MEMORANDUM

DATE: October 21, 2011

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SUBJECT: **ALAMOSA READINESS CENTER – HVAC SYSTEMS DESCRIPTION MOVING FORWARD WITH ABI EXPLANATION – BPCE 6487**

The following is taken from the master 60% narrative that is moving forward for the November 60% submittal. This should provide adequate information to develop a better budget cost for the system. Please contact me with any questions or concerns.

First, the indoor design conditions have been resolved and are now 70°F for winter heating setpoint (55°F unoccupied) and 76°F for summer cooling setpoint (90°F unoccupied). These temperatures were used in the preliminary sizing of the equipment included herein.

The owner selected alternative with which the design is proceeding is essentially Alternative #5 – Packaged roof top air handling units with Heating Water coils, and radiant floor heating from boiler. However, there will be an ABI for utilizing ground source heat pumps for only the regularly occupied spaces. For detailed descriptions of the LCCA, etc., please refer to the previous submittals.

Each vault will be provided with a small dedicated heating/cooling unit. If Alternative #1 is accepted, then this will be a wall mounted ductless split-system. There will be an indoor unit provided for each vault that will then utilize a common outdoor unit for both vaults. Also, per National Guard requirements, z-vents will be utilized to introduce air into the vaults and relieve air from them, thus satisfying the ventilation requirements. Dehumidification was in indicated as unnecessary and not desired for this space per the discussions during the design charette. Overall, this limits the quantity and size of the vault penetrations, thus minimizing security concerns.

All roof mounted equipment (HV's, ERV's, RTU's, etc.) will be designed to prevent drifting snow from covering any intakes or entraining into the units. This will be accommodated with proper equipment placement and proper roof curb heights.

The simulator area will be provided with mechanical cooling. Humidification is determined not necessary in this space based since the system is not completely electronically driven.

The communication and Audio Visual Equipment rooms are zoned independently from other systems for proper thermal control of the space as necessary with the sensitive electronic equipment. This will be DX split-systems so that they are capable of providing cooling all year.

Pursuant of the AT/FP requirements, a centrally located air distribution shutoff switch will be located and coordinated with the user. This will be controlled via the facility management system. The exact location will be coordinated based on the user input of whether public access to the switch is desired or if only facility personnel can access it.

All outside air intakes will be located such that they are a minimum of 10'-0" above grade per AT/FP requirements. Many of these are integral to the RTU's and will therefore comply with this requirement.

All new ductwork shall be sheet metal and Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and ASHRAE/IESNA 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."

Ducts shall be leak tested for compliance with ASHRAE/IESNA 90.1, Section 6.4.4.2.2 - "Duct Leakage Tests.". Duct shall be constructed to the following pressure classifications:

1. Supply Ducts: 3 inch w.g. pressure duct from equipment to diffuser.
2. Return Ducts: 3 inches w.g., negative pressure.
3. Exhaust Ducts: 3 inches w.g., negative pressure

Heating Only HVAC for Spaces

Certain Building areas that are not allowed to have cooling per the Army National Guard DG 415-1 Readiness Center Design Guide will be provided with a fan coil unit capable of delivering the ventilation required. These areas are:

- Assembly Hall
- Flammable Materials Storage
- Controlled Waste Handling Facility
- Unit Storage (Heated)
- Maintenance Training Workbays
- OCIE

HV-1 – serves the Assembly Hall (will be demand control from CO_2 sensor in the space), 800 cfm at approximately 0.75" external static pressure loss, -17°F entering air and 70°F discharge air (to match space setpoint).

HV-2 – serves the OCIE Lockers, Hall, Flam/CW and Facility Maintenance spaces (will operate on occupancy schedule established in the BAS system), 925 cfm at approximately 0.75" external static pressure loss, -17°F entering air and 70°F discharge air (to match space setpoint).

HV-3 – serves the Training Bay (will be activated whenever the exhaust serving this space is activated, user defined), 2,000 cfm at approximately 0.65" external static pressure loss, -17°F entering air and 60°F discharge air (to match space setpoint).

HV-4 – serves the Heated Storage (will operate on occupancy schedule established in the BAS system), 400 cfm at approximately 0.65" external static pressure loss, -17°F entering air and

55°F discharge air (to match space setpoint).

The heating and ventilation units (HV's) will all have the following options:

- No Mechanical cooling.
- Airflow shall be modulated based on heating setpoints.
- Heating coil served by facility central Heating Water System
- 100% outdoor dry bulb air economizer controls
- Pressurization Controls and relief air modulating power relief fan,
- MERV 7 (30% efficiency) Pre-Filters
- MERV 13 (85% efficiency) Final Filters
- Two-inch double wall rigid polyurethane foam panel cabinet construction with and insulation value of R-13
- Flow stations for measuring outside air volume
- Remote BAS interface terminals, digital and analog
- Electrical: 208/3/60

The basis of design for the 100% outside air HV units will be Trane Performance Climate Changers. These will be roof mounted, outdoor units. Relief for those spaces not being exhausted will be provided by relief hoods (with integral motorized dampers) that operate only when the system is supplying the ventilation air. All efforts are to be made such that these relief hoods are minimized in quantity and size. Many spaces can share a common location by using transfer air ducts.

These areas have the HV's sized only for the amount of ventilation air necessary for the space and only to heat that air to space temperature. The remainder of the heat for these spaces will be from a radiant floor heating system. The radiant floor heating system will serve all the areas listed above and also provide snow melt to the initial 10'-0" outside the building footprint at the training area. Other areas of snow-melt desired by the owner can easily be accommodated. A manual override to the automatic controls for the snow melt system will be included in the design such that the owner can preemptively warm the exterior slabs prior to a storm's arrival.

The Heating Water system will be generated by multiple condensing boilers, sized for a certain amount of redundancy. Total heating capacity is approximately 1,100 MBTUh for the facility. The snow melt system still needs to be fully defined as to the areas where snow melt is desired. Likely, based on a 10'-0" apron outside the vehicle doors, this system will add an additional 200 MBTUh to the boiler system (based on 200 BTUh per square foot of snow melt). Based on a total anticipated load of 1,300 MBTUh and a desire for redundancy, we suggest three condensing boilers sized at approximately 600 MBTUh capacities. The current basis of design for these boilers is a Laars NeoTherm 600. This design is flexible based on the desire of the owner for redundancy in equipment. These boilers are specified with a manufacturer provided boiler feed pump (primary pump) selected for a30°F temperature rise. The secondary pumps will be VFD controlled. The current design is for two secondary pumps (controlled in a lead lag arrangement) that preliminary sizes have indicated a Bell & Gossett Series 1510 Model 2BC with 5HP motor. A potential cost and footprint savings can be utilizing an inline pump for the secondary side of the system rather than end suction, base mounted as indicated herein.

The heating water will be distributed by a primary-secondary pumping system to maximize part load efficiency. This system will be a 50% propylene glycol and water mixture, thus providing a freezing temperature of -28°F. The glycol additive is necessary for freeze protection at the roof top units and heating and ventilating units based on a very low mixed air temperature. It is also necessary for the snowmelt system where the ambient temperatures will be very low.

To properly serve all heating elements (snow melt slab, radiant floor slabs, HW coils) and capitalize on the efficiency of condensing boilers, the HW system will be distributed at 120°F supply temperature and 90°F return temperature. These temperatures are valid for the coils and the snow melt slab; however, a decoupling heat exchanger or three way valve is necessary to generate an 85°F supply temperature to the radiant slabs. The full design of the heating water system will be based on minimizing complexity and maximizing efficiency.

Depending on the amount of flow necessary to the various elements served (i.e. HW coils, slab, snow melt), the system will be broken out in separate tertiary loops or combined in one full loop. This is predominantly going to be driven by the potential for freezing fluid in the snow melt slabs, in the dedicated outside air unit coils, and if the mixed air temperatures in the RTU's are low enough in the winter to constitute freezing concerns. All efforts will be made to minimize the concentration and amount of glycol necessary while still providing the freeze protection.

Heating and Cooling HVAC for Spaces

The offices, classrooms, common corridor/lobby spaces will be served via multiple appropriately zoned high efficiency single zone roof top units. These units will provide the cooling to the spaces via DX refrigeration and the heating will be provided by a heating water coil served by the central heating water system.

RTU-1 – serves the Phys Fit, Female RR, Female Locker, Male RR, Male Locker (will operate on occupancy schedule established in the BAS system, owner defined but with override capability in the space), 2,500 cfm at approximately 1.0" external static pressure loss, mixed air temperature is 83°F summer and 3°F winter, discharge air temperature is 55°F cooling and 95°F heating.

RTU-2 – serves the main Lobby and Vestibule spaces (will operate on occupancy schedule established in the BAS system), 1,300 cfm at approximately 1.0" external static pressure loss, mixed air temperature is 80.3°F summer and 59°F winter, discharge air temperature is 55°F cooling and 70°F heating (based on primary heating through the radiant slab).

RTU-3 – serves the west administrative spaces, rooms 1114-1119, (will operate on occupancy schedule established in the BAS system), 2,500 cfm at approximately 1.0" external static pressure loss, mixed air temperature is 80.2°F summer and 61°F winter, discharge air temperature is 55°F cooling and 70°F heating (based on primary heating through the radiant slab).

RTU-4 – serves the east administrative spaces, rooms 1214-1219 (will operate on occupancy schedule established in the BAS system), 2,300 cfm at approximately 1.0" external static pressure loss, mixed air temperature is 80.3°F summer and 59°F winter, discharge air temperature is 55°F cooling and 70°F heating (based on primary heating through the radiant slab).

RTU-5 – serves the two classroom spaces (will operate on occupancy schedule established in the BAS system but with override capability in the space), 2,000 cfm at approximately 1.0" external static pressure loss, mixed air temperature is 81°F summer and 42.5°F winter, discharge air temperature is 55°F cooling and 70°F heating (based on primary heating through the radiant slab).

RTU-6 – serves the administrative spaces in the "back of house" area (will operate on occupancy schedule established in the BAS system), 1,300 cfm at approximately 1.0" external static pressure loss, mixed air temperature is 80.3°F summer and 59°F winter, discharge air temperature is 55°F cooling and 70°F heating (based on primary heating through the radiant slab).

The packaged roof top units (RTU's) will all have the following options:

- R-410A Refrigerant for DX cooling with 95°F ambient air conditions
- Heating coil served by facility central Heating Water System
- 100% outdoor dry bulb air economizer controls with barometric relief
- MERV 7 (30% efficiency) Pre-Filters
- MERV 13 (85% efficiency) Final Filters
- Two-inch double wall rigid polyurethane foam panel cabinet construction with and insulation value of R-13
- Flow stations for measuring outside air volume
- Remote BAS interface terminals, digital and analog
- Electrical: 208/3/60
- EER: 13.0
- 5 year non-prorated compressor warranty

The manufacturer basis of design is currently Trane Precedent series. This model unit offers great efficiency on the cooling side and can be equipped with the HW coil for heating. The HW coils will be sized per unit based on whether it is only tempering the air during winter for ventilation (space heating accomplished with the radiant slab) or it is providing 95°-105°F air to the spaces to serve as the space heating method.

For the units serving the classroom spaces, demand control ventilation shall be utilized at the unit level with a remote mounted CO_2 sensor in both spaces.

<u>Alternate Bid Item No. 17</u>

As a requested Alternate Bid Item, the units serving the regularly occupied areas (RTU-2, 3, 4) can be modified from a packaged unit as described above to an outdoor packaged ground coupled heat pump. These units will need to be extended range heat pumps such that they function properly during rather high and rather low water temperatures. The capacity of these units remains consistent with those indicated for the typical RTU system.

Associated with this ABI will be an approximately 12-ton geothermal field (either horizontal or vertical depending on the soils report). The water will be pumped from the HVAC equipment through the geothermal interface via a manifold and pumps that will be similar to Bell & Gossett Series 90 Model 1-1/2A with a 2HP motor. For proper redundancy, two pumps shall be used in a lead/lag arrangement. This manifold and pumping area will be located in the main mechanical room with distribution piping from the geothermal interface (yet to be determined), and the equipment. The main distribution pipe size will be a 2" diameter pipe. All associated accessories for a hydronic geothermal system will also be required (appropriate isolation valves, strainers, temperature/pressure gauges and ports, VFD's for each pump to be a variable primary only pumping system, control valves, etc.).