Facility Overview

NWSC-2 Vendor Day

February 24, 2015

NCAR
NATIONAL CENTER FOR ATMOSPHERIC RESEARCH

NWSC Overview

- Construction completed in 2011 at a cost of approximately $70M; focus on energy efficiency
- 153,000 square feet; 12,000 square feet of raised computer floor (Module B)
- Operations began on October 2012; Yellowstone in production on December 20, 2012
- NWSC-2 system slated for Module A; currently reviewing design/build proposals for the facilities work
- All work that is independent of specific NWSC-2 design will be completed by March 2016; system-specific fit-up will be completed by June 2016.

NWSC Operations

- NWSC is located approximately 7 miles west of the city of Cheyenne, northwest of the intersection of Interstates 80 and 25 in the North Range Business Park
- City of Cheyenne Population as of 2012 – 61.5K
- NWSC Operations are 7x24x365; three teams in the building at all times
  - CASG – Cheyenne Administration Support Group – Computer Room Operators
  - ISGC – Infrastructure Support Group Cheyenne – Power Plant Operators
  - G4S Security (contract)
- Excellent receiving and staging areas
- Vendor office space

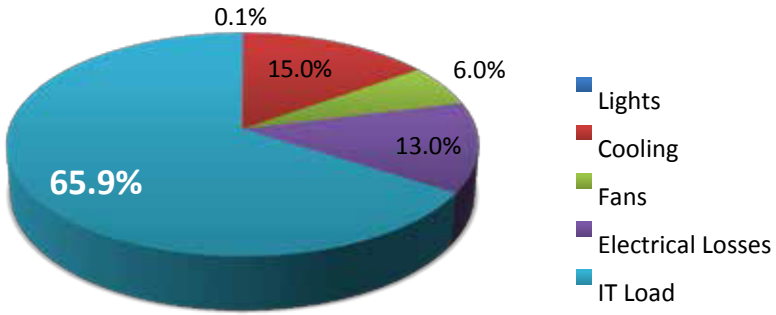
NWSC AWARD WINNING DESIGN

- Uptime Institute – Green Enterprise IT Award 2013
- Data Center Dynamics – Green Data Center of the Year 2013
- 2015 ASHRAE Technology Award – Honorable Mention – Category IV – Industrial Facilities or Processes - New

Big Picture Focus On Energy Efficiency

- Utilize the region's cool, dry climate to minimize energy use
  - Very low pressure drop
    - Minimize bends
    - Oversized pipe
  - Elevated chilled water temp
    - 65 degree
- Utilize liquid cooled computer solutions where practical
  - HPC Systems
- Utilize hot aisle containment for commodity equipment
- Focus on the biggest losses
  - Compressor based cooling
  - Transformer losses

Typical* Modern Data Center



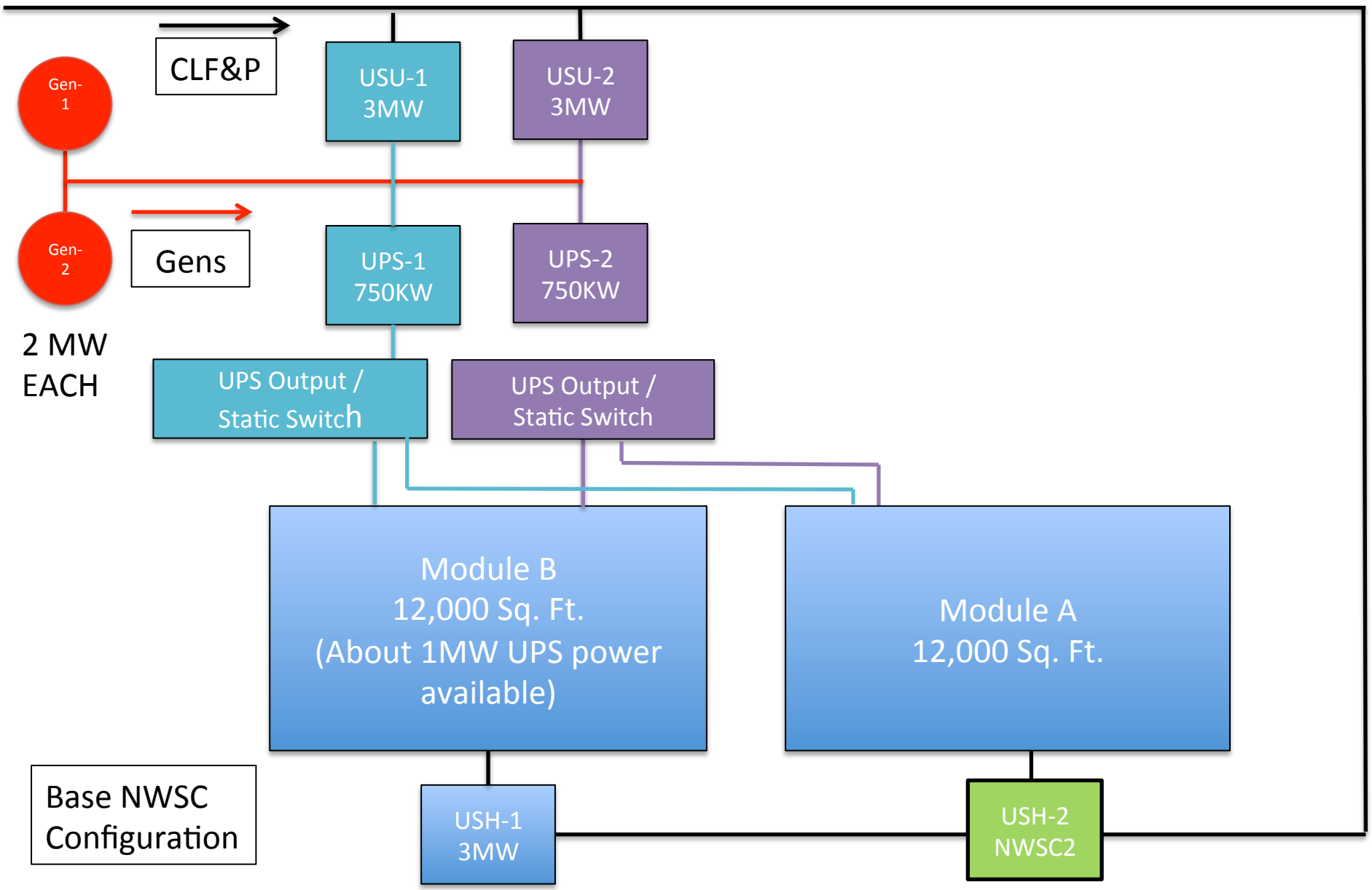
** Conventional variable primary, evaporative cooling based Tier II data center with traditional 45°F water*

NWSC Design

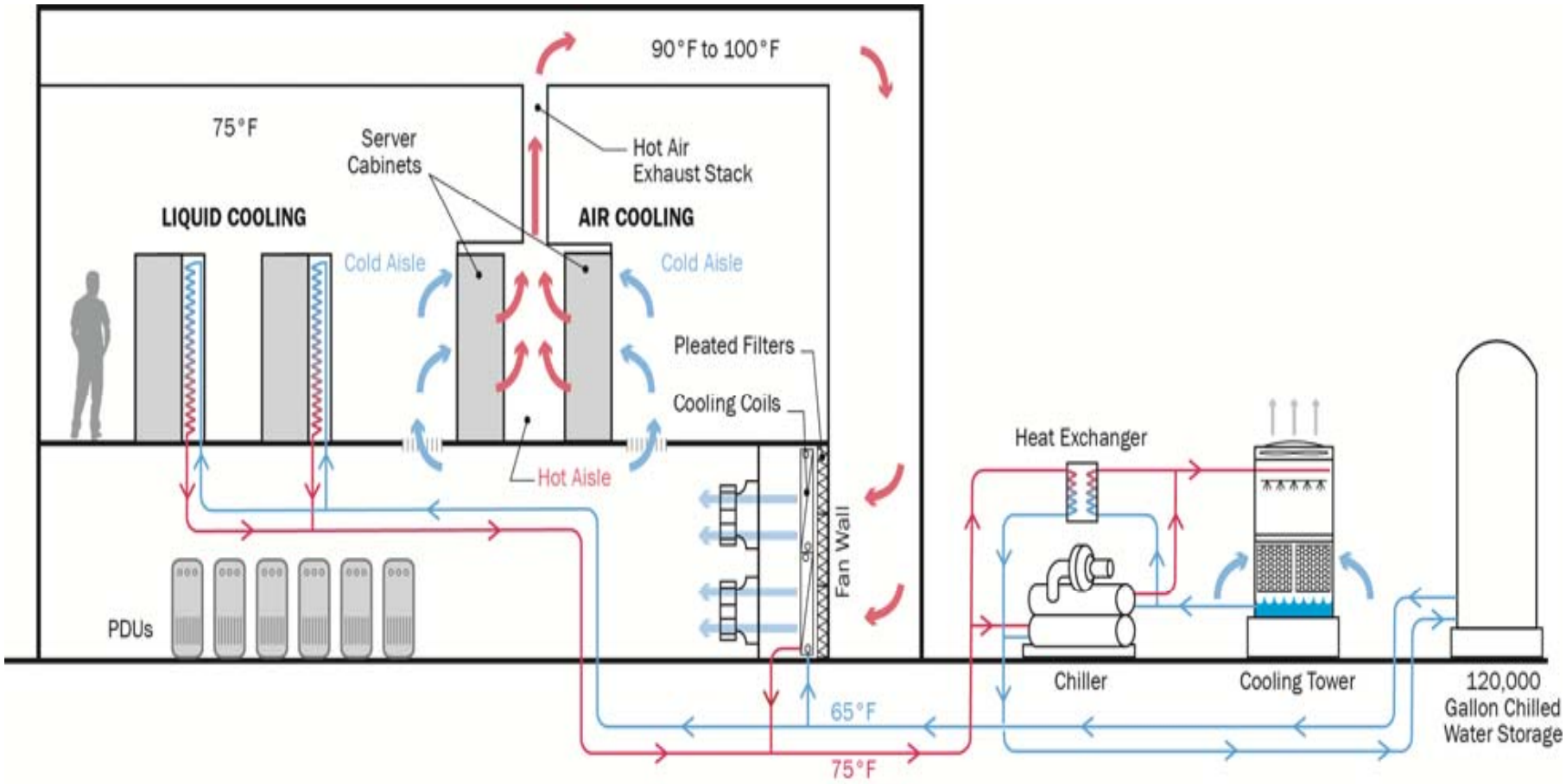
Innovative Sustainable Design Elements Abound throughout the Facility

- **Indirect evaporative cooling** provides low- energy economizer (free-cooling) cycle-based cooling system to provide chilled water for liquid- or air-cooled computing.
- **Implementation of broader ASHRAE indoor conditions** allow extended operating hours on economizer cycles for all but 300 hours per year, limiting mechanical refrigeration needs and lowering required refrigerant volume.
- **Large-capacity energy recovery heat pumps** cool computer systems and transfer waste heat to occupied areas.
- **Fan-wall technology** provides large air volume movement at very low pressure drop.
- **Duct-less air-based computer cooling system** further reduces pressure drop.
- **Low-energy, high-pressure fogging system** efficiently maintains humidification levels in critical spaces.
- **Envelope commissioning** ensures thermal and humidity control in critical IT spaces and occupant comfort in administrative areas.
- **Chilled water piping network with a very low pressure drop** is achieved with oversized piping, use of 45° turns instead of 90° elbows, and elimination of balance valves and other pressure-restricting devices in the mains.
- **Daylighting** in visitor and office areas reduces overall lighting power density.
- **Continuous insulation** on steel and precast concrete panel systems.
- **High-efficiency electrical components** configured into computing infrastructure to reduce electrical losses.
- **Direct connection of supercomputer processing nodes to utility power** limits power transformation and UPS losses.
- **Office HVAC systems design philosophy of limiting transport energy** using water-based cooling instead of air. Chilled beams used for cooling and radiant slab/baseboard radiation for heating.
- **Zero water blow-down** technology in the cooling towers significantly reduces water consumption in the cooling process.

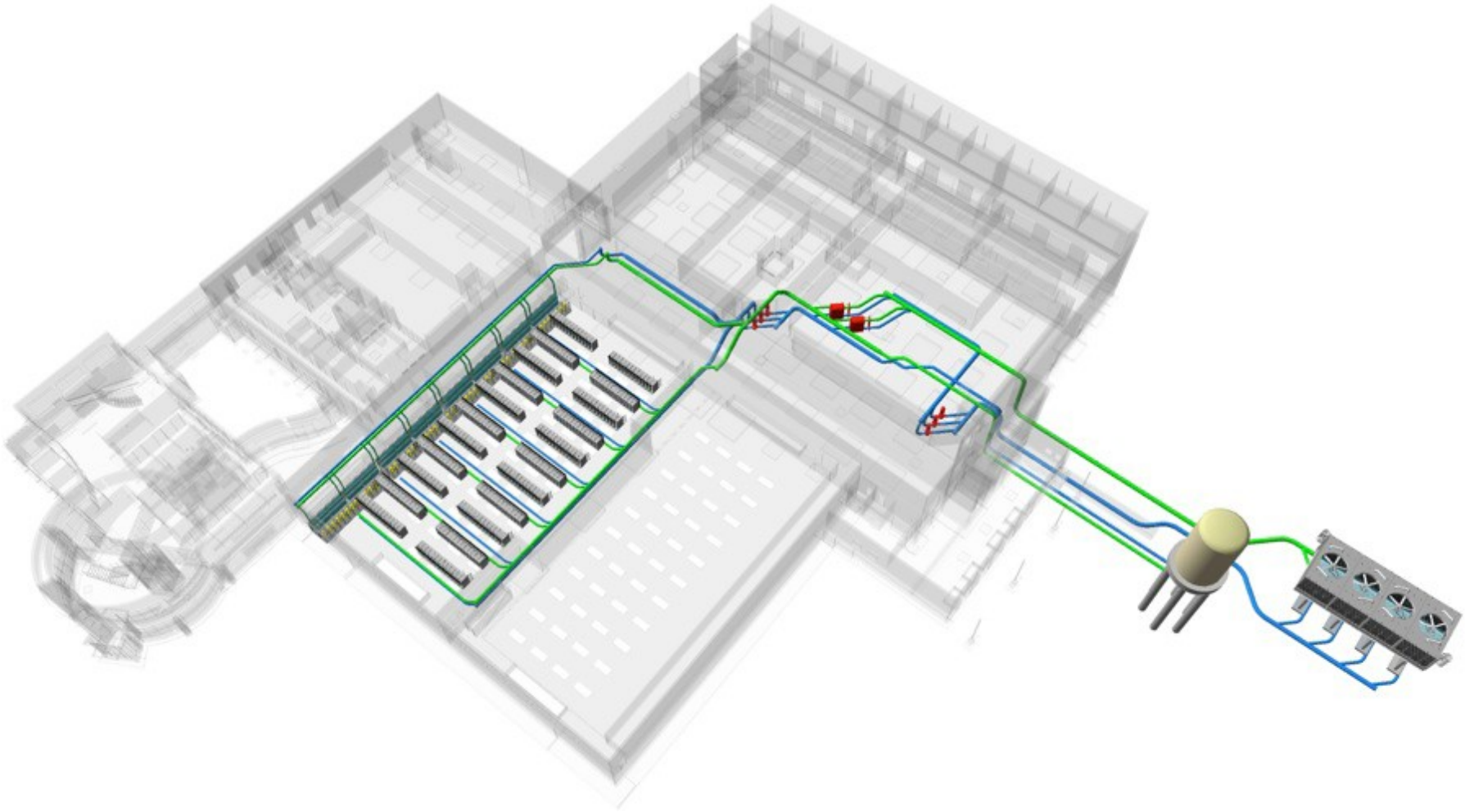
Electrical Overview

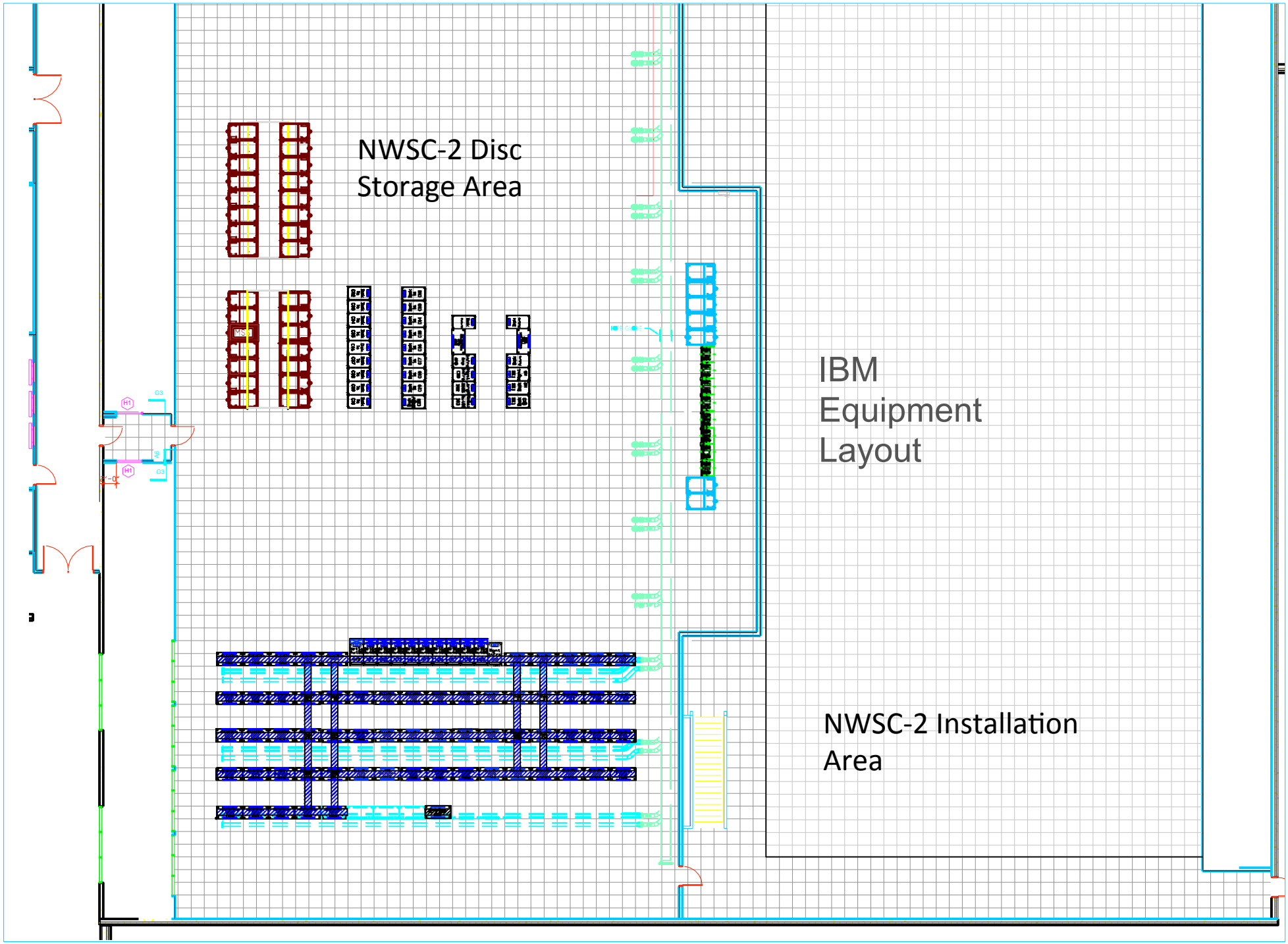


Mechanical Overview



65°F (18.3°C) Degree Chilled Water Evaporative Cooling Solution




NWSC-2 Disc
Storage Area
IBM
Equipment
Layout
NWSC-2 Installation
Area

NWSC LEED Gold Facility Preferences

Electrical

- Prefer 480V, 3 Phase-balanced loads
- Other voltages achievable

Mechanical

- Prefer liquid cooling: direct or heat exchanger doors
- Air cooling capacity ~ 2MW

Clean Room

* Restricted access; maintain clean environment