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DEA Clandestine Laboratory Training Center
Quantico Marine Corps Base, Quantico, VA

Mechanical Technical Report 2

Building and Plant Energy Analysis

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Executive Summary:

The DEA Clandestine Laboratory Training Center is located on the Quantico Marine Corps Base in Quantico, VA. It is a one-story building with a Mechanical Mezzanine Level that encompasses approximately 34,000 sq ft. The building spaces include multiple function types such as laboratories, classrooms, office space, and physical training areas.

In this report, the design loads and annual energy consumption and costs were estimated. The building's compliance with ASHRAE Standard 90.1-2004 was also evaluated. This standard sets forth minimum energy and efficiency requirements for all building types except low-rise residential buildings. Projected LEED certification was also investigated. It was found that a possible *Gold* certification could be achieved.

Mechanical System Summary:

Five air handling units (AHU's) located in the Mechanical Mezzanine Level supply the building with conditioned air. Each unit utilizes a draw-through centrifugal supply fan and receives OA ducted from an intake louver. Two of these units are capable of economizer mode. Return air is routed back to the AHU's through the plenum using transfer ducts and some longer duct runs where necessary. The Mechanical Room is both ventilated and pressurized by relief air from AHU's 1 and 3 which then is forced out of relief louvers that are ducted from the Mechanical Room. The Boiler Room has a constant volume (CV) inline centrifugal supply fan that provides the space with OA for both ventilation and combustion air. Three air conditioning units (ACU'S) with separate air-cooled condensing units (ACCU's) serve the LAN Equipment and Electrical Rooms via transfer air from adjacent spaces.

Chilled water is created via two air-cooled scroll chillers with six staged compressors each. Heating hot water comes from two gas-fired boilers. This water also heats domestic hot water via a heat exchanger. All of the AHU's have both cooling coils served by the chillers and heating coils served by the boilers, while two of the AHU's also contain pre-heat coils. Where necessary, reheating is performed via coils in certain VAV boxes. Unit heaters serve mechanical spaces, vestibules, stairways, and locker room areas via hot water from the boilers. Certain exterior zones are heated by fin-tube radiators. The design of the mechanical systems did not make allowances for future expansion.

LEED-NC Version 2.2 Rating:

Green Building Rating for New Construction and Major Renovations:

The Leadership in Energy and Environmental Design (LEED) rating system is intended to aid design professionals in creating energy-efficient and environmentally responsible buildings. LEED makes use of "green" building techniques to achieve lower operating costs and power consumption. It attempts to minimize the adverse effects buildings can have on the environment by limiting harmful emissions and encouraging the use of renewable energy sources. Taken as a whole, LEED certified buildings promote healthier settings in which to live and work.

When striving for LEED certification, the job is first classified as one of six project types: *New Construction (& Major Renovations)*, *Existing Buildings*, *Commercial Interiors*, *Core & Shell*, *Homes*, and *Neighborhood Development*. The Clandestine Laboratory Training Center falls under the *New Construction* classification. In this classification, there are six major categories in which it is possible to earn credits toward a LEED certification. The major categories include *Sustainable Sites* (14 possible credits), *Water Efficiency* (5 possible credits), *Energy & Atmosphere* (17 possible credits), *Materials and Resources* (13 possible credits), *Indoor Environmental Quality* (15 possible credits), and *Innovation and Design Process* (5 possible credits). Credits earned in each category are then totaled to determine the building's LEED certification score. A rating (*Certified*, *Silver*, *Gold*, or *Platinum*) is assigned based on this score.

In the sections that follow, the mechanical system of the Clandestine Laboratory Training Center will be assessed to determine its contribution to a LEED certification. For an evaluation of the entire building, please see the *LEED-NC Version 2.2 Registered Project Checklist* appendix. According to this preliminary assessment, it is possible for the building as a whole to earn anywhere from a *Certified* rating up to a *Gold* rating.

LEED Categories and Credits Earned:

Sustainable Sites:

The mechanical system does not account for any credits earned in these categories.

Water Efficiency:

Water Use Reduction, 20% Reduction and **Water Use Reduction**, 30% Reduction:
Both can be met because water-saving water closets, urinals, and faucets are specified.

Energy and Atmosphere:

Fundamental Commissioning of the Building Energy Systems:
Required for LEED accreditation, this prerequisite can be met by designating an individual to verify the installation and performance of energy-related systems in accordance with the Basis of Design. A summary report must then be submitted

regarding HVAC&R systems and their controls, lighting and daylighting controls, domestic hot water systems, and renewable energy systems.

Minimum Energy Performance:

Designed in accordance with the mandatory provisions and prescriptive requirements of ASHRAE Standard 90.1, the building meets the criteria for this required credit.

Fundamental Refrigerant Management:

To comply with this section, no chlorofluorocarbon-based refrigerants may be used. By utilizing R407C (a blend of hydrofluorocarbons) in both the chillers and the air conditioning units, this mandatory credit is attained.

Optimize Energy Performance:

This category, at 10 credits, has the highest possible amount of points that can be earned of all the sections. The LEED Accredited Professional on this project estimated that two credits could be earned in this section, which would require a 14% improvement in overall energy performance when compared to a baseline case. The baseline case would first have to be arrived at using a whole building energy simulation that complies with ASHRAE Standard 90.1. If the actual design of the building did, in fact, lower total energy consumption by 14% below the baseline case, the building could earn the two LEED credits estimated for this category.

Enhanced Refrigerant Management:

Two criteria must be met to get credit for this category. First, the fire suppression system cannot use ozone-depleting substances. This criterion is met by using a water-sprinkler system. Second, emission of ozone-depleting and global warming compounds from refrigerant must comply with following formula:

$LCGWP + LCODP \times 10^5 \leq 100$
$60.4 + 0 \times 10^5 =$ **60.4 < 100 …therefore credit is achieved**

LCODP = [ODPr x (Lr x Life + Mr) x Rc]/Life
LCODP = [0 x (2.0% x 10 + 10%) x 2.5]/20
LCODP = **0 lbCFC11/Ton-Year**

LCGWP = [GWPr x (Lr x Life + Mr) x Rc]/Life
LCGWP = [1610 x (2.0% x 10 + 10%) x 2.5]/20
LCGWP = **60.4 lbCO2/Ton-Year**

LCODP: Lifecycle Ozone Depletion Potential (lbCFC11/Ton-Year)
LCGWP: Lifecycle Direct Global Warming Potential (lbCO2/Ton-Year)

GWPr: Global Warming Potential of Refrigerant = 1610 lbCO2/lbr
ODPr: Ozone Depletion Potential of Refrigerant = 0 lbCFC11/lbr
Lr: Refrigerant Leakage Rate = 2.0% by default
Mr: End-of-life Refrigerant Loss = 10%

Rc: Refrigerant Charge = 2.5 lb/ton
Life: Equipment Life = 20 years by default

Materials & Resources:

The mechanical system does not account for any credits earned in these categories.

Indoor Environmental Quality:

Minimum IAQ Performance:
Designed in accordance with the Ventilation Rate Procedure of ASHRAE Standard 62.1, the building earns a credit for this mandatory category.

Environmental Tobacco Smoke Control:
If the building is not designated non-smoking, several criteria must be met to comply with this required category. By locating smoking areas at least 25 ft from entrances, outdoor air intakes, and operable windows; by not recirculating air from smoking rooms to other spaces; and by exhausting air from smoking rooms to create a sufficient negative relative pressure, the building can comply.

Outdoor Air Delivery Monitoring:
Ducted airflow measuring stations located upstream from the air handling units monitor outdoor air intake. Carbon dioxide levels in spaces of potentially dense population such as the conference room are monitored, and the outdoor air intake then modulates accordingly. By way of these strategies, the building earns a credit in this category.

Construction IAQ Management Plan, During Construction:
Credit can be earned in this category by implementing an IAQ plan that meets the guidelines set forth by SMACNA for occupied buildings under construction.

Construction IAQ Management Plan, Before Occupancy:
After all interior finishes have been installed, the IAQ of the building can be tested to determine if there are harmful levels of contaminants. Another option to obtain adequate IAQ is to flush the building with outside air while maintaining a certain temperature and humidity level. Either method will earn the building a credit for this category.

Indoor Chemical and Pollutant Source Control:
A credit is earned in this category by exhausting laboratory areas enough to create sufficient negative relative pressure and adequately filtering the incoming outdoor air.

Thermal Comfort, Design:
By designing the HVAC systems and building envelope in accordance with ASHRAE Standard 55, credit could be earned in this category.

Thermal Comfort, Verification:

By surveying building occupants, thermal comfort levels can be assessed. If the survey results depict a level of satisfaction below 20%, a plan must be implemented to remedy the poor thermal comfort level, thereby achieving a credit.

Innovation and Design Process:

LEED Accredited Professional:

Several LEED Accredited Professionals played major roles in the design of the building, thereby achieving credit for this category.

Total Mechanical System LEED Contribution:

From this assessment, it appears that the mechanical system could contribute 12 credits out of a possible 23 to 44 total credits. It is clear the mechanical system plays a significant role in the LEED certification of the Clandestine Laboratory Training Center by making up approximately ¼ to ½ of the total rating. However, this is only a pre-certification estimate and the true LEED rating will not be known until after construction.

ASHRAE Standard 90.1-2004 Evaluation:

See the *ASHRAE Standard 90.1-2004 Evaluation*.

Lost Space Due to Mechanical System:

The total floor area encompassed by the mechanical system, including the elevated Mechanical Mezzanine Level, is 4,610 ft^2. This figure includes a set of stairs and a hoist way, both of which serve only the mezzanine. Located beneath the approximate location of where the sloped roof peaks, the mezzanine level has been strategically placed to minimize its interference with other spaces in the building. This approach is equivalent to a rooftop or penthouse mechanical space. Aside from the boiler room and the adjacent stairs and hoist way serving the mezzanine, the footprint size of the building is unaffected by the mechanical system. These spaces make up only 760 ft^2 of approximately 34,000 ft^2 of total footprint, or just over 2%.

As far as vertical shaft space is concerned, little or no usable space is detracted from the remainder of the building. The building makes use of the generous plenum space between the sloped roof and the ceiling to route extensive ductwork such as in the laboratory exhaust system and to and from the mechanical room. Any drops or risers in the ductwork can easily be made on the way from the mezzanine level to the ceiling of the first floor. For a breakdown of the size of mechanical system spaces and their supporting areas, please see below.

Lost Space Due to Mechanical System

Space	Area (sq ft)
Mech. Room*	3,850
Boiler Room	525
Stairs	145
Hoist Way	90
Total	4,610

Mechanical System First Cost:

At $ 3,340,578 the mechanical system (includes HVAC and plumbing) makes up about 33% of the total estimated first cost of the training center. This constitutes by far the largest portion of the $ 10,242,000 estimated building price. The initial cost of the heating, ventilating, and air conditioning components of the building totals $ 87.42 per square foot of total floor area. This figure is higher than can be expected for most office and classroom use buildings, however, the extensive equipment in laboratory areas makes up for the more customary mechanical costs elsewhere. When the dense use of equipment in such spaces is taken into consideration with a relatively small overall footprint, the cause of the elevated cost per square foot can be understood. For a breakdown of the HVAC and plumbing initial costs, please see below.

Mechanical System Estimated First Cost*

	Materials	Labor	Unit Cost	Total	Cost/sqft
HVAC**	999,914	1,009,823	563,941	2,573,678	87.42
Plumbing	308,395	458,505	0	766,900	26.05
		Area (sqft)		**Total**	**Cost/sqft**
		29,440		3,340,578	113.47

*These figures were obtained directly from bidding documents.
**Fire protection costs are not included in this estimate.

Yearly Energy Utilization Data:

The actual annual energy consumption of the building was not able to be determined because, as of the time of this report, construction has not yet been completed. An

estimate of projected energy utilization has been prepared. Please see the *Estimated Annual Energy Consumption and Operating Costs* section of this report for this data.

Load and Energy Estimates:

A whole-building energy simulation was performed on the building using TRACE 700. Outdoor air ventilation rates, lights and equipment loads, design occupancy, and indoor design space conditions used in this simulation were taken directly from the design documents. Outdoor design conditions used were those specified in ASHRAE Fundamentals 2005 as 0.4% occurrence in Richmond, VA.

Design Load Estimates:

The peak design cooling load of the entire building was estimated to be 161.0 tons (see *System Summary — Design Cooling Capacities* appendix). Of this, 157.5 tons are to be taken care of by the chillers via the air handling unit cooling coils. The two 105.5-ton chillers now in place provide adequate capacity to meet this peak load requirement. For a detailed breakdown of load sources and their sensible and latent components, see the *Design Cooling Load Summary* appendix.

The peak design heating load of the entire building was estimated to be 1,226.7 MBH (see *System Summary — Design Heating Capacities* appendix). Of this, 1,200 MBH is to be handled by the boilers at the preheat and main coils. The two 1,500 MBH boilers now in place provide more than enough capacity to meet this peak load requirement, and may seem oversized. In the actual design, however, the boilers are also charged with supplying hot water to a heat exchanger to heat domestic hot water. This accounts for the apparent extra capacity of the real boiler versus the simulation.

Using the peak cooling load mentioned above and the total floor area listed in the *Monthly Energy Consumption* appendix, the total cooling load calculated is about 180 ft^2/ton. The actual cooling capacity of the present design is about 161 ft^2/ton, meaning it is capable of supplying more cooling per unit of floor area than the required amount obtained in this simulation.

Design Airflow Estimates:

From the *Load / Airflow Summary* appendix, summing all of the peak supply airflow rates to each space yields a total building peak supply airflow of 30,994 cfm, or 1.07 cfm/ft^2. Summing the actual supply airflows capable of the air handling units yields a capacity of 30,990 cfm, also at 1.07 cfm/ft^2. Assuming that the simulation did not account for any load diversity, the estimated value would be larger than the actual peak supply airflow at any given time. Also, the spaces served by AHU-1 utilize $C0_2$-based demand controlled ventilation in the actual design, possibly limiting the number of spaces that receive maximum outdoor air simultaneously. This means that, more than likely, the

supply capacity presently in place can deliver sufficient airflow according to the simulation.

The outdoor air ventilation rate per unit area attainted from the simulation has been determined to be 0.57 cfm/ft^2. The ventilation rate taken from design documents has been compared to the simulated value below.

Ventilation Rates per Square Foot

		Simulation		Actual Design
	%OA*	SA (cfm)**	OA (cfm)	OA (cfm)
AHU-1	79.76	10,197	8,133	2,280
AHU-2	100.00	5,959	5,959	8,040
AHU-3	9.78	11,377	1,113	1,310
AHU-4	43.33	1,992	863	880
AHU-5	55.90	537	300	340
Total			**16,368**	**12,850**
cfm/sqft			**0.57**	**0.44**

*values taken from *Engineering Checks* appendix
**values taken from *Load / Airflow Summary* appendix

Estimated Annual Energy Consumption and Operating Costs:

The same criteria used in the load estimation were also utilized in simulating the building's annual energy consumption. Equipment performance characteristics such as efficiency were taken from design documents.

As mentioned previously, annual energy consumption data for the building is not available because construction has not been completed. If an energy analysis had been carried out in the design process, that information could be compared to the data obtained from this simulation. However, a total energy study is generally performed during the design process only when multiple alternatives are being weighed. Even then, it is only completed if the owner has provided for the simulation in the project budget. An analysis was not performed in the design of this building because there were no alternative mechanical system designs being considered at that point in the design process.

Utility Rates:

To determine yearly operating costs, utility rates were assigned. The cost of natural gas was estimated from the rates paid by a neighboring building on the DEA Training Academy campus, and was set at $13.79 million per Btu. Electricity demand and consumption rates were estimated to be similar to those of the Virginia Electric and Power Company, a utility company which serves Prince William County, VA, where the DEA campus is located. The rates chosen were matched with those charged to buildings

with similar power usage and demand. For the entire electricity rate structure, see the *Virginia Electric and Power Company* appendix.

Two types of equipment, the gas-fired boilers and the emergency generator, are capable of running on #2 fuel oil. When the demand for natural gas exceeds what the supplier is capable of producing, the supplier can "cut off" the supply of natural gas. In this case, the boilers will be fired by fuel oil. When in need of emergency power, the generator will also run off of fuel oil. For simplicity, the energy simulation assumed no emergency situations and an unlimited supply of natural gas from the supplier, so #2 fuel oil was not included in the economic analysis.

Annual Energy and Cost Analysis:

According to the *Energy Consumption Summary* appendix, the total building energy use equals 5.42 million kBtu/yr. The appendix also breaks down the yearly consumption into categories. The lighting system leads the energy use at 29.3% of the total, while cooling and heating make up 20.2% and 19.4%, respectively.

The *Energy Cost Budget* appendix shows that, although lighting uses the most energy per year, it is space cooling that has the highest peak demand period at 534 MBH. This makes sense because lighting operates throughout the year at a fairly consistent rate, while cooling requirements will lessen in the winter and peak drastically in the summer. This appendix also breaks down consumption by utility, with electricity leading at 4.42 million kBtu/yr, followed by natural gas at 0.98 million kBtu/yr. The cost of electricity is $105,510 per year and $13,497 for gas, making the total estimated utility bill $119,006 annually. Maintenance costs were not considered in this simulation. For energy costs per unit area, see below.

Annual Energy Costs per Square Foot

Cooling		Equivalent kBtu	Cost ($) per kBtu*	Cost ($)	Cost ($) per sq ft
kwh	320,437	1,093,331	0.023854	26,080	**0.90**
Heating					
kwh Elec.	20,733	70,741	0.023854	1,687	**0.06**
kBtu Gas	978,935	978,935	0.01379	13,500	**0.47**
Lighting					
kwh	463,290	1,580,745	0.023854	37,707	**1.30**

*Elect cost per kBtu = $105,510 / 4,423,200 kBtu
**Gas cost per kBtu = $0.01379 / kBtu

LEED-NC Version 2.2 Registered Project Checklist

Clandestine Lab Training Center

DEA Training Academy, Quantico, Virginia

Yes	?	No			
3	**8**	**3**	**Sustainable Sites**		**14** Points
Y			Prereq 1	**Construction Activity Pollution Prevention**	Required
1			Credit 1	**Site Selection**	1
		1	Credit 2	**Development Density & Community Connectivity**	1
		1	Credit 3	**Brownfield Redevelopment**	1
	1		Credit 4.1	**Alternative Transportation**, Public Transportation Access	1
	1		Credit 4.2	**Alternative Transportation**, Bicycle Storage & Changing Rooms	1
	1		Credit 4.3	**Alternative Transportation**, Low-Emitting and Fuel-Efficient Vehicles	1
1			Credit 4.4	**Alternative Transportation**, Parking Capacity	1
	1		Credit 5.1	**Site Development**, Protect or Restore Habitat	1
	1		Credit 5.2	**Site Development**, Maximize Open Space	1
	1		Credit 6.1	**Stormwater Management**, Quantity Control	1
	1		Credit 6.2	**Stormwater Management**, Quality Control	1
	1		Credit 7.1	**Heat Island Effect**, Non-Roof	1
		1	Credit 7.2	**Heat Island Effect**, Roof	1
1			Credit 8	**Light Pollution Reduction**	1

Yes	?	No			
4	**1**		**Water Efficiency**		**5** Points
1			Credit 1.1	**Water Efficient Landscaping**, Reduce by 50%	1
1			Credit 1.2	**Water Efficient Landscaping**, No Potable Use or No Irrigation	1
	1		Credit 2	**Innovative Wastewater Technologies**	1
1			Credit 3.1	**Water Use Reduction**, 20% Reduction	1
1			Credit 3.2	**Water Use Reduction**, 30% Reduction	1

Yes	?	No			
3	**3**	**1**	**Energy & Atmosphere**		**17** Points
Y			Prereq 1	**Fundamental Commissioning of the Building Energy Systems**	Required
Y			Prereq 2	**Minimum Energy Performance**	Required
Y			Prereq 3	**Fundimental Refrigerant Management**	Required
2			Credit 1	**Optimize Energy Performance**	1 to 10
	1		Credit 2	**On-Site Renewable Energy**	1 to 3
	1		Credit 3	**Enhanced Commissioning**	1
1			Credit 4	**Enhanced Refrigerant Management**	1
	1		Credit 5	**Measurement & Verification**	1
		1	Credit 6	**Green Power**	1

continued…

Yes	?	No			
4	**5**	**4**	**Materials & Resources**		**13** Points
Y			Prereq 1	**Storage & Collection of Recyclables**	Required
		1	Credit 1.1	**Building Reuse**, Maintain 75% of Existing Walls, Floors & Roof	1

Yes	?	No			
4	**5**	**4**	**Materials & Resources**		**13** Points
Y			Prereq 1	**Storage & Collection of Recyclables**	Required
		1	Credit 1.1	**Building Reuse**, Maintain 75% of Existing Walls, Floors & Roof	1
		1	Credit 1.2	**Building Reuse**, Maintain 100% of Existing Walls, Floors & Roof	1
		1	Credit 1.3	**Building Reuse**, Maintain 50% of Interiorr Non-Structural Elements	1
1			Credit 2.1	**Construction Waste Management**, Divert 50% from Disposal	1
		1	Credit 2.2	**Construction Waste Management**, Divert 75% from Disposal	1
1			Credit 3.1	**Materials Reuse**, 5%	1
	1		Credit 3.2	**Materials Reuse**, 10%	1
1			Credit 4.1	**Recycled Content**, 10% (post-consumer + ½ pre-consumer)	1
	1		Credit 4.2	**Recycled Content**, 20% (post-consumer + ½ pre-consumer)	1
1			Credit 5.1	**Regional Materials**, 10% Extracted, Processed & Manufactured Regionally	1
	1		Credit 5.2	**Regional Materials,** 20% Extracted, Processed & Manufactured Regionally	1
	1		Credit 6	**Rapidly Renewable Materials**	1
	1		Credit 7	**Certified Wood**	1

Yes	?	No			
8	**4**	**3**	**Indoor Environmental Quality**		**15** Points
Y			Prereq 1	**Minimum IAQ Performance**	Required
Y			Prereq 2	**Environmental Tobacco Smoke** (ETS) **Control**	Required
1			Credit 1	**Outdoor Air Delivery Monitoring**	1
	1		Credit 2	**Increased Ventilation**	1
1			Credit 3.1	**Construction IAQ Management Plan**, During Construction	1
1			Credit 3.2	**Construction IAQ Management Plan**, Before Occupancy	1
1			Credit 4.1	**Low-Emitting Materials**, Adhesives & Sealants	1
	1		Credit 4.2	**Low-Emitting Materials**, Paints & Coatings	1
1			Credit 4.3	**Low-Emitting Materials**, Carpet Systems	1
1			Credit 4.4	**Low-Emitting Materials**, Composite Wood & Agrifiber Products	1
1			Credit 5	**Indoor Chemical & Pollutant Source Control**	1
1			Credit 6.1	**Controllability of Systems**, Lighting	1
		1	Credit 6.2	**Controllability of Systems**, Thermal Comfort	1
	1		Credit 7.1	**Thermal Comfort**, Design	1
	1		Credit 7.2	**Thermal Comfort**, Verication	1
		1	Credit 8.1	**Daylight & Views**, Daylight 75% of Spaces	1
		1	Credit 8.2	**Daylight & Views**, Views for 90% of Spaces	1

Yes	?	No			
1		**4**	**Innovation & Design Process**		**5** Points
		1	Credit 1.1	**Innovation in Design**: Provide Specific Title	1
		1	Credit 1.2	**Innovation in Design**: Provide Specific Title	1
		1	Credit 1.3	**Innovation in Design**: Provide Specific Title	1
		1	Credit 1.4	**Innovation in Design**: Provide Specific Title	1
1			Credit 2	**LEED™ Accredited Professional**	1

Yes	?	No			
23	**21**	**15**	**Project Totals**	**(pre-certification estimates)**	**69** Points

Certified 26-32 points **Silver** 33-38 points **Gold** 39-51 points **Platinum** 52-69 points

AHSRAE Standard 90.1-2004 Evaluation

5.0 Building Envelope

5.1 General

5.1.2 Space Conditioning Categories

5.1.2.1 All spaces evaluated fall under *nonresidential conditioned spaces*

5.1.2.3 Site is in Climate Zone 4 (see 5.1.4.1) - assume no *semiheated* or *unconditioned* spaces approved by building official

5.1.4 Climate

5.1.4.1 United States Locations: Site is determined to be in Climate Zone 4A (moist) using Figure B-1 and Table B-1 in Appendix B

5.2 Compliance Paths

5.2.1 Compliance Must comply with 5.1, 5.4, 5.7, 5.8 *and* 5.5 with fenestration requirements *or* 5.6

5.2.2 If using Section 11, must comply with 5.4

5.4 Mandatory Provisions

5.4.3 Air Leakage

5.4.3.4 Vestibules: Doors leading into lobbies are protected with enclosed vestibules

5.5 Prescriptive Building Envelope Option

5.5.1 Envelope must comply with *nonresidential* requirements of Table 5.5.4 for Zone 4A

5.5.3 Opaque Areas min. R values of continuous insulation in Appendix A or max U, C, and F for entire assembly in Appendix A

A1.1 Pre-calculatd Assemblies

A1.2 Roofs

A2.2 Insulation is Entirely Above Deck

A2.2.3 Roof U-factor taken from Table A2.2 (insulation above deck and continuous)

OK — **R-25 > 15.0** insulation (from specs)

OK — **U-0.039** for entire construction **< 0.063 max**

A3 Above-Grade Walls

A3.1 Mass Walls

A3.1.2.1 Mass wall heat capacity determined from Table A3.1C (assuming solid grouted at 115 lb/ft^3)

8 in CMU assembly: **HC=16.7**

12 in CMU assembly: **HC=25.6**

A3.1.3.1 Mass wall U-factor taken from Table A3.1A (assuming solid grouted at 115 lb/ft^3)

OK — **R-10 > 5.7** insulation

OK — 8 in CMU assembly, no framing: **U-0.085 < 0.151**

OK — 12 in CMU assembly, no framing, R-10 insulation: **U not listed** (*assume better than 8 in, so will comply if 8 in does)*

A4 Below-Grade Walls (does not apply to slab-on-grade)

A6 Slab-on-Grade Floors

A6.1 Floor is horizontally insulated to a distance of 24 in from perimeter with R-10

A6.3 F-factors

A6.3.1 F-factors taken from Table 6.3

OK — Unheated slab, 24 in horizontal, R-10 (Not Required): **F-0.70 < 0.73**

A7 Opaque Doors (does not apply, typical entrance doors are not opaque)

A8 Fenestration

A8.1 No skylights

A8.2 Unlabeled Vertical Fenestration: From Table A8.2

NOT OK — Metal frame, double glazing, **U-0.90**, **SHGC-0.68**, VLT-0.66

20.1-30%, fixed, **U-0.57 max**, **SHGC-0.39 max** all directions

***Exception to 5.5.4.4.1 may apply,** in which case overhanging projection provides enough shade that fenestration complies

5.8 Product Information and Installation Requirements

5.8.1 Insulation: R-values comply as noted in above sections

AHSRAE Standard 90.1-2004 Evaluation

6.0 Heating, Ventilating, and Air Conditioning

6.2 Compliance Paths

6.2.1 Must comply with 6.1, 6.7, 6.8, 6.4, and 6.5

* (gross floor area > 25,000 ft^2, cannot use 6.3)

6.4 Mandatory Provisions

6.4.1 Equipment Efficiences, Verification, and Labeling Requirements

Table 6.8.1A Air Conditioners and Condensing Units

Air cooled air conditioners, < 65,000 Btu/hr, split system

Minimum Efficiency: **12.0 SEER** (as of 1/23/06)

	MBH	HP	EER	
ACU-1:	34.9	1	46.78	**OK**
ACU-2:	19.4	0.25	104.02	**OK**
ACU-3:	20.3	0.33	82.46	**OK**

Table 6.8.1C Water Chilling Packages

Air cooled with condenser, electrically operated, all capacities

Minimum Efficiency: **COP=2.80**

	Ton	kW	COP	
CH-1 & 2	105.5	126.4	2.94	**OK**

IPLV=3.05 Max CH KW/Ton = **1.3 < 3.05** **OK**

Table 6.8.1E Furnaces, Duct Furnaces, and Unit Heaters

Electric resistance Unit Heaters not listed

Table 6.8.1F Boilers

Gas fired, > 300 MBH and < 2,500 MBH, at maximum capacity

Minimum Thermal Efficiency: **75%** **B-1 & 2 are 80% efficient at rated output** **OK**

6.4.3 Controls

6.4.3.1 Zone Thermostatic Controls: Supply of heating and cooling energy to each zone is controlled individually by thermostatic controls responding to the temperature of the zone.

6.4.3.1.2 Deadband: Zone thermostatic controls are capable of providing 5 degree deadband between heating and cooling.

Off-Hour Controls: System is capable of controlling start and stop times for each day of the week and uses CO2 sensors as an indirect means of occupant sensing.

6.4.3 Ventilation System Controls:

SYSTEM SUMMARY

DESIGN COOLING CAPACITIES

By ae

Building Airside Systems and Plant Capacities

		Peak Plant Loads								Block Plant Loads							
Plant	System	Main Coil ton	Aux Coil ton	Opt Vent Coil ton	Misc Load ton	Stg 1 Desic Cond ton	Stg 2 Desic Cond ton	Base Utility ton	Peak Total ton	Time Of Peak mo/hr	Main Coil ton	Aux Coil ton	Opt Vent Coil ton	Misc Load ton	Stg 1 Desic Cond ton	Stg 2 Desic Cond ton	Base Utility ton	Block Total ton
Cooling plant - Chiller		157.5	0.0	0.0	0.0	0.0	0.0	0.0	157.5	7/15	141.0	0.0	0.0	0.0	0.0	0.0	0.0	141.0
	AHU-1- classrooms	64.4	0.0	0.0	0.0	0.0	0.0	0.0	64.4	7/15	52.8	0.0	0.0	0.0	0.0	0.0	0.0	52.8
	AHU-2 Analytical Lab	46.5	0.0	0.0	0.0	0.0	0.0	0.0	46.5	7/15	43.6	0.0	0.0	0.0	0.0	0.0	0.0	43.6
	AHU-3 Offices Misc	33.2	0.0	0.0	0.0	0.0	0.0	0.0	33.2	7/15	31.4	0.0	0.0	0.0	0.0	0.0	0.0	31.4
	AHU-4 RAID	9.9	0.0	0.0	0.0	0.0	0.0	0.0	9.9	7/15	9.9	0.0	0.0	0.0	0.0	0.0	0.0	9.9
	AHU-5 Smokehouse	3.1	0.0	0.0	0.0	0.0	0.0	0.0	3.1	7/15	3.1	0.0	0.0	0.0	0.0	0.0	0.0	3.1
	small elec	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1	7/15	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1
	Stair	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.2	7/15	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.2
Cooling plant - SS		3.5	0.0	0.0	0.0	0.0	0.0	0.0	3.5	7/15	2.5	0.0	0.0	0.0	0.0	0.0	0.0	2.5
	LAN SS	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.6	7/15	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.6
	Elec SS	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.3	7/15	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.3
	Mech exterior load	2.6	0.0	0.0	0.0	0.0	0.0	0.0	2.6	7/15	1.7	0.0	0.0	0.0	0.0	0.0	0.0	1.7
Building totals		161.0	0.0	0.0	0.0	0.0	0.0	0.0	161.0		143.5	0.0	0.0	0.0	0.0	0.0	0.0	143.5

Building peak load is 161.0 tons.

Building maximum block load of 143.5 tons occurs in July at hour 15 based on system simulation.

SYSTEM SUMMARY

DESIGN HEATING CAPACITIES

By ae

System Coil Capacities

System Description	System Type	Main System Btu/h	Aux System Btu/h	Preheat Btu/h	Reheat Btu/h	Humid. Btu/h	Optional Vent Btu/h	Stg 1 Desic Regen Btu/h	Stg 2 Desic Regen Btu/h	Stg 1 Frost Prevention Btu/h	Stg 2 Frost Prevention Btu/h	Heating Totals Btu/h
AHU-1- classrooms	VAV w/Baseboard Heating	-193,676	0	-325,137	-165,895	0	0	0	0	0	0	-518,813
AHU-2 Analytical Lab	Variable Volume Reheat (30% Min Flow Def	-66,982	0	-238,249	-40,997	0	0	0	0	0	0	-305,231
AHU-3 Offices Misc	Variable Volume Reheat (30% Min Flow Def	-240,063	0	-44,465	-126,948	0	0	0	0	0	0	-284,528
AHU-4 RAID	Single Zone	-69,537	0	0	0	0	0	0	0	0	0	-69,537
AHU-5 Smokehouse	Single Zone	-21,937	0	0	0	0	0	0	0	0	0	-21,937
LAN SS	Packaged Terminal Air Conditioner	-8,274	0	0	0	0	0	0	0	0	0	-8,274
Elec SS	Packaged Terminal Air Conditioner	-2,989	0	0	0	0	0	0	0	0	0	-2,989
Mech exterior load	Packaged Terminal Air Conditioner	-11,359	0	0	0	0	0	0	0	0	0	-11,359
small elec	Packaged Terminal Air Conditioner	-1,117	0	0	0	0	0	0	0	0	0	-1,117
Stair	Packaged Terminal Air Conditioner	-2,949	0	0	0	0	0	0	0	0	0	-2,949
Totals		**-618,884**	**0**	**-607,851**	**-333,840**	**0**	**0**	**0**	**0**	**0**	**0**	**-1,226,736**

Building Plant Capacities

Plant	System	Peak Loads: Main Coil MBh	Preheat Coil MBh	Reheat Coil MBh	Humid. Coil MBh	Aux Coil MBh	Opt Vent Coil MBh	Misc Load MBh	Stg 1 Desic. Regen. MBh	Stg 2 Desic. Regen. MBh	Stg 1 Frost Prev. MBh	Stg 2 Frost Prev. MBh	Base Utility MBh	Absorption Load MBh
Heating plant - Boiler		592	608	0	0	0	0	0	0	0	0	0	0	0
	AHU-1- classrooms	194	325	0	0	0	0	0	0	0	0	0	0	0
	AHU-2 Analytical Lab	67	238	0	0	0	0	0	0	0	0	0	0	0
	AHU-3 Offices Misc	240	44	0	0	0	0	0	0	0	0	0	0	0
	AHU-4 RAID	70	0	0	0	0	0	0	0	0	0	0	0	0
	AHU-5 Smokehouse	22	0	0	0	0	0	0	0	0	0	0	0	0
Heating plant - SS		27	0	0	0	0	0	0	0	0	0	0	0	0
	LAN SS	8	0	0	0	0	0	0	0	0	0	0	0	0
	Elec SS	3	0	0	0	0	0	0	0	0	0	0	0	0
	Mech exterior load	11	0	0	0	0	0	0	0	0	0	0	0	0
	small elec	1	0	0	0	0	0	0	0	0	0	0	0	0
	Stair	3	0	0	0	0	0	0	0	0	0	0	0	0

Building peak load is 1,226.7 MBh.

Design Cooling Load Summary

By ae

DEA Clandestine Lab Training Center
Quantico Marine Corps Base, Quantico, VA

System - AHU-1- classrooms
Type - VAV w/Baseboard Heating

Coil Location - System

Coil Peak Calculation Time: July, hour 15
Ambient DB/WB/HR: 92 / 79 / 132

COOLING COIL LOAD INFORMATION

Load Component	Sensible Btu/h	Latent Btu/h	Total Btu/h	Percent of Total
Solar Gain	3,670		3,670	0.5 %
Glass Transmission	1,883		1,883	0.2 %
Wall Transmission	2,915		2,915	0.4 %
Roof Transmission	0		0	0.0 %
Floor Transmission	745		745	0.1 %
Partition Transmission	0		0	0.0 %
Net Ceiling Load	0		0	0.0 %
Lighting	39,869		39,869	5.2 %
People	75,838	66,334	142,171	18.4 %
Misc. Equipment Loads	29,712	0	29,712	3.8 %
Cooling Infiltration	0	0	0	0.0 %
Sub-Total ==>	154,632	66,334	220,965	28.6 %
Ventilation Load	153,281	355,878	509,158	65.8 %
Exhaust Heat	-33,850	0	-33,850	-4.4 %
Supply Fan Load	24,631		24,631	3.2 %
Return Fan Load	6,718		6,718	0.9 %
Net Duct Heat Pickup	0		0	0.0 %
Wall Load to Plenum	2,263		2,263	0.3 %
Roof Load to Plenum	35,338		35,338	4.6 %
Lighting Load to Plenum	3,294		3,294	0.4 %
Misc. Equip. Load to Plenum	0	0	0	0.0 %
Glass Transmission to Plenu	0		0	0.0 %
Glass Solar to Plenum	0		0	0.0 %
Over/Under Sizing	4,810		4,810	0.6 %
Reheat at Design	0	0	0	0.0 %
Total Cooling Loads	351,117	422,211	773,328	100.0 %

COOLING COIL SELECTION

Coil Selection Parameters

Coil Entering Air (DB / WB)	92.0 / 79.2	°F
Coil Entering Humidity Ratio	131.83	gr/lb
Coil Leaving Air (DB / WB)	52.1 / 49.9	°F
Coil Leaving Humidity Ratio	50.20	gr/lb
Coil Sensible Load	351.12	MBh
Coil Total Load	773.33	MBh
Cooling Supply Air Temperature	55.00	°F
Total Cooling Airflow	7,557.22	cfm
Resulting Room Relative Humidity	52.83	%

General Engineering Checks

Total Cooling Load	64.4	ton
Area / Load	122.91	ft²/ton
Total Floor Area	7,921	ft²
Cooling Airflow	1.03	cfm/ft²
Airflow / Load	126.20	cfm/ton
Percent Outdoor Air	100.0	%
Cooling Load Methodology	CLTD-CLF (ASHRAE TFM)	

Design Cooling Load Summary

By ae

DEA Clandestine Lab Training Center
Quantico Marine Corps Base, Quantico, VA

System - AHU-2 Analytical Lab
Type - Variable Volume Reheat (30% Min Flow Default)

Coil Location - System

Coil Peak Calculation Time: July, hour 16
Ambient DB/WB/HR: 92 / 79 / 130

COOLING COIL LOAD INFORMATION

Load Component	Sensible Btu/h	Latent Btu/h	Total Btu/h	Percent of Total
Solar Gain	9,175		9,175	1.6 %
Glass Transmission	1,415		1,415	0.3 %
Wall Transmission	2,434		2,434	0.4 %
Roof Transmission	1,477		1,477	0.3 %
Floor Transmission	0		0	0.0 %
Partition Transmission	1,871		1,871	0.3 %
Net Ceiling Load	0		0	0.0 %
Lighting	28,226		28,226	5.1 %
People	12,250	12,250	24,500	4.4 %
Misc. Equipment Loads	45,871	0	45,871	8.2 %
Cooling Infiltration	0	0	0	0.0 %
Sub-Total ==>	102,717	12,250	114,967	20.6 %
Ventilation Load	123,149	289,783	412,932	73.9 %
Exhaust Heat	0	0	0	0.0 %
Supply Fan Load	19,423		19,423	3.5 %
Return Fan Load	0		0	0.0 %
Net Duct Heat Pickup	0		0	0.0 %
Wall Load to Plenum	566		566	0.1 %
Roof Load to Plenum	6,627		6,627	1.2 %
Lighting Load to Plenum	0		0	0.0 %
Misc. Equip. Load to Plenum	0	0	0	0.0 %
Glass Transmission to Plenu	0		0	0.0 %
Glass Solar to Plenum	0		0	0.0 %
Over/Under Sizing	3,990		3,990	0.7 %
Reheat at Design	0	0	0	0.0 %
Total Cooling Loads	256,472	302,033	558,505	100.0 %

COOLING COIL SELECTION

Coil Selection Parameters

Coil Entering Air (DB / WB)	91.5 / 78.9	°F
Coil Entering Humidity Ratio	130.26	gr/lb
Coil Leaving Air (DB / WB)	52.1 / 52.0	°F
Coil Leaving Humidity Ratio	58.07	gr/lb
Coil Sensible Load	253.82	MBh
Coil Total Load	558.50	MBh
Cooling Supply Air Temperature	55.00	°F
Total Cooling Airflow	5,959.37	cfm
Resulting Room Relative Humidity	49.83	%

General Engineering Checks

Total Cooling Load	46.5	ton
Area / Load	67.25	ft²/ton
Total Floor Area	3,130	ft²
Cooling Airflow	1.90	cfm/ft²
Airflow / Load	128.04	cfm/ton
Percent Outdoor Air	100.0	%
Cooling Load Methodology	CLTD-CLF (ASHRAE TFM)	

Design Cooling Load Summary

By ae

DEA Clandestine Lab Training Center
Quantico Marine Corps Base, Quantico, VA

System - AHU-3 Offices Misc
Type - Variable Volume Reheat (30% Min Flow Default)

Coil Location - System

Coil Peak Calculation Time: July, hour 17
Ambient DB/WB/HR: 90 / 78 / 124

COOLING COIL LOAD INFORMATION

Load Component	Sensible Btu/h	Latent Btu/h	Total Btu/h	Percent of Total
Solar Gain	88,158		88,158	22.1 %
Glass Transmission	13,649		13,649	3.4 %
Wall Transmission	3,802		3,802	1.0 %
Roof Transmission	8,757		8,757	2.2 %
Floor Transmission	124		124	0.0 %
Partition Transmission	4,937		4,937	1.2 %
Net Ceiling Load	0		0	0.0 %
Lighting	62,377		62,377	15.7 %
People	7,390	7,445	14,836	3.7 %
Misc. Equipment Loads	27,303	0	27,303	6.9 %
Cooling Infiltration	3,452	10,150	13,602	3.4 %
Sub-Total ==>	219,950	17,595	237,545	59.6 %
Ventilation Load	17,340	55,067	72,408	18.2 %
Exhaust Heat	-6,739	0	-6,739	-1.7 %
Supply Fan Load	33,208		33,208	8.3 %
Return Fan Load	9,239		9,239	2.3 %
Net Duct Heat Pickup	0		0	0.0 %
Wall Load to Plenum	5,357		5,357	1.3 %
Roof Load to Plenum	37,367		37,367	9.4 %
Lighting Load to Plenum	1,255		1,255	0.3 %
Misc. Equip. Load to Plenum	0	0	0	0.0 %
Glass Transmission to Plenu	0		0	0.0 %
Glass Solar to Plenum	0		0	0.0 %
Over/Under Sizing	8,765		8,765	2.2 %
Reheat at Design	0	0	0	0.0 %
Total Cooling Loads	325,742	72,663	398,405	100.0 %

COOLING COIL SELECTION

Coil Selection Parameters

Coil Entering Air (DB / WB)	81.6 / 63.9	°F
Coil Entering Humidity Ratio	61.08	gr/lb
Coil Leaving Air (DB / WB)	52.1 / 50.4	°F
Coil Leaving Humidity Ratio	51.95	gr/lb
Coil Sensible Load	325.74	MBh
Coil Total Load	398.40	MBh
Cooling Supply Air Temperature	55.00	°F
Total Cooling Airflow	10,188.83	cfm
Resulting Room Relative Humidity	39.43	%

General Engineering Checks

Total Cooling Load	33.2	ton
Area / Load	308.46	ft²/ton
Total Floor Area	10,241	ft²
Cooling Airflow	1.02	cfm/ft²
Airflow / Load	314.26	cfm/ton
Percent Outdoor Air	10.7	%
Cooling Load Methodology	CLTD-CLF (ASHRAE TFM)	

Design Cooling Load Summary

By ae

DEA Clandestine Lab Training Center
Quantico Marine Corps Base, Quantico, VA

System - AHU-4 RAID
Zone - RAID

Coil Location - Zone

Coil Peak Calculation Time: July, hour 15
Ambient DB/WB/HR: 92 / 79 / 132

COOLING COIL LOAD INFORMATION

Load Component	Sensible Btu/h	Latent Btu/h	Total Btu/h	Percent of Total
Solar Gain	0		0	0.0 %
Glass Transmission	0		0	0.0 %
Wall Transmission	3,523		3,523	3.3 %
Roof Transmission	5,933		5,933	5.5 %
Floor Transmission	0		0	0.0 %
Partition Transmission	0		0	0.0 %
Net Ceiling Load	0		0	0.0 %
Lighting	20,478		20,478	19.0 %
People	10,000	10,000	20,000	18.6 %
Misc. Equipment Loads	0	0	0	0.0 %
Cooling Infiltration	0	0	0	0.0 %
Sub-Total ==>	39,934	10,000	49,934	46.4 %
Ventilation Load	14,707	36,144	50,851	47.3 %
Exhaust Heat	-694	0	-694	-0.6 %
Supply Fan Load	5,870		5,870	5.5 %
Return Fan Load	1,601		1,601	1.5 %
Net Duct Heat Pickup	0		0	0.0 %
Wall Load to Plenum	0		0	0.0 %
Roof Load to Plenum	0		0	0.0 %
Lighting Load to Plenum	0		0	0.0 %
Misc. Equip. Load to Plenum	0	0	0	0.0 %
Glass Transmission to Plenu	0		0	0.0 %
Glass Solar to Plenum	0		0	0.0 %
Over/Under Sizing	0		0	0.0 %
Reheat at Design	0	0	0	0.0 %
Total Cooling Loads	61,418	46,144	107,562	100.0 %

COOLING COIL SELECTION

Coil Selection Parameters

Coil Entering Air (DB / WB)	82.8 / 70.7	°F
Coil Entering Humidity Ratio	94.18	gr/lb
Coil Leaving Air (DB / WB)	52.1 / 52.0	°F
Coil Leaving Humidity Ratio	58.01	gr/lb
Coil Sensible Load	61.42	MBh
Coil Total Load	107.56	MBh
Cooling Supply Air Temperature	55.00	°F
Total Cooling Airflow	1,800.99	cfm
Resulting Room Relative Humidity	50.07	%

General Engineering Checks

Total Cooling Load	9.0	ton
Area / Load	223.13	ft²/ton
Total Floor Area	2,000	ft²
Cooling Airflow	0.90	cfm/ft²
Airflow / Load	200.93	cfm/ton
Percent Outdoor Air	43.3	%
Cooling Load Methodology	CLTD-CLF (ASHRAE TFM)	

Design Cooling Load Summary

By ae

DEA Clandestine Lab Training Center
Quantico Marine Corps Base, Quantico, VA

System - AHU-4 RAID
Zone - Eqpt- RAID

Coil Location - Zone

Coil Peak Calculation Time: July, hour 15
Ambient DB/WB/HR: 92 / 79 / 132

COOLING COIL LOAD INFORMATION

Load Component	Sensible Btu/h	Latent Btu/h	Total Btu/h	Percent of Total
Solar Gain	0		0	0.0 %
Glass Transmission	0		0	0.0 %
Wall Transmission	0		0	0.0 %
Roof Transmission	0		0	0.0 %
Floor Transmission	0		0	0.0 %
Partition Transmission	0		0	0.0 %
Net Ceiling Load	0		0	0.0 %
Lighting	710		710	32.9 %
People	0	0	0	0.0 %
Misc. Equipment Loads	0	0	0	0.0 %
Cooling Infiltration	0	0	0	0.0 %
Sub-Total ==>	710	0	710	32.9 %
Ventilation Load	321	849	1,171	54.2 %
Exhaust Heat	-63	0	-63	-2.9 %
Supply Fan Load	128		128	5.9 %
Return Fan Load	35		35	1.6 %
Net Duct Heat Pickup	0		0	0.0 %
Wall Load to Plenum	0		0	0.0 %
Roof Load to Plenum	0		0	0.0 %
Lighting Load to Plenum	177		177	8.2 %
Misc. Equip. Load to Plenum	0	0	0	0.0 %
Glass Transmission to Plenu	0		0	0.0 %
Glass Solar to Plenum	0		0	0.0 %
Over/Under Sizing	0		0	0.0 %
Reheat at Design	0	0	0	0.0 %
Total Cooling Loads	1,309	849	2,159	100.0 %

COOLING COIL SELECTION

Coil Selection Parameters

Coil Entering Air (DB / WB)	84.3 / 70.6	°F
Coil Entering Humidity Ratio	91.34	gr/lb
Coil Leaving Air (DB / WB)	52.1 / 52.0	°F
Coil Leaving Humidity Ratio	58.07	gr/lb
Coil Sensible Load	1.31	MBh
Coil Total Load	2.16	MBh
Cooling Supply Air Temperature	55.00	°F
Total Cooling Airflow	39.35	cfm
Resulting Room Relative Humidity	46.28	%

General Engineering Checks

Total Cooling Load	0.2	ton
Area / Load	1,111.82	ft²/ton
Total Floor Area	200	ft²
Cooling Airflow	0.20	cfm/ft²
Airflow / Load	218.77	cfm/ton
Percent Outdoor Air	43.3	%
Cooling Load Methodology	CLTD-CLF (ASHRAE TFM)	

Design Cooling Load Summary

By ae

DEA Clandestine Lab Training Center
Quantico Marine Corps Base, Quantico, VA

System - AHU-4 RAID
Zone - Ctrl- RAID

Coil Location - Zone

Coil Peak Calculation Time: July, hour 15
Ambient DB/WB/HR: 92 / 79 / 132

COOLING COIL LOAD INFORMATION

Load Component	Sensible Btu/h	Latent Btu/h	Total Btu/h	Percent of Total
Solar Gain	0		0	0.0 %
Glass Transmission	0		0	0.0 %
Wall Transmission	0		0	0.0 %
Roof Transmission	0		0	0.0 %
Floor Transmission	0		0	0.0 %
Partition Transmission	0		0	0.0 %
Net Ceiling Load	0		0	0.0 %
Lighting	887		887	10.4 %
People	485	489	975	11.4 %
Misc. Equipment Loads	1,775	0	1,775	20.7 %
Cooling Infiltration	0	0	0	0.0 %
Sub-Total ==>	3,148	489	3,637	42.5 %
Ventilation Load	1,237	3,291	4,528	52.9 %
Exhaust Heat	-242	0	-242	-2.8 %
Supply Fan Load	494		494	5.8 %
Return Fan Load	135		135	1.6 %
Net Duct Heat Pickup	0		0	0.0 %
Wall Load to Plenum	0		0	0.0 %
Roof Load to Plenum	3		3	0.0 %
Lighting Load to Plenum	0		0	0.0 %
Misc. Equip. Load to Plenum	0	0	0	0.0 %
Glass Transmission to Plenu	0		0	0.0 %
Glass Solar to Plenum	0		0	0.0 %
Over/Under Sizing	0		0	0.0 %
Reheat at Design	0	0	0	0.0 %
Total Cooling Loads	4,774	3,780	8,555	100.0 %

COOLING COIL SELECTION

Coil Selection Parameters

Coil Entering Air (DB / WB)	84.3 / 70.5	°F
Coil Entering Humidity Ratio	91.07	gr/lb
Coil Leaving Air (DB / WB)	52.1 / 52.0	°F
Coil Leaving Humidity Ratio	58.07	gr/lb
Coil Sensible Load	4.77	MBh
Coil Total Load	8.55	MBh
Cooling Supply Air Temperature	55.00	°F
Total Cooling Airflow	151.49	cfm
Resulting Room Relative Humidity	45.92	%

General Engineering Checks

Total Cooling Load	0.7	ton
Area / Load	364.71	ft²/ton
Total Floor Area	260	ft²
Cooling Airflow	0.58	cfm/ft²
Airflow / Load	212.50	cfm/ton
Percent Outdoor Air	43.3	%
Cooling Load Methodology	CLTD-CLF (ASHRAE TFM)	

Design Cooling Load Summary

By ae

DEA Clandestine Lab Training Center
Quantico Marine Corps Base, Quantico, VA

System - AHU-5 Smokehouse
Zone - Smoke House

Coil Location - Zone

Coil Peak Calculation Time: July, hour 15
Ambient DB/WB/HR: 92 / 79 / 132

COOLING COIL LOAD INFORMATION

Load Component	Sensible Btu/h	Latent Btu/h	Total Btu/h	Percent of Total
Solar Gain	0		0	0.0 %
Glass Transmission	0		0	0.0 %
Wall Transmission	811		811	2.2 %
Roof Transmission	0		0	0.0 %
Floor Transmission	0		0	0.0 %
Partition Transmission	0		0	0.0 %
Net Ceiling Load	0		0	0.0 %
Lighting	3,317		3,317	8.8 %
People	4,005	4,035	8,040	21.4 %
Misc. Equipment Loads	3,317	0	3,317	8.8 %
Cooling Infiltration	0	0	0	0.0 %
Sub-Total ==>	11,451	4,035	15,486	41.2 %
Ventilation Load	5,654	13,316	18,970	50.5 %
Exhaust Heat	-1,204	0	-1,204	-3.2 %
Supply Fan Load	1,749		1,749	4.7 %
Return Fan Load	477		477	1.3 %
Net Duct Heat Pickup	0		0	0.0 %
Wall Load to Plenum	718		718	1.9 %
Roof Load to Plenum	1,392		1,392	3.7 %
Lighting Load to Plenum	0		0	0.0 %
Misc. Equip. Load to Plenum	0	0	0	0.0 %
Glass Transmission to Plenu	0		0	0.0 %
Glass Solar to Plenum	0		0	0.0 %
Over/Under Sizing	0		0	0.0 %
Reheat at Design	0	0	0	0.0 %
Total Cooling Loads	20,238	17,351	37,589	100.0 %

COOLING COIL SELECTION

Coil Selection Parameters

Coil Entering Air (DB / WB)	86.1 / 73.3	°F
Coil Entering Humidity Ratio	103.75	gr/lb
Coil Leaving Air (DB / WB)	52.1 / 52.0	°F
Coil Leaving Humidity Ratio	58.07	gr/lb
Coil Sensible Load	20.24	MBh
Coil Total Load	37.59	MBh
Cooling Supply Air Temperature	55.00	°F
Total Cooling Airflow	536.69	cfm
Resulting Room Relative Humidity	52.16	%

General Engineering Checks

Total Cooling Load	3.1	ton
Area / Load	155.15	ft²/ton
Total Floor Area	486	ft²
Cooling Airflow	1.10	cfm/ft²
Airflow / Load	171.34	cfm/ton
Percent Outdoor Air	55.9	%
Cooling Load Methodology	CLTD-CLF (ASHRAE TFM)	

Design Cooling Load Summary

By ae

DEA Clandestine Lab Training Center
Quantico Marine Corps Base, Quantico, VA

System - Elec SS
Zone - Main Elec Exterior
Room - Main Elec Exterior

Coil Location - Room

Coil Peak Calculation Time: July, hour 15
Ambient DB/WB/HR: 92 / 79 / 132

COOLING COIL LOAD INFORMATION

Load Component	Sensible Btu/h	Latent Btu/h	Total Btu/h	Percent of Total
Solar Gain	0		0	0.0 %
Glass Transmission	0		0	0.0 %
Wall Transmission	432		432	13.5 %
Roof Transmission	0		0	0.0 %
Floor Transmission	0		0	0.0 %
Partition Transmission	0		0	0.0 %
Net Ceiling Load	0		0	0.0 %
Lighting	560		560	17.5 %
People	0	0	0	0.0 %
Misc. Equipment Loads	0	0	0	0.0 %
Cooling Infiltration	309	761	1,070	33.5 %
Sub-Total ==>	1,300	761	2,061	64.4 %
Ventilation Load	155	380	535	16.7 %
Exhaust Heat	-138	0	-138	-4.3 %
Supply Fan Load	72		72	2.2 %
Return Fan Load	0		0	0.0 %
Net Duct Heat Pickup	0		0	0.0 %
Wall Load to Plenum	213		213	6.6 %
Roof Load to Plenum	456		456	14.3 %
Lighting Load to Plenum	0		0	0.0 %
Misc. Equip. Load to Plenum	0	0	0	0.0 %
Glass Transmission to Plenu	0		0	0.0 %
Glass Solar to Plenum	0		0	0.0 %
Over/Under Sizing	0		0	0.0 %
Reheat at Design	0	0	0	0.0 %
Total Cooling Loads	2,057	1,141	3,198	100.0 %

COOLING COIL SELECTION

Coil Selection Parameters

Coil Entering Air (DB / WB)	81.7 / 66.6	°F
Coil Entering Humidity Ratio	74.30	gr/lb
Coil Leaving Air (DB / WB)	50.0 / 48.7	°F
Coil Leaving Humidity Ratio	49.23	gr/lb
Coil Sensible Load	2.06	MBh
Coil Total Load	3.20	MBh
Cooling Supply Air Temperature	50.76	°F
Total Cooling Airflow	60.65	cfm
Resulting Room Relative Humidity	50.00	%

General Engineering Checks

Total Cooling Load	0.3	ton
Area / Load	615.39	ft²/ton
Total Floor Area	164	ft²
Cooling Airflow	0.37	cfm/ft²
Airflow / Load	227.58	cfm/ton
Percent Outdoor Air	13.5	%
Cooling Load Methodology	CLTD-CLF (ASHRAE TFM)	

Design Cooling Load Summary

By ae

DEA Clandestine Lab Training Center
Quantico Marine Corps Base, Quantico, VA

System - LAN SS
Zone - Security exterior
Room - Security exterior

Coil Location - Room

Coil Peak Calculation Time: July, hour 15
Ambient DB/WB/HR: 92 / 79 / 132

COOLING COIL LOAD INFORMATION

Load Component	Sensible Btu/h	Latent Btu/h	Total Btu/h	Percent of Total
Solar Gain	0		0	0.0 %
Glass Transmission	0		0	0.0 %
Wall Transmission	0		0	0.0 %
Roof Transmission	291		291	15.4 %
Floor Transmission	0		0	0.0 %
Partition Transmission	0		0	0.0 %
Net Ceiling Load	0		0	0.0 %
Lighting	0		0	0.0 %
People	0	0	0	0.0 %
Misc. Equipment Loads	0	0	0	0.0 %
Cooling Infiltration	462	837	1,299	68.6 %
Sub-Total ==>	752	837	1,590	84.0 %
Ventilation Load	92	167	260	13.7 %
Exhaust Heat	0	0	0	0.0 %
Supply Fan Load	43		43	2.3 %
Return Fan Load	0		0	0.0 %
Net Duct Heat Pickup	0		0	0.0 %
Wall Load to Plenum	0		0	0.0 %
Roof Load to Plenum	0		0	0.0 %
Lighting Load to Plenum	0		0	0.0 %
Misc. Equip. Load to Plenum	0	0	0	0.0 %
Glass Transmission to Plenu	0		0	0.0 %
Glass Solar to Plenum	0		0	0.0 %
Over/Under Sizing	0		0	0.0 %
Reheat at Design	0	0	0	0.0 %
Total Cooling Loads	888	1,005	1,893	100.0 %

COOLING COIL SELECTION

Coil Selection Parameters

Coil Entering Air (DB / WB)	77.3 / 68.1	°F
Coil Entering Humidity Ratio	89.38	gr/lb
Coil Leaving Air (DB / WB)	54.3 / 51.4	°F
Coil Leaving Humidity Ratio	52.35	gr/lb
Coil Sensible Load	0.89	MBh
Coil Total Load	1.89	MBh
Cooling Supply Air Temperature	55.00	°F
Total Cooling Airflow	36.64	cfm
Resulting Room Relative Humidity	63.16	%

General Engineering Checks

Total Cooling Load	0.2	ton
Area / Load	621.30	ft²/ton
Total Floor Area	98	ft²
Cooling Airflow	0.37	cfm/ft²
Airflow / Load	232.31	cfm/ton
Percent Outdoor Air	13.4	%
Cooling Load Methodology	CLTD-CLF (ASHRAE TFM)	

Design Cooling Load Summary

By ae

DEA Clandestine Lab Training Center
Quantico Marine Corps Base, Quantico, VA

System - LAN SS
Zone - MDF/ IDF exterior
Room - MDF/ IDF exterior

Coil Location - Room

Coil Peak Calculation Time: July, hour 15
Ambient DB/WB/HR: 92 / 79 / 132

COOLING COIL LOAD INFORMATION

Load Component	Sensible Btu/h	Latent Btu/h	Total Btu/h	Percent of Total
Solar Gain	0		0	0.0 %
Glass Transmission	0		0	0.0 %
Wall Transmission	0		0	0.0 %
Roof Transmission	297		297	15.4 %
Floor Transmission	0		0	0.0 %
Partition Transmission	0		0	0.0 %
Net Ceiling Load	0		0	0.0 %
Lighting	0		0	0.0 %
People	0	0	0	0.0 %
Misc. Equipment Loads	0	0	0	0.0 %
Cooling Infiltration	471	854	1,325	68.6 %
Sub-Total ==>	768	854	1,622	84.0 %
Ventilation Load	94	171	265	13.7 %
Exhaust Heat	0	0	0	0.0 %
Supply Fan Load	44		44	2.3 %
Return Fan Load	0		0	0.0 %
Net Duct Heat Pickup	0		0	0.0 %
Wall Load to Plenum	0		0	0.0 %
Roof Load to Plenum	0		0	0.0 %
Lighting Load to Plenum	0		0	0.0 %
Misc. Equip. Load to Plenum	0	0	0	0.0 %
Glass Transmission to Plenu	0		0	0.0 %
Glass Solar to Plenum	0		0	0.0 %
Over/Under Sizing	0		0	0.0 %
Reheat at Design	0	0	0	0.0 %
Total Cooling Loads	906	1,025	1,931	100.0 %

COOLING COIL SELECTION

Coil Selection Parameters

Coil Entering Air (DB / WB)	77.3 / 68.1	°F
Coil Entering Humidity Ratio	89.38	gr/lb
Coil Leaving Air (DB / WB)	54.3 / 51.4	°F
Coil Leaving Humidity Ratio	52.35	gr/lb
Coil Sensible Load	0.91	MBh
Coil Total Load	1.93	MBh
Cooling Supply Air Temperature	55.00	°F
Total Cooling Airflow	37.39	cfm
Resulting Room Relative Humidity	63.16	%

General Engineering Checks

Total Cooling Load	0.2	ton
Area / Load	621.30	ft²/ton
Total Floor Area	100	ft²
Cooling Airflow	0.37	cfm/ft²
Airflow / Load	232.31	cfm/ton
Percent Outdoor Air	13.4	%
Cooling Load Methodology	CLTD-CLF (ASHRAE TFM)	

Design Cooling Load Summary

By ae

DEA Clandestine Lab Training Center
Quantico Marine Corps Base, Quantico, VA

System - LAN SS
Zone - Lan exterior
Room - Lan exterior

Coil Location - Room

Coil Peak Calculation Time: July, hour 15
Ambient DB/WB/HR: 92 / 79 / 132

COOLING COIL LOAD INFORMATION

Load Component	Sensible Btu/h	Latent Btu/h	Total Btu/h	Percent of Total
Solar Gain	0		0	0.0 %
Glass Transmission	0		0	0.0 %
Wall Transmission	547		547	15.0 %
Roof Transmission	439		439	12.1 %
Floor Transmission	0		0	0.0 %
Partition Transmission	0		0	0.0 %
Net Ceiling Load	0		0	0.0 %
Lighting	0		0	0.0 %
People	0	0	0	0.0 %
Misc. Equipment Loads	0	0	0	0.0 %
Cooling Infiltration	697	1,438	2,136	58.6 %
Sub-Total ==>	1,683	1,438	3,121	85.7 %
Ventilation Load	139	288	427	11.7 %
Exhaust Heat	0	0	0	0.0 %
Supply Fan Load	94		94	2.6 %
Return Fan Load	0		0	0.0 %
Net Duct Heat Pickup	0		0	0.0 %
Wall Load to Plenum	0		0	0.0 %
Roof Load to Plenum	0		0	0.0 %
Lighting Load to Plenum	0		0	0.0 %
Misc. Equip. Load to Plenum	0	0	0	0.0 %
Glass Transmission to Plenu	0		0	0.0 %
Glass Solar to Plenum	0		0	0.0 %
Over/Under Sizing	0		0	0.0 %
Reheat at Design	0	0	0	0.0 %
Total Cooling Loads	1,916	1,726	3,642	100.0 %

COOLING COIL SELECTION

Coil Selection Parameters

Coil Entering Air (DB / WB)	76.6 / 66.3	°F
Coil Entering Humidity Ratio	81.29	gr/lb
Coil Leaving Air (DB / WB)	54.3 / 51.1	°F
Coil Leaving Humidity Ratio	51.12	gr/lb
Coil Sensible Load	1.92	MBh
Coil Total Load	3.64	MBh
Cooling Supply Air Temperature	55.00	°F
Total Cooling Airflow	79.15	cfm
Resulting Room Relative Humidity	58.10	%

General Engineering Checks

Total Cooling Load	0.3	ton
Area / Load	487.61	ft²/ton
Total Floor Area	148	ft²
Cooling Airflow	0.53	cfm/ft²
Airflow / Load	260.76	cfm/ton
Percent Outdoor Air	9.3	%
Cooling Load Methodology	CLTD-CLF (ASHRAE TFM)	

Design Cooling Load Summary

By ae

DEA Clandestine Lab Training Center
Quantico Marine Corps Base, Quantico, VA

System - Mech exterior load
Zone - Mechanical Mezzanine Exterior
Room - Mechanical Mezzanine Exterior

Coil Location - Room

Coil Peak Calculation Time: June, hour 15
Ambient DB/WB/HR: 94 / 77 / 114

COOLING COIL LOAD INFORMATION

Load Component	Sensible Btu/h	Latent Btu/h	Total Btu/h	Percent of Total
Solar Gain	0		0	0.0 %
Glass Transmission	0		0	0.0 %
Wall Transmission	0		0	0.0 %
Roof Transmission	0		0	0.0 %
Floor Transmission	0		0	0.0 %
Partition Transmission	0		0	0.0 %
Net Ceiling Load	0		0	0.0 %
Lighting	11,754		11,754	59.0 %
People	0	0	0	0.0 %
Misc. Equipment Loads	0	0	0	0.0 %
Cooling Infiltration	0	0	0	0.0 %
Sub-Total ==>	11,754	0	11,754	59.0 %
Ventilation Load	0	0	0	0.0 %
Exhaust Heat	0	0	0	0.0 %
Supply Fan Load	0		0	0.0 %
Return Fan Load	0		0	0.0 %
Net Duct Heat Pickup	0		0	0.0 %
Wall Load to Plenum	0		0	0.0 %
Roof Load to Plenum	8,161		8,161	41.0 %
Lighting Load to Plenum	0		0	0.0 %
Misc. Equip. Load to Plenum	0	0	0	0.0 %
Glass Transmission to Plenu	0		0	0.0 %
Glass Solar to Plenum	0		0	0.0 %
Over/Under Sizing	0		0	0.0 %
Reheat at Design	0	0	0	0.0 %
Total Cooling Loads	19,915	0	19,915	100.0 %

COOLING COIL SELECTION

Coil Selection Parameters

Coil Entering Air (DB / WB)	90.9 / 67.0	°F
Coil Entering Humidity Ratio	61.33	gr/lb
Coil Leaving Air (DB / WB)	55.0 / 45.9	°F
Coil Leaving Humidity Ratio	31.50	gr/lb
Coil Sensible Load	19.91	MBh
Coil Total Load	19.91	MBh
Cooling Supply Air Temperature	55.03	°F
Total Cooling Airflow	328.32	cfm
Resulting Room Relative Humidity	28.92	%

General Engineering Checks

Total Cooling Load	1.7	ton
Area / Load	2,075.23	ft²/ton
Total Floor Area	3,444	ft²
Cooling Airflow	0.10	cfm/ft²
Airflow / Load	197.83	cfm/ton
Percent Outdoor Air	0.0	%
Cooling Load Methodology	CLTD-CLF (ASHRAE TFM)	

Design Cooling Load Summary

By ae

DEA Clandestine Lab Training Center
Quantico Marine Corps Base, Quantico, VA

System - Mech exterior load
Zone - Mechanical Exterior
Room - Mechanical Exterior

Coil Location - Room

Coil Peak Calculation Time: July, hour 15
Ambient DB/WB/HR: 92 / 79 / 132

COOLING COIL LOAD INFORMATION

Load Component	Sensible Btu/h	Latent Btu/h	Total Btu/h	Percent of Total
Solar Gain	0		0	0.0 %
Glass Transmission	0		0	0.0 %
Wall Transmission	1,257		1,257	11.2 %
Roof Transmission	665		665	5.9 %
Floor Transmission	0		0	0.0 %
Partition Transmission	0		0	0.0 %
Net Ceiling Load	0		0	0.0 %
Lighting	1,782		1,782	15.9 %
People	0	0	0	0.0 %
Misc. Equipment Loads	0	0	0	0.0 %
Cooling Infiltration	2,460	5,049	7,508	67.0 %
Sub-Total ==>	6,163	5,049	11,212	00.0 %
Ventilation Load	0	0	0	0.0 %
Exhaust Heat	0	0	0	0.0 %
Supply Fan Load	0		0	0.0 %
Return Fan Load	0		0	0.0 %
Net Duct Heat Pickup	0		0	0.0 %
Wall Load to Plenum	0		0	0.0 %
Roof Load to Plenum	0		0	0.0 %
Lighting Load to Plenum	0		0	0.0 %
Misc. Equip. Load to Plenum	0	0	0	0.0 %
Glass Transmission to Plenu	0		0	0.0 %
Glass Solar to Plenum	0		0	0.0 %
Over/Under Sizing	0		0	0.0 %
Reheat at Design	0	0	0	0.0 %
Total Cooling Loads	6,163	5,049	11,212	100.0 %

COOLING COIL SELECTION

Coil Selection Parameters

Coil Entering Air (DB / WB)	75.0 / 64.8	°F
Coil Entering Humidity Ratio	76.34	gr/lb
Coil Leaving Air (DB / WB)	55.0 / 51.9	°F
Coil Leaving Humidity Ratio	52.88	gr/lb
Coil Sensible Load	6.16	MBh
Coil Total Load	11.21	MBh
Cooling Supply Air Temperature	55.00	°F
Total Cooling Airflow	289.64	cfm
Resulting Room Relative Humidity	58.30	%

General Engineering Checks

Total Cooling Load	0.9	ton
Area / Load	558.71	ft²/ton
Total Floor Area	522	ft²
Cooling Airflow	0.55	cfm/ft²
Airflow / Load	310.01	cfm/ton
Percent Outdoor Air	0.0	%
Cooling Load Methodology	CLTD-CLF (ASHRAE TFM)	

Design Cooling Load Summary

By ae

DEA Clandestine Lab Training Center
Quantico Marine Corps Base, Quantico, VA

System - Stair
Zone - Stair exterior
Room - Stair exterior

Coil Location - Room

Coil Peak Calculation Time: July, hour 15
Ambient DB/WB/HR: 92 / 79 / 132

COOLING COIL LOAD INFORMATION

Load Component	Sensible Btu/h	Latent Btu/h	Total Btu/h	Percent of Total
Solar Gain	0		0	0.0 %
Glass Transmission	0		0	0.0 %
Wall Transmission	547		547	22.2 %
Roof Transmission	309		309	12.5 %
Floor Transmission	0		0	0.0 %
Partition Transmission	0		0	0.0 %
Net Ceiling Load	0		0	0.0 %
Lighting	0		0	0.0 %
People	0	0	0	0.0 %
Misc. Equipment Loads	0	0	0	0.0 %
Cooling Infiltration	490	1,045	1,535	62.3 %
Sub-Total ==>	1,345	1,045	2,390	97.0 %
Ventilation Load	0	0	0	0.0 %
Exhaust Heat	0	0	0	0.0 %
Supply Fan Load	74		74	3.0 %
Return Fan Load	0		0	0.0 %
Net Duct Heat Pickup	0		0	0.0 %
Wall Load to Plenum	0		0	0.0 %
Roof Load to Plenum	0		0	0.0 %
Lighting Load to Plenum	0		0	0.0 %
Misc. Equip. Load to Plenum	0	0	0	0.0 %
Glass Transmission to Plenu	0		0	0.0 %
Glass Solar to Plenum	0		0	0.0 %
Over/Under Sizing	0		0	0.0 %
Reheat at Design	0	0	0	0.0 %
Total Cooling Loads	1,419	1,045	2,464	100.0 %

COOLING COIL SELECTION

Coil Selection Parameters

Coil Entering Air (DB / WB)	75.0 / 64.4	°F
Coil Entering Humidity Ratio	74.20	gr/lb
Coil Leaving Air (DB / WB)	54.3 / 51.1	°F
Coil Leaving Humidity Ratio	51.00	gr/lb
Coil Sensible Load	1.42	MBh
Coil Total Load	2.46	MBh
Cooling Supply Air Temperature	55.00	°F
Total Cooling Airflow	62.69	cfm
Resulting Room Relative Humidity	56.69	%

General Engineering Checks

Total Cooling Load	0.2	ton
Area / Load	506.45	ft²/ton
Total Floor Area	104	ft²
Cooling Airflow	0.60	cfm/ft²
Airflow / Load	305.30	cfm/ton
Percent Outdoor Air	0.0	%
Cooling Load Methodology	CLTD-CLF (ASHRAE TFM)	

Design Cooling Load Summary

By ae

DEA Clandestine Lab Training Center
Quantico Marine Corps Base, Quantico, VA

System - small elec
Zone - Small Elec rm
Room - Small Elec rm

Coil Location - Room

Coil Peak Calculation Time: July, hour 16
Ambient DB/WB/HR: 92 / 79 / 130

COOLING COIL LOAD INFORMATION

Load Component	Sensible Btu/h	Latent Btu/h	Total Btu/h	Percent of Total
Solar Gain	0		0	0.0 %
Glass Transmission	0		0	0.0 %
Wall Transmission	0		0	0.0 %
Roof Transmission	0		0	0.0 %
Floor Transmission	142		142	12.9 %
Partition Transmission	0		0	0.0 %
Net Ceiling Load	0		0	0.0 %
Lighting	614		614	55.8 %
People	0	0	0	0.0 %
Misc. Equipment Loads	0	0	0	0.0 %
Cooling Infiltration	0	0	0	0.0 %
Sub-Total ==>	757	0	757	68.7 %
Ventilation Load	82	219	302	27.4 %
Exhaust Heat	0	0	0	0.0 %
Supply Fan Load	43		43	3.9 %
Return Fan Load	0		0	0.0 %
Net Duct Heat Pickup	0		0	0.0 %
Wall Load to Plenum	0		0	0.0 %
Roof Load to Plenum	0		0	0.0 %
Lighting Load to Plenum	0		0	0.0 %
Misc. Equip. Load to Plenum	0	0	0	0.0 %
Glass Transmission to Plenu	0		0	0.0 %
Glass Solar to Plenum	0		0	0.0 %
Over/Under Sizing	0		0	0.0 %
Reheat at Design	0	0	0	0.0 %
Total Cooling Loads	882	219	1,102	100.0 %

COOLING COIL SELECTION

Coil Selection Parameters

Coil Entering Air (DB / WB)	77.0 / 64.0	°F
Coil Entering Humidity Ratio	68.96	gr/lb
Coil Leaving Air (DB / WB)	54.3 / 54.0	°F
Coil Leaving Humidity Ratio	62.06	gr/lb
Coil Sensible Load	0.88	MBh
Coil Total Load	1.10	MBh
Cooling Supply Air Temperature	55.00	°F
Total Cooling Airflow	36.64	cfm
Resulting Room Relative Humidity	46.28	%

General Engineering Checks

Total Cooling Load	0.1	ton
Area / Load	980.36	ft²/ton
Total Floor Area	90	ft²
Cooling Airflow	0.41	cfm/ft²
Airflow / Load	399.06	cfm/ton
Percent Outdoor Air	12.3	%
Cooling Load Methodology	CLTD-CLF (ASHRAE TFM)	

MONTHLY ENERGY CONSUMPTION

By ae

Alternative: 1 DEA Clandestine Lab

------- Monthly Energy Consumption -------

Utility	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
Electric													
On-Pk Cons. (kWh)	84,665	76,680	91,165	96,764	121,044	137,658	147,793	142,942	122,981	97,405	90,979	85,912	1,295,989
On-Pk Demand (kW)	141	137	168	186	241	293	304	279	241	171	162	155	304
Gas													
On-Pk Cons. (therms)	2,139	2,035	1,054	442	203	149	149	169	227	774	947	1,502	9,789
On-Pk Demand (therms/hr)	5	5	3	2	1	0	0	0	1	2	3	4	5

Building Energy Consumption =	186,874	Btu/(ft2-year)
Source Energy Consumption =	494,722	Btu/(ft2-year)
Floor Area =	28,908	ft2

Load / Airflow Summary

By ae

System	Zone	Room **		Floor Area ft²	People #	Coil Cooling Sensible Btu/h	Coil Cooling Total Btu/h	Space Design Max SA cfm	Air Changes ach/hr	VAV Minimum SA cfm	Main Coil Heating Sensible Btu/h	Heating Fan Max SA cfm	Percent OA Clg	Percent OA Htg	ASHRAE 62-89 OA Fraction
		Classroom#1	Rm Peak	1,400	140.0	81,779	182,953	2,097	8.56	1,845	-45,787	0	79.8	0.0	0.7687
		Classroom #2	Rm Peak	1,400	140.0	80,641	181,004	2,073	8.46	1,825	-43,478	0	79.8	0.0	0.7773
		Multipurpose Room	Rm Peak	565	28.3	26,245	53,475	655	6.95	614	-14,121	0	79.8	0.0	1.0000 *
		Breakroom/Pantry	Rm Peak	537	16.0	53,637	95,975	1,500	16.76	600	-21,239	0	79.8	0.0	0.4506
		Class Eqpt #1	Rm Peak	100	0.0	3,265	6,123	82	4.91	43	-1,046	0	79.8	0.0	1.0000 *
		Class Eqpt#2	Rm Peak	285	0.0	10,217	19,656	270	5.69	108	-3,320	0	79.8	0.0	0.1387
		Conference Room	Rm Peak	430	21.5	20,535	42,136	523	8.12	262	-6,195	0	79.8	0.0	0.6325
		Toilets/ Showers	Rm Peak	850	10.0	37,730	59,698	567	4.00	567	-13,334	0	79.8	0.0	0.1130
		Phys Training	Rm Peak	465	17.0	31,776	74,706	760	9.81	608	-13,884	0	79.8	0.0	0.7549
		Equipment Tryon	Rm Peak	455	17.0	15,173	32,892	377	4.97	264	-6,766	0	79.8	0.0	0.7351
		Clothing Try-on	Rm Peak	455	17.0	15,865	33,929	387	5.10	271	-7,230	0	79.8	0.0	0.7162
		Mock Lab	Rm Peak	979	17.0	33,874	70,083	906	5.56	499	-17,276	0	79.8	0.0	0.7195
AHU-1- classrooms			**Sys Peak**	**7,921**	**423.8**	**424,546**	**866,439**	**10,197**			**-193,676**	**0**	**100.0**	**0.0**	
AHU-1- classrooms			**Sys Block**	**7,921**	**423.8**	**351,117**	**773,328**	**8,133**			**-193,685**	**0**	**100.0**	**0.0**	
		Analytical Lab	Rm Peak	2,010	48.0	196,004	430,928	4,484	12.75	1,345	-37,620	0	100.0	100.0	0.5353
		Glass Room	Rm Peak	230	1.0	19,996	43,326	475	12.38	142	-4,714	0	100.0	100.0	0.0808
		Lab Storage	Rm Peak	270	0.0	15,700	33,600	360	8.00	360	-7,993	0	100.0	100.0	1.0000 *
		Hall at Analytical Lab	Rm Peak	620	0.0	26,525	55,059	641	1.68	192	-16,655	0	100.0	100.0	0.1612
AHU-2 Analytical Lab			**Sys Peak**	**3,130**	**49.0**	**253,817**	**558,505**	**5,959**			**-66,982**	**0**	**100.0**	**100.0**	
AHU-2 Analytical Lab			**Sys Block**	**3,130**	**49.0**	**256,227**	**558,260**	**5,959**			**-66,948**	**0**	**100.0**	**100.0**	
		Reception/Lobby	Rm Peak	615	0.0	59,076	82,058	2,286	11.15	914	-57,310	0	9.8	19.4	0.0336
		Open Office	Rm Peak	3,012	22.0	99,987	122,106	3,647	4.84	1,459	-49,456	0	9.8	19.4	0.3016 *
		Office- Unit Chief	Rm Peak	140	1.0	13,260	15,202	471	22.43	188	-7,714	0	9.8	19.4	0.1039
		Copy	Rm Peak	100	0.7	4,571	5,613	162	10.77	65	-1,573	0	9.8	19.4	0.2165
		Storage- Office	Rm Peak	153	0.0	1,799	2,103	58	2.51	58	-1,495	0	9.8	19.4	0.1327
		Hall at classrooms	Rm Peak	2,100	0.0	82,149	93,255	2,565	1.98	1,026	-57,484	0	9.8	19.4	0.1023
		Hall for MDF LAN Sec Elec	Rm Peak	193	0.0	2,263	2,652	73	2.26	73	-1,886	0	9.8	19.4	0.1327
		F A T S	Rm Peak	385	4.0	16,110	18,519	307	4.79	307	-7,344	0	9.8	19.4	0.2605
		Laundry	Rm Peak	185	0.0	5,511	5,931	97	3.14	48	-1,336	0	9.8	19.4	0.1912
		Hall at Clan Lab Eqmt	Rm Peak	379	0.0	5,378	6,244	179	2.83	72	-2,624	0	9.8	19.4	0.2650
		Hall under Mezzanine	Rm Peak	1,453	0.0	45,232	48,534	763	3.15	763	-24,532	0	9.8	19.4	0.0953
		Storage- small	Rm Peak	56	0.0	680	799	28	2.95	28	-1,322	0	9.8	19.4	0.1017
		Clan Lab Eqpt	Rm Peak	1,470	0.0	21,319	25,293	743	1.44	743	-25,987	0	9.8	19.4	0.0989
AHU-3 Offices Misc			**Sys Peak**	**10,241**	**27.7**	**354,226**	**425,201**	**11,377**			**-240,063**	**0**	**10.7**	**19.4**	
AHU-3 Offices Misc			**Sys Block**	**10,241**	**27.7**	**325,742**	**398,405**	**10,434**			**-240,189**	**0**	**10.7**	**19.4**	
		Ctrl- RAID	Rm Peak	260	1.8	4,774	8,555	151	4.37	0	-4,260	114	43.3	44.0	0.2400
		Eqpt- RAID	Rm Peak	200	0.0	1,309	2,159	39	1.48	0	-1,161	20	43.3	44.0	0.2541

*** Critical space ventilation fraction (system 'z' factor)**

**** This report does not display heating only systems.**

System	Zone	Room **		Floor Area ft²	People #	Coil Cooling Sensible Btu/h	Coil Cooling Total Btu/h	Space Design Max SA cfm	Air Changes ach/hr	VAV Minimum SA cfm	Main Coil Heating Sensible Btu/h	Heating Fan Max SA cfm	Percent OA		ASHRAE 62-89
													Clg	Htg	OA Fraction
		RAID	Rm Peak	2,000	40.0	61,418	107,562	1,801	1.93	0	-64,117	1,801	43.3	44.0	0.4442 *
AHU-4 RAID			**Sys Peak**	**2,460**	**41.8**	**67,502**	**118,275**	**1,992**			**-69,537**	**1,934**	**43.3**	**44.0**	
AHU-4 RAID			**Sys Block**	**2,460**	**41.8**	**65,323**	**116,096**	**1,992**			**-70,094**	**1,934**	**43.3**	**44.0**	
		Smoke House	Rm Peak	486	15.0	20,238	37,589	537	6.63	0	-21,937	537	55.9	55.9	0.5590 *
AHU-5 Smokehouse			**Sys Peak**	**486**	**15.0**	**20,238**	**37,589**	**537**			**-21,937**	**537**	**55.9**	**55.9**	
AHU-5 Smokehouse			**Sys Block**	**486**	**15.0**	**20,238**	**37,589**	**537**			**-21,937**	**537**	**55.9**	**55.9**	
		Lan exterior	Rm Peak	148	0.0	1,916	3,642	79	1.28	0	-4,181	79	9.3	9.3	
		MDF/ IDF exterior	Rm Peak	100	0.0	906	1,931	37	0.90	0	-2,067	37	13.4	13.4	
		Security exterior	Rm Peak	98	0.0	888	1,893	37	0.90	0	-2,026	37	13.4	13.4	
LAN SS			**Sys Peak**	**346**	**0.0**	**3,711**	**7,466**	**153**			**-8,274**	**153**	**11.3**	**11.3**	
LAN SS			**Sys Block**	**346**	**0.0**	**3,711**	**7,466**	**153**			**-8,274**	**153**	**11.3**	**11.3**	
		Main Elec Exterior	Rm Peak	164	0.0	2,057	3,198	61	2.22	0	-2,989	61	13.5	13.5	
Elec SS			**Sys Peak**	**164**	**0.0**	**2,057**	**3,198**	**61**			**-2,989**	**61**	**13.5**	**13.5**	
Elec SS			**Sys Block**	**164**	**0.0**	**2,057**	**3,198**	**61**			**-2,989**	**61**	**13.5**	**13.5**	
		Mechanical Exterior	Rm Peak	522	0.0	6,163	11,212	290	1.33	0	-11,140	290	0.0	0.0	
		Mechanical Mezzanine Exterior	Rm Peak	3,444	0.0	19,915	19,915	328	0.57	0	-219	328	0.0	0.0	
Mech exterior load			**Sys Peak**	**3,966**	**0.0**	**26,078**	**31,126**	**618**			**-11,359**	**618**	**0.0**	**0.0**	
Mech exterior load			**Sys Block**	**3,966**	**0.0**	**23,745**	**28,794**	**618**			**-15,261**	**618**	**0.0**	**0.0**	
		Small Elec rm	Rm Peak	90	0.0	882	1,102	37	1.11	0	-1,117	37	12.3	12.3	
small elec			**Sys Peak**	**90**	**0.0**	**882**	**1,102**	**37**			**-1,117**	**37**	**12.3**	**12.3**	
small elec			**Sys Block**	**90**	**0.0**	**882**	**1,102**	**37**			**-1,117**	**37**	**12.3**	**12.3**	
		Stair exterior	Rm Peak	104	0.0	1,419	2,464	63	1.45	0	-2,949	63	0.0	0.0	
Stair			**Sys Peak**	**104**	**0.0**	**1,419**	**2,464**	**63**			**-2,949**	**63**	**0.0**	**0.0**	
Stair			**Sys Block**	**104**	**0.0**	**1,419**	**2,464**	**63**			**-2,949**	**63**	**0.0**	**0.0**	

*** Critical space ventilation fraction (system 'z' factor)**

**** This report does not display heating only systems.**

Schedule GS-2
INTERMEDIATE GENERAL SERVICE

I. APPLICABILITY

Except as modified herein, this schedule is applicable only to a non-residential Customer who elects to receive Electricity Supply Service and Electric Delivery Service from the Company and who has within the current and previous 11 billing months at least three peak measured demands of 30 kW or more and not more than two peak measured demands of 500 kW or more.

For a Customer served under this schedule whose peak measured demand has decreased to less than 30 kW, this schedule shall remain applicable to the Customer and the Customer shall not have the option to purchase electricity under Schedule GS-1 until such time the maximum measured demand has remained at less than 30 kW during all billing months within the current and previous 11 billing months.

At such time the Customer no longer meets the above applicability requirements, the Customer will remain on this schedule for the period (not exceeding two additional billing months) required to achieve an orderly transfer to the applicable schedule.

For new service, this schedule is applicable when the anticipated kW demand meets the above criteria.

II. 30-DAY RATE

A. Non-Demand Billing

1. Distribution Service Charges

   a. Basic Customer Charge
   Basic Customer Charge $21.17 per billing month.

   b. Plus Distribution kWh Charge

All kWh	@	2.433¢ per kWh

2. Electricity Supply Service Charges

   a. Electricity Supply kWh Charge

      1) For the billing months of June – September

All kWh	@	4.795¢ per kWh

      2) For the billing months of October – May

All kWh	@	4.075¢ per kWh

(Continued)

Schedule GS-2
INTERMEDIATE GENERAL SERVICE

(Continued)

II. 30-DAY RATE (Continued)

2. Electricity Supply Service Charges (Continued)

b. Each Electricity Supply kilowatthour used is subject to Fuel Charge Riders A and B.

B. Demand Billing

1. Distribution Service Charges

a. Basic Customer Charge
Basic Customer Charge $21.17 per billing month.

b. Distribution Demand Charge

All kW of Demand	@	$ 3.387 per kW

2. Electricity Supply Service Charges

a. Electricity Supply Demand Charge

1) For the billing months of June – September

All kW of Demand	@	$ 2.844 per kW

2) For the billing months of October – May

All kW of Demand	@	$1.406 per kW

b. Plus Electricity Supply kWh Charge

First 150 kWh per kW	@	4.617¢ per kWh
Next 150 kWh per kW	@	2.588¢ per kWh
Next 150 kWh per kW	@	1.119¢ per kWh
Additional kWh	@	0.272¢ per kWh

c. Each Electricity Supply kilowatthour used is subject to Fuel Charge Riders A and B.

(Continued)

Schedule GS-2
INTERMEDIATE GENERAL SERVICE

(Continued)

II. 30-DAY RATE (Continued)

C. The minimum charge shall be the highest of:

1. The Basic Customer Charge in Paragraph II.A.1.a. or II.B.1.a., whichever is applicable.

2. The amount as may be contracted for.

3. The sum of the charges in Paragraph II.A. or II.B., whichever is applicable, plus $1.480 multiplied by the number of kW by which any minimum demand established exceeds the demand determined under Paragraph IV.

4. If the demand determined under Paragraph IV is 50 kW or greater, the minimum charge for Non-Demand Billing under Paragraph II. A. shall not be less than $3.13 per kW of demand determined.

III. NON-DEMAND BILLING VS. DEMAND BILLING

A. The non-demand billing charges of Paragraph II.A. apply to customers whose kWh usage for the current month does not exceed 200 kWh per kW of the demand as determined under Paragraph IV.

B. The demand billing charges of Paragraph II.B. apply to customers whose kWh usage for the current month exceeds 200 kWh per kW of the demand as determined under Paragraph IV.

IV. DETERMINATION OF DEMAND

The kW of demand will be determined as the highest average kW load measured in any 30-minute interval during the billing month.

V. MINIMUM DEMAND

The minimum demand shall be such as may be contracted for, however:

A. When the kW demand determined has reached or exceeded 500 kW during the current or preceding eleven billing months, the minimum demand shall not be less than the highest demand determined during the current and previous eleven billing months.

V. MINIMUM DEMAND (Continued)

(Continued)

Schedule GS-2
INTERMEDIATE GENERAL SERVICE

(Continued)

B. When the Customer's power factor is less than 85 percent, a minimum demand of not less than 85 percent of the Customer's maximum kVA demand may be established.

VI. METER READING AND BILLING

A. Meters may be read in units of 10 kWh and bills rendered accordingly.

B. When the actual number of days between meter readings is more or less than 30 days, the Basic Customer Charge, the Distribution Demand Charge, the Electricity Supply Demand, the quantity of kWh in the first three blocks of the Demand Billing Electricity Supply kWh Charge and the minimum charge of the 30-day rate will each be multiplied by the actual number of days in the billing period and divided by 30.

VII. STANDBY, MAINTENANCE OR PARALLEL OPERATION SERVICE

A Customer requiring standby, maintenance or parallel operation service may elect service under this schedule provided the Customer contracts for the maximum kW which the Company is to supply. Standby, maintenance or parallel operation service is subject to the following provisions:

A. Suitable relays and protective apparatus shall be furnished, installed, and maintained at the Customer's expense in accordance with specifications furnished by the Company. The relays and protective equipment shall be subject, at all reasonable times, to inspection by the Company's authorized representative.

B. In case the maximum kW demand determined in Paragraph IV. or the minimum demand determined in Paragraph V. exceeds the contract demand, the contract demand shall be increased by such excess demand.

C. The demand billed under Paragraph II.B.2.a.1) or II.B.2.a.2) shall be the contract demand.

Schedule GS-2
INTERMEDIATE GENERAL SERVICE

(Continued)

VIII. TERM OF CONTRACT

The contract shall be open order unless (a) standby, maintenance or parallel operation service is provided, or (b) the Customer or the Company requests a written contract. In such cases, the term of contract for the purchase of electricity under this schedule shall be as mutually agreed upon, but for not less than one year. During the minimum term of applicability, the Customer may be billed under the corresponding Unbundled Rate Schedule GS-2U, if applicable.

ENERGY CONSUMPTION SUMMARY

By ae

	Elect Cons. (kWh)	Gas Cons. (kBtu)	% of Total Building Energy	Total Building Energy (kBtu/yr)	Total Source Energy* (kBtu/yr)
Primary heating					
Primary heating	5,924	978,935	18.5 %	999,153	1,091,117
Other Htg Accessories	14,809		0.9 %	50,545	151,649
Heating Subtotal	**20,733**	**978,935**	**19.4** %	**1,049,697**	**1,242,766**
Primary cooling					
Cooling Compressor	284,334		18.0 %	970,432	2,911,588
Tower/Cond Fans	34,470		2.2 %	117,647	352,978
Condenser Pump			0.0 %	0	0
Other Clg Accessories	1,632		0.1 %	5,570	16,712
Cooling Subtotal....	**320,437**		**20.2** %	**1,093,650**	**3,281,277**
Auxiliary					
Supply Fans	329,868		20.8 %	1,125,839	3,377,856
Pumps	13,911		0.9 %	47,477	142,445
Stand-alone Base Utilities			0.0 %	0	0
Aux Subtotal....	343,779		21.7 %	1,173,316	3,520,301
Lighting					
Lighting	463,290		29.3 %	1,581,209	4,744,102
Receptacle					
Receptacles	147,750		9.3 %	504,272	1,512,968
Cogeneration					
Cogeneration			0.0 %	0	0
Totals					
Totals**	**1,295,989**	**978,935**	**100.0** %	**5,402,145**	**14,301,412**

* Note: Resource Utilization factors are included in the Total Source Energy value.
** Note: This report can display a maximum of 7 utilities. If additional utilities are used, they will be included in the total.

Energy Cost Budget

By ae

Project Name: DEA Clandestine Lab Training Center	Date: October 25, 2006
City: Quantico Marine Corps Base, Quantico, VA	Weather Data: Richmond, Virginia

Note: The percentage displayed for the "Proposed/ Base %" column of the base case is actually the percentage of the total energy consumption		Alt-1 Base Case		
		Energy 10^6 Btu/yr	Proposed / Base %	Peak kBtuh
Lighting - Conditioned	Electricity	1,581.2	29	181
Space Heating	Electricity	70.8	1	19
	Gas	978.9	18	501
Space Cooling	Electricity	976.0	18	534
Pumps	Electricity	47.5	1	5
Heat Rejection	Electricity	117.7	2	54
Fans - Conditioned	Electricity	1,125.8	21	212
Receptacles - Conditioned	Electricity	504.3	9	58
Total Building Consumption		**5,402.2**		

		Base Case Alt-1
Total	**Number of hours heating load not met**	0
	Number of hours cooling load not met	0

	Base Case Alt-1	
	Energy 10^6 Btu/yr	Cost/yr $/yr
Electricity	4,423.2	105,510
Gas	978.9	13,497
Total	**5,402**	**119,006**