Illinois Department of
Public Health

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

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

#901129501

February 9, 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) has conducted an evaluation of indoor air quality (IAQ) at the Hinsdale Middle School, Hinsdale, Illinois from January 12 through January 26, 1995. A walk-through indoor air survey was conducted from 10:30 a.m. to 1 p.m. on January 12. Continuous air monitoring was conducted from January 12 through 26. The instruments used measured temperature (F), relative humidity (%RH), and carbon dioxide (CO_2). Carbon monoxide (CO) levels were checked during the walk-through investigation. 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 the level of carbon dioxide. 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 a major contributing cause of occupant complaints in the indoor air quality investigations conducted by IDPH. Hinsdale Middle School was originally designed with the open classroom concept in mind. However, changes in educational philosophy and enrollment has forced the school district to modify the interior structure of the building. This has led to the redesigning of the HVAC system to attempt to adequately supply make-up air to classrooms.

The results of the walk-through IAQ survey are shown in Table One. At your request, carbon monoxide levels were checked, but CO was not detected anywhere in the building. This is not surprising, since the school utilizes electric heat. The only combustion sources in the building

are gas burners in the science labs or vocational areas. 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 a 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. The walk-through allowed us to compare the IAQ of different rooms and wings in the building and to visually inspect other concerns.

Since CO_2 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 CO_2 indicate that outside air is not being adequately supplied to the building to mix with recirculated air. If indoor CO_2 concentrations are more than 1000 parts per million (ppm), complaints such as headaches; fatigue; and eye, nose and throat irritations may be anticipated. The elevated CO_2 concentration itself is not responsible for the complaints; however, high CO_2 concentrations are indicative of stale, stagnant air, which does contribute to occupant complaints. During the walk-through IAQ survey, elevated CO_2 levels were noted in Room 208 and Room 211, and in occupied classrooms in the temporary classroom wing. Teachers in the temporary classrooms have individual classroom control of the HVAC system. This should allow for better control of classroom IAQ. Elevated CO_2 in these classrooms may indicate a need to adjust individual air dampers to allow more outdoor make-up air to enter these rooms.

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) *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_2 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. Classrooms were being supplied with 11 to 12 CFM of outside air per person at peak occupancy during our continuous sampling.

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%.

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 20%, the ASHRAE thermal comfort range is from about 68 to 74 degrees. During the walk-through survey, elevated temperatures were found in the foreign language area on first floor and throughout much of the second floor. Elevated

temperatures were also shown during the continuous sampling. Relative humidities in the building were less than 20% on several occasions during the continuous sampling period. The school has no mechanism to control relative humidity.

In addition to the general indoor air parameters described above, other conditions were noted during the walk-through survey. Damaged carpeting was observed in Room 222. Apparently this room was the photographic dark room at some time in the past, and the damaged carpeting was the result of a chemical spill. There was no physical evidence of chemicals remaining in the carpeting. Stuffiness and an ozone odor was noticed in Room 205. This copy room has no direct connection to the ventilation system. A lack of exhaust ventilation was noted in the chemical storage room in the science area. Chemicals were stored on the shelves by chemical family, rather than by alphabetical order. This chemical family storage method is preferred as it prevents potentially reactive chemicals from being stored adjacent to each other. In a few second floor rooms, there was evidence of past water damage to ceiling tiles. However there were no mold-like odors or visible mold growth associated with these damaged tiles. Chemical odors were evident in the dark room in the first floor art area. By nature of its use, the art room appears to have the potential for elevated dust levels.

To address a number of concerns, IDPH conducted bioaerosol, ozone, mercury, and particulate sampling at areas of concern in the building on January 26. The dry conditions associated with 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. Bioaerosol sampling was conducted in the commons area, the learning center, a non-complaint area, and outside using an Anderson sampler and agar plates. Ten samples were collected, maintained at room temperature, and incubated at IDPH labs in Springfield, where they were read by a staff microbiologist. The sampling indicates that bioaerosol levels are extremely low in the areas tested and that there is no significant difference between complaint and non-complaint areas. The highest concentration, 35 colony-forming units per cubic meter (cfu/m3), was found in the commons area. The bioaerosol levels detected were very low and can serve as a baseline for subsequent sampling later in the year.

Ozone sampling was conducted in Room 205, a copy room staffed by one adult worker and used by teachers throughout the day. Using an ozone detector tube, a trace amount of ozone was detected. We would not anticipate adverse health effects from exposure to ozone at this level.

The level of mercury in the air of the science classrooms was tested using a mercury vapor analyzer. The detection limit of this instrument is 1 microgram of mercury per cubic meter of air. The science stockroom, science classrooms, science sink areas, and the stairwell outside the science rooms were tested. No airborne mercury was detected in any of these tests. At the request of school personnel, the volume of air able to be exhausted by hoods in the science labs was also checked. At full flow each hood was able to exhaust from 10 to 12 cubic feet of air per minute. Access to the on/off switch of these hoods was restricted, making it difficult to utilize their venting capability.

Because of concerns expressed by both teachers and the environmental committee, particulate sampling was conducted in nine different classrooms using a laser dust monitor. This instrument is able to detect airborne particles to less than 7 microns in size. The sampling indicates that total nuisance dust levels are much less than the OSHA standard of 5 milligrams per cubic meter

(mg/m3). The highest level detected, 0.044 mg/m3, was found in the wood shop during class time. Another concern was the possibility of fibrous glass dust entering the indoor air via deteriorated ductwork. Such fibers in the air would be expected to be a skin irritant. Assuming that these fibers are part of the total dust detected in the rooms tested, the levels are well below the National Institute of Occupational Safety and Health's recommended exposure limit of 5 mg/m3 for glass dust.

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 guidelines of 15 CFM per occupant.
2. As deteriorated supply ductwork is replaced in the building, minimize the exposure of occupants to fibrous glass dust.
3. Remove/replace damaged carpeting in room 222.
4. Improve the ventilation in the copy room, chemical storage areas, and dark room to decrease chemical odors.
5. Replace all water-damaged ceiling tiles.
6. Adjust thermostats into the ASHRAE thermal comfort range. We concur with the plan to provide individual thermostats where possible in problematic temperature fluctuation areas.
7. Conduct bioaerosol sampling in the spring or early fall when students are in session.
8. Reposition science room exhaust hoods so on/off switches are accessible. These hoods should be plugged in at all times.
9. Maintain a scheduled maintenance plan for AC pans and HVAC filters. A sample HVAC inspection check-list devised by USEPA is attached for your information.
10. Maintain a regular cleaning plan to reduce dust levels in problematic areas. Reduce the exposure of occupants to dust by cleaning after school hours, whenever possible.
11. The school may want to consult with an HVAC contractor to discuss a humidification system. Be aware that improperly designed humidification systems may cause microbial problems in buildings (bacteria, fungi) which can be much more harmful to the health of building occupants than the effects of low relative humidity.

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

Sincerely,

K. D. Runkle
Toxicology Section

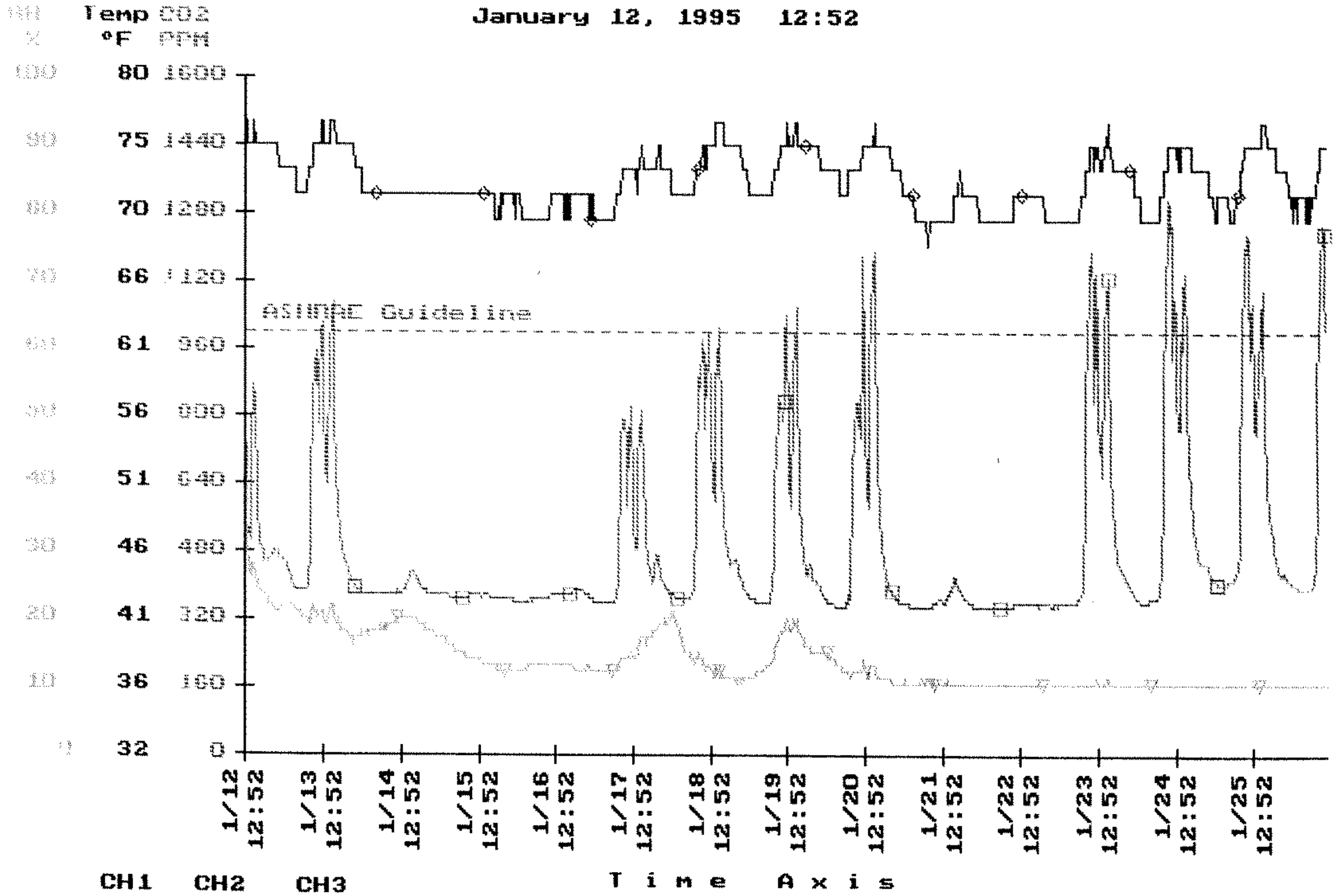
cc: DuPage Co. Health Dept.
IDPH W. Chicago Regional Office

TABLE ONE – H.M.S. WALK-THROUGH INDOOR AIR SURVEY
10:30 a.m. to 1 p.m., January 12, 1995

AREA SAMPLED	CO_2 LEVEL (ppm)	TEMPERATURE (F)	RELATIVE HUMIDITY
OUTDOOR CONDITIONS	325	45.6	80.2
FIRST FLOOR			
Main Office	815	72.5	33.4
Commons Area	820	75.3	29.4
P-1 (unoccupied)	710	71.3	32.0
P-1 (occupied)	1,110	72.3	36.9
P-4 (occupied)	1,015	73.6	33.8
wood shop	846	75.1	31.0
art room	882	74.5	33.2
dark room	740	73.7	35.0
home ec room	895	73.4	35.3
109 spanish room	865	75.4	31.3
110 french room	860	75.5	28.7
SECOND FLOOR			
201/202 science	876	76.0	30.4
Room 205	820	76.2	28.4
Room 208	1,000	76.0	30.4
Room 211	1,030	76.8	31.3
Room 212	870	76.2	30.0
library	820	76.0	29.5
Room 220	960	75.5	31.3
Room 221	840	74.8	31.0
Room 222 (unoccupied)	630	74.0	36.0
Room 217C	890	75.0	30.5
Room 216A	850	74.8	30.9
Room 216B	890	75.7	30.8
Room 216D	930	75.7	30.7
GYMNASIUM	740	73.0	32.0

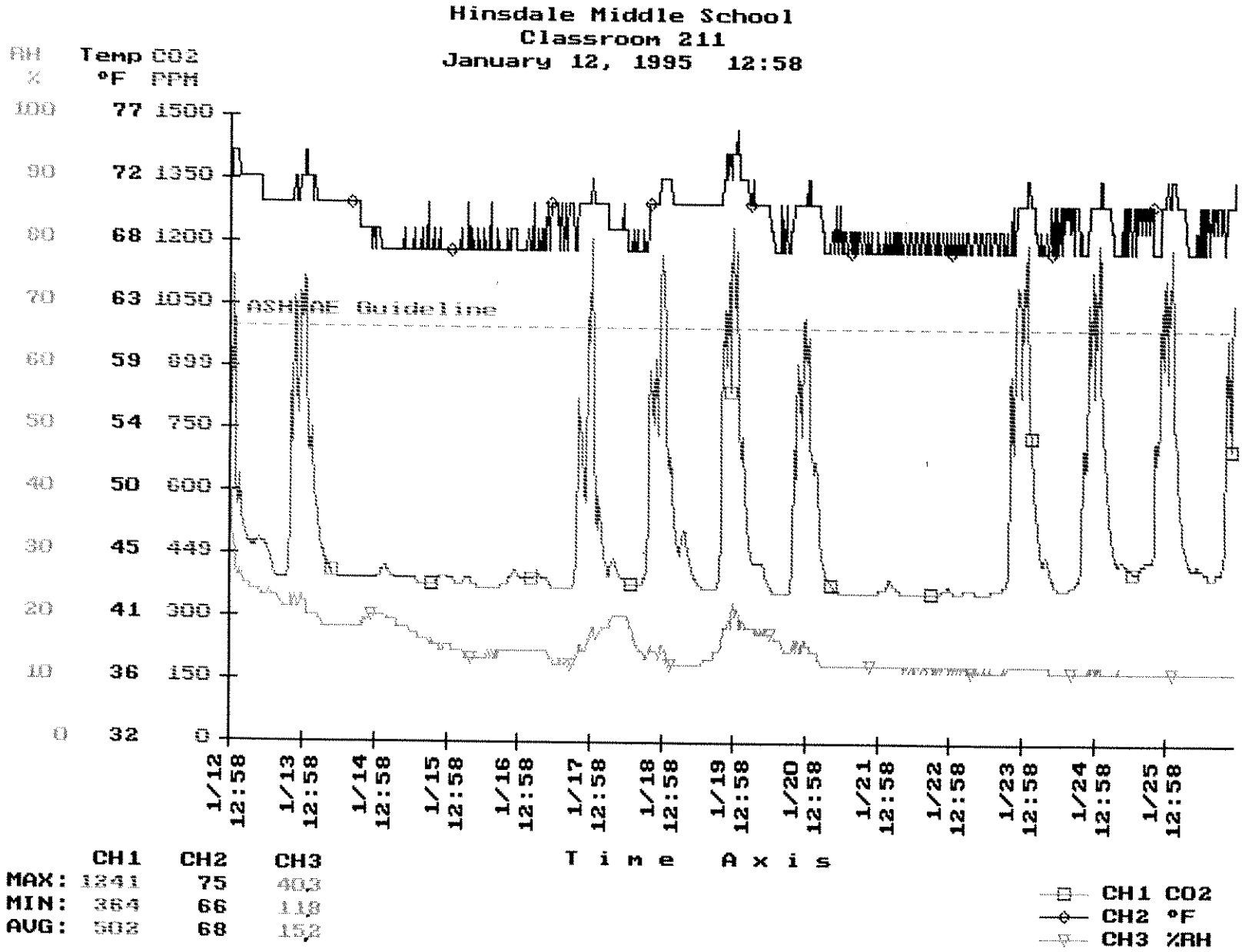
ppm = parts per million

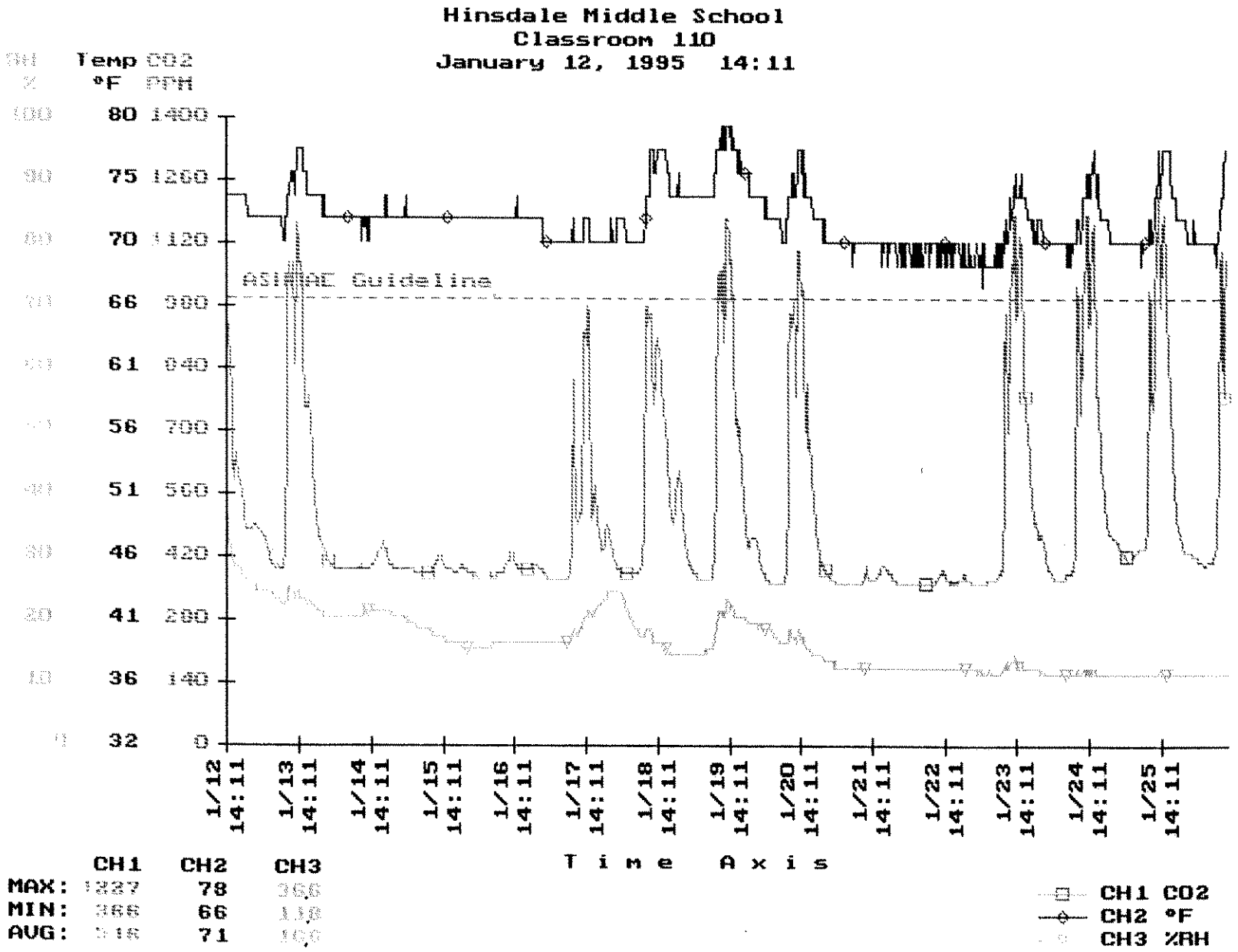
Hinsdale Middle School
Classroom 216D
January 12, 1995 12:52



	CH1	CH2	CH3
MAX:	1317	77	39.9
MIN:	351	68	10.7
AVG:	[illegible]	72	[illegible]

CH1 CO2
CH2 °F
CH3 %RH


Hinsdale Middle School
Classroom 211
January 12, 1995 12:58
RH
%
Temp
°F
CO2
PPM
100
90
80
70
60
50
40
30
20
10
0
77 1500
72 1350
68 1200
63 1050
59 900
54 750
50 600
45 449
41 300
36 150
32 0
ASHRAE Guideline
1/12 12:58
1/13 12:58
1/14 12:58
1/15 12:58
1/16 12:58
1/17 12:58
1/18 12:58
1/19 12:58
1/20 12:58
1/21 12:58
1/22 12:58
1/23 12:58
1/24 12:58
1/25 12:58
Time Axis
CH1 CH2 CH3
MAX: 1241 75 403
MIN: 364 66 119
AVG: 502 68 152
CH1 CO2
CH2 °F
CH3 %RH


Hinsdale Middle School
Classroom 110
January 12, 1995 14:11
Temp CO2
°F PPM
80 1400
75 1260
70 1120
66 980
61 840
56 700
51 560
46 420
41 280
36 140
32 0
ASHRAE Guideline
1/12 14:11
1/13 14:11
1/14 14:11
1/15 14:11
1/16 14:11
1/17 14:11
1/18 14:11
1/19 14:11
1/20 14:11
1/21 14:11
1/22 14:11
1/23 14:11
1/24 14:11
1/25 14:11
Time Axis
CH1 CH2 CH3
MAX: 1327 78 35.6
MIN: 366 66 13.8
AVG: 516 71 16.6
CH1 CO2
CH2 °F
CH3 %RH