OHI

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October 16, 2002

Mr. Mark LaFleur, Director
Municipal Building Maintenance
Town of Needham
1330 Highland Avenue
Needham, MA 02492

RE: Indoor Air Quality Assessment
Rooms 12, 13, 14 and 15 and Title I Reading Room
High Rock Elementary School

Dear Mr. LaFleur:

OccuHealth, Inc. (OHI) is submitting this report for the indoor air quality assessment conducted September 24th through October 2nd, 2002 in Rooms 12, 13, 14 and 15 and the Title I Reading Room in the High Rock Elementary School in Needham, Massachusetts.

Please call me at (508) 339-9119 with any questions regarding this report. Thank you for the opportunity to be of continued service.

Regards,
OCCUHEALTH, INC.

Thomas E Hamilton

Thomas E. Hamilton, CIH

Enclosure

OccuHealth

INDOOR AIR QUALITY ASSESSMENT
ROOMS 12, 13, 14 AND 15 AND TITLE I READING ROOM
HIGH ROCK ELEMENTARY SCHOOL
NEEDHAM, MASSACHUSETTS

Prepared for:

MR. MARK LAFLEUR, DIRECTOR
MUNICIPAL BUILDING MAINTENANCE
TOWN OF NEEDHAM
1330 HIGHLAND AVENUE
NEEDHAM, MA 02492

Conducted by:

OCCUHEALTH, INC.
44 WOOD AVENUE
MANSFIELD, MA 02048
(508) 339-9119

Report Date:

OCTOBER 16, 2002

INDOOR AIR QUALITY ASSESSMENT
ROOMS 12, 13, 14 AND 15 AND TITLE I READING ROOM
HIGH ROCK ELEMENTARY SCHOOL
NEEDHAM, MASSACHUSETTS

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EXECUTIVE SUMMARY

Introduction

OccuHealth, Inc. (OHI) was requested to conduct an indoor air quality (IAQ) assessment in Rooms 12, 13, 14 and 15 and the Title I Reading Room in the High Rock Elementary School in Needham, Massachusetts. The testing was conducted to evaluate the air quality in the rooms and included three individual tasks. Measured parameters included carbon dioxide concentrations, carbon monoxide levels, temperature and relative humidity. Air quality parameters were recorded with data-logging instrumentation in each room for one day between September 24th and October 2nd, 2002.

Summary of Findings and Recommendations

Task 1: Determine if adequate fresh air is introduced to the rooms by taking measurements for carbon dioxide.

The results of monitoring show that the carbon dioxide concentrations in Rooms 14 and 15 and the Title I Reading Room during occupied times generally ranged from approximately 500 parts per million (ppm) to 750 ppm and were below the 800 ppm maximum recommended by the Massachusetts Department of Public Health. The carbon dioxide levels in Rooms 12 and 13 generally exceeded 800 ppm during occupied times; however, the levels only exceeded the 1,000 ppm maximum recommended by the American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE) for very short periods during the day. Overall, the carbon dioxide levels in the monitored school rooms were acceptable.

Task 2: Measure carbon monoxide levels.

The recorded carbon monoxide levels in the five rooms during school hours averaged between 1.0 ppm and 2.0 ppm. OHI does not believe that the measured carbon monoxide levels pose a risk to the health of occupants of the school.

Task 3: Measure temperature and relative humidity.

All recorded temperatures in Rooms 12, 13, 14 and 15 and the Title I Reading Room during occupied times were below the recommended comfort ranges. The measured relative humidity in the rooms during occupied times varied with outdoor conditions and ranged from approximately 58% to 75%. Although the recorded relative humidity levels generally exceeded the ASHRAE-recommended maximum of 60%, OHI does

EXECUTIVE SUMMARY (cont.)

not recommend dehumidification of air in the rooms as it would be impracticable in the ground floor space.

Recommendation: Since recorded temperatures were below the recommended minimums, OHI recommends operating the heat in the rooms and/or increasing thermostat settings if students or staff are complaining of cool conditions.

1.0 INTRODUCTION

OccuHealth, Inc. (OHI) was requested to conduct an indoor air quality (IAQ) assessment in Rooms 12, 13, 14 and 15 and the Title I Reading Room in the High Rock Elementary School in Needham, Massachusetts. The testing was conducted to evaluate the air quality in the rooms and included three individual tasks. Measured parameters included carbon dioxide concentrations, carbon monoxide levels, temperature and relative humidity.

Air quality parameters were recorded with data-logging instrumentation in each room for one day between September 24th and October 2nd, 2002. This project was requested and authorized by Mr. Mark LaFleur, Director of Municipal Building Maintenance for the Town of Needham.

2.0 SCOPE OF SERVICES

OHI's IAQ assessment included the following specific tasks:

1. Determine if adequate fresh air is introduced to the five rooms by taking measurements for carbon dioxide.

2. Measure carbon monoxide levels.

2. Record temperature and relative humidity.

3.0 STUDY FINDINGS AND RECOMMENDATIONS

This section includes a detailed review of the data collected for each of the tasks listed in Section 2.0.

Air Monitoring Techniques

Air quality parameters were measured in Rooms 12, 13, 14 and 15 and the Title I Reading Room. The rooms were occupied by students and teaching personnel for a portion of each monitoring period. Carbon dioxide and carbon monoxide concentrations were measured using a TSI Model 8550 non-dispersive infrared analyzer, which expresses the concentration of each gas in parts per million (ppm). Temperature and relative humidity were measured using specialized probes on this instrument as well. Temperature was recorded in degrees Fahrenheit (°F) and relative humidity was recorded as a percent (%) of saturation.

The analyzer has the capability to log all of the data and recorded the four parameters at each of the five sampling locations for an extended period of time. The data-log graphs and summary sheets are attached.

3.1 Carbon Dioxide Concentrations - Task 1

Carbon dioxide (CO_2) in indoor environments is a by-product of human respiration and by itself does not pose an acute health hazard. Elevated levels of CO_2 may serve as an indicator of an insufficient intake of fresh air to the HVAC system or insufficient number of air changes in the environment, and so it is used as a surrogate measurement. The normal ambient (outdoor) level of CO_2 ranges between 325-375 parts per million by volume (ppm). CO_2 concentrations typically fluctuate according to the population density, with maximum concentrations occurring at times of high population.

The American Society of Heating, Refrigerating, and Air Conditioning Engineers (ASHRAE) currently recommends that CO_2 levels be maintained below a maximum of 1,000 ppm for occupant comfort (ASHRAE 62-1988, Ventilation for Acceptable Indoor Air Quality). The Massachusetts Department of Public Health recommends that CO_2 levels be maintained below a maximum of 800 ppm during occupied periods.

Symptoms of inadequate supply of fresh air include headaches, dizziness, lightheadedness, and drowsiness often accompanied by a sensation of stuffiness. These effects vary widely from person to person; however, most individuals do not have measurable effects until CO_2 levels exceed 800 ppm.

The graphed results of monitoring show that the carbon dioxide concentrations in Rooms 14 and 15 and the Title I Reading Room during occupied times generally ranged from approximately 500 ppm to 750 ppm. The graphs also show that the carbon dioxide level in Rooms 12 and 13 exceeded 800 ppm during occupied times; however, the level only exceeded 1,000 ppm for short periods during the day. Overall, the carbon dioxide levels in the monitored school rooms were acceptable.

On the carbon dioxide histograms there are some spikes in the data where the carbon dioxide levels peaked momentarily at very high levels. These spikes occur when occupants of the rooms allowed their breath to exhale on the sensor. These spikes are irrelevant and are not included in our data analysis.

3.2 Carbon Monoxide Levels - Task 2

Carbon monoxide is a by-product of (incomplete) combustion, and is often associated with improperly vented space heaters, boilers, and hot water heaters. Carbon monoxide may also occur from combustion of tobacco products. The current Occupational Safety and Health Administration (OSHA) Permissible Exposure Limit (PEL) for carbon monoxide is 50 ppm, expressed as an eight-hour time-weighted average exposure. Outdoor levels of 0-4 ppm are frequently measured in the outside ambient urban environments.

The recorded carbon monoxide levels in the five rooms during school hours averaged between 1.0 ppm and 2.0 ppm. OHI does not believe that the measured carbon monoxide levels pose a risk to the health of occupants of the school.

3.3 Temperature and Relative Humidity Results - Task 3

The ASHRAE-recommended comfort range for temperature and relative humidity in office/school buildings is summarized in the table below.

ASHRAE Comfort Range for Office/School Buildings

Relative Humidity	Winter Temperature	Summer Temperature
30%	68.5°F - 76.0°F	74.0°F - 80.0°F
40%	68.5°F - 75.5°F	73.5°F - 79.5°F
50%	68.5°F - 74.5°F	72.5°F - 79.0°F
60%	68.0°F - 74.0°F	72.5°F - 78.0°F

Note: This chart applies to persons clothed in typical winter and summer clothing participating in sedentary activity. Source: Adapted from ASHRAE 55-1981.

All recorded temperatures in Rooms 12, 13, 14 and 15 and the Title I Reading Room during occupied times were below the recommended comfort ranges. The measured relative humidity in the rooms during occupied times varied with outdoor conditions and ranged from approximately 58% to 75%. Although the recorded relative humidity levels generally exceeded the recommended maximum of 60%, OHI does not recommend dehumidification of air in the rooms as it would be impracticable in the ground floor space.

Since recorded temperatures were below the recommended minimums, OHI recommends operating the heat in the rooms and/or increasing thermostat settings if students or staff are complaining of cool conditions.

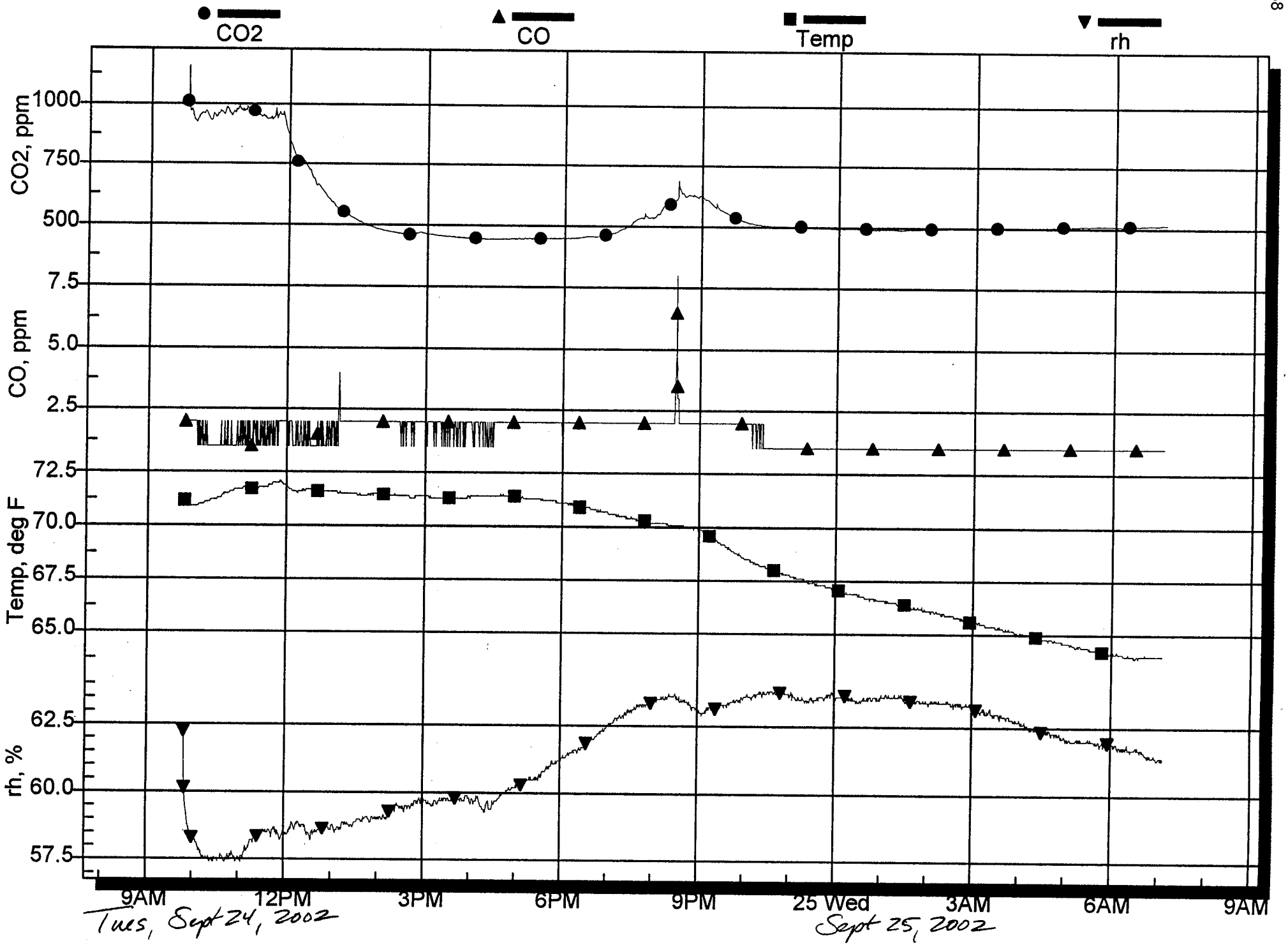
4.0 LIMITATIONS

The contents of this report are based on OccuHealth, Inc.'s best professional judgement, comparison of collected data with established industry guidelines, OHI's observations of the air handling equipment and information obtained from Town of Needham representatives.

ATTACHMENTS

Carbon Dioxide, Carbon Monoxide, Temperature and
Relative Humidity Data-Log Graphs and Summary Sheets

Room 12
High Rock Elementary School

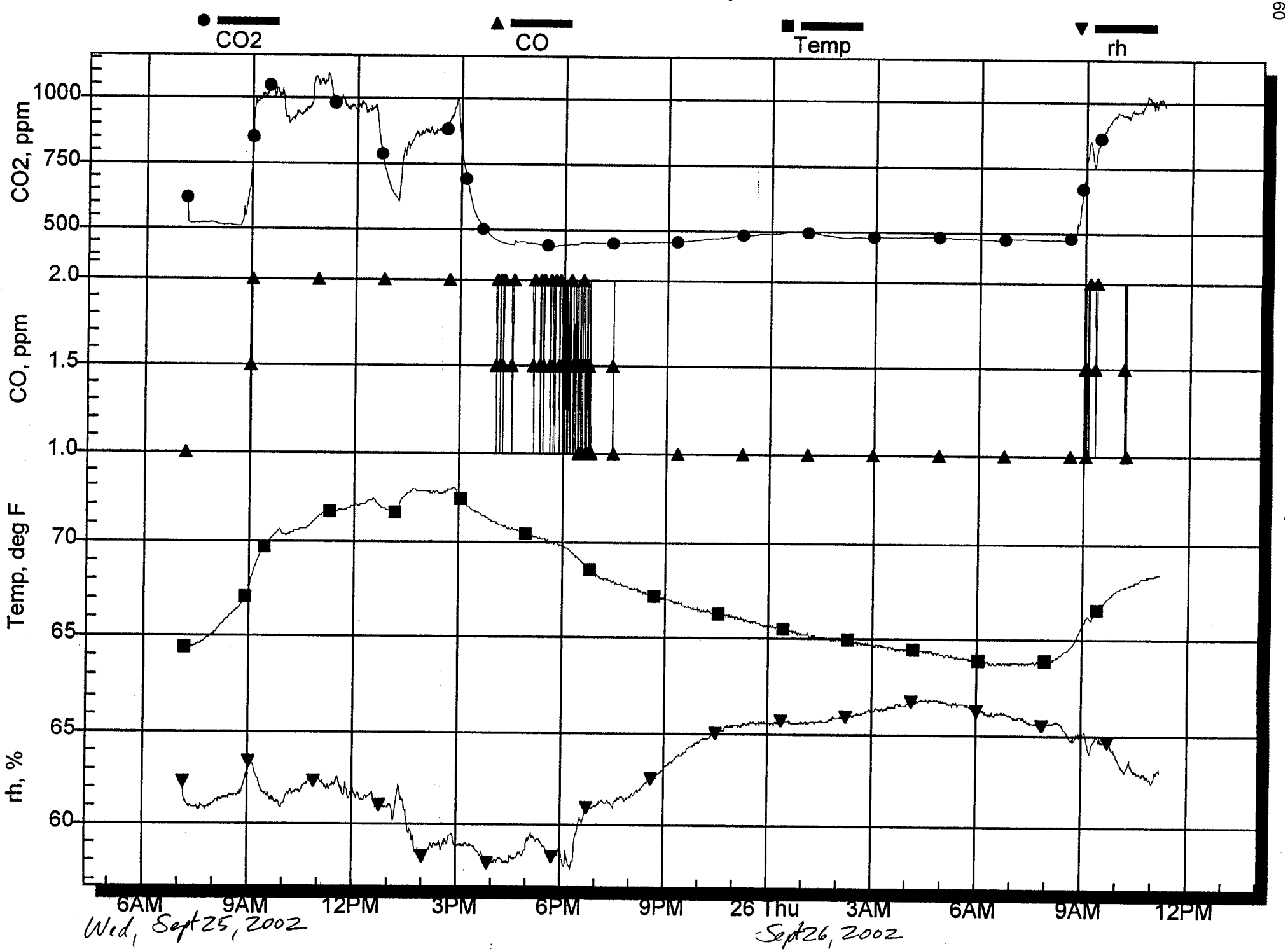


Current Test: 002
Start Time: 09:47:19 09/24/2002
Stop Time: 07:06:19 09/25/2002

Logging Interval: 30 seconds

Serial Number:	50372			
Sensor:	CO2	CO	Temp	rh
Cal. Date:	03/30/2001	03/30/2001	02/10/1999	02/10/1999
Channel:	CO2	CO	Temp	rh
(Units)	ppm	ppm	deg F	%
Average:	556	1	68.8	61.5
Minimum:	443	1	63.9	57.4
Time	16:14:49	10:03:19	06:27:49	10:23:19
Date	09/24/2002	09/24/2002	09/25/2002	09/24/2002
Maximum:	1158	8	72.1	63.8
Time	09:49:19	20:28:49	11:50:49	22:21:19
Date	09/24/2002	09/24/2002	09/24/2002	09/24/2002

Room 13
High Rock Elementary School

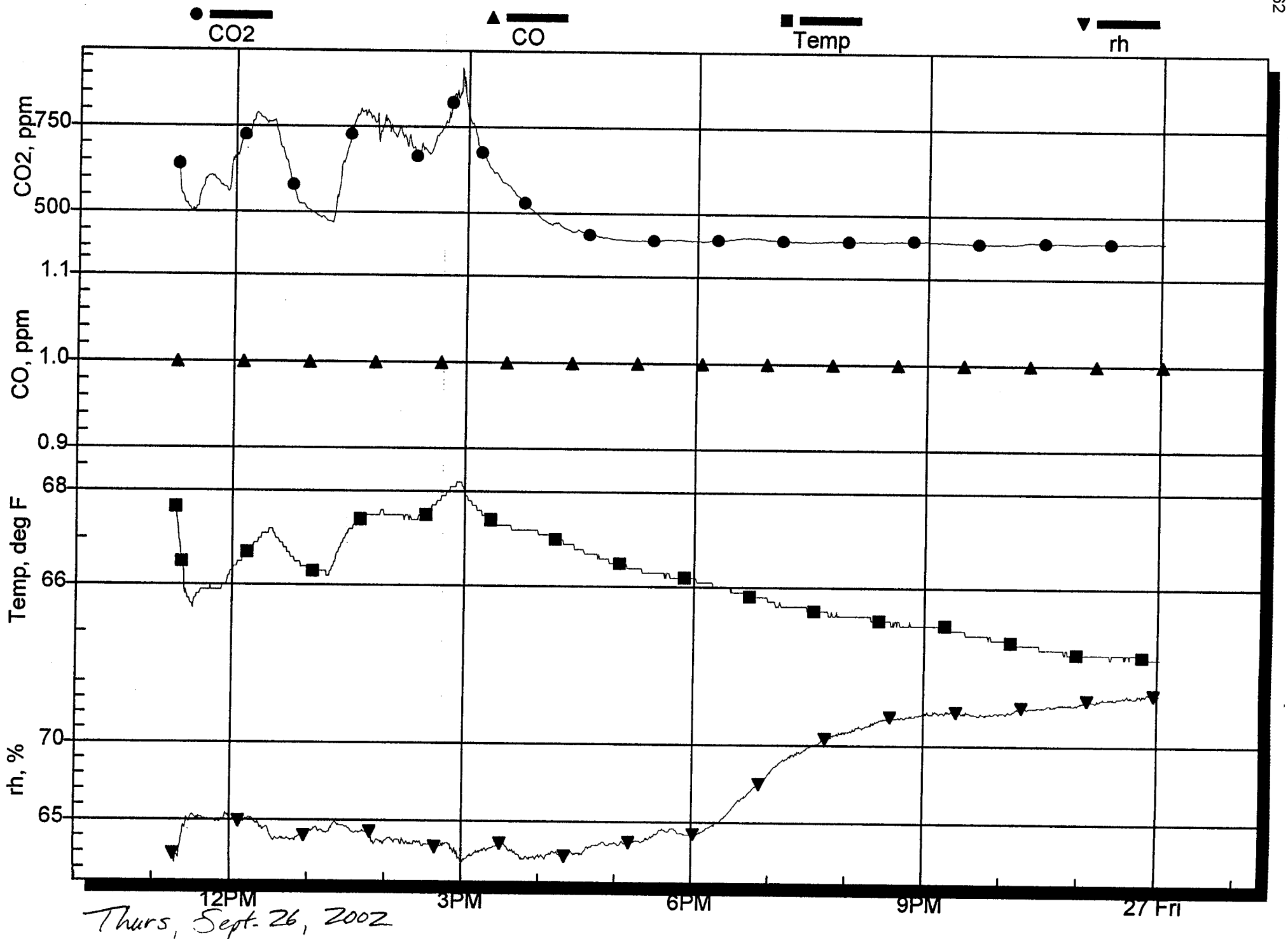


Current Test: 003
Start Time: 07:08:30 09/25/2002
Stop Time: 11:13:30 09/26/2002

Logging Interval: 30 seconds

Serial Number:	50372			
Sensor:	CO2	CO	Temp	rh
Cal. Date:	03/30/2001	03/30/2001	02/10/1999	02/10/1999
Channel:	CO2	CO	Temp	rh
(Units)	ppm	ppm	deg F	%
Average:	613	1	67.5	63.0
Minimum:	437	1	63.7	57.6
Time	17:40:00	07:09:00	06:21:30	18:18:00
Date	09/25/2002	09/25/2002	09/26/2002	09/25/2002
Maximum:	1095	2	72.9	67.0
Time	11:09:00	09:00:30	14:47:00	04:26:00
Date	09/25/2002	09/25/2002	09/25/2002	09/26/2002

Room 14
High Rock Elementary School



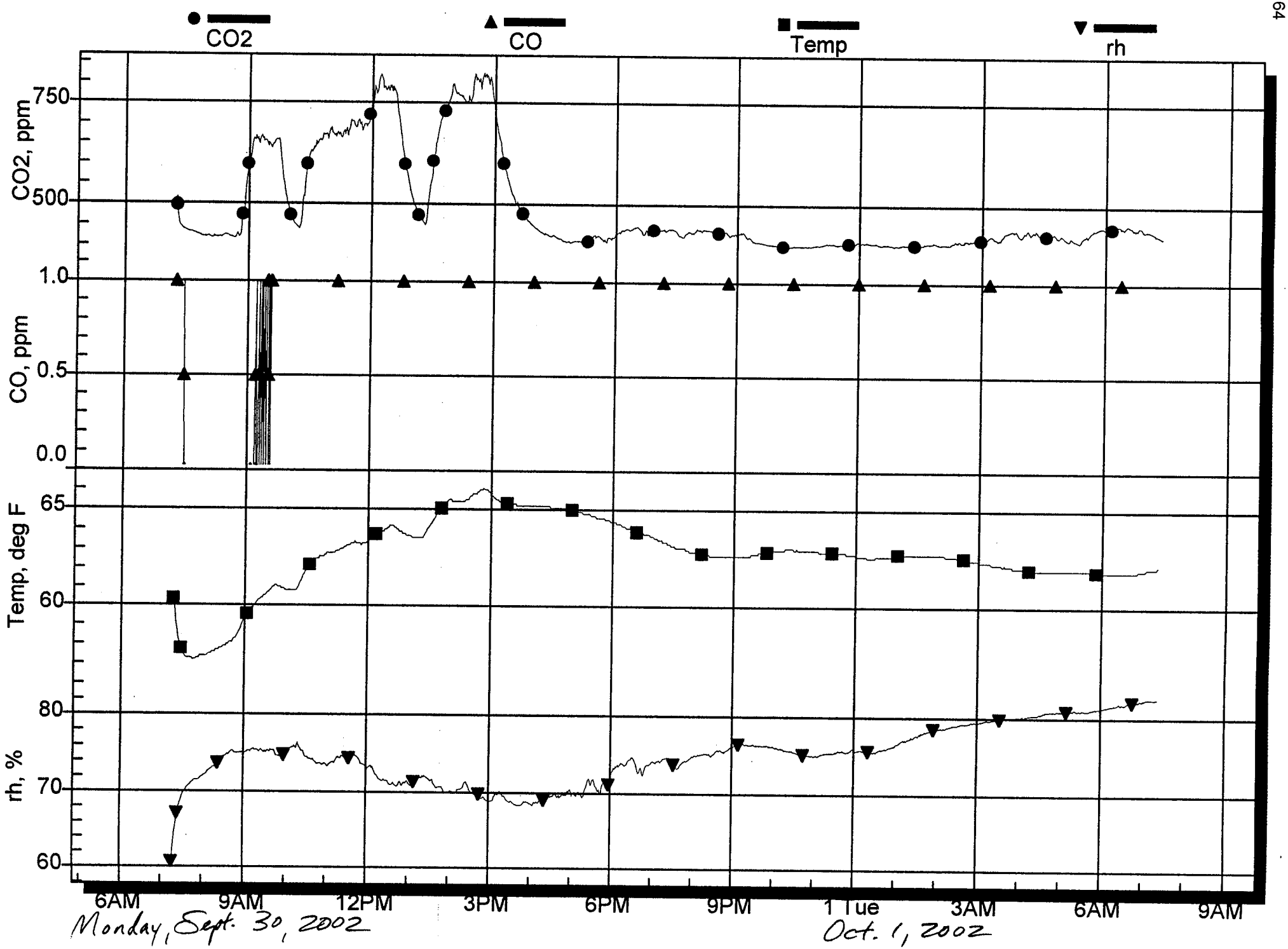
Thurs, Sept. 26, 2002

Current Test:	004	
Start Time:	11:15:33	09/26/2002
Stop Time:	00:02:33	09/27/2002

Logging Interval: 30 seconds

Serial Number:	50372			
Sensor:	CO2	CO	Temp	rh
Cal. Date:	03/30/2001	03/30/2001	02/10/1999	02/10/1999
Channel:	CO2	CO	Temp	rh
(Units)	ppm	ppm	deg F	%
Average:	511	1	66.1	67.2
Minimum:	419	1	64.5	62.3
Time	21:43:33	11:16:03	23:23:03	11:17:33
Date	09/26/2002	09/26/2002	09/26/2002	09/26/2002
Maximum:	919	1	68.2	73.5
Time	14:54:33	11:16:03	14:53:03	23:52:03
Date	09/26/2002	09/26/2002	09/26/2002	09/26/2002

Room 15
High Rock Elementary School

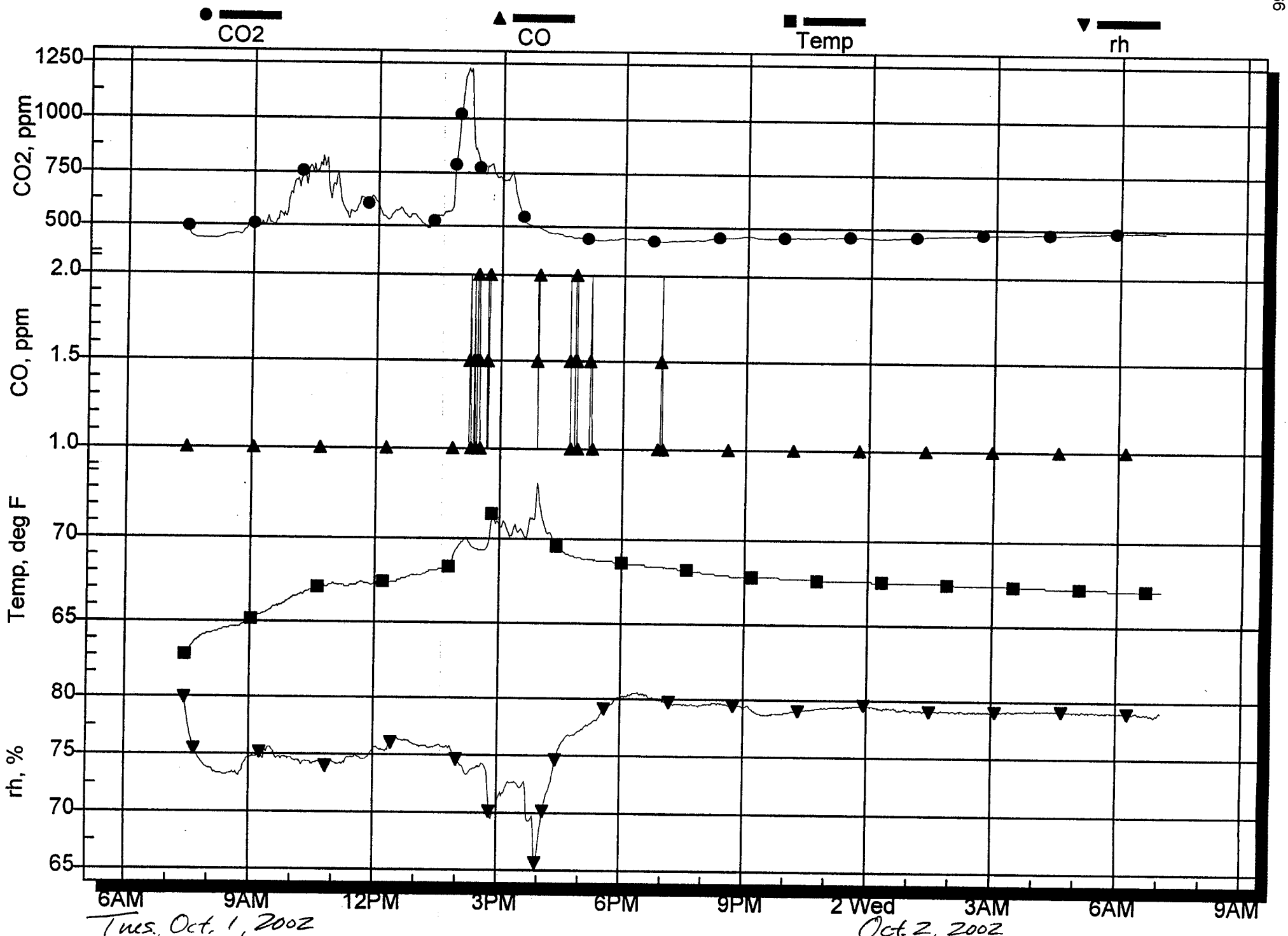


Current Test: 001
Start Time: 07:14:34 09/30/2002
Stop Time: 07:22:34 10/01/2002

Logging Interval: 60 seconds

Serial Number:	50372			
Sensor:	CO2	CO	Temp	rh
Cal. Date:	03/30/2001	03/30/2001	02/10/1999	02/10/1999
Channel:	CO2	CO	Temp	rh
(Units)	ppm	ppm	deg F	%
Average:	490	1	62.8	75.0
Minimum:	401	0	57.2	60.1
Time	22:09:34	07:28:34	07:43:34	07:15:34
Date	09/30/2002	09/30/2002	09/30/2002	09/30/2002
Maximum:	825	1	66.1	82.6
Time	14:42:34	07:15:34	14:48:34	07:06:34
Date	09/30/2002	09/30/2002	09/30/2002	10/01/2002

Title I Reading Room
High Rock Elementary School



Current Test: 002
Start Time: 07:25:01 10/01/2002
Stop Time: 07:04:01 10/02/2002

Logging Interval: 60 seconds

Serial Number:	50372			
Sensor:	CO2	CO	Temp	rh
Cal. Date:	03/30/2001	03/30/2001	02/10/1999	02/10/1999
Channel:	CO2	CO	Temp	rh
(Units)	ppm	ppm	deg F	%
Average:	517	1	67.7	77.2
Minimum:	432	1	63.0	65.4
Time	18:59:01	07:26:01	07:26:01	15:56:01
Date	10/01/2002	10/01/2002	10/01/2002	10/01/2002
Maximum:	1230	2	73.4	80.6
Time	14:09:01	14:16:01	15:55:01	18:25:01
Date	10/01/2002	10/01/2002	10/01/2002	10/01/2002