Indoor Environmental Quality + Workplace Environment
UMTC Biomedical Discovery District: Phase II – Cancer & Cardiology Research Building (CCRB)

April 2017, 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 UMTC Biomedical Discovery District: Phase II – Cancer & Cardiology Research Building (CCRB) facility and occupants' satisfaction with their work environments located in the facility. The CCRB was designed using the B3 Guidelines (formerly known as the Minnesota Sustainable Building Guidelines or MSBG) and completed for occupancy in May 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. This is a report of occupants' (hereafter called employees) responses from the survey conducted in April 2017.

This SPOES report focuses on employees' satisfaction with the physical environment as related to 26 indoor environmental 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).

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

An IEQ Score is also calculated for employees' satisfaction with IEQ criteria in their primary workspaces. This is a statistical combination of all category-level (explained below) 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' demographic, physical activity, and commuting practice data are collected to provide context for the study.

In the SPOES questionnaire, the 26 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 such as Overall View Conditions or Overall Indoor Air Quality. Some categories 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 (draft), humidity, and temperature. Overall Acoustic Conditions is a category with attributes of employees' ability to hear desired sounds and their ability to limit undesired sounds. There are 12 category-level and 14 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 all 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.

In the following list, **category (boldface)** criteria are listed in alphabetical order. If a category has attributes, they are listed with the category.

Overall Acoustic Quality
- Ability to hear desired sounds
- Ability to limit undesired sounds

Overall Appearance (aesthetics)
Overall Cleaning and Maintenance
Overall Daylighting Conditions
- Amount of daylighting
- Adjustability of daylighting

Overall Electric Lighting Conditions
- Amount of electric lighting
- Adjustability of electric lighting
- Adjustability of task lighting

Overall Furnishings
- Function of furnishings
- Adjustability of furnishings

Overall Indoor Air Quality
Overall Privacy
Overall Technology
- Access to electric outlets

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, e.g., temperature, humidity, or lighting levels of the environment taken. This study is limited to employees' perceptions.

3.0 Sample Description

3.1 Description of Building

The CCRB facility is located at 2232 6th St. SE, Minneapolis, MN. The CCRB (see Figure 1) is a five-story 296,000 square foot building and includes research labs and researcher, faculty, and administrative offices such as private offices and workstations. Researchers in this building focus on fighting heart disease and finding cures for cancer. Researchers continue their work in cardiac regeneration, cardiac development, muscular dystrophy, congenital heart medicine, and genomics. The Masonic Cancer Center utilizes the new space for two specific groups of investigators: chemical biologists focusing on studying chemical carcinogens as a cause of cancer and faculty focusing on novel new therapeutic strategies to fight cancer (UMN, 2017).

Figure 1. CCRB (Photo courtesy of UMN)

3.2 Description of Respondents

This survey was administered to 800 employees (part-time, full-time, visiting) with workspace in the facility during April 2017. The response rate to the questionnaire was approximately 12%. Of those responding, 53% were male, 45% were female, and 2% reported other. The mean age of respondents was 35 years, with a range from 18-73 years of age.

The CCRB was completed and ready for operation in May 2013. Since that time, 43% of respondents reported that they worked at the CCRB building for more than two years; 27% of respondents have worked 1-2 years in the building; and 30% have worked less than one year in the building. Relating to hours worked during a typical week at CCRB, 52% of employees reported they spend 40+ hours a week in the facility; 21% spend 30-40 hours a week at CCRB; 7% spend 20-29 hours a week; and 20% spend less than 20 hours at CCRB.

Relating to the time employees spend per week in their primary workspace, 52% of employees reported they spend more than 75% of their weekly time in their primary workspace; 28% spend 51-75% of their time in their primary workspace; 10% spend 25-50% of their time in their primary workspace; and 9% spend less than 25% of their time in their primary workspace. These responses indicate the amount of time employees are exposed to IEQ conditions in their workplace environment.

CCRB is a research facility with research laboratories and workplaces with private and shared offices. Employees indicated that about 70% of them worked in lab areas often with a desk area included, 24% worked in private or shared offices, and 6% worked in cubicles or desks in open areas. Employees indicated that 79% of their primary workspaces were located within 15 feet of an exterior window; 21% of employees were not within 15 feet of an exterior window.

4.0 Findings and Discussion

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

Employees responded to questions concerning the CCRB 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, which is identified 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). Gray represents the 'neither/nor' range of responses. In cases where there were no dissatisfied responses, the bar may be all green or gray and green. This graph is simply a visual image of the findings from Table 1.

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

Overall	Mean	SD	N	Interpretation
Satisfaction	5.99	1.00	114	Satisfied
Work Performance	5.64	1.07	113	Enhanced
Health	5.17	1.19	114	Enhanced

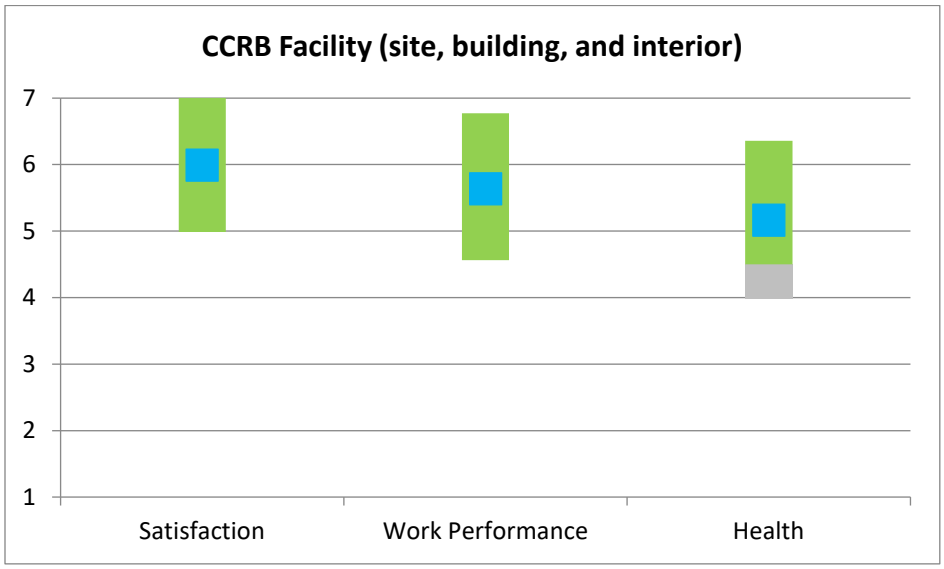

Figure 2. CCRB facility - overall satisfaction, work performance, and health

Results indicate that employees were highly **satisfied** (**M = 5.99**) with the CCRB physical environment of the facility (building, site, and interior) and reported that their overall work performance was **enhanced** (**M = 5.64**) by the facility. Employees reported that their overall health was **enhanced** (**M = 5.17**) 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 research lab). 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; an explanation of the graph was given for Figure 2.

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

Overall	Mean	SD	N	Interpretation
Satisfaction	5.14	1.40	109	Satisfied
Work Performance	5.06	1.38	109	Enhanced
Health	4.72	1.34	109	Enhanced

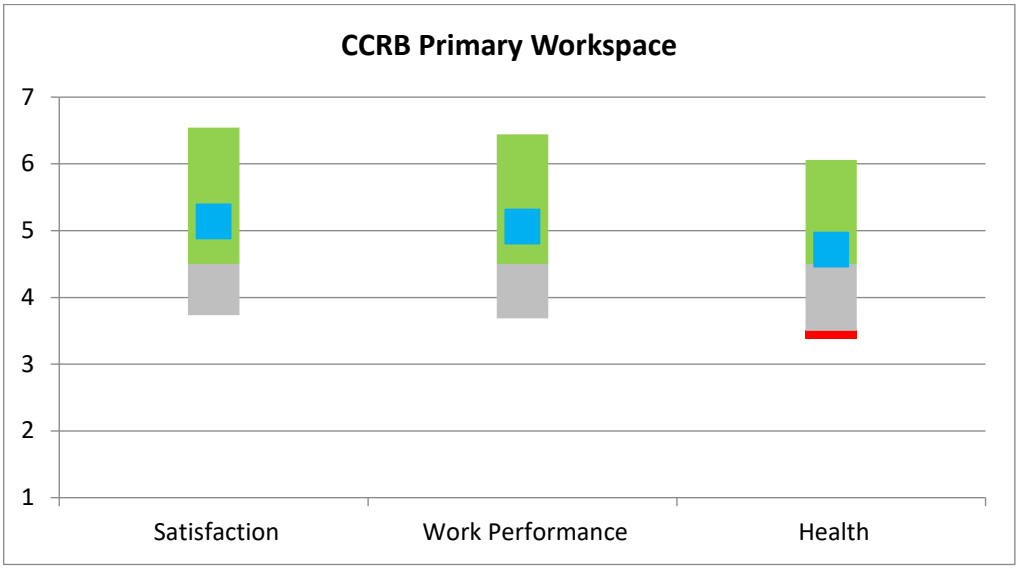

Figure 3. CCRB primary workspace - overall satisfaction, work performance, and health

Results indicate that employees were **satisfied (M = 5.14**) with their primary workspace, their overall work performance was **enhanced (M = 5.06)** by their primary workspace, and their overall health was **enhanced (M =4.72)** by their primary workspace.

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

Employees responded to questions concerning their satisfaction with IEQ categories (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 from highest to lowest mean, as well as how the responses are interpreted. Figure 4 is a visual image of the findings from Table 3; an explanation of the graph was given for Figure 2.

Table 3. CCRB primary workspace - satisfaction with IEQ criteria

#	**IEQ Criteria (1-26)** (Category level criteria are bold face)	**Mean**	**SD**	**N**	**Interpretation** (S = Satisfied) (D = Dissatisfied)
1	**Overall daylighting conditions**	**5.66**	**1.62**	**100**	**Satisfied**
2	**Overall vibration and movement**	**5.65**	**1.19**	**100**	**Satisfied**
3	Amount of daylighting	5.63	1.69	100	Satisfied
4	Amount of electric light	5.48	1.58	100	Satisfied
5	**Overall appearance (aesthetics)**	**5.45**	**1.37**	**101**	**Satisfied**
6	Access to electric outlets	5.44	1.53	100	Satisfied
7	**Overall indoor air quality**	**5.43**	**1.30**	**100**	**Satisfied**
8	Air velocity (drafty or stagnant)	5.42	1.34	101	Satisfied
9	Function of furnishings	5.41	1.40	100	Satisfied
10	Ability to hear desired sounds	5.38	1.25	101	Satisfied

Table 3. CCRB primary workspace - satisfaction with IEQ criteria, continued					
#	**IEQ Criteria (1-26)** (Category level criteria are bold face)	**Mean**	**SD**	**N**	**Interpretation** (S = Satisfied) (D = Dissatisfied)
11	**Overall technology**	**5.38**	**1.41**	**101**	**Satisfied**
12	**Overall electric lighting conditions**	**5.36**	**1.58**	**100**	**Satisfied**
13	Humidity (dry or moist)	5.36	1.38	101	Satisfied
14	Adjustability of daylighting	5.30	1.71	100	Satisfied
15	**Overall furnishings**	**5.28**	**1.34**	**101**	**Satisfied**
16	**Overall cleaning and maintenance**	**5.20**	**1.53**	**101**	**Satisfied**
17	Adjustability of furnishings	5.17	1.50	101	Satisfied
18	**Overall view conditions**	**5.12**	**1.70**	**101**	**Satisfied**
19	**Overall acoustic quality**	**4.82**	**1.59**	**101**	**Satisfied**
20	Adjustability of task lighting	4.82	1.82	101	Satisfied
21	**Overall thermal conditions**	**4.81**	**1.65**	**101**	**Satisfied**
22	Adjustability of task lighting	4.68	1.91	100	Satisfied
23	**Overall privacy (sound & visual privacy)**	**4.60**	**1.75**	**101**	**Satisfied**
24	Temperature (hot or cold)	4.48	1.77	101	Neither S or D
25	Ability to limit undesired sounds	4.46	1.63	101	Neither S or D
26	Adjustability of thermal conditions	3.73	1.99	99	Neither S or D

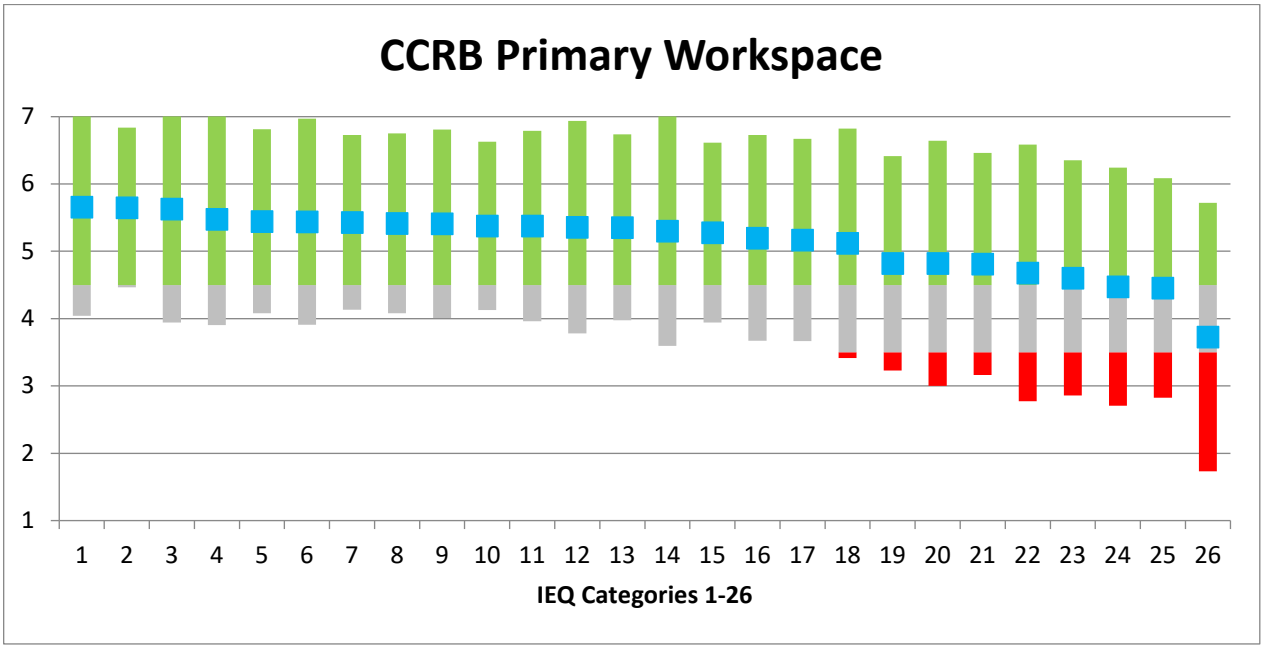

Figure 4. CCRB primary workspace - satisfaction with IEQ criteria (IEQ 1-26 refer to Table 3)

Results indicate that employees were **satisfied** with all 12 of the IEQ category criteria (see bold faced in Table 3) in their primary workspaces, i.e., means at or above 4.50. Relating to specific IEQ criteria, employees were **satisfied** with 23 of the IEQ criteria ranging from a mean of 4.60 (Overall privacy) to a high of 5.66 (Overall daylighting conditions). Employees indicate that they were **neither satisfied nor dissatisfied** with three IEQ criteria, temperature (4.48), ability to limit undesired sounds (4.46), and adjustability of thermal conditions (3.73). They were dissatisfied with none of the criteria. These three criteria are ripe for change to improve employees' satisfaction with their primary workspaces. Potential for change will be addressed in Section 6.2 Recommendations. Further explanation of these scores also can be found in Appendix A. Open-Ended Responses.

4.4 IEQ Satisfaction Scorecard

The IEQ Satisfaction Score is determined by calculating a mean of the 12 'Overall' category level IEQ criteria. At this time, criteria are weighted equally in this calculation as little evidence exists that provides rationale for weighting some criteria heavier than others. The IEQ 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 CCRB is **5.23,** which shows employees are satisfied with the IEQ of their primary workspace. The large number of IEQ categories with means above 4.5 contribute to this high IEQ Score**.**

Figure 5. CCRB primary workspace - IEQ Satisfaction Score

As shown in Table 3, satisfaction with the Overall daylighting conditions and Overall vibrations and movement were the categories with the highest satisfaction means (5.66 and 5.65 respectively). Having all category criteria in the satisfied range shows a high level of employee 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 CCRB (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, allows them 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 CCRB facility

CCRB facility (site, building, and interior)	Mean	SD	N	Interpretation
Overall physical activity (walking, stair use, etc.)	5.30	1.05	98	Enhanced

Results indicate that employees felt that CCRB **enhanced** (**M = 5.30**) their physical activities (walking, stair use, etc.).

5.2 Commuting Practices

CCRB is located on the UMN Twin Cities campus in Minneapolis, MN. The building has parking available for employees; it is located near public transit (bus and light rail) and an inter-campus bus. Table 5 provides results on employees' primary mode of transportation; Table 6 summarizes commuting distances between home and the CCRB facility; and Table 7 summarizes employees' ability to commute using alternative choices (walk, public transit, bike, van, or carpool, etc.). These results, although not related to IEQ, do offer insight into employees' commuting behaviors and opinions. These data can provide important information about commuting practices that can reduce transportation energy consumption.

Table 5. Commuting Practices – CCRB Primary mode of transportation

Primary Mode of Transportation (N=98)	**Drive Alone (or w/children <16)**	**Carpool**	**Public transit**	**Bicycle or Walk**	**Other**
Commuting to CCRB	51%	6%	13%	24%	6%

Related to primary modes of transportation, 51% of employees drive alone (or with children under 16) and the balance carpool, take public transit, or bicycle or walk.

Table 6. Commuting Practices – CCRB Commuting distance traveled

Miles Traveled (N=98)	**0-5 miles**	**6-15 miles**	**16-30 miles**	**31+ miles**
Home-to-CCRB (One-way)	44%	34%	17%	5%

Results indicate that 44% of employees commuted 0-5 miles one-way between home and the CCRB, followed by 34% who commute 6-15 miles, 17% commute between 16-30 miles, and 5% commute over 31+- miles to the CCRB facility. These are one-way miles.

Table 7. Commuting practices – CCRB location and alternative commuting behaviors

Alternative Commuting	Mean	SD	N
Ability to commute in alternative ways	4.84	1.65	98

Results indicate that location of the CCRB **enhances** (M = 4.84) employees' ability to commute to work in alternative ways, e.g., walk, bicycle, public transit, van or carpool, etc.

6.0 Conclusions

6.1 Summary

A post-occupancy evaluation was conducted of employees of CCRB at approximately four years after it was first occupied. This CCRB facility is used as a medical research center. This survey reports the responses from employees and their satisfaction with the physical environment of the facility and their primary workspace. Results indicate that 73% of employees spend more than 30 hours per week in the CCRB facility, and 80% of employees spend more than 50% of their time at CCRB in their primary work space.

The survey included questions related to employees' satisfaction with the facility (site, building, and interior) and influence of the facility on their work performance and health. Employees were **satisfied** with the facility (**M = 5.99)**; they found the facility **enhanced** their work performance (**M = 5.64)** and **enhanced** their health (**M = 5.17**). In addition, similar results were reported when employees were asked these same questions about their primary workspaces (private office, shared office, research labs, etc.). They reported **satisfaction** (**M = 5.14**) with their primary workspaces, that their work performance was **enhanced** (**M = 5.06**), and their health was **enhanced** (**M = 4.72**) by their primary workspace. As the range of scores was from 1-7, scores showed a moderately high level of satisfaction and enhancement.

Most survey questions related to employees' satisfaction with the IEQ criteria in their primary workspaces (private office, cubicles, etc.). Employees' responses showed they were **satisfied** with 23 of the 26 IEQ criteria. The mean satisfaction scores ranged from low satisfaction of **4.60** (Overall privacy) to a high of **5.66** (Overall daylighting conditions). Again, this shows a positive level of **satisfaction**. Employees responded **neither dissatisfied nor satisfied** to three IEQ criteria**,** Overall temperature **(4.48),** ability to limit undesired sounds **(4.46),** and adjustability of thermal conditions **(3.73).**

From employees' responses, an IEQ Score was developed and shows respondents' satisfaction with the IEQ of all category level criteria. For CCRB, the IEQ Satisfaction Score was **5.23.** This score reflects the influence of employees' satisfaction with all categories. Finally, employees reported that CCRB **enhances (5.30)** their physical activity, which is one of the sustainable design criteria that influences occupant behavior.

It seems that employees' satisfaction is moderately high, but could still be improved by addressing thermal conditions. Two of the three lowest scores relate to this issue. The following recommendations can help address change in these criteria to further improve employees' satisfaction. Exploring these areas in more detail and making adjustments may increase overall satisfaction at the primary workspace. It must be noted that the expense of building and operating a facility is second only to

employee-related expenses over the life of the building. Therefore, maintaining or improving employees' satisfaction is a sound investment, 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 results of the survey show a central tendency of moderate to high satisfaction with the facility and all 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.

6.2 Recommendations

Most IEQ criteria satisfaction scores are in the positive direction, however, improvement on criteria with the neither satisfied nor dissatisfied rating 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, and air conditioning) 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 what 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 a 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).

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 survey responses. CCRB employees made several important comments, which give insight into specific issues that should be addressed by building management. The comments are summarized below.

Overall Positive

- It's a beautiful facility. It's new, clean and efficient. The labs are also excellent. It's a great facility to work in.
- Overall the physical environment is great.
- This is one of the most quiet buildings I have ever worked in and I super appreciate it!
- High ceilings are great.

Aesthetics

- It could use more color, and the light/shadow in the office is on the low side. I suffer from seasonal affective disorder, and the lack of light compounded by the lack of color adversely affects my mood - especially in winter, but also year-round. Unlike the cubicle areas, the offices don't come with standing desks. Several office dwellers have had them added, after moving in, at considerable expense.
- Building feels "sterile" - apparently art work not allowed on walls? White walls give sterile look.
- Would be good to add color/art.
- The institutional white on all the walls is mentally draining.
- CCRB is simply a technical environment where the sterile concept of work comes before any considerations of aesthetics. The colored lights are cheesy. The planned kitchen area died because they never ask the occupants what they would like to have available. The lifts are so slow you can feel yourself age between floors. For all the pious platitudes about the university "being green" try to find anything living in this facility despite its vast window space. I know, I know: "Plants are messy." But again, it's your building not ours - we just spend most of our life in it.

Cleaning and Maintenance

- The lab bay floor is very dirty, often it is not swept for long periods of time especially under the cabinets. I'm not sure the lab bay floor has been waxed since we moved in.
- The floor in the lab space could be wiped once in a while.
- The floor has not been cleaned in months.
- The exterior windows (outside and inside) and lab area floors are constantly filthy. The floors are usually kept well swept but not well mopped.

Daylighting

- There are no windows in the office, which kind of sucks the soul out of you after 5 days with full-time hours.
- No windows to the outside world. Even the labs have windows.
- I have no outdoor windows.

Electric Lighting

- The lighting is insufficient. The task lighting is particularly poor. While on, the lights are sufficient, however the sensing mechanism is extremely poor, and timers are too short. The lights routinely turn off while I am sitting in front of them and working. It takes large movements to activate the lights. At a minimum, adjusting all of them to longer timers would help. Additionally, maintenance of light bulbs on bench space is horrible and many are out. Further, isolated rooms without lots of lights have horrible shadows when trying to work in those spaces.
- The daylight coming in through the windows is great but the electric lighting system is very annoying. We have an automated ceiling light in our lab that has never worked properly. We have switches where automatic lights would serve better (cold rooms). Some lights never turn off. Other lights turn on when you'd prefer them to stay off. The sensors don't seem to work properly. On the weekends when I am the only person here, all the lights come on and I go around manually turning them off because the daylight is enough. I'd much prefer switches.
- The energy-saving lights are a hassle in that they are too dim when they come on in "half" mode. It's not nearly enough light to work with and if my hands are full of chemicals/liquid nitrogen/animals when I enter the room, I must arrange some way to always press the "full" light button; adding extra work/movement/possibility for accidents when handling hazardous items.
- Motion sensor lights don't stay on long enough for certain tasks. When they go off I must stop what I'm doing to wave at them to reactivate, or struggle with insufficient light for my task. I'd like an override for this task.
- Additionally, timer only setting on our research bench lighting is very difficult to use. Light does not stay on for long and the sensors aren't sensitive. We frequently lose lighting mid-experiment and have to wave our hands around to activate it. It would be great if they could either be left on, are more sensitive, or take longer to turn off.
  The work area lighting (under shelf lighting) is also very annoying. There is exactly one switch and different ideas about whether it is helpful or not. I prefer no undershelf lighting but if I turn mine off, my neighbor can't use theirs. Also, for those that like their lights, the lights seem to burn out very frequently. It would also be nice to have the option to add work lighting in some of the alcoves where there is poor visibility but the shelves are the wrong size.
- The desk lighting is hard to control and the work spaces have linked-lighting, which is problematic for instances where one person wants desk lighting on and the other does not.
- Task lighting frequently shuts off during my tasks because I'm not moving vigorously. The work we do is more subtle and it's annoying when my lighting goes out and it doesn't start up again easily.
- I like the lights under the shelves and above the lab benches. However, since there is only one "On" switch this can be troublesome. The On switch is by my computer. It is often that there is too much glare from the light on my computer but the light is needed for the lab benches. I suppose that the intention is that if I am on the computer that there will not be a need for light on my bench. This is not true, I share the bench with one or two students and we each have different needs. I wish each under shelf light had its own on/off over-ride.

Indoor Air Quality

- I get bad fumes/smells into my office (corner) when trucks are running outside.

Privacy/Acoustics

- One of the above questions asked about privacy. This is a big problem for me. How can I have a private phone conversation in a lab filled with people? I tried to go to the "touch down" offices near the center of the building, but my cell phone does not work in this office and the lab phone doesn't work either.
- The acoustics in this building are atrocious. When in my private office, I can hear a person having a phone conversation in their own private office half-way across the building. I have to spend 90% of my time in my office with the door closed which lends a solitary confinement-type environment.
- Everyone having to work in their offices with the doors closed works against the concepts of science being a collaborative endeavor and our all being open and available for discussion and scientific ideas.
- The office furniture is terrible. I am a PI and I work in my office 10 hrs/day. The keyboard tray is positioned such that my elbow hits my desk when trying to work at an ergonomically appropriate height. The office size is also poor. I understand the "wanting to force use of collaboration space", but I still need space for books, files, and meetings with students in which a private setting is needed. My office is really not acceptable and substandard to those offices of my peers in the sciences. I am somewhat embarrassed when I bring external visitors to my office. It is always messy due to lack of space. It was a poor building design.

Space and Function

- Having my desk next to my bench in such an open work area hinders my creativity and work, primarily writing. It is really hard to do work like this in my designated work area. Everyone should have access to temporary quiet spaces for use. Also, believe or not, not being able to drink water/coffee at my desk decreases the amount of time I am at my desk working. It is still a health hazard to work next to my bench, were I work with biologicals and chemical agents graded as carcinogenic.
- The cafe is still empty after all this time and access to coffee/food is a problem especially in the winter.
- I find it odd that the safety showers are in the middle of busy walk ways and there are no drains below them.

Technology

- The Wi-Fi is pretty unstable.
- BETTER WIFI.
- The furniture is placed in front of electrical outlets.
- Connection to monitors in conference rooms are not great; it often blinks and flashes due to poor to connection.
- I have no outlets that aren't being used for the computer or phone.
- Many outlets do not work, or will not accept proper plugs because they are damaged, jammed, etc. since the move in date.

Thermal Conditions

- The temperature control is poor. In the lab, it is very cold regardless of season: insufficient heat in the winter and too much AC in the summer.
- While I generally find the temperature very comfortable, in some rooms, particularly when equipment is running and additional personal protective equipment must be worn, the temperature can be unbearably hot. Many of my colleagues also complain about the main lab spaces being too cool. Some of the conference rooms are the same, where one conference room runs too hot and another runs too cool. Particularly, in the conference rooms and side rooms, the ability to set the thermostat would be welcome.
- Temperature control is an issue. Often too hot. Need to open door to cool, but then have to deal with noise.
- The temperature is always very cold, at least in the winter, and it is rather dry.
- Office door is directly across from outside door so when people go in and out my office gest cold quickly.
- It's absolutely always too cold in the labs and locker rooms in our wing, during all seasons, and we have complained about it before. I know the labs in the wing next to us are usually too hot because of the position of the sun relative to their windows, so overall better temperature control that's specific to each wing is necessary. I also frequently work in a side room off a main equipment hallway, and it's excessively cold and drafty in there on a regular basis.
- If anything, the offices are very small, and frequently too cold in the winter - if the sun is not out my office gets very cold.
- Thermostats in the small rooms don't work particularly well and rooms are frequently way too hot.
- Wish I could adjust my own office temp.
- Temperature in the lab area is way too low. I have spoken to many people in the building and everyone complains about the temperature. People wear lab-coat or jacket to keep themselves warm. It definitely affects the work productivity. During summer the air conditioners are too strong, and during winters the heaters are at low setting. Overall, the lab area is too cold the entire year.

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.

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

Likert-type scale
A measurement technique, employed in questionnaires and interviews, that utilizes a range of standardized response categories 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, or a single question, 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).