[redacted]

[redacted]

EQ Credit 7.1 – Thermal Comfort Design

The design of the [redacted] project at 1099 Osage, [redacted] has been conducted to comply with ASHRAE Std. 55, 2004 by considering the following six variables affecting occupant thermal comfort:

1. Metabolic Rate
2. Clothing Insulation
3. Air Speed
4. Humidity
5. Radiant Temperature
6. Air Temperature

Metabolic Rate
Since the building function is a senior residential building where occupants will be living, socializing, and participating in community activities, the metabolic rates of the occupants will be a variety, including "Seated, Reading, or Writing" (1.0 met*), "Walking" (2.0 met*) and "Cooking," (1.8 met*). Calculations have been performed for each of these metabolic Rates.

Clothing Value
Senior residents typically wear clothes that are adapted to each season, and generally more insulative than then people of lesser ages. In the spring it is estimated that a typical male occupant will wear long a long sleeved shirt and trousers resulting in a clothing-value of 0.61clo*. The typical female senior occupant's ensemble is estimated to be a knee-length skirt, long-sleeved shirt and full slip, resulting in a clothing-value of 0.67clo. Since this is greater than the male occupant clothing value, the male value is used for PMV/PPD calculations. The summer clothing value for typical occupants is assumed to be the walking shorts and a short-sleeved shirt ensemble for all occupants (0.36clo). Fall is estimated to generally be equivalent to spring (also 0.61clo). In the winter it is estimated that the typical occupant will add a thin, long sleeved sweater (0.25clo*) to the long sleeved shirt and trousers ensemble* (0.86clo total).

Air Speed
Elevated air speeds at the occupant level in the residences and common areas are avoided in the 1099 Osage design by using diffusers that are far from the typical occupant locations and have a minimal discharge velocity needed to produce sufficient air mixing. On the first floor louvered ceiling diffusers are similarly used. In both cases discharge air will tend to cling to the ceilings and decelerate before falling into the space. The mean airspeed at the occupant level is designed to be approximately 40fpm or less.

Humidity
The ventilation air from the three rooftop make up air units that serve the corridors and lobby areas on all floors are cooled by direct evaporative cooling. These areas are also ventilated by operable windows or doors. The residences are also ventilated by operable windows. [redacted] arid climate and the high ventilation rate of the building the indoor relative humidity under normal operating conditions will be within the range of 20%RH to 60%RH.

Radiant Temperature
The 1099 Osage will not be utilizing radiant or radiant panel heating or cooling, and the building also meets the other three criteria required in ASHRAE 55 Appendix C to assume that operative temperature

*Refer to ASHRAE Standard 55, 2004 including Addenda d, e, f, and g.

equals air temperature. Additionally, the glazing is far less than 50% of the wall area. Thus, radiant temperature within the conditioned spaces will equal the air temperature.

Air Temperature

Acceptable operable air temperatures within the building were determined using Predicted Percent Dissatisfied (PPD) value calculations in a Microsoft Excel Spreadsheet. The clothing values (clo), metabolic rates (met), air temperature, and the other five factors affecting occupant comfort were input into the spreadsheet. PPD values were adjusted to less than 10% by changing the air. The calculations were repeated for all seasons. Metabolic rates for each space were held constant. Clothing values were adjusted seasonally, with fall and spring being equivalent. The heating and cooling equipment for each space type was designed to capable of adjusting the indoor air temperature to meet the occupant needs based on the outdoor air temperature throughout the year. These calculations have been uploaded to the 1099 Osage LEED Online project (File "**1099 Osage PMV-PDD Calcs for LEED IEQp7.1.pdf**").

Local Discomfort Effects:

Radiant Asymmetry - The radiant temperature within the building has been designed to reduce the percentage of people dissatisfied due to radiant asymmetry. Exterior walls and roofs have been well insulated and will comply with the allowable temperatures outlined in Table 5.2.4.1*. All of the glazing in the building has SHGC's well below 0.48 required by ASHRAE 55 Appendix C to assume that operative temperature equals air temperature.

Vertical Air Temperature Difference – Thermal stratification with a temperature difference greater than the 5.4°F from head to ankles in Table 5.2.4.3* is not likely to occur due to the mixing of induced room air and heated diffuser-discharge air.

Floor Surface Temperature - The floor surface temperatures in occupied spaces will not exceed the allowable range in Table 5.2.4.4* (66.2°F – 84.2°F) because most floors are above conditioned spaces. Those not above conditioned spaces are either slab on grade with perimeter insulation, or insulated with continuous insulation below the deck where exposed.

Draft - Every attempt has been made to reduce the airspeeds within the building and prevent draft discomfort. The airspeed at the occupied level was reduced by using high, centralized and ceiling diffusers that blow horizontally Additionally the maximum expected airspeed at the occupant level will not exceed the speeds specified in section 5.2.4.2*.

*Refer to ASHRAE Standard 55, 2004 including Addenda d, e, f, and g.