December 15, 2020

Mr. David Wisnewski
MN Department of Corrections
Suite 200
1450 Energy Park Drive
St Paul, MN  55108-5219

Subject: Air Quality Assessment
          Minnesota Correctional Facility – Red Wing
          IHSC Project Number: M20-551.7

Dear Mr. Wisnewski:

Industrial Hygiene Services Corporation (IHSC) has completed our assessment of air
quality associated with the living units at the Minnesota Correctional Facility in Red Wing,
Minnesota. The air quality assessment was developed to describe indoor air quality (IAQ)
metrics that were present within living unit areas of the facility and to develop
recommendations to improve observed conditions or the measured results that fall outside
of industry or regulatory standards.

Assessment work was completed on December 11, 2020.

SCOPE OF WORK AND ASSESSMENT LOCATIONS

The following areas and spaces within the facility were part of the IAQ assessment.

Air Handling Units (AHUs) in Living Units Brown, Dayden, Yale, Princeton,
Harvard, Stanford, and Knox

Specific AHUs within the referenced living units where data was collected as part of the air
quality assessment included:

- Brown Building
  - AHU 1
• Dayden Building
  o AHU 1
  o AHU2

• Yale Building
  o AHU 1

• Princeton Building
  o AHU 1

• Harvard Building
  o AHU 1

• Stanford Building
  o AHU 1

• Knox and Grinnell Buildings
  o No AHU serves these buildings (direct radiation and window A/C)

Adenosine Triphosphate Sampling in Living Unit Spaces

Facility staff informed IHSC personnel that all living units had no known cases of Covid-19 as of the date of the assessment. IHSC selected the Brown Building and Knox Building as representative living units to measure cleanliness and cleaning practices throughout the facility. IHSC obtained Adenosine Triphosphate (ATP) samples from surfaces within these buildings.

TEST PROCEDURES AND METHODS

To assess ambient IAQ conditions, IHSC used a variety of direct reading instruments to collect data that could be compared to relevant regulatory and industry standards for the purpose of describing overall indoor air quality.

Sampling and assessment focused on temperature, relative humidity (RH), carbon monoxide (CO), carbon dioxide (CO₂), air movement parameters including air velocity and air volume, and efficiency of filter capture through measurement of ultrafine particles (particles between 0.02 and 1 micron in diameter).

In addition, visual inspection and observations were recorded (Table 1) and digitally documented (Exhibit 1), where possible.
**Evaluation Parameters**

**Air Flow and Air Volume**

Air flow and volume measurements were made with a calibrated hot wire anemometer (TSI VelociCalc, Model 9535). Measurements were compared with building automation system controls, if available. Particular attention was given to air movement at room boundaries to determine pressurization features.

**Common Indoor Air Quality Parameters**

Industrial Hygiene Services Corporation obtained measurements for temperature, RH, CO, and CO₂ using a calibrated IAQ Calc (TSI IAQ Calc, Model 7545). Spot measurements collected were evaluated against published American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE) and Occupational Safety and Health Administration (OSHA) guidance. These data can indicate areas of inadequate air movement or mixing and the presence of contaminants from outside the room boundaries.

**Ultrafine Particle Concentration**

Ultrafine particle concentrations were measured to obtain heating, ventilation, and air conditioning (HVAC) air filter performance. A calibrated ultrafine particle counter (TSI P-Trak, Model 8525) was used upstream and downstream of the supply air filter banks to perform this assessment. In addition, indoor air or make-up air was evaluated against outside air to determine the concentration of ultrafine particulate that was captured through the return air system. This device measures particles between 0.02 and 1 micron in diameter. Measurements were obtained from the upstream and downstream side of the filter banks to determine capture efficiency and areas of by-pass that may be present in the filter bank.

**Heating, Ventilation, and Air Conditioning System Inspection**

Inspection of the evaluated HVAC systems occurred at specific locations where access was available or where critical components requiring maintenance were present. Qualitative visual inspection of the HVAC units was documented with digital images, where possible. Representative images are included with this report as Exhibit 1.
Adenosine Triphosphate Sampling

To evaluate the level of cleaning occurring at locations where staff and offenders have access to high touch surfaces and where routine cleaning of those surfaces should be occurring daily, IHSC used adenosine triphosphate (ATP) swabs to measure ATP concentrations. Surface bioburden was collected with Hygiena brand UltraSnap test swabs following the manufacturer’s instructions and analyzed in a Hygiena SystemSure Plus luminometer. Adenosine Triphosphate concentrations can be used to assess the level of cleanliness of the sampled surface.

Adenosine Triphosphate is the energy molecule that is present in all living cells. An ATP test will determine if a surface is contaminated with organic residue. An ATP test will not specify the type of organic residue present, but the results will indicate that a surface contains bioburden. Used as a screening tool, it is effective in rapidly evaluating surface conditions in nearly any work environment.

Adenosine Triphosphate was measured as a Relative Light Unit (RLU) or unit of measure for bioluminescence. Measuring the amount of bioluminescence from an ATP reaction provides an excellent indication of surface cleanliness because the quantity of light generated by the reaction is directly proportional to the amount of ATP present in the sample. The bioluminescence reaction is immediate, and results are expressed numerically on the luminometer screen in RLUs.

For interpretation of ATP surface sampling results in RLUs, the following criteria have been used in this report: lower than 30 RLUs = Pass (acceptable condition), 30 to 100 RLUs = Caution, and greater than 100 RLUs = Fail (unacceptable condition). The acceptance criteria levels were based on information provided by Hygiena’s product information, “Establishing RLU Pass/Fail Limits”, retrieved from https://www.hygiena.com/rlulimits-hc.html.

Surfaces evaluated included surfaces that offenders or staff would likely come in contact. Variation in measured ATP concentrations of similar surfaces is likely attributed to the inconsistent cleaning techniques employed by personnel during the cleaning process. The sample results and sample locations for all buildings tested are summarized in the attached Table 2.

Interviews and Maintenance Record Review

Industrial Hygiene Services Corporation reviewed maintenance activities, procedures, and discussed maintenance schedules with physical plant staff. Observations and information
obtained from facility personnel have been incorporated into the recommendations of this report.

**PROJECT OBSERVATIONS AND RESULTS**

**Air Handling Units (AHUs) in Living Units Brown, Dayden, Yale, Princeton, Harvard, Stanford, Know and Grinnell Buildings**

One of seven AHUs in the referenced buildings allowed the assessor to measure the UFP count while the AHU was completely sealed (Brown was the only living unit that could be tested when sealed). IHSC obtained IAQ data in the remaining units without a complete seal. AHU openings caused the measurements to reflect the actual conditions less accurately than the units that could be completely sealed during testing. In review of the data obtained from the other Minnesota correctional facilities assessed, IHSC has calculated that there was a 3.5% decrease in measured ultrafine particle filter capture when the AHU was not fully sealed. This indicates that a slight, but mostly negligible, loss of accuracy when taking measurements in unsealed AHUs.

All the Red Wing AHUs included at least one set of air filters with a Minimum Efficiency Reporting Value (MERV) of 8. No filters were observed with a MERV rating greater than 8. Replacement filters were observed in each of the mechanical spaces. Facility staff reported that filters are scheduled to be changed quarterly based on established periodic maintenance schedules established for the facility.

In general, the HVAC filters were found to both reduce the air velocity and ultrafine particle (UFP) levels. The average UFP level from all tested interior locations was 709 particles per cubic centimeter (pt/cm³), which is a very low number for occupied interior spaces. The exterior reading on the day of sampling was 1,290 pt/cm³, which is at the low end of a typical exterior reading for this time of year in Minnesota. The average capture efficiency for all AHUs at the facility using the exterior ultrafine particle measurement was 29 percent (%). When circulated indoor air was measured for ultrafine particles in all AHUs at the facility, there was an average of 24% UFP reduction in ultrafine particles, which is a very acceptable capture rate given the size of the AHUs and type of filters in use. Filter reduction efficiency is affected by several factors including gaps in the filter bank, MERV rating of the air filters, proper filter installation, and data collection technique.

The use of air filters with a MERV 8 rating within the living units is appropriate for the size and age of the air handling units. When present, elevated levels of UFP measured on the downstream side of the supply filters would indicate that maintenance or repair is necessary. The measured values of capture efficiency and UFP reduction are consistent with manufacturer performance data for filters with a MERV rating of 8.
The average recorded CO₂ level from in and adjacent to the AHUs was determined to be 653 parts per million (ppm). The exterior air on the day of sampling was measured at 420 ppm. The measured interior value falls below the 1,000-ppm threshold as set by OSHA as the upper indoor CO₂ limit. The air supplied to the living areas is a mixture of interior return air and fresh air from the exterior.

Air flow and indoor air quality parameters were measured at the supply and return register in the common area of the Brown and Stanford Buildings to gauge the air quality within the living unit spaces. The followings measurements were obtained:

<table>
<thead>
<tr>
<th>Building</th>
<th>Location</th>
<th>Supply (cfm)</th>
<th>Return (cfm)</th>
<th>Temp (°F)</th>
<th>Relative Humidity (%)</th>
<th>CO (ppm)</th>
<th>CO₂ (ppm)</th>
<th>Pressure Relative to the Exterior</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brown</td>
<td>Common Area</td>
<td>230</td>
<td>93</td>
<td>74.6</td>
<td>32.8</td>
<td>0</td>
<td>732</td>
<td>Positive</td>
</tr>
<tr>
<td>Stanford</td>
<td>Common Area</td>
<td>103</td>
<td>609</td>
<td>76.6</td>
<td>23.1</td>
<td>0</td>
<td>589</td>
<td>Negative</td>
</tr>
</tbody>
</table>

In both areas, air supplied was between 100 and 230 cubic feet per minute while the return air volume was between 93 and 609 cubic feet per minute. Common indoor air quality parameters measured in these spaces were within expected ranges published by the ASHRAE and the OSHA. Additional indoor air quality data for each living unit is presented later in the report.

**Brown Building Observations**

The Brown Building is served by a single air handling unit. The air handler is in a dedicated mechanical room, and the unit is outfitted with a single set of MERV 8 rated filters. The building is slightly positive in relation to the exterior, which could create an issue with exterior doors not closing completely.

The air handling unit, while older and of a pre-digital era, appeared to be maintained and records were present indicating maintenance activities and filter change out schedules. The facility engineer reported that the age of the AHU made it difficult to obtain and hold air flow needs of the occupants, causing balance issues in the building. This condition is magnified in the spring and fall when daytime and nighttime temperatures can vary widely.

The inside of the AHU housing was observed to have a small accumulation of debris. The filters were change on October 30, 2020 and were observed with expected debris on the filter face. Visible internal duct surfaces contained expected accumulation. Facility
personnel were unsure when, or if, the ventilation system had ever been cleaned. Air volume measurements (12,300 cubic feet per minute on the upstream side of the filters and 11,970 CFM on the downstream side of the filters) indicate significant air movement through the ventilation system and in the living space the building. Measurements of ultrafine particles upstream (454 pt/cm³) and downstream (444 pt/cm³) of the filter were very low and indicated an acceptable degree of particulate capture, given the type of filters in use. Measured values of UFP on the interior of the building were less than the ambient UFP level on the exterior of the building indicating adequate filtering of outside air.

The Brown Building was reported by facility staff to be free of known Covid-19 positive offenders. IHSC was able to enter the living unit and observed correctional officers and offenders properly wearing masks and maintaining reasonable social distances. Signage was present directing readers on how to implement Covid-safe practices.

**Dayden Building Observations**

The Dayden Building is severed by two AHUs. Both units are in a dedicated mechanical room within the building. Each unit is outfitted with a single set of MERV 8 rated filters. The Dayden Building is slightly negative in relation to the exterior.

The AHUs appeared to be well maintained and records were present indicating maintenance activities and filter change out schedules. The interior of AHU 1 and AHU 2 was observed to have a small accumulation of interior dirt present. AHU 2 was observed to have a slightly a greater accumulation of debris on filter faces than AHU 1. Facility personnel were unsure when, or if, the ventilation system had ever been cleaned. Air volume and ultrafine particle measurements for each unit were measured as presented below:

<table>
<thead>
<tr>
<th>Unit</th>
<th>Upstream Volume</th>
<th>Downstream Volume</th>
<th>Upstream UFP</th>
<th>Downstream UFP</th>
</tr>
</thead>
<tbody>
<tr>
<td>AHU 1</td>
<td>10,390</td>
<td>3,476</td>
<td>674</td>
<td>564</td>
</tr>
<tr>
<td>AHU 2</td>
<td>12,023</td>
<td>5,302</td>
<td>1,500</td>
<td>707</td>
</tr>
</tbody>
</table>

Air volume measurements indicate air movement through the ventilation system is acceptable with slightly higher volume drops at the filter bank than would normally be expected. Measurements of ultrafine particles were as expected, noting that the upstream loading of UFP in AHU2 may be an indication of the amount of dust present in the return side of the ventilation system. Measured values of UFP on the interior of the building were
less than the ambient UFP level on the exterior of the building indicating adequate filtering of outside air.

The Dayden Building was reported by facility staff to be free of known Covid-19 positive offenders. IHSC was able to enter the living unit and observed correctional officers and offenders properly wearing masks and maintaining reasonable social distances. Facility personnel indicated that extensive signage is present within the living unit to direct and remind occupants of proper Covid-19 practices.

Yale Building Observations

A single air handling unit serves the Yale Building. The air handler is in a dedicated mechanical room within the building and is outfitted with a single set of MERV 8 rated filters. The Yale Building is slightly negative in relation to the exterior.

The air handling unit appeared to be well maintained and records were present indicating maintenance activities and filter change out schedules. IHSC observed moderate accumulations of dirt on the interior surfaces of the air handling unit. Facility personnel were unsure when, or if, the ventilation system had ever been cleaned. Air volume measurements (8,824 cubic feet per minute [CFM] upstream to 5,880 CFM downstream) indicate air movement through the ventilation system and expected volume drops at the filter bank. Measurements of ultrafine particles upstream (1,120 pt/cm³) and downstream (770 pt/cm³) of the filter indicated an acceptable degree of particulate capture, given the type of filters in use. Measured values of UFP on the interior of the building were less than the ambient UFP level on the exterior of the building indicating adequate filtering of outside air.

The Yale Building was reported by facility staff to be free of known Covid-19 positive offenders. IHSC was able to enter the living unit and observed correctional officers and offenders properly wearing masks and maintaining reasonable social distances. Facility personnel indicated that extensive signage is present within the living unit to direct and remind occupants of proper Covid-19 practices.

Princeton Building Observations

A single air handling unit serves the Princeton Building. The air handler is in a dedicated mechanical room within the building and is outfitted with a single set of MERV 8 rated filters. The Princeton Building is slightly negative in relation to the exterior.
Maintenance records for the air handling unit were available and the filters had been changed in the air handling unit on October 28, 2020. The filter change was recorded on the side of the filters. IHSC observed slight accumulations of dirt on the interior surfaces of the air handling unit. Facility personnel were unsure when, or if, the ventilation system had ever been cleaned. Air volume measurements (8,824 cubic feet per minute [CFM] upstream to 5,779 CFM downstream) indicate acceptable air movement through the ventilation system. Measurements of ultrafine particles upstream (1,120 pt/cm³) and downstream (770 pt/cm³) of the filter indicated an acceptable degree of particulate capture, given the type of filters in use. Measured values of UFP on the interior of the building were less than the ambient UFP level on the exterior of the building indicating adequate filtering of outside air.

The Princeton Building was reported by facility staff to be free of known Covid-19 positive offenders. IHSC was able to enter the living unit and observed correctional officers and offenders properly wearing masks and maintaining reasonable social distances. Facility personnel indicated that extensive signage is present within the living unit to direct and reminder occupants of proper Covid-19 practices.

Harvard Building Observations

A single air handling unit serves the Harvard Building. The air handler is in a dedicated mechanical room within the building and is outfitted with a single set of MERV 8 rated filters. The Harvard Building is slightly negative in relation to the exterior.

Maintenance records for the air handling unit were available and filters were changed on October 28, 2020. IHSC observed moderate accumulations of dirt on the interior surfaces of the air handling unit, with a lesser accumulation on the downstream side of the system. Facility personnel were unsure when, or if, the ventilation system had ever been cleaned. Air volume measurements (6,939 cubic feet per minute [CFM] upstream to 7,658 CFM downstream) indicate air movement through the ventilation system and expected volume drops at the filter bank. Measurements of ultrafine particles upstream (614 pt/cm³) and downstream (1,080 pt/cm³) of the filter indicated an unusual condition in the building. Typically, downstream UFP levels are less than the upstream values due to the air passing through filtration. The observed condition could indicate opening in the downstream duct system that allow return air to by-pass the filter bank. IHSC did not observe obvious opening, gaps, or area of by-pass in the filter bank. Measured values of UFP on the interior of the building were less than the ambient UFP level on the exterior of the building indicating that filtering of the interior air is occurring.
The Harvard Building was reported by facility staff to be free of known Covid-19 positive offenders. IHSC was able to enter the living unit and observed correctional officers and offenders properly wearing masks and maintaining reasonable social distances. Facility personnel indicated that extensive signage is present within the living unit to direct and remind occupants of proper Covid-19 practices.

Stanford Building Observations

A single air handling unit serves the Stanford Building. The air handler is in a dedicated mechanical room within the building and is outfitted with a single set of MERV 8 rated filters. The Stanford Building is slightly negative in relation to the exterior.

Maintenance records for the air handling unit were available and the filters had been changed in the air handling unit on May 28, 2020. The filter change was recorded on the side of the filters. IHSC observed moderate accumulations of dirt on the interior surfaces of the air handling unit and small by-pass gaps in the filter bank. Facility personnel were unsure when, or if, the ventilation system had every been cleaned. Air volume measurements (4,005 cubic feet per minute [CFM] upstream to 2,773 CFM downstream) indicate acceptable air movement through the ventilation system. Measurements of ultrafine particles upstream (257 pt/cm³) and downstream (249 pt/cm³) of the filter indicated an acceptable degree of particulate capture, given the type of filters in use. Measured values of UFP on the interior of the building were less than the ambient UFP level on the exterior of the building indicating adequate filtering of outside air.

The Stanford Building was reported by facility staff to be free of known Covid-19 positive offenders. IHSC was able to enter the living unit and observed correctional officers and offenders properly wearing masks and maintaining reasonable social distances. Facility personnel indicated that extensive signage is present within the living unit to direct and remind occupants of proper Covid-19 practices.

Knox and Grinnell Building Observations

The Know and Grinnell Living Units are not served by an air handling unit but provide heat through direct radiation and cooling through window-mounted air conditioning units. IHSC obtained data from these buildings to determine general indoor air quality in living units where there was no mechanical movement or filtering of air in use. The Knox and Grinnell Buildings are slightly positive in relation to the exterior.

Measured values of UFP on the interior of the buildings were less than the ambient UFP level on the exterior of the building.
The Knox and Grinnell Buildings were reported by facility staff to be free of known Covid-19 positive offenders. IHSC was able to enter the living units and observed correctional officers and offenders properly wearing masks and maintaining reasonable social distances. Facility personnel indicated that extensive signage is present within the living units to direct and remind occupants of proper Covid-19 practices.

**Indoor Air Quality Measurements**

The American Society of Heating, Refrigeration and Air Conditioning Engineers and OSHA recommends ambient room temperature between 68 degrees Fahrenheit (°F) to 76°F.

The American Society of Heating, Refrigeration and Air Conditioning Engineers recommends a RH level between 30% and 70%. The Occupational Safety and Health Administration recommends a level between 20% and 60%. The average humidity level recorded in interior areas were below the OSHA and ASHRAE recommendations. Low humidity levels have been shown to dry the lining of nasal passages making occupants susceptible to rhinoviruses.

The American Society of Heating, Refrigeration and Air Conditioning Engineers recommends a CO₂ level below 1,000 parts per million (ppm). The Occupational Safety and Health Administration, based on the National Institute for Occupational Safety and Health recommendations, recommends 600 ppm for minimal air quality complaints and 1,000 ppm as an upper limit for indoor levels. The Occupational Safety and Health Administration also has a Permissible Exposure Limit (PEL) Time Weighted Average (TWA) of 5,000 ppm. The minimum, maximum, and average readings for all areas tested were all well below the maximum recommended CO₂ reading of 1,000 ppm.

The American Society of Heating, Refrigeration and Air Conditioning Engineers recommends a CO level below 9 ppm in an office setting, and Minnesota OSHA sets a PEL TWA over an eight-hour period of 35 ppm. Measurements for CO on December 11 were 0 ppm at all locations except the mechanical spaces for the Harvard and Stanford Buildings, which was measured at 1.8 ppm and 1.7 ppm, respectively. The two values over zero are negligible and CO will not be addressed in the rest of the report.

Table 1 attached to this report presents data obtained at each air handling unit and living unit space that was functioning and accessible.
Brown Building

Temperature measured in the common area was 67.1°F, the RH measured was 44.1%, and the CO₂ level was measured was 645 ppm. The temperature measured in the Brown Building was slightly less than the OSHA and ASHRAE recommended range. The CO₂ levels and the RH measurements were within the OSHA and ASHRAE recommended comfort range.

Using 30 Relative Light Units (RLUs) as an acceptable level of bioburden cleanliness, a single surface in the building where measurements were taken met this criteria (officer desk). Using 100 RLUs as cautionary, five areas in the Brown Building were found to have bioburden levels greater than 100: a chess table, a telephone handle, a sink handle, a countertop, and a chair outside of the common area.

Based on the criteria presented above, five areas within the Brown Building indicated unacceptable levels of bioburden present. Those surfaces included a Jpay Kiosk keyboard, TV remote control, a door push plate, a door handle, and the top of an end table. The variation in bioburden values is likely due to inconsistent effort used to clean surfaces within the living unit, or the frequency of cleaning of those surfaces. Surfaces like those sampled should be cleaned, as practicable, after each use.

The facility has developed a standard operating procedure for the use of handheld sprayers and food service sanitizer and disinfectant to clean commonly touched surfaces within the living units. The food service sanitizer in use will effectively address viruses, bacteria, and fungi. The period that the surface must remain damp to achieve the manufacturers efficacy performance is generally two minutes. Physically scrubbing a surface that has been sprayed will further enhance the effectiveness of the sanitizer and disinfectant.

A copy of the of the Department of Corrections Workplace Cleaning/Disinfecting Procedures is attached at Attachment 4, Exhibit 2. This is an very good outline of cleaning procedures and cleaning frequency to be followed within the living units.

Several signs addressing Covid-19 were seen on the exterior and within the common areas of the building.
Dayden Building

Ambient conditions were measured in the Dayden Building. The temperature was measured at 68.6°F, the RH was measured at 27.4%, and the CO₂ level was measured at 473 ppm. All measured values were within the OSHA and ASHRAE recommended range.

Several signs addressing Covid-19 were seen on the exterior and within the common areas of the building.

Yale Building

Ambient conditions were measured in the Yale Building. The temperature was measured at 78.4°F, the RH was measured at 24.8%, and the CO₂ level was measured at 790 ppm. All measured values were within the OSHA and ASHRAE recommended range, although temperature and CO₂ levels were trending toward the upper end of the range and could indicate lack of air movement within the living unit space.

Several signs addressing Covid-19 were seen on the exterior and within the common areas of the building.

Princeton Building

Ambient conditions were measured in the Princeton Building. The temperature was measured at 75.5°F, the RH was measured at 26.1%, and the CO₂ level was measured at 745 ppm. All measured values were within the OSHA and ASHRAE recommended range. As indicated earlier in the report, mixing of air and the overall balance of air delivery is likely to account for the elevated CO₂ and temperature measured within the space.

Several signs addressing Covid-19 practices were seen on the exterior and within the common areas of the building.

Harvard Building

Ambient conditions were measured in the Harvard Building. The temperature was measured at 84.1°F, the RH was measured at 30.0%, and the CO₂ level was measured at 1,097 ppm. As indicated earlier in the report, mixing of air and the overall balance of air delivery is likely to account for the elevated CO₂ and temperature measured within the space.
Several signs addressing Covid-19 precautions were seen in the common areas of the building.

**Stanford Building**

Ambient conditions were measured in the Stanford Building. The temperature was measured at 81.0°F, the RH was measured at 28.0%, and the CO₂ level was measured at 627 ppm. All measured values were within the OSHA and ASHRAE recommended range, although the measured temperature slightly exceeded the top of the recommended comfort range.

Several signs addressing Covid-19 precautions were seen in the common areas of the building.

**Novell Building**

The interior of the Novell Building was not accessed due to the presence of the roof top AHUs. No ambient indoor air quality measurements were obtained from this building.

**Knox and Grinnell Buildings**

While there is no air handling unit in the Knox or Grinnell Building, ambient conditions were measured. The temperature was measured at 70.9°F, the RH was measured at 28.5%, and the CO₂ level was measured at 731 ppm. All measured values were within the OSHA and ASHRAE recommended range.

Five surfaces were sampled in the Knox Building for the presence of bioburden. Using 30 Relative Light Units (RLUs) as an acceptable level of bioburden cleanliness, no areas of the building where measurements were taken met this criteria. Using 100 RLUs as cautionary, a single area in the Knox Building (metal countertop) was found to have bioburden levels greater than 100.

Based on the criteria presented above, four areas within the Knox Building indicated unacceptable levels of bioburden present. Those surfaces included an end table, a wood handrail, a metal door handle, and an area of ceramic floor. The variation in bioburden values is likely due to inconsistent effort used to clean surfaces within the living unit, or the frequency of cleaning of those surfaces. Surfaces like those sampled should be cleaned, as practicable, after each use.
The facility has developed a standard operating procedure for the use of handheld sprayers and food service sanitizer and disinfectant to clean commonly touched surfaces within the living units. The food service sanitizer in use will effectively address viruses, bacteria, and fungi. The period that the surface must remain damp to achieve the manufacturers efficacy performance is generally two minutes. Physically scrubbing a surface that has been sprayed will further enhance the effectiveness of the sanitizer and disinfectant.

A copy of the of the Department of Corrections Workplace Cleaning/Disinfecting Procedures is attached at Attachment 4, Exhibit 2. This is an very good outline of cleaning procedures and cleaning frequency to be followed within the living units.

Several signs addressing Covid-19 precautions were seen in the common areas of the building.

**Building Exterior Measurements**

Exterior to the building, the temperature was measured at 41.5°F, the RH was measured at 38.7%, and the CO₂ level measured at 420 ppm.

**COVID-19 Response Practices**

On the day of the assessment, staff, contractors, and offenders were observed to be wearing face masks properly.

Signs at the front entrance to the facility direct staff, visitors, and vendors not to enter if they are showing symptoms consistent with COVID-19. Further, signs said face coverings and social distancing were required. Entrants have their temperature taken to confirm it is below the current required Center for Disease Control level before they can enter the building.

Floor markings were found inside the secure perimeter where lines of staff would typically be formed. Signage directing offenders and staff to wear masks and remain socially distanced were observed in passageways and in living units as the assessors passed through them to go to the AHU Rooms or were visible in common areas.

**RECOMMENDATIONS**

Overall, the air quality in the living units at the Red Wing facility is very good. Based on the observations and measurements made at the Red Wing facility, IHSC has outlined the following recommendations for action or considerations to modify current practice:
1. Develop an annual cleaning schedule for AHUs and ducts in the living units; however, this recommendation is not required with the same urgency as other correctional facility units evaluated. Full time occupancy of the building will create duct occlusion that will reduce air quality and air movement capacity over time. In a sequenced manner, duct cleaning is recommended for these buildings in the next two to five years. Duct cleaning in the future for the facility should be done on rotational basis so that at least two buildings are inspected and cleaned (if necessary) on an annual basis. Begin with the buildings with highest occupancy and work toward the buildings with lower occupancy.

2. When duct cleaning is performed, duct interiors should be treated with Oxine (or an equivalent) as a broad-spectrum sanitizer and disinfectant.

3. When installing air filters, ensure the filter is properly seated in the frame to create a seal. Review filter placement in the Stanford Building. Minimizing air by-pass in the filter racks will improve the capture efficiency of particulate material present in the HVAC system.

4. Filters are scheduled to be replaced quarterly in the living units. Improve the recordkeeping and labeling of filter service at each AHU.

5. At the time of filter change, inspect each air handling unit filter bank to remove gaps, openings, and other areas of by-pass. Air quality can be improved by more efficient capture of particulate in the filter media.

6. Consider routine and frequent electrostatic spraying of living units. Electrostatic spray surface cleaning is the process of spraying an electrostatically charged mist onto surfaces and objects. Electrostatic spray uses a specialized solution that is combined with air and atomized by an electrode inside the sprayer. Subsequently, the spray contains positively charged particles that can aggressively adhere to surfaces and objects. Because the particles in the spray are positively charged, the droplets become attracted to all negative surfaces, covering the visible area, underside, and backside, with the sanitizing agent.

Surfaces that are already covered will repel the spray, making the method extremely efficient. This allows the appropriate sanitizers, mold preventatives and disinfectants to wrap around and evenly coat all types of surfaces for a more complete clean.
For awkwardly shaped objects or hard to reach places, cleaning staff only have to point and spray; the nature of the mist allows it to coat surfaces evenly, and envelope objects—even if the mist is only sprayed from one side. After the spray is applied, the sanitizing agent works to disinfect the covered surfaces. For this reason, electrostatic spray is an excellent solution for germ and contaminant ridden areas.

7. Routine cleaning of surfaces within the living unit areas evaluated was acceptable. Continued diligence with the use of a backpack sprayer or handwork to routinely clean commonly used or touched surfaces will reduce bioburden present on those surfaces and will aide in decreasing the risk of pathogen transmission. Focus hand wiping on commonly used surfaces such as vending machine keypads, door handles, and phone receivers, or where effective coverage with the disinfectant is not possible. Rigorously implement the Department of Corrections Workplace Cleaning/Disinfecting Procedures.

8. Increase the frequency of cleaning surfaces within the living units and verify its efficacy by measuring the RLUs of ATP on those surfaces. Consider routine cleaning of surfaces at twice the frequency that currently employed. Cleaners used should be selected from the Environmental Protection Agency’s (EPA) N-listed cleaners: https://www.epa.gov/pesticide-registration/list-n-disinfectants-coronavirus-covid-19

9. Continue emphasizing the need for good Covid-19 practices in the living units, including social distancing, routine cleaning of commonly handled items, hand washing, and correct use of face coverings. Keeping the virus out of the living units is the surest way of protecting offenders and staff.

10. To the extent possible, segregate of positive cases from negative cases so that community spread can be controlled at a higher level.

11. The air handling equipment in the Brown Building (in particular) is aged and is difficult to operate in a manner to ensure common indoor air quality parameters can be maintained within published ranges. Consideration should be given to developing a capital improvement plan to replace this unit with one that can better integrate with other facility units and provide improved indoor air quality to the occupants.
We appreciate the opportunity to assist your office. If you have any questions, please contact me at (651) 287-5375.

Sincerely,

INDUSTRIAL HYGIENE SERVICES CORPORATION

Timothy P. Huber, CHMM, PG
Senior Project Manager

cc: Mr. Glen Heino, RECS
    Mr. Al Pfeilsticker, MCF-Red Wing

Attachments (4):

Table 1 – Air Handling Units Air Velocity, IAQ, and Ultrafine Particulate Measurements
Table 2 - ATP Surface Sampling Results
Exhibit 1 – Representative Site Images
Exhibit 2 - Department of Corrections Workplace Cleaning/Disinfecting Procedures
ATTACHMENT 1

Air Handling Unit Air Velocity, Indoor Air Quality, and Ultrafine Particle Measurements
<table>
<thead>
<tr>
<th>Building</th>
<th>Unit or Location Relative to Filter</th>
<th>AHU-1</th>
<th>AHU-2</th>
<th>AHU Penthouse</th>
<th>AHU-1</th>
<th>AHU-2</th>
<th>AHU Penthouse</th>
</tr>
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<tbody>
<tr>
<td></td>
<td></td>
<td>Room</td>
<td>Room</td>
<td>Room</td>
<td>Room</td>
<td>Room</td>
<td>Room</td>
</tr>
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<td></td>
<td>Relative to Filter</td>
<td>Upstream</td>
<td>Downstream</td>
<td>Upstream</td>
<td>Downstream</td>
<td>Downstream</td>
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</tr>
<tr>
<td>Brown Living Unit</td>
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<td></td>
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</tr>
<tr>
<td></td>
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<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Positive Pressure</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Main Door</td>
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<td></td>
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</tr>
<tr>
<td></td>
<td>AHU Room</td>
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</tr>
<tr>
<td></td>
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</tr>
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<td></td>
<td>AHU Penthouse</td>
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</tr>
</tbody>
</table>

### Comments
- Filters changed 10/30/20. Filters clean. Small dust build-up in AHU. AHU older and not digitized. Harder to maintain pressure balance.
- Facility engineer indicated that the return may be plenum. Positive pressure in building.
- Filters changed 09/28/20. Generally clean inside AHU. Pitot hole used upstream. Negative pressure in building.
- Filters changed 09/28/20. Some dirt build-up upstream. Pitot hole used upstream.
<table>
<thead>
<tr>
<th>Building</th>
<th>Unit or Location</th>
<th>Relative to Filter</th>
<th>Air Velocity</th>
<th>IAQ</th>
<th>P-Trak</th>
<th>Comments</th>
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<tbody>
<tr>
<td>Yale Living Unit</td>
<td>AHU Room</td>
<td>Ambient</td>
<td>NA</td>
<td>78.4</td>
<td>24.8</td>
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<td></td>
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<td>522</td>
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<td>Stanford Living Unit</td>
<td>AHU Room</td>
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<td>102.74</td>
<td>76.6</td>
<td>23.1</td>
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<td>467</td>
<td>NA</td>
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<td>Main Door</td>
<td>Negative Pressure</td>
<td>519</td>
<td>280.26</td>
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</table>
## AIR HANDLING UNIT VELOCITY, IAQ, AND ULTRAFINE PARTICULATES

<table>
<thead>
<tr>
<th>Building</th>
<th>Unit or Location</th>
<th>Relative to Filter</th>
<th>Air Velocity</th>
<th>IAQ</th>
<th>P-Trak</th>
<th>Comments</th>
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<tbody>
<tr>
<td>Knox Living</td>
<td>Common Area</td>
<td>Ambient</td>
<td>NA</td>
<td>NA</td>
<td>70.9</td>
<td>28.5</td>
</tr>
<tr>
<td>Outside</td>
<td>Outside</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>41.5</td>
<td>38.7</td>
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ATTACHMENT 2

Living Unit ATP Surface Sampling Results
<table>
<thead>
<tr>
<th>Sample #</th>
<th>Location</th>
<th>Item</th>
<th>Surface</th>
<th>Item</th>
<th>Surface</th>
<th>Item</th>
<th>Surface</th>
<th>Item</th>
<th>Surface</th>
<th>RLUs</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Brown Building, Common Area</td>
<td>Chess Table</td>
<td>Plastic</td>
<td>Brown Building, Guard Desk</td>
<td>Desktop</td>
<td>Painted Wood</td>
<td>Plastic</td>
<td>Brown Building, Common Area</td>
<td>Telephone Handle</td>
<td>Plastic</td>
<td>30</td>
</tr>
<tr>
<td>2</td>
<td>Brown Building, Guard Desk</td>
<td>Chess Table</td>
<td>Plastic</td>
<td>Brown Building, Across From Guard Desk</td>
<td>Telephone Handle</td>
<td>Plastic</td>
<td>25</td>
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<tr>
<td>3</td>
<td>Brown Building, Common Area</td>
<td>Telephone Handle</td>
<td>Plastic</td>
<td>Brown Building, Common Area</td>
<td>Push Plate</td>
<td>Metal</td>
<td>80</td>
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<tr>
<td>5</td>
<td>Brown Building, Common Area</td>
<td>Handle of Sink on Right wall</td>
<td>Plastic</td>
<td>Brown Building, Quiet Area</td>
<td>Chair Outside of Quiet Area</td>
<td>Metal</td>
<td>408</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Brown Building, Quiet Area</td>
<td>Counter Top</td>
<td>Wood</td>
<td>Brown Building, Quiet Area</td>
<td>Door Handle</td>
<td>Metal</td>
<td>51</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Brown Building, Quiet Area</td>
<td>Chair Outside of Quiet Area</td>
<td>Plastic</td>
<td>Brown Building, Common Area</td>
<td>End Table</td>
<td>Plastic</td>
<td>320</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Brown Building, Common Area</td>
<td>Chess Table</td>
<td>Plastic</td>
<td>Brown Building, Common Area</td>
<td>End Table</td>
<td>Plastic</td>
<td>37</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>9</td>
<td>Brown Building, Common Area</td>
<td>Chess Table</td>
<td>Plastic</td>
<td>Brown Building, Common Area</td>
<td>End Table</td>
<td>Plastic</td>
<td>109</td>
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</tr>
</tbody>
</table>
# Adenosine Triphosphate Swab Sample Results

<table>
<thead>
<tr>
<th>Sample #</th>
<th>Location</th>
<th>Item</th>
<th>Surface</th>
<th>RLU Results</th>
<th>Surface Guidance Level (RLU)</th>
<th>Pass/Caution/Fail</th>
</tr>
</thead>
<tbody>
<tr>
<td>12</td>
<td>Knox Building, Middle Stairwell</td>
<td>Handrail</td>
<td>Stained Wood</td>
<td>244</td>
<td>&lt;30</td>
<td>Fail</td>
</tr>
<tr>
<td>13</td>
<td>Knox Building, Kitchen</td>
<td>Countertop</td>
<td>Metal</td>
<td>38</td>
<td>&lt;30</td>
<td>Caution</td>
</tr>
<tr>
<td>14</td>
<td>Knox Building, Main Entry Door</td>
<td>Door Handle</td>
<td>Metal</td>
<td>114</td>
<td>&lt;30</td>
<td>Fail</td>
</tr>
<tr>
<td>15</td>
<td>Knox Building, Middle Stairwell</td>
<td>Floor</td>
<td>Ceramic Tile</td>
<td>116</td>
<td>&lt;30</td>
<td>Fail</td>
</tr>
</tbody>
</table>

* RLU – Relative light unit or unit of measure for bioluminescent measurements. Measuring the amount of bioluminescence from an ATP reaction provides an excellent indication of surface cleanliness because the quantity of light generated by the reaction is directly proportional to the amount of ATP present in the sample. The bioluminescence reaction is immediate and results are expressed numerically on the luminometer screen in Relative Light Units (RLU).

Interpretation of ATP surface sampling results (RLUs): <30 = Pass, 30 to 100 = Caution, and >100 = Fail. Guideline for Surface Sampling of Indoor Environmental Surfaces, Includes Initial Assessments, Pre-Cleaning, and Post Cleaning Verification Testing of Indoor Environment.
ATTACHMENT 3

Representative Site Images
Air Quality Assessment
Red Wing, Minnesota

Dirt Build-Up Downstream on Coil Face in AHU-1 of Yale Living Unit

Filter Bank Access Door Insulation Shedding Seen in AHU-1 of Princeton Living Unit

Moderate Dirt Build-Up in AHU-1 of Harvard Living Unit

Small Gap in Filter Bank in AHU-1 of Stanford Living Unit

Covid-19 Signage on Front Office Entrance in Administrative Building – Typical of Signage Seen Posted Around Facility and in Living Units

Photographs Taken By: Daniel Flynn
IHSC Project Number: M20-551.7
Workplace Disinfection Procedures

- **Cleaning Chemical Recommendation** Minncor’s Neutral Germicidal is a disinfectant that cleans and deodorizes in one step and can be used in staff, offender and public areas. Read product label and follow directions for use.

- **Dilution Ratio** Add 1 ounce of concentrated Germicidal per gallon of water. Don gloves and eye protection when cleaning.

- **Application** Apply solution with a mop, cloth, sponge, or hand-pump trigger sprayer so as to wet all surfaces thoroughly.

- **Contact Time** Allow to remain wet and air dry, or wait for 10 minutes then remove excess liquid. For heavily soiled areas, a pre-cleaning step is required.

- **Maximum Effectiveness** In addition to standard housekeeping practices, it is recommended to disinfect frequently touched surfaces and shared equipment.

- **Prioritize** Follow recommended guidelines below to help prioritize cleaning.

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Areas and Equipment</th>
</tr>
</thead>
<tbody>
<tr>
<td>After user change, shift change.</td>
<td>Frequently “hand-touched” surfaces: doorknobs, handrails, light switches, control panels, etc.</td>
</tr>
<tr>
<td>Once to twice daily</td>
<td>Shared workstation equipment: desks, counters, chairs, phones, keyboards/mouse, etc.</td>
</tr>
<tr>
<td>Once daily</td>
<td>Shared correctional equipment: keys, cuffs, irritants, etc.</td>
</tr>
<tr>
<td>As needed</td>
<td>Exercise and sports equipment: weights, benches, machine handles, etc.</td>
</tr>
<tr>
<td></td>
<td>Bathrooms surfaces: faucets, dispensers, etc.</td>
</tr>
<tr>
<td></td>
<td>Any other frequently touched surfaces and used equipment.</td>
</tr>
<tr>
<td></td>
<td>Public areas: conference rooms, visiting, classrooms, transportation and fleet vehicles (e.g., mules, gators, etc.).</td>
</tr>
<tr>
<td></td>
<td>Tools: hand and power tools, shakedown tools, etc.</td>
</tr>
<tr>
<td></td>
<td>Offices and individual workstations. A regular office/workstation cleaning schedule is recommended.</td>
</tr>
</tbody>
</table>