Clean Air Group
Specializing in Commercial & Public Buildings

September 8, 1998

Mr. Tim Geraghty
Higher Education Services Office
400 Capitol Square Building
550 Cedar Street
St. Paul, MN 55101

Dear Mr. Geraghty:

In response to your request, the Clean Air Group conducted an on-site evaluation of the ETC Building at 1450 Energy Park Drive in St. Paul, Minnesota on September 1, 1998. This on site evaluation consisted of a review of the building construction and systems, a walk-through of the third floor space and environmental monitoring to confirm or rule out many common problems associated with microbial growth and indoor air quality in buildings.

Building Evaluation:

A visual inspection was made of the building and of the heating, ventilation and air-conditioning system. Because of the current remodeling of the space, only a few measurements were taken of air temperature, relative humidity, carbon dioxide and carbon monoxide. Bulk microbial samples were taken of carpet dust and internal fibrous glass insulation. The results of the laboratory analysis will be available in a week and will be amended to this report. Data tables and figures are found in the main report. Conclusions and recommendations are provided here along with abbreviated observations.

The primary focus of the investigation was to identify any significant problems with the building that would affect indoor air quality.

Conclusions/Recommendations:

Generally this building appeared to be in very good condition and well maintained. Significant indoor air quality concerns were not identified. Minor or easily fixed indoor air quality concerns were identified and are listed on the next page.

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1. Significant by pass of air around the air filters in the AHU-1 was observed. Visible debris and some dead insects were observed on the upstream side of the cooling coils and in adjacent ductwork. This must have been a recent problem because the supply air ductwork generally appeared to be clean. This problem needs to be corrected but likely has not caused long term problems for the HVAC system.

2. Some of the insulated chilled water pipes on the downstream side of the cooling coils have absorbed moisture and have surface microbial growth occurring. Fibrous glass insulation should not have been used in this location. Closed cell foam insulation works best in these high moisture areas. The insulation in this areas should be removed and replaced with a closed cell foam insulation.

3. The cooling coil drip pans should be redesigned to drain to a dry condition. This lowers the moisture levels near the cooling coils and help prevent microbial growth in this area.

4. Carpet is present at ground level near the exterior doors. Carpet in these locations is much more difficult to keep clean and free of microbial growth. Carpet in this location should be replaced with a cleanable hard surface floor. Cleanable floor mat can be used on top of the hard surface flooring.

The Clean Air Group will be happy to provide consultation on any of the work described above. Thank you for the opportunity to evaluate this building

Sincerely,

Paul Ellringer

Paul J. Ellringer, P.E., CIH
Vice President

Katy Bobne

Katy Bobne
President

Clean Air Group
Specializing in Commercial & Public Buildings

ETC Building
Evaluation of Part of the Third Floor
1450 Energy Park Drive
St. Paul, Minnesota

In response to your request, the Clean Air Group on September 1, 1998 conducted an on-site evaluation of approximately 18,000 square feet of the third floor of the ETC Building at 1450 Energy Park Drive in St. Paul, Minnesota. The building was built in 1983 and has 250,000 square feet of space on four floors which includes the lower level. A visual inspection was made of the interior and exterior of the building. The heating, ventilation and air conditioning (HVAC) system was evaluated. Measurements were taken of air temperature, relative humidity, carbon dioxide, and carbon monoxide. Because the space was vacant and under construction, minimal air sampling was performed. Microbial Samples were taken of carpet dust and internal fibrous glass ductwork insulation. The results of these samples will be amended to this report when they are available. Data tables and photos follow this section.

1. Building Shell Evaluation

A. Building Exterior

The exterior walls of this building which are not windows are covered with aluminum see Photos 7 and 8. An evaluation of the exterior walls did find weep holes above the windows and doors which allow internal moisture to weep to the exterior, See Photo 8. Effective drainage planes in exterior walls of buildings have weep holes above windows and doors and at the base of the walls to allow internal moisture to weep to the exterior.

The exterior wall construction consisted of an aluminum and glass exterior surface, approximately 3" of foam insulation, ½" waterproof gypsum sheeting, 6"steel studs and ½ inch gypsum sheetrock. Vinyl wallpaper is used on some interior walls but is not present on any exterior walls.

The landscaping around the building allows water near the base of the walls to drain away from the building.

B. Building Interior

Walls

The interior walls of the building were inspected and all appeared to be in good shape. The interior walls are steel studs and gypsum sheetrock.

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Windows

The windows in the building appear to be in good shape. The windows are gold-plated double thermopane windows.

Ceiling Tiles

The ceiling tiles in the building appeared to be in good shape.

Carpet

The carpet in the space will be replaced as part of the build out. Carpet dust samples were taken of the carpet in place and carpet in other areas of the building for comparison. Carpet is present at ground level near the exterior doors, see Photo 10. Carpet in this area should be replaced with a cleanable hard surface floor. Microbial carpet dust samples were collected from the carpet in this location to determine microbial loading.

2. Short Term Monitoring for Temperature, Relative Humidity, Carbon Dioxide, and Carbon Monoxide

Presently 90% of this building is occupied. Only this portion of the third floor of the building is currently vacant. Measurements taken are listed in Table 1. Temperature readings ranged from 70 to 71 degrees with relative humidity levels of 57-59 percent. Carbon dioxide levels varied from 888 to 948 parts per million (ppm). Carbon monoxide levels were all 2 ppm.

All of these readings were within normal ranges.

Temperature and Relative Humidity - There is no one "ideal" temperature and relative humidity. For the comfort of most workers in Minnesota the temperature in the fall, winter and spring should be 70 - 74 degrees, borderline within the following ranges 68 - 70 and 74 - 76 with temperatures below 68 or more than 76 unacceptable. Temperatures in the summer should be 70 - 76 degrees, borderline within the following ranges 68 - 70 and 76 - 78 degrees, with temperatures more than 78 or below 68 unacceptable. Relative humidity should stay within the range of 30 - 50 percent, borderline levels are 20 - 30 and 50 - 60 percent with levels more than 60 percent or below 20 percent unacceptable.

Carbon Dioxide Levels - Carbon dioxide is a normal constituent of exhaled breath and can be used as a screening technique to evaluate whether adequate quantities of fresh outdoor air are being introduced into a building or work area. The outdoor, ambient concentration of carbon dioxide is usually 330 - 425 ppm (parts per million). Usually the carbon dioxide level is higher inside than outside, even in buildings with few complaints about indoor air

quality. However, if indoor carbon dioxide concentrations are more than 1000 to 1100 ppm (3 to 4 times the outside level), there is probably a problem of inadequate ventilation and complaints such as headaches, fatigue and eye and throat irritation is frequently found to be prevalent.

Carbon Monoxide Levels - Carbon monoxide is a normal constituent of exhaust gases from internal combustion engines and cigarette smoke. For office areas, levels of carbon monoxide are normally in the 0 to 5 ppm range and should not exceed 9 ppm. The direct reading TSI instrument being used here cannot measure accurately, carbon monoxide gas below two ppm.

3. Ventilation Information

The outdoor air ventilation rates for the office space were calculated using the floor plan for the building and information from the blue prints. Based on existing operation, 164 cubic feet per minute (cfm) of outdoor air is provided per 1000 square feet of occupied space. This meets or exceeds the minimum fresh air requirements of the present building code and the ASHRAE Standard 62-1989.

The ASHRAE (American Society of Heating, Refrigeration and Air Conditioning Engineers, Inc.) Standard 62-1989 (present Minnesota Building Code) requires 140 cfm (cubic feet per minute) of outside air per 1,000 square feet of office space (7 occupants per 1,000 square feet of office space) or 20 cfm of outdoor air per expected occupant. The design capacity of the existing system appears to be a minimum of 164 cfm of outside air per 1,000 square feet of office space.

The fresh air intakes (FAI) for the building are away from the building and resemble stacks, See Photo 9. These are good locations for the fresh air intakes.

4 Inspection of Air Handling Units

There are six large air handling units in the building which are all interconnected. This building receives chilled water for cooling and hot water for heating from a central district type energy source. This building does not have its own cooling tower or heating source. One of the air handling units, AHU-1 on the Lower Level was inspected. This building uses central type air handling units with hundreds of variable air volume (VAV) boxes which are each connected to a room thermostat. One VAV box was taken apart to determine the condition of the interior components. The minimum setting on the VAV boxes is 20 percent. This building uses economizers and takes advantage of free cooling with outdoor air. During the spring and the fall the system can operate with up to 100 percent outdoor air. During this testing the system was operating at its minimum setting which is 20 percent outdoor air.

The central air handling units are presently using a two inch thick 30 percent dust spot efficient filters. Most manufacturers of the equipment and health authorities recommend at a minimum that 25-35 percent ASHRAE dust spot efficient filters be used. These filters are typically called pleated filters and their collection efficiency is certified by the manufacturer using the ASHRAE Standard 52.1-1992, Atmospheric Dust Spot Efficiency Test. These filters are every effective at filtering dirt out of return air streams and is the lowest quality filter recommended for an office building.

The cooling coils were a little dirty, see Photo 1. In addition to debris a number of insects were observed on the upstream side of the cooling coils. Small piles of dead insects were also observed on the floor of the air handling unit, see Photo 3. The presence of the insects indicates significant bypass around the filters. These filters need to be inspected for bypass and this problem corrected. The drain pans for the cooling coils allow 1 ½ inches of standing water to be present, see Photo 4. Biocide capsules have been used in these drainage pans and the water appeared to be clean and free of microbial growth. The pans were rusting out as can be seen in Photo 4. Drainage pans of this type should be designed to drain to a dry condition.

Immediately downstream of the cooling coils several chilled water pipes were insulated on the exterior with fibrous glass, see Photo 2. This insulation has become discolored with possible microbial growth. This insulation should be removed and replaced with a closed cell foam type insulation.

Most of the ductwork in this building is insulated on the exterior, see Photo 5. The internal surfaces are mostly bare galvanized metal. The supply air ductwork in the mechanical room was inspected and was found to be clean. Internal fibrous glass liners were observed in two locations inside the HVAC system. Inside the VAV boxes and for about ten feet downstream of the VAV boxes. The return air ductwork inside the mechanical room was also lined internally with fibrous glass. Samples of internal liners were collected from both of these locations to determine their condition. The results of this testing will be amended to a future report. These internal fibrous glass liners appeared to have some visible debris present on them but did appear to be free of microbial growth.

Table 1 - Short Term Temperature, Relative Humidity (RH), Carbon Dioxide and Carbon Monoxide Levels - Tuesday, September 1, 1998					
Area	Time	Temperature (^{O}F)	Relative Humidity (%)	Carbon Dioxide (ppm)	Carbon Monoxide (ppm)
Vacant 3rd floor space - interior wall	1330	70.7	59.2	888	2
3rd floor MNSCU - interior office	1335	70.2	58.6	948	2
3rd floor MNSCU - exterior office	1335	70.1	58.5	918	2
3rd floor near North elevator	1400	70.6	57.2	911	2

Clean Air Group Inc.
Minneapolis, Minnesota
Photo Worksheet

Photo #: 1 Date: 9/1/98

Location: ETC Building
1450 Energy Park Drive
St. Paul, MN

Air Handling Unit -1
Lower Level

Description: Dirty cooling coils upstream from fan.

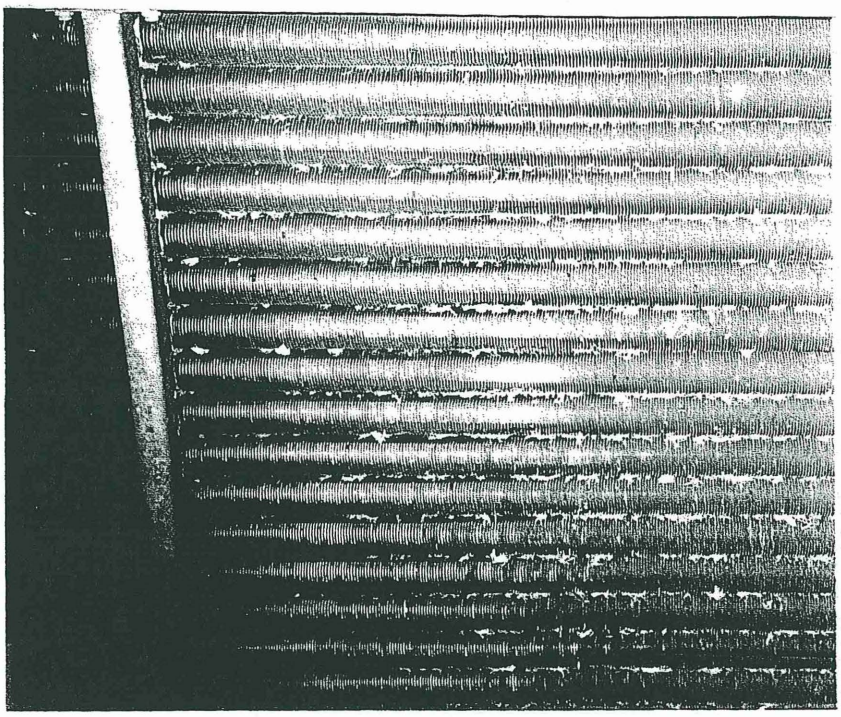
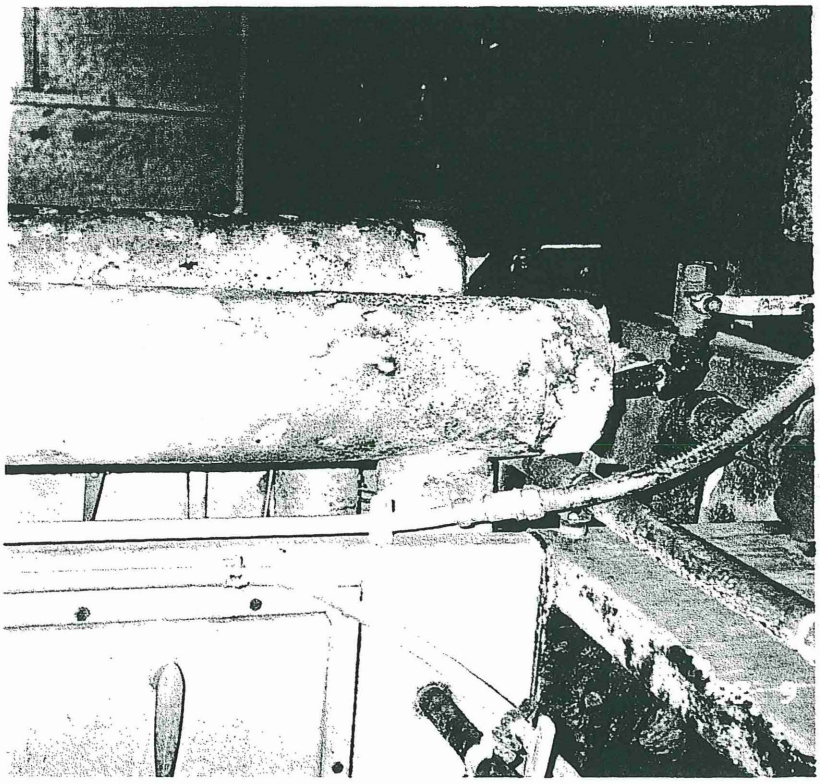


Photo #: Date: 9/1/98

Location: ETC Building
1450 Energy Park Drive
St. Paul, MN

Air Handling Unit -1
Lower Level

Description: Moldy insulation on pipes.



Clean Air Group Inc.
Minneapolis, Minnesota
Photo Worksheet

Photo #: 3 Date: 9/1/98

Location: ETC Building
1450 Energy Park Drive
St. Paul, MN

Air Handling Unit -1
Lower Level

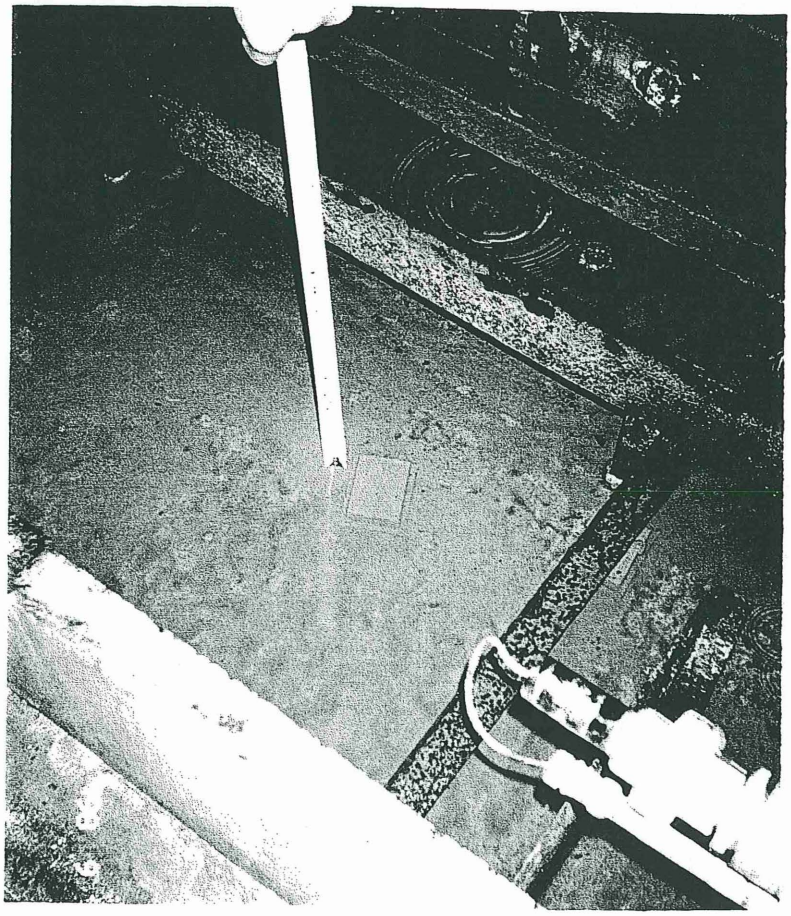
Description: Dead bug debris due to bypass around filter.

Photo #: 4 Date: 9/1/98

Location: ETC Building
1450 Energy Park Drive
St. Paul, MN

Air Handling Unit -1
Lower Level

Description: 1½" of standing water in drain pan.



Clean Air Group Inc.
Minneapolis, Minnesota
Photo Worksheet

Photo #: 5 Date: 9/1/98

Location: ETC Building
1450 Energy Park Drive
St. Paul, MN

Room LL4
(Under construction)

Description: External liner on ductwork in ceiling.

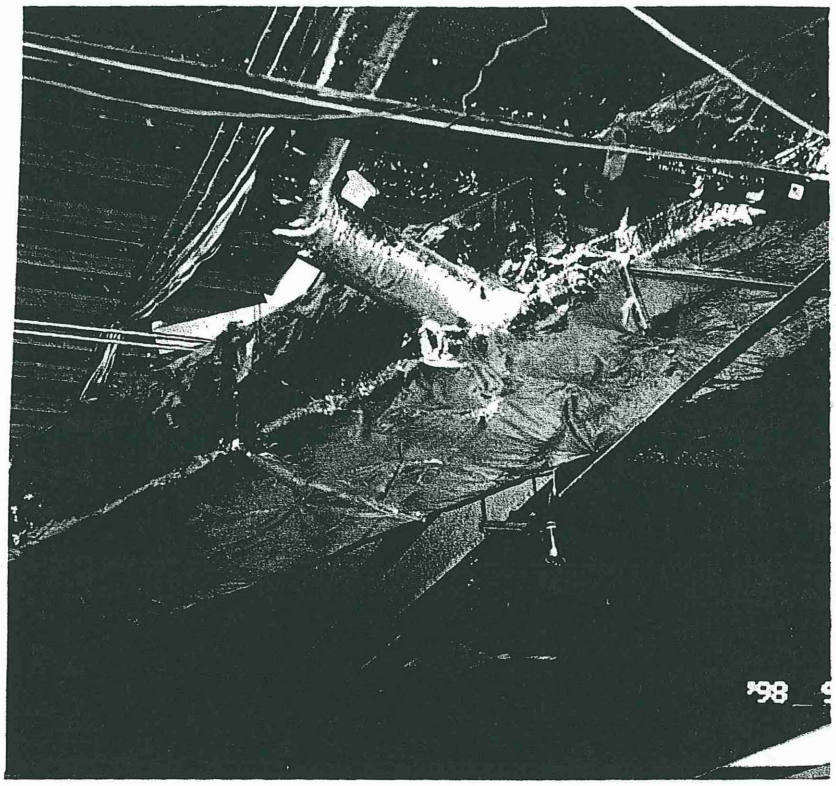
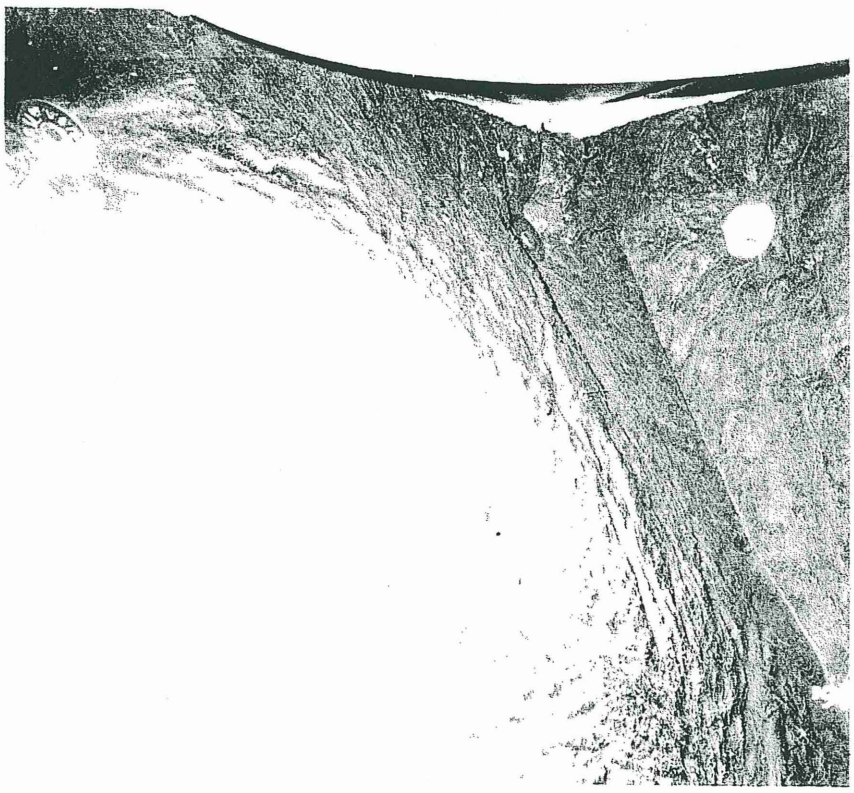


Photo #: 6 Date: 9/1/98

Location: ETC Building
1450 Energy Park Drive
St. Paul, MN

Room LL4
(Under construction)

Description: Internal liner in VAV box.



Clean Air Group Inc.
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Photo Worksheet

Photo #: 7 Date: 9/1/98

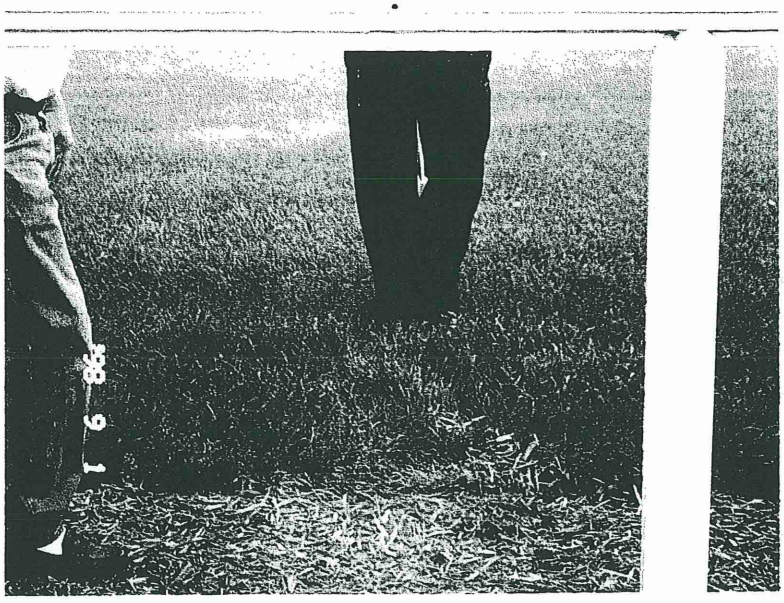
Location: ETC Building
1450 Energy Park Drive
St. Paul, MN

Description: Exterior wall.

Photo #: 8 Date: 9/1/98

Location: ETC Building
1450 Energy Park Drive
St. Paul, MN

Description: Weepholes above windows in exterior walls.



Clean Air Group Inc.
Minneapolis, Minnesota
Photo Worksheet

Photo #: 9 Date: 9/1/98

Location: ETC Building
1450 Energy Park Drive
St. Paul, MN

Description: A fresh air intake outside building.

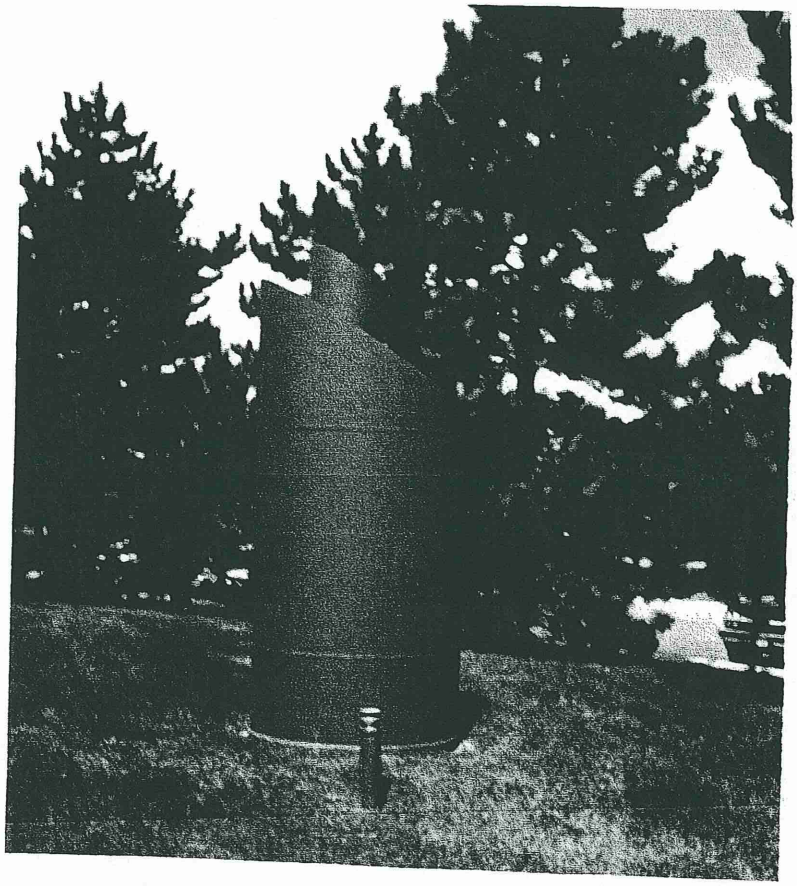


Photo #: 10 Date: 9/1/98

Location: ETC Building
1450 Energy Park Drive
St. Paul, MN

Description: East entrance of building. Carpet dust sampling done.