Nassau Community College Life Sciences Building

Garden City, New York

Technical Report One

ASHRAE Standard 62.1-2007 and Standard 90.1-2007 Analysis

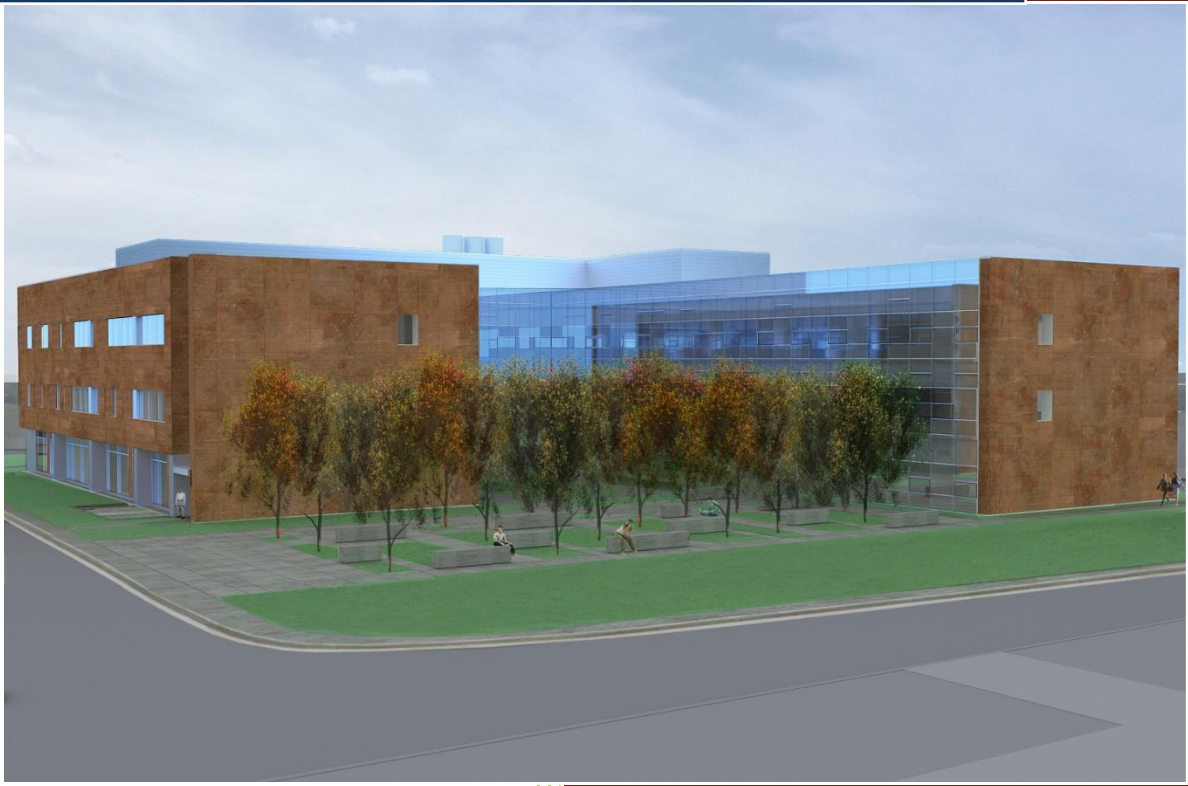

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Table of Contents

List of Tables

Executive Summary

The purpose of this report is to determine if new building on Nassau Community College's campus are incompliance with both ASHRAE Standard 62.1-2007 and Standard 90.1-2007. The Life Sciences Building is a new 72,400 square foot laboratory building that will house both the chemistry department as well as the upcoming nursing department. The building will be comprised of general lecture halls, computer labs, organic and inorganic chemistry laboratories and office spaces for the faculty.

An analysis of ASHRAE Standard 62.1-2007, Ventilation for Acceptable Indoor Air Quality, was the first standard to be evaluated. The purpose of this standard is to specify minimum ventilation rates and other means to provide acceptable indoor air quality for the building's occupants. Two of the standard's section were selected, Section 5 and Section 6. These two were selected because they are directly related to the design and specifications of the building rather than the outdoor air, operation and maintenance or construction, which may be out of the designer's control. Section 5 incorporates requirements in the building mechanical components that control indoor air quality such as outdoor intake requirements, particulate filtration and combustion air. All requirements under Section 5 were checked against the Life Sciences Building and were determined to be compliant. Section 6 diagrams a procedure in order to calculate the minimum ventilation air that is required for acceptable indoor air quality. All air handlers in the Life Sciences Building were selected or analysis for a compliance check.

ASHRAE Standard 90.1-2007, Energy Standard for Buildings Except Low-Rise Residential Buildings, was the second analysis in this report. The purpose of this standard is to provide minimum equipment efficiencies and insulation values in order to create an energy efficient design. The Life Science Building was checked against Sections 5 through 10 in this standard. Neither the building's exterior glazing to wall ratio, nor were the U-values for the exterior walls incompliance with this standard. Furthermore, efficiencies for certain fans did not meet the criteria set forth by this standard. In order to make up for the exterior glazing to wall ratio, the glazing far surpass the requirements for both SHGC and U-value. Power distribution and lighting densities were determined to be in compliance with this standard.

The Life Sciences Building has submitted its application for LEED certification and is striving for LEED Gold. Therefore, it is not surprising that where requirements failed for aesthetic purposes, like the percent glazing ratio, other requirements overachieved. This report will provide a more detailed breakdown of each section in each standard and illustrate which parts of the system fails according to the standard and which parts succeed.

Building Overview

The Nassau Community College Life Sciences Building will house the expanding Chemistry Department and rising Nursing Department. The building will be a cluster of general lecture halls, computer labs, inorganic and organic laboratories, practical skills nursing rooms and faculty offices. The Life Science Building is a “U-shape” where the courtyard façade is a floor-to-floor glass curtain wall system. Faculty offices on all three floors are facing the courtyard and can have periods of high heat transfer through the curtain wall. The classrooms, lecture halls and laboratories, are located along the opposite exterior perimeter. The façade is composed of copper rain screen panels and long strips of glazing. There may also be periods of high heat transfer through this façade, but it was designed for a high aesthetic appeal rather than thermal function.

The design of the Life Sciences Building was highly influenced by the occupants, both students and faculty, as well as its use. It was designed to easily connect to the greater campus with spaces to accommodate the overall student population, not just the Chemistry and Nursing Departments. Furthermore, function played a role in the design because of the hazardous chemical storage and waste spaces that need to be guarded under restricted access but readily available to the classrooms for learning.

Mechanical System Overview

The Life Sciences Building receives conditioned air from three air handlers located in the Penthouse. One of the air handlers is a 100 percent outdoor air unit due to the nature of the chemistry laboratories that it serves. The supply air to the laboratory spaces is exhausted through a laboratory exhaust system. Three large exhaust fans operate as one unit, which pulls contaminated air from the laboratories. Because this air handler is a 100 percent outdoor air unit, a heat recover run-around loop transfers sensible heat from the exhaust fans to the air handler to either pre-heat or pre-cool the incoming outdoor air. All three air handlers are part of a variable air volume (VAV) system with terminal reheat coils.

The Life Sciences Building as well as the Nassau Community College campus is served by a campus-wide high temperature hot water and chilled water system. The high temperature hot water creates building hot water through several heat exchangers for the perimeter radiation, fan coils, cabinet unit heaters and air handler pre-heat coils. The 100 percent outdoor air unit’s pre-heat coil uses a glycol system, which is heated via heat exchanger by the high temperature hot water system. A primary/secondary system is utilized with the chilled water and high temperature hot water systems. Booster pumps have been designed for the chilled water system in the event that there is a decrease in pressure in the primary line. The majority of the heat exchangers and pumps are located along with the service entrance in the basement mechanical equipment room.

The Central Utility Plant that serves Nassau Community College is operated by Suez Energy and is comprised of a boiler and chiller plant. This 60 MW cogeneration facility produces 250 psig steam, 270°F high temperature hot water and 42°F chilled water that are distributed to various surrounding facilities such as Nassau University Medical Center (NUMC), Nassau Veterans Memorial Coliseum and Long Island Marriott Hotel. Figure 1 below is a diagram provided by Parsons Brinckerhoff's report that shows the location of the Central Utility Plant in red as well as the steam loads in blue stars and the high temperature hot water loads in yellow stars. Nassau Community College is denoted by the dotted yellow circle. Nassau Community College uses 50.6% of the high temperature hot water and chilled water produced by the Central Utility Plant compared to all buildings tapped into the high temperature hot water service.

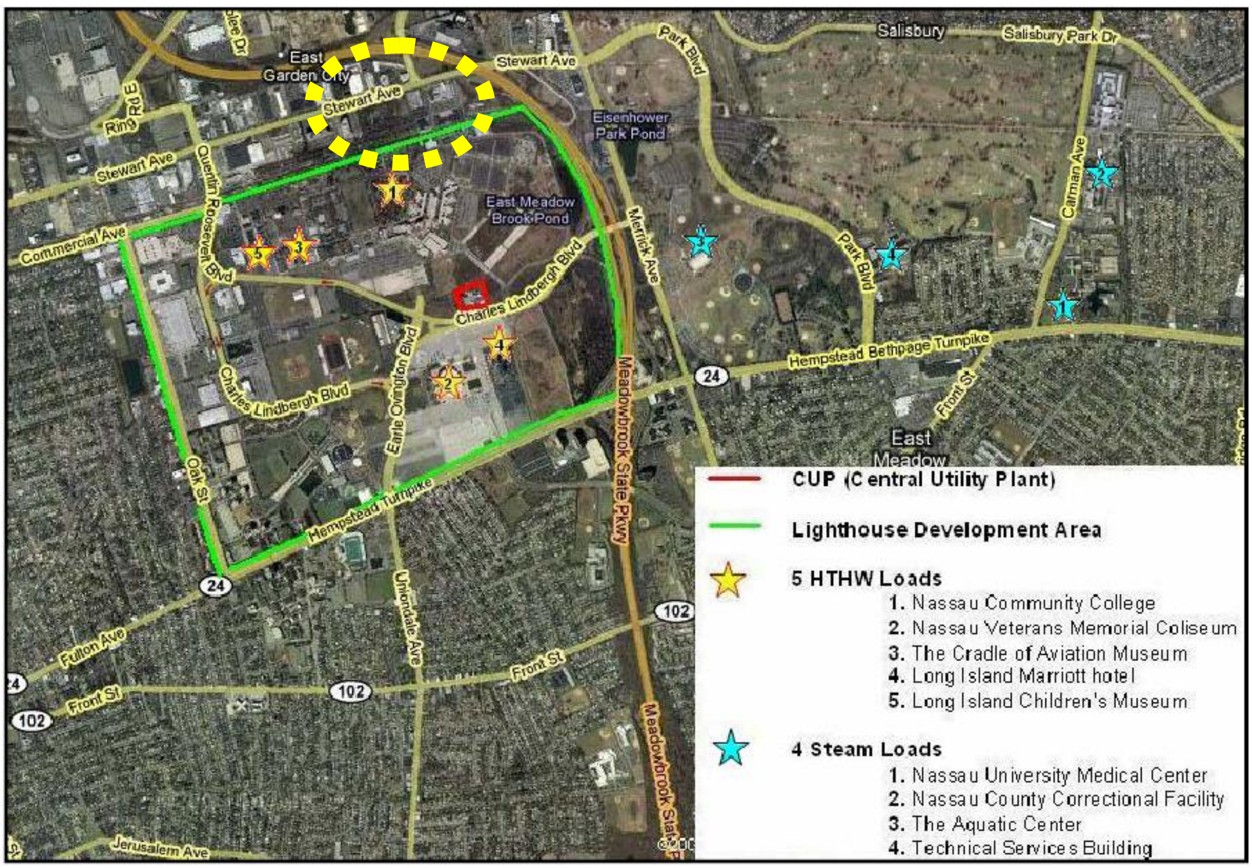

Figure 1 – Location of Central Utility Plan (Red) and NCC (Yellow)

ASHRAE Standard 62.1-2007 Analysis

Section 5 Analysis

Section 5.1 Natural Ventilation

Exterior spaces have operable windows but all spaces are ventilated mechanically. Therefore, natural ventilation is not a method of ventilation for this building.

Section 5.2 Ventilation Air Distribution

The Life Sciences Building is able to meet the minimum ventilation requirement under and load condition. The construction documents specify explicitly a minimum airflow rate through each VAV terminal unit that complies with Section 6 of Standard 62.1. The discussion of Section 6 is discussed later in this report.

Section 5.3 Exhaust Duct Location

Chemistry laboratories, hazardous chemical storage, hazardous waste storage as well as general chemical storage rooms are all ducted and negatively pressurized relative to its surroundings and exhausted through laboratory exhaust fans located in the penthouse. General exhaust ducts are specified to be negatively pressurized to 2 in. Wg. relative to the surroundings and laboratory exhaust ducts are to be 3 in. Wg. relative to the surroundings. The laboratory exhaust fans are specified to maintain an exhaust intake velocity of 4,000 FPM through the stack in order to provide the proper clearance plume.

Section 5.4 Ventilation System Controls

The mechanical ventilation controls are designed to allow reduction in airflow when the spaces within each zone are unoccupied. Being that the Life Sciences Building is partly a VAV system, the VAV terminal units have been specified on the drawings to turn down to a minimum ventilation airflow rate that is greater than the minimum requirement given in Section 6 of Standard 62.1. Therefore, the Life Sciences Building complies with this section.

Section 5.5 Airstream Surfaces

Duct liners exposed to airstreams are specified to comply with ASTM C 1071 and UL 181. ASTM C 1071 incorporates ASTM C 1338. Therefore, the Life Sciences Building complies with this section.

Section 5.6 Outdoor Air Intakes

Noxious or dangerous exhausts are more than 30’. Therefore all outdoor air intakes are more than the minimum distance apart as per Table 5-1 in Standard 62.1. The main concern is the laboratory exhausts fans, which are a minimum of 48 feet from an outdoor air intake louver. All louvers are specified to provide the appropriate rain entrainment resistance and contain a ½" bird screen mounted flush with the louver. Therefore, all outdoor air intakes comply with this section.

Section 5.7 Local Capture of Contaminants

The exhaust from spaces where contaminants could be an issue of indoor air quality in spaces such as the hazardous chemical storage or the chemical laboratory rooms are exhausted through the roof by dedicated laboratory exhaust fans.

Section 5.8 Combustion Air

The emergency generator exhaust flue is ducted and sized with the appropriate CFM through and exhaust vent on located on the roof. An adequate amount of outdoor air to ensure a complete combustion process is ducted into the emergency generator room directly from the exterior. Therefore, the Life Sciences Building complies with this section.

Section 5.9 Particulate Matter Removal

The filters located in the air handlers are specified to comply with ASHRAE Standard 52.2 and therefore comply with this section.

Section 5.10 Dehumidification Systems

The Life Sciences Building is specified to maintain a maximum relative humidity ratio of 60%. Therefore, the Life Sciences Building complies with this section. The volume of return air is specified to be less than the volume of outdoor air in order to assure a positive building pressurization.

Section 5.11 Drain Pans

Drain pans are specified to be of doubled-wall construction with the interior wall being stainless steel. The pan shall be pitched positively in two directions with a 2" minimum drain connection. Stacked cooling coils are specified to have intermediate drain pans or troughs to channel to main pan. The Life Sciences Building specifies that the drain pans to comply with ASHRAE Standard 62.1 and therefore complies with this section.

Section 5.12 Finned-Tube Coils and Heat Exchangers

Drain pans are provided beneath each cooling coil assembly as per Section 5.11. No specification has been stated regarding the minimum 18 in. access space for the perimeter finned-tube radiation.

Section 5.13 Humidifiers and Water-Spray Systems

The Life Sciences Building does not use humidifiers or water-spray systems. This section does not apply.

Section 5.14 Access for Inspection, Cleaning and Maintenance

Access doors for each air handler are specified to be at least 24" by 60" located in the proper sections to allow access to each element of the unit. Appropriate clearances have been designated on the drawings for the removal and maintenance of the coils in each air handler. Access doors have been located for variable air volume box re-heat coils. The Life Science Building complies with this section.

Section 5.15 Building Envelope and Interior Surfaces

A continuous moisture barrier is located behind exterior copper panels. For below grade walls, a continuous waterproof membrane will be used. Internal piping and ductwork that has the ability to fall below the local dew point temperature will be provided with preventative insulation. The Life Science Building complies with this section.

Section 5.16 Buildings with Attached Parking Garages

No parking structure is attached to the Life Sciences Building. This section does not apply.

Section 5.17 Air Classification and Recirculation

Part of the Life Sciences Building is Class 1 air, which is returned via plenum return from the offices, lecture rooms and general classrooms. This air can be re-circulated back into the building. Class 2 air from the restrooms and janitor's closets are ducted separately from other systems through a dedicated general exhaust system up through the roof. The chemistry laboratory, hazardous chemical storage, hazardous waste storage spaces contain Class 4 air by design and are isolated through a laboratory exhaust system up through the roof.

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

The Life Science Building is applying for LEED certification and therefore is a non-smoking facility. This section does not apply.

Section 6 Analysis

For the purpose of verifying the ventilation and exhaust requirements of ASHRAE Standard 62.1 Section 6, all air handlers (AHU-1, AHU-2 and AHU-3) were selected for the analysis. Each air handler is not restricted to one floor of the building, and due to the variety of different spaces it was beneficial to analyze all spaces requiring ventilation. The following are the sets of equations based on ASHRAE Standard 62.1-2007 Section 6 that are required for this analysis.

Ventilation Rate Procedure

Note: All tables and equations in this section refer to those found in ASHRAE Standard 62.1-2007

Breathing Zone Outdoor Airflow (V_{bz}):

$$V_{bz} = R_{p+} \cdot P_z + R_a \cdot A_z \qquad \text{(Eq. 6-1)}$$

where,
A_z = zone floor area (ft^2)
P_z = zone population, the largest number of people expected to occupy the zone during typical usage. (Estimated values found in Table 6-1)
R_p = outdoor airflow rate per person (CFM/person) (Values found in Table 6.1)
R_a = outdoor airflow rate per unit area (CFM/ft^2) (Values found in Table 6.1)

Zone Air Distribution Effectiveness (E_z):

$$E_z = 1 \qquad \text{(Determined from Table 6-2)}$$

Zone Outdoor Airflow (V_{oz}):

$$V_{oz} = V_{bz} / E_z \qquad \text{(Eq. 6-2)}$$

Primary Outdoor Air Fraction (Z_p):

$$Z_p = V_{oz} / V_{pz} \qquad \text{(Eq. 6-5)}$$

System Ventilation Efficiency (E_v):

E_v is found in Table 6-3based on the maximum Z_p value

Uncorrected Outdoor Air Intake (V_{ou}):

$$V_{ou} = D \cdot \Sigma_{all\ zones}(R_p \cdot P_z) + \Sigma_{all\ zones}(R_a \cdot A_z) \qquad \text{(Eq. 6-6)}$$

Occupant Diversity (D):

$$D = P_s / \Sigma_{all\ zones} P_z \qquad \text{(Eq. 6-7)}$$

where,
P_s = system population

Outdoor Air Intake (V_{ot}):

$$V_{ot} = V_{ou} / E_v \quad \text{(Eq. 6-8)}$$

Appendix A contains the spreadsheet for each air handler used to calculate the ventilation based on the method described. For the majority of spaces occupancies were not calculated based on ASHRAE Standard 62.1 Table 6-1. Rather the design assumptions for occupancies were used when known. Furthermore, restrooms were categorized as janitor closets for the purpose of the spreadsheet because of the high airflow rate per square foot that would be necessary for ventilation. The vending area was categorized as a coffee station based on the assumptions put forth by the design team.

Appendix B provides a summary of each space grouped by air handler and illustrates its compliance with ASHRAE Standard 62.1-2007 Section 6 based on design airflow rates and minimum required airflow rates. As specified by the drawings, air handlers AHU-1 and AHU-2 are to supply a minimum of 12,775 CFM of outdoor air, which equates to 40 percent of the total supply airflow at the design condition. The ventilation rate procedure of Section 6 requires a minimum of 9,700 and 4,850 CFM of outdoor air for air handlers AHU-1 and AHU-2 respectively. Air handler AHU-3 is a 100 percent outdoor air unit, which supplies the laboratory spaces. The ventilation requirements for these spaces are far surpassed by the quantity supply air that has been designed. This calculation illustrates that the cooling design load quantity of supply air id the determining factor for the amount of airflow delivered to each space being served by AHU-3.

ASHRAE Standard 62.1-2007 Summary

The HVAC design of the Life Sciences Building surpasses the requirements of Section 5 where the Section is applicable. The Life Sciences Building is applying for LEED certification, which effects the design considerations from the beginning.

The minimum ventilation requirements of Section 6 are exceeded in the design of Life Sciences Building. Two of the air handlers provide 40 percent of the supply air as outdoor at the design condition, which is more than the required ratio mandated by Section 6. The third air handler is a 100 percent outdoor air unit, which is designed to meet both the ventilation requirements and the room cooling loads. The 100 percent outdoor air unit will provide the laboratory and hazardous storages spaces with a safer environment.

ASHRAE Standard 90.1-2007 Analysis

Section 5 – Building Envelope

5.1.4 Climate Zone

The climate zone for Nassau Community College Life Sciences Building is located in Garden City, NY on Long Island, which corresponds to zone 4A. Zone 4A is defined by having mixed weather conditions as well as experiencing periods of high humidity. The climate zone was determined using Table B-1 in ASHRAE Standard 90.1-2007 or by viewing Figure 2 below.

Figure 2 – United States Climate Regions

5.4 Mandatory Provisions

The exterior envelope of the Life Sciences Building is specified on the drawings to be sealed where exterior door frames, fenestration and the copper rain screen panels join in order to prevent infiltration of unconditioned air.

The two building entrance to the Life Sciences Building contain vestibules that provide a barrier between the interior conditioned space and the exterior. The smallest of the vestibules has a distance of 10 feet between the exterior and interior doors, which is greater than the mandated 7 feet.

5.5 Prescriptive Building Envelope

The prescriptive building envelope method was used to determine the Life Sciences Building's compliance with Standard 90.1's building envelope requirements. Located in Table 5.5-4 in

Standard 90.1 are values corresponding to maximum U-values, R-values, C-values, F-values and SHGC for the appropriate assemblies. Standard 90.1 mandates that no more than 40% of a building's façade may be comprised of vertical fenestration as compared to exterior wall area. The summary of Standard 90.1's requirements and the Life Sciences Building's design can be viewed in Tables 2 through 4 below.

	Glazing Area (ft^2)	Wall Area (ft^2)	Percent Glazing	Standard 90.1 Compliance (Y/N)
Life Science Building	16,901	42,084	40.16%	N

Table 1 – Total Building Glazing Area

The Life Sciences Building does not comply with Standard 90.1. This is due to the large storefront windows on the first floor that increase the aesthetic appeal of the building. Furthermore, the courtyard side of the building that houses the faculty offices contains a glass curtain wall that stretches from the ground to the third floor. This is to accommodate the faculty who contribute to the operations and education of the campus. The Life Sciences Building would only need a small adjustment in the windows for the smaller teaching classrooms in order to meet Standard 90.1 requirements

Exterior Materials		Prescribed Nonresidential		Prescribed Nonresidential		Standard 90.1 Compliance (Y/N)
Element	Element Construction	Assembly Maximum	Insulation Minimum	Assembly Maximum	Insulation Minimum	
Roof	Insulation Entirely above Deck	U-0.048	R-20.0 c.i.	U-0.06811	R-14.7	Y
Walls, Above Grade	Steel-Framed	U-0.064	R-9.5 c.i.	U-0.04678	R-21.4	N
Walls, Below Grade	Below-Grade Wall	C-1.140	NR	C-1.33	NR	N
Slab-On- Grade Floors	Unheated	F-0.730	NR	F-0.36	NR	Y

Table 2 - Building Material Properties

Two of the exterior façade elements do not meet the requirements of Standard 90.1. The walls above grade as well as the walls below grade do not have the resistance required. The walls below grade to not pass because of the lack of insulation required. The above grade walls do not meet Standard 90.1 because the composition was selected based on aesthetics rather than function. In order to compensate for the thermal loss through the above grade walls, the curtain walls and windows far surpass the requirements for maximum U-value and maximum SHGC as seen in Table 4 below.

Fenestration	Prescribed Nonresidential		Actual Design Assembly		Standard 90.1 Compliance (Y/N)
	Maximum U-Value	Maximum SHGC	Maximum U-Value	Maximum SHGC	
Metal Framing	U-0.50	SHGC-0.40	U-0.28	SHGC-0.27	Y

Table 3 - Building Fenestration Properties

Section 6 – Heating, Ventilating, and Air Conditioning

6.2 Compliance Path

Two methods are described in Standard 90.1 in order to evaluate the efficiency of the overall building mechanical system – the Simplified Approach Option or the Mandatory Provisions method.

6.3 The Simplified Approach Option for HVAC Systems

The Simplified Approach Option can be used if the building is two stories or fewer in height and in the gross floor area is less than 25,000 square feet. Since the Life Sciences Building does not meet either of those conditions, the Mandatory Provisions method will be used in this analysis.

6.4 Mandatory Provisions

The Life Science building is has zone thermostats to control both the heating and cooling space temperature. The thermostatic controls respond with an accuracy ranging from ±2°F to ±5°F. In order to prevent setpoint overlap, the thermostat will call for heat when the outdoor air temperature falls below 50°F. An outdoor air temperature below 50°F will activate the perimeter finned tube radiation and decrease the quantity of CFM supplied from the air handler to the zone.

The thermostat is also controlled by periods of occupancy based on a carbon dioxide sensor. During occupied hours the space is to maintain a temperature of 72°F. When unoccupied, the setpoint is between 68°F and 76°F to keep the space occupant ready. When the air handler is off, the space temperature will be maintained at a 55°F minimum

In the event of a fire alarm emergency, the ventilation dampers at the top of the elevator shaft are programmed to open. During all other operating modes, the elevator shaft vent is normally closed. The air handlers will shut down upon receiving a fire alarm signal. In a smoke purge situation, the air handlers operate both the return and supply fan at full capacity in full exhaust, which draws in 100 percent outdoor air to purge smoke.

Insulation for supply and return ductwork is dependent on location and use. All exterior ductwork must be insulated regardless of its use. Return ductwork is insulated in mechanical equipment rooms. Supply ductwork is insulated between the fan discharge and terminal outlet.

The outdoor air intake ductwork between the air entrance and fan inlet shall be insulated. The emergency generator exhaust will be insulated for safety due to the extremely hot temperatures of combustion. Sizes for ductwork insulation can be viewed in Table 5. All piping supply and return lines are insulated regardless of service. Make-up water and condensate drain piping is also insulated. A summary of the Life Sciences Building's piping insulation thickness can be seen in Table 6.

Ductwork Insulation Thickness		
Duct Location	Insulation Material	
	Rigid Fiberglass	Flexible Fiberglass
Interior	2"	2"
Exterior	3"	N/A

Table 4 - Ductwork Insulation Thickness

Pipe Insulation Thickness				
Service	Material	<1"	1" – 1¼"	1½" – 6"
Chilled Water (40°F - Ambient)	Fiberglass	1"	2"	2"
	Cellular Glass	1"	2"	2"
Hot Water (<250°F)	Fiberglass	1"	2"	2"

Table 5 – Pipe Insulation Thickness

Duct seam and joint sealing is specified as per the Sheet Metal and Air Conditioning Contractors' National Association (SMACNA) and is also designed to meet the requirements of Standard 90.1.

6.5 Prescriptive Path

Of the three air handlers serving the Life Sciences Building, one is a 100% outdoor air unit. The two remaining air handlers have the capability to provide up to 100% of the design supply air quantity as outdoor air for cooling. Outdoor air dampers are specified to return to minimum outdoor air position when the outside air is 55°F, which is not among the acceptable control types for high-limit shutoff. The normal outdoor air fraction of supply air is 50%.

Based on the Motor Nameplate Horsepower method of calculating fan system power limitations, Table 7 provides a summary of which fans in the Life Sciences Building comply with the maximum allowable motor horsepower for a given airflow rate. It is worth noting that E/F-9 A, B, C complies with Standard 90.1 even though it is a laboratory exhaust fan serving fume hoods on the second floor. Furthermore, E/F-9 A, B, C contains a heat recovery run-around loop that recovers sensible heat, which preconditions make-up air entering the air handler.

Fan Compliance				
Unit	HP	CFM	CFM x 0.0015	90.1 Compliance
AHU-1 Supply	40	25,550	38.32	N
AHU-2 Supply	40	25,550	38.32	N
AHU-3 Supply	30	24,000	36	Y
AHU-1 Return	15	25,550	38.32	Y
AHU-2 Return	15	25,550	38.32	Y
E/F-1	¼	1,367	2.05	Y
E/F-3	¼	1,367	2.05	Y
E/F-4	1/6	1,095	1.64	Y
E/F-5	1/6	1,095	1.64	Y
E/F-6	2	4,500	6.75	Y
E/F-7	3	6,500	9.75	Y
E/F-8	1 ½	4,050	6.08	Y
E/F-9 A,B,C	20	24,050	36.08	Y

Table 6 – Life Sciences Building Fan

6.7 Submittals

A complete set of construction documents including operating manuals and sequence of operation will be handed to Nassau Community College upon completion of the Life Sciences Building. There will also be a balancing report of both the air and hydronic systems. The Life Sciences Building has submitted an application for LEED certification, therefore commissioning will we completed at the end of construction.

Section 7 – Service Water Heating

The Life Sciences Building does not contain combustion equipment for service water heating. Hot water that is supplied to the air handlers, perimeter radiation and to other various hydronic heating equipment is produced via heat exchanger by campus provided high temperature hot water. The sole combustion element of the mechanical system is the emergency generator that does not produce hot water in the event of an emergency.

Section 8 – Power

The Life Sciences Building electrical system is specified to comply with the National Electric Code (NEC), which states that feeder conductors are to have a maximum voltage drop of 2% and a maximum branch voltage drop of 3% at the design load condition. Therefore, the Life Sciences Building complies with this section. Furthermore, the construction drawings, including the single-line diagrams of the building electrical distribution as well as the floor plans, along with operating and maintenance manuals will be turned over to Nassau Community College at the completion of construction.

Section 9 – Lighting

9.2 Compliance Path

In Standard 90.1 there are two different methods to determine the compliance of the Life Sciences Building with the maximum lighting power density: the Building Area Method or the Space-by-Space Method. The Building Area Method involves totaling up the power consumed by all lighting fixtures used in the building during normal operating hours and dividing by the total building area. The Building Area Method will be used for this analysis.

9.4 Mandatory Provisions

The Life Sciences Building contains occupancy sensors in all spaces. The sensors are combined with locally controlled switches for each space.

9.5 Building Area Method Compliance Path

The Life Sciences Building falls into the category of school/university on ASHRAE Standard 90.1 Table 9.5.1. The Lighting Power Density (LPD) is designated to be no higher than 1.2 W/ft^2 for this category. Table 8 below gives a summary of the breakdown of the lighting density for the Life Sciences Building by providing the number of each fixture per floor and the number of Watts per each fixture. The calculated W/ft^2 is 0.90, which is well below the mandated maximum of 1.2 W/ft^2.

Lighting Density Compliance							
Fixture	Basement	1st	2nd	3rd	Penthouse	W/fixt.	Total W
FK1	-	29	32	32	-	63	5859
FK2	-	46	62	85	-	63	12159
FK3	-	-	-	101	-	63	6363
FL2	1	-	-	-	-	79	79
FL3	-	1	-	-	-	79	79
FL4	3	10	7	7	2	79	2291
FL5	-	-	-	-	1	63	63
FN1	-	22	22	22	-	63	4158
FN2	-	4	4	4	-	63	756
FN3	-	19	12	12	-	63	2709
FP1	-	30	-	-	-	63	1890
FP2	-	-	25	-	-	63	1575
FP5	-	24	-	-	-	63	1512
FP6	-	24	-	-	-	63	1512
FP7	-	-	26	-	-	63	1638
FP8	-	-	24	-	-	63	1512
FR4	15	-	-	-	-	79	1185
FR5	62	4	4	4	40	79	9006
FR6	-	4	-	-	-	79	316
FT6	-	-	7	-	-	117	819
PB1	-	36	38	20	-	26	2444
PU2	2	-	-	-	-	26	52
PU3	6	-	-	-	-	42	252
			Total=				58229
			Building Area =				64,563
			W/SF =				0.90
			Standard 90.1 Compliant (Y/N)				Y

Table 7 – Life Sciences Building Power Density

Section 10 – Other Equipment

All other pieces of mechanical equipment that have electrical motors are subject to this section, which defines minimum efficiencies for motors based upon rated horsepower and motor speed. There are a series of pumps used in the Life Sciences Building, none of which comply with the required minimum efficiencies of this section. Of the motors listed in Table 9, all utilize variable frequency drives (VFD) except pumps P-5, P-6A, B and P-11. Heat recovery pump P-11 does not have a VFD due to the nature of its operation. Pump P-11 is specified to operate continuously at a constant speed whenever the outside air temperature is below 55°F or above 80°F. Furthermore, all pumps serving air hander pre-heat coils operate in the same manner; when the outside air temperature is below 55°F, they run at constant speed.

Pump Motor Efficiency Compliance						
Pump	Service	HP	Efficiency	RPM	Min. Efficiency	Standard 90.1 Compliance
P-1, 2	CHW Booster	15	82.4	1750	91	N
P-3, 4	CHW Service	15	82.8	1750	91	N
P-5	Glycol	1.5	66.5	1750	84	N
P-6A, B	AHU-Circulation	3/4	62.4	1750	-	N
P-7, 8	Radiation	5	65.8	1750	87.5	N
P-9, 10	Re-heat	3	62.6	1750	86.5	N
P-11	Heat Recovery	2	69.2	1750	84	N

Table 8 – Life Sciences Building Pump Motor Efficiency Compliance

ASHRAE 90.1-2007 Summary

In order to determine compliance with ASHRAE Standard 90.1-2007, the prescriptive performance evaluation method was used for all sections. All things considered, the Life Sciences Building complies with this standard with some minor exceptions. The two major failures, according to Standard 90.1, are the overall glazing percentage of exterior wall area and exterior wall U-values and fan power usage.

The overall glazing percentage is over the acceptable limit by only a fraction of a percent and could be corrected with a slight sacrifice to aesthetics. The exterior walls, both above and below grade, have U-values that fall below the maximum. The walls above grade are constructed of copper rain screen panels and metal studs with a layer of insulation. This construction serves as a more aesthetic appeal rather than a functional thermal boundary. However, the large glazing areas have U-values and SHGC's that far surpass the requirements of this standard. The increase in thermal properties for the exterior glazing is to compensate for the below minimum requirements of the walls.

The supply fans for air handlers AHU-1 and AHU-2 are the only two fans that do not comply with this standard. These fans have a high external static pressure to overcome due to the long runs of ductwork to the building's extremities. A small adjustment in ductwork sizing and routing would allow for the supply fan to overcome a smaller external pressure drop. The return fans for these respective units are used for a plenum return, which is why their power requirements are much less.

The Life Sciences Building has submitted is application for LEED certification with a maximum of 69 potential points, which would yield a LEED Platinum rating. As a result, energy efficiency was a major design consideration where the majority of ASHRAE Standard 90.1 was followed. With a few minor adjustments, the Life Science Building would be compliant in all aspects of ASHRAE Standard 90.1.

References

ANSI/ASHRAE. (2007). *Standard 62.1 – 2007, Ventilation for Acceptable Indoor Air Quality*. Atlanta, GA: American Society of Heating Refrigeration and Air Conditioning Engineers, Inc.

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

Cannon Design. Architectural Construction Documents. Cannon Design, New York, NY.

Cannon Design. Electrical Construction Documents. Cannon Design, New York, NY.

Cannon Design. Mechanical Construction Documents. Cannon Design, New York, NY.

Appendix A – Minimum Ventilation Calculation

	Name	Units		System							
Building:	Nassau Community College Life Sciences Building										
System Tag/Name:	AHU-1										
Operating Condition Description:	Design Peak Cooling Load Condition										
Units (select from pull-down list)	IP										
Inputs for System	**Name**	**Units**		**System**							
Floor area served by system	As	sf		19053							
Population of area served by system (including diversity)	Ps	P	100% diversity	328							
Design primary supply fan airflow rate	Vpsd	cfm		27,500							
OA req'd per unit area for system (Weighted average)	Ras	cfm/sf		0.08							
OA req'd per person for system area (Weighted average)	Rps	cfm/p		8.0							
Inputs for Potentially Critical zones											
Zone Name			*Zone title turns purple italic for critical zone(s)*		*Lobby*	Corridor #2	Group Study	General Classroom	General Classroom	General Classroom	Chem. Computer
Zone Tag					First 17 Lobbies	First 19 Corridors	Frist 20 Classrooms (age 9 plus)	First 21 Lecture classroom	First 22 Lecture classroom	First 23 Lecture classroom	First 24 Computer lab
Space type			Select from pull-down list								
Floor Area of zone	Az	sf			375	451	1018	1181	755	761	989
Design population of zone	Pz	P	(default value listed; may be overridden)		10	0	35.63	36	24	24	25
Design total supply to zone (primary plus local recirculated)	Vdzd	cfm			100	200	1600	1950	1200	1100	1800
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%	100%	100%	100%
Air distribution type at conditioned analyzed			Select from pull-down list		CS	CS	CS	CS	CS	CS	CS
Zone air distribution effectiveness at conditioned analyzed	Ez				1.00	1.00	1.00	1.00	1.00	1.00	1.00
Primary air fraction of supply air at conditioned analyzed	Ep										
Results											
Ventilation System Efficiency	Ev			0.42							
Outdoor air intake required for system	Vot	cfm		9687							
Outdoor air per unit floor area	Vot/As	cfm/sf		0.51							
Outdoor air per person served by system (including diversity)	Vot/Ps	cfm/p		29.5							
Outdoor air as a % of design primary supply air	Ypd	cfm		35%							
Detailed Calculations											
Initial Calculations for the System as a whole											
Primary supply air flow to system at conditioned analyzed	Vps	cfm	= VpdDs =	27500							
UncorrectedOA requirement for system	Vou	cfm	= Rps Ps + Ras As =	4113							
Uncorrected OA req'd as a fraction of primary SA	Xs		= Vou / Vps =	0.15							
Initial Calculations for individual zones											
OA rate per unit area for zone	Raz	cfm/sf			0.06	0.06	0.12	0.06	0.06	0.06	0.12
OA rate per person	Rpz	cfm/p			5.00	0.00	10.00	7.50	7.50	7.50	10.00
Total supply air to zone (at condition being analyzed)	Vdz	cfm			100	200	1600	1950	1200	1100	1800
Unused OA req'd to breathing zone	Vbz	cfm	= Rpz Pz + Raz Az =		72.5	27.1	478.5	340.9	225.3	225.7	368.7
Unused OA requirement for zone	Voz	cfm	= Vbz/Ez =		73	27	478	341	225	226	369
Fraction of zone supply not directly recirc. from zone	Fa		= Ep + (1-Ep)Er =		1.00	1.00	1.00	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	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	1.00	1.00	1.00
Unused OA fraction required in supply air to zone	Zd		= Voz / Vdz =		0.73	0.14	0.30	0.17	0.19	0.21	0.20
Unused OA fraction required in primary air to zone	Zp		= Voz / Vpz =		0.73	0.14	0.30	0.17	0.19	0.21	0.20
System Ventilation Efficiency											
Zone Ventilation Efficiency (App A Method)	Evz		= (Fa + FbXs - FcZ) / Fa =		0.42	1.01	0.85	0.97	0.96	0.94	0.94
System Ventilation Efficiency (App A Method)	Ev		= min (Evz) =	0.42							
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 =	9687							
OA intake req'd as a fraction of primary SA	Y		= Vot / Vps =	0.35							
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 =	24							

Building:	Nassau Community College Life Sciences Building										
System Tag/Name:	AHU-1										
Operating Condition Description:	Design Peak Cooling Load Condition										
Units (select from pull-down list)	IP										
Inputs for System	**Name**	**Units**			**System**						
Floor area served by system	As	sf			19053						
Population of area served by system (including diversity)	Ps	P	100% diversity		328						
Design primary supply fan airflow rate	Vpsd	cfm			27,500						
OA req'd per unit area for system (Weighted average)	Ras	cfm/sf			0.08						
OA req'd per person for system area (Weighted average)	Rps	cfm/p			8.0						
Inputs for Potentially Critical zones											
Zone Name						Corr. #3	Fac. Office	Fac. Office	Fac. Office	Fac. Office	Fac. Office	Fac. Office
Zone Tag			*Zone title turns purple italic for critical zone(s)*			First 26	First 27	First 28	First 29	First 30	First 31	First 32
Space type			Select from pull-down list			Corridors	Office space	Office space	Office space	Office space	Office space	Office space
Floor Area of zone	Az	sf				622	109	105	105	105	105	105
Design population of zone	Pz	P	(default value listed; may be overridden)			0	1	1	1	1	1	1
Design total supply to zone (primary plus local recirculated)	Vdzd	cfm				350	350	325	325	325	325	325
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%	100%	100%	100%
Air distribution type at conditioned analyzed			Select from pull-down list			CS	CS	CS	CS	CS	CS	CS
Zone air distribution effectiveness at conditioned analyzed	Ez					1.00	1.00	1.00	1.00	1.00	1.00	1.00
Primary air fraction of supply air at conditioned analyzed	Ep											
Results												
Ventilation System Efficiency	Ev				0.42							
Outdoor air intake required for system	Vot	cfm			9687							
Outdoor air per unit floor area	Vot/As	cfm/sf			0.51							
Outdoor air per person served by system (including diversity)	Vot/Ps	cfm/p			29.5							
Outdoor air as a % of design primary supply air	Ypd	cfm			35%							
Detailed Calculations												
Initial Calculations for the System as a whole												
Primary supply air flow to system at conditioned analyzed	Vps	cfm	= VpdDs	=	27500							
UncorrectedOA requirement for system	Vou	cfm	= Rps Ps + Ras As	=	4113							
Uncorrected OA req'd as a fraction of primary SA	Xs		= Vou / Vps	=	0.15							
Initial Calculations for individual zones												
OA rate per unit area for zone	Raz	cfm/sf				0.06	0.06	0.06	0.06	0.06	0.06	0.06
OA rate per person	Rpz	cfm/p				0.00	5.00	5.00	5.00	5.00	5.00	5.00
Total supply air to zone (at condition being analyzed)	Vdz	cfm				350	350	325	325	325	325	325
Unused OA req'd to breathing zone	Vbz	cfm	= Rpz Pz + Raz Az	=		37.3	11.5	11.3	11.3	11.3	11.3	11.3
Unused OA requirement for zone	Voz	cfm	= Vbz/Ez	=		37	12	11	11	11	11	11
Fraction of zone supply not directly recirc. from zone	Fa		= Ep + (1-Ep)Er	=		1.00	1.00	1.00	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	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	1.00	1.00	1.00
Unused OA fraction required in supply air to zone	Zd		= Voz / Vdz	=		0.11	0.03	0.03	0.03	0.03	0.03	0.03
Unused OA fraction required in primary air to zone	Zp		= Voz / Vpz	=		0.11	0.03	0.03	0.03	0.03	0.03	0.03
System Ventilation Efficiency												
Zone Ventilation Efficiency (App A Method)	Evz		= (Fa + FbXs - FcZ) / Fa	=		1.04	1.12	1.11	1.11	1.11	1.11	1.11
System Ventilation Efficiency (App A Method)	Ev		= min (Evz)	=	0.42							
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	=	9687							
OA intake req'd as a fraction of primary SA	Y		= Vot / Vps	=	0.35							
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	=	24							

Building:	Nassau Community College Life Sciences Building										
System Tag/Name:	AHU-1										
Operating Condition Description:	Design Peak Cooling Load Condition										
Units (select from pull-down list)	IP										
Inputs for System	**Name**	**Units**		**System**							
Floor area served by system	As	sf		19053							
Population of area served by system (including diversity)	Ps	P	100% diversity	328							
Design primary supply fan airflow rate	Vpsd	cfm		27,500							
OA req'd per unit area for system (Weighted average)	Ras	cfm/sf		0.08							
OA req'd per person for system area (Weighted average)	Rps	cfm/p		8.0							
Inputs for Potentially Critical zones											
Zone Name					Corr. #2	Chem. Admin Suite	Director's Office	Conf. Room	Fac. Office	Fac. Office	Fac. Office
			Zone title turns purple italic for critical zone(s)								
Zone Tag					Second 18	Second 20	Second 20A	Second 20C	Second 26	Second 27	Second 28
Space type			Select from pull-down list		Corridors	Office space	Office space	Conference/meeting	Office space	Office space	Office space
Floor Area of zone	Az	sf			598	299	174	247	109	105	105
Design population of zone	Pz	P	(default value listed; may be overridden)		0	4	1	12	1	1	1
Design total supply to zone (primary plus local recirculated)	Vdzd	cfm			250	350	175	500	350	325	325
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				[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Inputs for Operating Condition Analyzed											
Percent of total design airflow rate at conditioned analyzed	Ds	%		100%	100%	100%	100%	100%	100%	100%	100%
Air distribution type at conditioned analyzed			Select from pull-down list		CS	CS	CS	CS	CS	CS	CS
Zone air distribution effectiveness at conditioned analyzed	Ez				1.00	1.00	1.00	1.00	1.00	1.00	1.00
Primary air fraction of supply air at conditioned analyzed	Ep										
Results											
Ventilation System Efficiency	Ev			0.42							
Outdoor air intake required for system	Vot	cfm		9687							
Outdoor air per unit floor area	Vot/As	cfm/sf		0.51							
Outdoor air per person served by system (including diversity)	Vot/Ps	cfm/p		29.5							
Outdoor air as a % of design primary supply air	Ypd	cfm		35%							
Detailed Calculations											
Initial Calculations for the System as a whole											
Primary supply air flow to system at conditioned analyzed	Vps	cfm	= VpdDs =	27500							
UncorrectedOA requirement for system	Vou	cfm	= Rps Ps + Ras As =	4113							
Uncorrected OA req'd as a fraction of primary SA	Xs		= Vou / Vps =	0.15							
Initial Calculations for individual zones											
OA rate per unit area for zone	Raz	cfm/sf			0.06	0.06	0.06	0.06	0.06	0.06	0.06
OA rate per person	Rpz	cfm/p			0.00	5.00	5.00	5.00	5.00	5.00	5.00
Total supply air to zone (at condition being analyzed)	Vdz	cfm			250	350	175	500	350	325	325
Unused OA req'd to breathing zone	Vbz	cfm	= Rpz Pz + Raz Az =		35.9	37.9	15.4	74.8	11.5	11.3	11.3
Unused OA requirement for zone	Voz	cfm	= Vbz/Ez =		36	38	15	75	12	11	11
Fraction of zone supply not directly recirc. from zone	Fa		= Ep + (1-Ep)Er =		1.00	1.00	1.00	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	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	1.00	1.00	1.00
Unused OA fraction required in supply air to zone	Zd		= Voz / Vdz =		0.14	0.11	0.09	0.15	0.03	0.03	0.03
Unused OA fraction required in primary air to zone	Zp		= Voz / Vpz =		0.14	0.11	0.09	0.15	0.03	0.03	0.03
System Ventilation Efficiency											
Zone Ventilation Efficiency (App A Method)	Evz		= (Fa + FbXs - FcZ) / Fa =		1.01	1.04	1.06	1.00	1.12	1.11	1.11
System Ventilation Efficiency (App A Method)	Ev		= min (Evz) =	0.42							
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 =	9687							
OA intake req'd as a fraction of primary SA	Y		= Vot / Vps =	0.35							
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 =	24							

Building:	Nassau Community College Life Sciences Building										
System Tag/Name:	AHU-1										
Operating Condition Description:	Design Peak Cooling Load Condition										
Units (select from pull-down list)	IP										
Inputs for System	**Name**	**Units**		**System**							
Floor area served by system	As	sf		19053							
Population of area served by system (including diversity)	Ps	P	100% diversity	328							
Design primary supply fan airflow rate	Vpsd	cfm		27,500							
OA req'd per unit area for system (Weighted average)	Ras	cfm/sf		0.08							
OA req'd per person for system area (Weighted average)	Rps	cfm/p		8.0							
Inputs for Potentially Critical zones											
Zone Name					Fac. Office	Fac. Office	Fac. Office	Fac. Office	Faculty Lounge	Prac. Skills Training Rm	Corr. #2
Zone Tag			*Zone title turns purple italic for critical zone(s)*		Second 36	Second 37	Second 38	Second 39	Third 15	Third 17	Third 18
Space type			Select from pull-down list		Office space	Office space	Office space	Office space	Classrooms (age 9 plus)	Lecture classroom	Corridors
Floor Area of zone	Az	sf			106	105	105	102	301	1423	1111
Design population of zone	Pz	P	(default value listed; may be overridden)		1	1	1	1	10.535	37	0
Design total supply to zone (primary plus local recirculated)	Vdzd	cfm			150	150	150	150	525	2100	500
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%	100%	100%	100%
Air distribution type at conditioned analyzed			Select from pull-down list		CS	CS	CS	CS	CS	CS	CS
Zone air distribution effectiveness at conditioned analyzed	Ez				1.00	1.00	1.00	1.00	1.00	1.00	1.00
Primary air fraction of supply air at conditioned analyzed	Ep										
Results											
Ventilation System Efficiency	Ev			0.42							
Outdoor air intake required for system	Vot	cfm		9687							
Outdoor air per unit floor area	Vot/As	cfm/sf		0.51							
Outdoor air per person served by system (including diversity)	Vot/Ps	cfm/p		29.5							
Outdoor air as a % of design primary supply air	Ypd	cfm		35%							
Detailed Calculations											
Initial Calculations for the System as a whole											
Primary supply air flow to system at conditioned analyzed	Vps	cfm	= VpdDs =	27500							
UncorrectedOA requirement for system	Vou	cfm	= Rps Ps + Ras As =	4113							
Uncorrected OA req'd as a fraction of primary SA	Xs		= Vou / Vps =	0.15							
Initial Calculations for individual zones											
OA rate per unit area for zone	Raz	cfm/sf			0.06	0.06	0.06	0.06	0.12	0.06	0.06
OA rate per person	Rpz	cfm/p			5.00	5.00	5.00	5.00	10.00	7.50	0.00
Total supply air to zone (at condition being analyzed)	Vdz	cfm			150	150	150	150	525	2100	500
Unused OA req'd to breathing zone	Vbz	cfm	= Rpz Pz + Raz Az =		11.4	11.3	11.3	11.1	141.5	362.9	66.7
Unused OA requirement for zone	Voz	cfm	= Vbz/Ez =		11	11	11	11	141	363	67
Fraction of zone supply not directly recirc. from zone	Fa		= Ep + (1-Ep)Er =		1.00	1.00	1.00	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	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	1.00	1.00	1.00
Unused OA fraction required in supply air to zone	Zd		= Voz / Vdz =		0.08	0.08	0.08	0.07	0.27	0.17	0.13
Unused OA fraction required in primary air to zone	Zp		= Voz / Vpz =		0.08	0.08	0.08	0.07	0.27	0.17	0.13
System Ventilation Efficiency											
Zone Ventilation Efficiency (App A Method)	Evz		= (Fa + FbXs - FcZ) / Fa =		1.07	1.07	1.07	1.08	0.88	0.98	1.02
System Ventilation Efficiency (App A Method)	Ev		= min (Evz) =	0.42							
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 =	9687							
OA intake req'd as a fraction of primary SA	Y		= Vot / Vps =	0.35							
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 =	24							

Building:	Nassau Community College Life Sciences Building											
System Tag/Name:	AHU-1											
Operating Condition Description:	Design Peak Cooling Load Condition											
Units (select from pull-down list)	IP											
Inputs for System	**Name**	**Units**			**System**							
Floor area served by system	As	sf			19053							
Population of area served by system (including diversity)	Ps	P	100% diversity		328							
Design primary supply fan airflow rate	Vpsd	cfm			27,500							
OA req'd per unit area for system (Weighted average)	Ras	cfm/sf			0.08							
OA req'd per person for system area (Weighted average)	Rps	cfm/p			8.0							
Inputs for Potentially Critical zones												
Zone Name			*Zone title turns purple italic for critical zone(s)*			Nursing Admin Suite	Storage	Director's Office/Conf. Room	Nursing Learing Center/Media Storage	Nursing Computer Exam Room	Corr. #3	Fac. Office
Zone Tag						Third 19	Third 20	Third 21	Third 23	Third 24	Third 36	Third 27
Space type			Select from pull-down list			Office Space	Storage rooms	Office space	Classrooms (age 9 plus)	Computer lab	Corridors	Office space
Floor Area of zone	Az	sf				517	155	470	666	1643	613	109
Design population of zone	Pz	P	(default value listed; may be overridden)			4	0	1	8	48	0	1
Design total supply to zone (primary plus local recirculated)	Vdzd	cfm				350	150	500	700	2100	350	375
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%	100%	100%	100%
Air distribution type at conditioned analyzed			Select from pull-down list			CS	CS	CS	CS	CS	CS	CS
Zone air distribution effectiveness at conditioned analyzed	Ez					1.00	1.00	1.00	1.00	1.00	1.00	1.00
Primary air fraction of supply air at conditioned analyzed	Ep											
Results												
Ventilation System Efficiency	Ev				0.42							
Outdoor air intake required for system	Vot	cfm			9687							
Outdoor air per unit floor area	Vot/As	cfm/sf			0.51							
Outdoor air per person served by system (including diversity)	Vot/Ps	cfm/p			29.5							
Outdoor air as a % of design primary supply air	Ypd	cfm			35%							
Detailed Calculations												
Initial Calculations for the System as a whole												
Primary supply air flow to system at conditioned analyzed	Vps	cfm	= VpdDs	=	27500							
UncorrectedOA requirement for system	Vou	cfm	= Rps Ps + Ras As	=	4113							
Uncorrected OA req'd as a fraction of primary SA	Xs		= Vou / Vps	=	0.15							
Initial Calculations for individual zones												
OA rate per unit area for zone	Raz	cfm/sf				0.06	0.12	0.06	0.12	0.12	0.06	0.06
OA rate per person	Rpz	cfm/p				5.00	0.00	5.00	10.00	10.00	0.00	5.00
Total supply air to zone (at condition being analyzed)	Vdz	cfm				350	150	500	700	2100	350	375
Unused OA req'd to breathing zone	Vbz	cfm	= Rpz Pz + Raz Az	=		51.0	18.6	33.2	159.9	677.2	36.8	11.5
Unused OA requirement for zone	Voz	cfm	= Vbz/Ez	=		51	19	33	160	677	37	12
Fraction of zone supply not directly recirc. from zone	Fa		= Ep + (1-Ep)Er	=		1.00	1.00	1.00	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	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	1.00	1.00	1.00
Unused OA fraction required in supply air to zone	Zd		= Voz / Vdz	=		0.15	0.12	0.07	0.23	0.32	0.11	0.03
Unused OA fraction required in primary air to zone	Zp		= Voz / Vpz	=		0.15	0.12	0.07	0.23	0.32	0.11	0.03
System Ventilation Efficiency												
Zone Ventilation Efficiency (App A Method)	Evz		= (Fa + FbXs - FcZ) / Fa	=		1.00	1.03	1.08	0.92	0.83	1.04	1.12
System Ventilation Efficiency (App A Method)	Ev		= min (Evz)	=	0.42							
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	=	9687							
OA intake req'd as a fraction of primary SA	Y		= Vot / Vps	=	0.35							
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	=	24							

Building:	Nassau Community College Life Sciences Building									
System Tag/Name:	AHU-1									
Operating Condition Description:	Design Peak Cooling Load Condition									
Units (select from pull-down list)	IP									

	Name	Units	Formula	System						
Inputs for System										
Floor area served by system	As	sf		19053						
Population of area served by system (including diversity)	Ps	P	100% diversity	328						
Design primary supply fan airflow rate	Vpsd	cfm		27,500						
OA req'd per unit area for system (Weighted average)	Ras	cfm/sf		0.08						
OA req'd per person for system area (Weighted average)	Rps	cfm/p		8.0						
Inputs for Potentially Critical zones										
Zone Name					Fac. Office	Fac. Office	Fac. Office	Fac. Office	Fac. Office	Fac. Office	Elec.
Zone Tag			*Zone title turns purple italic for critical zone(s)*		Third 28	Third 29	Third 30	Third 31	Third 32	Third 33	Third 34
Space type		Select from pull-down list			Office space	Office space	Office space	Office space	Office space	Office space	Electrical equipment rooms
Floor Area of zone	Az	sf			105	105	105	105	105	106	56
Design population of zone	Pz	P	(default value listed; may be overridden)		1	1	1	1	1	1	0
Design total supply to zone (primary plus local recirculated)	Vdzd	cfm			350	350	350	350	350	350	50
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%	100%	100%	100%
Air distribution type at conditioned analyzed		Select from pull-down list			CS	CS	CS	CS	CS	CS	CS
Zone air distribution effectiveness at conditioned analyzed	Ez				1.00	1.00	1.00	1.00	1.00	1.00	1.00
Primary air fraction of supply air at conditioned analyzed	Ep										
Results											
Ventilation System Efficiency	Ev			0.42							
Outdoor air intake required for system	Vot	cfm		9687							
Outdoor air per unit floor area	Vot/As	cfm/sf		0.51							
Outdoor air per person served by system (including diversity)	Vot/Ps	cfm/p		29.5							
Outdoor air as a % of design primary supply air	Ypd	cfm		35%							
Detailed Calculations											
Initial Calculations for the System as a whole											
Primary supply air flow to system at conditioned analyzed	Vps	cfm	VpdDs	27500							
UncorrectedOA requirement for system	Vou	cfm	Rps Ps + Ras As	4113							
Uncorrected OA req'd as a fraction of primary SA	Xs		Vou / Vps	0.15							
Initial Calculations for individual zones											
OA rate per unit area for zone	Raz	cfm/sf			0.06	0.06	0.06	0.06	0.06	0.06	0.06
OA rate per person	Rpz	cfm/p			5.00	5.00	5.00	5.00	5.00	5.00	0.00
Total supply air to zone (at condition being analyzed)	Vdz	cfm			350	350	350	350	350	350	50
Unused OA req'd to breathing zone	Vbz	cfm	Rpz Pz + Raz Az		11.3	11.3	11.3	11.3	11.3	11.4	3.4
Unused OA requirement for zone	Voz	cfm	Vbz/Ez		11	11	11	11	11	11	3
Fraction of zone supply not directly recirc. from zone	Fa		Ep + (1-Ep)Er		1.00	1.00	1.00	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	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	1.00	1.00	1.00
Unused OA fraction required in supply air to zone	Zd		Voz / Vdz		0.03	0.03	0.03	0.03	0.03	0.03	0.07
Unused OA fraction required in primary air to zone	Zp		Voz / Vpz		0.03	0.03	0.03	0.03	0.03	0.03	0.07
System Ventilation Efficiency											
Zone Ventilation Efficiency (App A Method)	Evz		(Fa + FbXs - FcZ) / Fa		1.12	1.12	1.12	1.12	1.12	1.12	1.08
System Ventilation Efficiency (App A Method)	Ev		min (Evz)	0.42							
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	9687							
OA intake req'd as a fraction of primary SA	Y		Vot / Vps	0.35							
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	24							

Building:	Nassau Community College Life Sciences Building									
System Tag/Name:	AHU-1									
Operating Condition Description:	Design Peak Cooling Load Condition									
Units (select from pull-down list)	IP									
Inputs for System	**Name**	**Units**		**System**						
Floor area served by system	As	sf		19053						
Population of area served by system (including diversity)	Ps	P	100% diversity	328						
Design primary supply fan airflow rate	Vpsd	cfm		27,500						
OA req'd per unit area for system (Weighted average)	Ras	cfm/sf		0.08						
OA req'd per person for system area (Weighted average)	Rps	cfm/p		8.0						
Inputs for Potentially Critical zones										
Zone Name					Fac. Office	Fac. Office	Fac. Office	Fac. Office	Fac. Office	Fac. Office
Zone Tag			*Zone title turns purple italic for critical zone(s)*		Third 35	Third 36	Third 37	Third 38	Third 39	Third 40
Space type			Select from pull-down list		Office space	Office space	Office space	Office space	Office space	Office space
Floor Area of zone	Az	sf			102	105	106	105	105	102
Design population of zone	Pz	P	(default value listed; may be overridden)		1	1	1	1	1	1
Design total supply to zone (primary plus local recirculated)	Vdzd	cfm			175	175	175	175	175	175
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%	100%	100%
Air distribution type at conditioned analyzed			Select from pull-down list		CS	CS	CS	CS	CS	CS
Zone air distribution effectiveness at conditioned analyzed	Ez				1.00	1.00	1.00	1.00	1.00	1.00
Primary air fraction of supply air at conditioned analyzed	Ep									
Results										
Ventilation System Efficiency	Ev			0.42						
Outdoor air intake required for system	Vot	cfm		9687						
Outdoor air per unit floor area	Vot/As	cfm/sf		0.51						
Outdoor air per person served by system (including diversity)	Vot/Ps	cfm/p		29.5						
Outdoor air as a % of design primary supply air	Ypd	cfm		35%						
Detailed Calculations										
Initial Calculations for the System as a whole										
Primary supply air flow to system at conditioned analyzed	Vps	cfm	= VpdDs =	27500						
UncorrectedOA requirement for system	Vou	cfm	= Rps Ps + Ras As =	4113						
Uncorrected OA req'd as a fraction of primary SA	Xs		= Vou / Vps =	0.15						
Initial Calculations for individual zones										
OA rate per unit area for zone	Raz	cfm/sf			0.06	0.06	0.06	0.06	0.06	0.06
OA rate per person	Rpz	cfm/p			5.00	5.00	5.00	5.00	5.00	5.00
Total supply air to zone (at condition being analyzed)	Vdz	cfm			175	175	175	175	175	175
Unused OA req'd to breathing zone	Vbz	cfm	= Rpz Pz + Raz Az =		11.1	11.3	11.4	11.3	11.3	11.1
Unused OA requirement for zone	Voz	cfm	= Vbz/Ez =		11	11	11	11	11	11
Fraction of zone supply not directly recirc. from zone	Fa		= Ep + (1-Ep)Er =		1.00	1.00	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	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	1.00	1.00
Unused OA fraction required in supply air to zone	Zd		= Voz / Vdz =		0.06	0.06	0.06	0.06	0.06	0.06
Unused OA fraction required in primary air to zone	Zp		= Voz / Vpz =		0.06	0.06	0.06	0.06	0.06	0.06
System Ventilation Efficiency										
Zone Ventilation Efficiency (App A Method)	Evz		= (Fa + FbXs - FcZ) / Fa =		1.09	1.08	1.08	1.08	1.08	1.09
System Ventilation Efficiency (App A Method)	Ev		= min (Evz) =	0.42						
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 =	9687						
OA intake req'd as a fraction of primary SA	Y		= Vot / Vps =	0.35						
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 =	24						

Building:			Nassau Community College Life Sciences Building			
System Tag/Name:			AHU-1			
Operating Condition Description:			Design Peak Cooling Load Condition			
Units (select from pull-down list)			IP			
Inputs for System	**Name**	**Units**			**System**	ures
Floor area served by system	As	sf			19053	
Population of area served by system (including diversity)	Ps	P	100% diversity		328	P/1000 sf
Design primary supply fan airflow rate	Vpsd	cfm			27,500	cfm/sf
OA req'd per unit area for system (Weighted average)	Ras	cfm/sf			0.08	ave cfm/sf
OA req'd per person for system area (Weighted average)	Rps	cfm/p			8.0	ave cfm/p
Inputs for Potentially Critical zones						
Zone Name						
			Zone title turns purple italic for critical zone(s)			rages
Zone Tag						
Space type						
			Select from pull-down list			
Floor Area of zone	Az	sf				total sf
Design population of zone	Pz	P	(default value listed; may be overridden)			total P
Design total supply to zone (primary plus local recirculated)	Vdzd	cfm				total cfm
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					average
Inputs for Operating Condition Analyzed						
Percent of total design airflow rate at conditioned analyzed	Ds	%			100%	average
Air distribution type at conditioned analyzed			Select from pull-down list			
Zone air distribution effectiveness at conditioned analyzed	Ez					average
Primary air fraction of supply air at conditioned analyzed	Ep					average
Results						
Ventilation System Efficiency	Ev				0.42	
Outdoor air intake required for system	Vot	cfm			9687	
Outdoor air per unit floor area	Vot/As	cfm/sf			0.51	
Outdoor air per person served by system (including diversity)	Vot/Ps	cfm/p			29.5	
Outdoor air as a % of design primary supply air	Ypd	cfm			35%	

make that primary over design

Primary airflow rate to zones
27500 cfm

Detailed Calculations						
Initial Calculations for the System as a whole						
Primary supply air flow to system at conditioned analyzed	Vps	cfm	= VpdDs	=	27500	System population without diversity
UncorrectedOA requirement for system	Vou	cfm	= Rps Ps + Ras As	=	4113	System population diversity, D
Uncorrected OA req'd as a fraction of primary SA	Xs		= Vou / Vps	=	0.15	
Initial Calculations for individual zones						
OA rate per unit area for zone	Raz	cfm/sf				
OA rate per person	Rpz	cfm/p				
Total supply air to zone (at condition being analyzed)	Vdz	cfm				
Unused OA req'd to breathing zone	Vbz	cfm	= Rpz Pz + Raz Az	=		
Unused OA requirement for zone	Voz	cfm	= Vbz/Ez	=		
Fraction of zone supply not directly recirc. from zone	Fa		= Ep + (1-Ep)Er	=		
Fraction of zone supply from fully mixed primary air	Fb		= Ep	=		
Fraction of zone OA not directly recirc. from zone	Fc		= 1-(1-Ez)(1-Ep)(1-Er)	=		
Unused OA fraction required in supply air to zone	Zd		= Voz / Vdz	=		Maximum Zd
Unused OA fraction required in primary air to zone	Zp		= Voz / Vpz	=		Maximum Zp
System Ventilation Efficiency						
Zone Ventilation Efficiency (App A Method)	Evz		= (Fa + FbXs - FcZ) / Fa	=		
System Ventilation Efficiency (App A Method)	Ev		= min (Evz)	=	0.42	
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	=	9687	
OA intake req'd as a fraction of primary SA	Y		= Vot / Vps	=	0.35	
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	=	24	

Building:	Nassau Community College Life Sciences Building
System Tag/Name:	AHU-2
Operating Condition Description:	Design Peak Cooling Load Condition
Units (select from pull-down list)	IP

	Name	Units		System
Inputs for System				
Floor area served by system	As	sf		18401
Population of area served by system (including diversity)	Ps	P	100% diversity	320
Design primary supply fan airflow rate	Vpsd	cfm		27,650
OA req'd per unit area for system (Weighted average)	Ras	cfm/sf		0.08
OA req'd per person for system area (Weighted average)	Rps	cfm/p		7.3

	Name	Units		System	Corr. #1	General Classroom	General Classroom	General Classroom	General Classroom	Men	Women
Inputs for Potentially Critical zones											
Zone Name			*Zone title turns purple italic for critical zone(s)*		Corr. #1	General Classroom	General Classroom	General Classroom	General Classroom	Men	Women
Zone Tag					First 01	First 03	First 04	First 05	First 06	First 08	First 09
Space type		Select from pull-down list			Corridors	Lecture classroom	Lecture classroom	Lecture classroom	Lecture classroom	Storage rooms	Storage rooms
Floor Area of zone	Az	sf			1,492	1074	755	1067	1056	243	314
Design population of zone	Pz	P	(default value listed; may be overridden)		0	36	24	36	36	4	5
Design total supply to zone (primary plus local recirculated)	Vdzd	cfm			750	1600	1100	1600	1300	225	325
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%	100%	100%	100%
Air distribution type at conditioned analyzed		Select from pull-down list			CS	CS	CS	CS	CS	CS	CS
Zone air distribution effectiveness at conditioned analyzed	Ez				1.00	1.00	1.00	1.00	1.00	1.00	1.00
Primary air fraction of supply air at conditioned analyzed	Ep										
Results											
Ventilation System Efficiency	Ev			0.78							
Outdoor air intake required for system	Vot	cfm		4844							
Outdoor air per unit floor area	Vot/As	cfm/sf		0.26							
Outdoor air per person served by system (including diversity)	Vot/Ps	cfm/p		15.1							
Outdoor air as a % of design primary supply air	Ypd	cfm		18%							
Detailed Calculations											
Initial Calculations for the System as a whole											
Primary supply air flow to system at conditioned analyzed	Vps	cfm	= VpdDs =	27650							
UncorrectedOA requirement for system	Vou	cfm	= Rps Ps + Ras As =	3793							
Uncorrected OA req'd as a fraction of primary SA	Xs		= Vou / Vps =	0.14							
Initial Calculations for individual zones											
OA rate per unit area for zone	Raz	cfm/sf			0.06	0.06	0.06	0.06	0.06	0.12	0.12
OA rate per person	Rpz	cfm/p			0.00	7.50	7.50	7.50	7.50	0.00	0.00
Total supply air to zone (at condition being analyzed)	Vdz	cfm			750	1600	1100	1600	1300	225	325
Unused OA req'd to breathing zone	Vbz	cfm	= Rpz Pz + Raz Az =		89.5	334.4	225.3	334.0	333.4	29.2	37.7
Unused OA requirement for zone	Voz	cfm	= Vbz/Ez =		90	334	225	334	333	29	38
Fraction of zone supply not directly recirc. from zone	Fa		= Ep + (1-Ep)Er =		1.00	1.00	1.00	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	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	1.00	1.00	1.00
Unused OA fraction required in supply air to zone	Zd		= Voz / Vdz =		0.12	0.21	0.20	0.21	0.26	0.13	0.12
Unused OA fraction required in primary air to zone	Zp		= Voz / Vpz =		0.12	0.21	0.20	0.21	0.26	0.13	0.12
System Ventilation Efficiency											
Zone Ventilation Efficiency (App A Method)	Evz		= (Fa + FbXs - FcZ) / Fa =		1.02	0.93	0.93	0.93	0.88	1.01	1.02
System Ventilation Efficiency (App A Method)	Ev		= min (Evz) =	0.78							
Ventilation System Efficiency (Table 6.3 Method)	Ev		= Value from Table 6.3 =	0.80							
Minimum outdoor air intake airflow											
Outdoor Air Intake Flow required to System	Vot	cfm	= Vou / Ev =	4844							
OA intake req'd as a fraction of primary SA	Y		= Vot / Vps =	0.18							
Outdoor Air Intake Flow required to System (Table 6.3 Method)	Vot	cfm	= Vou / Ev =	4766	77.96						
OA intake req'd as a fraction of primary SA (Table 6.3 Method)	Y		= Vot / Vps =	0.17	0.02						
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 =	-25							

Building:	Nassau Community College Life Sciences Building										
System Tag/Name:	AHU-2										
Operating Condition Description:	Design Peak Cooling Load Condition										
Units (select from pull-down list)	IP										
Inputs for System	**Name**	**Units**		**System**							
Floor area served by system	As	sf		18401							
Population of area served by system (including diversity)	Ps	P	100% diversity	320							
Design primary supply fan airflow rate	Vpsd	cfm		27,650							
OA req'd per unit area for system (Weighted average)	Ras	cfm/sf		0.08							
OA req'd per person for system area (Weighted average)	Rps	cfm/p		7.3							
Inputs for Potentially Critical zones											
Zone Name			*Zone title turns purple italic for critical zone(s)*		Elec.	Tele.	Vending	Fac. Office	Fac. Office	Fac. Office	Fac. Office
Zone Tag					First 10	First 15	First 40	First 41	First 42	First 43	First 44
Space type		Select from pull-down list			Electrical equipment rooms	Electrical equipment rooms	Coffee Stations	Office space	Office space	Office space	Office space
Floor Area of zone	Az	sf			110	69	203	106	105	105	105
Design population of zone	Pz	P	(default value listed; may be overridden)		0	0	4	1	1	1	1
Design total supply to zone (primary plus local recirculated)	Vdzd	cfm			100	50	225	325	325	325	325
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%	100%	100%	100%
Air distribution type at conditioned analyzed		Select from pull-down list			CS	CS	CS	CS	CS	CS	CS
Zone air distribution effectiveness at conditioned analyzed	Ez				1.00	1.00	1.00	1.00	1.00	1.00	1.00
Primary air fraction of supply air at conditioned analyzed	Ep										
Results											
Ventilation System Efficiency	Ev			0.78							
Outdoor air intake required for system	Vot	cfm		4844							
Outdoor air per unit floor area	Vot/As	cfm/sf		0.26							
Outdoor air per person served by system (including diversity)	Vot/Ps	cfm/p		15.1							
Outdoor air as a % of design primary supply air	Ypd	cfm		18%							
Detailed Calculations											
Initial Calculations for the System as a whole											
Primary supply air flow to system at conditioned analyzed	Vps	cfm	= VpdDs =	27650							
UncorrectedOA requirement for system	Vou	cfm	= Rps Ps + Ras As =	3793							
Uncorrected OA req'd as a fraction of primary SA	Xs		= Vou / Vps =	0.14							
Initial Calculations for individual zones											
OA rate per unit area for zone	Raz	cfm/sf			0.06	0.06	0.06	0.06	0.06	0.06	0.06
OA rate per person	Rpz	cfm/p			0.00	0.00	5.00	5.00	5.00	5.00	5.00
Total supply air to zone (at condition being analyzed)	Vdz	cfm			100	50	225	325	325	325	325
Unused OA req'd to breathing zone	Vbz	cfm	= Rpz Pz + Raz Az =		6.6	4.1	32.2	11.4	11.3	11.3	11.3
Unused OA requirement for zone	Voz	cfm	= Vbz/Ez =		7	4	32	11	11	11	11
Fraction of zone supply not directly recirc. from zone	Fa		= Ep + (1-Ep)Er =		1.00	1.00	1.00	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	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	1.00	1.00	1.00
Unused OA fraction required in supply air to zone	Zd		= Voz / Vdz =		0.07	0.08	0.14	0.03	0.03	0.03	0.03
Unused OA fraction required in primary air to zone	Zp		= Voz / Vpz =		0.07	0.08	0.14	0.03	0.03	0.03	0.03
System Ventilation Efficiency											
Zone Ventilation Efficiency (App A Method)	Evz		= (Fa + FbXs - FcZ) / Fa =		1.07	1.05	0.99	1.10	1.10	1.10	1.10
System Ventilation Efficiency (App A Method)	Ev		= min (Evz) =	0.78							
Ventilation System Efficiency (Table 6.3 Method)	Ev		= Value from Table 6.3 =	0.80							
Minimum outdoor air intake airflow											
Outdoor Air Intake Flow required to System	Vot	cfm	= Vou / Ev =	4844							
OA intake req'd as a fraction of primary SA	Y		= Vot / Vps =	0.18							
Outdoor Air Intake Flow required to System (Table 6.3 Method)	Vot	cfm	= Vou / Ev =	4768							
OA intake req'd as a fraction of primary SA (Table 6.3 Method)	Y		= Vot / Vps =	0.17							
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 =	-25							

Building:	Nassau Community College Life Sciences Building										
System Tag/Name:	AHU-2										
Operating Condition Description:	Design Peak Cooling Load Condition										
Units (select from pull-down list)	IP										
Inputs for System	**Name**	**Units**		**System**							
Floor area served by system	As	sf		18401							
Population of area served by system (including diversity)	Ps	P	100% diversity	320							
Design primary supply fan airflow rate	Vpsd	cfm		27,650							
OA req'd per unit area for system (Weighted average)	Ras	cfm/sf		0.08							
OA req'd per person for system area (Weighted average)	Rps	cfm/p		7.3							
Inputs for Potentially Critical zones											
Zone Name			*Zone title turns purple italic for critical zone(s)*		Fac. Office	Fac. Office	Fac. Office	Fac. Office	Fac. Office	Fac. Office	Fac. Office
Zone Tag					First 45	First 46	First 47	First 48	First 49	First 50	First 51
Space type			Select from pull-down list		Office space	Office space	Office space	Office space	Office space	Office space	Office space
Floor Area of zone	Az	sf			105	105	105	105	105	105	105
Design population of zone	Pz	P	(default value listed; may be overridden)		1	1	1	1	1	1	1
Design total supply to zone (primary plus local recirculated)	Vdzd	cfm			325	325	325	325	325	325	325
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%	100%	100%	100%
Air distribution type at conditioned analyzed			Select from pull-down list		CS	CS	CS	CS	CS	CS	CS
Zone air distribution effectiveness at conditioned analyzed	Ez				1.00	1.00	1.00	1.00	1.00	1.00	1.00
Primary air fraction of supply air at conditioned analyzed	Ep										
Results											
Ventilation System Efficiency	Ev			0.78							
Outdoor air intake required for system	Vot	cfm		4844							
Outdoor air per unit floor area	Vot/As	cfm/sf		0.26							
Outdoor air per person served by system (including diversity)	Vot/Ps	cfm/p		15.1							
Outdoor air as a % of design primary supply air	Ypd	cfm		18%							
Detailed Calculations											
Initial Calculations for the System as a whole											
Primary supply air flow to system at conditioned analyzed	Vps	cfm	= VpdDs =	27650							
UncorrectedOA requirement for system	Vou	cfm	= Rps Ps + Ras As =	3783							
Uncorrected OA req'd as a fraction of primary SA	Xs		= Vou / Vps =	0.14							
Initial Calculations for individual zones											
OA rate per unit area for zone	Raz	cfm/sf			0.06	0.06	0.06	0.06	0.06	0.06	0.06
OA rate per person	Rpz	cfm/p			5.00	5.00	5.00	5.00	5.00	5.00	5.00
Total supply air to zone (at condition being analyzed)	Vdz	cfm			325	325	325	325	325	325	325
Unused OA req'd to breathing zone	Vbz	cfm	= Rpz Pz + Raz Az =		11.3	11.3	11.3	11.3	11.3	11.3	11.3
Unused OA requirement for zone	Voz	cfm	= Vbz/Ez =		11	11	11	11	11	11	11
Fraction of zone supply not directly recirc. from zone	Fa		= Ep + (1-Ep)Er =		1.00	1.00	1.00	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	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	1.00	1.00	1.00
Unused OA fraction required in supply air to zone	Zd		= Voz / Vdz =		0.03	0.03	0.03	0.03	0.03	0.03	0.03
Unused OA fraction required in primary air to zone	Zp		= Voz / Vpz =		0.03	0.03	0.03	0.03	0.03	0.03	0.03
System Ventilation Efficiency											
Zone Ventilation Efficiency (App A Method)	Evz		= (Fa + FbXs - FcZ) / Fa =		1.10	1.10	1.10	1.10	1.10	1.10	1.10
System Ventilation Efficiency (App A Method)	Ev		= min (Evz) =	0.78							
Ventilation System Efficiency (Table 6.3 Method)	Ev		= Value from Table 6.3 =	0.80							
Minimum outdoor air intake airflow											
Outdoor Air Intake Flow required to System	Vot	cfm	= Vou / Ev =	4844							
OA intake req'd as a fraction of primary SA	Y		= Vot / Vps =	0.18							
Outdoor Air Intake Flow required to System (Table 6.3 Method)	Vot	cfm	= Vou / Ev =	4768							
OA intake req'd as a fraction of primary SA (Table 6.3 Method)	Y		= Vot / Vps =	0.17							
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 =	-25							

Building:	Nassau Community College Life Sciences Building											
System Tag/Name:	AHU-2											
Operating Condition Description:	Design Peak Cooling Load Condition											
Units (select from pull-down list)	IP											
Inputs for System	**Name**	**Units**			**System**							
Floor area served by system	As	sf			18401							
Population of area served by system (including diversity)	Ps	P	100% diversity		320							
Design primary supply fan airflow rate	Vpsd	cfm			27,650							
OA req'd per unit area for system (Weighted average)	Ras	cfm/sf			0.08							
OA req'd per person for system area (Weighted average)	Rps	cfm/p			7.3							
Inputs for Potentially Critical zones												
Zone Name			*Zone title turns purple italic for critical zone(s)*			Fac. Office	Fac. Office	Men	Women	Elec.	Tele.	Vending
Zone Tag						First 52	First 53	Second 07	Second 08	Second 09	Second 14	Second 40
Space type		Select from pull-down list				Office space	Office space	Storage rooms	Storage rooms	Electrical equipment rooms	Electrical equipment rooms	Coffee stations
Floor Area of zone	Az	sf				105	109	243	310	110	69	201
Design population of zone	Pz	P	(default value listed; may be overridden)			1	1	4	5	0	0	4
Design total supply to zone (primary plus local recirculated)	Vdzd	cfm				325	350	225	325	100	50	225
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%	100%	100%	100%
Air distribution type at conditioned analyzed		Select from pull-down list				CS	CS	CS	CS	CS	CS	CS
Zone air distribution effectiveness at conditioned analyzed	Ez					1.00	1.00	1.00	1.00	1.00	1.00	1.00
Primary air fraction of supply air at conditioned analyzed	Ep											
Results												
Ventilation System Efficiency	Ev				0.78							
Outdoor air intake required for system	Vot	cfm			4844							
Outdoor air per unit floor area	Vot/As	cfm/sf			0.26							
Outdoor air per person served by system (including diversity)	Vot/Ps	cfm/p			15.1							
Outdoor air as a % of design primary supply air	Ypd	cfm			18%							
Detailed Calculations												
Initial Calculations for the System as a whole												
Primary supply air flow to system at conditioned analyzed	Vps	cfm	= VpdDs	=	27650							
UncorrectedOA requirement for system	Vou	cfm	= Rps Ps + Ras As	=	3793							
Uncorrected OA req'd as a fraction of primary SA	Xs		= Vou / Vps	=	0.14							
Initial Calculations for individual zones												
OA rate per unit area for zone	Raz	cfm/sf				0.06	0.06	0.12	0.12	0.06	0.06	0.06
OA rate per person	Rpz	cfm/p				5.00	5.00	0.00	0.00	0.00	0.00	5.00
Total supply air to zone (at condition being analyzed)	Vdz	cfm				325	350	225	325	100	50	225
Unused OA req'd to breathing zone	Vbz	cfm	= Rpz Pz + Raz Az	=		11.3	11.5	29.2	37.2	6.6	4.1	32.1
Unused OA requirement for zone	Voz	cfm	= Vbz/Ez	=		11	12	29	37	7	4	32
Fraction of zone supply not directly recirc. from zone	Fa		= Ep + (1-Ep)Er	=		1.00	1.00	1.00	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	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	1.00	1.00	1.00
Unused OA fraction required in supply air to zone	Zd		= Voz / Vdz	=		0.03	0.03	0.13	0.11	0.07	0.08	0.14
Unused OA fraction required in primary air to zone	Zp		= Voz / Vpz	=		0.03	0.03	0.13	0.11	0.07	0.08	0.14
System Ventilation Efficiency												
Zone Ventilation Efficiency (App A Method)	Evz		= (Fa + FbXs - FcZ) / Fa	=		1.10	1.10	1.01	1.02	1.07	1.05	0.99
System Ventilation Efficiency (App A Method)	Ev		= min (Evz)	=	0.78							
Ventilation System Efficiency (Table 6.3 Method)	Ev		= Value from Table 6.3	=	0.80							
Minimum outdoor air intake airflow												
Outdoor Air Intake Flow required to System	Vot	cfm	= Vou / Ev	=	4844							
OA intake req'd as a fraction of primary SA	Y		= Vot / Vps	=	0.18							
Outdoor Air Intake Flow required to System (Table 6.3 Method)	Vot	cfm	= Vou / Ev	=	4768							
OA intake req'd as a fraction of primary SA (Table 6.3 Method)	Y		= Vot / Vps	=	0.17							
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	=	-25							

Building:	Nassau Community College Life Sciences Building										
System Tag/Name:	AHU-2										
Operating Condition Description:	Design Peak Cooling Load Condition										
Units (select from pull-down list)	IP										
Inputs for System	**Name**	**Units**			**System**						
Floor area served by system	As	sf			18401						
Population of area served by system (including diversity)	Ps	P	100% diversity		320						
Design primary supply fan airflow rate	Vpsd	cfm			27,650						
OA req'd per unit area for system (Weighted average)	Ras	cfm/sf			0.08						
OA req'd per person for system area (Weighted average)	Rps	cfm/p			7.3						
Inputs for Potentially Critical zones						Potentially Critical Zones					
Zone Name			*Zone title turns purple italic for critical zone(s)*			Fac. Office	Fac. Office	Fac. Office	Fac. Office	Fac. Office	Fac. Office	Fac. Office
Zone Tag						Second 41	Second 42	Second 43	Second 44	Second 45	Second 46	Second 47
Space type		Select from pull-down list				Office space	Office space	Office space	Office space	Office space	Office space	Office space
Floor Area of zone	Az	sf				106	105	105	105	105	105	105
Design population of zone	Pz	P	(default value listed; may be overridden)			1	1	1	1	1	1	1
Design total supply to zone (primary plus local recirculated)	Vdzd	cfm				325	325	325	325	325	325	325
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					[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Inputs for Operating Condition Analyzed												
Percent of total design airflow rate at conditioned analyzed	Ds	%			100%	100%	100%	100%	100%	100%	100%	100%
Air distribution type at conditioned analyzed		Select from pull-down list				CS	CS	CS	CS	CS	CS	CS
Zone air distribution effectiveness at conditioned analyzed	Ez					1.00	1.00	1.00	1.00	1.00	1.00	1.00
Primary air fraction of supply air at conditioned analyzed	Ep											
Results												
Ventilation System Efficiency	Ev				0.78							
Outdoor air intake required for system	Vot	cfm			4844							
Outdoor air per unit floor area	Vot/As	cfm/sf			0.26							
Outdoor air per person served by system (including diversity)	Vot/Ps	cfm/p			15.1							
Outdoor air as a % of design primary supply air	Ypd	cfm			18%							
Detailed Calculations												
Initial Calculations for the System as a whole												
Primary supply air flow to system at conditioned analyzed	Vps	cfm	= VpdDs	=	27650							
UncorrectedOA requirement for system	Vou	cfm	= Rps Ps + Ras As	=	3793							
Uncorrected OA req'd as a fraction of primary SA	Xs		= Vou / Vps	=	0.14							
Initial Calculations for individual zones												
OA rate per unit area for zone	Raz	cfm/sf				0.06	0.06	0.06	0.06	0.06	0.06	0.06
OA rate per person	Rpz	cfm/p				5.00	5.00	5.00	5.00	5.00	5.00	5.00
Total supply air to zone (at condition being analyzed)	Vdz	cfm				325	325	325	325	325	325	325
Unused OA req'd to breathing zone	Vbz	cfm	= Rpz Pz + Raz Az	=		11.4	11.3	11.3	11.3	11.3	11.3	11.3
Unused OA requirement for zone	Voz	cfm	= Vbz/Ez	=		11	11	11	11	11	11	11
Fraction of zone supply not directly recirc. from zone	Fa		= Ep + (1-Ep)Er	=		1.00	1.00	1.00	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	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	1.00	1.00	1.00
Unused OA fraction required in supply air to zone	Zd		= Voz / Vdz	=		0.03	0.03	0.03	0.03	0.03	0.03	0.03
Unused OA fraction required in primary air to zone	Zp		= Voz / Vpz	=		0.03	0.03	0.03	0.03	0.03	0.03	0.03
System Ventilation Efficiency												
Zone Ventilation Efficiency (App A Method)	Evz		= (Fa + FbXs - FcZ) / Fa	=		1.10	1.10	1.10	1.10	1.10	1.10	1.10
System Ventilation Efficiency (App A Method)	Ev		= min (Evz)	=	0.78							
Ventilation System Efficiency (Table 6.3 Method)	Ev		= Value from Table 6.3	=	0.80							
Minimum outdoor air intake airflow												
Outdoor Air Intake Flow required to System	Vot	cfm	= Vou / Ev	=	4844							
OA intake req'd as a fraction of primary SA	Y		= Vot / Vps	=	0.18							
Outdoor Air Intake Flow required to System (Table 6.3 Method)	Vot	cfm	= Vou / Ev	=	4768							
OA intake req'd as a fraction of primary SA (Table 6.3 Method)	Y		= Vot / Vps	=	0.17							
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	=	-25							

	Name	Units	Formula		System	Fac. Office	Fac. Office	Fac. Office	Fac. Office	Fac. Office	Fac. Office	Corr. #1
Building:	Nassau Community College Life Sciences Building											
System Tag/Name:	AHU-2											
Operating Condition Description:	Design Peak Cooling Load Condition											
Units (select from pull-down list)	IP											
Inputs for System	**Name**	**Units**			**System**							
Floor area served by system	As	sf			18401							
Population of area served by system (including diversity)	Ps	P	100% diversity		320							
Design primary supply fan airflow rate	Vpsd	cfm			27,650							
OA req'd per unit area for system (Weighted average)	Ras	cfm/sf			0.08							
OA req'd per person for system area (Weighted average)	Rps	cfm/p			7.3							
Inputs for Potentially Critical zones												
Zone Name			*Zone title turns purple italic for critical zone(s)*			Fac. Office	Fac. Office	Fac. Office	Fac. Office	Fac. Office	Fac. Office	Corr. #1
Zone Tag						Second 48	Second 49	Second 50	Second 51	Second 52	Second 53	Third 01
Space type		Select from pull-down list				Office space	Office space	Office space	Office space	Office space	Office space	Corridors
Floor Area of zone	Az	sf				105	105	105	105	105	109	1501
Design population of zone	Pz	P	(default value listed; may be overridden)			1	1	1	1	1	1	0
Design total supply to zone (primary plus local recirculated)	Vdzd	cfm				325	325	325	325	325	350	700
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%	100%	100%	100%
Air distribution type at conditioned analyzed		Select from pull-down list				CS	CS	CS	CS	CS	CS	CS
Zone air distribution effectiveness at conditioned analyzed	Ez					1.00	1.00	1.00	1.00	1.00	1.00	1.00
Primary air fraction of supply air at conditioned analyzed	Ep											
Results												
Ventilation System Efficiency	Ev				0.78							
Outdoor air intake required for system	Vot	cfm			4844							
Outdoor air per unit floor area	Vot/As	cfm/sf			0.26							
Outdoor air per person served by system (including diversity)	Vot/Ps	cfm/p			15.1							
Outdoor air as a % of design primary supply air	Ypd	cfm			18%							
Detailed Calculations												
Initial Calculations for the System as a whole												
Primary supply air flow to system at conditioned analyzed	Vps	cfm	= VpdDs	=	27650							
UncorrectedOA requirement for system	Vou	cfm	= Rps Ps + Ras As	=	3793							
Uncorrected OA req'd as a fraction of primary SA	Xs		= Vou / Vps	=	0.14							
Initial Calculations for individual zones												
OA rate per unit area for zone	Raz	cfm/sf				0.06	0.06	0.06	0.06	0.06	0.06	0.06
OA rate per person	Rpz	cfm/p				5.00	5.00	5.00	5.00	5.00	5.00	0.00
Total supply air to zone (at condition being analyzed)	Vdz	cfm				325	325	325	325	325	350	700
Unused OA req'd to breathing zone	Vbz	cfm	= Rpz Pz + Raz Az	=		11.3	11.3	11.3	11.3	11.3	11.5	90.1
Unused OA requirement for zone	Voz	cfm	= Vbz/Ez	=		11	11	11	11	11	12	90
Fraction of zone supply not directly recirc. from zone	Fa		= Ep + (1-Ep)Er	=		1.00	1.00	1.00	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	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	1.00	1.00	1.00
Unused OA fraction required in supply air to zone	Zd		= Voz / Vdz	=		0.03	0.03	0.03	0.03	0.03	0.03	0.13
Unused OA fraction required in primary air to zone	Zp		= Voz / Vpz	=		0.03	0.03	0.03	0.03	0.03	0.03	0.13
System Ventilation Efficiency												
Zone Ventilation Efficiency (App A Method)	Evz		= (Fa + FbXs - FcZ) / Fa	=		1.10	1.10	1.10	1.10	1.10	1.10	1.01
System Ventilation Efficiency (App A Method)	Ev		= min (Evz)	=	0.78							
Ventilation System Efficiency (Table 6.3 Method)	Ev		= Value from Table 6.3	=	0.80							
Minimum outdoor air intake airflow												
Outdoor Air Intake Flow required to System	Vot	cfm	= Vou / Ev	=	4844							
OA intake req'd as a fraction of primary SA	Y		= Vot / Vps	=	0.18							
Outdoor Air Intake Flow required to System (Table 6.3 Method)	Vot	cfm	= Vou / Ev	=	4766							
OA intake req'd as a fraction of primary SA (Table 6.3 Method)	Y		= Vot / Vps	=	0.17							
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	=	-25							

Building:	Nassau Community College Life Sciences Building										
System Tag/Name:	AHU-2										
Operating Condition Description:	Design Peak Cooling Load Condition										
Units (select from pull-down list)	IP										
Inputs for System	**Name**	**Units**			**System**						
Floor area served by system	As	sf			18401						
Population of area served by system (including diversity)	Ps	P	100% diversity		320						
Design primary supply fan airflow rate	Vpsd	cfm			27,650						
OA req'd per unit area for system (Weighted average)	Ras	cfm/sf			0.08						
OA req'd per person for system area (Weighted average)	Rps	cfm/p			7.3						
Inputs for Potentially Critical zones											
Zone Name		*Zone title turns purple italic for critical zone(s)*				*Prac. Skills Training*	Prac. Skills Training	Prac. Training	Prep Room	Men	Women	Elec.
Zone Tag						Third 03	Third 04	Third 05	Third 06	Third 07	Third 08	Third 09
Space type		Select from pull-down list				Classrooms (age 9 plus)	Classrooms (age 9 plus)	Classrooms (age 9 plus)	Office space	Storage rooms	Storage rooms	Electrical equipment rooms
Floor Area of zone	Az	sf				1426	1419	1396	299	243	310	110
Design population of zone	Pz	P	(default value listed; may be overridden)			36	36	36	2	4	5	0
Design total supply to zone (primary plus local recirculated)	Vdzd	cfm				1500	1500	1500	300	225	325	100
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%	100%	100%	100%
Air distribution type at conditioned analyzed		Select from pull-down list				CS	CS	CS	CS	CS	CS	CS
Zone air distribution effectiveness at conditioned analyzed	Ez					1.00	1.00	1.00	1.00	1.00	1.00	1.00
Primary air fraction of supply air at conditioned analyzed	Ep											
Results												
Ventilation System Efficiency	Ev				0.78							
Outdoor air intake required for system	Vot	cfm			4844							
Outdoor air per unit floor area	Vot/As	cfm/sf			0.26							
Outdoor air per person served by system (including diversity)	Vot/Ps	cfm/p			15.1							
Outdoor air as a % of design primary supply air	Ypd	cfm			18%							
Detailed Calculations												
Initial Calculations for the System as a whole												
Primary supply air flow to system at conditioned analyzed	Vps	cfm	= VpdDs	=	27650							
UncorrectedOA requirement for system	Vou	cfm	= Rps Ps + Ras As	=	3793							
Uncorrected OA req'd as a fraction of primary SA	Xs		= Vou / Vps	=	0.14							
Initial Calculations for individual zones												
OA rate per unit area for zone	Raz	cfm/sf				0.12	0.12	0.12	0.06	0.12	0.12	0.06
OA rate per person	Rpz	cfm/p				10.00	10.00	10.00	5.00	0.00	0.00	0.00
Total supply air to zone (at condition being analyzed)	Vdz	cfm				1500	1500	1500	300	225	325	100
Unused OA req'd to breathing zone	Vbz	cfm	= Rpz Pz + Raz Az	=		531.1	530.3	527.5	27.9	29.2	37.2	6.6
Unused OA requirement for zone	Voz	cfm	= Vbz/Ez	=		531	530	528	28	29	37	7
Fraction of zone supply not directly recirc. from zone	Fa		= Ep + (1-Ep)Er	=		1.00	1.00	1.00	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	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	1.00	1.00	1.00
Unused OA fraction required in supply air to zone	Zd		= Voz / Vdz	=		0.35	0.35	0.35	0.09	0.13	0.11	0.07
Unused OA fraction required in primary air to zone	Zp		= Voz / Vpz	=		0.35	0.35	0.35	0.09	0.13	0.11	0.07
System Ventilation Efficiency												
Zone Ventilation Efficiency (App A Method)	Evz		= (Fa + FbXs - FcZ) / Fa	=		0.78	0.78	0.79	1.04	1.01	1.02	1.07
System Ventilation Efficiency (App A Method)	Ev		= min (Evz)	=	0.78							
Ventilation System Efficiency (Table 6.3 Method)	Ev		= Value from Table 6.3	=	0.80							
Minimum outdoor air intake airflow												
Outdoor Air Intake Flow required to System	Vot	cfm	= Vou / Ev	=	4844							
OA intake req'd as a fraction of primary SA	Y		= Vot / Vps	=	0.18							
Outdoor Air Intake Flow required to System (Table 6.3 Method)	Vot	cfm	= Vou / Ev	=	4766							
OA intake req'd as a fraction of primary SA (Table 6.3 Method)	Y		= Vot / Vps	=	0.17							
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	=	-25							

Building:	Nassau Community College Life Sciences Building										
System Tag/Name:	AHU-2										
Operating Condition Description:	Design Peak Cooling Load Condition										
Units (select from pull-down list)	IP										
Inputs for System	**Name**	**Units**		**System**							
Floor area served by system	As	sf		18401							
Population of area served by system (including diversity)	Ps	P	100% diversity	320							
Design primary supply fan airflow rate	Vpsd	cfm		27,650							
OA req'd per unit area for system (Weighted average)	Ras	cfm/sf		0.08							
OA req'd per person for system area (Weighted average)	Rps	cfm/p		7.3							
Inputs for Potentially Critical zones											
Zone Name			*Zone title turns purple italic for critical zone(s)*		Tele.	Vending	Fac. Office	Fac. Office	Fac. Office	Fac. Office	Fac. Office
Zone Tag					Third 14	Third 41	Third 42	Third 43	Third 44	Third 45	Third 46
Space type			Select from pull-down list		Electrical equipment rooms	Coffee Stations	Office space	Office space	Office space	Office space	Office space
Floor Area of zone	Az	sf			69	202	106	105	105	105	105
Design population of zone	Pz	P	(default value listed; may be overridden)		0	4	1	1	1	1	1
Design total supply to zone (primary plus local recirculated)	Vdzd	cfm			50	175	350	350	350	350	350
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%	100%	100%	100%
Air distribution type at conditioned analyzed			Select from pull-down list		CS	CS	CS	CS	CS	CS	CS
Zone air distribution effectiveness at conditioned analyzed	Ez				1.00	1.00	1.00	1.00	1.00	1.00	1.00
Primary air fraction of supply air at conditioned analyzed	Ep										
Results											
Ventilation System Efficiency	Ev			0.78							
Outdoor air intake required for system	Vot	cfm		4844							
Outdoor air per unit floor area	Vot/As	cfm/sf		0.26							
Outdoor air per person served by system (including diversity)	Vot/Ps	cfm/p		15.1							
Outdoor air as a % of design primary supply air	Ypd	cfm		18%							
Detailed Calculations											
Initial Calculations for the System as a whole											
Primary supply air flow to system at conditioned analyzed	Vps	cfm	= VpdDs =	27650							
UncorrectedOA requirement for system	Vou	cfm	= Rps Ps + Ras As =	3793							
Uncorrected OA req'd as a fraction of primary SA	Xs		= Vou / Vps =	0.14							
Initial Calculations for individual zones											
OA rate per unit area for zone	Raz	cfm/sf			0.06	0.06	0.06	0.06	0.06	0.06	0.06
OA rate per person	Rpz	cfm/p			0.00	5.00	5.00	5.00	5.00	5.00	5.00
Total supply air to zone (at condition being analyzed)	Vdz	cfm			50	175	350	350	350	350	350
Unused OA req'd to breathing zone	Vbz	cfm	= Rpz Pz + Raz Az =		4.1	32.1	11.4	11.3	11.3	11.3	11.3
Unused OA requirement for zone	Voz	cfm	= Vbz/Ez =		4	32	11	11	11	11	11
Fraction of zone supply not directly recirc. from zone	Fa		= Ep + (1-Ep)Er =		1.00	1.00	1.00	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	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	1.00	1.00	1.00
Unused OA fraction required in supply air to zone	Zd		= Voz / Vdz =		0.08	0.18	0.03	0.03	0.03	0.03	0.03
Unused OA fraction required in primary air to zone	Zp		= Voz / Vpz =		0.08	0.18	0.03	0.03	0.03	0.03	0.03
System Ventilation Efficiency											
Zone Ventilation Efficiency (App A Method)	Evz		= (Fa + FbXs - FcZ) / Fa =		1.05	0.95	1.10	1.10	1.10	1.10	1.10
System Ventilation Efficiency (App A Method)	Ev		= min (Evz) =	0.78							
Ventilation System Efficiency (Table 6.3 Method)	Ev		= Value from Table 6.3 =	0.80							
Minimum outdoor air intake airflow											
Outdoor Air Intake Flow required to System	Vot	cfm	= Vou / Ev =	4844							
OA intake req'd as a fraction of primary SA	Y		= Vot / Vps =	0.18							
Outdoor Air Intake Flow required to System (Table 6.3 Method)	Vot	cfm	= Vou / Ev =	4766							
OA intake req'd as a fraction of primary SA (Table 6.3 Method)	Y		= Vot / Vps =	0.17							
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 =	-25							

Building:	Nassau Community College Life Sciences Building									
System Tag/Name:	AHU-2									
Operating Condition Description:	Design Peak Cooling Load Condition									
Units (select from pull-down list)	IP									

Item	Name	Units	Formula / Notes	System						
Inputs for System										
Floor area served by system	As	sf		18401						
Population of area served by system (including diversity)	Ps	P	100% diversity	320						
Design primary supply fan airflow rate	Vpsd	cfm		27,650						
OA req'd per unit area for system (Weighted average)	Ras	cfm/sf		0.08						
OA req'd per person for system area (Weighted average)	Rps	cfm/p		7.3						
Inputs for Potentially Critical zones										
Zone Name			*Zone title turns purple italic for critical zone(s)*		Fac. Office	Fac. Office	Fac. Office	Fac. Office	Fac. Office	Fac. Office	Fac. Office
Zone Tag					Third 47	Third 48	Third 49	Third 50	Third 51	Third 52	Third 53
Space type			Select from pull-down list		Office space	Office space	Office space	Office space	Office space	Office space	Office space
Floor Area of zone	Az	sf			105	105	105	105	105	105	105
Design population of zone	Pz	P	(default value listed; may be overridden)		1	1	1	1	1	1	1
Design total supply to zone (primary plus local recirculated)	Vdzd	cfm			350	350	350	350	350	350	350
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%	100%	100%	100%
Air distribution type at conditioned analyzed			Select from pull-down list		CS	CS	CS	CS	CS	CS	CS
Zone air distribution effectiveness at conditioned analyzed	Ez				1.00	1.00	1.00	1.00	1.00	1.00	1.00
Primary air fraction of supply air at conditioned analyzed	Ep										
Results											
Ventilation System Efficiency	Ev			0.78							
Outdoor air intake required for system	Vot	cfm		4844							
Outdoor air per unit floor area	Vot/As	cfm/sf		0.26							
Outdoor air per person served by system (including diversity)	Vot/Ps	cfm/p		15.1							
Outdoor air as a % of design primary supply air	Ypd	cfm		18%							
Detailed Calculations											
Initial Calculations for the System as a whole											
Primary supply air flow to system at conditioned analyzed	Vps	cfm	= VpdDs =	27650							
UncorrectedOA requirement for system	Vou	cfm	= Rps Ps + Ras As =	3793							
Uncorrected OA req'd as a fraction of primary SA	Xs		= Vou / Vps =	0.14							
Initial Calculations for individual zones											
OA rate per unit area for zone	Raz	cfm/sf			0.06	0.06	0.06	0.06	0.06	0.06	0.06
OA rate per person	Rpz	cfm/p			5.00	5.00	5.00	5.00	5.00	5.00	5.00
Total supply air to zone (at condition being analyzed)	Vdz	cfm			350	350	350	350	350	350	350
Unused OA req'd to breathing zone	Vbz	cfm	= Rpz Pz + Raz Az =		11.3	11.3	11.3	11.3	11.3	11.3	11.3
Unused OA requirement for zone	Voz	cfm	= Vbz/Ez =		11	11	11	11	11	11	11
Fraction of zone supply not directly recirc. from zone	Fa		= Ep + (1-Ep)Er =		1.00	1.00	1.00	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	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	1.00	1.00	1.00
Unused OA fraction required in supply air to zone	Zd		= Voz / Vdz =		0.03	0.03	0.03	0.03	0.03	0.03	0.03
Unused OA fraction required in primary air to zone	Zp		= Voz / Vpz =		0.03	0.03	0.03	0.03	0.03	0.03	0.03
System Ventilation Efficiency											
Zone Ventilation Efficiency (App A Method)	Evz		= (Fa + FbXs - FcZ) / Fa =		1.10	1.10	1.10	1.10	1.10	1.10	1.10
System Ventilation Efficiency (App A Method)	Ev		= min (Evz) =	0.78							
Ventilation System Efficiency (Table 6.3 Method)	Ev		= Value from Table 6.3 =	0.80							
Minimum outdoor air intake airflow											
Outdoor Air Intake Flow required to System	Vot	cfm	= Vou / Ev =	4844							
OA intake req'd as a fraction of primary SA	Y		= Vot / Vps =	0.18							
Outdoor Air Intake Flow required to System (Table 6.3 Method)	Vot	cfm	= Vou / Ev =	4766							
OA intake req'd as a fraction of primary SA (Table 6.3 Method)	Y		= Vot / Vps =	0.17							
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 =	-25							

Building:	Nassau Community College Life Sciences Building						
System Tag/Name:	AHU-2						
Operating Condition Description:	Design Peak Cooling Load Condition						
Units (select from pull-down list)	IP						
Inputs for System	**Name**	**Units**		**System**		**Check Figures**	
Floor area served by system	As	sf		18401			
Population of area served by system (including diversity)	Ps	P	100% diversity	320		17.4 P/1000 sf	
Design primary supply fan airflow rate	Vpsd	cfm		27,650		1.50 cfm/sf	
OA req'd per unit area for system (Weighted average)	Ras	cfm/sf		0.08		0.08 ave cfm/sf	
OA req'd per person for system area (Weighted average)	Rps	cfm/p		7.3		7.30 ave cfm/p	
Inputs for Potentially Critical zones							
Zone Name			*Zone title turns purple italic for critical zone(s)*		Fac. Office	Totals/averages	
Zone Tag					Third 54		
Space type			Select from pull-down list		Office space		
Floor Area of zone	Az	sf			109	18401 total sf	
Design population of zone	Pz	P	(default value listed; may be overridden)		1	320 total P	
Design total supply to zone (primary plus local recirculated)	Vdzd	cfm			375	27650 total cfm	
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					1.00 average	
Inputs for Operating Condition Analyzed							
Percent of total design airflow rate at conditioned analyzed	Ds	%		100%	100%	100% average	make that primary over design
Air distribution type at conditioned analyzed			Select from pull-down list		CS		
Zone air distribution effectiveness at conditioned analyzed	Ez				1.00	100% average	Primary airflow rate to zones
Primary air fraction of supply air at conditioned analyzed	Ep					1.00 average	27650 cfm
Results							
Ventilation System Efficiency	Ev			**0.78**			
Outdoor air intake required for system	Vot	cfm		**4844**			
Outdoor air per unit floor area	Vot/As	cfm/sf		**0.26**			
Outdoor air per person served by system (including diversity)	Vot/Ps	cfm/p		**15.1**			
Outdoor air as a % of design primary supply air	Ypd	cfm		**18%**			
Detailed Calculations							
Initial Calculations for the System as a whole							
Primary supply air flow to system at conditioned analyzed	Vps	cfm	= VpdDs =	27650		320 System population without diversity	
UncorrectedOA requirement for system	Vou	cfm	= Rps Ps + Ras As =	3793		1.00 System population diversity, D	
Uncorrected OA req'd as a fraction of primary SA	Xs		= Vou / Vps =	0.14			
Initial Calculations for individual zones							
OA rate per unit area for zone	Raz	cfm/sf			0.06		
OA rate per person	Rpz	cfm/p			5.00		
Total supply air to zone (at condition being analyzed)	Vdz	cfm			375	27650	
Unused OA req'd to breathing zone	Vbz	cfm	= Rpz Pz + Raz Az =		11.5	3793	
Unused OA requirement for zone	Voz	cfm	= Vbz/Ez =		12	3793	
Fraction of zone supply not directly recirc. from zone	Fa		= Ep + (1-Ep)Er =		1.00		
Fraction of zone supply from fully mixed primary air	Fb		= Ep =		1.00		
Fraction of zone OA not directly recirc. from zone	Fc		= 1-(1-Ez)(1-Ep)(1-Er) =		1.00		
Unused OA fraction required in supply air to zone	Zd		= Voz / Vdz =		0.03	0.35 Maximum Zd	
Unused OA fraction required in primary air to zone	Zp		= Voz / Vpz =		0.03	0.35 Maximum Zp	
System Ventilation Efficiency							
Zone Ventilation Efficiency (App A Method)	Evz		= (Fa + FbXs - FcZ) / Fa =		1.11		
System Ventilation Efficiency (App A Method)	Ev		= min (Evz) =	**0.78**			
Ventilation System Efficiency (Table 6.3 Method)	Ev		= Value from Table 6.3 =	0.80			
Minimum outdoor air intake airflow							
Outdoor Air Intake Flow required to System	Vot	cfm	= Vou / Ev =	**4844**			
OA intake req'd as a fraction of primary SA	Y		= Vot / Vps =	**0.18**			
Outdoor Air Intake Flow required to System (Table 6.3 Method)	Vot	cfm	= Vou / Ev =	4766			
OA intake req'd as a fraction of primary SA (Table 6.3 Method)	Y		= Vot / Vps =	0.17			
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 =	-25			

Building:	Nassau Community College Life Sciences Building										
System Tag/Name:	AHU-3										
Operating Condition Description:	Design Peak Cooling Load Condition										
Units (select from pull-down list)	IP										
Inputs for System	**Name**	**Units**			**System**						
Floor area served by system	As	sf			12052						
Population of area served by system (including diversity)	Ps	P	100% diversity		143						
Design primary supply fan airflow rate	Vpsd	cfm			23,005						
OA req'd per unit area for system (Weighted average)	Ras	cfm/sf			0.10						
OA req'd per person for system area (Weighted average)	Rps	cfm/p			9.8						
Inputs for Potentially Critical zones											
Zone Name						Corr. #1	*Inorgan. Chem Lab*	Inorgan. Chem Lab	Inorgan. Chem Lab	Chemical Stockroom	Chem. Stock Office	Cart/Equip Storage
Zone Tag	*Zone title turns purple italic for critical zone(s)*					Second 01	Second 03	Second 04	Second 05	Second 06	Second 06A	Second 17
Space type		Select from pull-down list				Corridors	Classrooms (age 9 plus)	Classrooms (age 9 plus)	Classrooms (age 9 plus)	Storage rooms	Office space	Storage rooms
Floor Area of zone	Az	sf				1,533	1283	1271	1275	533	87	294
Design population of zone	Pz	P	(default value listed; may be overridden)			0	26	26	26	2	1	0
Design total supply to zone (primary plus local recirculated)	Vdzd	cfm				1,000	2500	2500	2500	750	100	350
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					75%	75%	75%	75%	75%	75%	75%
Inputs for Operating Condition Analyzed											
Percent of total design airflow rate at conditioned analyzed	Ds	%			100%	100%	100%	100%	100%	100%	100%	100%
Air distribution type at conditioned analyzed		Select from pull-down list				CS	CS	CS	CS	CS	CS	CS
Zone air distribution effectiveness at conditioned analyzed	Ez					1.00	1.00	1.00	1.00	1.00	1.00	1.00
Primary air fraction of supply air at conditioned analyzed	Ep											
Results											
Ventilation System Efficiency	Ev				0.95							
Outdoor air intake required for system	Vot	cfm			2765							
Outdoor air per unit floor area	Vot/As	cfm/sf			0.23							
Outdoor air per person served by system (including diversity)	Vot/Ps	cfm/p			19.3							
Outdoor air as a % of design primary supply air	Ypd	cfm			12%							
Detailed Calculations												
Initial Calculations for the System as a whole												
Primary supply air flow to system at conditioned analyzed	Vps	cfm	= VpdDs	=	23005							
UncorrectedOA requirement for system	Vou	cfm	= Rps Ps + Ras As	=	2622							
Uncorrected OA req'd as a fraction of primary SA	Xs		= Vou / Vps	=	0.11							
Initial Calculations for individual zones												
OA rate per unit area for zone	Raz	cfm/sf				0.06	0.12	0.12	0.12	0.12	0.06	0.12
OA rate per person	Rpz	cfm/p				0.00	10.00	10.00	10.00	0.00	5.00	0.00
Total supply air to zone (at condition being analyzed)	Vdz	cfm				1000	2500	2500	2500	750	100	350
Unused OA req'd to breathing zone	Vbz	cfm	= Rpz Pz + Raz Az	=		92.0	414.0	412.5	413.0	64.0	10.2	35.3
Unused OA requirement for zone	Voz	cfm	= Vbz/Ez	=		92	414	413	413	64	10	35
Fraction of zone supply not directly recirc. from zone	Fa		= Ep + (1-Ep)Er	=		1.00	1.00	1.00	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	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	1.00	1.00	1.00
Unused OA fraction required in supply air to zone	Zd		= Voz / Vdz	=		0.09	0.17	0.17	0.17	0.09	0.10	0.10
Unused OA fraction required in primary air to zone	Zp		= Voz / Vpz	=		0.09	0.17	0.17	0.17	0.09	0.10	0.10
System Ventilation Efficiency												
Zone Ventilation Efficiency (App A Method)	Evz		= (Fa + FbXs - FcZ) / Fa	=		1.02	0.95	0.95	0.95	1.03	1.01	1.01
System Ventilation Efficiency (App A Method)	Ev		= min (Evz)	=	0.95							
Ventilation System Efficiency (Table 6.3 Method)	Ev		= Value from Table 6.3	=	0.98							
Minimum outdoor air intake airflow												
Outdoor Air Intake Flow required to System	Vot	cfm	= Vou / Ev	=	2765							
OA intake req'd as a fraction of primary SA	Y		= Vot / Vps	=	0.12							
Outdoor Air Intake Flow required to System (Table 6.3 Method)	Vot	cfm	= Vou / Ev	=	2664	101.17						
OA intake req'd as a fraction of primary SA (Table 6.3 Method)	Y		= Vot / Vps	=	0.12	0.04						
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	=	-89							

Building:	Nassau Community College Life Sciences Building
System Tag/Name:	AHU-3
Operating Condition Description:	Design Peak Cooling Load Condition
Units (select from pull-down list)	IP

Item	Name	Units		System	Corr. 32	Inorgan. Chem Lab	Organ Chem Lab	Organ Istrument.	Organ Chem Lab	Corr. #3	Corr. #2
Inputs for System											
Floor area served by system	As	sf		12052							
Population of area served by system (including diversity)	Ps	P	100% diversity	143							
Design primary supply fan airflow rate	Vpsd	cfm		23,005							
OA req'd per unit area for system (Weighted average)	Ras	cfm/sf		0.10							
OA req'd per person for system area (Weighted average)	Rps	cfm/p		9.8							
Inputs for Potentially Critical zones					Potentially Critical Zones						
Zone Name			*Zone title turns purple italic for critical zone(s)*		Corr. 32	Inorgan. Chem Lab	Organ Chem Lab	Organ Istrument.	Organ Chem Lab	Corr. #3	Corr. #2
Zone Tag					Second 18	Second 19	Second 21	Second 22	Second 23	Second 25	Base 01
Space type			Select from pull-down list		Corridors	Classrooms (age 9 plus)	Classrooms (age 9 plus)	Classrooms (age 9 plus)	Classrooms (age 9 plus)	Corridors	Corridors
Floor Area of zone	Az	sf			598	1289	947	292	947	680	711
Design population of zone	Pz	P	(default value listed; may be overridden)		0	20	20	2	20	0	0
Design total supply to zone (primary plus local recirculated)	Vdzd	cfm			300	2500	3840	350	3840	350	1925
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%	100%	100%	100%
Air distribution type at conditioned analyzed			Select from pull-down list		CS	CS	CS	CS	CS	CS	CS
Zone air distribution effectiveness at conditioned analyzed	Ez				1.00	1.00	1.00	1.00	1.00	1.00	1.00
Primary air fraction of supply air at conditioned analyzed	Ep										
Results											
Ventilation System Efficiency	Ev			0.95							
Outdoor air intake required for system	Vot	cfm		2765							
Outdoor air per unit floor area	Vot/As	cfm/sf		0.23							
Outdoor air per person served by system (including diversity)	Vot/Ps	cfm/p		19.3							
Outdoor air as a % of design primary supply air	Ypd	cfm		12%							
Detailed Calculations											
Initial Calculations for the System as a whole											
Primary supply air flow to system at conditioned analyzed	Vps	cfm	= VpdDs =	23005							
UncorrectedOA requirement for system	Vou	cfm	= Rps Ps + Ras As =	2622							
Uncorrected OA req'd as a fraction of primary SA	Xs		= Vou / Vps =	0.11							
Initial Calculations for individual zones											
OA rate per unit area for zone	Raz	cfm/sf			0.06	0.12	0.12	0.12	0.12	0.06	0.06
OA rate per person	Rpz	cfm/p			0.00	10.00	10.00	10.00	10.00	0.00	0.00
Total supply air to zone (at condition being analyzed)	Vdz	cfm			300	2500	3840	350	3840	350	1925
Unused OA req'd to breathing zone	Vbz	cfm	= Rpz Pz + Raz Az =		35.9	354.7	313.6	55.0	313.6	40.8	42.7
Unused OA requirement for zone	Voz	cfm	= Vbz/Ez =		36	355	314	55	314	41	43
Fraction of zone supply not directly recirc. from zone	Fa		= Ep + (1-Ep)Er =		1.00	1.00	1.00	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	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	1.00	1.00	1.00
Unused OA fraction required in supply air to zone	Zd		= Voz / Vdz =		0.12	0.14	0.08	0.16	0.08	0.12	0.02
Unused OA fraction required in primary air to zone	Zp		= Voz / Vpz =		0.12	0.14	0.08	0.16	0.08	0.12	0.02
System Ventilation Efficiency											
Zone Ventilation Efficiency (App A Method)	Evz		= (Fa + FbXs - FcZ) / Fa =		0.99	0.97	1.03	0.96	1.03	1.00	1.09
System Ventilation Efficiency (App A Method)	Ev		= min (Evz) =	0.95							
Ventilation System Efficiency (Table 6.3 Method)	Ev		= Value from Table 6.3 =	0.98							
Minimum outdoor air intake airflow											
Outdoor Air Intake Flow required to System	Vot	cfm	= Vou / Ev =	2765							
OA intake req'd as a fraction of primary SA	Y		= Vot / Vps =	0.12							
Outdoor Air Intake Flow required to System (Table 6.3 Method)	Vot	cfm	= Vou / Ev =	2664							
OA intake req'd as a fraction of primary SA (Table 6.3 Method)	Y		= Vot / Vps =	0.12							
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 =	-69							

Item	Name	Units	Formula		System	Main Telecom Rm	Custododial/ Maintenance	Check Figures	
Building:	Nassau Community College Life Sciences Building								
System Tag/Name:	AHU-3								
Operating Condition Description:	Design Peak Cooling Load Condition								
Units (select from pull-down list)	IP								
Inputs for System	**Name**	**Units**			**System**			**Check Figures**	
Floor area served by system	As	sf			12052				
Population of area served by system (including diversity)	Ps	P	100% diversity		143			11.9 P/1000 sf	
Design primary supply fan airflow rate	Vpsd	cfm			23,005			1.91 cfm/sf	
OA req'd per unit area for system (Weighted average)	Ras	cfm/sf			0.10			0.10 ave cfm/sf	
OA req'd per person for system area (Weighted average)	Rps	cfm/p			9.8			9.83 ave cfm/p	
Inputs for Potentially Critical zones									
Zone Name			*Zone title turns purple italic for critical zone(s)*			Main Telecom Rm	Custododial/ Maintenance	Totals/averages	
Zone Tag						Base 06	Base 15		
Space type			Select from pull-down list			Electrical equipment rooms	Storage rooms		
Floor Area of zone	Az	sf				211	101	12052 total sf	
Design population of zone	Pz	P	(default value listed; may be overridden)			0	0	143 total P	
Design total supply to zone (primary plus local recirculated)	Vdzd	cfm				100	100	23005 total cfm	
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							1.00 average	
Inputs for Operating Condition Analyzed									
Percent of total design airflow rate at conditioned analyzed	Ds	%			100%	100%	100%	100% average	make that primary ove
Air distribution type at conditioned analyzed			Select from pull-down list			CS	CS		
Zone air distribution effectiveness at conditioned analyzed	Ez					1.00	1.00	100% average	Primary airflow rate to zones 23005 cfm
Primary air fraction of supply air at conditioned analyzed	Ep							1.00 average	
Results									
Ventilation System Efficiency	Ev				0.95				
Outdoor air intake required for system	Vot	cfm			2765				
Outdoor air per unit floor area	Vot/As	cfm/sf			0.23				
Outdoor air per person served by system (including diversity)	Vot/Ps	cfm/p			19.3				
Outdoor air as a % of design primary supply air	Ypd	cfm			12%				
Detailed Calculations									
Initial Calculations for the System as a whole									
Primary supply air flow to system at conditioned analyzed	Vps	cfm	= VpdDs	=	23005			143 System population without diversity	
UncorrectedOA requirement for system	Vou	cfm	= Rps Ps + Ras As	=	2622			1.00 System population diversity, D	
Uncorrected OA req'd as a fraction of primary SA	Xs		= Vou / Vps	=	0.11				
Initial Calculations for individual zones									
OA rate per unit area for zone	Raz	cfm/sf				0.06	0.12		
OA rate per person	Rpz	cfm/p				0.00	0.00		
Total supply air to zone (at condition being analyzed)	Vdz	cfm				100	100	23005	
Unused OA req'd to breathing zone	Vbz	cfm	= Rpz Pz + Raz Az	=		12.7	12.1	2622	
Unused OA requirement for zone	Voz	cfm	= Vbz/Ez	=		13	12	2622	
Fraction of zone supply not directly recirc. from zone	Fa		= Ep + (1-Ep)Er	=		1.00	1.00		
Fraction of zone supply from fully mixed primary air	Fb		= Ep	=		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		
Unused OA fraction required in supply air to zone	Zd		= Voz / Vdz	=		0.13	0.12	0.17 Maximum Zd	
Unused OA fraction required in primary air to zone	Zp		= Voz / Vpz	=		0.13	0.12	0.17 Maximum Zp	
System Ventilation Efficiency									
Zone Ventilation Efficiency (App A Method)	Evz		= (Fa + FbXs - FcZ) / Fa	=		0.99	0.99		
System Ventilation Efficiency (App A Method)	Ev		= min (Evz)	=	0.95				
Ventilation System Efficiency (Table 6.3 Method)	Ev		= Value from Table 6.3	=	0.98				
Minimum outdoor air intake airflow									
Outdoor Air Intake Flow required to System	Vot	cfm	= Vou / Ev	=	2765				
OA intake req'd as a fraction of primary SA	Y		= Vot / Vps	=	0.12				
Outdoor Air Intake Flow required to System (Table 6.3 Method)	Vot	cfm	= Vou / Ev	=	2684				
OA intake req'd as a fraction of primary SA (Table 6.3 Method)	Y		= Vot / Vps	=	0.12				
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	=	-69				

Appendix B – Minimum Ventilation Compliance Check

AHU-1						
Room Number	Room Name	Level	Area	Design Ventilation	Minimum Ventilation	Standard 62.1 Compliant (Y/N)
1-17	Lobby	Level 1	375 SF	100	73	Y
1-19	Corr. #2	Level 1	451 SF	200	27	Y
1-20	Group Study Area	Level 1	1018 SF	1600	478	Y
1-21	36-Person General Classroom	Level 1	1181 SF	1950	341	Y
1-22	24-Person General Classroom	Level 1	755 SF	1200	225	Y
1-23	24-Person General Classroom	Level 1	761 SF	1100	226	Y
1-24	Chemistry Computer Cluster	Level 1	989 SF	1800	369	Y
1-26	Corr. #3	Level 1	622 SF	350	37	Y
1-27	Fac. Office	Level 1	109 SF	350	12	Y
1-28	Fac. Office	Level 1	105 SF	325	11	Y
1-29	Fac. Office	Level 1	105 SF	325	11	Y
1-30	Fac. Office	Level 1	105 SF	325	11	Y
1-31	Fac. Office	Level 1	105 SF	325	11	Y
1-32	Fac. Office	Level 1	105 SF	325	11	Y
1-33	Fac. Office	Level 1	106 SF	325	11	Y
1-34	Elec.	Level 1	56 SF	100	3	Y
1-35	Fac. Office	Level 1	102 SF	150	11	Y
1-36	Fac. Office	Level 1	105 SF	150	11	Y
1-37	Fac. Office	Level 1	106 SF	150	11	Y
1-39	Seating Niche	Level 1	432 SF	300	12	Y
2-15	Faculty Lounge	Level 2	301 SF	500	96	Y
2-18	Corr.#2	Level 2	598 SF	250	36	Y
2-20	Chemistry Admin. Suite	Level 2	299 SF	350	38	Y
2-20A	Director's Office	Level 2	174 SF	175	15	Y
2-20C	Conf. Room	Level 2	247 SF	500	75	Y
2-26	Fac. Office	Level 2	109 SF	350	12	Y
2-27	Fac. Office	Level 2	105 SF	325	11	Y
2-28	Fac. Office	Level 2	105 SF	325	11	Y
2-29	Fac. Office	Level 2	105 SF	325	11	Y
2-30	Fac. Office	Level 2	105 SF	325	11	Y
2-31	Fac. Office	Level 2	105 SF	325	11	Y
2-32	Fac. Office	Level 2	106 SF	325	11	Y
2-33	Elec.	Level 2	56 SF	100	3	Y
2-34	Fac. Office	Level 2	102 SF	150	11	Y
2-35	Fac. Office	Level 2	105 SF	150	11	Y
2-36	Fac. Office	Level 2	106 SF	150	11	Y

2-37	Fac. Office	Level 2	105 SF	150	11	Y
2-38	Fac. Office	Level 2	105 SF	150	11	Y
2-39	Fac. Office	Level 2	102 SF	150	11	Y
3-15	Faculty Lounge	Level 3	301 SF	525	141	Y
3-17	Practical Skills Training Room	Level 3	1423 SF	2100	363	Y
3-18	Corr. #2	Level 3	1111 SF	500	67	Y
3-19	Nursing Admin. Suite	Level 3	517 SF	350	51	Y
3-20	Storage	Level 3	155 SF	150	19	Y
3-21	Director's Office/Conf. Room	Level 3	470 SF	500	33	Y
3-23	Nursing Learning Center/Media Stor.	Level 3	666 SF	700	160	Y
3-24	Nursing Computer Exam Room	Level 3	1643 SF	2100	677	Y
3-26	Corr. #3	Level 3	613 SF	350	37	Y
3-27	Fac. Office	Level 3	109 SF	375	12	Y
3-28	Fac. Office	Level 3	105 SF	350	11	Y
3-29	Fac. Office	Level 3	105 SF	350	11	Y
3-30	Fac. Office	Level 3	105 SF	350	11	Y
3-31	Fac. Office	Level 3	105 SF	350	11	Y
3-32	Fac. Office	Level 3	105 SF	350	11	Y
3-33	Fac. Office	Level 3	106 SF	350	11	Y
3-34	Elec.	Level 3	56 SF	100	3	Y
3-35	Fac. Office	Level 3	102 SF	175	11	Y
3-36	Fac. Office	Level 3	105 SF	175	11	Y
3-37	Fac. Office	Level 3	106 SF	175	11	Y
3-38	Fac. Office	Level 3	105 SF	175	11	Y
3-39	Fac. Office	Level 3	105 SF	175	11	Y
3-40	Fac. Office	Level 3	102 SF	175	11	Y

AHU-2						
Room Number	Room Name	Level	Area	Design Ventilation	Minimum Ventilation	Standard 62.1 Compliant (Y/N)
1-01	Corr. #1	Level 1	1492 SF	750	90	Y
1-03	36-Person General Classroom	Level 1	1074 SF	1600	334	Y
1-04	24-Person General Classroom	Level 1	755 SF	1100	225	Y
1-05	36-Person General Classroom	Level 1	1067 SF	1600	334	Y
1-06	36-Person General Classroom	Level 1	1056 SF	1300	333	Y
1-08	Men	Level 1	243 SF	225	29	Y
1-09	Women	Level 1	314 SF	325	38	Y
1-10	Elec.	Level 1	110 SF	100	7	Y
1-15	Tele.	Level 1	69 SF	50	4	Y
1-40	Vending	Level 1	203 SF	225	32	Y
1-41	Fac. Office	Level 1	106 SF	325	11	Y

1-42	Fac. Office	Level 1	105 SF	325	11	Y
1-43	Fac. Office	Level 1	105 SF	325	11	Y
1-44	Fac. Office	Level 1	105 SF	325	11	Y
1-45	Fac. Office	Level 1	105 SF	325	11	Y
1-46	Fac. Office	Level 1	105 SF	325	11	Y
1-47	Fac. Office	Level 1	105 SF	325	11	Y
1-48	Fac. Office	Level 1	105 SF	325	11	Y
1-49	Fac. Office	Level 1	105 SF	325	11	Y
1-50	Fac. Office	Level 1	105 SF	325	11	Y
1-51	Fac. Office	Level 1	105 SF	325	11	Y
1-52	Fac. Office	Level 1	105 SF	325	11	Y
1-53	Fac. Office	Level 1	109 SF	350	12	Y
2-07	Men	Level 2	243 SF	225	29	Y
2-08	Women	Level 2	310 SF	325	37	Y
2-09	Elec.	Level 2	110 SF	100	7	Y
2-14	Tele.	Level 2	69 SF	50	4	Y
2-40	Vending	Level 2	201 SF	225	32	Y
2-41	Fac. Office	Level 2	106 SF	325	11	Y
2-42	Fac. Office	Level 2	105 SF	325	11	Y
2-43	Fac. Office	Level 2	105 SF	325	11	Y
2-44	Fac. Office	Level 2	105 SF	325	11	Y
2-45	Fac. Office	Level 2	105 SF	325	11	Y
2-46	Fac. Office	Level 2	105 SF	325	11	Y
2-47	Fac. Office	Level 2	105 SF	325	11	Y
2-48	Fac. Office	Level 2	105 SF	325	11	Y
2-49	Fac. Office	Level 2	105 SF	325	11	Y
2-50	Fac. Office	Level 2	105 SF	325	11	Y
2-51	Fac. Office	Level 2	105 SF	325	11	Y
2-52	Fac. Office	Level 2	105 SF	325	11	Y
2-53	Fac. Office	Level 2	109 SF	350	12	Y
3-01	Corr. #1	Level 3	1501 SF	700	90	Y
3-03	Practical Skills Training Room	Level 3	1426 SF	1500	531	Y
3-04	Practical Skills Training Room	Level 3	1419 SF	1500	530	Y
3-05	Practical Skills Training Room	Level 3	1396 SF	1500	528	Y
3-06	Prep Room	Level 3	299 SF	300	28	Y
3-07	Men	Level 3	243 SF	225	29	Y
3-08	Women	Level 3	310 SF	325	37	Y
3-09	Elec.	Level 3	110 SF	100	7	Y
3-14	Tele.	Level 3	69 SF	50	4	Y
3-41	Vending	Level 3	202 SF	175	32	Y
3-42	Fac. Office	Level 3	106 SF	350	11	Y
3-43	Fac. Office	Level 3	105 SF	350	11	Y

3-44	Fac. Office	Level 3	105 SF	350	11	Y
3-45	Fac. Office	Level 3	105 SF	350	11	Y
3-46	Fac. Office	Level 3	105 SF	350	11	Y
3-47	Fac. Office	Level 3	105 SF	350	11	Y
3-48	Fac. Office	Level 3	105 SF	350	11	Y
3-49	Fac. Office	Level 3	105 SF	350	11	Y
3-50	Fac. Office	Level 3	105 SF	350	11	Y
3-51	Fac. Office	Level 3	105 SF	350	11	Y
3-52	Fac. Office	Level 3	105 SF	350	11	Y
3-53	Fac. Office	Level 3	105 SF	350	11	Y
3-54	Fac. Office	Level 3	109 SF	375	12	Y

AHU-3						
Room Number	Room Name	Level	Area	Design Ventilation	Minimum Ventilation	Standard 62.1 Compliant (Y/N)
2-01	Corr. #1	Level 2	1533 SF	1000	92	Y
2-03	Inorganic Chemistry Lab	Level 2	1283 SF	2500	414	Y
2-04	Inorganic Chemistry Lab	Level 2	1271 SF	2500	413	Y
2-05	Inorganic Chemistry Lab	Level 2	1275 SF	2500	413	Y
2-06	Chemical Stockroom	Level 2	533 SF	750	64	Y
2-06A	Chem. Stockroom Office	Level 2	87 SF	100	10	Y
2-17	Cart/Equipment Storage Room	Level 2	294 SF	350	35	Y
2-18	Corr. #2	Level 2	598 SF	300	36	Y
2-19	Inorganic Chemistry Lab	Level 2	1289 SF	2500	355	Y
2-21	Organic Chemistry Lab	Level 2	947 SF	3840	314	Y
2-22	Organic Instrumentation	Level 2	292 SF	350	55	Y
2-23	Organic Chemistry Lab	Level 2	947 SF	3840	314	Y
2-25	Corr. #3	Level 2	680 SF	350	41	Y
B-01	Corr. #2	Basement	711 SF	1925	43	Y
B-06	Main Telecom Room	Basement	221 SF	100	13	Y
B-15	Custodial/Maintenance	Basement	101 SF	100	12	Y