



Indoor Environment Quality + Workplace Environment Hennepin Energy Recovery Center (HERC) Administration Building, Report 2

June 2015, Minneapolis, MN

Sustainable Post-Occupancy Evaluation Survey (SPOES)

B3 Guidelines

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1.0 Overview

The purpose of this report is to examine the connection between sustainable design criteria used in the design of the Hennepin Energy Recovery Center (HERC) and employees' satisfaction with their work environments located in the HERC. The HERC facility was designed using the B3 Guidelines (formerly known as the Minnesota Sustainability Guidelines or MSBG) and completed for occupancy in 2013. The B3 Guidelines track specific state-funded, B3 buildings as a means of demonstrating real outcomes aimed at the conservation of energy resources, creation and maintenance of healthy environments, and occupants' satisfaction with their work environments. The Sustainable Post-Occupancy Evaluation Survey (SPOES) was developed to assess human outcomes in workplace, classroom, and residence hall settings in compliance with the B3 Guidelines project tracking requirements. The survey was conducted in June 2015 and is the second of two required survey events for this building. (Report 1 can be found at <http://www.b3mn.org/poe>.)

This SPOES report focuses on employees' satisfaction with the physical environment as related to 25 indoor environment quality (IEQ) criteria such as lighting, thermal, and acoustic conditions in their primary workspaces, i.e., offices. Employees' satisfaction with the facility (site, building, and interior) and the effect of the facility's physical environment on their perceptions of their work performance and health also are included. Finally, a brief look at employees' commuting and physical activities within the building are reported. The report provides descriptive information about employees' perceptions of the IEQ of their work environments. In addition, this information serves the broader development of knowledge regarding the influence of IEQ on employees.

2.0 Method

SPOES consists of a self-administered, Internet-based, questionnaire submitted to and completed by employees. The SPOES questionnaire has been tested for **validity** (measures what it is intended to measure) and **reliability** (repeatability or replicability of findings). Employees rate their level of satisfaction on a **Likert-type scale** (measurement scale) from 1 (very dissatisfied) to 7 (very satisfied) with IEQ of the facility and their primary workspaces. They also rate the influence of their physical environment on their perception of their work performance and health on a scale from 1 (hinders) to 7 (enhances). There were no physical measurements taken of environmental conditions such as temperature or acoustic level. This study is limited to employees' perceptions.

The report provides a descriptive summary of the results stated as a **mean** (average of all responses), **standard deviations** (SD) (how different scores are from each other and the mean), and **number of responses** (N) for each question analyzed. The mean for a 7-point scale is 4.00. Lower or higher means reflect stronger tendencies towards dissatisfaction/satisfaction and hinders/enhances. Means that are close to the center of the scale (4) are considered to be neither dissatisfied/hinders or satisfied/enhances.

When interpreting **mean** responses, the following labels were used:

- 1.00 - 3.50 dissatisfied (hinders)
- 3.51 - 4.50 neither satisfied (enhances) nor dissatisfied (hinders)
- 4.51 - 7.00 satisfied (enhances)

An IEQ Score is also calculated for employees' satisfaction with IEQ in their primary workspaces. This is a statistical combination of all category-level IEQ scores, which results in a single IEQ score for all respondents and is reported in an IEQ Scorecard.

2.1 Description of the Questionnaire

Employees first rate their level of satisfaction with the facility (site, building, and interior) and the influence of their physical environment on their perception of their work performance and health. Then they respond to questions about their satisfaction with their primary workspaces in relation to IEQ criteria from the B3 Guidelines. Additionally, employees' physical activities and commuting practices are investigated.

In the SPOES questionnaire, the 25 IEQ criteria listed below are evaluated. There are two levels of criteria, categories and attributes. As shown in the list, the "overall" criteria are boldfaced and called "categories" or "category level" criteria. A category is broader or more general and may have "attributes" or "attribute level" criteria and provide greater detail about the category. For example, Overall Thermal Conditions is a category level question, and there are four attribute level questions related to thermal conditions such as adjustability, air velocity, humidity, and temperature. Another example of a category with attributes is Overall Acoustic Conditions with attributes of employees' ability to hear desired sounds and their ability to limit undesired sounds. Other categories do not have attributes, such as Overall View Conditions or Overall Indoor Air Quality. There are 12 category-level and 13 attribute level questions. Means are calculated and reported for all category and attribute-level criteria.

An IEQ Satisfaction Score is also calculated for employees' satisfaction with IEQ in their primary workspaces. This is a statistical combination of the 12 category-level criteria only and results in a single, mean IEQ Satisfaction Score for employees' satisfaction with the physical conditions of their primary workspaces. Attribute-level criteria are not included in the IEQ Score because unequal weight would be given to criteria that have both category and attribute-level questions.

Overall Acoustic Quality

- Ability to hear desired sounds
- Ability to limit undesired sounds

Overall Appearance (aesthetics)

Overall Cleaning and Maintenance

Overall Daylighting Conditions

- Adjustability of daylighting
- Amount of daylighting

Overall Electric Lighting Conditions

- Adjustability of electric lighting
- Adjustability of task lighting
- Amount of electric lighting

Overall Furnishings

- Adjustability of furnishings
- Function of furnishings

Overall Indoor Air Quality

Overall Privacy

Overall Technology

Overall Thermal Conditions

- Adjustability of thermal conditions
- Air velocity (drafty/stagnant)
- Humidity (dry or moist)
- Temperature (hot or cold)

Overall Vibration and Movement

Overall View Conditions

2.2 Limitations

Employees' participation is voluntary, and responses are self-reported. As is true with all survey research, the responses indicate employees' perceptions. There were no physical measurements taken, e.g., environmental temperature, humidity, or lighting levels.

3.0 Sample Description

3.1 Building Description

The HERC facility is located at 505 6th St., Minneapolis, Minnesota, and was developed in tandem with a multi-faceted project involving a community plaza, transportation center, parking facility, and office space (See Figure 1). The site is located in the North Loop area, adjacent to the warehouse district and Minneapolis downtown business environment. The building complex is near Target Field, home of the Minnesota Twins® and adjacent to Target Center, home of the Minnesota Timberwolves. Target Field Station (formerly referred to as the Interchange building) serves as a central hub for of the Metropolitan Transit public bus service, the Blue Line LRT (Hiawatha Light Rail Transit), Northstar Commuter Rail, and the Green Line (Central Corridor Line). Future expansions of the LRT are proposed into the Southwest and Northwest communities around the metropolitan area (<http://www.hennepin.us/your-government/facilities/hennepin-energy-recovery-center>).



Figure 1. HERC main facility and adjacent spaces (Photo credit <http://www.covanta.com/en/facilities/facility-by-location/hennepin/about.aspx>)

The HERC facility is owned by Hennepin County and operated by Covanta Energy, Inc. The building includes 15,000 square feet (sf) of parking on the ground level and 15,000 sf of office space on the 2nd floor. It stands adjacent to the main HERC building, which serves as a waste-to-energy facility and converts disposable waste to a renewable energy for the adjacent North Loop area and downtown district business environment (<http://www.hennepin.us/your-government/facilities/hennepin-energy-recovery-center>). In addition to pursuing the B3 Guidelines, the HERC facility received LEED Certification as a BD+C: New Construction V3 facility in 2014. This report contains the results of the SPOES issued to employees having workspace in the HERC.

3.2 Description of Respondents

The HERC had approximately 45 employees with assigned workspace in the facility during the spring semester period and administration of the survey event. The response rate to the questionnaire was approximately 22%. Of those responding, 100% were male. The mean age of respondents was slightly over 44 years, with a range of 28 to 55 years.

Prior to relocating to the current site in 2013, employees working in the new HERC facility had office space in the main HERC building since 1989. Since that time, 43% of the respondents have worked at the new site for more than 3 years, 29% have worked there from 2-3 years, 14% have worked between 1-2 years and 14% have worked less than 1 year. Relating to hours worked during a typical week at the HERC facility, 57% of the employees reported they spend 40+ hours a week in the facility, 14% spend 20-49 hours in the facility, and 29% spend less than 20 hours in the facility. Relating to the percentage of time employees spend per week in their primary workspace, 43% of the employees reported they spend more than 75% of their time per week in their primary workspace, 29% spend 51-75% of their time per week in their primary workspace, and 29% spend 25-50% of their time per week in their primary workspace. (Numbers do not add up to 100% due to rounding).

HERC is a workplace with private offices, workstations, and miscellaneous workspace distributed around the facility. Results indicated 45% of the employees have private offices and 55% worked in other locations throughout the facility. Employees also indicated that 71% of their primary workspaces were located within 15 feet of an exterior window, and 29% of employees were not within 15 feet of an exterior window.

4.0 Findings and Discussion

4.1 HERC Facility (Site, Building, and Interior): Overall Satisfaction, Work Performance, and Health

Employees responded to questions concerning the HERC facility (site, building, and interior) and their overall satisfaction with the facility, overall perceptions of their work performance in relation to the facility, and their overall perception of their health in relation to the facility. Table 1 shows the means and standard deviations of their responses as well as how the responses are interpreted. Figure 2 is a graph that shows the mean for each question with a blue mark. The standard deviation is shown by the green/red, vertical bar with green representing satisfied (or enhanced) and red representing dissatisfaction (or hindered). In cases where there were no dissatisfied responses the bar may be all green. Gray represents the 'neither/nor' range of responses. This graph is simply a visual image of the findings from Table 1.

Table 1. HERC facility - overall satisfaction, work performance, and health

HERC Admin Facility (site, building, and interior)	Mean (1-7)	SD	N	Interpretation
Overall Satisfaction	5.44	1.33	9	Satisfied
Overall Work Performance	5.56	1.59	9	Enhances
Overall Health	5.67	1.22	9	Enhances

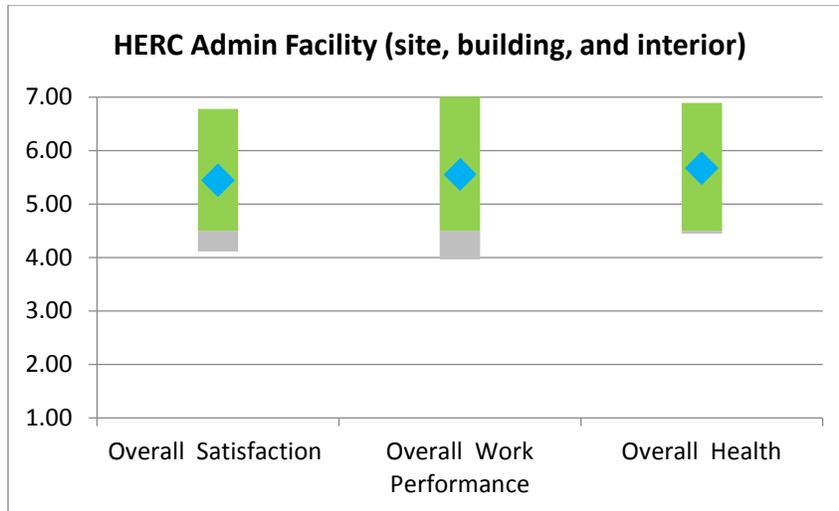


Figure 1. HERC facility - overall satisfaction, work performance, and health

Results indicated that employees were **satisfied (M = 5.44)** with the HERC facility (building, site, and interior) and reported that their overall work performance was **enhanced (M = 5.56)** by the facility. Employees reported that their overall health was **enhanced (M = 5.67)** by the facility.

4.2 Primary Workspace: Overall Satisfaction, Work Performance, and Health

Employees responded to questions concerning their overall satisfaction and overall perceptions of their work performance and health as related to their primary workspace (e.g., private office, workstation, or other primary workspace). Table 2 shows the means and standard deviations of their responses as well as how the responses are interpreted. Figure 3 is a visual image of the findings from Table 2.

Table 2. Primary workspace – overall satisfaction, work performance and health

Primary Workspace	Mean (1-7)	SD	N	Interpretation
Overall Satisfaction	5.11	2.20	9	Satisfied
Overall Work Performance	5.11	1.90	9	Enhances
Overall Health	5.00	2.12	9	Enhances

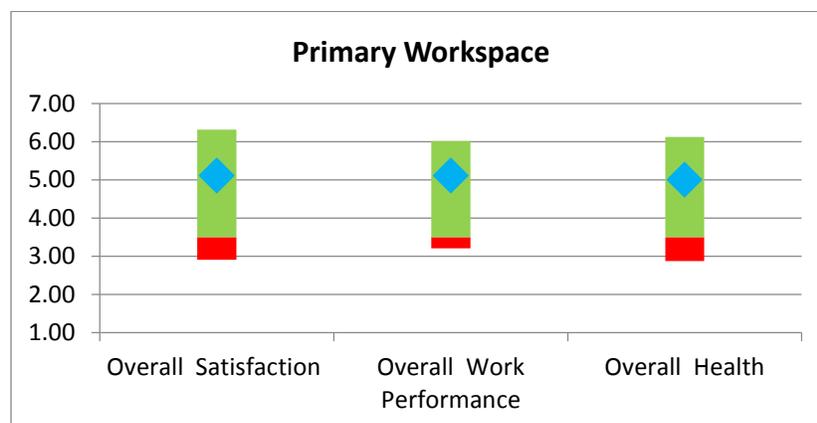


Figure 2. Primary workspace - overall satisfaction, work performance, and health

Results indicate that employees were **satisfied (M = 5.11)** with their primary workspace, their overall work performance was **enhanced (M = 5.11)** by their primary workspace, and their overall health was **enhanced (M = 5.00)** by their primary workspace.

4.3 Primary Workspace: Satisfaction with Indoor Environment Quality (IEQ)

Employees responded to questions concerning their satisfaction with IEQ criteria (thermal conditions, indoor air quality, acoustic conditions, etc.) related to their primary workspace (e.g., private office, workstation, or other primary workspace). Table 3 shows the means and standard deviations of their responses as well as how the responses are interpreted. Figure 4 is a visual image of the findings from Table 3.

Table 3. Primary workspace - satisfaction with IEQ conditions

#	IEQ Criteria (1-25) (Category Level Criteria are Boldface)	Mean	SD	N	Interpretation (D = Dissatisfied) (S = Satisfied)
1	Amount of electric light	6.00	1.00	9	Satisfied
2	Overall electric lighting conditions	5.78	0.97	9	Satisfied
3	Overall cleaning and maintenance	5.67	1.41	9	Satisfied
4	Overall technology	5.56	1.81	9	Satisfied
5	Function of your furnishings	5.56	1.81	9	Satisfied
6	Overall view conditions	5.56	1.67	9	Satisfied
7	Overall furnishings	5.44	1.94	9	Satisfied
8	Overall appearance (aesthetics)	5.33	2.12	9	Satisfied
9	Adjustability of your furnishings	5.33	2.12	9	Satisfied
10	Overall vibration and movement	5.22	1.20	9	Satisfied
11	Amount of daylighting	5.22	2.05	9	Satisfied
12	Overall daylighting conditions	5.22	2.05	9	Satisfied
13	Adjustability of the daylighting	4.89	2.26	9	Satisfied
14	Ability to hear desired sounds	4.89	1.45	9	Satisfied
15	Overall acoustic quality	4.89	1.45	9	Satisfied
16	Overall indoor air quality	4.89	1.45	9	Satisfied
17	Overall privacy conditions	4.78	1.79	9	Satisfied
18	The ability to limit undesired sounds	4.67	1.73	9	Satisfied
19	Adjustability of your task lighting	4.44	1.94	9	Neither S or D
20	Adjustability of the electric lighting	4.33	1.80	9	Neither S or D
21	Temperature (hot or cold)	3.89	1.27	9	Neither S or D
22	Humidity (dry or moist)	3.78	1.72	9	Neither S or D
23	Air velocity (drafty or stagnant)	3.67	1.80	9	Neither S or D
24	Overall thermal conditions	3.33	1.32	9	Dissatisfied
25	Adjustability of the thermal conditions	3.00	1.87	9	Dissatisfied

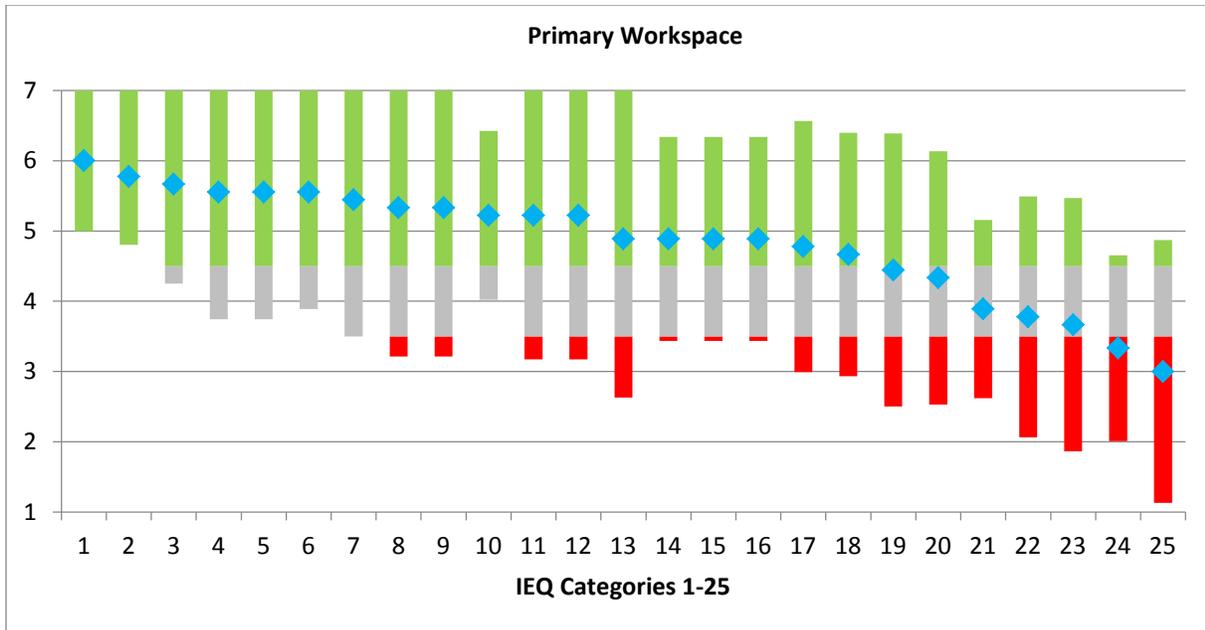


Figure 3. Primary workspace - satisfaction with IEQ categories (IEQ 1-25 are listed in Table 3 above)

Results indicate that employees were satisfied with 18 of the IEQ criteria in their primary workspaces, i.e., means at or above 4.50. They were neither dissatisfied nor satisfied with five IEQ criteria, and dissatisfied with only two IEQ criteria related to thermal conditions (overall and adjustability). Criteria associated with means below 4.5 are ripe for change to improve employees’ satisfaction with their primary workspaces and will be addressed in Section 6.2 Recommendations.

4.4 IEQ Satisfaction Scorecard

The IEQ Satisfaction Score is determined by calculating a mean of all 10 category level variables. At this time, all criteria are weighted equally in this calculation as little evidence exists that provides rationale for weighting some criteria heavier than others. The weighted mean is representative of a fair overall IEQ score and can serve as a benchmark of employees’ satisfaction with the physical environment of their primary workspace. As shown in Figure 5, the **IEQ Satisfaction Score** for HERC is **5.14**.



Figure 4. Primary Workspace - IEQ Satisfaction Score

Overall, employees showed a positive, but low level satisfaction with IEQ criteria as indicated by the weighted mean score of **5.14**. As shown in Table 3, means associated with eight of the twelve category level criteria pulled the IEQ score in a positive direction: Overall electric lighting conditions (M = 5.78),

Overall cleaning and maintenance (M = 5.67), Overall technology (M = 5.56), Overall view conditions (M = 5.56), Overall furnishings (M = 5.44), Overall appearance (aesthetics) (M = 5.33), Overall vibration and movement (M = 5.22), and Overall daylighting conditions (M = 5.22).

Lower levels of satisfaction and dissatisfaction with the four IEQ categories pulled the satisfaction score down as follows Overall acoustic quality (M = 4.89), Overall indoor air quality (M = 4.89), Overall privacy conditions (M = 4.78), Overall thermal conditions (M = 3.33). These issues can be addressed by building management to increase employees' satisfaction. Please note that the IEQ Satisfaction Score only uses the category level criteria (those labeled 'Overall'; see section 2.1, paragraph 3 for explanation).

5.0 Physical Activity Engagement and commuting Practices

In the final section of the survey, employees responded to questions regarding their overall physical activity while at HERD (site, building, and interior) and their commuting practices.

5.1 Physical Activity Engagement

Providing employees with opportunities for alternative paths of travel around the workplace, e.g., taking stairs as opposed to the elevator, provides opportunities to engage in additional types of physical activities. Engaging in physical travel throughout the work environment can be associated with healthier lifestyles.

Table 4. Overall physical activity (walking, stair use, etc.) affected by the HERC facility

HERC facility (site, building, and interior)	Mean	SD	N	Interpretation
Overall physical activity (walking, stair use, etc.)	4.88	1.25	8	Enhances

Results indicate that employees felt that HERC moderately **enhanced** (M = 4.88) their physical activities (walking, stair use, etc.). Further, 38% of the employees indicated that the facility **enhanced** their overall physical activity and 63% were **neither hindered nor enhanced** with the facility's influence on their overall physical activity. (Note: does not equal 100% due to rounding.)

5.2 Commuting Practices

The HERC facility is located adjacent to Target Field Station, a central public transit hub for busses, light rail, commuter rail, and public parking. Table 5 provides results on employees' primary mode of transportation. Table 6 summarizes commuting distances between home and the HERC facility. Table 7 summarizes employees' ability to commute using alternative choices (walk, public transit, bike, van or carpool, etc.) between home and the HERC facility. These data provide researchers, building owners, and employers with information related to employees' commuting practices and the impact on the carbon footprint. These data, while not specific to the IEQ data, are addressed in the B3 guidelines.

Table 5. Commuting Practices – HERC Primary mode of transportation

Commuting Mode (primary)	Drive alone (or with children < 16)	Carpool or vanpool
Employees travel to work (%)	75%	25%

Related to modes of transportation, 75% of employees drive alone (or with children under 16), and 25% use a carpool or vanpool service as a primary mode of travel between home and work.

Table 6. Commuting Distances – HERC Commuting distance traveled

Commuting Mileage (one-way)	6-15 miles	16-30 miles	31-45 miles	46-60 miles
Employee's daily travel to work (%)	12.5%	37.5%	37.5%	12.5%

Results indicate that 12.5% of employees commuted 6-15 miles one-way between home and the HERC, followed by 37.5% who commute 16-30 miles, 37.5% commute between 31-45 miles, and 12.5% commute between 46-60 miles. All of these are one-way miles.

Table 7. Commuting Practices – HERC location and alternative commuting behaviors

HERC Facility (site, building, and interior)	Mean	SD	N	Interpretation
Alternative Commuting Practices	4.63	1.60	8	Enhances

Results indicate that the location of the HERC Admin facility **enhanced (M = 4.63)** employees ability to commute to work in alternative ways, e.g., walk, bicycle, public transit, van or carpool, etc. Further, 38% of the employees indicated that the location **enhanced** their commuting options, 50% were **neither hindered nor enhanced** by the location of HERC, and 13% indicated that the location **hindered** their ability to commute in alternative ways. (Note: does not equal 100% due to rounding.)

6.0 Conclusions

6.1 Summary

A post-occupancy evaluation was conducted of employees of CMRR at approximately two years after it was first occupied. Nearly 22% of the employees responded to the survey.

The survey included questions related to employees' overall satisfaction with the facility (site, building, and interior) and influence of the facility on their overall work performance and health. Employees were **satisfied** with the facility (**M = 5.44**); they found the facility **enhances** their overall work performance (**M = 5.56**) and **enhances** their overall health (**M = 5.67**). Slightly lower results were reported when employees were asked these same questions about their primary workspaces (private office, shared office, laboratory, etc.). They reported overall **satisfaction (M = 5.11)** with their primary workspaces and that their overall work performance was **enhanced (M = 5.11)** by their primary workspaces. However, their overall health was **enhanced (M = 5.00)** by their primary workspace. As the range of scores was from 1-7, scores that showed satisfaction are in the moderate satisfaction range.

Most of the survey questions related to employees' satisfaction with the IEQ criteria in their primary workspaces (private office, laboratory, etc.). Employees' responses showed they were **satisfied** with the majority of the IEQ criteria. The mean satisfaction scores ranged from **4.67** (Ability to limit undesired sounds) to **6.00** (Amount of electric lighting). Employees responded **neither dissatisfied nor satisfied** with Adjustability of task lighting (4.44), Adjustability of electric lighting (4.33), Temperature (3.89),

Humidity (3.78), and Air velocity (3.67). Lastly employees were **dissatisfied** with Overall thermal conditions (3.33) and Adjustability of thermal conditions (3.00).

From the employees' responses, an IEQ Score was developed and shows respondents' satisfaction with the IEQ of all category level criteria. For HERC, the IEQ Satisfaction Score was **5.14**. This score reflects the moderate satisfaction level with all categories except Overall thermal conditions. Finally, employees reported that CMRR **enhances** their physical activity, which is one of the sustainable design criteria that influences occupant behavior.

6.2 Recommendations

The satisfaction scores are certainly in the positive direction, however, improvement may be possible. For IEQ categories that can be physically measured (e.g., thermal, acoustic, and lighting), it is recommended that these measurements be taken in the primary workspaces. Specific recommendations for the most common areas of occupants' concern follow:

Acoustic Conditions

- Identify acoustic criteria for overall requirements.
- Determine if any task areas differ now from their original spatial layout/use (i.e., collaborative work spaces now located adjacent to focused work areas, individual workstations).
- Develop specialized acoustical performance requirements to support functional programming employees' tasks (e.g., sources of recurrent noise that need to be controlled, special user populations that may have distinct auditory performance limitations, or multiple uses of building spaces that may have different acoustic criteria). Identify and apply appropriate acoustics modeling software for the project.
- Measure acoustic performance onsite with full building systems (heating, ventilation, air conditioning; HVAC) running.
- Identify employees' privacy concerns via focus groups and/or log complaints relative to acoustical conditions for further evaluation.
- Consider employees' tasks within shared spaces to determine if spatial layout changes can be made for increased acoustic control.

Lighting Conditions

- Identify employees' lighting performance criteria that are to be met to achieve goals by conducting onsite measurements of existing illumination and compare them to standards for employees' tasks as identified by the Illuminating Engineering Society (IES).
- Determine if any task areas differ now from original intent to be sure illumination quantity and quality are not impeded by physical changes to the space (i.e., walls, ceilings, furnishings, fixtures, or equipment).
- Develop additional quality lighting criteria as needed for special facility (e.g., influence of daylight quality or quantity) or employee (e.g., age, task duration) issues.
- Log complaints related to lighting conditions for further evaluation.
- Identify poor lighting conditions in the workspace caused by a lack of control over daylighting, which can cause glare and eyestrain.

Personal Adjustability

- Determine if adjustability issues arise with temperature, lighting, or furnishings via a focus group.
- Identify personal, individual problem areas and relate them to other IEQ issues via log of complaints relative to adjustability.
- Provide education to employees about any existing/achievable adjustment options, e.g., furnishings, air diffusers, lighting, temperature control, etc.

Privacy Conditions

- Identify employees' privacy concerns via focus groups or log complaints relative to privacy to determine if visual or audio privacy is most affected.
- Determine if any task areas or responsibilities differ from original intent and develop alternatives or modifications.
- Consider adding noise masking equipment and/or visual screening depending on the nature of the complaints.
- Document and compare acoustic privacy problem areas with acoustic measurements to pinpoint specific problem areas.

Thermal Conditions

- Measure thermal performance conditions on site.
- Log complaints related to thermal conditions for further evaluation.
- Determine special thermal comfort requirements or problems that may be encountered in the building due to physicality of work activities, duration of sitting, or design/layout considerations. Focus groups can be useful in identifying problem locations.
- Determine if any employees' task areas differ now from original layout to determine if air flow is meeting systems design intent.
- Review conditions that affect thermal comfort using ASHRAE Standard 55-2004 or *Human Factors Design Handbook* (see B3 Guidelines).

Overall Recommendations

It seems obvious that employees' satisfaction can be improved by addressing criteria that had "dissatisfied" or "neither dissatisfied nor satisfied" scores. The above recommendations can help address change to these criteria. The criteria employees were dissatisfied with Overall thermal conditions and Adjustability of thermal conditions, which can be addressed by the above recommendations. However, as the mean satisfaction scores for many criteria hovered just above 'neutral,' it is reasonable to begin addressing some of these criteria to further improve employees' satisfaction. Exploring these criteria in more detail and making adjustments may increase overall satisfaction at the primary workspace. It must be noted that employee expense is second only to the cost of the actual facility in most business operations. It is a good investment to improve employees' satisfaction, which, in turn affects their performance and their health.

This study investigated employees' satisfaction with the facility and primary workspaces. IEQ satisfaction is individual, but the results of the survey show a central tendency of moderate satisfaction with the facility and most of the IEQ categories. The results can be used as a diagnostic tool to aid in improving IEQ conditions for employees and to set the benchmarks from which improvement can be measured in the future.

Appendix A. Open-Ended Responses

Employees had the opportunity to raise specific concerns on the overall facility and their primary workspaces. Important information can be gleaned from the open-ended responses. HERC employees raised specific concerns about just a few issues. There were positive comments as well. Following are qualitative responses to the criteria. Generally, the comments are shown as written.

Overall Building and Primary Workspace

- Need more room and less random traffic
- Train noise is much louder than expected, noise through walls is much more than expected.
- Nothing dries in my locker. Humid in lunchroom. humid in locker room
- No light switch or controls in my office.
- Water in sinks do not control temp well. It goes from very hot to very cold every few seconds.
- Not built to handle exterior noises (train).

Overall Building and Primary Workspace – Overall Positive

- The admin building is nice
- Beautiful building.

Appendix B. Glossary

Descriptive statistics

Statistics used to summarize large sets of data (i.e., means, frequencies, medians). Descriptive statistics describe only the sample under consideration and are not intended to infer results to the larger population.

Factor analysis

A multivariate statistical procedure that is used to identify and group together general dimensions or factors that underlie a large number of variables in a set of data. The procedure transforms the variables into new principal components or orthogonal factors. Variables within each factor are related to each other but have no relationship to variables in other factors.

Frequency

A descriptive statistic that provides information about how many of a particular response or measurement are observed.

Likert-type scale

A measurement technique, employed in questionnaires and interviews, that utilizes a range of standardized response criteria such as strongly agree, agree, etc.

Mean

The average score of a set of data calculated by adding all scores together, then dividing by the number of scores.

N

The number of subjects or participants responding to the questions in the study

Reliability

The repeatability or replicability of findings; the same results are produced each time. Instruments and procedures should produce the same results when applied to similar people in similar situations, or on a second occasion.

Standard deviation

A statistic used to measure the variability of a group of scores (how different scores are from each other and the mean). For example, if the range of scores is 1-7 and the mean (average) is 5.0 with a standard deviation of 1.0, then the scores are closely clustered around the mean, i.e., there is one unit of variation among all scores. If the mean was 5.0 and the SD was 3.0, there is a broader range of variation among the scores...a smaller SD means the scores are similar and the mean score is likely to be more accurate and more useful (this is better!).

Validity

The extent to which an instrument or procedure measures what it is intended to measure (internal validity). The generalizability of results to another population (external validity).