

**Illinois Department of
Public
Health**

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

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

#901129501

901129504

February 15, 1995

Ms. Sue Kumuda
School District #181
Buildings and Grounds
120 W. Walker
Clarendon Hills, IL 60514

Dear Ms. Kumuda:

The Illinois Department of Public Health (IDPH) conducted an evaluation of indoor air quality (IAQ) at Prospect Elementary School, Clarendon Hills, Illinois, from January 12 through January 26, 1995. A walk through indoor air survey was conducted from 1:30 to 2:30 p.m. on January 12. The instruments used measured temperature in degrees fahrenheit (F), relative humidity (%RH), and carbon dioxide (CO₂). Carbon monoxide (CO) levels were checked during the walk-through survey. The graphs generated from this 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 the level of CO₂. The lower line marked with a triangle symbol represents relative humidity. 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 different parts of the building. 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 the primary cause of occupant complaints in the indoor air quality investigations conducted by IDPH. Prospect Elementary School consists of two wings of classrooms with varying capacity for outside make-up air. Some rooms are equipped with blowers which circulate air when heaters are not operating. Other rooms do not appear to have this function. Windows are opened to varying degrees by teachers to regulate temperature and to relieve "stuffy" conditions.

The results of the walk-through survey are shown on Table One. Carbon monoxide gas was sampled for, but none was detected anywhere in the building. The outdoor temperature and

relative humidity at the time of the survey were unseasonably high for January in Northern Illinois. Please keep in mind that our walk-through survey is merely a "snapshot" of air conditions that can change from day to day inside a building. The longer term sampling is much more indicative of the typical indoor environment.

Since CO₂ is a normal constituent of exhaled breath, measurements can be used to determine if the quantity of outdoor air that is being delivered to occupants is adequate. High concentrations of CO₂ indicate that outside air is not being adequately supplied to the building to mix with recirculated air. If indoor CO₂ concentrations are more than 1000 parts per million (ppm), complaints such as headaches, fatigue, eye, nose and throat irritations are often found to be prevalent. The elevated CO₂ concentration itself is not responsible for the complaints; however, high CO₂ concentrations are indicative of stale stagnant air which can contribute to occupant complaints. During the walk-through IAQ survey, elevated CO₂ levels were noted in room 16, room 18, room 4, and the music room. The art room and the computer room had very few occupants, yet the CO₂ levels were approaching 1000 ppm. At maximum occupancy, these rooms probably do not receive an adequate volume of make-up air.

Currently, there are no regulations for the amount of outdoor air that is supplied to buildings. The American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE) has published guidelines, *Ventilation for Acceptable Indoor Air Quality* (62-1989), that 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 CO₂ concentration of 1000 ppm. This ASHRAE guideline is marked with a dotted line on the graphs to indicate when the volume of make-up air to the classrooms was low. Room 16 had the poorest IAQ during the long term sampling. This classroom was being supplied with 7 CFM per person of outside air at peak occupancy on January 17. The music room was being supplied with 10 CFM per person of outside air on days with peak occupancy. On other days, the volume of make-up air met ASHRAE guidelines.

Relative humidity is also routinely sampled 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%.

In general, classroom temperatures during the long-term sampling 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 20%, the ASHRAE thermal comfort range is from about 68 to 74 F. Relative humidities in the building averaged 20% during the sample period. Although the school has no mechanism to control relative humidity, these levels are not terribly dry for Northern Illinois during winter conditions.

In addition to the general indoor air parameters described above, IDPH conducted bioaerosol, sampling in the computer classroom and in [REDACTED] classroom on January 26. Samples were collected, maintained at room temperature, and incubated at IDPH labs in Springfield where they were read by a staff microbiologist. No microbial colony forming units were detected. The dry conditions of winter are not conducive to microbial growth. Although there was occasional evidence of water damage, there was no visible mold growth in the school, and no mold-like odors were present.

Based on our sampling, our observations, and the concerns of district employees, IDPH recommends the following:

1. Make sure make-up air is adequate to meet the ASHRAE guideline of 15 CFM per occupant.
2. Consider installing fans to circulate air more efficiently within the classrooms.
3. Remove/replace water damaged ceiling tiles.
4. Find the source of roof leaks and repair them to prevent water damage in the future. If leaking water continues to be a problem, microbial sampling should be conducted in the late spring or early fall when students are in session.
5. Adjust thermostats into the ASHRAE thermal comfort range.

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

Sincerely,



K. D. Runkle
Toxicology Section

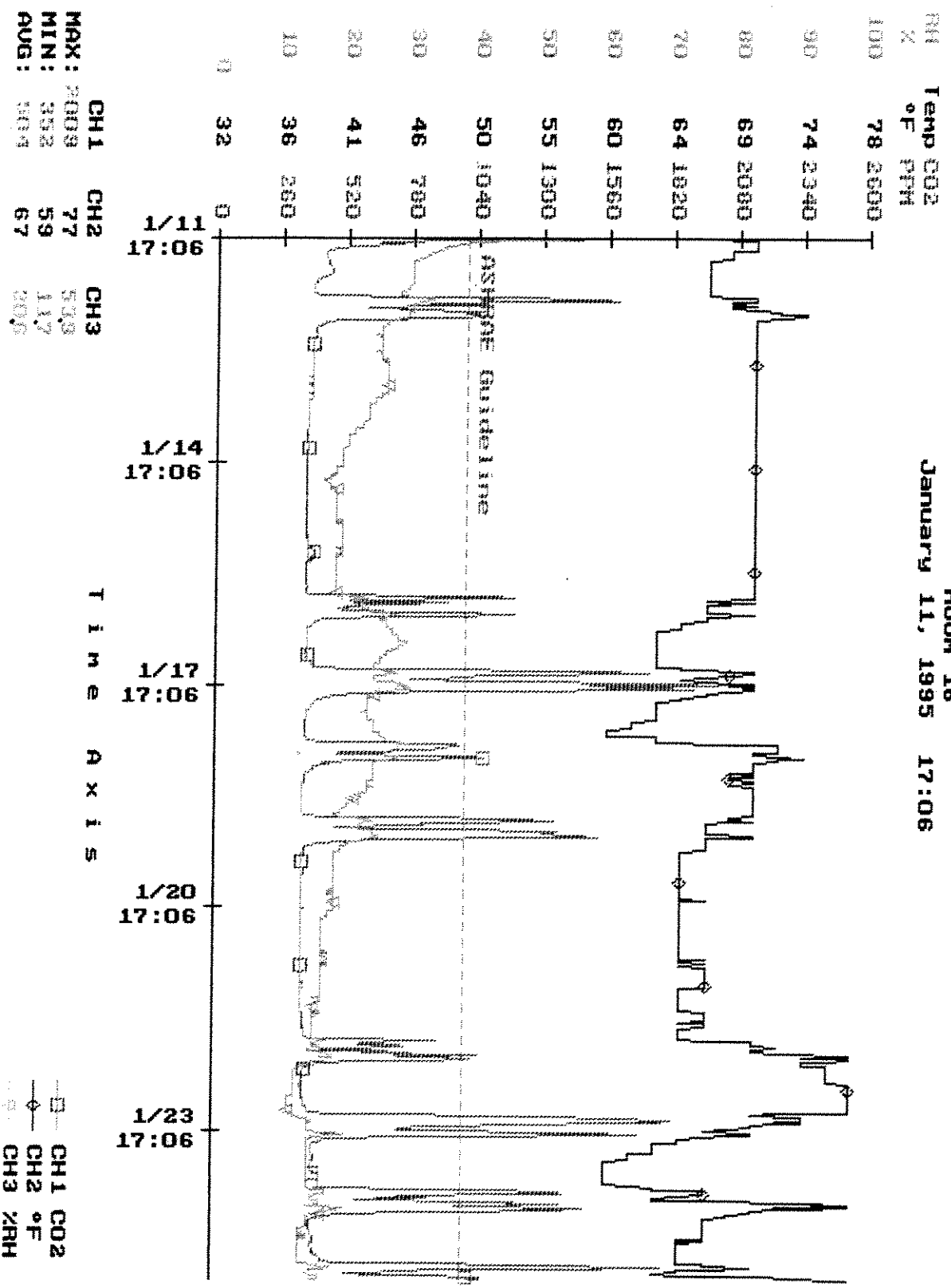
cc: DuPage Co. Health Dept.
IDPH W. Chicago Regional Office

TABLE ONE – P.E.S. WALK-THROUGH INDOOR AIR SURVEY
2 p.m. to 2:30 p.m., January 12, 1995

AREA SAMPLED	CO₂ LEVEL (ppm)	TEMPERATURE (F)	RELATIVE HUMIDITY
OUTDOOR CONDITIONS	305	56.5	52.2
copy room	865	73.3	32.3
Room 16	1,220	74.1	35.4
Room 18	1,195	74.3	34.0
Room 17	730	73.2	30.0
Room 15	675	73.5	28.8
Art Room (unoccupied)	925	71.5	33.0
Music Room	1,350	73.7	36.0
Room 10 (unoccupied)	890	73.0	33.0
Computer Room	990	73.0	35.0
Room 4	1,190	72.2	36.5

ppm = parts per million

Prospect Elementary School
 Room 16
 January 11, 1995 17:06



CH1
 MAX: 2009
 MIN: 352
 AVG: 504

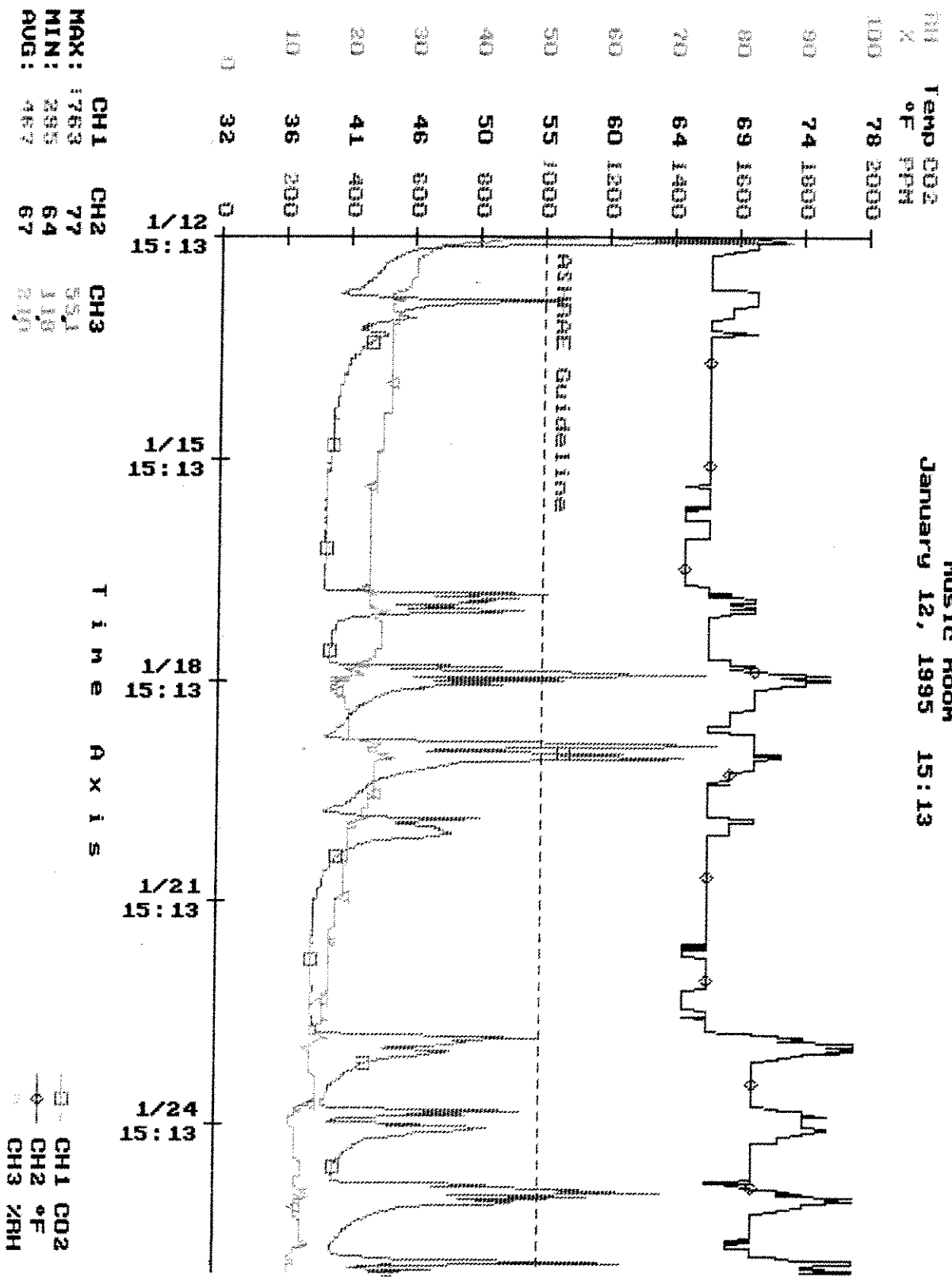
CH2
 77
 59
 67

CH3
 509
 117
 207

T i m e A x i s

CH1 CO2
 CH2 °F
 CH3 XRH

Prospect Elementary School
 Music Room
 January 12, 1995 15:13



MAX: 1769
 MIN: 295
 AVG: 487

CH1
 CH2
 CH3

Time Axis

CH1 CO2
 CH2 °F
 CH3 %RH