CareFirst Cumberland

Cumberland, MD

Technical Report I

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Mechanical Option

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Executive Summary

Technical report 1 analyzes on the CareFirst Cumberland in Cumberland, MD which was completed in 2011. The CareFirst Cumberland consists of a 45,000 SF, provide 2 floors above grade. The space is mostly used for the office spaces, providing more than 200 workstations. The purpose of this report is to evaluate the CareFirst Cumberland's HVAC system, lighting, electrical distribution system, power system, and overall construction standard by American Society of Heating, Refrigerating, and Air Conditioning Engineers. ASHARE 62.1- Ventilation for Acceptable Indoor Air Quality and ASHRAE Standard 90.1-Energy Standard for Buildings was used to analyze in this report. For the ASHRAE 62.1, minimum ventilation rates to provide indoor air quality that is acceptable to human occupants and that minimizes adverse health effects were specified. For the ASHRAE 90.1, minimum equipment efficiencies for energy efficient design were provided to limitation of the building energy.

Project Background

CareFirst Cumberland relocated in new building for expansion due to lack of office spaces. VOA Architect and Venderweil, LLC. worked with sustainably energy solution of geothermal system into the CareFirst Cumberland.

Mechanical Summary

The CareFirst Cumberland has 6 different air handling units with total 21,750 CFM. Most of the space is air-conditioned with rooftop unit. The IT room has more supply air intake more it needs.

ASHRAE Standard 62.1

Section 5: Systems and Equipment

Section 5.1 - Natural Ventilation

This section is not applicable, mechanical design system for the natural ventilation is not integrated into the building.

Section 5.2 - Ventilation Air Distribution

CareFirst Cumberland is complied with the ventilation air distribution requirement. The minimum ventilation airflow requirement is discussed late in Section 6. The manual volume dampers are located to adjust supply airflow, and airflow rates are label in the design documents.

Section 5.3 - Exhaust Duct Location

For the CareFirst Cumberland, five of Rooftop electrical fans maintain a constant negative pressure though exhaust duct to prevent leaking into occupied spaces, supply, return, outdoor air ducts,

or plenums. Rooftop electrical fans are held at different external static pressure by different range of airflow.

Section 5.4 - Ventilation System Controls

All occupied space is supplied ventilation with the geothermal heat pump units that can be served cooling and heating both ways. Temperature and carbon dioxide sensor are connected into this unit to sense temperature and carbon dioxide rate of the zone. The automatic control damper programmed with the carbon dioxide sensor to maintain the minimum outdoor airflow as required by Section 6.

Section 5.5 - Airstream Surface

All airstream surfaces in equipment and ducts in the heating, ventilating, and air-conditioning system are galvanized steel that comply with ASTM A 653/A 653M. Specification states that the Fibrous-Glass duct liner is applied antimicrobial erosion-resistant coating to the interior surface of the duct to act as a moisture repellent and erosion-resistant coating. Tested by NRTL and registered by the EPA. Exhaust ductwork is made of aluminum sheet metal, test by ASTM B209, Alloy 3003, and temper H14.

Section 5.6 - Outdoor Air Intake

According to table 5-1, from section 5.6 of ASHRAE Standard 62.1, the ventilation system outdoor intakes are designed that the shortest distance from the intake to any specific potential outdoor contaminant source must equal to or greater than distance listed.

TABLE 5-1 Air Intake Minimum Separation Distance

Object	Minimum Distance, ft (m)
Significantly contaminated exhaust (Note 1)	15 (5)
Noxious or dangerous exhaust (Notes 2 and 3)	30 (10)
Vents, chimneys, and flues from combustion appliances and equipment (Note 4)	15 (5)
Garage entry, automobile loading area, or drive-in queue (Note 5)	15 (5)
Truck loading area or dock, bus parking/idling area (Note 5)	25 (7.5)
Driveway, street, or parking place (Note 5)	5 (1.5)
Thoroughfare with high traffic volume	25 (7.5)
Roof, landscaped grade, or other surface directly below intake (Notes 6 and 7)	1 (0.30)
Garbage storage/pick-up area, dumpsters	15 (5)
Cooling tower intake or basin	15 (5)
Cooling tower exhaust	25 (7.5)

Note 1: Significantly contaminated exhaust is exhaust air with significant contaminant concentration, significant sensory-irritation intensity, or offensive odor.
Note 2: Laboratory fume hood exhaust air outlets shall be in compliance with NFPA 45-1991[3] and ANSI/AIHA Z9.5-1992.[4]
Note 3: Noxious or dangerous exhaust is exhaust air with highly objectionable fumes or gases and/or exhaust air with potentially dangerous particles, bioaerosols, or gases at concentrations high enough to be considered harmful. Information on separation criteria for industrial environments can be found in the ACGIH Industrial Ventilation Manual [5] and in the *ASHRAE Handbook—HVAC Applications*.[6]
Note 4: Shorter separation distances are permitted when determined in accordance with (a) Chapter 7 of ANSI Z223.1/NFPA 54-2002[7] for fuel gas burning appliances and equipment, (b) Chapter 6 of NFPA 31-2001[8] for oil burning appliances and equipment, or (c) Chapter 7 of NFPA 211-2003[9] for other combustion appliances and equipment.
Note 5: Distance measured to closest place that vehicle exhaust is likely to be located.
Note 6: No minimum separation distance applies to surfaces that are sloped more than 45 degrees from horizontal or that are less than 1 in. (3 cm) wide.
Note 7: Where snow accumulation is expected, distance listed shall be increased by the expected average snow depth.

Outdoor air intakes are part of the mechanical ventilation system that manage rain and snow entrainment to limit water penetration to inlet area through louvers.

Section 5.7 - Local Capture of Contaminants

The discharge from noncombustion equipment that captures the contaminants generated by the equipment is directly ducted to the outdoor. The CareFirst Cumberland comply this requirement.

Section 5.8 - Combustion Air

CareFirst Cumberland mechanical room contains boiler, fuel-burning appliance, which is required to provide with sufficient air for combustion and adequate removal of combustion products. According to the drawing document, the boiler exhaust is provided.

Section 5.9 - Particulate Matter Removal

CareFirst Cumberland provide particulate matter filters or air cleaners having a minimum efficiency reporting value MERV-8 filter at the upstream and downstream in the variable-volume rooftop water source heat pump.

Section 5.10 - Dehumidification Systems

The maximum relative humidity in the CareFirst Cumberland is 50%. According to ASHRAE 62.1 section 5.10.1, occupied space relative humidity must limited to 65% or less, therefore, the CareFirst Cumberland is complied with the requirement.

Section 5.11 - Drain Pans

The drain pans are located in rooftop unit to prevent standing water and limit water droplet carryover. The length between inlet and outlet must be greater than the maximum fan suction static pressure in inches. To prevent sag and condensate overflow, the drain lines must support with lengths suggested in figure 1.

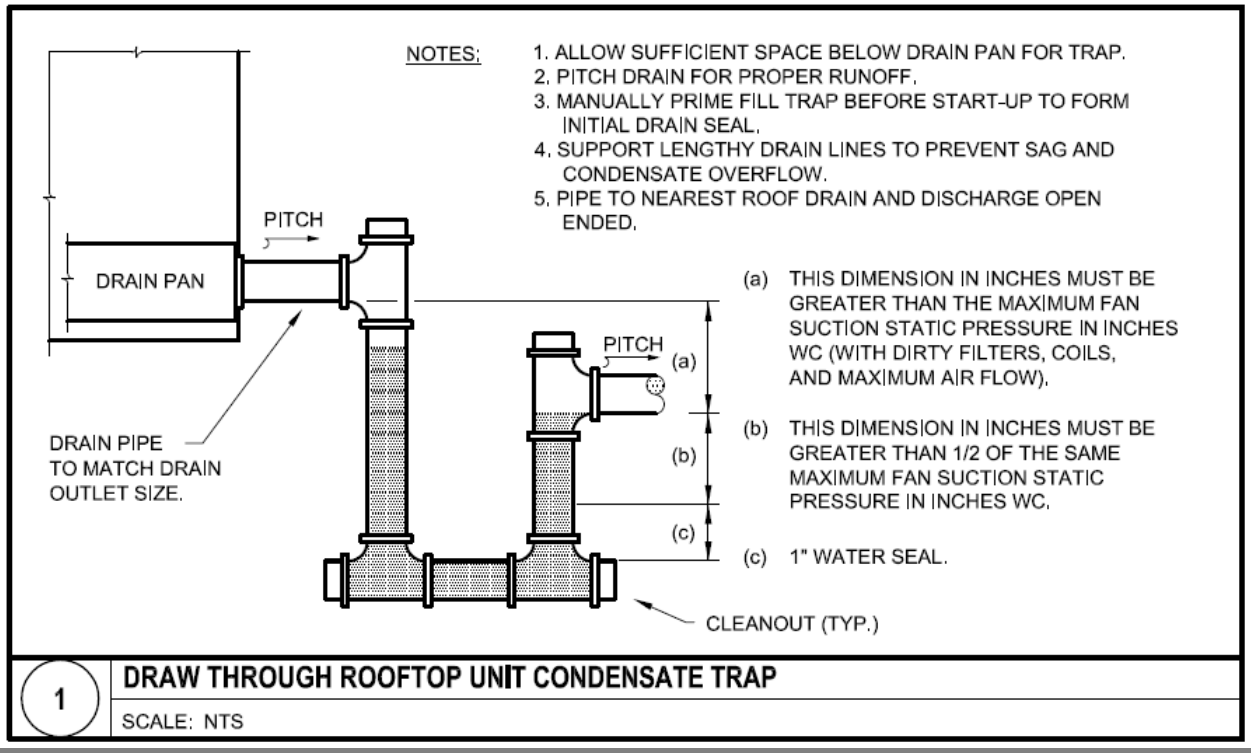

Figure 1: Drain pan in Rooftop unit

Section 5.12 – Finned-tube Coils and Heat Exchangers

According with section 5.11, a drain pan is provided beneath all dehumidifying cooling coil assemblies and all condensate-producing heat exchangers. With adequate intervening access space of 18 in, finned-tube coil cleaning is available.

Section 5.13 – Humidifiers and Water-Spray Systems

Water used for steam and direct evaporation humidifiers, air washers and other water-spray system that is originated directly from a potable source. Ductwork obstructions are installed downstream of humidifier within a distance of greater than the absorption distance recommended by the humidifier manufacturer; therefore, the design complies with this section.

Section 5.14 – Access for Inspection, Cleaning and Maintenance

All ventilation equipment in CareFirst Cumberland is installed with sufficient working space for inspection and routine maintenance. All air distribution system, including outdoor air intake areaway, plenums, drain pans, fans, and humidifiers provided convenient and unobstructed access for inspection, cleaning, and routine maintenance.

Section 5.15 – Building Envelope

All building envelope is provided with a weather barrier to prevent liquid water penetration into the envelope. For the pipes, ducts, and other surface within the building whose surface temperatures are expected to fall below the surrounding dew-point temperature is all insulated with insulating material.

Section 5.16 – Building with Attached Parking Garages

This section is not applied, since the CareFirst Cumberland does not have attached parking garages.

Section 5.17 – Air Classification Recirculation

Diazo printing equipment discharge classified as air class 4 in table 5-2 from ASHRAE Standard 62.1 Section 5.17, that contains highly objectionable fumes or gases, therefore, the air cannot be recirculated and reused, all air must exhausted to the outside. The CareFirst Cumberland's mail room complied with this section.

TABLE 5-2 Airstreams

Description	Air Class
Diazo printing equipment discharge	4
Commercial kitchen grease hoods	4
Commercial kitchen hoods other than grease	3
Laboratory hoods	4
Residential kitchen vented hoods	3

Section 5.18 – Requirements for Buildings Containing ETS Areas and ETS-Free Areas

The CareFirst Cumberland is a smoke free facility; therefore, this section does not apply.

Section 6: Ventilation Rate Procedure Analysis

According to ASHRAE 62.1, section 6, the ventilation system design consider and follow the restriction of the Ventilation Rate Procedure to prescribe the outdoor air intake rates that determined based on space type/application, occupancy level, and floor area. Based on space, the contaminant concentrations are different, because the contaminant source is from occupant, building material, or equipment.

In this section, the mechanical ventilation of the CareFirst Cumberland, rooftop units and air conditioning unit in computer rooms were analyzed. Section 6.2.1.1 complied with the CareFirst Cumberland drawing documents. Particulate matter filters of MERV-8 used in rooftop unit.

The following calculation procedure comes from ASHRAE Standard 62.1, section 6.

- The ventilation rate required in the breathing zone of the occupiable space , which can be determined with equation 6-1
  - $V_{bz}=R_p \cdot P_z + R_a \cdot A_z$ (Equation 6-1)
    - R_p = outdoor airflow rate required per person as determined from Table 6-1
    - P_z = zone population: the largest number of people expected to occupy the zone during typical usage. If P_z cannot be predicted accurately, the zone floor area and default occupant density in Table 6-1 can be used for the estimation.
    - R_a =outdoor airflow rate required per unit are as determined from Table 6-1
    - A_z = zone floor area (ft^2): the net occupiable floor area of the zone
- The outdoor airflow must determine to the zone by the supply air distribution system with equation 6-2.
  - $V_{oz}=V_{bz}/E_z$ (Equation 6-2)
    - E_z =zone air distribution effectiveness using Table 6-2

- When one air handler supplies a mixture of outdoor air and recirculated air to only one zone, outdoor air intake flow can be determine with $V_{ot}=V_{oz}$ (Equation 6-3)
  E_v =system ventilation efficiency using Table 6-3
- $Z_p=V_{oz}/V_{pz}$ (Equation 6-5)
  - Z_p =zone primary outdoor air fraction
  - V_{pz} = minimum expected primary airflow for design purposes
- $V_{ou}=D\,\Sigma_{all\ zones}(R_p \cdot P_z) + \Sigma(R_a \cdot Az)$ (Equation 6-6)
  - $D= P_s/_{\Sigma all\ zones}\,P$, occupant diversity (Equation 6-7)
    - P_s = system population
- Uncorrected outdoor air intake (V_{ou}) can be adjusted by using Equation 6-8.
  - Equation 6-8 used for the multi-zone recirculating system
    $V_{ot} =V_{ou}/E_v$ (Equation 6-8)

Appendix A is attached to show detail comparison of the design condition and the minimum ventilation requirements calculation each zone with compliance with ASHRAE Standard 62.1, section 6. The result of calculation can be found in figure 2.

AHU	Max. CFM by AHU	Min. OA required	Compliance with ASHRAE 62.1
RTU-1	9000	4260	Yes
CRAC-1	5500	150	Yes
CRAC-2	5500	150	Yes
CRAC-3	600	24	Yes
CRAC-4	600	16	Yes
AC-1	550	5	Yes

Figure 2: Results of compliance

Standard 62.1 Summary

The CareFirst Cumberland is both of section 5 and section 6 complied with ASHRAE 62.1. Since low minimum outdoor air intake required

ASHRAE Standard 90.1

Section 5: Building Envelope

Section 5.1.4 – Climate

The CareFirst Cumberland is located in Cumberland, MD which corresponds to climate zone 4A. This climate zone was determined by Table-B-1 of ASHRAE Standard 90.1-2007 or by viewing the Figure 3 below.

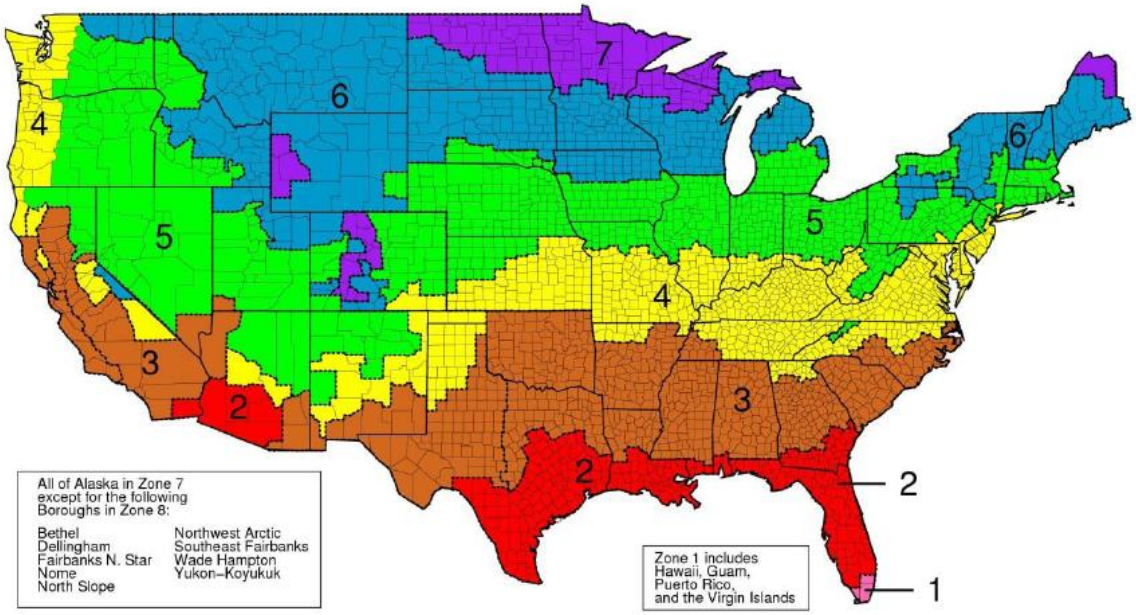

Figure 3: United States Climate Zones

Section 5.4 – Mandatory Provisions

The building envelope of the CareFirst Cumberland is sealed, caulked, gasketed, or weather-stripped to minimize air leakage in all area listed under ASHRAE 90.1, section 5.4.3.1. Building entrances that separate conditioned space from the exterior protected with an enclosed vestibule, with all doors opening into and out of the vestibule equipped with self-closing door device at a minimum distance of 7 ft when in the closed position.

Section 5.5 – Prescriptive building Envelope

The building envelope of the CareFirst Cumberland complied with section 5.5 of ASHRAE 90.1. Design heat transfer load condition of the envelope compared to values specified in ASHRAE; conclude with envelope design satisfied with the requirement.

Building Envelope Requirements For Climate Zone 4A							
Table 5.5-6		Nonresidential ASHRAE		Nonresidential Design		ASHRAE Compliant	
		Assembly Maximum	Insulation Min. R-Value	Assembly Maximum	Insulation Min. R-Value		
Opaque Elements	construction	U-value C-value F-vlaue	R-Vaule	U-value C-value F-vlaue	R-Vaule	U-value C-value F-vlaue	R-Vaule
Roof	Metal Building	0.065	20	0.045	19.8	Yes	Yes
Walls, Above-Grade	Mass	0.104	9.5	0.096	8.7	Yes	Yes
Walls, Below-Grade	Below-Grade	1.14	NA	NA	NA	NA	NA
Floor	Mass	0.087	8.3	NA	NA	NA	NA
Slab-on Grade	Unheated	0.73	NA	0.49		Yes	Yes
Opaque Doors	Swinging	0.7	NA				
Fenestration		U-Value	SHGC	U-Value	SHGC	U-Value	SHGC
Verticle Glazing	Metal Frame	0.5					

Section 6: Heating, Ventilating, and Air Conditioning

Section 6.2 – Compliance Paths

According to section 6.2, HVAC system must meet the requirement either Simplified Approach Option or Mandatory Provision; however, Simplified Approach cannot be used, since the gross floor area of the CareFirst Cumberland is greater than 25,000 ft^2.

Section 6.4 – Mandatory Provisions

The CareFirst Cumberland meets all minimum equipment efficiencies required in ASHRAE Table 6.8.1A through 6.8.1G.

Compliance with section 6.4.1.1-ASHRAE Table 6.8.1					
Condensing Boiler					
Tag	Subcategory	Size Category (Btu/h)	Minimum Efficiency	Design Efficiency	ASHRAE Compliant
B-1	Gas-Fired	>2,500,000	80%	86%	Yes

The control system consists of sensors, indicators, actuators, interface equipment, accessories, and software connected to controller to control the mechanical system of the CareFirst Cumberland. Zones are individually controlled by automatic thermostatic control. Its control has a dead band of 5

degrees complying with section 6.4.2.1.2. The HVAC air-distribution system including all supply and return duct and plenums, stated that sufficient thickness of duct liner comply with energy code.

Section 6.5 – Prescriptive Path

The climate zone 4A does not require the air or water economizer. The CareFirst Cumberland's HVAC system has a total fan system of exceeding 5 horsepower. A fan power limitation complied with Table 6.5.3.1.1A, option 2, with Table 6.5.3.1.1B fan power pressure adjusted.

Section 6.7 – Submittals

The CareFirst Cumberland received full construction documents, the record drawings of the actual installation provided to the building owner. Recording drawings include that the location and performance of data of equipment, general configuration of duct and pipe distribution system including sized, and the terminal air or water design flow rate.

Section 7: Service Water Heating

Section 7.4 – Mandatory Provisions

All water heating equipment, hot-water supply boiler meets the requirement listed in ASHRAE Table 7.8. The CareFirst Cumberland has geothermal heating system with thirty of geothermal heat pumps. Four typical geothermal heat pumps designed in different temperature and capacities.

Section 7.5 – Prescriptive Path

The CareFirst Cumberland is exclusively used for potable water heating and not used additional functions for space heating; therefore this section does not apply.

Section 8: Power

The CareFirst Cumberland designed with maximum voltage drop of feeder and branch circuit at 2% and 3%; therefore, this the building electrical distribution system is comply with ASHRAE Standard 90.1, section 8.4.1.

Section 9: Lighting

Section 9.4 – Mandatory Provisions

According to the specification, lighting in the CareFirst Cumberland is controlled with time switches, outdoor photoelectric switches, indoor occupancy sensors, and lighting contactors. For electronic time switches programmed 8 ON/OFF set points on a 24-hour schedule and an annual holiday schedule that overrides the weekly operation on holidays. To prevent the false operation, outdoor photoelectric switches operate with light-level monitoring range of 1.5 to 10 fc. Indoor occupancy sensor operates when covered area is occupied and off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 20 minutes. Beside automatic lighting sensor, manual wall-switch sensor is also provided in case of the light level is higher than the set point of the sensor.

Section 9.5 – Building Area Method compliance Path

ASHRAE 90.1, Table 9.5.1 specifies that office should have a maximum of 1.0 LPD (W/ ft^2). A study of was completed that the CareFirst Cumberland has a LPD of 0.65 complying with the ASHRAE Standard. A detailed breakdown is in Appendix C.

ASHRAE Standard 90.1 Summary

ASHRAE Standard 90.1 provides minimum requirements for the energy-efficient design of buildings except low-rise residential building. The provision of this section applied to the envelope of buildings to defined heat transfer through building. The mechanical system and equipment used in conjunction with HVAC, service water heating, electric power distribution, electric motors, and lighting.

To determine compliance of ASHRAE Standard 90.1, performance evaluation used with the supported drawing documents. The CareFirst Cumberland did not comply on every section of ASHRAE. The building envelope designed with sacrificed R-values; however, the significantly large percent in building façade was window and curtain wall.

Lighting in the CareFirst Cumberland is quite lower than limit set forth by ASHRAE. The lower LPD has high efficiency and energy-saving overall, but this can cause low light-level in the building.

A further evaluation of system performances will be conducted in Technical report 2 and 3.

REFERENCES

ANSI/AHSRAE. (2007). Standard 62.1-2007, Ventilation for Acceptable indoor Air Quality. Atlanta, GA: American Society of Heating, Refrigerating, and Air Conditioning Engineers, Inc.

ANSI/AHSRAE. (2007). Standard 90.1-2007, Energy Standard for Buildings Except Low-Rise Residential Building. Atlanta, GA: American Society of Heating, Refrigerating, and Air Conditioning Engineers, Inc.

CareFirst Cumberland. Contruction Documents. CareFirst Cumberland, Cumberland, MD.

Project Team

- Owner: CFBC Properties, LLC.
- General Contractor: Carl Belt, Inc., http://www.thebeltgroup.com/
- Architects: VOA Associates, Inc.,http://www.voa.com/
- Civil Engineer: SPECS, Consulting Engineers & Surveyors, http://www.specllc.com/
- MEP Engineer: R.G. Vanderweil Engineers, LLP,http://www.vanderweil.com/
- Structural Engineer: Tadjer Coher Edelson Associates, Inc.,http://www.tadjerco.com/

APPENDIX A

RTU-1	Zone Occupancy type	people /1000 SF	R_P	P_z	R_a	A_z	V_{bz}
	Lobby	10	5	4	0.06	385	42
	Office Spaces	5	5	168	0.06	33615	2857
	Conference Rooms	50	5	200	0.06	4000	1240
	Corridor	0	0	0	0.06	2000	120
							4260

APPENDIX B

Building:	CareFirst Cumberland									
System Tag/Name:	RTU-1 Base Building									
Operating Condition Description:										
Units (select from pull-down list)	IP									
Inputs for System	**Name**	**Units**				**System**				
Floor area served by system	As	sf				40000				
Population of area served by system (including diversity)	Ps	P	100%	diversity		448				
Design primary supply fan airflow rate	Vpsd	cfm				9,000				
OA req'd per unit area for system (Weighted average)	Ras	cfm/sf				0.06				
OA req'd per person for system area (Weighted average)	Rps	cfm/p				5.0				
Inputs for Potentially Critical zones							Potentially Critical Zones			
Zone Name	*Zone title turns purple italic for critical zone(s)*						Lobby	Office	Conference/Training	*Corridor*
Zone Tag							combined	combined		combined
Space type		Select from pull-down list					Lobbies/prefunction	Office space	Conference/meeting	Corridors
Floor Area of zone	Az	sf					385	33615	4000	2000
Design population of zone	Pz	P	(default value listed; may be overridden)				11.55	168.075	200	0
Design total supply to zone (primary plus local recirculated)	Vdzd	cfm					180	4720	4000	130
Induction Terminal Unit, Dual Fan Dual Duct or Transfer Fan?		Select from pull-down list or leave blank if N/A								
Local recirc. air % representative of ave system return air	Er									
Inputs for Operating Condition Analyzed										
Percent of total design airflow rate at conditioned analyzed	Ds	%				100%	100%	100%	100%	100%
Air distribution type at conditioned analyzed		Select from pull-down list					CS	CS	CS	CS
Zone air distribution effectiveness at conditioned analyzed	Ez						1.00	1.00	1.00	1.00
Primary air fraction of supply air at conditioned analyzed	Ep									
Results										
Ventilation System Efficiency	Ev					**0.59**				
Outdoor air intake required for system	Vot	cfm				**7854**				
Outdoor air per unit floor area	Vot/As	cfm/sf				**0.20**				
Outdoor air per person served by system (including diversity)	Vot/Ps	cfm/p				**17.5**				
Outdoor air as a % of design primary supply air	Ypd	cfm				**87%**				
Detailed Calculations										
Initial Calculations for the System as a whole										
Primary supply air flow to system at conditioned analyzed	Vps	cfm	=	VpdDs	=	9030				
UncorrectedOA requirement for system	Vou	cfm	=	Rps Ps + Ras As	=	4640				
Uncorrected OA req'd as a fraction of primary SA	Xs		=	Vou / Vps	=	0.51				
Initial Calculations for individual zones										
OA rate per unit area for zone	Raz	cfm/sf					0.06	0.06	0.06	0.06
OA rate per person	Rpz	cfm/p					7.50	5.00	5.00	0.00
Total supply air to zone (at condition being analyzed)	Vdz	cfm					180	4720	4000	130
Unused OA req'd to breathing zone	Vbz	cfm	=	Rpz Pz + Raz Az	=		109.7	2857.3	1240.0	120.0
Unused OA requirement for zone	Voz	cfm	=	Vbz/Ez	=		110	2857	1240	120
Fraction of zone supply not directly recirc. from zone	Fa		=	Ep + (1-Ep)Er	=		1.00	1.00	1.00	1.00
Fraction of zone supply from fully mixed primary air	Fb		=	Ep	=		1.00	1.00	1.00	1.00
Fraction of zone OA not directly recirc. from zone	Fc		=	1-(1-Ez)(1-Ep)(1-Er)	=		1.00	1.00	1.00	1.00
Unused OA fraction required in supply air to zone	Zd		=	Voz / Vdz	=		0.61	0.61	0.31	0.92
Unused OA fraction required in primary air to zone	Zp		=	Voz / Vpz	=		0.61	0.61	0.31	0.92
System Ventilation Efficiency										
Zone Ventilation Efficiency (App A Method)	Evz		=	(Fa + FbXs - FcZ) / Fa	=		0.90	0.91	1.20	0.59
System Ventilation Efficiency (App A Method)	Ev		=	min (Evz)	=	**0.59**				
Ventilation System Efficiency (Table 6.3 Method)	Ev		=	Value from Table 6.3	=	n/a				
Minimum outdoor air intake airflow										
Outdoor Air Intake Flow required to System	Vot	cfm	=	Vou / Ev	=	**7854**				
OA intake req'd as a fraction of primary SA	Y		=	Vot / Vps	=	**0.87**				
Outdoor Air Intake Flow required to System (Table 6.3 Method)	Vot	cfm	=	Vou / Ev	=	n/a				
OA intake req'd as a fraction of primary SA (Table 6.3 Method)	Y		=	Vot / Vps	=	n/a				
OA Temp at which Min OA provides all cooling										
OAT below which OA Intake flow is @ minimum		Deg F	=	{(Tp-dTsf)-(1-Y)*(Tr+dTr	=	52				

APPENDIX C

Fixture type	Watt	# of Lamp	Quantity	Total Watts
F1	32	2	91	5824
F2	32	2	18	1152
F3	32	2	10	640
F4	32	2	8	512
F5	26	1	5	130
A	750	3	3	6750
B	750	2	2	3000
C	750	3	3	6750
D	750	1	4	3000
E	750	2	1	1500
F	18	1	4	72
P	26	1	8	208
L	26	1	6	156
S1	42	1	2	84
S2	32	1	14	448
			Total Watt = 30226	
			LPD	0.64669762