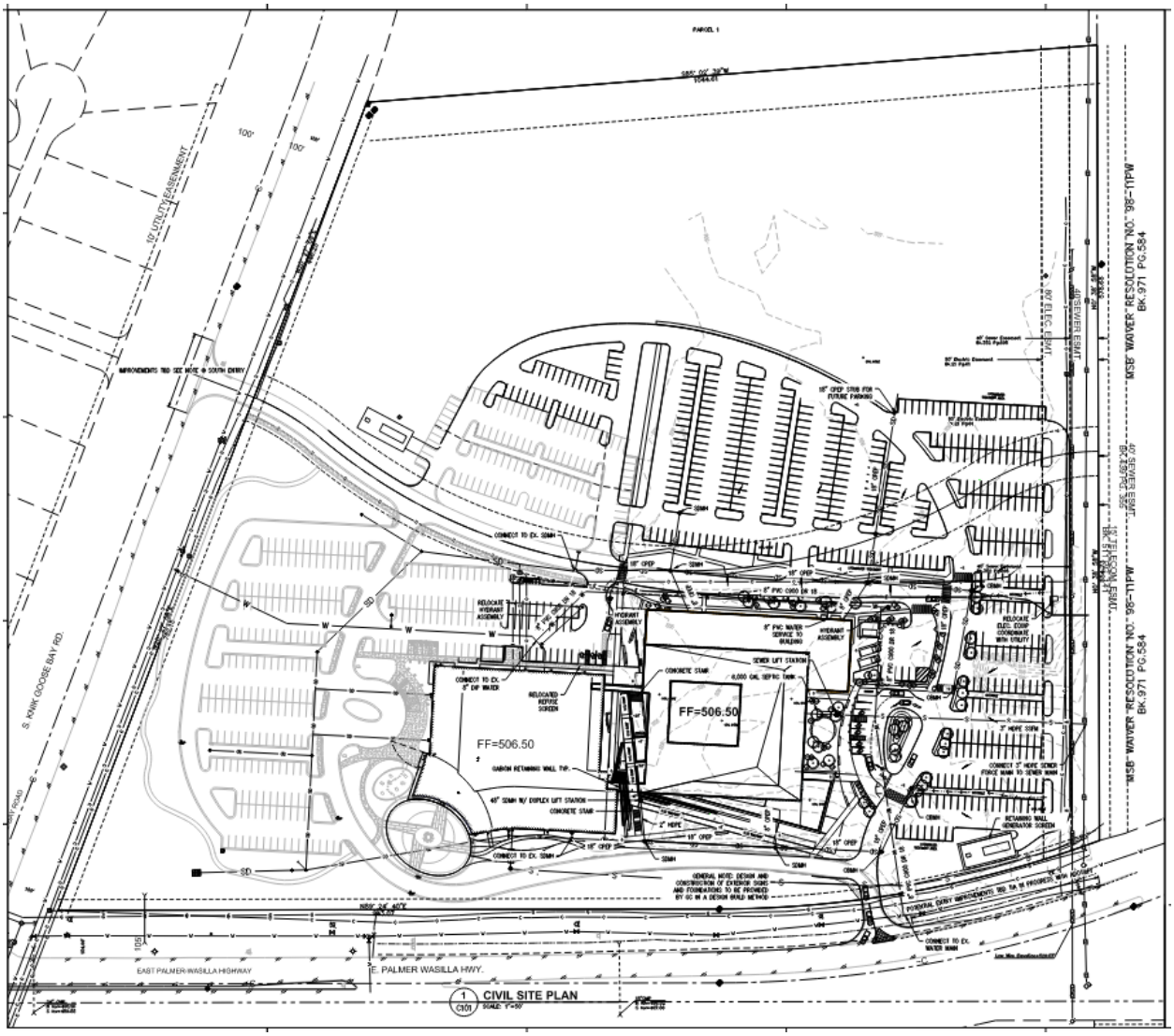


Figure 1 - 35% Schematic Design Civil Site Plan

Figure 2 - Master Plan for Phase 2 Expansion from the Conceptual Design Phase

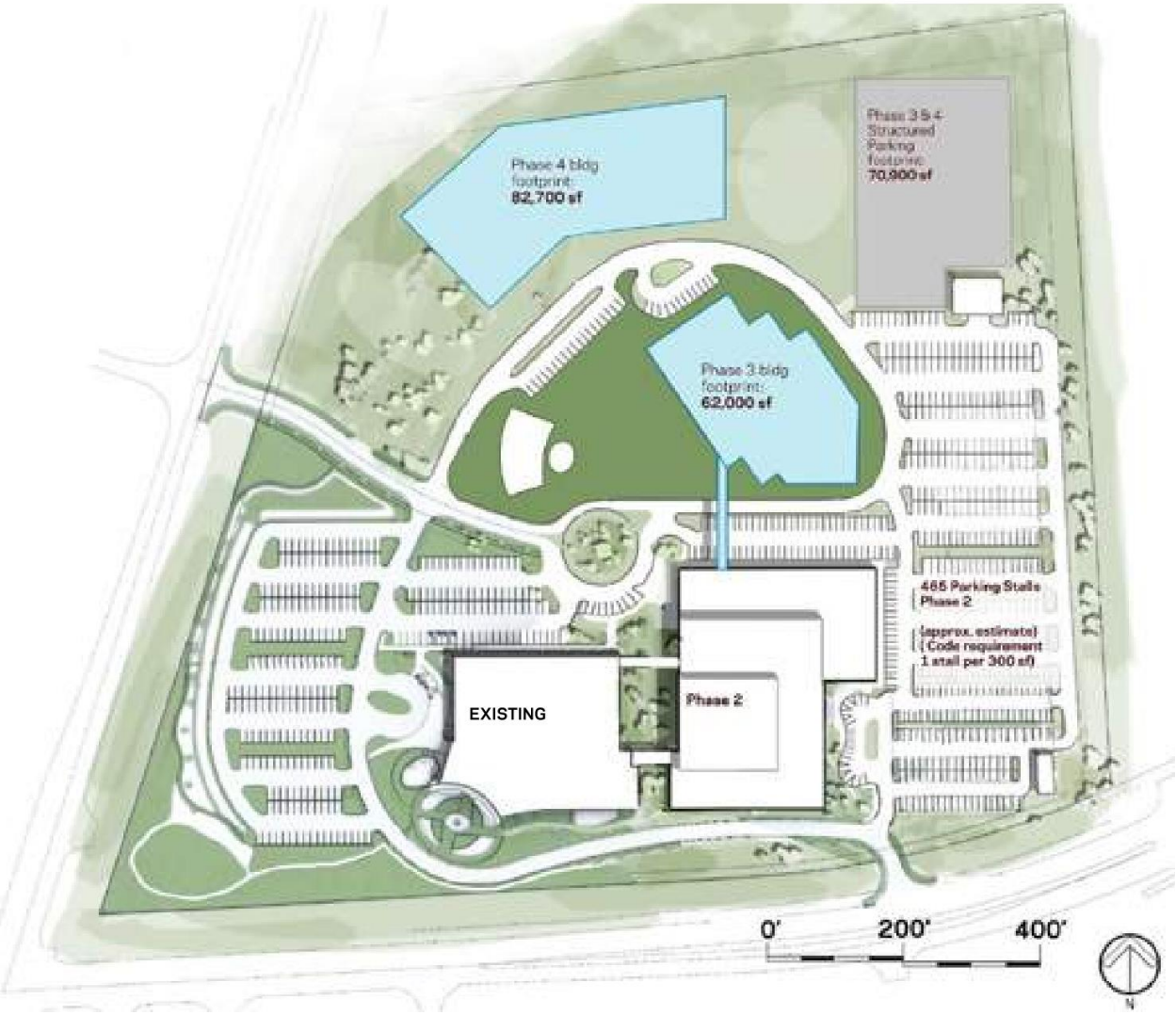


Figure 3 - Master Plan for Future Expansions from the Conceptual Design Phase

Restrictions & Limitations

Exterior Noise Generation

No specific code requirements have been identified. SCF desires to avoid creating nuisance noise on the property.

Visual Screening

Local Wasilla Municipal Code 16.24.030 A.6 (WMC) All ground level equipment must be screened with landscaping or landscaping and decorative fencing.

Water Pressure Availability

The design has continued forward with both a domestic water booster pump and a fire suppression booster pump as well to meet the water pressure requirements of the facility.

Height Restrictions & Setback

Local Wasilla Municipal Code 16.24.030 A.6 (WMC) requirements limit building heights in zoning district C to 35 feet above the average finished grade of the lot. Exceptions must obtain approved conditional use from the commission AND obtain approval of conformance to UBC and UFC from the borough fire code official.

Refer to WMC for other setbacks and restrictions.

Wetlands

The property contains potential wet areas. There are no known wetland designations.

Applicable Codes and Standards

- State & Local Codes
  - Wasilla Municipal Code
  - Alaska Administrative Code
- FGI
  - 2022 Guidelines for Design and Construction of Outpatient Facilities
- ASHRAE Guidelines & Standards
  - Standard 55 - Thermal Environmental Conditions for Human Occupancy
  - Standard 62.1 - Ventilation for Acceptable Indoor Air Quality
  - Standard 90.1 - Energy Standard for Buildings Except Low-Rise Residential Buildings
  - Standard 170 - Ventilation of Health Care Facilities
  - Standard 189.1 - Standard for the Design of High-Performance Green Buildings
  - Standard 189.3 - Design, Construction, and Operation of Sustainable High-Performance Health Care Facilities
  - Standard 202 - Commissioning Process for Buildings and Systems
- ASHE
  - Health Facility Commissioning Guide
- IHS (formal compliance documentation is not anticipated)
  - 2022 Architect Engineer Design Guide (for Commissioning Scope guidance)

Project Goals

The goals defining successful accomplishment of this project are detailed in this section.

Economics: First Cost, Change Orders, Life Cycle Cost

1. Design on budget [C]
2. "Right-size" facility [C]
3. Minimize Change Orders and delays [F]
4. Minimize Life Cycle Cost [F]

Schedule

5. Occupy expansion by March 2027 [A/E]
6. Occupy renovation by May 2028 [A/E]

Environmental: Energy Efficiency and Sustainability

7. Target Energy Use at minimum 75 score in EPA Portfolio Manager and/or below 25th percentile of CBECS energy use data as presented in ASHRAE 100-2024 based on appropriate building category [F]
8. Target Greenhouse Gas Intensity to align with Energy Target [F]
9. Provide dynamic feedback and education to users about energy use [C]
10. Establish goals and templates for sustainability and resilience for VNPCC Phase II and future projects [F]
11. Incorporate sustainability elements [C]
12. Reduce waste during construction, generated at site, and through life of building [C]

Occupant Satisfaction

13. Make this a "Place of Pride" for the Alaska Native Community [C]
14. Demonstrate Respect for Community Members [C]
15. Provide a Comfortable and Healthy Working Environment [C]
16. Provide for occupants' Acoustic Privacy [CxA]
17. Prevent spread of disease within facility [C]

Operation & Maintenance

18. Target O&M costs no higher than existing $/SF/Yr [F]
19. Mitigate snow accumulation and removal [C]
20. Coordinate building systems useful life with the building life [F]
21. Provide Building Systems that require minimal maintenance and are easy to maintain / operate through the life of the building [C]
22. Reduce impact of power outages [C]

Program and Services Needs and Capacity for Future Growth

Program goals listed below were initially developed during Visioning and Pre-Programming. Needs have since been vetted through multiple rounds of meetings and discussions between the Design Team, Program Directors, and SCF Planning. Refer to the Appendix A – Program Request Summaries and to the Functional Uses, Floor Area, & Occupancy Requirements section of this document for detailed programming space and size lists. [V] [C] [F]

Admin:

23. Provide space needs listed below: [V]

- Locate on the top floor.
- Provide standard integrated care team stations and a Conference room.
- Provide locker spaces for storage of personal items and a break room.
- Provide four lactation rooms distributed throughout the facility.

24. Shared spaces:
    - Large conference room can double as an employee lunch space
    - Break room can be a multipurpose room, also used for Admin employees to gather.
    - Request gymlets or a central exercise room, can share with programs [V]

Audio / Eye:

25. Rearrange and improve to better suit workflow. [V]
    - Provide Optometry waiting space and retail
    - Include a Staffing room and 2 screening rooms, and 6 exam rooms
    - Provide an additional larger Procedure room
    - Provide a Double wall Audio booth
    - Can share Housekeeping Closet, consolidated office for 12 people, and Break Rooms.
    - Add sink to Tech room.
    - Provide hard surface floors in both Optometry and Audiology.

Behavioral Health:

26. Provide space for 23 providers: [V]
    - 24 therapy rooms, 5 talking rooms, 2 group rooms, storage space, Soiled Room, 2 alcoves, clean rooms, and dirty rooms
    - Room sizes:

Type of Room	**Target Area, square feet**
Family work Therapy Offices	120-130
Therapy Offices	120-160
Family and Youth Work Therapy Offices	140-150
Talking Rooms	110-120
Group Rooms	420-440
Group Room/Play Therapy	360-420
Larger Pod Spaces	450-500
Storage Space	300
Larger Conference Room	550

    - Provide additional restrooms [V]

27. Shared space: [V]
    - conference room can be combined with the break room.
    - storage space can be in the open office.
    - rooms that can be used for de-escalation and general treatment

Complementary Medicine & Traditional Healing:

28. Provide space needs: [V]
    - 3 acupuncture rooms, 4 massage therapy rooms, 4 chiropractic care rooms, 1 chiropractic pediatric care room, Talking Rooms, Toilet Rooms, Locker Room, Office Spaces to accommodate 12 workstations, Alcoves, ICT spaces, Soiled Linen Room, and Clean Linen Room.

- Complementary Medicine prefers common exercise spaces.
- Future services include Electrical stimulation.

29. Shared space: [V]
    - Open office and scheduling space can be combined with back office,
    - Break rooms and locker rooms can be shared with adjacent departments.
    - Gym areas can be combined with PT/OT.

Dental:

30. Provide for the future Dental program to serve approximately 2,000 customer-owners over the year. [V]
    - 27 Operatories, Storage, additional Closed Rooms, and a Consult Room
    - Individual rooms not open bays
    - Provide dental chairs up to twice the current 21 chairs capacity (21-45 chairs).
    - Anticipate panel size of 900 to 1,000 with approximately 18 panels by 2025. [V]

Facility Services (Property, Supply, Employees):

31. Provide larger soiled linen room (3-4 times current size) or satellite rooms in each building. [V]
32. Provide 656 square feet for Information management, Lost & Found Storage, Housekeeping storage, and Property room for uniform storage and equipment. [V]
33. Provide 850 square feet of space to accommodate Lockers, an employee lounge, and toilets. [V]
34. Property & Supply space needs: [V]
    - 1 office/storage for crew and supplies bigger than the existing one,
    - 4 janitor closets each bigger than existing ones,
    - Significant expansion of soiled linen space.
    - larger med gas room
    - adequate room in Recycle to break down boxes,
    - receiving area large enough for up to 8 pallets, a pallet jack, and room to move pallets around.
    - employee areas, open counter spaces preferred rather than a dedicated desk space.
35. Shared space: [V]
    - Can combine Biohazard Room within the Soiled Linen room.
    - Mail Room/Handling can be included in the program areas.
    - Pharmacy storage could be located within the department.
    - Shop maintenance is used as a conference room – but shop maintenance can be moved to the out-bldg.

Health Education / Traditional Healing:

36. Program Needs [V]
    - Add 4treatment rooms, a talking room, minimum of 5 office spaces, a dedicated Kitchen, a Waiting Area, reception area for 2 employees, and a cultural center for 8-10 dedicated to the program.
    - Provide a Lactation Room or Tobacco Cessation Room, Storage room, and Office Space.
    - Provide Demonstration & traditional healing teaching kitchens [F]
    - Dedicate the Susitna space for this program
    - Design for easy navigation for elders

- Provide acoustic dampening.
- Offsite storage for seasonal items. [V]

37. Shared space: [V]
    - Shared registration between Trad healing and comp med.
    - Utilize Admin spaces for employee meetings.
    - Possible for storage to be included in Susitna/Kitchen.

IT-Comms/ Security/ HSKP:

38. Existing building needs: [V]
    - Utilize the South Comm Room.
    - Provide a designated hardware storage area in existing building

39. New building needs: [V]
    - Provide at least two new Comm, 1 comm room per floor
    - Provide adequate (better) air conditioning
    - Provide
        i) dedicated staging room for equipment,
        ii) storage space with workstations for e-waste/decommissioned equipment,
        iii) adequate workspace to help support off campus IT work,
        iv) secondary egress out of the building for telecom utilities,
        v) additional EVAC chair storage space,
        vi) centrally monitored security screen for camera stations viewing,
        vii) "Front of house" security workstation with information desk.
    - Locate dedicated staging and storage spaces close to delivery space/Loading dock.

Lab:

40. Improve / address lack of storage and safety issues
41. Space Needs: [V]
    - Dedicated training room for 2 providers,
    - blood draw room for atypical scenarios,
    - storage room, minimum 10'x12'
    - break room,
    - restrooms,
    - lockers for employees.
    - core lab (approximate 1,025 SF),
    - PCR needs to be a separate room but within the Lab and needs to include Microbiology.
    - Drop off windows cannot be in corridor due to HIP, these spaces need additional privacy.
42. If the Lab is not close to Urgent Care, then provide additional services support: [V]
    - Urine analysis, dip stick, rapid strep test for the 24 hr. Urgent Care if Lab is closed.
    - Urgent Care needs room for POC testing while more significant analysis is done in the lab.
43. Shared Space:
    - office 2 people doubling as a training room.
    - Blood Draw can be a part of Urgent Care.
    - The Break Rooms can be shared between the departments but with a secure door, vestibule, and badge access. The Lab also needs direct access to the break room from within the department.

Pharmacy:

44. Provide 4-6 additional car slots for prescription pick-up [V]
45. Space needs: [V]
    - 50% larger than the existing one
    - 5 tech bay stations
    - 2 private Consultation Rooms (non-carpeted),
    - 8 dispensing windows,
    - Waiting area separate from the Check-in area,
    - Check-in area,
    - break room with a kitchenette inside the Pharmacy dept, 250% larger than the existing space,
    - locker room, 15-18 employees
    - employee toilet,
    - more high-density storage
46. Provide designated space(s) for compounding: [V]
    - non-sterile – the existing VNPCC size is sufficient
    - Only a positive compounding room and ante room needed, no Negative compounding Rooms are needed.
47. Shared space:
    - Shipping-receiving area can be shared as a direct connection from dock
    - Consult rooms are multi-purpose for flu/immunizations and medication teaching.
    - Housekeeping Closet can be shared with another dept. [V]
48. Wish List: [V]
    - Covered curb-side pickup area
    - Larger mailout area red with another Mediset unit
    - Additional providers to operate

Primary Care:

49. Current space needs: [V]
    - Provide larger rooms for family group sessions
    - Talking rooms:
        i) Improve acoustic isolation for better privacy,
        ii) Provide a kid-friendly room.
        iii) Improve layout to place caregiver near door and allow better furniture arrangement.
    - Provide a dedicated room for TOVA testing,
    - Provide larger Phone room and remove wall between phone room and Clerical space.
    - Provide: [V]
        i) more storage,
        ii) additional employees,
        iv) support clinic rooms with adjacent toilets,
        v) conference room and support clinic for diabetes-related services.
50. Projected Space Needs:
    - For 2033, the Primary Care program is projected to need 1-1.5 PC Clinics.
    - Projections for 2036 include 45,950 of space, including
        i) 13-21 Exam Rooms,
        ii) 2-3 Procedure Rooms,
        iii) 2.5 Vital Alcoves per clinic that are tucked away,

iv) large room(s) for family group sessions,
v) 1-2 Primary Care Clinics. [V]

51. Shared space: [V]
    - Pair or stack clinics if required, may lead to duplication of shared spaces
    - Group clinics together to share spaces for supplies and medications.
    - Maintain a shared Reception/Waiting Room for Wellness, Comp Med, and Radiology
    - Larger rooms for family group sessions can be shared with other departments
52. Expanded ancillary services include [V]
    - Lab testing services for blood, stat, micro, hematology, basic chemistry, and phlebotomy.
    - ultrasound capabilities requiring an on-site radiologist,
    - echo services,
    - cardiology stress tests,
    - CT scanning
53. Provide Lactation rooms large enough for 2 employees.
54. Provide Locker space for program employees and Admin employees.

Public Space:

55. Size men's restroom based on existing size.
56. Reduce size of printer alcove that is part of the Waiting Room
57. Increase size/capacity of current café to provide food & nourishment [V]
    - For Employees and Visitors: Enlarge current café serving prepackaged items – no plan for commercial kitchen [F]
    - No plans for food trucks or farmer's market [F]
58. Provide Community gathering space big enough for full staff meetings [C]

Radiology / Imaging:

59. Space Needs: [V]
    - Facility services are projected to require 9,200 square feet of space to accommodate Bari Toil, Cont, Dress, Proc/Ultra, Proc Mammo, Proc Rad, Room, Tech Work/QC Office, toilet, ultrasound, and support spaces
    - For 2033, the Radiology program is projected to need 2 modalities but no CT. Projections for 2036 needs include a total of 9,200 square feet of Imaging space, including 1 R/F, 1 MRI, 1 CT, and 3 Modalities.
    - Ultrasounds:
      i) Provide larger dedicated rooms for Ultrasounds.
      ii) Provide linen closet in each room for customer-owners
      iii) Provide adequate storage space and adjoining toilets.
    - Provide a Biopsy procedure room.
    - Provide a dedicated check-in counter and waiting area
    - Provide a single location for techs to go to escort customer-owners back for appointments.
    - Provide Employees locker space, a break room, and a meeting/conference room for training. Locker space can be located within the break room and employee toilets.
60. Shared / multipurpose space: [V]
    - For offices and staffing, technicians can be cross trained in X-ray, CT, and Mammo for 2 of the modalities.
    - Provide Ultrasound as a large room that is multipurpose – Ultrasound procedure room and Echo – with an adjoining toilet.

- The break room could be shared with UC or Lab.
- Control area for CT and MRI may be shared if possible due to code and/or tech certifications.

61. Expanded Services: [V]
    - Plan for the addition of a radiologist on-site and a reading room
    - Provide more customer-owner toilets in Radiology depts.
    - Provide tech work office for approximately 12 techs.

Wellness Center (Exercise/PT/OT):

62. Space needs:
    - Leading up to 2033, the Wellness Center program is projected to need: 2-3 comprehensive medical facilities and 2-4 physical therapy/occupational therapy units.
    - Projections for 2036 needs include 7.5k to 10k square feet of space, including 2-3 comprehensive medical facilities and 2-4 physical therapy/occupational therapy units. [V]

Adult PT/OT:

63. Provide larger ADL kitchen doubled in size, include an ADL toilet room,
64. Increase the gym by at least 50%
65. Space needs to accommodate 24 – 25 providers: [V]
    - Talking rooms (110 SF each),
    - 5 PT exam rooms for 12 PT providers and 5 PT Assistants,
    - 2 exam rooms for OT,
    - Adult SLP space,
    - large exercise space,
    - Locker rooms with showers to accommodate customer-owners, caregivers, and staff..
    - Space for 2 check-in employees and 2 back-end employees
    - reduced waiting room size.
    - Maintain access for customer-owners with mobility issues
66. Shared space: [V]
    - therapist room sharing is possible.
    - exercise center and PT exercise area could be combined
    - Kitchen and Bathroom ADL can be shared with Peds/CFDS and Peds PT/OT,

Aqua Therapy:

67. Plan for expansion of any potential water PT Pool for therapy. [V]

Pediatric PT/OT/ABA:

68. Consolidate onto one floor.
69. Provide larger Waiting room for this program [V]
70. Space needs: [V]
    - 4 exam rooms at 150 SF each;
    - 5 Therapy rooms;
    - a Large gym dedicated for ortho/rehab;
    - Storage space 2 x 100 SF and 1 x 350 SF
    - ADL Toilets; single toilet instead of stalls; higher quantity
    - 2 Talking Rooms with space for 1-2 adults, 2 kids, and 2 providers;
    - a Lactation room large enough to accommodate feeding therapy;
    - 2 registration/Check in desks;
    - Soiled Room at 150 SF.

- Pediatrics 13,000 customer-owner visits per year
- Speech Therapy 12,000 customer-owner visits per year.

71. Shared spaces: [V]
    - ADL kitchen and ADL bathroom with a tube can be shared with PT/OT.
    - Locker/shower can be shared with adult programs.
    - This facility can operate with storage solutions in CFDS or facilities buildings.
    - Centralized break room.
    - Multipurpose conference rooms can double as large family conference rooms
72. Expanded services: [V]
    - There are 3 primary options for the future of pediatric PT/OB/ABA. The chosen option should be sized to account for the 150% growth in customer-owners by 2033.
        i) Option 1 would centralize them in anchorage, effectively eliminating the spacing requirement for this expansion project.
        ii) Option 2 would be building space in VNPCC for employees out of Anchorage.
        iii) Option 3 would build out a separated CFDS program in the valley.
        iv) Options 2 and 3 would both have the same spatial requirements in VNPCC.

Site and Overall:

73. Provide additional car slots for prescription pick-up [V]
74. Sufficient space for temporary outdoor trailer drive-thru testing/vaccination [C]

75. Site: Placement of outbuildings to not limit expansion [C]
76. Building: Flexible accommodations for future Program occupancy change [C]
    - Lay out Structural and MEP systems to anticipate renovations [F]

Functional Uses, Floor Area, & Occupancy Requirements

Functional Program:

Room Data Sheets:

Tables 1 & 2 below list desired services and areas for each Program as presented in Concept Design documents. Program needs have been vetted through multiple rounds of meetings and discussions between the Design Team, Program Directors, and SCF Planning. [V] [C] [F]

Table 1 – Department Program Summary - 35% Schematic Design

Program	Room/Services	Program (Cont)	Room/Services (Cont)
Admin	• Check-In • Conference Rooms • Interview Room • Large Conference • Leadership Office • Open Offices • Phone Rm • Printer • Staff Toilets • Waiting Room	Adult PT/OT	• Activity Room • ADL Bathroom • Adult SLP • Training Kitchen • Bathroom/Toilets • Bottle Filler • Break Room • CM/ Check Out • Clean Supply • Exam Rooms PT • Exam Rooms OT • Exercise Center • Family Toilet • ICT • Prep Kitchen

Program	Room/Services	Program (Cont)	Room/Services (Cont)
			• Lockers/Toilet/Shower • Reception/Check In • Soiled Linen • Storage • Supply • Talk Room • Waiting Room • Walkers/Crutches
Aqua Therapy	• Aqua Therapy • Dressing/Showers/Toilets • Lockers • Storage W/D Workspaces	Audio & Eye Care	AU • Audio Booth • Audio Talking • Audio Tech Lab EY • Exam Rooms • ICT • Lens Training • Lens Trials • Procedure Rooms • Reception/Check in • Repair/ Work • Retail • Screening Rooms • Storage Rooms • Toilet Patient • Toilet Staff • Waiting Room
Behavioral Health	BH • Case Management • Clean Supply • Group Rooms • ICT • Registration/Check-In • Soiled Hold • Storage • Support Clinic • Talking Rooms • Talking/ FHR • Therapy Rooms Lg • Therapy Rooms Sm • Toilet Patient • Vitals Alcove • Waiting Room	Comp Med & Trad. Heal	• Acupuncture • Alcove • Bottle Warmer • Chiros • Chiros Peds • Clean Linen & Supply • ICT • Massage • Printer • Soiled Hold • Storage • Talking Room • Tea/Coffee Machine • Toilet Patient • Traditional Healing Rooms • Waiting • Wheelchair Alcove
Circulation	• Corridor • Multi-Purpose Entry Lobby • Pedestrian Walkway • Reception • Vestibule CI • Corridor	Dental - Existing	• Alcove • Chart • Dental Waiting • Employee Lockers • Employee Shower • Family Conference Room • Housekeeping

Program	Room/Services	Program (Cont)	Room/Services (Cont)
	• Circulation • Circulation – Property and Supply • Dry Riser • Hallway • Storage • Vestibule		• Kiosk • Open Exam • Pan • Staff Toilets • Patient Toilets • Phone Room • Supply Room
Dental - Phase 1	• Alcove • Circulation • Close Treatment • Decontamination • Decontamination Drop • Dental Lab • Employee lounge • Equipment/Peds Equip. • Housekeeping • Hydration • Lab Expansion • Medication Safety Zone • Open Exam • Open Office • Operation Rooms • Pan • Patient Toilet • Procedure Rooms • Reception + CMS • Staff Lactation • Staff Toilet • Staff Work • Sterile • Sterile Supply • Sub-Sterile • Talking room	Dental - Phase 2	• Alcove • Central Supply and Storage • Decontamination Drop • Hydration • Operation Rooms • Pan • Patient Toilet • Talking Room
Health Education - Renovation	• Class Room • Kitchen • Storage • Team Office	HSKP & Linen	<u>HK</u> • House Keeping
Imaging	<u>Existing</u> • Dress • Proc/Ultra • Proc Mammo • Toil US <u>Renovation</u> • Changing • Corridor • CT • CT Control • CT Prep • Dexa • House Keeping • MECH • MRI	Lab	<u>Renovation</u> • Core Lab • Corridor • House Keeping • Lab Drop Off • Office • PCR • Receiving • Staff Lounge • Staff Break • Storage • Toilet St

Program	Room/Services	Program (Cont)	Room/Services (Cont)
	• MRI Control • MRI Equip • MRI Zone 3 • PAT Toilet • Proc Rad • Rad Fluoro • Reading • Soiled Hold • Staff Lounge • Staff Toilet • Storage • Tech Work • Tech Work/QC Office • Toilet Patient • Ultrasound • Waiting		
MEP	<u>Electrical</u> • Comms • Elec. • Elevator • Fire Pump/Sprinkler & Boiler • IT • IT Rack • IT Storage • Main Comm • Main Elec • MEP TBD • Shaft • Stair 2 • Stair 3	Multipurpose Space	• Community Room 2 • Multi-Purpose Community Room • Storage
Pediatric PT/OT/ABA	• Case MNGMT • Exam • Feeding Therapy • Large Activity • Observe • Recep/Check in • Storage • Talking • Therapy Lg • Therapy Sm • Toddler Therapy • Toilets PAT • Vitals ALC. • Waiting • XL Gym	Pharmacy	<u>Renovation</u> • Admin/Check-in • Ante • Circulation • Conference • Dispensing/Consult • Dispensing • Haz Storage • House Keeping • Med Gas • Non-Sterile Compounding • Pharm Control • Pharm Wait • Pharmacy • Receiving • Ref • Staff Toilet • Staff Lounge • Sterile Non-HD Compounding • Supervisors

Program	Room/Services	Program (Cont)	Room/Services (Cont)
			• Vestibule
Primary Care	• AED • Baby ALC. • Clean Supply • Clerical • Conference/Proce Room • EM ALC. • Exam Rooms • Family Isolation • Group Rooms • ICT • Med • Ortho Supply/ Linen • PPED • Print • Procedure Rooms • Reception/Check-In • Scale ALC. • Soiled Utility • Storage/ Talking • Support CLI. • Talking Room • Talking /FHR • Toilets Bariatric • Toilet Pat • Staff Toilet/Shower • Waiting Rm <u>Renovation</u> • Conference • Exam Room • Staff Loung • Toilet Patient	Property & Supply	<u>PS</u> • Admin Supply • Bulk Storage • CFDS Storage • Clean Linen • Health ED Storage • Mail Room • Maint/Purch/MTRL Handl • Med Gas • Recycling • Soiled Linen • Staff Toilet
Public / Public Facility	<u>Renovation</u> • Café • Café Storage • Lost/Found • Public Toilets – M • Tribal Office <u>PF</u> • Lactation • Toilet Area • Toilet Public	Shared / Shared Wellness	• Clean Supply • ICT (Shared PEDS and Adult) • Print • Soiled Utility • Staff Lounge • Toilet Staff

Table 2 - Building Program Summary - 35% Schematic Design

Program	Area (SF)			No. of Employees	No. of customer-owners/day
	Existing	PH1 Construction	PH 2 Remodel		
Admin	3,477	5,947	-	12	N/A
Adult PT/OT	5,734	10,045	-	24-25	-
Aqua Therapy	0	975	-	-	-
Audio / Eye	5,166	4,889	-	16	148 (3)
Behavioral Health	5,823	8,373	-	Budget for 23 (1) Currently have 17	23 (1) (2)
Comp Med & Trad. Heal	1,507	4,940	-	7	-
Circulation & Circulation CI	-	34,871			
Dental	11,523	8,867	4,937		0
Health Education	0	0	1,000	10	-
HSKP & Linen	792	307	-	5	N/A
Imaging	691	0	5,995	15	-
Lab	874	0	2,281	-	-
MEP - Electrical	-	4,610		-	-
Multipurpose Space	0	1,872	-	8-10	-
Pediatric PT/OT/ABA	0	5,859	-	Speech Therapy - 10	Speech Therapy - 55
				Occupational Therapy -	Occ. Therapy -
Pharmacy	3,304	0	6,723	14	44
Primary Care	23,559	16,884	1,549	60	-
Property & Supply - PS	2,678	3,675	-	3	N/A
Public / Public Facilities - PF	1,768	1,773	935	N/A	500
Shared/ Shared Wellness	-	4,155	-	-	-

(1) Indicates a maximum projected need from the Pre-Design Program – Draft 05/26/2023

(2) Space type is indicated to be 1:1 for staffing/room/patients

(3) Number calculated through assumptions

Life Span, Cost, and Quality

Intent of this section is to clearly document the Owner's expectations for lifespan of materials, cost of construction, and the level of quality desired. By providing this information, unrealistic expectations are eliminated.

Equipment Reliability

SCF expects specified equipment to be high quality and reliability. Avoid cutting-edge technology in favor of time-proven systems, while still utilizing modern equipment. Provide simpler solutions when possible. Provide sufficient redundancy so that equipment is not a single point of failure. Provide equipment from proven manufacturers with support available in Alaska. [CxA]

Building Systems Automation and Flexibility

The Building Automation System shall be open protocol based on products offered by Convergint Inc. (formerly ATS) and shall be compatible with and incorporated with existing VNPCC BAS systems. [F]

Desired Technologies and Preferred Manufacturers

Official SCF Design Standards are currently in development. Specific known preferences are listed below. This list will be further developed after Schematic Design.

a) Boilers: Basis of design shall be _____ to match existing VNPCC and simplify maintenance [F]
b) Air handlers shall use Fan arrays by _____ as basis of design [F]
c) Ground-Source Heat Pumps shall not be utilized in the design [F]

Budget Considerations and Limitations

Expected budgetary restrictions and considerations are contained in this section.

[see Economics: First Cost, Change Orders, Life Cycle Cost and Economics]

Performance Criteria

The performance criteria on which the project will be evaluated by the CxA Team are included in this section. Each performance criterion is intended to be measurable and verifiable.

Commissioning Program

Benchmarks for performance

1. In Phase 1 - Expansion, Successfully demonstrate proper installation and functionality of these systems at minimum:

System & Equipment	Sampling Rate
Life Safety System	
Fire Alarm Control Panel and Annunciator Panel	100%
Fire Pump with Jockey Pump	100%
Flow Switch	100%
Fire Sprinklers	50%
Doors with Frames Fire Rating	50%
Exit Light Fixtures	50%
Emergency Lighting	50%
Smoke Detectors and Sensors	50%
Fire and Smoke Dampers	100%
Horn/Strobe Lights for Fire Alarm	25%
Manual Pull Stations	25%
Building Security and Communication System	

System & Equipment	Sampling Rate
Nurse Call System	100%
Infant Protection and Alarm System	100%
Security System	100%
Public Address System	100%
Building Automation System with Control Strategies	
Direct Digital Control (DDC) or Building Automation System (BAS)	100%
Energy Management Control System (EMCS)	100%
Electrical or Pneumatic Controls	100%
Air Handling Unit System	
Air Handling Unit including Supply and Return (or Relief) fans (including air pressure adjacency validation)	100%
Exhaust Air Fans	100%
Terminal Units (or VAV boxes)	25%
Diffusers/Grilles (Supply, Return and Exhaust)	25%
Ductwork (Supply, Return, Exhaust)	25%
Chilled and Hot water pumping system	25%
Major Mechanical Systems	
Chilled Water System including Chiller, Cooling Tower and Pumps	100%
Heating Hot Water System including Boiler, Fuel system and Pumps	100%
Process System (Steam for Sterilizers, Humidifier, etc.)	100%
Major Electrical Systems	
Main Switchgear and all electrical panel boards	100%
Emergency & Standby Generators with ATS	100%
Arc Flash Hazard warning signs on electrical panels	100%
Coordination and Short Circuit Study information	100%
Lighting Protection with Building Grounding System	100%
Transient Voltage Surge Suppression (TVSS) System	100%
Advanced Metering System	100%
Renewable Energy System	100%
Building Lighting Control system	50%
Regular and K-type Transformers	50%
Backflow Preventer	
Potable water, Fire Sprinkler system, Chiller, Cooling Tower, and Boiler water supply	100%
Medical Gas and Dental Vacuum System	
Oxygen System, Nitrous Oxide System, Medical Air System, Dental Air System, Dental Vacuum System, Laboratory Gas System, Air Compressor, Medical Gas System Equipment	100%
Standby Generator Fuel Gas System	100%
Medical Equipment Power Supply System	
CT-Scanner, X-Ray and MRI equipment, UPS requirements to protect equipment	100%
Telecommunication and Television Cable System users	By Users
Building Security System users	By Users
Medical Waste Disposal System users	By Users

2. For Phase II – Renovation:

- Scope of Cx activity will be determined during 35% and 65% Design and will depend on the extents of renovation. [CxA]
- Cx scope may also depend on need for re-commissioning of existing systems as determined by Energy Audit results

Problems to avoid

3. Allow sufficient time in construction schedule for automation controls setup and troubleshooting prior to functional testing. [CxA]

Specific occupant requirements

No additional criteria were identified by owner or occupants.

Economics

Benchmarks for performance

4. Total Budget Cap of $226M: program goals must be met.
   - Maintain 10% escalation & contingency in Cost Estimates
   - FF&E is included in Cap
   - History: Target budget was $100-150M (for 80-100k SF), now $200M for 120-140k SF
5. Change Orders and delays are minimized
   - Target Maximum of 5% Change Orders
   - Avoid late changes to the design: floor plans fixed after 65%
   - Allow sufficient time in the design phase for review and verification of achievement of the Owner's Project Requirements
6. Facility is the "Right-size"
   - Completed spaces are not under- or over- utilized on Day One (except where SCF has acknowledged that spaces will be underutilized/unutilized when the expansion first opens and may remain so for up to a few years)
   - Existing VNPCC footprint is fully utilized
   - Duplication is avoided by sharing spaces
7. Minimize Life Cycle Cost
   - Building systems useful life is coordinated with the building life; systems needing replacement within 50 years have a clear path for the work to occur
   - Systems are Commissioned to operate correctly
   - Design is Flexible to limit effort for future remodel & renovation
   - If applicable, Use incentives from Utilities for specific HVAC and Renewable systems

Problems to avoid

None identified

Specific occupant requirements

8. Plan for the future:
   - Anticipate how Telemedicine and virtual appointments could impact space needs and architecture.
   - Dental: future expansion space held for future – will be reassessed in 2027

Schedule

The key project milestones are:

Milestone & Estimated Date of Completion	2023	2024	2025	2026	2027	2028	2029
Design Ph I & II	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**
~~Sustainability Charette~~	~~06-28~~						
~~Concept & Program Completed~~	~~01-15~~						
~~OPR Initial Draft Completed~~		~~04-01~~					
~~Schematic design~~		~~05-28~~					
Design development		11-21					
Construction documents			05-15				
Award contract			06-27				
Construction Ph I - Expansion	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**
Pre-construction meeting			09-23				
All submittals approved			11-01				
Structural frame complete				02-01			
Facility sealed				07-01			
Major HVACR equipment installed					02-01		
Startup					03-01		
Testing					04-01		
Tuning					05-01		
Substantial completion					06-01		
C.O. & Warranty start date					07-01		
Lessons learned workshop					10-01		
10-month warranty review meeting						05-01	
Construction Ph II - Renovation	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**
Pre-construction meeting					07-01		
All submittals approved					09-01		
Structural frame complete						N/A	
Facility sealed						05-01	
Major HVACR equipment installed						06-15	
Startup						07-01	
Testing						07-15	
Tuning						08-01	
Substantial completion						09-01	
C.O. & Warranty start date						09-15	
Lessons learned workshop						10-01	
10-month warranty review meeting							07-01

Environment & Energy

Benchmarks for performance

9. Passive design is utilized to the extent feasible: building orientation is optimized; thermal envelope is prioritized; natural light is utilized; etc.
10. SCF is in the process of determining appropriate target energy use and energy audit is in process and when it is complete a target energy use will be determined. There is concern

about using the existing facility energy as an example due to its current high energy use rate.

11. Building is well-insulated with a balanced use of glazing (targeting 35% per Concept docs) Target exceedance of IECC (Energy Code) using ASHRAE 189.1 (and 189.3) including Table E-7:

Table E-7 Example Building Envelope Compliance Values for Climate Zone 7* (I-P)
(Supersedes Table 5.5-7 in ANSI/ASHRAE/IES Standard 90.1)

	Nonresidential	
Opaque Elements	**Assembly Maximum**	**Insulation Min. R-Value****
Roofs		
Insulation entirely above deck	U-0.027	R-40 c.i.
Metal building [a]	U-0.028	R-10 + R19 + R-13 c.i.
Attic and other roofs	U-0.016	R-71
Walls, above grade		
Mass	U-0.067	R-17.5 c.i.
Metal building	U-0.042	R-11 + R-19 c.i.
Steel framed	U-0.047	R-13 + R-15.6 c.i.
Wood framed and other	U-0.048	R-13 + R-12.5 c.i.
Wall, below grade		
Below-grade *wall*	C-0.060	R-17.5 c.i.
Floors		
Mass	U-0.040	R-23 c.i.
Steel joist	U-0.030	R-49
Wood framed and other	U-0.026	R-38+ R-7.5 c.i.
Slab-on-grade floors		
Unheated	F-0.485	R-20 for 48 in.
Heated	F-0.637	R-20 full slab
Opaque doors		
Swinging	U-0.352	
Nonswinging	U-0.295	

Fenestration	**Assembly Max. U**	**Assembly Max. SHGC**	**Assembly Min. VT/SHGC**
Vertical glazing, 0% to 40% of *wall*			
Fixed	U-0.28	E&W-0.38, S-0.40, N-0.50	1.10 (for all types)
Operable	U-0.34	E&W-0.34, S-0.36, N-0.46	
Entrance door	U-0.60	E&W-0.34, S-0.36, N-0.46	
Skylight, 0% to 3% of *roof*			
All types	U-0.42	NR	NR

12. Minimize infiltration through building envelope
    - Target compliance: ASHRAE 189.1 7.3.1.2 requires 0.20 CFM/SF of envelope (at 0.3 in. H2O = 75 Pa pressure diff) to improve on 90.1
      i) Test per 10.6: WHILE AIR BARRIER IS ACCESSIBLE per ASTM E779, ASTM E1827, ASTM E3158, CAN/CGSB-149.10, CAN/CGSB-149.15, or ISO 9972

- Minimum compliance: ASHRAE 90.1 5.4.3.1.4 requires 0.35 for > 10,000 SF buildings
  i) Test per ASTM E3158 using 3rd party tester per 4.2.5.1

13. Minimize air leakage at regulated rooms e.g. patient isolation, pharmacy, etc. (USP non-sterile 795) Pressure test for regulated spaces shows minimal leakage. Target 0.35 CFM/SF of room surface area when tested per ASTM E3158
14. Maximize night setback capability; avoid ventilating, heating, and cooling spaces when unoccupied. Sequences of Operation clearly describes rules for applying setbacks.
15. Carbon Footprint: Target Greenhouse Gas Intensity 13.1 lb CO_2e/SF/yr [F]

    ON HOLD PENDING RESOLUTION OF ENERGY USE TARGET

16. Lighting
    - Provide Interior lighting control compliant with ASHRAE 90.1
    - Utilize occupancy sensors and photocells to minimize heat gain and glare.
    - Maximize use of natural light.
    - Design to improve on energy code by complying with lighting levels in ASHRAE 189.1-2023 7.4.6 which references ASHRAE 90.1-9.5 and then details modifications. If the Building Area Method is used, refer to the following table. Otherwise, see the reference material for targets.

Table 7.4.6.1A Lighting Power Densities Using the Building Area Method

Building Area Type [a]	LPD, W/ft^2	LPD, W/m^2
Automotive facility	0.58	6.3
Convention center	0.51	5.5
Courthouse	0.64	6.9
Dining: Bar lounge/leisure	0.60	6.4
Dining: Cafeteria/fast food	0.59	6.4
Dining: Family	0.55	6.0
Dormitory	0.41	4.4
Exercise center	0.56	6.1
Fire station	0.47	5.0
Gymnasium	0.60	6.5
Health care clinic	0.63	6.8
Hospital	0.76	8.2
Hotel/Motel	0.40	4.3
Library	0.72	7.8
Manufacturing facility	0.60	6.5
Motion picture theater	0.38	4.1
Multifamily	0.41	4.4
Museum	0.48	5.2
Office	0.56	6.1
Parking garage	0.12	1.3
Penitentiary	0.56	6.1
Performing arts theater	0.64	6.9
Police station	0.54	5.8
Post office	0.55	5.9
Religious facility	0.62	6.7
Retail	0.75	8.1
School/university	0.55	5.9
Sports arena	0.61	6.6
Town hall	0.58	6.2
Transportation	0.45	4.9
Warehouse	0.41	4.4
Workshop	0.74	7.9

a. In cases where both a general building area type and a specific building area type are listed, the specific building area type shall apply

17. Provide feedback and education to users about energy use
    - Live Readouts in public area show:
        i) performance metrics for each space
        ii) renewable energy gains
        iii) carbon footprint
        iv) improvement over time
18. Incorporate sustainability elements
    - Use lessons and guidance from existing VNPCC facility
    - Water conserving fixtures are used throughout the campus.
    - Design has plan for conversion to other energy sources and/or includes on-site renewable energy such as wind or solar
    - Electric Vehicle charging stations are provided

- Consider use of storm water repurposed for irrigation. Strive for Net zero water runoff.
- Energy is harvested from human sources such as PT activity rooms, with feedback to show contribution.

19. Reduce waste during construction, generated at site, and through life of building
    - Design is for long-term, limiting need for future remodel & renovation
    - Contractor implements specified waste management requirements including after occupancy
    - Selected building materials consider source, reuse, waste, and have a plan for end-of-life
    - Selected materials include natural and local (e.g. wood)
    - The number of different materials used is minimized to the extent possible

Problems to avoid

20. Demonstrates design consideration for Occupant comfort to avoid personal Fans and Space Heaters
21. Condensing boilers should be designed to operate in condensing mode
22. Sunshade operability issues
23. Internal Sunshades should NOT rely on batteries

Specific occupant requirements.

24. Exterior Shades on glazing are provided where appropriate
25. Lighting occupancy sensors

Occupant Satisfaction

Benchmarks for performance

26. Respect occupants' Acoustic Privacy
    - Design meets 2022 FGI noise criteria 1.2-6.1 Acoustic Design
    - ASHRAE recommendations are followed & met for non-FGI Public vs Private spaces
    - HVAC system acoustics minimize sound transfer

Table 1.2-4: Maximum Design Criteria for Noise in Interior Spaces Caused by Building Systems[1]

Room Type	NC [2, 3]	dBA
Patient Care and Diagnostic Areas		
Multiple-occupant patient care area	45	50
Exam/treatment room	40	45
Procedure room	40	45
Class 2 imaging room	40	45
Operating room[4]	50	55
Class 3 imaging room[4]	50	55
Telemedicine room	30	35
Support Areas		

Room Type	NC [2, 3]	dBA
Medication safety zone	40	45
Testing/research lab, minimal speech	55	60
Research lab, extensive speech	50	55
Group teaching lab	45	50
Public Areas		
Corridors and public areas	45	50
Conference room	35	40
Teleconferencing room	25	30
Auditorium, large lecture room	30	35
Administrative Areas		
Private office	40	45

[1]Additional spaces shall be added based on the building program.
[2]See *Sound & Vibration 2.0*: *Design for Health Care Facilities* for a discussion of room noise rating criteria.
[3]Spaces shall be designed to fall below the maximum values shown in this table with no rattles or tonal characteristics.

Table 1.2-6: Design Criteria for Speech Privacy for Enclosed Rooms and Open-Plan Spaces[1, 2]

Level	Metrics			
Speech Privacy—Closed Plan	**PI**	**AI**	**SII**	**SPC**
Confidential	≥95	≤0.05	≤0.10	60–69
Normal	80–94	0.06–0.20	0.11–0.25	52–59
Defining standard	ASTM E1130	ASTM E1130	ANSI S3.5	ASTM E2638
Speech Privacy—Open Plan	**PI**	**AI**	**SII**	**SPC[3]**
Confidential	Special consideration required[4]			
Normal	80–94	0.06–0.20	0.11–0.25	—
Marginal	60–79	0.21–0.40	0.26–0.45	—
Defining standard	ASTM E1130	ASTM E1130	ANSI S3.5	—

[1]The indicated AI and SII values shall be considered the maximum accepted values. The indicated PI and SPC values shall be considered the minimum accepted values.

[2]Equivalence among these metrics, as indicated, is correlative. Some of the metrics may not be suitable for a particular space. The referenced standards indicate that PI and AI are appropriate for use in open-plan spaces and that SPC is appropriate for closed-plan spaces. The referenced standard for SII indicates it may be used for either type of space.

[3]SPC does not apply to open-plan spaces.

[4]Achieving confidential speech privacy in open-plan spaces may be difficult due to the lack of barriers, low ambient sound levels, increased occupant density, reduced occupant separation, and typical speech levels.

27. Vibration does not exceed FGI 1.2-6.1.7 Design Criteria for Building Vibration.
    For Footfall vibration limitations refer to Table 1.2-7.
    Table 1.2-7: Maximum Limits on Floor Vibration Caused by Footfalls in Outpatient Facilities

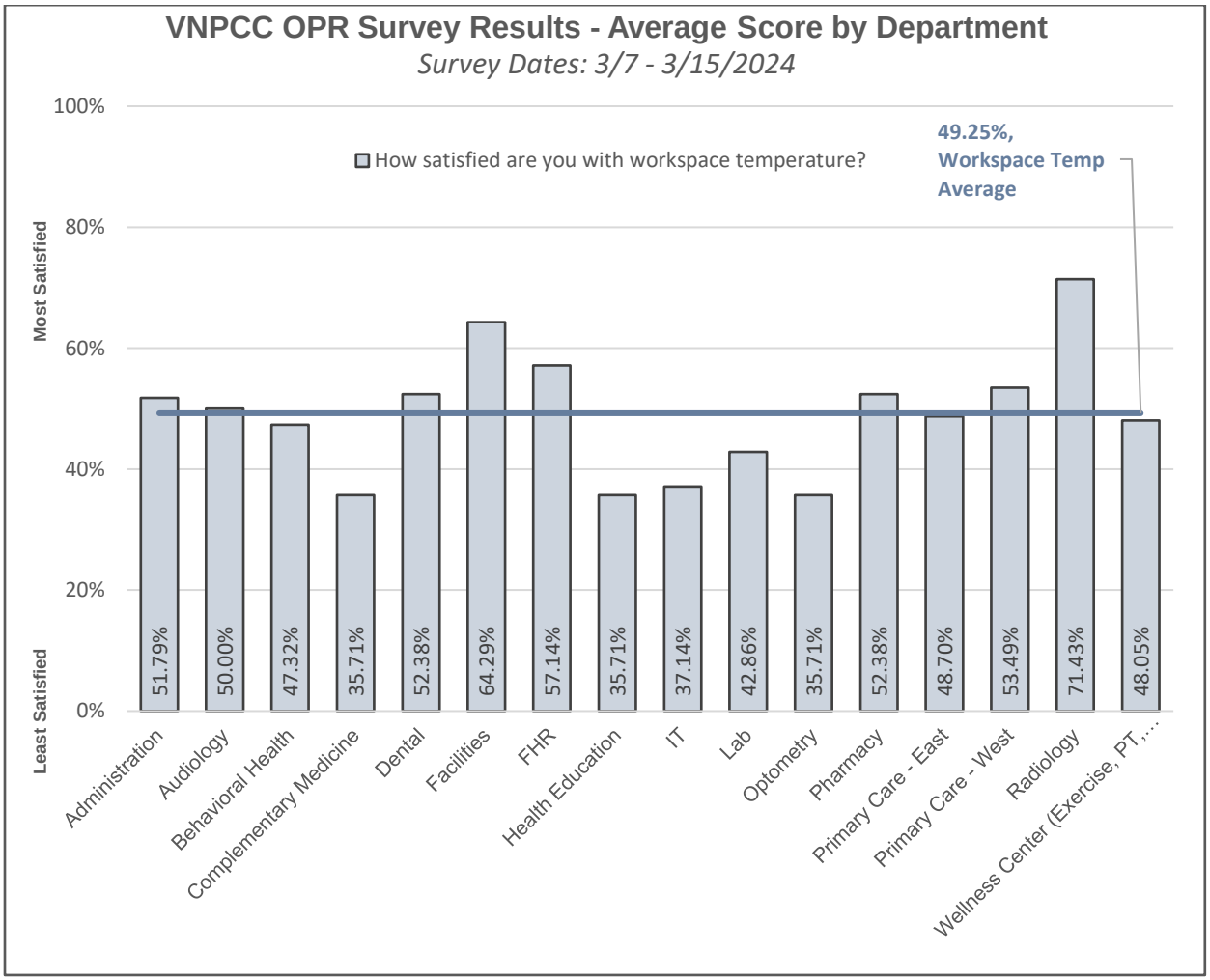
Space Type	Structural Framing Footfall Vibration Peak Velocity (micro-in/s)
Patient Care and Diagnostic Areas	
Exam room*	8000
Treatment room	8000
Class 1 imaging room	8000
Procedure room	4000
Class 2 imaging room	4000
Operating room	4000
Class 3 imaging room	4000
Public and Administrative Areas	
Administrative areas	8000
Public circulation areas	8000

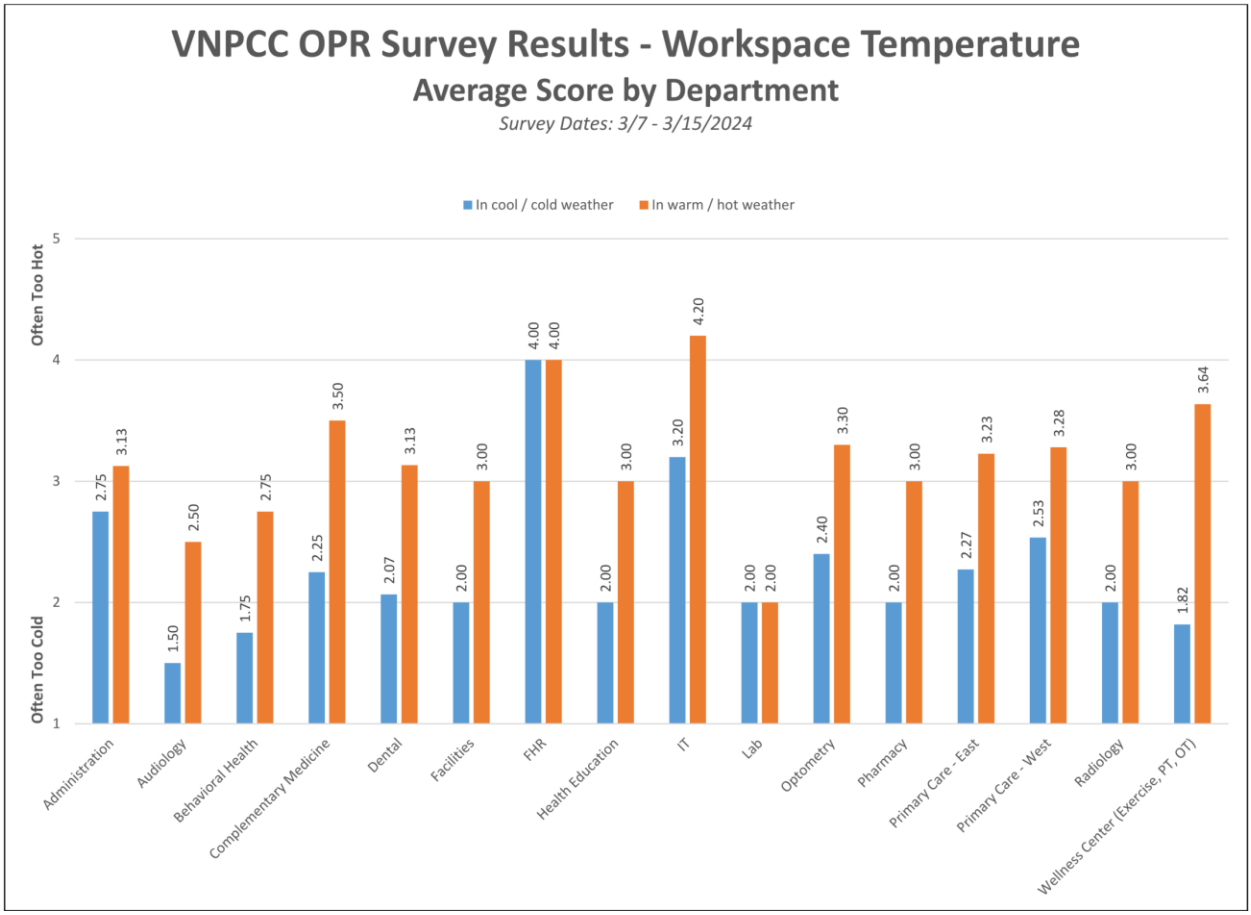
*Lower vibration limits could be required by the manufacturer of vibration-sensitive equipment for services performed in specialty exam rooms [see Section 2.1-3.2.2.2 (2)(c) (Single-patient exam room for specialty clinical services)]; such limits shall be considered during structural design.

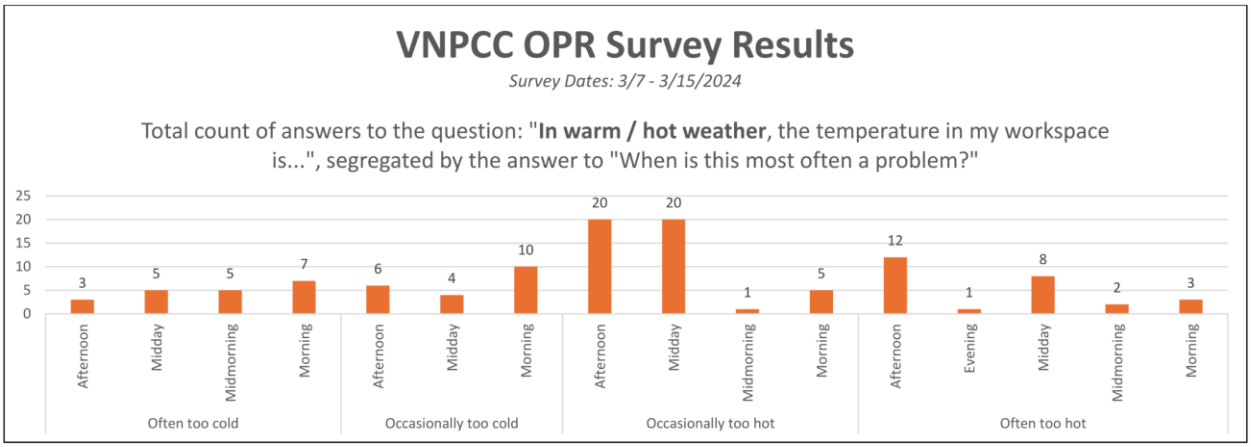
28. Make this a "Place of Pride" for the Alaska Native Community
    - Invites connection with environment and Community
    - Promotes sense of reliance for safety and healing
    - Design is sensitive to location
        i) Evokes Openness to nature
        ii) Supports animal populations
        iii) Maintains "Fire-wise" landscape
        iv) Resists and Mitigates effects of Wind
        v) Utilizes Local Wood/natural materials instead of plastic (where compatible with healthcare requirements)
29. Demonstrate Respect for Community Members
    - Transportation is Efficient across the campus
    - Fixtures used by children have appropriate mounting heights
    - Design shows Consideration for elders and veterans
        i) Most if not all spaces are ADA compliant
        ii) Restrooms are within Short distances
        iii) Paths of travel are as short as possible

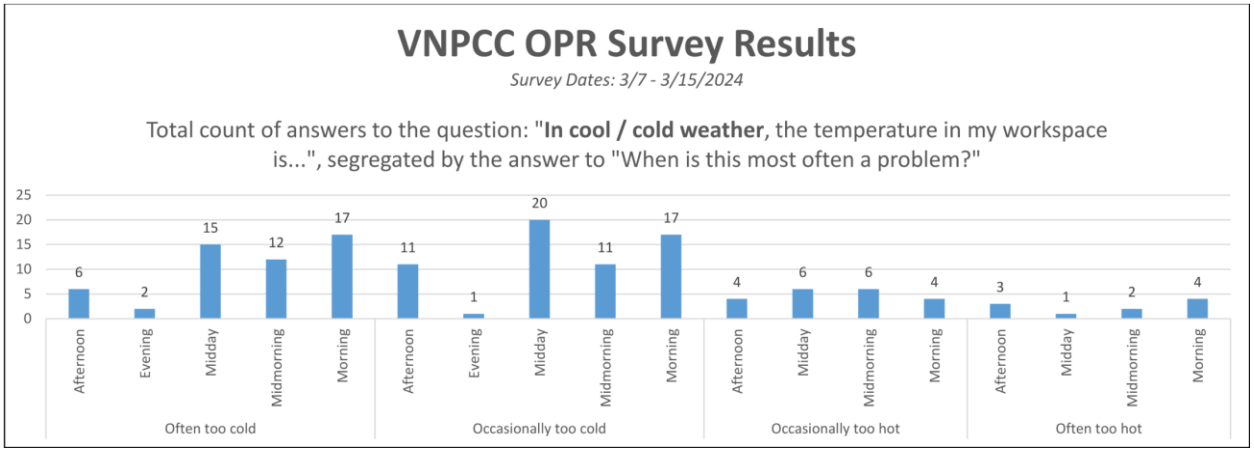
iv) Resting places are provided along travel paths
v) Intergenerational learning spaces are provided

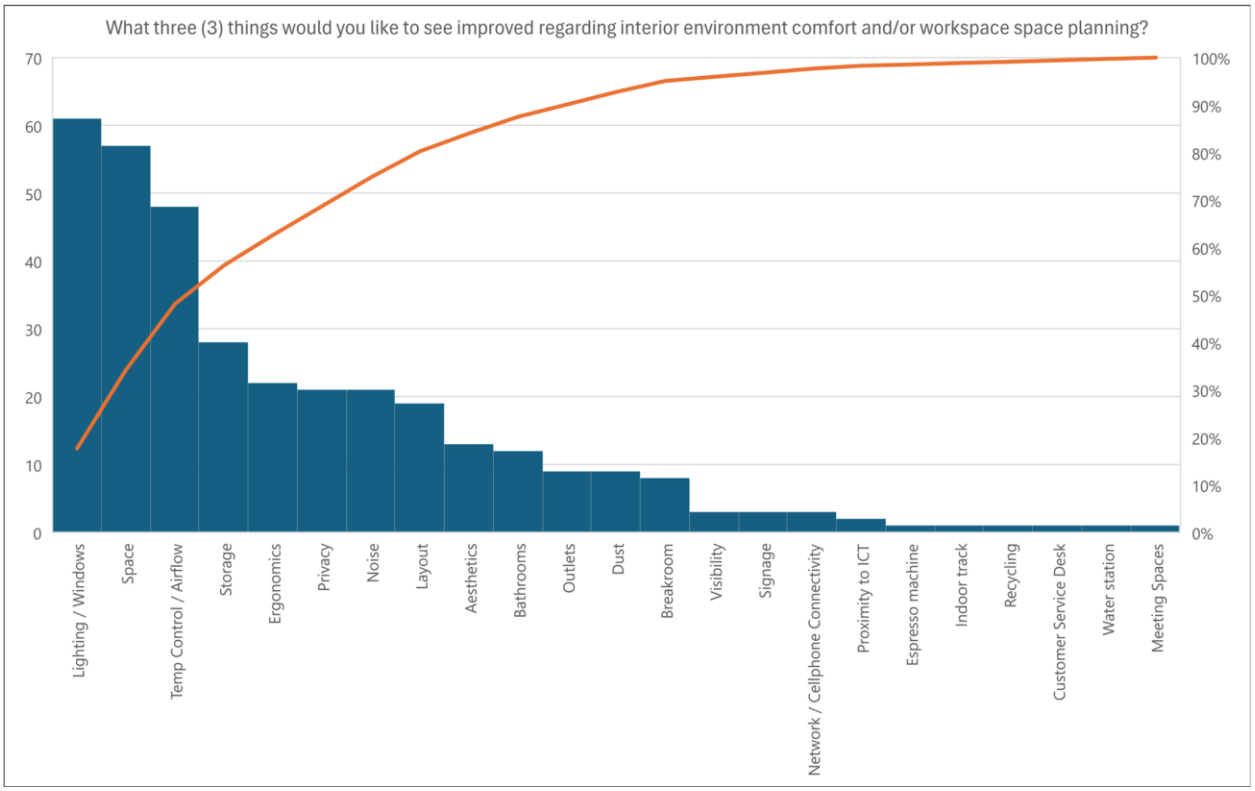
30. Provide a comfortable and healthy working environment.
    - Humidity levels maintained per ASHRAE 170 as appropriate per space
    - Air Filtration meets applicable requirements of ASHRAE 62.1 (MERV-8 min) and ASHRAE 170 (MERV-8 or -14). Consider MERV-14 minimum for all occupied areas.
    - Design includes capacity for MERV-11 outdoor air pre-filters to reduce impact of PM2.5 during events such as wildfire, pollen, glacial silt. Refer to ASHRAE 62.1 6.1.4.2.
    - HVAC system adjusts capacity to Accommodate varying occupancy load including expected future capacity.
    - Products on the "Red List" are avoided
    - Space between buildings is light and welcoming
    - Existing Lobby is kept from overheating and has reduced glare
    - Occupants have access to natural light: interior daylighting with "earthy-feel"
    - Glare from solar array is mitigated.
    - Employees are satisfied with thermal comfortability: Occupant survey results based on ASHRAE 55 criteria are better than existing. Realistic success target is 80% satisfaction:




VNPCC OPR Survey Results - Workspace Temperature
Average Score by Department
Survey Dates: 3/7 - 3/15/2024
In cool / cold weather
In warm / hot weather
Often Too Hot
Often Too Cold
5
4
3
2
1
2.75
3.13
1.50
2.50
1.75
2.75
2.25
3.50
2.07
3.13
2.00
3.00
4.00
4.00
2.00
3.00
3.20
4.20
2.00
2.00
2.40
3.30
2.00
3.00
2.27
3.23
2.53
3.28
2.00
3.00
1.82
3.64
Administration
Audiology
Behavioral Health
Complementary Medicine
Dental
Facilities
FHR
Health Education
IT
Lab
Optometry
Pharmacy
Primary Care - East
Primary Care - West
Radiology
Wellness Center (Exercise, PT, OT)


VNPCC OPR Survey Results
Survey Dates: 3/7 - 3/15/2024
Total count of answers to the question: "In warm / hot weather, the temperature in my workspace is...", segregated by the answer to "When is this most often a problem?"
25
20
15
10
5
0
3
5
5
7
6
4
10
20
20
1
5
12
1
8
2
3
Afternoon
Midday
Midmorning
Morning
Afternoon
Midday
Morning
Afternoon
Midday
Midmorning
Morning
Afternoon
Evening
Midday
Midmorning
Morning
Often too cold
Occasionally too cold
Occasionally too hot
Often too hot





31. Reduce spread of disease within facility
    - Airflow rates follow ASHRAE 62.1 or 170 design requirements as applicable
      i) Additional Outside Air supplied (coordinated with energy use goals)
    - Air Cleaning: appropriate measures are provided to improve Indoor Air Quality beyond Industry minimums:
      i) Air filtration ratings exceeded (e.g MERV 14 vs 8)
      ii) UV cleaning provided e.g. at cooling coils
      iii) Ionization provided at each supply air system
    - Negative pressure (AII) room capability is provided for defined set of Exam Rooms
    - ICRA Developed & Followed during construction

Problems to avoid

32. Employee dissatisfaction in ICT (integrated care team) open plan interactive space – perception is too much furniture, too many people
33. Avoid need for "personal comfort enhancements" like fans and space heaters

Specific occupant requirements

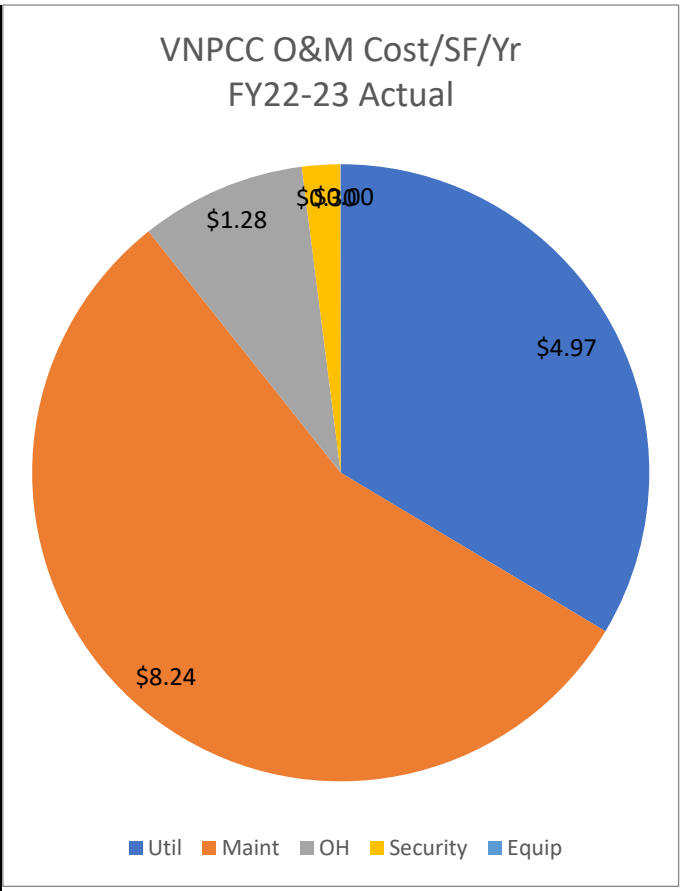
34. Provide Community gathering space
    - Electrical Load for Community space sized for large number of crock pots running at once.
35. Space for drive-thru testing/vaccination
36. Food & nourishment options are available e.g. healthy internal café fare, space for food trucks is possible, space for outdoor grilling is available, berry picking is allowed on site.

Operation & Maintenance

Benchmarks for performance

37. Target O&M costs of /SF/Yr To be determined [F]

O&M Expense Category		Type
520201	Insurance - Bldg	OH
530102	Utilities: Gas	Util
530103	Utilities: Electric	Util
530104	Utilities: Refuse	Util
530105	Utilities: Water & Sewer	Util
530111	Equipment Lease (> 1 year)	FFE
540101	Building Repairs & Maintenance	Maint
540104	Warranties & Maint. Agreements	Maint
560103	Elevator Services	Maint
560105	Fire Alarm Monitoring &Testing	Maint
560106	HVAC Services	Maint
560108	Janitorial Services	Maint
560111	Security Services/Monitoring	OH
560112	Snow Removal/Sanding/Sweeping	Maint
560113	Window & Artwork Cleaning	Maint
560115	Landscaping	Maint
560201	Consulting/Contractual - Bldg	OH
565101	Program Supplies	FFE
570203	Taxes & Licenses - Bldg	OH



38. Employ up to _____ people (at occupancy vs. 11-year target) by program
39. Provide building systems with useful life coordinated with the building life
    - Design includes pathway for eventual replacement of building systems & components
    - Resilient & robust materials are selected

40. Provide building systems that require minimal maintenance and are easy to maintain / operate through the life of the building
41. Reduce impact of power outages
    - 100% power backup provided for Entire building (new portion)

Problems to avoid.

42. Pressurization causing issues with operability of closure-required doors and facilities personnel making changes

Specific occupant requirements.

43. Culturally appropriate electrical design (e.g. crockpots in breakrooms)
44. Roofing system and materials shall match existing VNPCC

Construction Process

Benchmarks for performance

45. Environmental requirements
    - Develop ICRA & Follow during construction

Problems to avoid

No additional criteria were identified by owner or occupants.

Specific occupant requirements

No additional criteria were identified by owner or occupants.

Maintenance requirements

The facility will be maintained primarily by a dedicated group of maintenance staff. The training and training materials must be sufficient to allow them a understanding of the various components of the system, the interaction between those components, and troubleshooting issues that may arise. Any specific knowledge that the maintenance staff will require must be covered in the training materials, including hands-on demonstrations with the equipment. The team should also be familiarized with the controls and what standard operating ranges would be for the various systems, as well as key indicators of trouble within the system.

A system manual will be created for this facility. This document will contain maintenance information and standard operating conditions of the system. The system manual will assist the maintenance personnel in properly operating the system within the design conditions and outline regular maintenance required by the system. The systems manual will also contain information on the warranties of the equipment that was installed. The content covered in the system manual does not excuse from covering content in the training.

The design of the system must take the maintenance requirements of the equipment into account. Where possible easy to maintain and straightforward systems are desired to reduce the complexity and need for maintenance. Properly spacing and intelligently locating equipment is essential to promoting maintenance and proper operation of the systems. In addition, the designers must consider limited capabilities of 3rd party vendors when selecting systems and equipment.

SRA Tracking

A Safety Risk Assessment (SRA) has been identified as a requirement for this project. This project will leverage The Center for Health Design Safety Risk Assessment Tool for the creation and progression of this document. An SRA is a tool to encourage an analysis of various risks that may be of concern throughout a medical facility. The SRA will bring together various stake holders, design team members, and users to evaluate what risks are likely to be present in the facility. In addition, the participants will consider how to mitigate those risk factors, resulting in a improved end product. The SRA will be overseen by the A/E team for the duration of this project. The SRA was created during the 35% Schematic Design phase, and will be reviewed and updated during each subsequent design phase. The OPR will track completion of each of these reviews to document that each has taken place.

SRA Accountability Tracker					
	Design Phase Meeting			Construction	Closeout
	35% Initial Meeting	65% Meeting	95% Meeting	Design Changes Recorded	Final Acceptance
Date of SRA Task Item Completion	06/25/24				

OPR Version History

Below is a summary of the changes made throughout the predesign, design, construction, and occupancy and operations activities. This information is critical to understand and document the trade-offs made over time and the resulting impact on the project.

Rev. No.	Date	Description of Revisions
1	2/19/2024	Initial draft for review & discussion with SCF
2	2/20/2024	Live markup during OPR meeting with SCF
3	2/29/2024	Markup and addition of information request by SCF
4	3/5/2024	Live markup during OPR meeting with SCF
5	3/8/2024	CxA edits & writing
6	3/14/2024	CxA edits, writing, reorg, add space planning summary; send to SCF for review/discussion
7	3/20/2024	CxA edits & writing, reorg, add maintenance cost target
8	3/24/2024	CxA edits
9	4/5/2024	CxA edits
10	5/12/2024	CxA edits
11	6/20/2024	Pick up SCF comments
12	8/23/2024	Pick up A/E comments
13	10/3/2024	CxA Minor Edits, Programming Update, SRA Tracker Addition

Appendix A – Program Request Summaries

Updated per 35% design information.

Admin:

Space Program Needs

The admin program can be the least customer-owner friendly spot and can be located on the top floor and/or away from other departments. Admin program functions need standard integrated care team stations and a Conference room. Admin is also requesting locker spaces for storage of personal items and a break room. The facility needs four lactation rooms. The lactation rooms can be distributed throughout the facility, but one room should be in the admin area. Carpet is okay in the conference rooms but should be avoided in clinical spaces. [V]

Flexibility in the Project Program

Admin has stated that the large conference room can double as an employee lunch space and the break room can be a multipurpose room, also used for Admin employees to gather. The employees would like gymlets or a central exercise room but can share with programs (i.e. PT gyms can be used by the employees). [V]

Audio / Eye:

Existing

The Optometry department is currently well-situated and does not require relocation or expansion. However, it could benefit from rearrangement and improvements to better suit workflow.

Space Program Needs

The Tech room needs the addition of a sink. Presently, there are 6 total exam rooms along with 1 accessible exam room. To optimize space utilization, the existing Contacts room should be converted to an Audio space, and the new Contact room should be grouped with the rest of Optometry. The large accessible room can be divided into 1 contact room and 1 exam room, and the large Contacts Room could also serve as storage. The two Procedure rooms, which are currently undersized, serve as special testing rooms and would benefit from the addition of another room. Additionally, the floor plan should be updated to include a Staffing room, 2 screening rooms, and 2 exam rooms, with a preference for arranging them from south to north. [V]

Carpet is undesirable in both Optometry and Audiology and there should be hard surface floors.

Optometry needs a waiting space for check-in and check-out and retail addition of 200 square feet

Additional 2 rooms requested. There is need for another Double wall Audio booth which should be located away from loud spaces like break rooms, toilets for customer-owners and employees, storage, a sink, alcove for printer and office supplies, and lockers for coat and shoe storage. There is no need for a CFDS dedicated space. [V]

Flexibility in the Project Program

The following spaces can be shared or utilized in a group setting: Housekeeping Closet, consolidated office for 16 people, and Break Rooms.

Future Expansion Requirements

Retail space would be nice to have in the Valley. [V]

Behavioral Health:

PH II – Remodel

The current department is undersized and understaffed. Currently, there is budget for 23 providers, but the program only has 6 providers. The current number of restrooms is too low due to high demand during the turnover periods. Office spaces are adequately sized and properly portioned at 120 SF. Currently the waiting space is 700 SF. [V]

Space Program Needs

This program requires 25 therapy offices, 5 talking rooms, 3 group rooms, storage space, dedicated Lab, Soiled Room, 4 alcoves, clean and dirty rooms, and a break room with kitchenette and lockers (500 sq.ft).. Family work Therapy Offices should be 120 -130 SF, Therapy Offices with observation windows should be 120 – 130 SF, Family and Youth Work Therapy Offices should be 140 – 150 SF, Talking Rooms should be 110 – 120 SF., Group Rooms should be 360 – 420 SF., Group Room/Play Therapy with Observation Windows should be 360 – 420 SF, Larger Pod Spaces should be 450 – 500 SF, Storage Space should be 300 SF, Larger Conference Room should be 550 SF. One of the Group Rooms needs to be provided with a one-way window for observation. Pod should be provided to accommodate 31 employees. [V]

Flexibility in the Project Program

The conference room can be combined with the break room. In addition, the storage space can be in the open office. The soundproof rooms in urgent care can hold customer-owners for de-escalation and can be used for general treatment as well. [V]

Comp Med & Trad. Heal:

Space Program Needs

This program requires 2 acupuncture rooms, 2 massage therapy rooms, 4 chiropractic care rooms, Talking Rooms, Toilet Rooms, Locker Room, Office Spaces to accommodate 12 workstations, Alcoves, ICT spaces, Soiled Linen Room, and Clean Linen Room. Complimentary Medicine prefers common exercise spaces. If it does not fit in the program, gymlets can be an option but ideally centralized and combined with PT/OT. Gyms are not used for intense workouts most users do not shower. [V]

Flexibility in the Project Program

Soiled and clean rooms can be shared with adult PT/OT or traditional medicine. Complementary Medicine and PT/OT can share a Waiting Room, Reception area, and Talking and Support rooms.

Open office and scheduling space can be combined with back office, and break rooms and locker rooms can be shared with adjacent departments. Gym areas can be combined with PT/OT. [V]

Future Expansion Requirements

Future services include Electrical stimulation. [V]

Dental:

PH II – Remodel

Currently, the amount of provided lockers are sufficient in Wellness and Dental. The Administrative space is adequate as-is. The dental lab is transitioning to digital impression which will reduce the lab size, due to this the current lab size is likely adequately sized. The existing front desk is adequately sized to accommodate expansion. Sterile area is currently oversized and could handle double the capacity that it currently serves. The current panel size is 11. [V]

Space Program Needs

Shell space is needing to be provided for the future Dental program. This program needs 5 large Operatories, Storage, additional Closed Rooms, Consult Room, and a Surgery Suite. The new dental areas need to be individual rooms, open bays are not good practice after COVID. If expansion follows current trends, then overall need for dental chairs is on the order of twice the current capacity (21 chairs). [V]

Flexibility in the Project Program

The Dental mechanical room (on 1st floor) could potentially expand into the adjacent lab space to increase capacity. Recovery currently takes place in the operatory. [V]

Future Expansion Requirements

Initially projection of around 21-45 chairs for dental across 9 general IDCTs and 2 pediatric IDCTs to serve approximately 2,000 customer-owners over the year (2-7/work-day) or roughly 2 customer-owners per 1 provider. Dental would like to account for a panel size of 900 to 1,000 with approximately 18 panels by 2025. [V]

Facility Services (Property, Supply, Employees):

PH II – Remodel

The facility currently stores clean linen in archive records. The outbuilding storage area is approximately 2,800 square feet but can be smaller. The main departments that require linen services are Radiology, Wellness, 2 additional Clinics, and Traditional Healing. Currently the soiled linen room is very undersized.

Current employees are 2 couriers and 1 admin space in the office within Material and Handling –3 desks. [V]

Space Program Needs

Facility services are projected to require 656 square feet of space to accommodate Information management, Lost & Found Storage, Housekeeping storage, and Property room for uniform

storage and equipment. The workforce is expected to expand to meet the new building requirements. [V]

Employee Facilities are projected to require 850 square feet of space to accommodate Lockers, an employee lounge, and toilets. [V]

Recommend having soiled linen as satellite rooms in each building, but a large linen room could work if it is 3-4 times the existing linen room size. In general, Property & Supply needs a lot more space based on different departments: 1 big office/storage for crew and supplies that is bigger than the existing one, 3 janitor closets that area all bigger than existing ones, Biohazard room should be at least twice as big as existing one, med gas room could be larger, need adequate room in Recycle to break down boxes, and the receiving area needs to be large enough for up to 8 pallets, a pallet jack, and adequate room to move pallets around. For employee areas, open counter spaces preferred rather than a dedicated desk space. Facility office space in the outbuilding/shop could have a few more workspaces. [V]

Flexibility in the Project Program

There does not need to be a dedicated Biohazard Room, but rather, can be sectioned off within the Soiled Linen room. Mail Room/Handling for sorting and stacking does not need to be a dedicated space but needs to be included in the program areas. Pharmacy storage could be located within the department.

Shop maintenance is used as a conference room – but shop maintenance can be moved to the out-bldg. [V]

Future Expansion Requirements

Need to consider a Warehouse where most of the maintenance can occur. [V]

Health Education / Traditional Healing:

PH II – Remodel

The current program has 6 Treatment rooms which will not be sufficient for the expansion. [V]

Susitna is currently used most often by Health Ed, but does support some administrative employees, this is not desired. The current Office space is for 17 employees with desk space of 38 SF per desk; this size of working area is too small. [V]

Space Program Needs

The new program should add 2 more treatment rooms and contain a minimum of 5 office spaces, and a dedicated Kitchen (if smell is a factor), a Waiting Area, reception area for 2 employees, and a cultural center for 8-10 dedicated to the program. This program caters to older customer-owners and should be easy to navigate. Treatment spaces should be the same design with lockable storage in the room. There are extra requirements for acoustic dampening. There is no need for an ICT space in this program. [V]

This program needs a Lactation Room or Tabacco Cessation Room, Storage room, Check-in area, and Office Space. The employees consist of 3 Health Educators, a Program Coordinator, 2 PCs, a supervisor, and a shared manager. Office space should be provided for 17 employees with roughly 55 SF per desk.

The Susitna should be a dedicated space for this program. [V]

- Provide food & nourishment [C]
  i) Provide Demonstration & traditional healing teaching kitchens [F]

Flexibility in the Project Program

Can share kitchen space with Health Education if smell is not a factor. [V]

This program uses a combination of both on and off-site storage. Currently 1 talking room can work IF it is adjoined with another department that has more talking rooms. If not, ideally 2 talking rooms.

Shared registration with Trad healing, comp med, PT, and/or Health Education. Utilize Admin spaces for employee meetings. Possible for storage to be included in Susitna/Kitchen. The Susitna/Kitchen may be shared with Traditional Healing. [V]

Future Expansion Requirements

Offsite storage for seasonal items. [V]

IT-Comms/ Security/ HSKP:

Existing

The existing VNPCC Comm Room serves 2nd floor spaces, with the South Comm Room not being utilized. Currently, the IT group is storing hardware in a level 2 Comm Rack room, but would prefer to have a designated storage area. It was also mentioned that the Comm rooms are never adequately ventilated [air conditioned]. The IT room serves the West wing on both levels and needs to increase by 1.5 times. Information Management has a large Comm room that is half utilized by equipment and half for Comms. [V]

Space Program Needs

It is projected that a minimum of 5 IT workstations –preferably in the Admin Suite— and two new Comm Rooms will be needed in the expansion project; however, if the expansion is “tech heavy” more spaces would be needed. IT would like 1 comm room per floor with adequate air conditioning (existing rooms are not well done). There is request for a dedicated staging room for equipment, storage space with workstations for e-waste/decommissioned equipment, adequate workspace to help support off campus IT work, secondary egress out of the building for telecom utilities, additional EVAC chair storage space, centrally monitored security screen for camera stations viewing, and a “front of house” security workstation with information desk. It was noted that the dedicated staging and storage spaces should be close to the delivery space/Loading dock. [V]

Lab:

PH II – Remodel

The Lab program currently has a lack of storage and safety issues currently with tight spaces for techs moving in the same hallway. The PCR room is in a lot of demand currently. [V]

Space Program Needs

The Lab Program needs larger sized hallways to prevent bumping into each other. Another option is to provide a “back of house” corridor to improve circulation. The Lab program needs a dedicated training room for 2 providers, blood draw room for atypical scenarios, storage room, a break room, restrooms, and lockers for employees. The core lab has similar space requirements as the PCC lab (approximate 1,025 SF), and the storage area needs to be at a minimum 10[-ft]x12[-ft]. PCR needs to be a separate room but within the Lab and needs to include Microbiology. Drop off windows cannot be in corridor due to HIP, these spaces need additional privacy. The Lab program does not need waiting space. [V]

Flexibility in the Project Program

Shared office 2 people doubling as a training room. Blood Draw can be a part of Urgent Care.

The Break Rooms can be shared between the departments but with a secure door, vestibule, and badge access. The Lab also needs a direct access to the break room from within the department.

If the Lab is not close to Urgent Care, then additional services will need to have space to provide support: Urine analysis, dip stick, rapid strep test for the 24 hr Urgent Care if Lab is closed. Urgent Care needs room for POC testing while more significant analysis is done in the lab. [V]

Pharmacy:

PH II – Remodel

Currently 350 to 500 prescriptions are filled per day with 4 desks in the office. The current office is undersized and not located correctly. The central Pharmacy needs to be approximately 50% larger than the existing one. Currently the VNPCC pharmacy does non-sterile compounding (mainly creams) but not in a designated space. For curbside pickup there are currently only 2 car slots and the Pharmacy would like more spaces. [V]

Space Program Needs

This program needs 2 private Consultation Rooms (non-carpeted), 8 dispensing windows, a Waiting area, Check-in area, larger break room, locker room, employee toilet, and more and high-density storage. The seating for the Waiting area should be separate from the Check-in area. Additionally, there is a need for hazardous and sterile compounding rooms – only a positive room and ante room needed, no Negative Room are needed. The program is moving away from nonsterile compounding rooms, but there is still need for a compounding area for outpatients – the existing VNPCC size is sufficient. To service this area there is a need for 5 tech bay stations and lockers to serve the 15-18 employees. The breakroom in this program should be approximately 250% larger than the existing space. Employee Break space used by 4-5 people at a time with a kitchenette and needed inside the Pharmacy dept. Pharmacy uses kitchenette space for different events and it is essential that it is a part of the dept. program. [V]

Flexibility in the Project Program

The shipping receiving area can be shared as a direct connection from dock, or dedicated area within the pharmacy. Consult rooms are multi-purpose for flu/immunizations and medication teaching. The Housekeeping Closet can be shared with another dept. [V]

Future Expansion Requirements

A covered curb-side pickup area would provide better access to the pharmacy. A larger mailout area is desired with another Mediset unit to help in serving the 800 customer-owners. This would require additional providers to operate and additional slots for cars (4-6 would be ideal). [V]

Primary Care:

Existing

The current room arrangement is not ideal, and larger rooms are desired for family group sessions.

Improvements to the existing clinic include quieter rooms, a dedicated room for TOVA testing, enhanced privacy, and a kid-friendly talking room. Additionally, the talking rooms arrangement is not ideal since it puts the caregiver furthest from door and the narrow shape is not conducive for furniture arrangement.

There was some debate on where or not the Phone room should remain in the programs, if it does remain, then it is too small, and that it would be ideal if the wall between phone room and Clerical space is removed. [V]

The current clinic needs more storage, additional employees, improved talking rooms with better sound control, an ultrasound room connected to a toilet, support clinic rooms with adjacent toilets, and a conference room and support clinic for diabetes-related services. [V]

Space Program Needs

Leading up to 2033, the Primary Care program is projected to need 1-1.5 PC Clinics. Projections for 2036 include 45,950 of space, including 13-21 Exam Rooms, 2-3 Procedure Rooms, 2.5 Vital Alcoves per clinic that are tucked away, large room(s) for family group sessions, and 1-2 Primary Care Clinics. [V]

Flexibility in the Project Program

The proximity of multiple clinics enables the possibility of pairing or stacking them if required, although some duplication of shared spaces might be necessary. Grouping clinics together facilitates the utilization of shared spaces for supplies and medications. Additionally, maintaining a shared Reception/Waiting Room for Wellness, Comp Med, and Radiology similar to the current setup is recommended. Furthermore, there is a preference for larger rooms to accommodate family group sessions—which can be shared with other departments as needed. [V]

Future Expansion Requirements

Other expanded ancillary services include moderate complexity lab services including testing for blood, stat, micro, hematology, basic chemistry, and centralized potentially phlebotomy; ultrasound capabilities requiring an on-site radiologist, echo services, cardiology stress tests, and CT scanning.

Urgent care requirements include real-time lab testing, CT scanning with contrasts, an ante partum room for customer-owner monitoring, and infusion capabilities within the lab. Lactation

employees will need rooms large enough for 2 employees and have an attached employee toilet. Locker space will need to be provided for program employees and Admin employees. [V]

Public:

Increase restrooms for females and size men's restroom based on existing size. The printer alcove that is part of the Waiting Room can be reduced in size. The current size of the café does not meet current needs. A larger food service area is recommended. [V]

- Provide Community gathering space big enough for full staff meetings [C]
- Provide food & nourishment [C]
  i) For Employees and Visitors: Intent is to enlarge current café serving prepackaged items – no plan for commercial kitchen [F]
  ii) No plans for food trucks or farmer's market [F]

Radiology / Imaging:

Existing

Currently, the bone density room is utilized as another ultrasound but it's too small. For customer-owners in primary care that need an x-ray required to dress, relocate to the radiology area, and then undress again. This type of decentralized model is not a good use of technician's time and is not conducive to keeping up a good flow of customer-owners. Additionally, Ultrasound rooms share a linen room, but would like to have a linen closet in each room for customer-owners. [V]

Space Program Needs

Facility services are projected to require 9,200 square feet of space to accommodate Bari Toil, Cont, Dress, Proc/Ultra, Proc Mammo, Proc Rad, Room, Tech Work/QC Office, toilet, ultrasound, and support spaces. The workforce is expected to expand to meet the new building requirements. [V]

Leading up to 2033, the Radiology program is projected to need 2 modalities but no CT. Projections for the 2036 needs include a total of 9,200 square feet of Imaging space, including 1 R/F, 1 MRI, 1 CT, and 3 Modalities.

Ultrasounds should be done in a dedicated room as the standard exam room is too small to accommodate equipment. Currently only mammogram screenings are being provided at VNPCC and there are very few Mammo customer/owners who require biopsies (1-2 per year), but there is need for a Biopsy procedure room. The program also needs a dedicated check-in counter and waiting area for the department. There is a need for a single location for techs to go to escort customer-owners back for appointments. Ultrasound procedure rooms need adequate storage space and adjoining toilets. Employees are requesting locker space, a break room, and a meeting/conference room for training. Locker space can be located within the break room and employee toilets. [V]

Flexibility in the Project Program

For offices and staffing, technicians can be cross trained in X-ray, CT, and Mammo for 2 of the modalities.

The Echo room should be designed to support ultrasound. Ultrasound is suggested to be a large room that is multipurpose – Ultrasound procedure room and Eco – with an adjoining toilet. The requested break room could be shared with UC or Lab. The control area for CT and MRI can be shared but may not be possible due to code and/or tech certifications. [V]

Future Expansion Requirements

Reading is currently done remotely in Anchorage – this can continue but it limits the procedures that can be done on-site. Plan for the addition of a radiologist on-site— since one is required for fluoroscopy. If a radiologist is on-site, then a reading room needs to be included. A radiologist on staff would also allow expansion of women's services. Currently only Mammo screening is done, but no diagnostics. A radiologist on staff could allow ultrasound guided biopsies and stereotactic. Radiology depts. need a higher percentage of customer-owner toilets. It is projected that a tech work office will be needed for approximately 12 techs. [V]

Future Expansion Requirements

Currently, 24/7 operation is unlikely, but the department should be designed to accommodate it in the future. Urgent care in the existing building is a good idea but after-hours entry/exit needs to be reviewed. If urgent care is relocated to the existing pharmacy area design needs to make sure the community gathering space should not feel like ED entry. [V]

Wellness Center (Exercise/PT/OT):

Leading up to 2033, the Wellness Center program is projected to need: 2-3 comprehensive medical facilities and 2-4 physical therapy/occupational therapy units. Projections for the 2036 needs include 7.5k to 10k square feet of space, including 2-3 comprehensive medical facilities and 2-4 physical therapy/occupational therapy units. As designed, the Wellness center showers and locker rooms are sufficient. [V]

Adult PT/OT:

PH II – Remodel

The ADL kitchen needs to double in size, this also needs an ADL toilet room, these may be able to be combined into a single larger space. Currently the gym is undersized and an increase of 50% would likely still be inadequate. There are also 3 existing PT rooms and no existing OT rooms. The men's locker room is undersized and needs additional lockers, changing rooms, bench, and wall hooks. [V]

Space Program Needs

This program requires talking rooms (110 SF each), 6 PT exam rooms for 12 PT providers and 5 PT Assistants, 6 exam rooms for OT, Adult SLP space, large exercise space, employee locker space, and the addition of a family restroom with shower for customer-owners. Locker rooms need to accommodate customer-owners and caregivers. Space for 2 check-in employees and 2 back-end employees would be sufficient and a reduced waiting room size. This would meet the current needs of the program so long as space for customer-owners with mobility issues is maintained. The FHR room is not necessary for this program. The above spaces need to accommodate 24 – 25 providers. [V]

Flexibility in the Project Program

Not every therapist needs a room so room sharing is possible. Additionally, the exercise center and PT exercise area could be combined. Sharing of storage with Comp Med can also be done or shared storage and waiting space. Storage can be provided for Adult PT/OT and Comp Med or could have shared storage and shared waiting spaces. Kitchen and Bathroom ADL is shared with Peds PT/OT, this area can be shared with Peds/CFDS. [V]

Future Expansion Requirements

The addition of stroke management recovery/rehabilitation would likely require additional waiting space due to the additional care givers. [V]

Aqua Therapy:

A topic that came out of the “what would be so grand that it seems impossible” discussion was the addition of a therapy pool at the facility. It was discussed that if a water (PT Pool) element is included in this phase of the design there is also the ability to expand in terms of the future larger pool for therapy. [V]

Pediatric PT/OT/ABA:

Existing Facility

Currently located on different floors which is not preferred. The waiting room in Anchorage CFDS is too small. The Waiting room should be expanded for this program and building. [V]

Space Program Needs

This programs requires: 4 exam rooms at 150 SF each; 12 Therapy rooms; a Large gym dedicated for ortho/rehab; Storage space 2 x 100 SF and 1 x 350 SF storage; ADL Toilets; 2 Talking Rooms with space for 1-2 adults, 2 kids, and 2 providers; a Lactation room large enough to accommodate feeding therapy; Showers; Lockers; 2 registration/Check in desks; and a Soiled Room at 150 SF. Toilet rooms should be single toilet instead of stalls and should be a higher percentage of the program foot print than other programs. The Pediatrics and Speech Therapy spaces need to be capable of serving 13,000 and 12,000 customer-owner visits per year, respectively. [V]

Flexibility in the Project Program

The ADL kitchen and ADL bathroom with a tube can be shared with PT/OT. The toilet/shower can also be shared with adult programs. This facility can operate with storage solutions in CFDS or facilities buildings. A centralized break room should be considered. Multipurpose conference rooms are needed, for large family conference rooms –flexible spaces with Kitchenette could work. [V]

Future Expansion Requirements

There are 3 primary options for the future of pediatric PT/OB/ABA. Option 1 would centralize them in anchorage, effectively eliminating the spacing requirement for this expansion project. Option 2 would be building space in VNPCC for employees out of Anchorage. Option 3 would build out a separated CFDS program in the valley. Options 2 and 3 would both have the same special requirements for in VNPCC. The chosen option should be sized to account for the 150% growth in customer-owners by 2033. [V]

Site and Overall:

- Space for outdoor trailer drive-thru testing/vaccination [C]
- Site: Placement of outbuildings to not limit expansion [C]
- Building: Flexible accommodations for future Program occupancy change [C]
  i) Lay out Structural and MEP systems to anticipate renovations [F]