

Technical Report One

ASHRAE Std 62.1 and Std 90.1 Analysis

WESTINGHOUSE ELECTRIC CO.
NUCLEAR ENGINEERING
HEADQUARTERS CAMPUS

Pittsburgh, PA

Daniel P. Aughenbaugh
Mechanical

Dr. Bahnfleth – Advisor



Table of Contents

Executive Summary	3
System Description	4
ASHRAE 62.1 Analysis	5
Section 5 Analysis	5
Section 6 Analysis	7
Outdoor Air Flow Assumptions	9
Findings	10
62.1 Conclusions	11
ASHRAE 90.1 Analysis	12
Section 5 Building Envelope	12
Section 6 Heating Ventilating and Air Conditioning	14
Section 7 Service Water Heating	16
Section 9 Lighting	17
90.1 Conclusions	18
References	19
Appendix A	20

Executive Summary

The purpose of this report is to determine compliance or non-compliance of Building 1 of the Westinghouse Nuclear Engineering Campus with ASHRAE Standards 62.1 and 90.1.

Building 1 houses primarily office areas and conference rooms. Building 1 also contains a cafeteria/kitchen, data center, fitness center/locker rooms, and support facilities.

The ASHRAE Standard 62.1 Analysis showed that the building is largely compliant with the requirements of Section 5, indoor air quality. Section 6 calculations were done with two out of the four main AHUs. The two represent roughly half of the symmetrical building's rooms and also represent the largest and smallest Outdoor Air percentages. The Section 6 calculations show that all spaces receive more than adequate ventilation. It should be noted, if the occupancy was known rather than using the default values for occupancy, the critical zone would probably change to one of the densely populated office areas.

Analysis with respect to ASHRAE Standard 90.1 determined that the building as a whole almost meets requirements for acceptance. The main area in which there was a problem was the overall R-value of the exterior wall. The overall exterior R-value is R-11, which could be adjusted slightly in order to meet the required R-11.4. It should be noted that the Energy Cost Budget method may have been applied. A minor problem was found with the air system fans. Many of the supply fans did not meet code because of high horsepower. These fans had high horsepower designs because of the pressure drop of MERV-13 and HEPA filters in the system; therefore they may actually meet code.

It was determined that the Building is close to compliance with the two ASHRAE Standards. Compliance is of particular importance for this building as it is pursuing LEED® Certification. Both Minimum Outdoor Airflow and Minimum Building Performance as defined by ASHRAE in both Standards 62.1 and 90.1 respectively are prerequisites and must apply to even be considered for LEED® Certification.

Introduction

Westinghouse Nuclear Engineering Building 1 houses primarily office areas and conference rooms. Building 1 also contains a cafeteria/kitchen, data center, fitness center/locker rooms, and support facilities. The building contains three centrifugal chillers and three cooling towers. Electric re-heat coils are the primary heat source for each zone.

The majority of the office areas will involve a large amount of computer processing loads due to the high amount of programming needed. The offices also have a large human load from the significant amount of employees working in the office areas.

The facade of building 1 is a combination of aluminum curtainwalls, aluminum windows, insulated metal wall panels, brick, and polished concrete block. The roof system is a white Thermoplastic membrane system.

System Description

Building 1 has a VAV system coupled with electric heating coils and a chilled water loop.

Airside:

There are four ~260 ton Air Handling Units (AHUs) on the roof in a penthouse for serviceability. Each AHU is placed on a curb to allow for difference between location of the mechanical shafts and the intake and outlet of the AHU. For the 62.1 Analysis only AHU 1 and AHU 2 were considered.

Waterside:

There is a Mechanical Room in the basement containing three 450 ton chillers which are connected to three cooling towers located in the Mechanical Penthouse.

Zone Conditioning:

Interior space conditioning is maintained through the use of Variable Air Volume (VAV) Boxes. Perimeter spaces are conditioned with Parallel Fan Powered Boxes (FPBs) which have electric heating coils to reheat the air before it enters the space. For the Data Center, Computer Room Air-Conditioning (CRAC) Units are specified and distribute cooled air through an under-floor air distribution (UFAD) system.

ASHRAE 62.1

Section 5 Analysis

Section 5.1 Natural Ventilation

None of the windows in Building 1 are operable; therefore, Natural Ventilation is not a ventilation method for the building.

Section 5.2 Ventilation Air Distribution

All Spaces meet ventilation requirements. This is assuming that VAV Terminal boxes and Fan Powered boxes in the system are calibrated correctly so that the minimum flow through the box is that required to maintain minimum ventilation rates.

Section 5.3 Exhaust Duct Location

All exhaust from kitchens, toilet rooms, and other exhausted areas are ducted and pressurized negatively with respect to the spaces through which it passes, complying with this requirement.

Section 5.4 Ventilation System Controls

Ventilation controls work with occupancy sensors along with energy optimization programs. The control language for the system is BACNet.

Section 5.5 Airstream Surfaces

All airstream surfaces in equipment and ducts in the HVAC system are resistant to mold growth and erosion.

Section 5.6 Outdoor Air Intakes

All outdoor air intakes are at least the minimum safe distance away from any potential outdoor contaminant source even with exhaust fans and cooling towers being on the same level.

The outdoor air intakes have also been designed to manage rain entrainment with the use of rain hoods with a 0.5"x 0.5"birdscreen.

Section 5.7 Local Capture of Contaminants

All exhaust from Kitchens and other like spaces are ducted to exhaust fans on the roof.

Section 5.8 Combustion Air

All combustion air from the Snow Melting Boiler, Emergency Generator and Gas Fired Unit Heaters throughout the building is directly exhausted to outside of the building.

Section 5.9 Particulate Matter Removal

All Air Handling Units in the Building shall have filters of MERV-13 for occupancy purposes. During construction, all units will be sealed up to prevent particulates from entering the system.

Section 5.10 Dehumidification Systems.

The maximum relative humidity for the spaces is specified as 60%. Positive building pressurization is specified in the controls system throughout the year.

Section 5.11 Drain Pans

All drain pans are specified to be double sloped, positive draining with stainless steel pan. Drain connection shall be located at the lowest point of the pan. A full-width IAQ drain pan will extend at least 6" downstream of the last coil in the section.

Section 5.12 Finned-Tube Coils and Heat Exchangers

No Finned-Tube Coils were used to condition perimeter spaces; therefore, this section does not apply.

Section 5.13 Humidifiers and Water-Spray Systems

Humidification of spaces is specified to be handled by return air mixture and fan powered boxes in winter season.

Section 5.14 Access for Inspection, Cleaning and Maintenance

Typical access door sizes range from 18x72in to 30x72in on AHUs 1, 2, 3& 4.

Section 5.15 Building Envelope and Interior Surfaces

Reinforced-Polyethylene Vapor Retarders are provided in the wall construction to allow a maximum permeance rating of 0.0507 perm. Interior pipes and ducts shall be insulated to maintain temperature and to prevent condensation to build on the surface.

Section 5.16 Buildings with Attached Parking Garages

No parking structure is attached to the building; therefore this section does not apply.

Section 5.17 Air Classification and Recirculation

Most of the Building's Return air is classified as Class 1 coming from the offices, conference rooms and supporting spaces. The exhaust air from the Kitchen hoods is Class 4 but it is exhausted straight through the roof, avoiding recirculation. All toilet room exhaust is Class 2 but is also exhausted straight through the roof.

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

Building 1 is designed for LEED Certified, and no smoking is allowed within the building therefore smoking is only permitted 25 feet away from the building. With the outdoor air intakes on the roof, this should not cause an IAQ problem.

Section 6 Analysis

For the purpose of checking the airflow rate in Building 1, two AHUs—AHU1 and AHU2, were followed to all of their associated diffusers in their respective zones. This allowed for an effective check of the calculation method for outdoor airflow rate without covering the entire building.

Ventilation Rate Procedure

Breathing Zone Outdoor Airflow (V_{bz}):

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

where

A_z = zone floor area (ft²)

P_z = zone population, largest number of people expected to occupy the space during typical usage. (Estimated using values found in Table 6-1)

R_p = outdoor airflow rate per person (cfm/person) (Defined in Table 6-1)

R_a = outdoor airflow rate per unit area (cfm/ft²) (Defined in Table 6-1)

Zone Air Distribution Effectiveness (E_z)

$$E_z = 1 \text{ (As defined by Table 6-2)}$$

Zone Outdoor Airflow (V_{oz})

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

Zone Primary Outdoor Air Fraction (Z_p)

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

Note: For VAV Systems, V_{pz} is the minimum expected primary airflow for design purposes.

System Ventilation Efficiency (E_v)

$$E_v \text{ is found using the Maximum } Z_p \text{ value. (As defined by Table 6-3)}$$

Uncorrected Outdoor Air Intake (V_{ou})

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

where

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

P_s = system population, total population in the area served by the system

Outdoor Air Intake

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

Outdoor Air Flow Calculation Assumptions

1. Only AHU1 and AHU2 are calculated because they represent one half of a very symmetrical building and they represent the AHU's with the highest and lowest OA percentages.
2. Due to a lack of access to classified areas, all project and research spaces are calculated as Computer (not printer) or Computer Labs.
3. Toilet rooms are calculated as Storage Rooms, being the closest in population and CFM/ft².

ASHRAE 62.1 Findings

From The ASHRAE 62.1 Spreadsheet found in Appendix A, it can be seen that the highest Z_p value for AHU1 is found in one of the Auditoriums. With a high population density, it would be expected that the critical zone would be an office area or an auditorium. However, the spreadsheet uses the ASHRAE Standard numbers for occupant density which are not necessarily true. The Auditorium in question has a total area of 1518 ft² and according the spreadsheet there are 98.67 occupants in that room. This number seems to be moderately high when considering the layout of the auditorium.

From The ASHRAE 62.1 Spreadsheet found in Appendix A, it can be seen that the highest Z_p value for AHU2 is found in the Repro Center. The Repro Center was modeled as a computer lab, so with a large population density in a relatively small room it's easy to see why the Repro Center is the critical space. However, no information was permitted to be used for this spaces function so the assumption of being a "computer lab" may be incorrect. The Repro Center has a total area of 2200 ft² and according the spreadsheet there are 55 occupants in that room.

Comparing the calculated air flow rate from all the diffusers to that shown in plans, the flow rate calculated is only at 52,254CFM. With the AHU1 designed to handle 71,100CFM, this extra 20,000CFM seems inefficient even with possible expansion of unoccupied spaces.

Comparing the calculated air flow rate from all the diffusers to that shown in plans, the flow rate calculated is only at 45,411CFM. With the AHU2 designed to handle 63,000CFM, this extra 18,000CFM seems inefficient even with possible expansion of unoccupied spaces. Also, the calculated OA% is 75%, which is significantly higher than the designed percentage of about 50%. This difference may be accounted for in Repro Center or another near critical zone being inaccurately calculated.

62.1 Conclusion

The HVAC design of Building 1 goes above and beyond the requirements set forth in Section 5 of AHSRAE 62.1 in an effort to increase the air quality of the building. This increase in indoor air quality is a result of recent drives towards healthier building environments. One such action is the use of temporary fans and dehumidifiers located throughout the building during construction. This was done so that all ducts and AHUs could be sealed up during construction to prevent contaminants from entering the air system. This action is associated with a LEED Indoor Environmental Quality point.

As well as checking for compliance with section 5, calculations were performed to determine minimum outdoor airflow requirements of the AHU1 and AHU2 systems. From these calculations it can be assumed that if the intended occupancy numbers were known, the Zp values would decrease. This decrease is due to the conservative ASHRAE occupant density estimate, to ensure that enough outside air is brought into the space for maximum occupancy.

With some adjustment of the calculations and an investigation of the sizing issue of the Air Handling Units, Building 1 meets the requirements of ASHRAE 62.1

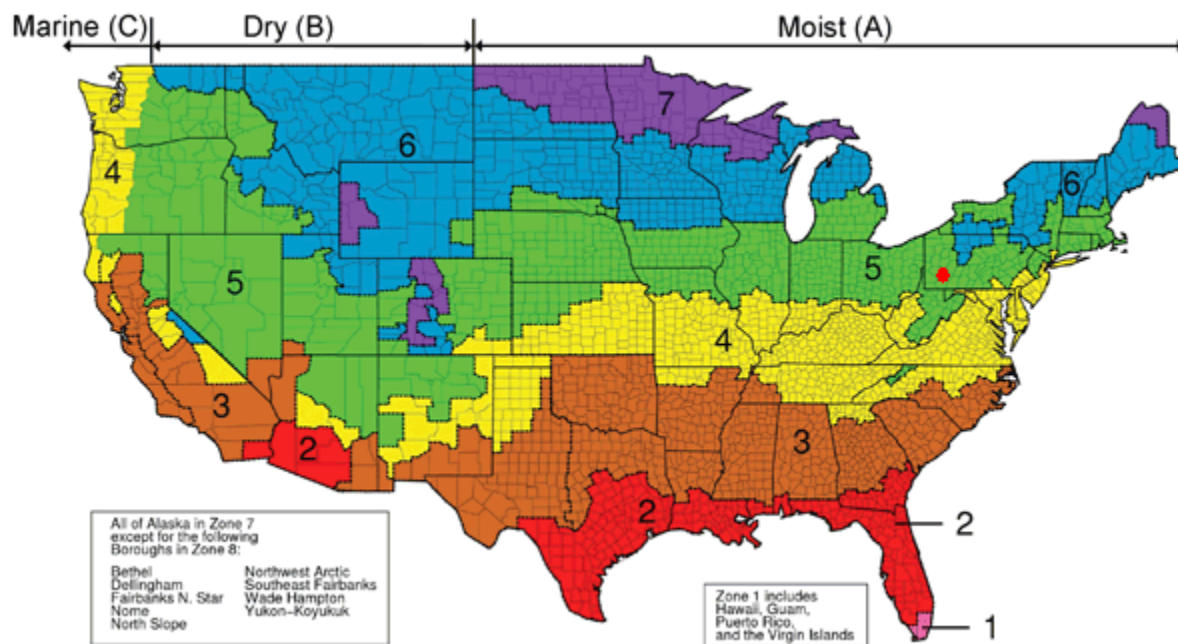
ASHRAE 90.1

Standard 90.1 is mainly concerned with the energy efficiency measures taken in the design of the building. It focuses on building envelope, Heating Ventilation and Air Conditioning systems, and Lighting and Electrical design.

Section 5 Analysis- Building Envelope

Section 5.1.4 Climate

The site location is situated in Climate Zone 5. See the below figure.



Section 5.4 Mandatory Provisions

All exterior joints in vertical surfaces and nontraffic horizontal surfaces shall be sealed. These joints include perimeter joints between exterior cladding and frames of doors and windows. All internal joints such as control and expansion joints on exposed interior surfaces of exterior walls. The loading dock doors shall be equipped with weatherstripping gaskets around the perimeter of the door. The building's vestibules are 12ft from exterior door to interior door.

Section 5.5 Prescriptive Building Envelope Option

There are two compliance paths for fenestration area: the prescriptive option and the trade-off option. The prescriptive option was used for this analysis. The tables below summarize amount of glazing on vertical surfaces and the values for building materials, respectively.

Fenestration Area				
Façade	Glass (SF)	Gross Wall (SF)	Percentage Glass	Complies?
North	10113	28966	34.9	YES
South	9710	24044	40.4	NO
East	11797	29540	39.9	YES
West	10334	20721	49.9	NO

The results of the fenestration table show the building does not quite meet ASHRAE’s standard for glazing area. The south face only needs a slight adjustment to comply. The west wall is significantly higher because of its prominence as the “front” of the building and more emphasis was put on its aesthetic appearance.

The table below summarizes the values of the building enclosure materials.

Compliance with Envelope Prescriptive Requirements						
Element	Description	90.1 Specified Values		Specified Values		Complies?
		Max U	Min R	Max U	Min R	
Roof	Insulation Entirely above Deck	0.048	R-20	0.03	R-33	YES
Walls, Above Grade	Mass	0.09	R-11.4c.i.	0.09	R-11	NO
Walls, Below Grade	Mass	0.119	R-7.5c.i.	*0.1	*R-10	YES
Floors	Steel-Joist	0.038	R-30	*0.5	*R-2	NO
Fenestration	Description	U-Value	SHGC	U-Value	SHGC	Complies?
Metal Framing	Curtainwalls	0.45	0.4	0.66	N/A	NO
Metal Framing	Aluminum Windows	0.55	0.4	0.38	0.38	YES
Metal Doors	Entrance	0.8	0.4	0.66	N/A	NO

(*)- Value calculated, may not be accurate.

For the building Envelope Prescriptive approach, most of the elements were compliant with requirements. Floors were found non-compliant as they have no insulation. This is acceptable because the levels above and below the floor are to be at the same temperature. The below grade walls have two-inch insulation specified around the perimeter to decrease the thermal loss through the ground.

The walls have a low overall R-value because of the large amount of glazing. To make up for this, the roof was highly insulated. No exterior shading was prescribed for this building with the exception of the 8ft overhang over the west side first floor walkway. This overhang shades only the two main corridors of the first floor. The building's enclosure is not quite compliant with ASHRAE standards as shown, however it seems as though the designers used a whole-building performance method such as the Energy Cost Budget method in Chapter 11 of ASHRAE 90.1.

Section 6 Analysis- Heating Ventilating and Air Conditioning (HVAC)

This section provides minimum efficiencies of equipment to be used for HVAC systems.

Section 6.2 Compliance Path

There are two compliance paths for assessing the efficiency of the building's HVAC system: the Simplified Approach and the Mandatory Provisions and Prescriptive Path. The Mandatory Provisions and Prescriptive Path shall be used for this analysis.

Section 6.4 Mandatory Provisions

The supply of heating and cooling energy to each zone is individually controlled by thermostatic controls responding to temperature with the zone with an accuracy of

$\pm 0.5^{\circ}\text{C}$. At the end of the occupancy work-day, the controls are set to automatically set-back to a minimum capacity.

All outdoor air supply and exhaust hoods, vents, and ventilators are equipped with motorized dampers that automatically shut when the spaces served are not in use. The Snow Melting System has automatic controls for initiating the system when the ambient air temperature is at 34°F . All ductwork is sealed at the joints with either mastic sealer or slip and drive connections for a leakage of a max of 1%.

Section 6.5 Prescriptive Path

The air economizers in the AHU's are capable of supplying 100% outdoor air while the normal fraction of supply air is about 40%.

As seen below, several fans in the air system exceed the prescribed horsepower. But with the exception of EF-3, 4, 5, 6, 7, all the non-compliance fans are the AHU supply fans. This is very likely due to the extra pressure drop associated with MERV-13 and HEPA filters in the AHUs.

Fan Compliance				
Unit	HP	CFM	CFM*0.0015	Complies?
AHU-1 Supply	150	71100	106.65	NO
AHU-2 Supply	150	63000	94.5	NO
AHU-3 Supply	150	74000	111	NO
AHU-4 Supply	150	72500	108.75	NO
AHU-5 Supply	15	8000	12	NO
AHU-6 Supply	7.5	5000	7.5	YES
AHU-1 Return	60	71100	106.65	YES
AHU-2 Return	60	63000	94.5	YES
AHU-3 Return	50	74000	111	YES
AHU-4 Return	60	72500	108.75	YES
AHU-5 Return	3	8000	12	YES
AHU-6 Return	3	5000	7.5	YES
EF-1	5	8,385	12.5775	YES
EF-2	7.5	11920	17.88	YES
EF-3,4,5,6,7	1.5	900	1.35	NO

EF-8	0.167	660	0.99	YES
------	-------	-----	------	-----

The VAV fan controls (including Fan Powered Boxes) are driven by variable-speed drives.

No energy recovery system is necessary for the AHUs because the largest outdoor air percentage among them is only 50% which is well below the 70% requirement.

Section 6.7 Submittals

All HVAC systems are specified to be tested to ensure that control elements are calibrated, adjusted, and in proper working condition.

Section 6.8 Minimum Equipment Efficiency Tables

All of the CRAC Units used meet the minimum efficiency required by ASHRAE 90.1 Section 6.8. See the below table for EER values.

CRAC Unit Compliance		
Unit	Cooling Capacity	EER
CRAC-1	128000 BTU/hr	8.4
CRAC-2	255000 BTU/hr	8.6
CRAC-3	199000 BTU/hr	7.6

There are three 450-ton chillers that have a COP of 6.43 and a NPLV of 7.0 which is greater than the required value. The three cooling towers have axial fans with a performance of 54 GPM/hp which is greater than the required performance.

Section 7 Analysis- Service Water Heating

Discusses requirements for service water heaters and its conveyance through the building.

Domestic Hot Water is supplied by two 285,000 BTU/hr natural gas heaters. A 318 gallon storage tank is provided. The system has a recovery capacity of 327 gallons/hr at 100deg F. The system has an efficiency of 95% which is greater than the required 80%.

Section 9 Analysis- Lighting

Contains information on the required power distribution and density for lighting systems.

There are two ways to calculate Lighting Power Density. The first method is to find the total wattage serving the lighting and divide by the square footage of the building. And the other method is the space by space method in which the density for each space is calculated and then compared to a specified density for each occupancy type. Building Area Method Compliance for Building 1 is shown in the table below. As seen, the Watts/SF is 0.683 which is well below the prescribed maximum for an office building of 1.0 Watts/SF.

Lighting Compliance									
Fixture	B	1st Flr	2nd Flr	3rd Flr	4th Flr	5th Flr	Pent.	Watts/Fixt.	Total Watts
A	100	50	12	12	12	12	100	61	18178
B	7	0	0	0	0	0	0	70	490
C	57	20	12	9	9	9	0	37	4292
D	0	8	0	0	0	0	0	72	576
E	284	403	704	630	630	724	0	67	226125
J	1	0	0	0	0	0	0	70	70
K	34	41	38	38	38	38	0	66	14982
L	0	26	0	0	0	0	0	76	1976
M	0	0	4	0	0	0	0	186	744
N	8	8	8	8	8	8	0	25	1200
O	6	7	6	6	6	6	0	70	2590
P	0	4	0	0	0	0	0	42	168
Q	0	22	0	0	0	0	0	145	3190
R	212	25	66	0	0	0	0	70	21210

S	0	93	0	0	0	0	0	108	10044
S1	0	8	0	0	0	0	0	55	440
U	0	16	0	0	0	0	0	90	1440
X	0	6	0	0	0	0	0	33	198
Y	2	2	2	2	2	2	0	2	24
Z	8	0	0	0	0	0	0	65	520
Ω	8	0	0	0	0	0	0	229	1832
Δ	0	0	0	0	0	3	0	62	186
ΔΔ	0	3	0	0	0	0	0	105	315
EXIT	34	40	33	30	30	34	0	4	804
Area SF	82179	82091	72009	65231	65231	63069	25974		
								Total Area SF	455784
								Total Watts	311594
								Watts/SF	0.683
								Complies?	YES

ASHRAE 90.1 Conclusions

All the preceding calculations were performed according to the prescriptive method for building efficiency and the building largely met the requirements. The only areas that did not comply was the building enclosure and air system fans. The large amount of glazing produced an overall R-value to be slightly below the requirement. However, a whole-building performance via the Energy Cost Budget method of Chapter 11 of 90.1 may have been applied. The designers have not been able to respond to my queries about this matter. The Westinghouse Headquarters projected is being delivered as a Design-Bid-Build, so this very well may have been the case. Also, the air system fans are higher horsepower than the prescribed values from the standards, but this is more than likely due to increased pressure drop due to the use of MERV-13 and HEPA filters which were designed to increase the overall IAQ.

Some notable values that significantly exceeded ASHRAE’s standards were the Lighting Power Density ($0.683 < 1.0$) and the Roof Construction R-value ($33.0 > 20.0$). These were probably the result of energy-efficient designing.

References

Both ASHRAE 62.1-2007 and ASHRAE Standard 90.1-2007 were referenced extensively throughout this paper. Also Referenced were the ASHRAE Handbook of Fundamentals and the Handbook of HVAC Systems and Equipment.

Appendix A

Following is the calculation information for the outdoor airflow requirements of ASHRAE Standard 62.1 Section 6. This includes calculated areas and flow rates per each space in the building and the calculation spreadsheets for AHU 1 and AHU2.

Space Areas, Function and Air Flow Rate

(note: air flow rates for Fan Powered Boxes taken at cooling conditions)

AHU1 Spaces

Room #	Function	Square Footage	CFM
FIRST FLOOR			
E19	FACILITIES SHOP	1904	1170
E19A	UNASSIGNED	1568	930
-	CORRIDOR	672	2285
TE101	AUDITORIUM	1363	950
TE104	AUDITORIUM	1518	950
TE102	TRAINING PREP ROOM	338	190
TE117	STORAGE	243	130
TE105	CONFERENCE	414	280
TE107	MED. ROOM	364	120
TE110	OFFICE	3588	4320
TE119	CONFERENCE	195	160
E17	CORRIDOR	1302	220
TE103	CORRIDOR	468	100
SECOND FLOOR			
TE201	CONFERENCE	132	120
TE202	CONFERENCE	132	120
TE203	CONFERENCE	132	120
TE204	CONFERENCE	81	80
TE205	CONFERENCE	81	80
TE206	CONFERENCE	81	80

TE207	CONFERENCE	81	80
TE213	OFFICE	4324	2755
TE211	OFFICE	228	325
TE210	CONFERENCE	247	360
TE212	OFFICE	6003	5100
TE214	OFFICE	6824	7100
E25	BREAKROOM	230	500
E21	WOMEN	375	80
E22	MEN	264	80
THIRD FLOOR			
TE301	CONFERENCE	132	120
TE302	CONFERENCE	132	120
TE303	CONFERENCE	132	120
TE304	CONFERENCE	81	80
TE305	CONFERENCE	81	80
TE306	CONFERENCE	81	80
TE307	CONFERENCE	81	80
TE313	OFFICE	4324	2755
TE311	OFFICE	228	325
TE310	CONFERENCE	247	360
TE312	OFFICE	6003	6070
E31	WOMEN	375	80
E32	MEN	264	80
TE314	OFFICE	8672	9170
E35	BREAKROOM	230	500
FOURTH FLOOR			
TE401	CONFERENCE	132	120
TE402	CONFERENCE	132	120
TE403	CONFERENCE	132	120
TE404	CONFERENCE	81	80
TE405	CONFERENCE	81	80
TE406	CONFERENCE	81	80
TE407	CONFERENCE	81	80
TE414	OFFICE	4324	2755
TE411	OFFICE	228	325
TE410	CONFERENCE	247	360
TE412	OFFICE	6003	6070
E41	WOMEN	375	80
E42	MEN	264	80
TE414	OFFICE	8672	9170
E45	BREAKROOM	230	500

FIFTH FLOOR			
TE501	CONFERENCE	132	120
TE502	CONFERENCE	132	120
TE503	CONFERENCE	132	120
TE504	CONFERENCE	81	80
TE505	CONFERENCE	81	80
TE506	CONFERENCE	81	80
TE507	CONFERENCE	81	80
TE513	OFFICE	4324	2915
TE511	OFFICE	342	460
TE510	CONFERENCE	342	500
TE512	OFFICE	2880	2470
-	CORRIDOR	468	125
-	CORRIDOR	864	200
-	OFFICE	144	75
-	OFFICE	144	75
TE512.1	OFFICE	234	440
TE512.2	OFFICE	234	440
E51	WOMEN	375	80
E52	MEN	264	80
TE514	OFFICE	10414	10005
E55	BREAKROOM	207	500

AHU2 Spaces

Room #	Description	Area	Supply Air CFM
BASEMENT			
E01	WOMEN	391	500
E02	MEN	350	500
TE001	FACILITY	1484	560
TEC01	CORRIDOR	2640	600
TEC01A	CORRIDOR	480	140
TE005	STORAGE	442	180
TE003	STAGING	462	185
TC020	OFFICE	1200	805
TC021	OFFICE	2000	990
TE004	LABS	1452	275
TC002	SERVERS	4224	750
TC003	PBX ROOM	816	100

TC004	IT NETWORK	816	100
TC022	RECEPTION	484	140
TC000	ELEV LOBBY	1224	160
TCC02	CORRIDOR	1680	260
TCC01	CORRIDOR	1120	160
TWC06	CORRIDOR	1772	620
TWCO26	STORAGE	152	80
TC01	REPRO CENTER	2200	950
TW012	GAME ROOM	1073	700
TW019	REF. LIBRARY	884	420
TW023	CENTRAL FILE	2000	950
TC023	ELEC. ROOM	72	550
TC012	LAUNDRY	231	2100
TC007	CONSULTATION	204	120
TC013	MEN'S TOILET/LOCKERS	1924	650
TC008	WOMEN'S TOILET/LOCKERS	2020	650
TC006	FITNESS	4788	5550
TC005	GROUP EX	1269	1800
TW013	NPP MODEL ROOM	377	180
TW014	OPAL PROJECT	506	260
TW015	NPP NRC	143	90
TW016	NPP FILE	143	85
TW017	NPP DRAFTING	748	370
TW021	LAW STORAGE	625	260
TWC02	CORRIDOR	2914	230
TWC05	CORRIDOR	440	140
TW032	CUSTOM SERVICE	1739	420
TW025	SERVER ROOM	1238	100
-	CORRIDOR	1378	300
TW026	EDS MCA	1296	160
TW027	EDS OBSERVATION	200	160
TW028	EDS INSTRUCTOR	400	40
TW029	TDS MCA	1296	160
TW030	TDS OBSERVATION	238	160
TW031	TDS INSTRUCTOR	336	40
W01	FACILITY STORAGE	2976	400
FIRST FLOOR			
E12	MEN	350	550
E11	WOMEN	434	550
-	PASSAGE	4379	6000
TE118	CONFERENCE	91	85

TE120	CONFERENCE	91	85
TE111	OFFICE	3818	6100
TE114	INT. ROOM	156	120
TE113	INT. ROOM	156	120
TE115	INT. ROOM	156	120
C17	WAITING	180	600
C16	VESTIBULE	260	610
C15	LOBBY	1660	1500
C11	CORRIDOR	1352	200
SECOND FLOOR			
TE212	OFFICE	1560	1250
TC211	OFFICE	195	140
TC226	BALCONY	1100	1040
TC222	CONFERENCE	286	160
C23	LOBBY	480	150
TC203	SERVING	165	110
TC224	PASSAGE	288	100
TC201	CONFERENCE	130	120
TC213	CONFERENCE	286	160
TC219	CONFERENCE	117	85
TC220	CONFERENCE	117	85
TW214	OFFICE	2852	2215
TC204	CONFERENCE	220	320
TC205	CONFERENCE	220	320
TC210	CONFERENCE	506	320
TC214	COPY CENTER	208	440
TE214	OFFICE	3786	2735
TC215	CONFERENCE	121	85
TC216	CONFERENCE	121	85
-	CONFERENCE	121	85
TC209	CONFERENCE	432	320
TC208	CONFERENCE	432	320
TC207	CONFERENCE	432	320
TC206	CONFERENCE	483	200
TC202	CONFERENCE	483	320
TC212	OFFICE	195	140
THIRD FLOOR			
TC310	CONFERENCE	221	160
TC311	CONFERENCE	408	320
TC308	CONFERENCE	552	830
-	OFFICE	1044	610

TC313	CONFERENCE	121	85
TC314	CONFERENCE	121	85
TC315	CONFERENCE	121	85
TC312	COPY CENTER	208	440
TC307	CONFERENCE	384	850
TC306	CONFERENCE	552	830
TC303	CONFERENCE	408	320
TC304	CONFERENCE	208	320
TC302	SERVERY	195	115
C33	LOBBY	480	215
TC301	CONFERENCE	130	120
C34	CORE SHELL	7571	5580
T319	CONFERENCE	108	85
TC317	CONFERENCE	108	85
TC318	CONFERENCE	108	85
FOURTH FLOOR			
TC410	CONFERENCE	221	160
TC411	CONFERENCE	408	320
TC408	CONFERENCE	552	830
-	OFFICE	1044	610
TC413	CONFERENCE	121	85
TC414	CONFERENCE	121	85
TC415	CONFERENCE	121	85
TC412	COPY CENTER	208	440
TC407	CONFERENCE	384	850
TC406	CONFERENCE	552	830
TC403	CONFERENCE	408	320
TC404	CONFERENCE	208	320
TC402	SERVERY	195	115
C43	LOBBY	480	215
TC401	CONFERENCE	130	120
C44	CORE SHELL	7571	5580
T419	CONFERENCE	108	85
TC417	CONFERENCE	108	85
TC418	CONFERENCE	108	85
FIFTH FLOOR			
TC515	OFFICE	288	365
TC513	OFFICE	280	85
TC516	OFFICE	280	240
TC514	OFFICE	210	80
TC533	COPY CENTER	240	105

TC519	OFFICE	285	105
TC518	OFFICE	304	535
TC520	CONFERENCE	450	710
TC517	WAITING	240	125
TC523	OFFICE	221	180
TC522	OFFICE	576	530
C53	LOBBY	480	420
TC501	CONFERENCE	130	120
TC509	COPY CENTER	182	440
-	OFFICE	1044	660
TC512	CONFERENCE	121	85
TC511	CONFERENCE	121	85
TC510	CONFERENCE	121	85
TC502	CONFERENCE	432	280
TC503	SERVERY	132	170
-	CORRIDOR	432	150
TC508	CONFERENCE	432	280
TC506	CONFERENCE	108	50
TC507	CONFERENCE	108	50
TC505	CONFERENCE	432	280
TC504	CONFERENCE	432	280
TC531	CONFERENCE	121	85
TC530	CONFERENCE	121	85
TC529	CONFERENCE	121	85
-	OFFICE	1988	2435
TW514	OFFICE	3212	3770
-	OFFICE	1024	480
TC526	KITCHEN	273	290
TC527	CONFERENCE	480	360

Building:	Westinghouse Nuclear Engineering Headquarters BLDG 1
System Tag/Name:	AHU-1
Operating Condition Description:	
Units (select from pull-down list)	IP

Inputs for System	Name	Units	System
Floor area served by system	As	sf	59,249
System population (including diversity)	Ps	P	852
Design primary supply fan airflow rate	Vpsd	cfm	52,253
Average outdoor airflow rate per unit area for the system	Ras	cfm/sf	0.06
Average outdoor airflow rate per person for the system	Rps	cfm/p	5.8

Inputs for Potentially Critical Zones	Zone Name	Zone Tag	Space type	Facilities Shop	Facilities Shop	Unassigned	Corridor
			Select from pull-down list	e19	e19	e19a	
			Select from pull-down list or leave blank if N/A	Storage rooms	Storage rooms	Office space	Corridors
Floor Area of zone	Az	sf		952	952	1,568	672
Design population of zone	Pz	P (default value listed; may be overridden)		0	0	7.84	0
Design discharge airflow to zone (total primary plus local recirculated)	Vdzd	cfm		585	585	930	2285
Local recirc.air fraction representative of ave system return air	Er			None	None	None	None

Inputs for Operating Condition Analyzed	Percent of total design airflow rate at conditioned analyzed	Ds	%	100%	100%	100%	100%	100%
Air distribution type at conditioned analyzed			Select from pull-down list	CS	CS	CS	CS	CS
Zone air distribution effectiveness at conditioned analyzed	Ez			1.00	1.00	1.00	1.00	1.00
Primary air fraction of supply air at conditioned analyzed	Ep							

Results	System Ventilation Efficiency	Ev		0.29
Outdoor air intake airflow rate required at condition analyzed <td>Vot</td> <td>cfm</td> <td></td> <td>29754</td>	Vot	cfm		29754
Outdoor air intake rate per unit floor area <td>Vot/As</td> <td>cfm/sf</td> <td></td> <td>0.50</td>	Vot/As	cfm/sf		0.50
Outdoor air intake rate per person served by system (including diversity) <td>Vot/Ps</td> <td>cfm/p</td> <td></td> <td>34.9</td>	Vot/Ps	cfm/p		34.9
Outdoor air intake rate as a % of design primary supply air <td>Vot/Vpsd</td> <td>%</td> <td></td> <td>57%</td>	Vot/Vpsd	%		57%
Uncorrected outdoor air intake airflow rate <td>Vou</td> <td>cfm</td> <td></td> <td>8649</td>	Vou	cfm		8649

Detailed Calculations						
Initial Calculations for the System as a whole						
Primary supply air flow to system at conditioned analyzed	Vps	cfm	= Vpsd Ds	=		52253
UncorrectedOA requirement for system	Vou	cfm	= Rps Ps + Ras As	=		8649
Uncorrected OA req'd as a fraction of primary SA	Xs		= Vou / Vps	=		0.17
Initial Calculations for individual zones						
OA rate per unit area for zone	Ra	cfm/sf			0.12	0.12
OA rate per person for zone	Rp	cfm/p			0.00	0.00
Total supply air to zone (at condition being analyzed)	Vdz	cfm	= Vdsd Ds		585	585
Unused OA req'd to breathing zone	Vbz	cfm	= Rpz Pz + Raz Az	=	114.2	114.2
Unused OA requirement for zone	Voz	cfm	= Vbz/Ez	=	114	114
Fraction of supply air to zone from sources outside the zone	Fa		= Ep + (1-Ep)Er	=	1.00	1.00
Fraction of supply air to zone from fully mixed primary air	Fb		= Ep	=	1.00	1.00
Fraction of outdoor air to zone from sources outside the zone	Fc		= 1-(1-Ez)(1-Ep)(1-Er)	=	1.00	1.00
Outdoor air fraction required in air discharged to zone	Zd		= Voz / Vdz	=	0.20	0.20
System Ventilation Efficiency						
Zone Ventilation Efficiency	Evz		= (Fa + FbXs - FcZ) / Fa	=	0.97	0.97
System Ventilation Efficiency	Ev		= min (Evz)	=		0.29

Auditorium	Auditorium	training room,storage	conf	Med. Rm	office	office	office	conf	corridors	conf	conf	conf	confs
te101	te104	te102,te117	te105	te107	te110	te110	te110	te119	e17,te103	te201	te202	te203	te204,te205,te206,te207
Lecture classroom	Lecture classroom	Conference/meeting	Conference/meeting	Office space	Office space	Office space	Office space	Conference/meeting	Corridors	Conference/meeting	Conference/meeting	Conference/meeting	Conference/meeting
1,363	1,518	581	414	364	1,196	1,196	1,196	195	1,770	132	132	132	324
88.595	98.67	29.05	20.7	1.82	5.96	5.98	5.98	9.75	0	6.6	6.6	6.6	16.2
950	950	320	280	120	1440	1440	1440	160	320	120	120	120	320
None	None	None	None	None	None	None	None	None	None	None	None	None	None
100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
CS	CS	CS	CS	CS	CS	CS	CS	CS	CS	CS	CS	CS	CS
1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
7.50	7.50	5.00	5.00	5.00	5.00	5.00	5.00	5.00	0.00	5.00	5.00	5.00	5.00
950	950	320	280	120	1440	1440	1440	160	320	120	120	120	320
746.2	831.1	180.1	128.3	30.9	101.6	101.7	101.7	60.5	106.2	40.9	40.9	40.9	100.4
746	831	180	128	31	102	102	102	60	106	41	41	41	100
1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
0.79	0.87	0.56	0.46	0.26	0.07	0.07	0.07	0.38	0.33	0.34	0.34	0.34	0.31
0.38	0.29	0.60	0.71	0.91	1.09	1.09	1.09	0.79	0.83	0.82	0.82	0.82	0.85

office	office	office	office	conf	office	office	office	office	office	office	office	office	office
te213	te213	te213	te211	te210	te212	te212	te212	te212	te212	te214	te214	te214	te214
Office space	Office space	Office space	Office space	Conference/ meeting	Office space	Office space	Office space	Office space	Office space	Office space	Office space	Office space	Office space
1,441	1,441	1,441	228	247	1,500	1,500	1,500	1,500	1,500	1,365	1,365	1,365	1,365
7.205	7.205	7.205	1.14	12.35	7.5	7.5	7.5	7.5	7.5	12	8	6.825	6.825
918	918	918	325	360	1275	1275	1275	1275	1275	1420	1420	1420	1420
None	None	None	None	None	None	None	None	None	None	None	None	None	None
100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
CS	CS	CS	CS	CS	CS	CS	CS	CS	CS	CS	CS	CS	CS
1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
918	918	918	325	360	1275	1275	1275	1275	1275	1420	1420	1420	1420
122.5	122.5	122.5	19.4	76.6	127.5	127.5	127.5	127.5	127.5	141.9	121.9	116.0	116.0
122	122	122	19	77	128	128	128	128	128	142	122	116	116
1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
0.13	0.13	0.13	0.06	0.21	0.10	0.10	0.10	0.10	0.10	0.10	0.09	0.08	0.08
1.03	1.03	1.03	1.11	0.95	1.07	1.07	1.07	1.07	1.07	1.07	1.08	1.08	1.08

breakroom	women,men	conf	conf	conf	confs	office	office	office	office	conf	office	office	office
e25	e21,e22	te301	te302	te303	te304,te305,te306,te306	te313	te313	te313	te311	te310	te312	te312	te312
Corridors	Storage rooms	Conference/meeting	Conference/meeting	Conference/meeting	Conference/meeting	Office space	Office space	Office space	Office space	Conference/meeting	Office space	Office Space	Office space
230	639	132	132	132	324	1,441	1,441	1,441	228	247	1,500	1,500	1,500
0	0	6.6	6.6	6.6	16.2	7.205	7.205	7.205	1.14	12.35	7.5	7.5	7.5
500	160	120	130	120	320	918	918	918	325	360	1517	1517	1517
None	None	None	None	None	None	None	None	None	None	None	None	None	None
100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
CS	CS	CS	CS	CS	CS	CS	CS	CS	CS	CS	CS	CS	CS
1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

0.06	0.12	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
0.00	0.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
500	160	120	130	120	320	918	918	918	325	360	1517	1517	1517
13.8	76.7	40.9	40.9	40.9	100.4	122.5	122.5	122.5	19.4	76.6	127.5	127.5	127.5
14	77	41	41	41	100	122	122	122	19	77	128	128	128
1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
0.03	0.48	0.34	0.31	0.34	0.31	0.13	0.13	0.13	0.06	0.21	0.08	0.08	0.08
1.14	0.69	0.82	0.85	0.82	0.85	1.03	1.03	1.03	1.11	0.95	1.08	1.08	1.08

Potentially Critical Zones

office	women,men	office	office	office	office	office	office	breakroom	conf	conf	conf	confs	office
te312	e31,e32	te314	te314	te314	te314	te314	te314	e35	te401	te402	te403	ter04,te4,te406,te406	te413
Office space	Storage rooms	Office space	Office space	Office space	Office space	Office Space	Office Space	Corridors	Conference/meeting	Conference/meeting	Conference/meeting	Conference/meeting	Office space
1,500	639	1,445	1,445	1,445	1,445	1,445	1,445	230	132	132	132	324	1,441
7.5	0	7.225	7.225	7.225	7.225	7.225	7.225	0	6.6	6.6	6.6	16.2	7.205
1517	160	1528	1528	1528	1528	1528	1528	500	120	130	120	320	918
None	None	None	None	None	None	None	None	None	None	None	None	None	None
100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
CS	CS	CS	CS	CS	CS	CS	CS	CS	CS	CS	CS	CS	CS
1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

0.06	0.12	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
5.00	0.00	5.00	5.00	5.00	5.00	5.00	5.00	0.00	5.00	5.00	5.00	5.00	5.00
1517	160	1528	1528	1528	1528	1528	1528	500	120	130	120	320	918
127.5	76.7	122.8	122.8	122.8	122.8	122.8	122.8	13.8	40.9	40.9	40.9	100.4	122.5
128	77	123	123	123	123	123	123	14	41	41	41	100	122
1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
0.08	0.48	0.08	0.08	0.08	0.08	0.08	0.08	0.03	0.34	0.31	0.34	0.31	0.13
1.08	0.69	1.09	1.09	1.09	1.09	1.09	1.09	1.14	0.82	0.85	0.82	0.85	1.03

office	office	office	conf	office	office	office	office	women,men	office	office	office	office	office
te413	te413	te411	te410	te412	te412	te412	te412	e41,e42	te414	te414	te414	te414	te414
Office space	Office space	Office space	Conference/ meeting	Office space	Office Space	Office space	Office space	Storage rooms	Office space	Office space	Office space	Office space	Office Space
1,441	1,441	228	247	1,500	1,500	1,500	1,500	639	1,445	1,445	1,445	1,445	1,445
7.205	7.205	1.14	12.35	7.5	7.5	7.5	7.5	0	7.225	7.225	7.225	7.225	7.225
918	918	325	360	1517	1517	1517	1517	160	1528	1528	1528	1528	1528
None	None	None	None	None	None	None	None	None	None	None	None	None	None
100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
CS	CS	CS	CS	CS	CS	CS	CS	CS	CS	CS	CS	CS	CS
1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.12	0.06	0.06	0.06	0.06	0.06
5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	0.00	5.00	5.00	5.00	5.00	5.00
918	918	325	360	1517	1517	1517	1517	160	1528	1528	1528	1528	1528
122.5	122.5	19.4	76.6	127.5	127.5	127.5	127.5	76.7	122.8	122.8	122.8	122.8	122.8
122	122	19	77	128	128	128	128	77	123	123	123	123	123
1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
0.13	0.13	0.06	0.21	0.08	0.08	0.08	0.08	0.48	0.08	0.08	0.08	0.08	0.08
1.03	1.03	1.11	0.95	1.08	1.08	1.08	1.08	0.69	1.09	1.09	1.09	1.09	1.09

office	breakroom	conf	conf	conf	confs	office	office	office	office	conf	office	office	corridors
te414	e45	te501	te502	te503	te504,te505,te506,te507	te513	te513	te513	te511	te510	te512	te512	
Office Space	Corridors	Conference/meeting	Conference/meeting	Conference/meeting	Conference/meeting	Office space	Office space	Office space	Office Space	Conference/meeting	Office Space	Office space	Corridors
1,445	230	132	132	132	324	1,441	1,441	1,441	342	342	1,440	1,440	1,332
7.225	0	6.6	6.6	6.6	16.2	7.205	7.205	7.205	1.71	17.1	7.2	7.2	0
1528	500	120	120	120	320	971	971	971	460	500	1235	1235	325
None	None	None	None	None	None	None	None	None	None	None	None	None	None
100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
CS	CS	CS	CS	CS	CS	CS	CS	CS	CS	CS	CS	CS	CS
1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
5.00	0.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	0.00
1528	500	120	120	120	320	971	971	971	460	500	1235	1235	325
122.8	13.8	40.9	40.9	40.9	100.4	122.5	122.5	122.5	29.1	106.0	122.4	122.4	79.9
123	14	41	41	41	100	122	122	122	29	106	122	122	80
1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
0.08	0.03	0.34	0.34	0.34	0.31	0.13	0.13	0.13	0.06	0.21	0.10	0.10	0.25
1.09	1.14	0.82	0.82	0.82	0.85	1.04	1.04	1.04	1.10	0.95	1.07	1.07	0.92

--	--	--	--	--	--	--	--	--	--	--	--

Check Figures
 14.4 P/1000 sf
 0.88 cfm/sf
 0.06 ave cfm/sf
 5.8 ave cfm/p

offices	office	office	women,men	office	office	office	office	office	office	office	breakroom
	te512.1	te512.2	e51,e52	te514	te514	te514	te514	te514	te514	te514	e55
Office space	Office space	Office space	Storage rooms	Office space	Office space	Office space	Office space	Office space	Office space	Office space	Corridors
288	234	234	639	1,488	1,488	1,488	1,488	1,488	1,488	1,488	207
1.44	1.17	1.17	0	7.44	7.44	7.44	7.44	7.44	7.44	7.44	0
150	440	440	160	1429	1429	1,429	1,429	1,429	1,429	1,429	500
None	None	None	None	None	None	None	None	None	None	None	None
100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
CS	CS	CS	CS	CS	CS	CS	CS	CS	CS	CS	CS
1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Totals/averages
 59249 total sf
 618 total P
 52253 total cfm
 1.00 average
 100% average
 1.00 average
 1.00 average

0.06	0.06	0.06	0.12	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
5.00	5.00	5.00	0.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	0.00
150	440	440	160	1429	1429	1429	1429	1429	1429	1429	500
24.5	19.9	19.9	76.7	126.5	126.5	126.5	126.5	126.5	126.5	126.5	12.4
24	20	20	77	126	126	126	126	126	126	126	12
1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
0.16	0.05	0.05	0.48	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.02
1.00	1.12	1.12	0.69	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.14

617.995 System pop
 1.38 System pop
 52253
 7304
 7304
 0.87 Maximum Z

Primary airflow rate to zones
52253 cfm
100% Percent of design

ulation without diversity
ulation diversity, D

d

Building:	Westinghouse Nuclear Engineering Headquarters BLDG 1
System Tag/Name:	AHU-2
Operating Condition Description:	
Units (select from pull-down list)	IP

Inputs for System	Name	Units	System
Floor area served by system	As	sf	74,657
System population (including diversity)	Ps	P	1,443
Design primary supply fan airflow rate	Vpsd	cfm	45,411
Average outdoor airflow rate per unit area for the system	Ras	cfm/sf	0.07
Average outdoor airflow rate per person for the system	Rps	cfm/p	9.9

Inputs for Potentially Critical Zones				Basement West Toilets	Facility Shop	Corridors	Storage	Staging,Office	Office	Labs
Zone Name				E01,E02	TE001	TECO1,TECO 1A	TE005	te003,tc020	tc021	te004
Zone Tag				Storage rooms	Storage rooms	Corridors	Storage rooms	Office space	Office space	Computer (not printing)
Space type		Select from pull-down list		741	1,484	3,120	442	1,662	2,000	1,452
Floor Area of zone	Az	sf		0	0	0	0	8.31	10	5.808
Design population of zone	Pz	P (default value listed; may be overridden)		1,270	560	740	180	990	990	275
Design discharge airflow to zone (total primary plus local recirculated)	Vdzd	cfm		None	None	None	None	None	None	None
Induction Terminal Unit, Dual Fan Dual Duct or Transfer Fan?		Select from pull-down list or leave blank if N/A		0.00	0.00	0.00	0.00	0.00	0.00	0.00
Local recirc.air fraction representative of ave system return air	Er									

Inputs for Operating Condition Analyzed				100%	100%	100%	100%	100%	100%	100%	100%
Percent of total design airflow rate at conditioned analyzed	Ds	%		CS	CS	CS	CS	CS	CS	CS	CS
Air distribution type at conditioned analyzed		Select from pull-down list		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Zone air distribution effectiveness at conditioned analyzed	Ez										
Primary air fraction of supply air at conditioned analyzed	Ep										

Results				0.57
System Ventilation Efficiency	Ev			34072
Outdoor air intake airflow rate required at condition analyzed	Vot	cfm		0.46
Outdoor air intake rate per unit floor area	Vot/As	cfm/sf		23.6
Outdoor air intake rate per person served by system (including diversity)	Vot/Ps	cfm/p		75%
Outdoor air intake rate as a % of design primary supply air	Vot/Vpsd	%		19534
Uncorrected outdoor air intake airflow rate	Vou	cfm		

Detailed Calculations											
Initial Calculations for the System as a whole											
Primary supply air flow to system at conditioned analyzed	Vps	cfm	=	Vpsd Ds	=	45411					
UncorrectedOA requirement for system	Vou	cfm	=	Rps Ps + Ras As	=	19534					
Uncorrected OA req'd as a fraction of primary SA	Xs		=	Vou / Vps	=	0.43					
Initial Calculations for individual zones											
OA rate per unit area for zone	Ra	cfm/sf				0.12	0.12	0.06	0.12	0.06	0.06
OA rate per person for zone	Rp	cfm/p				0.00	0.00	0.00	0.00	5.00	5.00
Total supply air to zone (at condition being analyzed)	Vdz	cfm	=	Vdsd Ds	=	1270	560	740	180	990	275
Unused OA req'd to breathing zone	Vbz	cfm	=	Rpz Pz + Raz Az	=	88.9	178.1	187.2	53.0	141.3	170.0
Unused OA requirement for zone	Voz	cfm	=	Vbz/Ez	=	89	178	187	53	141	170
Fraction of supply air to zone from sources outside the zone	Fa		=	Ep + (1-Ep)Er	=	1.00	1.00	1.00	1.00	1.00	1.00
Fraction of supply air to zone from fully mixed primary air	Fb		=	Ep	=	1.00	1.00	1.00	1.00	1.00	1.00
Fraction of outdoor air to zone from sources outside the zone	Fc		=	1-(1-Ez)(1-Ep)(1-Er)	=	1.00	1.00	1.00	1.00	1.00	1.00
Outdoor air fraction required in air discharged to zone	Zd		=	Voz / Vdz	=	0.07	0.32	0.25	0.29	0.14	0.17
System Ventilation Efficiency											
Zone Ventilation Efficiency	Evz		=	(Fa + FbXs - FcZ) / Fa	=	1.36	1.11	1.18	1.14	1.29	1.26
System Ventilation Efficiency	Ev		=	min (Evz)	=	0.57					

Servers,PBX Rm,IT Network	Reception	Elev Lobby, Corridors	Corridor,Storage	Repro Center	Game Room	Ref. Library	Central File	Elec. Room	Laundry	Consultation	Men's LockerRoom	Men's LockerRoom	Women's Locker Room	Women's Locker Room	Fitness	Fitness
tcoo2,tc003,tc004	tc022	tc000,tcc02,tc01	twc06,twc026	tc01	tw012	tw019	tw023	tc023	tc012	tc007	tc013	tc013	tc008	tc008	tc006	tc006
Computer (not printing)	Office space	Lobbies	Corridors	Computer lab	Game arcades	Libraries	Libraries	Storage rooms	Coin-operated laundries	Office space	Health club/weight rooms	Health club/weight rooms	Health club/weight rooms	Health club/weight rooms	Health club/weight rooms	Health club/weight rooms
5,856	484	4,024	1,924	2,200	1,073	884	2,000	72	231	204	962	962	1,010	1,010	1,596	1,596
23.424	2.42	3	0	55	21.46	8.84	20	0	4.62	1.02	9.62	9.62	10.1	10.1	15.96	15.96
950	140	580	700	950	700	420	950	550	2100	120	325	325	325	325	1850	1850
None	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None
0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60
100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
CS	CS	CS	CS	CS	CS	CS	CS	CS	CS	CS	CS	CS	CS	CS	CS	CS
1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

0.06	0.06	0.06	0.06	0.12	0.18	0.12	0.12	0.12	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
5.00	5.00	5.00	0.00	10.00	7.50	5.00	5.00	0.00	7.50	5.00	20.00	20.00	20.00	20.00	20.00	20.00
950	140	580	700	950	700	420	950	550	2100	120	325	325	325	325	1850	1850
468.5	41.1	256.4	115.4	814.0	354.1	150.3	340.0	8.6	48.5	17.3	250.1	250.1	262.6	262.6	415.0	415.0
468	41	256	115	814	354	150	340	9	49	17	250	250	263	263	415	415
1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
0.49	0.29	0.44	0.16	0.86	0.51	0.36	0.36	0.02	0.02	0.14	0.77	0.77	0.81	0.81	0.22	0.22
0.94	1.14	0.99	1.27	0.57	0.92	1.07	1.07	1.41	1.41	1.29	0.66	0.66	0.62	0.62	1.21	1.21

Fitness	Group Ex	NPP Model Room	Opal Project	NPP NRC,NPP File	NPP Drafting	Law Storage	Corridors	Customer Service	Server Rm,Corridor	EDS MCA, EDS Observ, EDS Ins	TDS MCA, TDS Observ, TDS Ins	Facility Storage	1st Floor Toilets	Passage	Passage	Conference Rooms
tc006	tc005	tw013	tw014	tw015,tw016	tw017	tw021	twc02,twc05	tw032	tw025	tw026,tw027,tw028	tw029,tw030,tw031	W01	e12,e11			te118,te120
Health club/weight rooms	Health club/aerobics room	Computer lab	Computer lab	Computer lab	Computer lab	Storage rooms	Corridors	Office space	Corridors	Computer (not printing)	Computer (not printing)	Warehouses	Storage rooms	Corridors	Corridors	Conference/meeting
1,596	1,269	377	506	286	748	625	3,354	1,739	2,616	1,896	1,870	2,976	784	2,190	2,190	182
15.96	50.76	9.425	12	8	18.7	0	0	8.695	0	7.584	7.48	0	0	0	0	9.1
1850	1800	180	260	175	370	260	370	420	400	360	360	400	1100	3000	3000	170
None	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
CS	CS	CS	CS	CS	CS	CS	CS	CS	CS	CS	CS	CS	CS	CS	CS	CS
1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

0.06	0.06	0.12	0.12	0.12	0.12	0.12	0.06	0.06	0.06	0.06	0.06	0.06	0.12	0.06	0.06	0.06
20.00	20.00	10.00	10.00	10.00	10.00	0.00	0.00	5.00	0.00	5.00	5.00	0.00	0.00	0.00	0.00	5.00
1850	1800	180	260	175	370	260	370	420	400	360	360	400	1100	3000	3000	170
415.0	1091.3	139.5	180.7	114.3	276.8	75.0	201.2	147.8	157.0	151.7	149.6	178.6	94.1	131.4	131.4	56.4
415	1091	139	181	114	277	75	201	148	157	152	150	179	94	131	131	56
1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
0.22	0.61	0.77	0.70	0.65	0.75	0.29	0.54	0.35	0.39	0.42	0.42	0.45	0.09	0.04	0.04	0.33
1.21	0.82	0.66	0.74	0.78	0.68	1.14	0.89	1.08	1.04	1.01	1.01	0.98	1.34	1.39	1.39	1.10

Open Office	Open Office	Open Office	Open Office	Int. Rm	Int. Rm	Int. Rm	Waiting	Vestibule	Lobby	Corridor	Open Office	Open Office	Open Office	Office	Balcony	Conf Rm
te111	te111	te111	te111	te114	te113	te115	c17	c16	c15	c11	te212	te212	te212	tc211	tc226	tc222
Office space	Office space	Office space	Office Space	Conference/ meeting	Conference/ meeting	Conference/ meeting	Booking/waiti ng	Lobbies	Main entry lobbies	Corridors	Office Space	Office Space	Office Space	Office space	Corridors	Conference/ meeting
955	955	955	955	156	156	156	180	260	1,660	1,352	520	520	520	195	1,100	286
4.775	4.775	4.775	4.775	7.8	7.8	7.8	9	39	16.6	0	2.6	2.6	2.6	0.975	0	14.3
1525	1525	1525	1525	120	120	120	600	610	1500	200	417	417	417	140	1040	160
None	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
CS	CS	CS	CS	CS	CS	CS	CS	CS	CS	CS	CS	CS	CS	CS	CS	CS
1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
5.00	5.00	5.00	5.00	5.00	5.00	5.00	7.50	5.00	5.00	0.00	5.00	5.00	5.00	5.00	0.00	5.00
1525	1525	1525	1525	120	120	120	600	610	1500	200	417	417	417	140	1040	160
81.2	81.2	81.2	81.2	48.4	48.4	48.4	78.3	210.6	182.6	81.1	44.2	44.2	44.2	16.6	66.0	88.7
81	81	81	81	48	48	48	78	211	183	81	44	44	44	17	66	89
1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
0.05	0.05	0.05	0.05	0.40	0.40	0.40	0.13	0.35	0.12	0.41	0.11	0.11	0.11	0.12	0.06	0.55
1.38	1.38	1.38	1.38	1.03	1.03	1.03	1.30	1.08	1.31	1.02	1.32	1.32	1.32	1.31	1.37	0.88

Office	Conf	Conf	Conf	Conf	Office	Conf	Copy Center	Conf	Conf	Conf	Conf	Servery, Lobby	Conf	Core Shell	Core Shell	Core Shell
tc212	tc202	tc310	tc311	tc308		tc313,tc314,tc315	tc312	tc307	tc306	tc303	tc304	tc302,c33	tc301	c34	c34	c34
Office space	Conference/ meeting	Conference/ meeting	Conference/ meeting	Conference/ meeting	Office space	Conference/ meeting	Computer lab	Conference/ meeting	Conference/ meeting	Conference/ meeting	Conference/ meeting	Corridors	Conference/ meeting	Office space	Office space	Office space
195	483	221	408	552	1,044	363	208	384	552	408	208	675	130	1,893	1,893	1,893
0.975	24.15	11.05	20.4	27.6	5.22	18.15	5.2	19.2	27.6	20.4	10.4	3	6.5	9.465	9.465	9.465
140	320	160	320	830	610	255	440	850	830	320	320	330	120	1395	1395	1395
None	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None
0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60
100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
CS	CS	CS	CS	CS	CS	CS	CS	CS	CS	CS	CS	CS	CS	CS	CS	CS
1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.12	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
5.00	5.00	5.00	5.00	5.00	5.00	5.00	10.00	5.00	5.00	5.00	5.00	0.00	5.00	5.00	5.00	5.00
140	320	160	320	830	610	255	440	850	830	320	320	330	120	1395	1395	1395
16.6	149.7	68.5	126.5	171.1	88.7	112.5	77.0	119.0	171.1	126.5	64.5	40.5	40.3	160.9	160.9	160.9
17	150	69	126	171	89	113	77	119	171	126	64	41	40	161	161	161
1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
0.12	0.47	0.43	0.40	0.21	0.15	0.44	0.17	0.14	0.21	0.40	0.20	0.12	0.34	0.12	0.12	0.12
1.31	0.96	1.00	1.03	1.22	1.28	0.99	1.26	1.29	1.22	1.03	1.23	1.31	1.09	1.31	1.31	1.31

Core Shell	Conf	Conf	Conf	Conf	Office	Conf	Copy Center	Conf	Conf	Conf	Conf	Servery,Lobby	Conf	Core Shell	Core Shell	Core Shell
c34	t319,tc317,tc318	tc410	tc411	tc408		tc413,tc414,tc415	tc412	tc407	tc406	tc403	tc404	tc402,c43	tc401	c44	c44	c44
Office space	Conference/meeting	Conference/meeting	Conference/meeting	Conference/meeting	Office space	Conference/meeting	Computer lab	Conference/meeting	Conference/meeting	Conference/meeting	Conference/meeting	Corridors	Conference/meeting	Office space	Office space	Office space
1,893	324	221	408	552	1,044	363	208	384	552	408	208	675	130	1,893	1,893	1,893
9.465	16.2	11.05	20.4	27.6	5.22	18.15	5.2	19.2	27.6	20.4	10.4	3	6.5	9.465	9.465	9.465
1395	255	160	320	830	610	255	440	850	830	320	320	330	120	1395	1395	1395
None	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None
0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60
100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
CS	CS	CS	CS	CS	CS	CS	CS	CS	CS	CS	CS	CS	CS	CS	CS	CS
1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.12	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
5.00	5.00	5.00	5.00	5.00	5.00	5.00	10.00	5.00	5.00	5.00	5.00	0.00	5.00	5.00	5.00	5.00
1395	255	160	320	830	610	255	440	850	830	320	320	330	120	1395	1395	1395
160.9	100.4	68.5	126.5	171.1	88.7	112.5	77.0	119.0	171.1	126.5	64.5	40.5	40.3	160.9	160.9	160.9
161	100	69	126	171	89	113	77	119	171	126	64	41	40	161	161	161
1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
0.12	0.39	0.43	0.40	0.21	0.15	0.44	0.17	0.14	0.21	0.40	0.20	0.12	0.34	0.12	0.12	0.12
1.31	1.04	1.00	1.03	1.22	1.28	0.99	1.26	1.29	1.22	1.03	1.23	1.31	1.09	1.31	1.31	1.31

Core Shell	Conf	Office	Office	Office	Office,Copy Center,Office	Office space	Conf	Waiting,Office	Office	Lobby	Conf	Copy Center	Office	Confs	Conf	Servery,Corridor
c44	t419,tc417,tc418	tc515	tc513	tc516	tc514,tc533,tc519	tc518	tc520	tc517,tc523	tc522	c53	tc501	tc509		tc512,tc511,tc510	tc502	tc503
Office space	Conference/meeting	Office space	Office space	Office space	Office space	Office space	Conference/meeting	Office space	Office space	Corridors	Conference/meeting	Computer lab	Office space	Conference/meeting	Conference/meeting	Corridors
1,893	324	288	280	280	735	304	450	461	576	480	130	182	1,044	363	432	564
9.465	16.2	1.44	1.4	1.4	3.675	1.52	22.5	2.305	2.88	0	6.5	4.55	5.22	18.15	21.6	0
1395	255	365	85	240	290	535	710	305	530	420	120	440	660	255	280	320
None	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
CS	CS	CS	CS	CS	CS	CS	CS	CS	CS	CS	CS	CS	CS	CS	CS	CS
1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.12	0.06	0.06	0.06	0.06
5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	0.00	5.00	10.00	5.00	5.00	0.00
1395	255	365	85	240	290	535	710	305	530	420	120	440	660	255	280	320
160.9	100.4	24.5	23.8	23.8	62.5	25.8	139.5	39.2	49.0	28.8	40.3	67.3	88.7	112.5	133.9	33.8
161	100	24	24	24	62	26	140	39	49	29	40	67	89	113	134	34
1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
0.12	0.39	0.07	0.28	0.10	0.22	0.05	0.20	0.13	0.09	0.07	0.34	0.15	0.13	0.44	0.48	0.11
1.31	1.04	1.36	1.15	1.33	1.21	1.38	1.23	1.30	1.34	1.36	1.09	1.28	1.30	0.99	0.95	1.32

											Check Figures	
											19.3 P/1000 sf 0.61 cfm/sf 0.07 ave cfm/sf 9.9 ave cfm/p	
Conf	Conf	Conf	Confs	Office	Office	Office	Office	Office	Kitchen	Conf	Totals/averages	
tc508	tc506,tc507	tc505	tc531,tc530,tc529		tw514	tw514	tw514		tc526	tc527		
Conference/ meeting	Conference/ meeting	Conference/ meeting	Conference/ meeting	Office space	Office space	Office space	Office space	Office space	Reception areas	Conference/ meeting		
432	216	432	363	1,988	1,071	1,071	1,071	1,024	273	480		74657 total sf 548 total P 45411 total cfm
21.6	10.8	21.6	18.15	9.94	5.355	5.355	5.355	5.12	8.19	24		
280	100	280	255	2435	1256	1256	1256	480	290	360		
None	None	None	None	None	None	None	None	None	None	None		1.00 average
0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60		
100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%		100% average
CS	CS	CS	CS	CS	CS	CS	CS	CS	CS	CS		1.00 average
1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00 average
												Primary airflow rate to zones 45411 cfm 100% Percent of design

											547.841 System population without diversity 2.63 System population diversity, D	
0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06		
5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00		
280	100	280	255	2435	1256	1256	1256	480	290	360	45411	
133.9	67.0	133.9	112.5	169.0	91.0	91.0	91.0	87.0	57.3	148.8	10691	
134	67	134	113	169	91	91	91	87	57	149	10691	
1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		
1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		
1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		
0.48	0.67	0.48	0.44	0.07	0.07	0.07	0.07	0.18	0.20	0.41		0.86 Maximum Zd
0.95	0.76	0.95	0.99	1.36	1.36	1.36	1.36	1.25	1.23	1.02		