

Illinois Department of  
**Public  
Health**

John R. Lumpkin, M.D., M.P.H., Director

525-535 West Jefferson Street • Springfield, Illinois 62761-0001  
#901149701

March 14, 1997

Mr. Tim Neubauer  
Director of Construction & Facilities  
Community Unit School District #220  
616 West Main St.  
Barrington, IL 60010

Dear Mr. Neubauer:

The Illinois Department of Public Health (IDPH) has evaluated the indoor air quality sampling results from two elementary schools in your district. Continuous air monitoring was conducted from March 5 through 11. The instruments used measured temperature, relative humidity (%RH), and carbon dioxide (CO<sub>2</sub>). The graphs generated from the continuous sampling are attached. The uppermost line marked with a diamond symbol represents the temperature over the sampling period. The middle line marked with a square symbol represents CO<sub>2</sub>. The lower line marked with a triangle symbol represents %RH. The maximum, minimum, and average values over the sample period are shown in the lower left corner of the graph.

The purpose of the sampling was to determine if the heating, ventilation, and air conditioning (HVAC) system was operating properly and to evaluate the air quality in temporary and regular classrooms. An HVAC system includes all heating, cooling, and ventilation equipment serving a building. A properly designed HVAC system provides thermal comfort; distributes adequate amounts of outdoor air to meet ventilation needs of all building occupants; and isolates and removes odors and contaminants through pressure control, filtration, and exhaust fans. HVAC systems have been identified as a major contributing cause of occupant complaints in the indoor air quality investigations conducted by IDPH.

Since CO<sub>2</sub> is a normal constituent of exhaled breath, measurements can be used to determine if the quantity of outside air that is being delivered to occupants is adequate. High concentrations of CO<sub>2</sub> indicate that outside air is not being adequately supplied to the building to mix with recirculated air. If indoor CO<sub>2</sub> concentrations are more than 1,000 parts per million (ppm), complaints such as headaches; fatigue; and eye, nose and throat irritations may be anticipated. **The elevated CO<sub>2</sub> concentration itself is not responsible for the complaints; however, high CO<sub>2</sub> concentrations are indicative of stale, stagnant air, which does contribute to occupant complaints.** IDPH has found that classroom CO<sub>2</sub> levels frequently exceed 1,000 ppm in schools throughout the state. This

does not mean that students in these classrooms will get sick; however, the HVAC systems supplying these rooms may need to be inspected and adjusted.

During the continuous sampling, slightly elevated CO<sub>2</sub> levels were noted in the afternoon hours in Grove East Mobile/South Classroom and Roslyn Room 28. Grove Room 9 showed slightly elevated CO<sub>2</sub> levels in both morning and afternoon peak periods. The Roslyn School temporary building showed elevated CO<sub>2</sub> levels during peak occupancy on March 5 and 10. Ventilation was excellent in the Grove East Mobile/North Classroom. Elevated CO<sub>2</sub> in classrooms may indicate a need to adjust individual air dampers to allow more outside make-up air to enter these rooms.

Currently, there are no regulations for the amount of outside air supplied to buildings. The American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE) *Ventilation for Acceptable Indoor Air Quality* (62-1989) recommends the amount of outdoor air that should be supplied to buildings. These guidelines are recognized throughout the country and some states have adopted these guidelines into legislation. These guidelines recommend that school classrooms be supplied with 15 cubic feet per minute (CFM) of outside air per person. This volume of make-up air roughly corresponds with a CO<sub>2</sub> concentration of 1,000 ppm. This ASHRAE guideline is marked with a dotted line on the graphs.

The Illinois State Board of Education (ISBE) requires schools follow the building standards that were in effect at the time the school was built. The two elementary schools sampled were constructed when 5 CFM of outside air per person was the requirement. ISBE's Health/Life Safety Code for Public Schools states that if a component or system must be replaced, the replacement part or system must meet the new code. If a building is renovated or remodeled, the new code will apply to the renovated or remodeled areas. The new code, which came into effect March 24, 1995, includes the 1993 BOCA National Building Code that requires 15 CFM of outside air per person.

At peak occupancy during our continuous sampling the lowest air supply rate for each classroom was:

Grove School East Mobile/North Classroom	17 CFM/person
Grove School East Mobile/South Classroom	9 CFM/person
Grove School Room 9	9 CFM/person
Roslyn School Temporary Building	7 CFM/person
Roslyn School Room 28	12 CFM/person

Relative humidity is also routinely checked in indoor air investigations. Relative humidity can be an important factor for occupant comfort. High relative humidity reduces the body's ability to lose heat and can increase levels of body odors. Sensitivity to odors increases with increased humidity, as does release of gases from some building materials. High relative humidity (above 60%) can support microbial growth inside buildings. Relative humidities that are too low can dehydrate skin and mucous membranes. Recent studies have found higher rates of nasal, eye, skin, and mucous membrane symptoms; lethargy; and headaches in low relative humidity environments. Occupants who wear contact lenses often have problems with low relative humidities, due to lenses irritating the eyes from lack of moisture. The ASHRAE 62-1989 Ventilation Standard recommends that relative humidity be maintained between 30% and 60%. Relative humidities in the buildings were

less than 30% during much of the continuous sampling period. These schools, like most schools in the state, have no mechanisms to control relative humidity.

In general, classroom temperatures were maintained slightly higher than the upper range of the comfort zone recommended by ASHRAE (*Thermal Environmental Conditions for Human Occupancy* 55-1992). At a relative humidity of 30%, the ASHRAE thermal comfort range during winter months is from about 68 to 75 degrees. Slightly elevated temperatures were found during the continuous sampling.

The ventilation rates in the mobile classrooms at Grove School are not significantly different from the ventilation rate in Room 9. In fact, the East Mobile/North Classroom had the best ventilation of all of the rooms sampled. The temporary classroom at Roslyn School does not appear to provide adequate ventilation on peak occupancy days. IDPH recommends:

1. Adjust HVAC systems so outside make-up air is adequate. The ISBE requirement is being met, but the district may wish to increase the amount of outside make-up air in some classrooms to help reduce building complaints.
2. Adjust thermostats into the ASHRAE thermal comfort range.

If you have any questions or require additional information, feel free to contact us at (217) 782-5830.

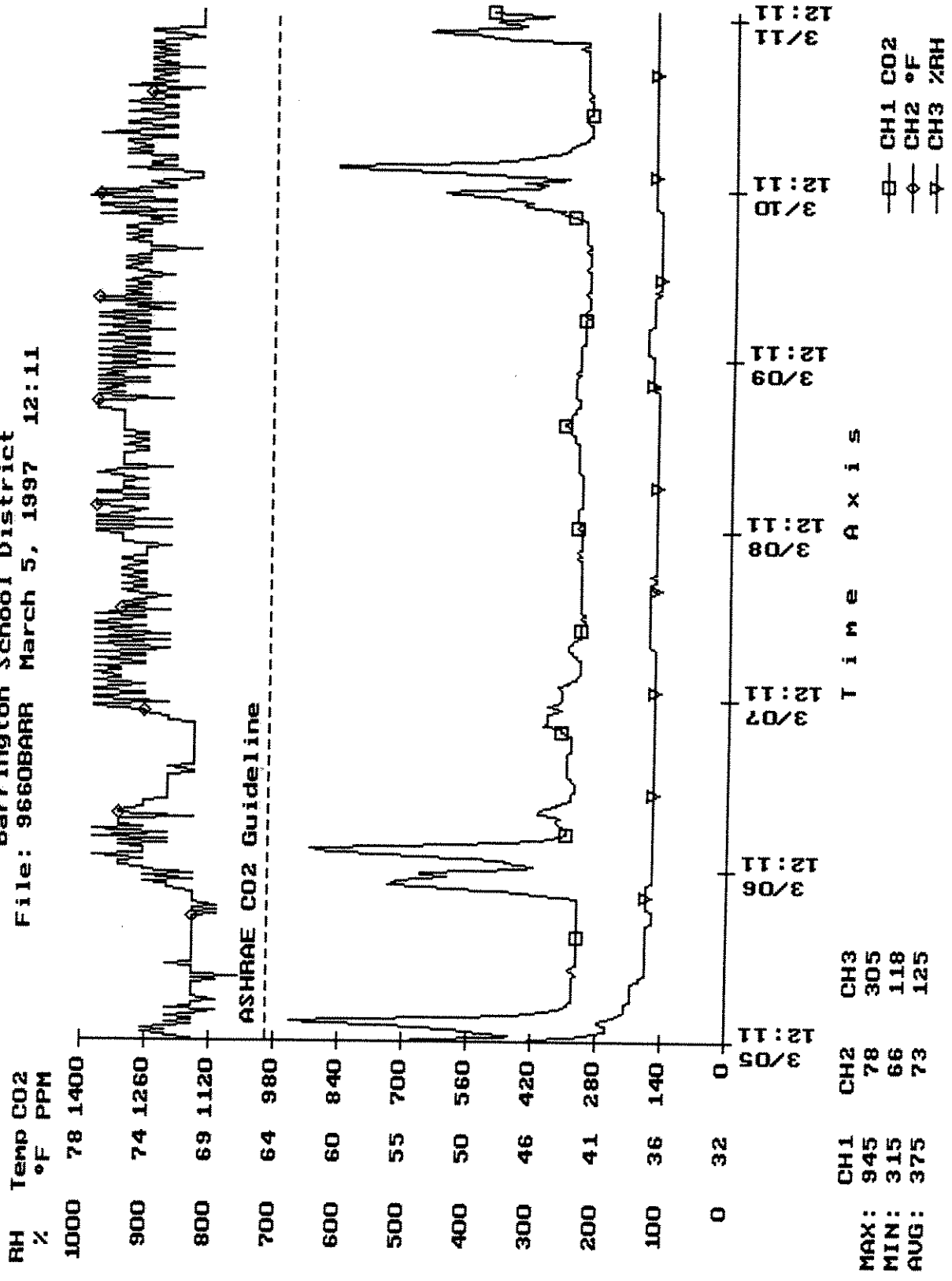
Sincerely,



K. D. Runkle  
Toxicology Section

cc: IDPH W. Chicago Regional Office

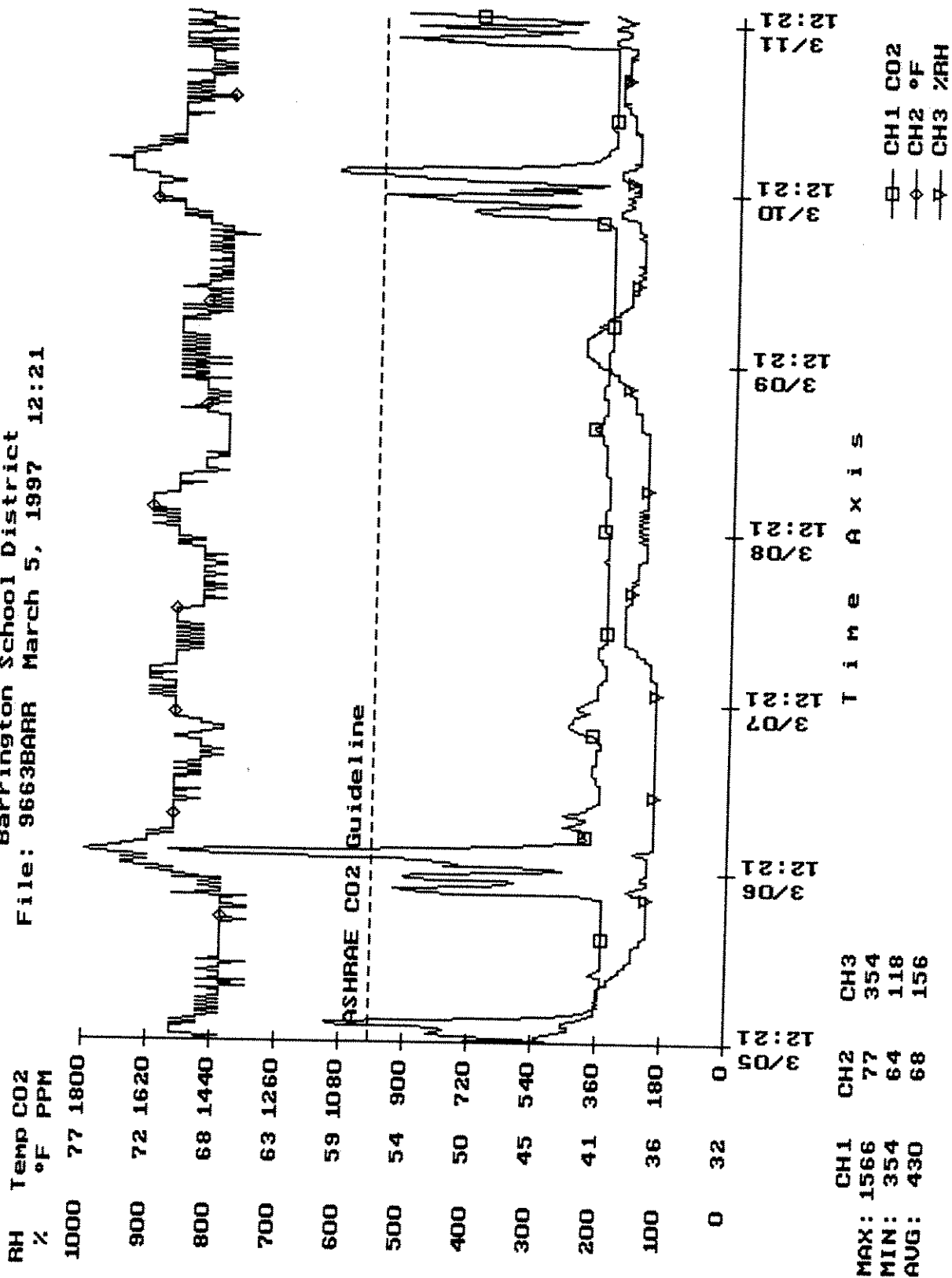
Grove Elementary - East Mobile/North  
 Barrington School District  
 File: 9660BARR March 5, 1997 12:11



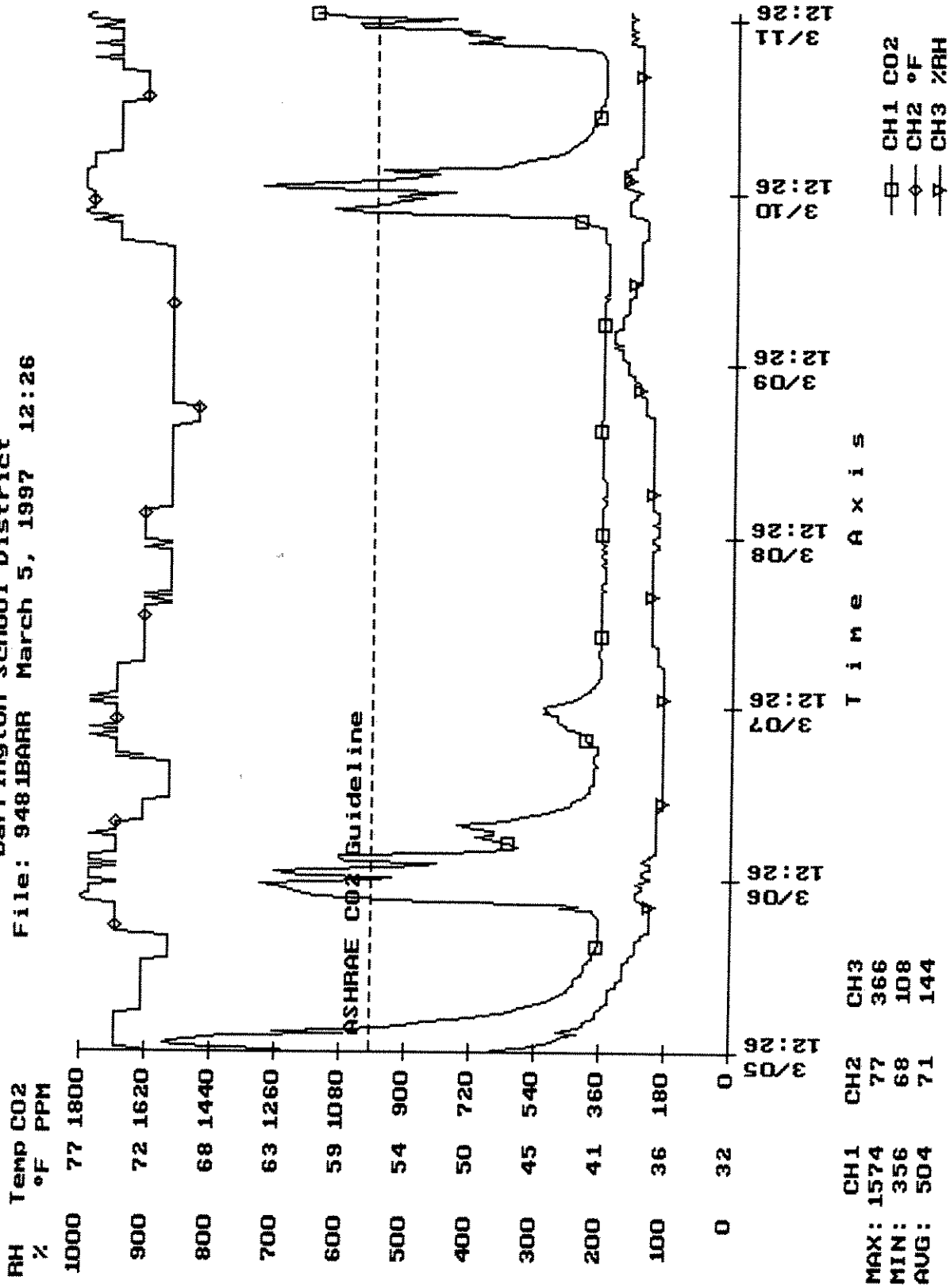
	CH1	CH2	CH3
MAX:	945	78	305
MIN:	315	66	118
AUG:	375	73	125

□ CH1 CO2  
 ◇ CH2 °F  
 ▽ CH3 %RH

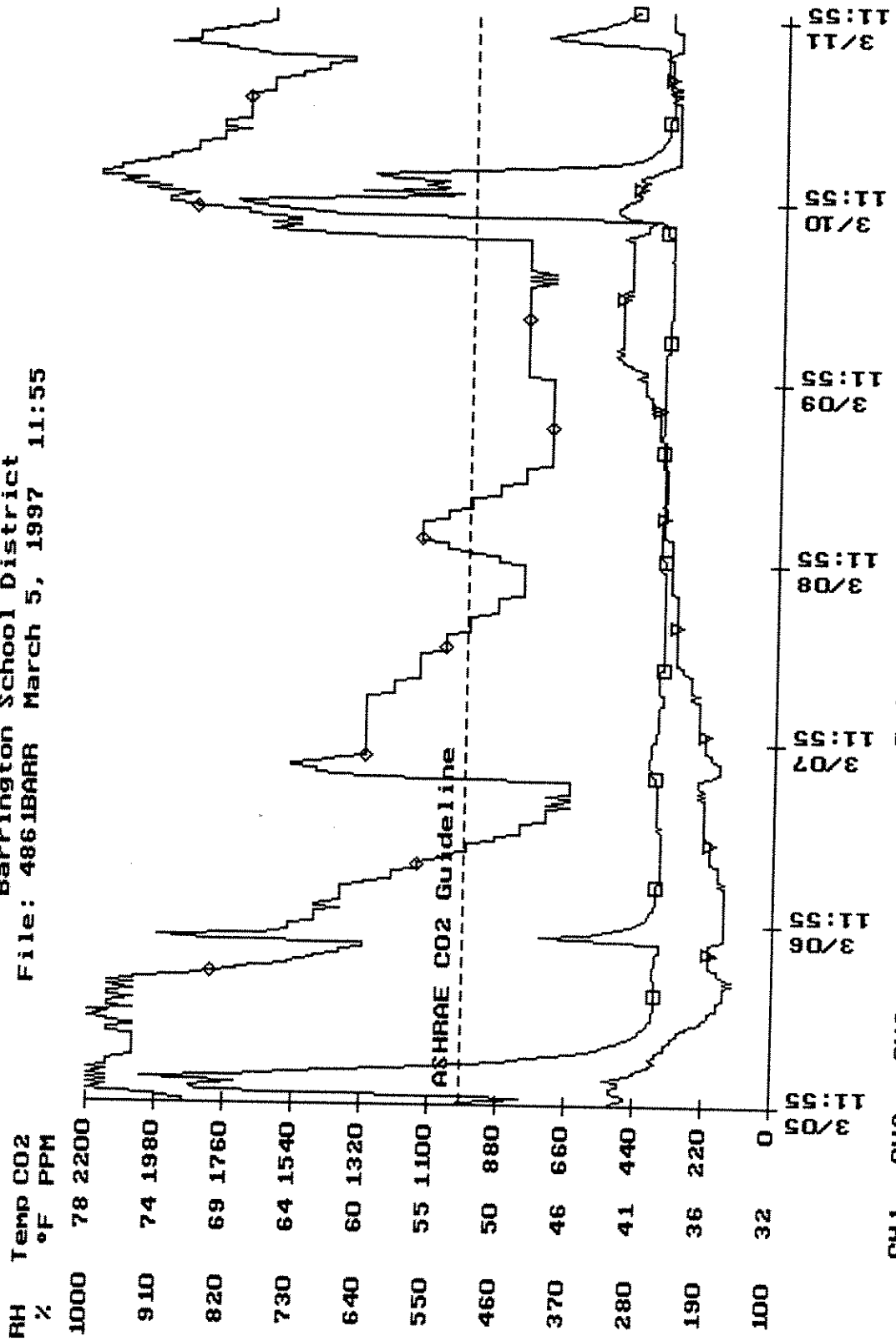
Grove Elementary - East Mobile/South  
 Barrington School District  
 File: 9663BARR March 5, 1997 12:21



Grove Elementary - Room 9  
 Barrington School District  
 File: 9481BARR March 5, 1997 12:26



Roslyn School - Temp Building  
 Barrington School District  
 File: 4861BARR March 5, 1997 11:55



RH %  
 1000  
 910  
 820  
 730  
 640  
 550  
 460  
 370  
 280  
 190  
 100

Temp CO2 °F PPM  
 78 2200  
 74 1980  
 69 1760  
 64 1540  
 60 1320  
 55 1100  
 50 880  
 46 660  
 41 440  
 36 220  
 32 0

Time Axis  
 3/05 11:55  
 3/06 11:55  
 3/07 11:55  
 3/08 11:55  
 3/09 11:55  
 3/10 11:55  
 3/11 11:55

CH1 CH2 CH3  
 MAX: 2029 78 321  
 MIN: 360 44 156  
 AUG: 479 58 239

CH1 CO2  
 CH2 °F  
 CH3 %RH

Roslyn School - Room 28  
 Barrington School District  
 File: 8135BARR March 5, 1997 13:14

