Saint Paul Public Schools
Frost Lake Elementary School

Assessment Date:
4/7/2023 - 4/10/2023
Project Description

IEA conducted a ventilation inspection in Frost Lake Elementary School by IEA representative, Sashya Wandmaker, with the intent of gathering visual observations and overall ventilation information which will assist the District in making informed and proactive decisions to improve and maintain acceptable air quality in the building. This inspection is based upon the Environmental Protection Agency's (EPA's) Tools for Schools IAQ guidelines and the recommended Minnesota Department of Education (MDE) portion of a school district's IAQ management plan. Ventilation verification is also recommended by American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE).

Some observations gathered during the inspection may identify issues which may require additional testing, evaluation, further investigation, or maintenance on the ventilation systems.

The findings, conclusions and recommendations presented herein are believed to be accurate and representative of the building on the date and time of the inspection.

GENERAL COMMENTS

The analysis and opinions expressed in this report are based upon data obtained from Saint Paul Public Schools at the indicated locations. This report does not reflect variations in conditions that may occur across the site, property, or facility. Actual conditions may vary and may not become evident without further assessment.

The report is prepared for the exclusive use of our client for specific application to the project discussed and has been prepared in accordance with generally accepted indoor air quality practices. Other than as provided in the preceding sentence, no warranties are extended or made.
Building Information

General information regarding the building was collected by IEA during an interview with building maintenance staff. The information gathered during this process is a vital component, as it is helpful in determining how these items may play a role in possible IAQ related issues.

Below is a summary of the information gathered during the interview:

- Automation controls are managed internally.
- A Building Automation System is present. The automation control software program is Tridium and controls can not be accessed remotely.
- Schedules:
  
<table>
<thead>
<tr>
<th>Ventilation operation:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Day:</td>
<td>Occupied?</td>
</tr>
<tr>
<td>Monday-Friday</td>
<td>Yes</td>
</tr>
<tr>
<td>Monday-Friday</td>
<td>Yes</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Typical occupancy:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Day:</td>
<td>Occupied?</td>
</tr>
<tr>
<td>Monday-Friday</td>
<td>Yes</td>
</tr>
<tr>
<td>Saturday</td>
<td>No</td>
</tr>
<tr>
<td>Sunday</td>
<td>No</td>
</tr>
<tr>
<td>Holiday</td>
<td>No</td>
</tr>
</tbody>
</table>

  | Notes: Monday and Wednesday until 9, Tuesday, Thursday, and Friday out at normal time |

- It is not known whether or not CO2 sensors are associated with the ventilation system.
- VAVs are present. They are fan powered with a Unknown filter.
- It is not known whether or not the building has variable frequency drives (VFD).
- The heating system is a steam boiler.
- A cooling system is present and is a Dx type system.
- Filters used are:

<table>
<thead>
<tr>
<th>Filter Type</th>
<th>MERV Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pleated</td>
<td>MERV 11</td>
</tr>
<tr>
<td>Pleated</td>
<td>MERV 13</td>
</tr>
<tr>
<td>Pleated</td>
<td>MERV 8</td>
</tr>
</tbody>
</table>

- Filters are changed 3 times.
- Energy Recovery Units are present.
- Units do not contain system Enhancements.
- Personal air purifiers are supplied for individual rooms. They are of unknown make or model.
  - Location: all classrooms
- It is not known whether or not the building was commissioned during the original construction.
Air Handling Unit Designations & Service Zones:
1st Floor
### Ventilation System
The following information was gathered by IEA on 4/7/2023 - 4/10/2023 with support from the district building representative during the on-site interview. The type of heating, ventilating and air-conditioning (HVAC) system and its assessment is included for each unit below:

<table>
<thead>
<tr>
<th>Unit Designation:</th>
<th>AHU-05</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location of Unit:</td>
<td>Mechanical room 1418</td>
</tr>
<tr>
<td>Areas Served:</td>
<td>See attached map N Classrooms</td>
</tr>
<tr>
<td>System Enhancements:</td>
<td>None</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Supply System</th>
<th>Outdoor Air</th>
<th>Cleanliness and Observations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Supply System - Constant Volume</td>
<td>Outdoor air intake is inaccessible</td>
<td>Outdoor air filters are not present.</td>
</tr>
<tr>
<td>- Heating - Hot Water</td>
<td>Outdoor air intake is located on the roof.</td>
<td>Return air filters are not present.</td>
</tr>
<tr>
<td>- Cooling - None</td>
<td>It is not known if there are nearby pollution sources.</td>
<td>Mixed air pre-filters are not present. Mixed air main filters are somewhat dirty and on the border of needing replacement (scoring 3 out of 5) and fit well. Mixed air main filters are installed correctly.</td>
</tr>
<tr>
<td>- Energy Recovery Unit (ERU) - None</td>
<td>Outdoor air intake is in good condition.</td>
<td>Drain pans are not applicable or not present. Drain pan condition is not known.</td>
</tr>
<tr>
<td>Filter Type - Mixed</td>
<td>Heating coils are clean.</td>
<td>Heat wheels are not present.</td>
</tr>
<tr>
<td>- Pre-filter: None</td>
<td>Exterior ducting is visible. Exterior ducting insulation is in good condition.</td>
<td></td>
</tr>
<tr>
<td>- Main filter: Pleated, MERV 11</td>
<td>Interior ducting is not visible. Interior ducting insulation is in an unknown condition. Interior ducting is of unknown cleanliness.</td>
<td>Air handling room is free of trash/chemicals.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Outside damper is open, and its condition is good.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Return damper is open, and its condition is good.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>The general condition of the unit is good.</td>
</tr>
<tr>
<td>Unit Designation:</td>
<td>AHU-06</td>
<td></td>
</tr>
<tr>
<td>------------------</td>
<td>--------</td>
<td></td>
</tr>
<tr>
<td>Location of Unit:</td>
<td>Mechanical room 1111</td>
<td></td>
</tr>
<tr>
<td>Areas Served:</td>
<td>See attached map S Classrooms</td>
<td></td>
</tr>
<tr>
<td>System Enhancements:</td>
<td>None</td>
<td></td>
</tr>
</tbody>
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<tr>
<th>Supply System</th>
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<tr>
<td>Type</td>
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<tr>
<td>• Supply System - Constant Volume</td>
<td>Outdoor air intake is inaccessible</td>
<td>Outdoor air filters are not present.</td>
</tr>
<tr>
<td>• Heating - Hot Water</td>
<td>Outdoor air intake is located in an unknown location.</td>
<td>Return air filters are not present.</td>
</tr>
<tr>
<td>• Cooling - None</td>
<td>It is not known if there are nearby pollution sources.</td>
<td>Mixed air pre-filters are not present. Mixed air main filters are somewhat dirty and on the border of needing replacement (scoring 3 out of 5) and fit well. Mixed air main filters are installed correctly.</td>
</tr>
<tr>
<td>• Energy Recovery Unit (ERU) - None</td>
<td>Outdoor air intake is in good condition.</td>
<td>Mixed air pre-filters are not present. Mixed air main filters are somewhat dirty and on the border of needing replacement (scoring 3 out of 5) and fit well. Mixed air main filters are installed correctly.</td>
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<table>
<thead>
<tr>
<th>Filter Type - Mixed</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>• Pre-filter: None</td>
<td>Heating coils are clean.</td>
</tr>
<tr>
<td>• Main filter: Pleated, MERV 8</td>
<td>Heat wheels are not present.</td>
</tr>
</tbody>
</table>

- Exterior ducting is visible. Exterior ducting insulation is in good condition.
- Interior ducting is not visible. Interior ducting insulation is in an unknown condition. Interior ducting is of unknown cleanliness.
- Air handling room is free of trash/chemicals.
- Outside damper is inaccessible, and its condition is not known.
- Return damper is inaccessible, and its condition is not known.
- The general condition of the unit is good.
<table>
<thead>
<tr>
<th>Unit Designation:</th>
<th>AHU-07</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location of Unit:</td>
<td>Mech room 0104</td>
</tr>
<tr>
<td>Areas Served:</td>
<td>See attached map Cafeeteria</td>
</tr>
<tr>
<td>System Enhancements:</td>
<td>None</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Supply System</th>
<th>Outdoor Air</th>
<th>Cleanliness and Observations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Supply System - VAV</td>
<td>Outdoor air intake is accessible</td>
<td>Outdoor air filters are not present.</td>
</tr>
<tr>
<td>• Heating - Hot Water</td>
<td>Outdoor air intake is located on the roof.</td>
<td>Return air filters are not present.</td>
</tr>
<tr>
<td>• Cooling - Dx</td>
<td>No nearby pollution sources were found.</td>
<td>Mixed air pre-filters are clean and not in need of replacement (scoring 2 out of 5) and fit well. Mixed air pre-filters are installed incorrectly. Mixed air main filters are somewhat dirty and on the border of needing replacement (scoring 3 out of 5) and fit well. Mixed air main filters are installed incorrectly.</td>
</tr>
<tr>
<td>• Energy Recovery Unit (ERU) - None</td>
<td></td>
<td>Drain pans are not applicable or not present. Drain pan condition is not known.</td>
</tr>
<tr>
<td>Filter Type - Mixed</td>
<td></td>
<td>Heating coils are clean and cooling coils are clean.</td>
</tr>
<tr>
<td>• Pre-filter: Pleated, MERV 8</td>
<td>Outdoor air intake is in good condition.</td>
<td>Heat wheels are not present.</td>
</tr>
<tr>
<td>• Main filter: Pleated, MERV 13</td>
<td></td>
<td>Exterior ducting is visible. Exterior ducting insulation is in good condition.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Interior ducting is not visible. Interior ducting insulation is in an unknown condition. Interior ducting is of unknown cleanliness.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Air handling room is free of trash/chemicals.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Outside damper is inaccessible, and its condition is not known.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Return damper is open, and its condition is good.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>The general condition of the unit is good.</td>
</tr>
<tr>
<td>Unit Designation:</td>
<td>AHU-08</td>
<td></td>
</tr>
<tr>
<td>------------------</td>
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<td></td>
</tr>
<tr>
<td>Location of Unit:</td>
<td>1502 mechanical room</td>
<td></td>
</tr>
<tr>
<td>Areas Served:</td>
<td>See attached map Gymnasium</td>
<td></td>
</tr>
<tr>
<td>System Enhancements:</td>
<td>None</td>
<td></td>
</tr>
</tbody>
</table>

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<td>Type</td>
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<td></td>
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<tr>
<td>Supply System - Constant Volume</td>
<td>Outdoor air intake is inaccessible</td>
<td>Outdoor air filters are not present.</td>
</tr>
<tr>
<td>Heating - Hot Water</td>
<td>Outdoor air intake is located on an exterior wall.</td>
<td>Return air filters are not present.</td>
</tr>
<tr>
<td>Cooling - None</td>
<td>No nearby pollution sources were found.</td>
<td>Mixed air filters are somewhat dirty and on the border of needing replacement (scoring 3 out of 5) and fit well.</td>
</tr>
<tr>
<td>Energy Recovery Unit (ERU) - None</td>
<td>Outdoor air intake is in good condition.</td>
<td>Mixed air filters are installed correctly.</td>
</tr>
</tbody>
</table>

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<thead>
<tr>
<th>Filter Type - Mixed</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-filter: Pleated, MERV 8</td>
<td></td>
<td>Drain pans are not applicable or not present. Drain pan condition is not known.</td>
</tr>
<tr>
<td>Main filter: Pleated, MERV 13</td>
<td></td>
<td>Heating coils are clean.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Heat wheels are not present.</td>
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<table>
<thead>
<tr>
<th>Unit Designation:</th>
<th>DOAS-01</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location of Unit:</td>
<td>Mech room 1316</td>
</tr>
</tbody>
</table>
| Areas Served:     | See attached map  
                      West classrooms |
| System Enhancements: | None |

<table>
<thead>
<tr>
<th>Supply System</th>
<th>Outdoor Air</th>
<th>Cleanliness and Observations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Supply System - Constant Volume</td>
<td>Outdoor air intake is accessible</td>
<td>Outdoor air pre-filters are somewhat dirty and on the border of needing replacement (scoring 4 out of 5) and fit well. Outdoor air pre-filters are installed correctly. Outdoor air main filters are dirty and in need of replacement (scoring 5 out of 5) and fit well. Outdoor air main filters are installed correctly.</td>
</tr>
<tr>
<td>• Heating - Hot Water</td>
<td>Outdoor air intake is located on the roof.</td>
<td>Return air pre-filters are not present. Return air main filters are somewhat dirty and on the border of needing replacement (scoring 3 out of 5) and fit well. Return air main filters are installed correctly.</td>
</tr>
<tr>
<td>• Cooling - Dx</td>
<td>It is not known if there are nearby pollution sources.</td>
<td>Drain pans are not applicable or not present. Drain pan condition is not known.</td>
</tr>
<tr>
<td>• Energy Recovery Unit (ERU) - Fixed Plate</td>
<td></td>
<td>Heating coils are clean and cooling coils are clean.</td>
</tr>
<tr>
<td>Filter Type - Outdoor</td>
<td></td>
<td>Heat wheels are inaccessible.</td>
</tr>
<tr>
<td>• Pre-filter: Pleated, MERV 8</td>
<td>Outdoor air intake is in good condition.</td>
<td>Exterior ducting is visible. Exterior ducting insulation is in good condition.</td>
</tr>
<tr>
<td>• Main filter: Pleated, MERV 13</td>
<td></td>
<td>Interior ducting is not visible. Interior ducting insulation is in an unknown condition. Interior ducting is of unknown cleanliness.</td>
</tr>
</tbody>
</table>

<p>| Filter Type - Return |                              |                              |
| • Pre-filter: None |                              | Air handling room is free of trash/chemicals. |
| • Main filter: Pleated, MERV 8 |                              | Outside damper is open, and its condition is good. |
|                              |                              | Return damper is open, and its condition is good. |
|                              |                              | The general condition of the unit is good. |</p>
<table>
<thead>
<tr>
<th>Unit Designation:</th>
<th>DOAS-02</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location of Unit:</td>
<td>Mech room 1316</td>
</tr>
</tbody>
</table>
| Areas Served:     | See attached map  
|                   | East classrooms |
| System Enhancements: | None |

<table>
<thead>
<tr>
<th>Supply System</th>
<th>Outdoor Air</th>
<th>Cleanliness and Observations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Supply System - Constant Volume</td>
<td>Outdoor air intake is accessible</td>
<td>Outdoor air filters are somewhat dirty and on the border of needing replacement (scoring 4 out of 5) and fit well. Outdoor air filters are installed correctly.</td>
</tr>
<tr>
<td>• Heating - Hot Water</td>
<td>Outdoor air intake is located on an exterior wall.</td>
<td>Return air pre-filters are not present. Return air main filters are somewhat dirty and on the border of needing replacement (scoring 3 out of 5) and fit well. Return air main filters are installed incorrectly.</td>
</tr>
<tr>
<td>• Cooling - Dx</td>
<td>It is not known if there are nearby pollution sources.</td>
<td>Drain pans are not applicable or not present. Drain pan condition is not known.</td>
</tr>
<tr>
<td>• Energy Recovery Unit (ERU) - Fixed Plate</td>
<td>Outdoor air intake is in good condition.</td>
<td>Heating coils are clean and cooling coils are clean.</td>
</tr>
</tbody>
</table>

**Filter Type - Outdoor**

- Pre-filter: Pleated, MERV 8
- Main filter: Pleated, MERV 13

**Filter Type - Return**

- Pre-filter: None
- Main filter: Pleated, MERV 8

- Outdoor air intake is accessible
- Outdoor air intake is located on an exterior wall.
- Outdoor air intake is in good condition.
- Heating coils are clean and cooling coils are clean.
- Heat wheels are inaccessible.
- Exterior ducting is visible. Exterior ducting insulation is in good condition.
- Interior ducting is not visible. Interior ducting insulation is in an unknown condition. Interior ducting is of unknown cleanliness.
- Air handling room is free of trash/chemicals.
- Outside damper is open, and its condition is good.
- Return damper is open, and its condition is good.
- The general condition of the unit is good.
<table>
<thead>
<tr>
<th>Unit Designation:</th>
<th>DOAS-03</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location of Unit:</td>
<td>mechanical room 1502</td>
</tr>
<tr>
<td>Areas Served:</td>
<td>See attached map.</td>
</tr>
<tr>
<td>System Enhancements:</td>
<td>None</td>
</tr>
</tbody>
</table>

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<tr>
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<tr>
<td><strong>Type</strong></td>
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<td></td>
</tr>
<tr>
<td>Supply System - Constant Volume</td>
<td>Outdoor air intake is accessible.</td>
<td>Outdoor air filters are somewhat dirty and on the border of needing replacement (scoring 4 out of 5) and fit well. Outdoor air filters are installed correctly.</td>
</tr>
<tr>
<td>Heating - Hot Water</td>
<td>Outdoor air intake is located on an exterior wall.</td>
<td>Return air pre-filters are not present. Return air main filters are somewhat dirty and on the border of needing replacement (scoring 3 out of 5) and fit well. Return air main filters are installed correctly.</td>
</tr>
<tr>
<td>Cooling - Dx</td>
<td>No nearby pollution sources were found.</td>
<td>Drain pans are not applicable or not present. Drain pan condition is not known.</td>
</tr>
<tr>
<td>Energy Recovery Unit (ERU) - None</td>
<td>Outdoor air intake is in good condition.</td>
<td>Heating coils are clean and cooling coils are clean.</td>
</tr>
<tr>
<td><strong>Filter Type - Outdoor</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre-filter: Pleated, MERV 8</td>
<td></td>
<td>Heat wheels are not present.</td>
</tr>
<tr>
<td>Main filter: Pleated, MERV 13</td>
<td></td>
<td>Exterior ducting is visible. Exterior ducting insulation is in good condition.</td>
</tr>
<tr>
<td><strong>Filter Type - Return</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre-filter: None</td>
<td></td>
<td>Interior ducting is not visible. Interior ducting insulation is in an unknown condition. Interior ducting is of unknown cleanliness.</td>
</tr>
<tr>
<td>Main filter: Pleated, MERV 8</td>
<td></td>
<td>Air handling room is free of trash/chemicals.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Outside damper is open, and its condition is good.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Return damper is open, and its condition is good.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>The general condition of the unit is good.</td>
</tr>
<tr>
<td>Unit Designation:</td>
<td>MAU-01 (100% OA)</td>
<td></td>
</tr>
<tr>
<td>------------------</td>
<td>------------------</td>
<td></td>
</tr>
<tr>
<td>Location of Unit:</td>
<td>mechanical room 0104</td>
<td></td>
</tr>
</tbody>
</table>
| Areas Served: | See attached map
Kitchen hood |
| System Enhancements: | None |

<table>
<thead>
<tr>
<th>Supply System</th>
<th>Outdoor Air</th>
<th>Cleanliness and Observations</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Type</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Supply System - Constant Volume</td>
<td>Outdoor air intake is accessible</td>
<td>Outdoor air pre-filters are not present. Outdoor air main filters are somewhat dirty and on the border of needing replacement (scoring 4 out of 5) and fit well. Outdoor air main filters are installed correctly.</td>
</tr>
<tr>
<td>• Heating - Hot Water</td>
<td>Outdoor air intake is located on the roof.</td>
<td>Return air filters are not present.</td>
</tr>
<tr>
<td>• Cooling - None</td>
<td>No nearby pollution sources were found.</td>
<td>Drain pan plugged status is not known. Drain pan condition is not known.</td>
</tr>
<tr>
<td>• Energy Recovery Unit (ERU) - None</td>
<td></td>
<td>Heating coils are clean.</td>
</tr>
<tr>
<td><strong>Filter Type - Outdoor</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Pre-filter: None</td>
<td>Outdoor air intake is in good condition.</td>
<td>Heat wheels are not present.</td>
</tr>
<tr>
<td>• Main filter: Pleated, MERV 8</td>
<td></td>
<td>Exterior ducting is visible. Exterior ducting insulation is in good condition.</td>
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</table>
Dirty or poorly fitting filters were observed in units AHU-07, DOAS-01 and DOAS-02 during the ventilation inspection.

**Recommendation:** The operations and maintenance program for filter changes should be reviewed and revised to ensure proper filter changes to optimize filtration capacity.
Appendix A

Photo Documentation
AHU-05
Mixed Main Filter Cleanliness

AHU-06
Mixed Main Filter Cleanliness

AHU-07
Mixed Pre-Filter Installation

AHU-07
Mixed Main Filter Cleanliness
AHU-07
Mixed Main Filter Installation

AHU-08
Mixed Pre-Filter Cleanliness

AHU-08
Mixed Main Filter Cleanliness

DOAS-01
Outdoor Pre-Filter Cleanliness
DOAS-01
Outdoor Main Filter Cleanliness

DOAS-01
Return Main Filter Cleanliness

DOAS-02
Outdoor Pre-Filter Cleanliness

DOAS-02
Outdoor Main Filter Cleanliness
DOAS-03
Return Main Filter Cleanliness

MAU-01 (100% OA)
Outdoor Main Filter Cleanliness