



**Indoor Environmental Quality + Workplace Environment  
Minnesota State University, Mankato – Clinical Sciences Building (CSB)  
Mankato, MN**

**May 2019, 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 and interior restoration of the Minnesota State University, Mankato – Clinical Sciences Building (CSB) facility and occupants' satisfaction with their work environments located in the facility. This report communicates responses from employees about the overall facility and their workplace (WP). The facility was designed using the B3 Guidelines (formerly known as the Minnesota Sustainable Building Guidelines or MSBG), which were in effect at the time that the renovation and addition were funded. It was completed for occupancy in December 2016. 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 2019.

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 (hindered) to 7 (enhanced).

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 hindered/enhanced. Means that are close to the center of the scale (4) are considered to be neither dissatisfied/hindered or satisfied/enhanced.

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

- 1.00 - 3.50 dissatisfied (or hindered)
- 3.51 - 4.50 neither dissatisfied (or hindered) nor satisfied (or enhanced)
- 4.51 - 7.00 satisfied (or enhanced)

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 Mankato CSB facility resides on the campus of Minnesota State University, Mankato, a part of the Minnesota State University system, and is accessible via US Highway 169. The Mankato CSB facility (see Figure 1) is the main classroom building for science classes. It consists of laboratories/studios, active learning classrooms, and a lecture room, as well as spaces for faculty offices, common and student spaces, and other support areas. These areas are distributed across this three-floor facility (plus an unoccupied basement shell). Of the overall construction project of 80,153 square feet, 57,802 is currently occupied. Laboratories/studios, active learning classrooms, and the lecture room comprise 21,102 square feet of the building.; a classroom study was previously conducted in 2018. This study focuses on the overall facility and faculty and staff offices, approximately 4,561 square feet of the CSB.



Figure 1. Mankato CSB (Photo courtesy of MN State University, Mankato)

### 3.2 Project Team

The relevant project team members to the SPOES process for Mankato CSB was comprised of the owner, design team, and commissioning agent, and general contractor. They are identified below, relative to their capacity and involvement.

Owner	Minnesota State University, Mankato
Architect	Perkins + Will and ISG
Mechanical and Electrical Engineer	LKPB Engineers
Interior Designer	Perkins + Will
Landscape Architect	Perkins + Will
Commissioning Agent	Sebesta Blomberg
General Contractor	Shaw-Lundquist Associates, Inc.

**3.3 Description of Respondents**

This survey was administered to 59 employees with workspace in the facility in April 2019. The response rate to the questionnaire was approximately 31%. Of those responding, 100% were female. The mean age of respondents was 47 years, with a range from 27-65 years of age.

The Mankato CSB restoration was completed and ready for operation in December 2016. Since that time, 71% of the respondents reported that they worked in Mankato CSB facility for more than two years, 24% of the respondents reported that they worked at the Mankato CSB facility for 1-2 years, and 6% of the respondents have spent less than one year at this facility. Relating to hours worked during a typical week at the Mankato CSB, nearly 24% of the employees reported they spend 40+ hours a week in the facility, 41% spend 30-40 hours a week at the Mankato CSB, nearly 12% spend 20-29 hours at the facility, and nearly 24% work there less than 20 hours per week. (Note that these totals do not add up to 100%, due to rounding error.)

Relating to the time employees spend per week in their primary workspace, over 23% of the employees reported they spend more than 75% of their weekly time in their primary workspace; over 29% spend 51-75% of their time in their primary workspace; over 23% spend 25-50% of their time in their primary workspace; and over 23% 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.

The Mankato CSB is a workplace with private offices, enclosed shared offices, cubicles with low partitions, benching (long worktable consisting of multiple workspaces; hoteling), and a work area in a lab, all serving as primary workspaces. Approximately 94% of employees indicated that their primary workspaces were located within 15 feet of an exterior window and nearly 6% of the employees were not within 15 feet of an exterior window.

**4.0 Findings and Discussion**

**4.1 Mankato CSB Facility (Site, Building, and Interior): Overall Satisfaction, Work Performance, and Health**

Employees responded to questions concerning the Mankato CSB 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 Mankato CSB facility - overall satisfaction, work performance, and health

Overall	Mean	SD	N	Interpretation
Satisfaction	6.39	0.59	18	Satisfied
Work Performance	6.11	1.05	18	Enhanced
Health	5.50	1.12	18	Enhanced

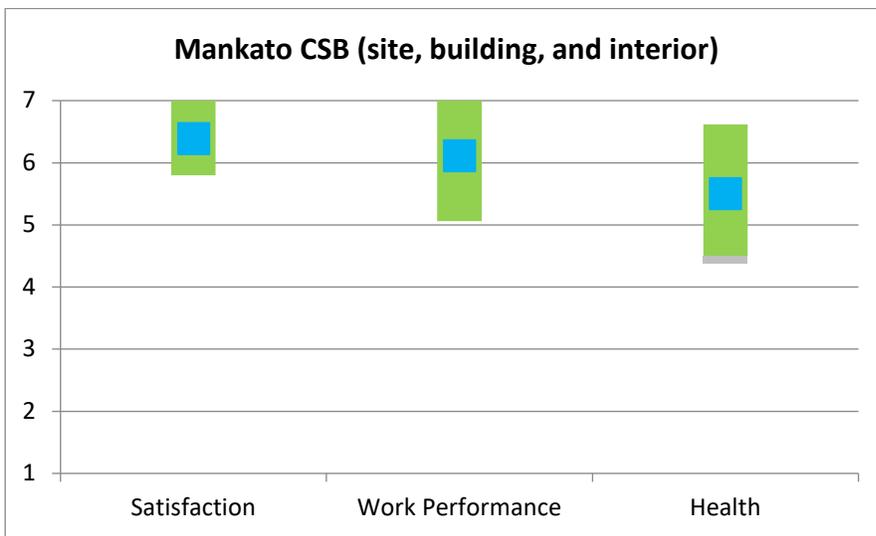


Figure 2. Mankato CSB facility - overall satisfaction, work performance, and health

Results indicate that employees were **satisfied (M = 6.39)** with the physical environment of the Mankato CSB facility (building, site, and interior) and reported that their overall work performance was **enhanced (M = 6.11)** by the facility. Employees reported that their overall health was **enhanced (M = 5.50)** 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, shared office, 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; an explanation of the graph was given for Figure 2.

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

Overall	Mean	SD	N	Interpretation
Satisfaction	5.89	0.99	18	Satisfied
Work Performance	6.00	0.94	18	Enhanced
Health	5.50	1.21	18	Enhanced

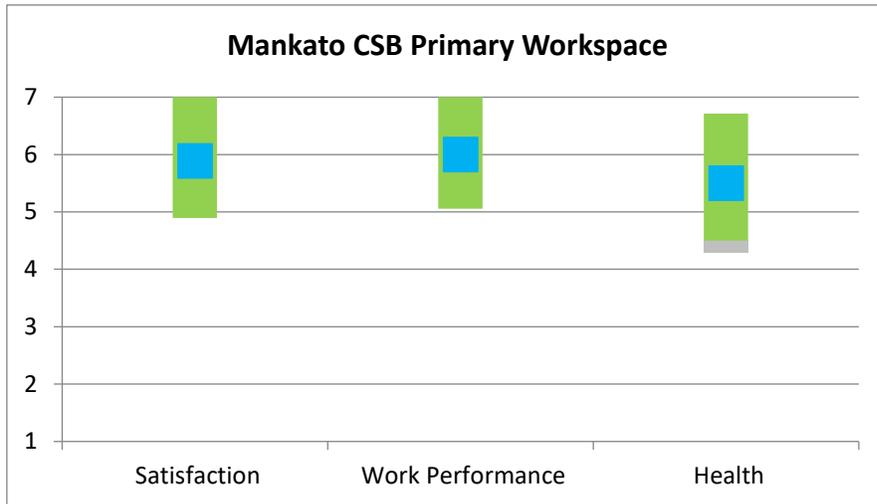


Figure 3. Mankato CSB primary workspace - overall satisfaction, work performance, and health

Results indicate that employees were **satisfied (M = 5.89)** with their primary workspace, their overall work performance was **enhanced (M = 6.00)** by their primary workspace, and their overall health was **enhanced (M = 5.50)** 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. Mankato CSB primary workspace - satisfaction with IEQ criteria

#	IEQ Criteria (1-26) (Category level criteria are <b>bold face</b> )	Mean	SD	N	Interpretation (D = Dissatisfied) (S = Satisfied)
<b>1</b>	<b>Overall cleaning and maintenance</b>	<b>6.65</b>	<b>0.76</b>	<b>17</b>	<b>Satisfied</b>
<b>2</b>	<b>Overall daylighting conditions</b>	<b>6.35</b>	<b>1.23</b>	<b>17</b>	<b>Satisfied</b>
3	Amount of daylighting	6.35	1.23	17	Satisfied
4	Ability to hear desired sounds	6.29	0.82	17	Satisfied
5	Adjustability of daylighting	6.29	1.32	17	Satisfied
<b>6</b>	<b>Overall appearance (aesthetics)</b>	<b>6.29</b>	<b>0.89</b>	<b>17</b>	<b>Satisfied</b>
<b>7</b>	<b>Overall vibration and movement</b>	<b>6.29</b>	<b>0.82</b>	<b>17</b>	<b>Satisfied</b>
<b>8</b>	<b>Overall indoor air quality</b>	<b>6.24</b>	<b>1.39</b>	<b>17</b>	<b>Satisfied</b>
9	Function of furnishings	6.24	0.88	17	Satisfied
10	Adjustability of task lighting	6.12	1.32	17	Satisfied
<b>11</b>	<b>Overall furnishings</b>	<b>6.12</b>	<b>1.08</b>	<b>17</b>	<b>Satisfied</b>
12	Humidity (dry or moist)	6.06	1.06	17	Satisfied
<b>13</b>	<b>Overall view conditions</b>	<b>6.06</b>	<b>1.47</b>	<b>17</b>	<b>Satisfied</b>
14	Adjustability of furnishings	6.06	1.11	17	Satisfied
15	Air velocity (drafty or stagnant)	6.00	0.91	17	Satisfied
16	Amount of electric light	6.00	1.50	17	Satisfied
<b>17</b>	<b>Overall technology</b>	<b>6.00</b>	<b>1.61</b>	<b>17</b>	<b>Satisfied</b>
<b>18</b>	<b>Overall electric lighting conditions</b>	<b>5.94</b>	<b>1.47</b>	<b>17</b>	<b>Satisfied</b>
19	Access to electric outlets	5.94	1.30	17	Satisfied
20	Adjustability of task lighting	5.82	1.85	17	Satisfied
21	Ability to limit undesired sounds	5.65	1.33	17	Satisfied
<b>22</b>	<b>Overall acoustic quality</b>	<b>5.59</b>	<b>1.42</b>	<b>17</b>	<b>Satisfied</b>
<b>23</b>	<b>Overall privacy (sound and visual privacy)</b>	<b>5.59</b>	<b>1.42</b>	<b>17</b>	<b>Satisfied</b>
<b>24</b>	<b>Overall thermal conditions</b>	<b>5.29</b>	<b>1.56</b>	<b>17</b>	<b>Satisfied</b>
25	Temperature (hot or cold)	5.18	1.58	17	Satisfied
26	Adjustability of thermal conditions	5.06	1.60	16	Satisfied

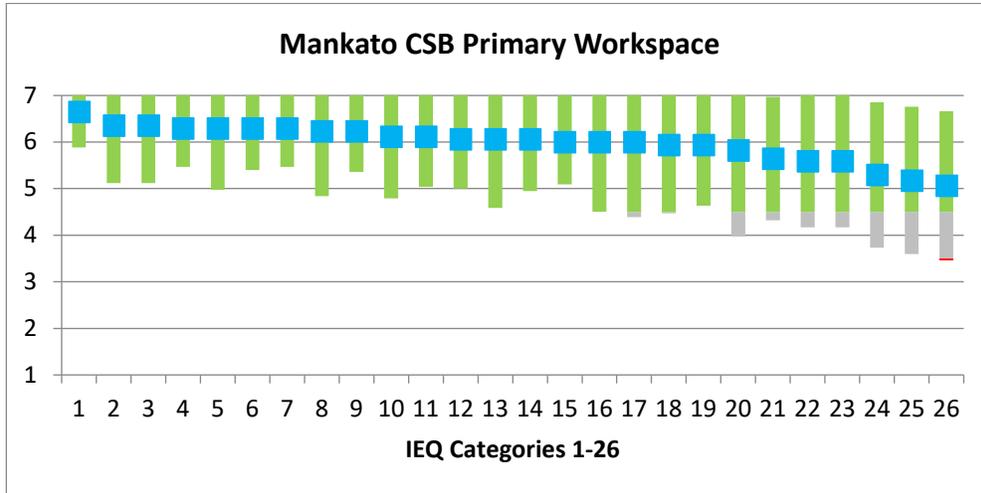


Figure 4. Mankato CSB primary workspace - satisfaction with IEQ criteria (IEQ 1-26 refer to Table 3)

Results indicate that employees were **satisfied** with all 26 IEQ criteria in their primary workspaces, i.e., means at or above 4.50. Satisfied means ranged from **6.65** (Overall cleaning and maintenance) to **5.06** (adjustability of thermal conditions). Though all means were in the moderate to moderately-high satisfied range, potential for positive change, is 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 the Mankato CSB is **6.03**, which falls in the upper quadrant of the satisfied range, i.e., a moderately high IEQ Score.

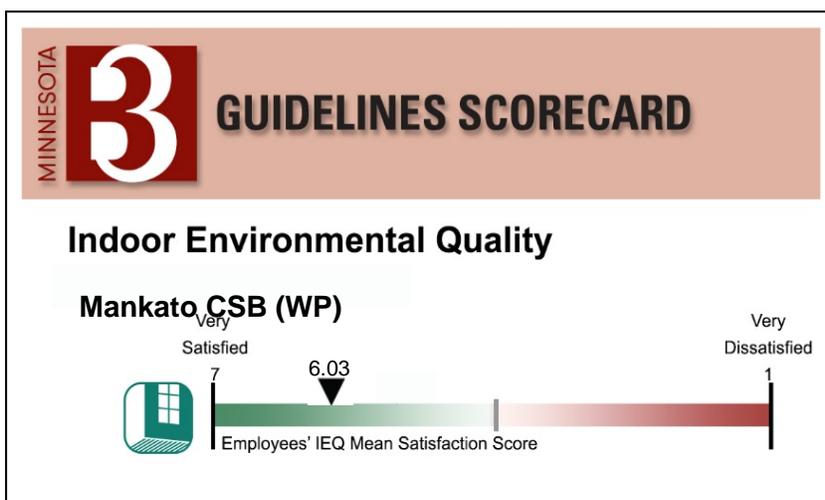


Figure 5. Mankato CSB primary workspace - IEQ Satisfaction Score

As shown in Table 3, satisfaction with Overall cleaning and maintenance, Overall daylighting conditions, Overall appearance (aesthetics), Overall vibration and movement, and Overall indoor air quality were the five (5) categories with the highest satisfaction means (**6.24 or higher**), in the higher end of the satisfied range. In combination with the three (3) moderately high satisfied scores ranging from **6.12** (Overall furnishings) to **6.06** (Overall view conditions), and **6.00** (Overall technology), they were successful in pulling the IEQ Satisfaction Score in a strongly positive direction. The remaining four (4) IEQ scores were more moderately positive, ranging from 5.94 (Overall electric lighting conditions) to **5.29** (Overall thermal conditions). 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 Mankato CSB (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 Mankato CSB facility

<b>Mankato CSB (site, building, and interior)</b>	<b>Mean</b>	<b>SD</b>	<b>N</b>	<b>Interpretation</b>
Overall physical activity (walking, stair use, etc.)	5.76	1.26	17	Enhanced

Results indicate that employees felt that Mankato CSB **enhanced (M = 5.76)** their physical activities (walking, stair use, etc.).

### **5.2 Commuting Practices**

The Mankato CSB facility resides in the center of the Capitol Complex grounds. It is accessible via highways 94 to the south and 35E to the east and the Green Line light rail on University Avenue to the north. There are also multiple public transportation bus stops located nearby. Vehicle parking is available at surface lots, parking ramps, and on-street locations, including disability parking available throughout. In addition, bicycle racks and EV charging stations are located near the Mankato CSB. Note that the overall percentages presented below may not total 100%, due to rounding.

Table 5 provides results on employees’ primary mode of transportation; Table 6 summarizes commuting distances between home and the Mankato CSB facility; and Table 7 summarizes employees’ ability to commute using alternative choices (walk, public transit, bike, van or carpool, motorcycle/moped, 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 – Mankato CSB Primary mode of transportation

Primary Mode of Transportation (N=17)	Drive Alone (or w/children <16)	Walk
Commuting to Mankato CSB	94%	6%

Related to primary modes of transportation, over 94% of employees drive alone (or with children under 16), nearly 6% of employees walk. No employees use a carpool or vanpool, public transportation, a bicycle, or a motorcycle/moped to get to work, and none telecommute.

Table 6. Commuting Practices – Mankato CSB Commuting distance traveled

Miles Traveled (N=17)	0-5	6-15	16-30	31-45	46-60
Home-to-Mankato CSB (One-way)	29%	35%	18%	6%	12%

Results indicate that over 29% of employees commute 0-15 miles one-way between home and the Mankato CSB, followed by over 35% who commute 6-15 miles, nearly 18% who commute 16-30 miles, nearly 6% who commute 31-45 miles, and nearly 12% who commute 46-60 miles. No one commutes more than 60 miles. These are one-way miles.

Table 7. Commuting practices – Mankato CSB location and alternative commuting behaviors

Alternative Commuting	Mean	SD	N
Ability to commute in alternative ways	4.59	1.82	17

Results indicate that location of the Mankato CSB **enhanced (M = 4.59)** employees’ ability to commute to work in alternative ways, e.g., walk.

## 6.0 Conclusions

### 6.1 Summary

A post-occupancy evaluation was conducted of employees of the Mankato CSB at approximately 28 months after it was first occupied. About 31% of faculty and staff responded to the survey, reporting their satisfaction with the physical environment of the facility and their primary workspace. Results indicate that over 71% of employees spend more than 30 hours per week in the Mankato CSB facility, and over 85% of employees spend more than 50% of their time at the Mankato CSB 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 = 6.39**); they found the facility **enhanced** their work performance (**M = 6.11**) and **enhanced** their health (**M = 5.50**). In addition, similar results were reported when employees were asked these same questions about their primary workspaces (private office, shared office, workstations, etc.). They reported **satisfaction (M = 5.89)** with their primary workspaces, that their work performance was **enhanced (M = 6.00)**, and their health was **enhanced (M = 5.50)** by their

primary workspace. As the range of scores was from 1-7, the scores showed a moderately high level of satisfaction with the facility and the primary workspace. (The satisfaction/enhancement range is 4.51-7.00).

Most of the survey questions related to employees' satisfaction with the IEQ criteria in their primary workspaces (private office, workstations, etc.). Employees' responses showed they were **satisfied** with all 26 IEQ criteria. The mean satisfaction scores ranged from **6.65** (Overall cleaning and maintenance) to **5.06** (adjustability of thermal conditions). Again, this shows a consistently positive level of **satisfaction**.

From employees' responses, an IEQ Score was developed and shows respondents' moderately high level of satisfaction with the majority of all IEQ category level criteria. For the Mankato CSB, the IEQ Satisfaction Score was **6.03**. This score reflects the influence of the very high satisfaction level (6.65-6.24) of five (5) of the 12 categories and the influence of the moderately high satisfaction level (6.12-5.29) of the remaining six (6) categories. Finally, employees reported that the Mankato CSB **enhanced (5.76)** their physical activity, which is one of the sustainable design criteria that influences occupant behavior.

Although employees' satisfaction mean scores were positive, it is possible that they could be further enhanced. 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 the results of the survey show a central tendency of moderately lower 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.

## **6.2 Recommendations**

Several IEQ criteria satisfaction scores are in the positive direction, however, improvement on the 'neutral' and 'dissatisfied' criteria 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 level and quality of lighting 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 the applicable version of ASHRAE Standard 55, or Human Factors Design Handbook (see B3 Guidelines). For additional information, consider reviewing Human Factors and Ergonomics Design Handbook, Third Edition (2016), by Barry Tillman, published by McGraw-Hill, NY.

## **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. The Mankato CSB employees raised some general and very specific concerns and positive comments related to acoustic quality, amenities, daylighting/electric lighting and lighting controls, furnishings, operations and cleaning/maintenance, site, spatial layout, technology/electrical, thermal conditions and control, and wayfinding and signage. Generally, the comments are shown exactly as written.

### **Overall Positive/Negative**

- I think it is a nice building.
- Truly an amazing workplace!
- In general, it's a beautiful building and I really love the energy efficient features such as automatic lights, faucets, flushing.
- I work on the third floor and make myself take the stairs most of the time, so I get a little extra exercise each day.

### **Acoustic Quality**

- My office has an open ceiling and the blower/fan seems quite loud compared to other offices with acoustic tile ceilings.

### **Amenities**

- Need more drinking fountains!

### **Daylighting/Electric Lighting and Lighting Controls**

- I love having the big windows and natural light. When I started working on campus, I was in a basement office with no windows. I will never go back to a work environment like that!
- Overhead lighting changes from bright to dim on its own. Will not hold a light intensity once set.
- The windows in my office are partial, starting at shoulder height (for a short person), which limits my view of anything but the sky. Other offices have floor to ceiling windows.

### **Furnishings**

- All the desk spaces were originally fixed countertops. I have since had to purchase a sit-stand desk to accommodate my needs.

### **Operations and Cleaning/Maintenance**

- Concern about possible mold due to building not being fully enclosed and moisture getting into sheet rock/walls.

### **Site**

- It takes me 9 minutes to drive and it takes an hour on public transit to get here. Also, there is no incentive to take public transit a couple days a week when I already have to pay for my monthly parking. Why isn't there any incentive to not drive every single day?! And why don't buses come here?!

### **Spatial Layout**

- Office could be a little wider to have the ability to rotate desk.
- The design of my workspace is odd with limited options to rearrange it.

### **Technology/Electrical**

- Can always use more outlets and ethernet ports in offices.
- Minimal plug-ins in office.
- Another Dell/ Microsoft computer, non- Apple computer, would be nice. One that is updated and not slow.
- Computer equipment provided was older and placed in our work space from another location.
- Technology for recording does not work.

### **Thermal Conditions and Control**

- Sometimes I don't have someone in the office next to me (where temperature control is located) so sometimes office is cold/warm. I do like it warmer though in summer and winter, so it hasn't been a big issue. Sometimes, it gets too warm in summer though, especially when very humid.
- The air temperature varies a great deal throughout the building and there are thermostats, but they are unreliable and not present in all spaces. For example, some offices are quite warm, and some are quite cold. The stairwells are very warm (due to the windows) but doesn't seem to regulate well depending on weather.

### **Wayfinding and Signage**

- Bathroom signage could be added.

## 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).