Technical Report 1

FDA Building One – White Oak, MD

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Technical Report 1 serves as a proof of compliance with the systems and equipment requirements in section 5 of Standard 62.1. This covers a number of important issues such as measures to prevent mold growth, measures to prevent re-entry of contaminated air, and particulate filtration. The report also shows the results of the Ventilation Rate Calculation Procedure of Standard 62.1, which determine whether a building meets ventilation and exhaust requirements at design conditions. Compliance with the building envelope, HVAC systems, service water heating, power, lighting, and electric motor efficiency criteria of ASHRAE Standard 90.1 was also detailed.

Executive Summary:

The purpose of this report is to determine if the renovated FDA Building One is in compliance with both, ASHRAE Standard 62.1-2007 as well as Standard 90.1-2007. FDA Building One is 102,000 SF of renovated space which is office and administrative areas for the Office of the Commissioner of the FDA and related staff.

ASHRAE Standard 62.1-2007, Ventilation for Acceptable Indoor Air Quality, was the first standard to be evaluated for building compliance. This standard describes means and methods to achieve acceptable indoor air quality within the building. An analysis of Section 5 was performed for the building which went through and determined compliance with requirements set forth for acceptable indoor air quality such as outdoor air intake requirements, mold resistance, particulate filtration, and building air classification. All HVAC requirements that were examined within Section 5 were determined to be compliant for the building. Section 6 outlines requirements for the minimum ventilation rates that must be supplied to the varying space types in order to maintain acceptable indoor air quality. The entire building was analyzed using the ventilation rate procedure and met the minimum ventilation rates required due to Outside AHU supplying 100% outside air to service critical spaces.

An analysis of ASHRAE Standard 90.1-2007, Energy Standard for Buildings Except Low Rise Residential Buildings, was tough to perform due to the fact that the FDA Campus is serviced by a Central Utility Plant containing a co-generation plant, chillers and boilers – all of which sizing information was not made available in time for this analysis. Nevertheless, this analysis is to determine the buildings compliance with minimum equipment efficiencies and building insulation values. Both, the buildings' façade and glazing materials exceeded the minimum insulation values set forth within the section. The building does comply with special requirements by the use of energy recovery wheel associated with the 100% OA AHU. Power distribution and lighting power densities were also determined to be in compliance with the requirements set forth in this section.

It is not surprising that both of these standards have been met, and on occasion, exceeded due to the fact that this building has achieved a LEED® Gold certification. These two standards are building blocks to improve on when striving towards an energy efficient healthy building. Both an energy efficient building and a healthy environment to work in are important when designing a building of this size and occupancy classification.

Building Overview:

Building One is the seventh White Oak structure completed as part of the FDA's consolidation project on the White Oak, MD campus. GSA oversaw the renovation of the 102,000 square foot, four-story historic Building One - originally the headquarters of the Naval Surface Warfare Center for 52 years - to accommodate portions of the FDA's Office of the Commissioner and related executive functions.

Flanked by two office buildings, Building One creates a formal entry forecourt. The entry drive, forecourt, and Mahan Road were re-graded to match the elevation of the courtyard area. A new circle, built to match the scale of the new forefront, replaces the original circle in front of the main entrance. The building integrates 148 offices, nine conference rooms and several workstations and shared business areas and connects to the campus' first Central Shared Use space with access through the first floor lobby.

The design of the building is entirely historic preservation with a few modern touches to the façade. Special considerations were taken into account in order to compliment the design of the existing buildings as well as match the architectural materials that were selected for the original campus facade. KlingStubbins in part with RTKL was hired to be the design team and worked directly with the State Historic Planning Office (SHPO) as well as the National Capitol Planning Commission (NCPC). The historical considerations of this building played a large role in the building material selection as well as the façade and glazing design

Mechanical System Overview

FDA Building One receives conditioned supply air from three air handling units (AHU's). The first of the AHU's (OAHU-1) is strictly providing 100% outside air to the peripheral office spaces, the AHU supplying the security pavilion and VAV boxes serviced in part by the third AHU; sized at 5,300 CFM with an energy recovery wheel. The AHU servicing the security pavilion (AHU-2) is provided at constant volume, sized at approximately 7,300 CFM with reheat. The AHU servicing conference rooms and interior areas (AHU-1) through VAV and CAV boxes as well as Dual Duct Air Terminal Units, sized at 19,000 CFM with pre-heat. Two-pipe fan coil units (FCU's) are used in both the electrical closets and telecommunications closets, as well as around the perimeter in private offices.

The building is a part of the larger campus which is serviced by a Central Utility Plant containing a co-generation plant, chillers, boilers, cooling towers, etc. This is in part of an energy saving strategy, in conjunction with reliability concerns, to provide the entire campus with electricity, heating and air conditioning. The utility plant will be able to monitor loads amongst the various buildings and size up or down the supply of utilities based on the demand loads. In this manner, the utility plant itself can function with utmost efficiency, allow for redundancy and extreme load scenarios.

ASHRAE Standard 62.1 Evaluation

Section 5 Compliance

5.1 Natural Ventilation

The windows in Building One are inoperable for occupant security and safety reasons.
Natural ventilation was not considered as a ventilation strategy for this building due to the ventilation requirements of the FDA/GSA as well as high internal loads throughout the building.

5.2 Ventilation Air Distribution

Minimum building ventilation is able to be met under any load condition specified within Section 6 of Standard 62.1-2007 which is discussed later in the report. This building easily meets these requirements due to the use of the Outside AHU providing OA directly to spaces through VAV and dual duct systems.
Building One uses a fully ducted supply and return system so worries of inadequate ventilation requirements due to a plenum system are not an issue. The construction documents provide air balance schedules that explicitly list out the design supply airflow rate, infiltration rate, exfiltration rate, exhaust rate, air change rate, and pressurization requirements.

5.3 Exhaust Duct Location

Building rooms that contain potentially harmful contaminants are each served with dedicated roof exhaust fans. These dedicated exhaust fans are serving rooms such as flammable storage, pump room and elevator machine room. The discharge of the exhaust fans have a 15' duct extension that reduces in size to provide a 1,200 fpm discharge velocity. Providing such a high discharge velocity helps to ensure that these contaminants will not be recirculated throughout this building as well as surrounding buildings.

5.4 Ventilation System Controls
The mechanical ventilation controls of the building provide a constant supply air volume of outdoor air to spaces. In Building One, some of the spaces are able to have reduced ventilation rates while they are unoccupied. The RFP enables rooms such as conference room ventilation rates to be set back by the use of occupancy sensors. However, these reduced ventilation rates are still above the minimum required ventilation rate as outlined in Section 6.

5.5 Airstream Surfaces
The surfaces that are in contact with the airstream in this building are primarily sheet metal duct. Flexible duct is used to branch from the sheet metal supply mains to connect to the supply diffusers. Both of these supply materials are compliant with both the resistance to mold growth and resistance to erosion subsections.

5.6 Outdoor Air Intakes
Building One draws the necessary outdoor air for the mechanical system through a rooftop mechanical penthouse. The edge of the outdoor intake with the bird screen is mounted flush. This outdoor intake location is in accordance with all of the minimum distances located within Table 5-1 in Standard 62.1-2007.

5.7 Local Capture of Contaminants
The exhaust from all spaces with equipment that produces contaminants is directly exhausted to the roof through the use of dedicated exhaust fans.

5.8 Combustion Air
There are no combustion related contaminants in the building from boilers because the boilers are not located in the building. The emergency generators that serve the campus are within the Central Utility Plant. With no combustion equipment being placed in either of the buildings this section required no further analysis.

5.9 Particulate Matter Removal
The rating of the filters in Building One's air handlers is MERV 13 which exceed the minimum filter rating of MERV 6 that is provided in this section.

5.10 Dehumidification Systems
The relative humidity in all occupied spaces is maintained at a level of 50% which is below the 65% maximum limit. Building One maintains a positive pressurization at all times by having a greater supply air flow rate than exhaust air flow rate.

5.11 Drain Pans
The air handling unit specifications call out that the drain pans installed on all AHU's located in Building One are constructed of stainless steel and located under the complete cooling coil section and extend beyond the leaving air side of the coil. Cooling coil drain pans are required to be pitched in two planes and pitched towards the drain connection. After the drain pans are installed they are leveled and trapped as per the manufacturer's recommendations.

5.12 Finned-Tube Coils and Heat Exchangers
Cooling coils are specified to have a minimum of 18" of separation between which is compliant with this sub section. All the AHU's are specified at 453 ft/min which is less than the 500 fpm maximum stated within this section.

5.13 Humidifiers and Water-Spray Systems
The humidifiers that are used in the air handlers use potable water for humidification which meets the water quality requirements of this section. Turning vanes and other obstructions that are installed downstream of the humidifier are placed at distances which exceed the manufacturers recommendation.

5.14 Access for Inspection, Cleaning, and Maintenance
Access panels are located on all AHU's to provide access for maintenance of the all of the areas called specified within this sub section. The construction of all access doors and panels are called out in the air handling unit specifications to be the same as the AHU. All of the access door sizes are large enough to provide unobstructed access to each part that is maintained. Viewing windows are to be provided on all access doors that lead to areas containing moving parts.

5.15 Building Envelope and Interior Surfaces
A vapor barrier is provided in the exterior wall construction assembly to prevent moisture condensation within the wall. Exterior joints where panels meet are sealed to prevent air leakage within the building. Both pipes and ducts whose surface temperatures may fall below the dew point of the air are insulated to prevent condensation on their surface.

5.16 Buildings with Attached Parking Garages
The parking structure is not attached to the building. As a result this section did not require analysis.

5.17 Air Classification for Recirculation
The air classification for the office areas in Building A is air class 1. Air class 1 is defined in this section as air with a low contaminant concentration, low irritation intensity, and an inoffensive odor. This air classification was determined from Table 6-1 in Standard 62.1-2007.

5.18 Requirements for Buildings Containing ETS Areas and ETS-Free Areas
The entire building is a smoking-free zone. Smoking is permitted on the campus, but must be a minimum distance away from the entrances of the buildings. The intakes of the AHU's draw air from the rooftop so they will not be affected by ETS on the campus.

Ventilation Rate Procedure Analysis

The ventilation rate procedure is defined in Section 6 of ASHRAE Standard 62.1-2007. The following sets of equations were used in the analysis shown in the Appendix for a variety of rooms to demonstrate that the required minimum ventilation rates are always met. The spreadsheet used for this calculation determines the minimum ventilation rates required based upon user inputs of room size, room type, and supply air volume.

Equation: **Standard 62.1 Location:**

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

Where: A_z = Zone floor area (ft^2)

P_z = Zone population ($people$)

R_p = Outdoor air flow rate ($\frac{cfm}{person}$)

R_a = Outdoor air flow rate ($\frac{cfm}{ft^2}$)

Zone Air Distribution Effectiveness:

$E_z = 1.0$ (Table 6-2)

Zone Outdoor Airflow:

$V_{oz} = \frac{V_{bz}}{E_z}$ (Equation 6-2)

100% Outdoor Air Systems:

$V_{ot} = \sum_{allzones} \cdot V_{oz}$ (Equation 6-4)

System Ventilation Efficiency:

E_v is found using max Z_p value (Table 6-3)

Uncorrected Outdoor Air Intake:

$V_{ou} = D \cdot \sum_{allzones} (R_p \cdot P_z) + \sum_{allzones} (R_a \cdot A_z)$ (Equation 6-6)

Occupant Diversity:

$D = \frac{P_s}{(\sum_{allzones} \cdot P_z)}$ (Equation 6-7)

Where: P_s = System Population

Running the calculations for a typical floor of the building and for some of the first floor spaces is an adequate representation of the building requirements in terms of ventilation. Performing this calculation shows that the system does in fact meet the minimum ventilation rate and the minimum air change requirement for each room type. The supply airflow rates are rarely driven from the minimum air change requirements given in the UFC and are mainly driven by the loads within the space.

Summary of Compliance - ASHRAE Standard 90.1 - Energy Standard Analysis

Within Standard 90.1 Energy Standard for Buildings, this standard analyzes certain aspects of the building such as Building Envelope, HVAC and Lighting and Electrical loads. FDA Building One complies with a majority of the standard however, considering the building is a historical redevelopment certain parts of the building could not be altered to far exceed the minimum requirements. This is a constant challenge for redevelopment projects and a problem that will be provided with a better solution in years to come.

Section 5 Building Envelope

5.1 General

Envelope alterations had to be taken into account because this building was a redevelopment and a skylight was built into the security pavilion near the entrance. Therefore, the Section 5 was carefully analyzed in order to comply with requirements concerning insulation, air leakage and fenestration. The climate zone of the FDA Campus at White Oak, MD is located within the 4A region, which is defined as having mixed weather conditions and can have periods of high humidity

5.4 Mandatory Provisions

Vestibule at the entrance is constructed to separate the conditioned building from the outside weather conditions. Insulation compliance and Fenestration and Doors compliance are found within Section 5.8. Throughout the exterior and interior of the building, depending on the exposure, Elastomeric Sealants and Non-Elastomeric Sealants are used. Due to the building's historical standing, the joints had to be cleaned, primed, sealed and a protective coating was also applied once the sealant was cured. The envelope was sealed in areas around the windows, doors, walls, foundations as well as utility penetration areas throughout floors.

5.5 Prescriptive Building Envelope Option

The building envelope is in compliance for all elements of the building. Both the roof and the walls above grade as well as the flooring and slab-on-grade meets the standards insulation criteria.

		Prescribed Nonresidential		Acual Construction Assemblies		Compliance (Y/N)
Area	Construction Method	Assembly Maximum	Insulation Minimum	Assembly Maximum	Insulation Minimum	
Roof	Insulation Entirely Above Deck	U-0.048	R-20.0 c.i.	U-0.024	R-41.66	Y
Walls Above Grade	Mass	U-0.104	R-9.5 c.i.	U-0.0535	R-18.7	Y
Floors	Mass	U-0.087	R-8.3 c.i.	U-0.052	R-19.2	Y
Slab on Grade Floors	Unheated	F-0.73	NR	F-0.69	NR	Y

The glazing on North and South sides of the building is 28% of the façade area. The glazing on the East and West sides of the building is 22% of the façade area. Both of these are within the 40% limit of this section.

Section 6 – Heating, Ventilation, and Air Conditioning

6.2 Compliance Path

There are two options to evaluate the efficiency of a buildings HVAC system, the simplified approach and the prescriptive path. The prescriptive path was used for this evaluation because WRNMMC was over the 25,000sf maximum size and over the maximum two story requirement as stated in order to use the simplified approach.

6.4 Mandatory Provisions

Tables 6.8.1 A-G in Standard 90.1-2007 provides minimum performance requirements that must be met for the mechanical equipment in the building. Unfortunately information regarding the Central Utility Plant was not provided for this report and is also considered outside the scope of the project. HVAC controls have been located in every zone to provide occupant comfort and space adjustability. The ventilation rate in some occupancy zones is able to be setback during unoccupied hours, but this is not applicable to all HVAC zones as per the control schematics. The specifications state that ductwork must be designed to operate at static pressures in excess of 3 in w.c. which complies with the requirements within this section.

6.5.3 Air System Design and Control

Since all three AHU's supply outside air through constant volume or mixed ratio's the economizer mode of the air handlers is able to supply 100% outside air as well. All of the fans that are used in Building One have been analyzed for their compliance with Table 6.5.3.1.1A in Standard 90.1-2007.

6.5.6 Energy Recovery

Since Building One's OAHU supplies 100% outside air at a volumetric flow rate of greater than 5,000 CFM then it must use exhaust energy recovery as stated in section 6.5.6.1. The exhaust air energy recovery system shall be at least 50% effective in the transfer of enthalpy between air streams. Controls must allow for the energy recovery system to be bypassed when the AHU is operating in economizer mode. The OAHU uses an energy recovery wheel with a total efficiency of 88%.
Heat recovery for service water heating must also be utilized due to FDA Building One meeting all of the design criteria stated within section 6.5.6.2.1 in Standard 90.1-2007. This is obtained through the use of plate and frame heat exchanger. The plate and frame heat exchanger is used to preheat the domestic hot water needs of the building.

Section 7 – Service Water Heating

Section 7 of ASHRAE Standard 90.1-2007 evaluates service water heating requirements for existing buildings and new buildings. The minimum hot water pipe insulation thickness is shown below. Since the building is using the existing Central Utility Plant for all of the heating needs there are no minimum equipment efficiencies that need to be met within this category.

Operating Temperatures	Pipe Diameter	Minimum Insulation Thickness	Specified Insulation Thickness	Compliance (Y/N)
<250°F	< 1.5"	1.5"	1.5"	Y
	2"-6"	2"	2"	Y
	>8"	2"	2"	Y

Section 8 – Power

Section 8 outlines prescriptive requirements for the buildings power distribution system. A sample branch and feeder section of wire was taken from the voltage drop calculations and shown below. Electrical drawings as well as equipment operation and maintenance manuals have been turned over to the owner upon completion of the building.

	Maximum Voltage Drop %	Calculated Voltage Drop %	Compliance (Y/N)
Feeder Circuit	2	1.93	Y
Branch Circuit	3	2.22	Y

Section 9 – Lighting

Section 9 provides information on how to calculate the lighting power density within the building. Two separate methods are provided for this calculation, the space by space method and the building area method. Occupancy sensors and automatic light shutoffs are provided in the conference rooms.

9.5 Building Area Method Compliance Path

Table 9.5.1 within Standard 90.1-2007 lists lighting power densities for various building area types. The maximum lighting power density is 1.0 W/ft2 for an office building. Since Building A is zoned as a Business Occupancy, it is assumed that it will use the office lighting power density of 1.0 W/ft2.

Floor Number	Total Lighting Power Density (W/ft^2)	Maximum Lighting Power Density (W/ft^2)	Compliance
1	0.89	1	Y
2	0.86	1	Y
3	0.89	1	Y
4	0.93	1	Y

References:

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

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

-KlingStubbins w/ RTKL. Architectural Construction Documents. Washington, DC.