MEETING LOG
DIRECTORATE FOR ENGINEERING SCIENCES

SUBJECT: Meeting with Camping Heater Manufacturers to Present result of Preliminary Emissions Testing and to Express Concerns About Current standards Requirements

PLACE: CPSC Headquarters, 4330 East West Highway, Bethesda, MD

MEETING DATE: March 12,1996

LOG ENTRY SOURCE: Donald W. Switzer DWS

ENTRY DATE: December 13, 1996

COMMISSION ATTENDEES:

See Attached Attendance Sheet

NON-COMMISSION ATTENDEES:

See Attached Attendance Sheet

MEETING SUMMARY

Staff made the attached presentation to the manufacturers. The manufacturers agreed to work to improve product performance, and develop improved requirements in the voluntary standards.

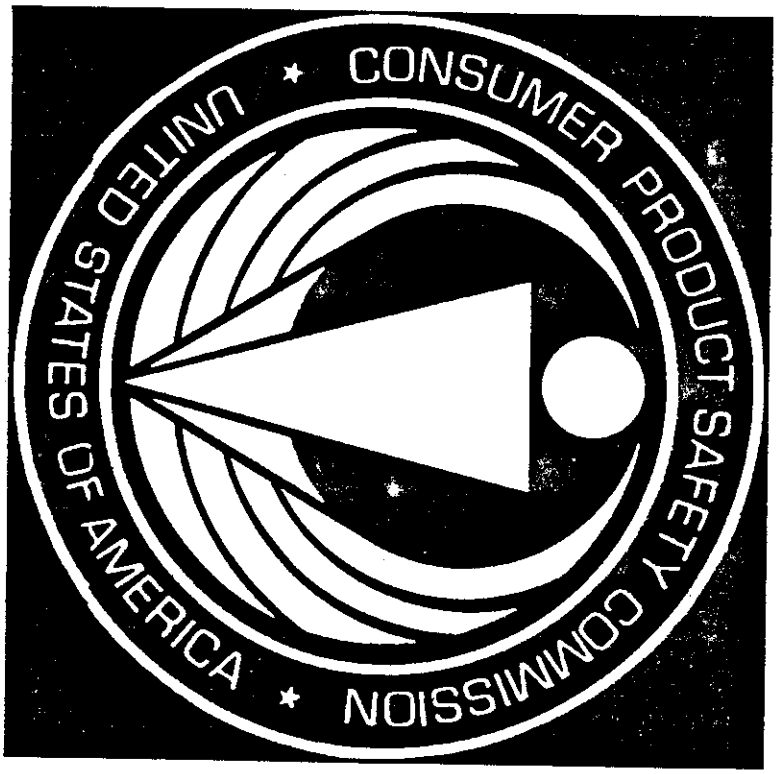
Attachments (2)

Attendance List
March 12, 1996
Presentation of Preliminary Results
of
Emissions Tests of Gas-Fired Camping Heaters

Don Switzer	CPSC
Rex Weigand	The Coleman Co., Inc.
Randy May	The Coleman Co., Inc.
Frank Schmidt	The Coleman Co., Inc.
Alan Able	Mr. Heater/Enerco
John Mullet	Nelson/Weather-Rite
Kenneth R. Bell	The Coleman Co., Inc.
William Rowe	CPSC
Robert Franklin	CPSC
Laureen Burton	CPSC
Bill Menza	CPSC
Michael Babich	CPSC
Catherine Chamberland	CPSC
William King	CPSC
Marc Schoem	CPSC
John Fitch	CPSC
George Sweet	CPSC
Robert Ochsman	CPSC
Maureen Cislo	Product Safety Letter
Tim Johnson	CPSC
Andrew Stadnik	CPSC
Susan Mccarthy	International Approval Services, Inc. US
Ralph Hoekstra	Century-Primus
Robert Marsden	International Approval Services, Inc. Canada
Richard Wiley	Desa
David Schmeltzer	CPSC
Larry Hershman	CPSC
Ronald Medford	CPSC
Jim Bertoch	CPSC
Lori Saltzman	CPSC

CPSC
PRESENTATION OF
PRELIMINARY RESULTS OF
CAMPING HEATER TESTS

MARCH 12, 1996


CONSUMER PRODUCT SAFETY COMMISSION
UNITED STATES OF AMERICA

Purpose of Meeting

- Discuss ways to work together to improve gas fired portable camping heater safety.
- Summarize results of preliminary testing of camping heaters.
- Solicit comments on possible solutions.
- Advise industry of CPSC issues about standard requirements.

Topics

- Introduction
- Death estimates
- Health effects
  - CO and oxygen effects on average healthy adults
- Human factors assessment
  - Specific incident information
- Current standard requirements

Topics (cont'd)

- CPSC testing
  - Test setup
  - Heater test results
  - Tent and vehicle air exchange rates
  - Future testing
- Interpretation of results
- Voluntary standard improvements
- CPSC staff suggestions

CPSC History

- Established in 1973 under the Consumer Product Safety Act
- Independent federal regulatory agency
- 3 Commissioners
- Jurisdictional authority in 5 acts
  - Consumer Product Safety Act (CPSA)
  - Federal Hazardous Substances Act (FHSA)
  - Flammable Fabrics Act (FFA)
  - Poison Prevention & Packaging Act (PPPA)
  - Refrigerator Safety Act (RSA)

CPSC Mission

- Protect public against unreasonable risks of injuries and death associated with consumer products
- Develop safety standards - mandatory and voluntary
- Minimize conflicting state and local regulations
- Provide comparative safety information
- Promote research and investigations into causes and prevention of injuries

How CPSC Prevents Injuries

Voluntary Standards

Mandatory Standards

Recalls/Compliance

Information/Education

Partnerships

Conferences

Guidelines

CPSC Cooperates in Developing Voluntary Standards

- Provides injury data and technical information to voluntary standard developer
- Supported 40 standards development committees in FY 1995
- Monitors compliance to selected voluntary standards

Estimates of Camping Heater Deaths

Year	Deaths
1992	13
1991	18
1990	13
1989	23
1988	17

- No trend evident
- No injury data available at this time
- Source: National Center for Health Statistics / CPSC

CO Effects in Average Healthy Adults
(% Carboxyhemoglobin)

- 2-10% - Generally no perceptible effect.
- 10-20% - Headache, impaired vision.
- 20-30% - Throbbing headache, nausea, impaired judgment.
- 30-40% - Severe headache, nausea, vomiting, confusion.
- 40-50% - Coma, convulsions, possible death.

Appropriate CO Level

- **Based on Coburn-Forster-Kane equation, moderately active, average healthy adult will not achieve 10% COHb after 10 hours exposure to 65 ppm CO.**
  - **Does not account for effects of alcohol, altitude, reduced oxygen.**
  - **May not protect sensitive populations.**

Effects of Reduced Oxygen Levels in Air at Sea Level

(20.59% Oxygen in the atmosphere)

- 16-12 % - Breathing and pulse increase, slight coordination disturbance
- 14-10% - Emotional upset, abnormal fatigue on exertion, impaired respiration
- 10-6 % - Nausea and vomiting, loss of consciousness, inability to move freely
- <6% - Convulsion, breathing stops

Appropriate Oxygen Level

- **Based on health effects, average healthy adult should not be exposed to oxygen levels below 16% (at sea level).**

Interactions

- Human and animal studies indicate CO exposure effects may be enhanced at high altitude.
- Human and animal studies indicate CO exposure effects enhanced by alcohol.
- Animal studies indicate CO toxicity may be increased by reduced oxygen.

Human Factors Assessment

- Based on 23 In-Depth Investigations
- Use patterns
- Warning labels

Regional and Seasonal Use

- Ages 17-81; Average - 33
- Incidents have occurred in almost every region of the country
- One incident in July. All others October to May.

Location of Victims Where Specifics Known

Location	Incidents
• Camper shell	8
• Tent	6
• Van	4
• Trailer	1
• Shed/Ice fishing shack	2
• Truck cab	1
• House boat	1

Ventilation Where Specifics Known

Ventilation	Incidents
• Closed	11
• Open	4
• No windows	4
• Vent blocked	1

Warning Labels Where Specifics Known

- Labels on heaters
  - Yes 13
  - No 2
- Labeling does not appear effective

Current Standard Requirements (ANSI Z21.63)

- "Concentration of CO not in excess of 35 ppm is produced in a room with no air exchanges occurring during combustion of the amount of gas necessary to reduce the oxygen of the room to 19.4 % by volume."
- "Concentration of CO not in excess of 250 ppm is produced in a room with no air exchanges occurring during combustion of the amount of gas necessary to reduce the oxygen concentration to 15.1 % by volume."

Questions???

CPSC Testing

- Preliminary test results
- Tent air exchange results
- Vehicle air exchange results
- Future testing

Testing Setup

- **Measurements recorded**
  - Carbon Monoxide
  - Carbon Dioxide
  - Oxygen
  - Hydrocarbons
  - Temperature
  - Fuel flow

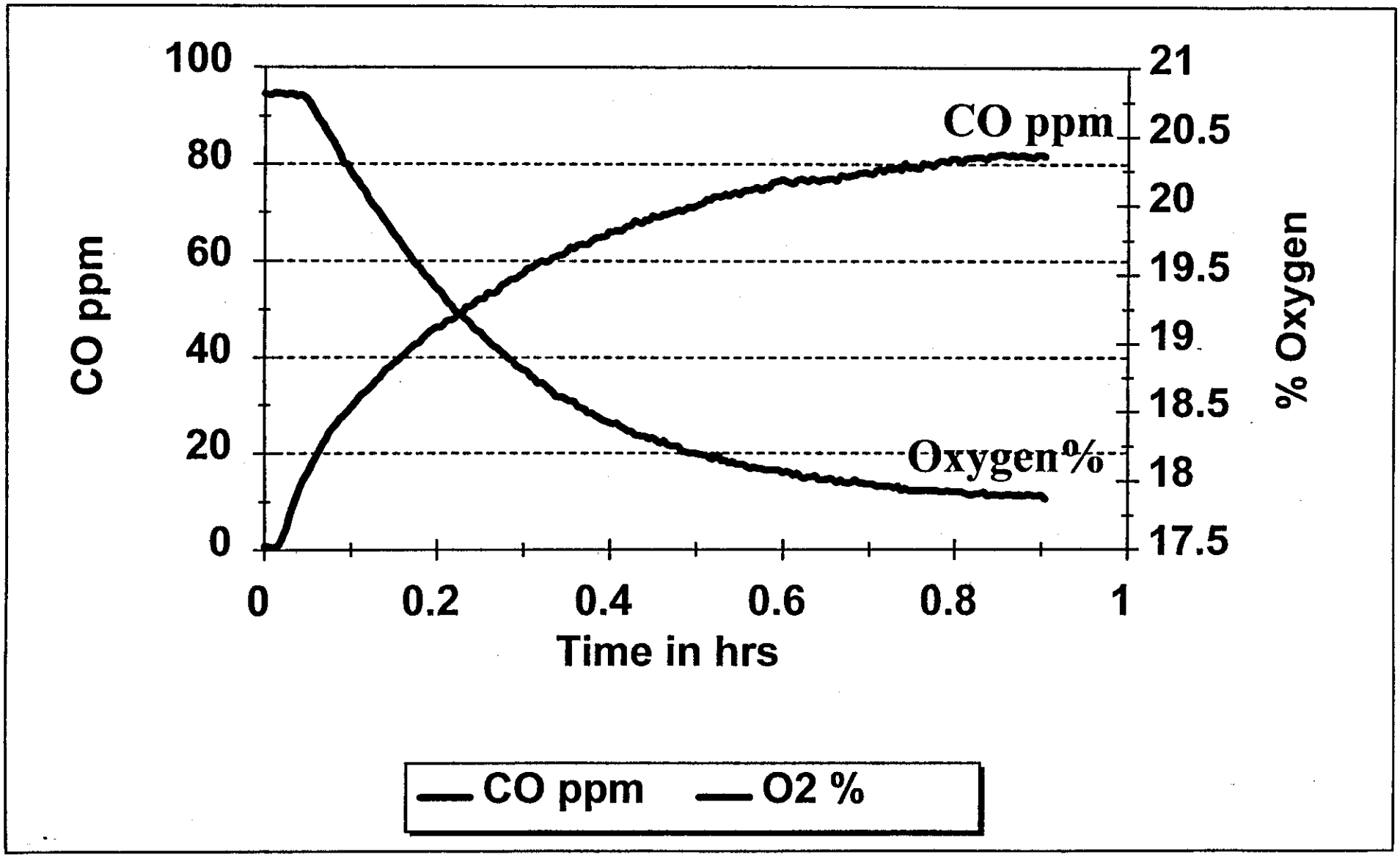
Testing Setup (Cont'd)

- Equipment
  - 100 cu ft chamber
  - Gas analyzers
  - Thermocouples
  - Data collection system

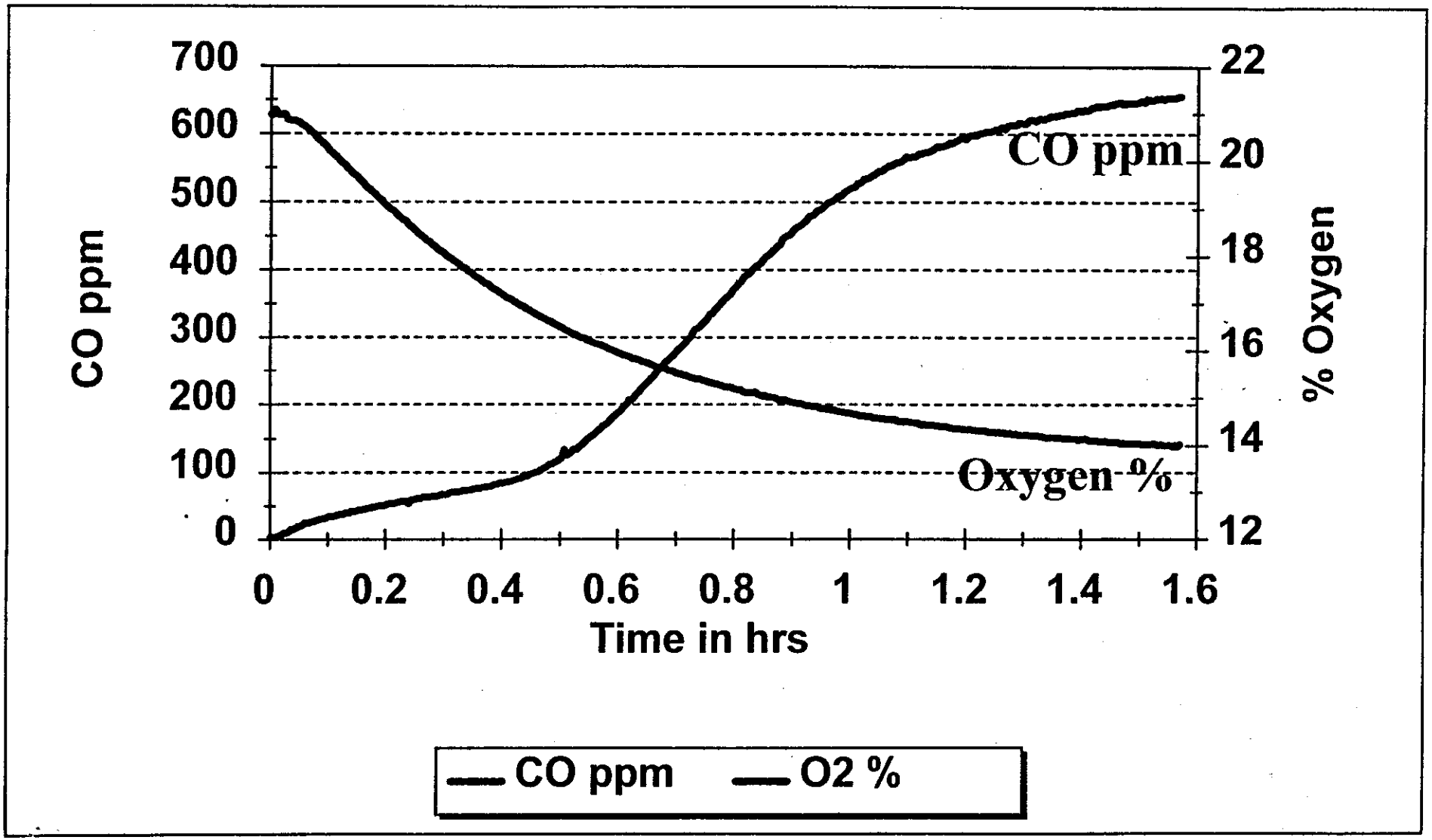
CPSC Testing

- **BTU Ranges**
  - 10,000+ BTU
  - 5,000 - 8,000 BTU
  - 3,000 - 5,000 BTU
  - Under 3,000 BTU
- **Air Exchange Rates**
  - 0, 2, 4 ACH

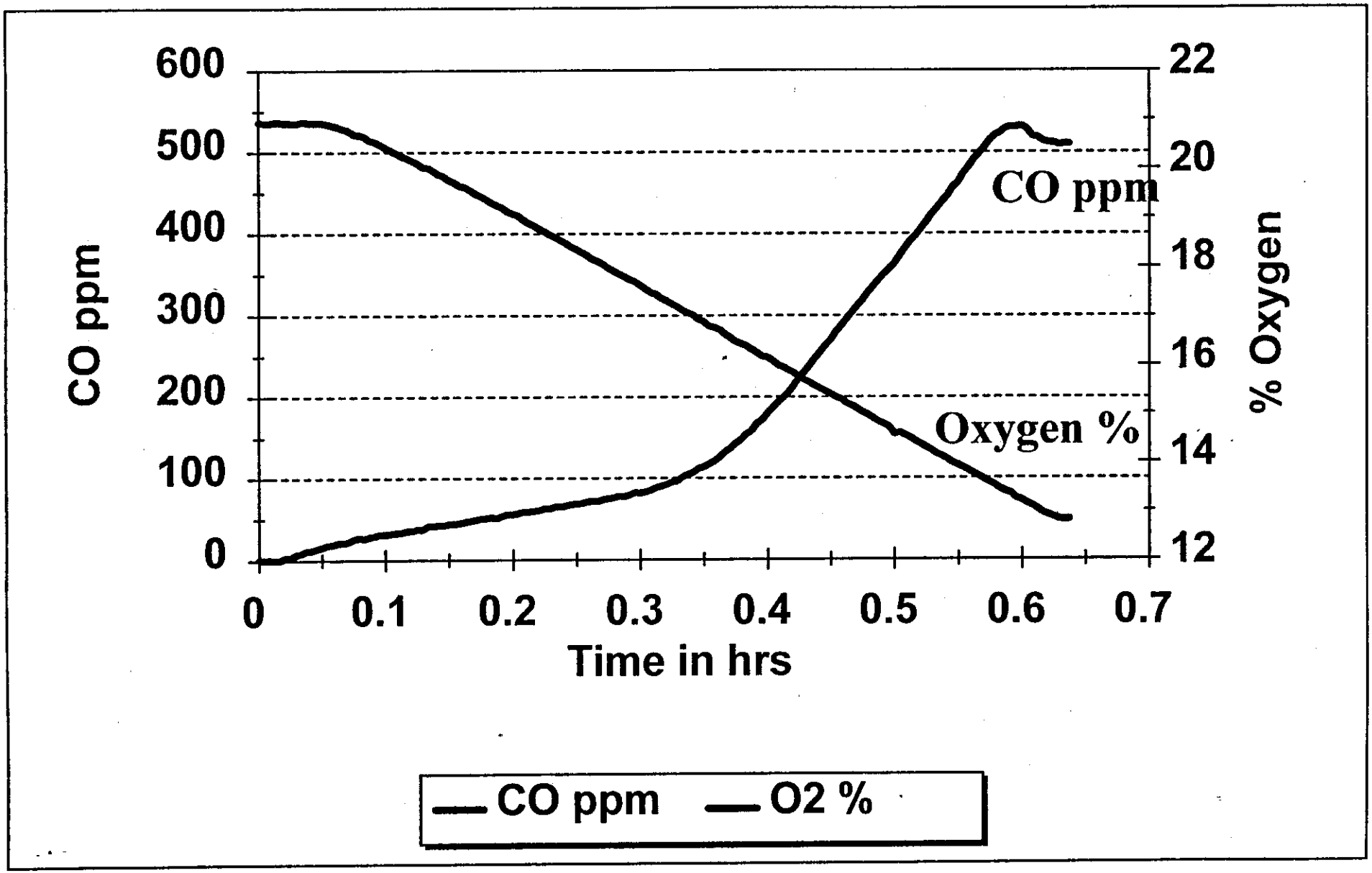
10,000+ BTU Range; 4.35 ACH



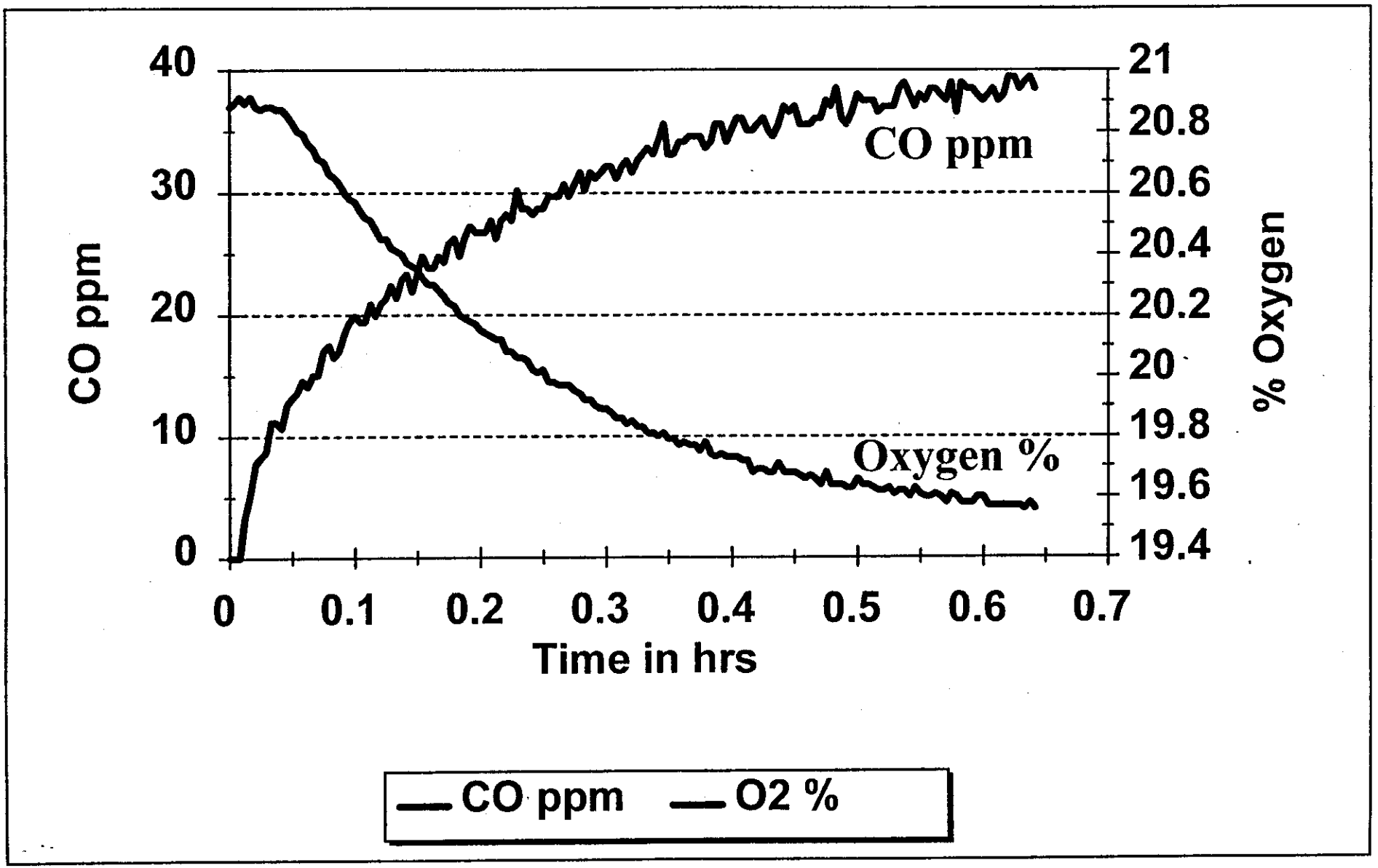
10,000+ BTU Range; 1.8 ACH



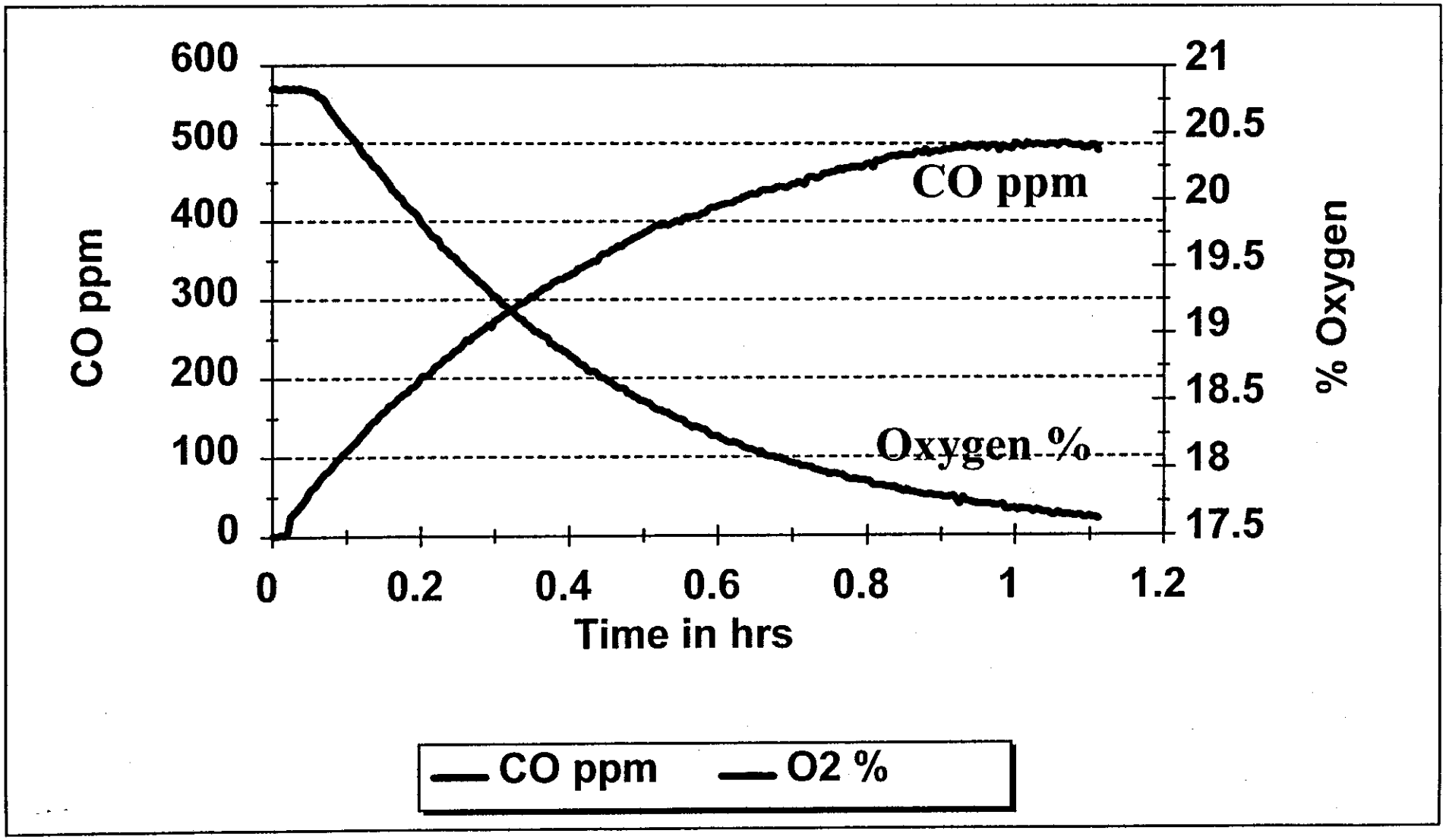
10,000+ BTU Range; 0 ACH



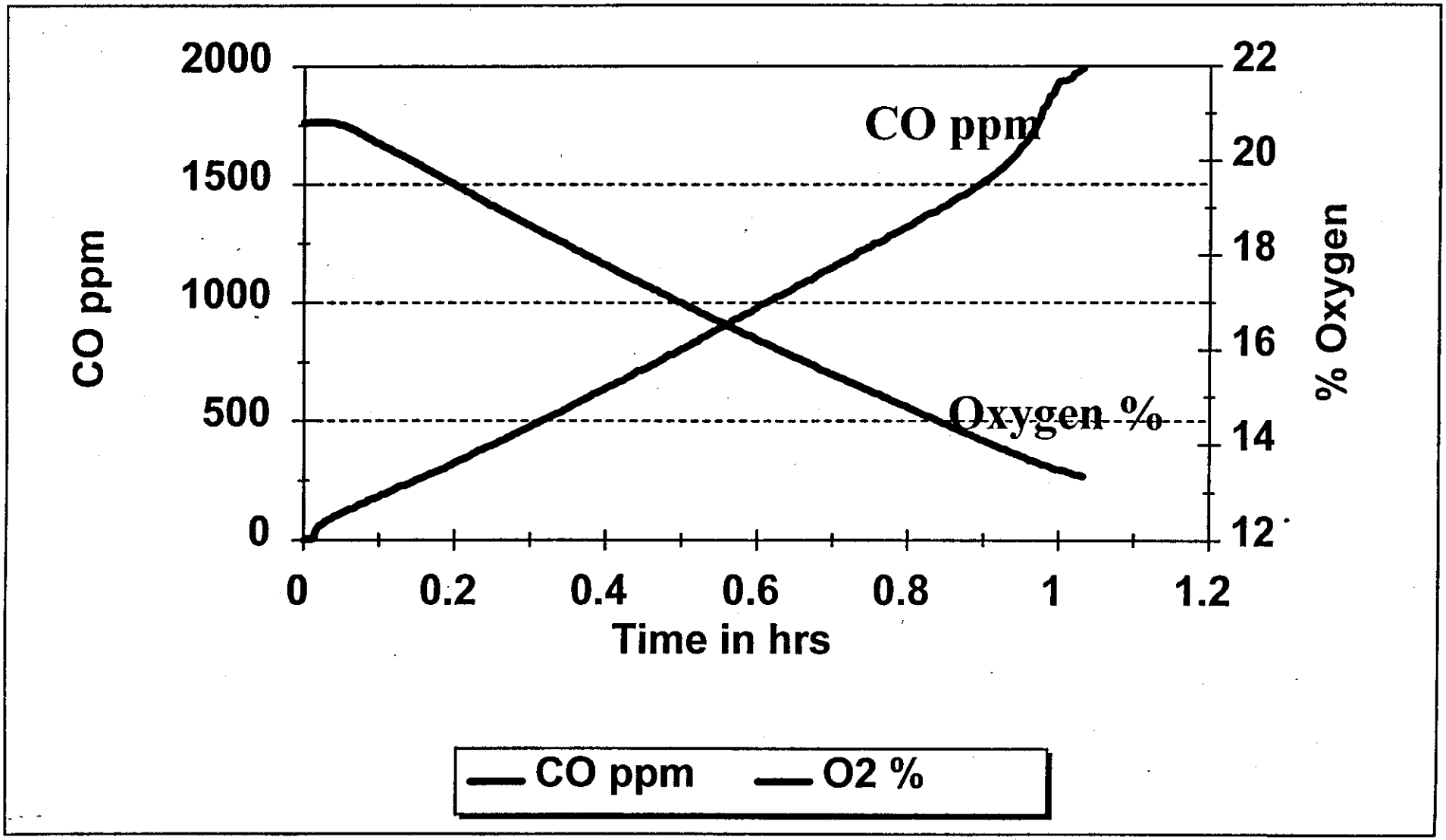
5-8,000 BTU Range; 4.4 ACH



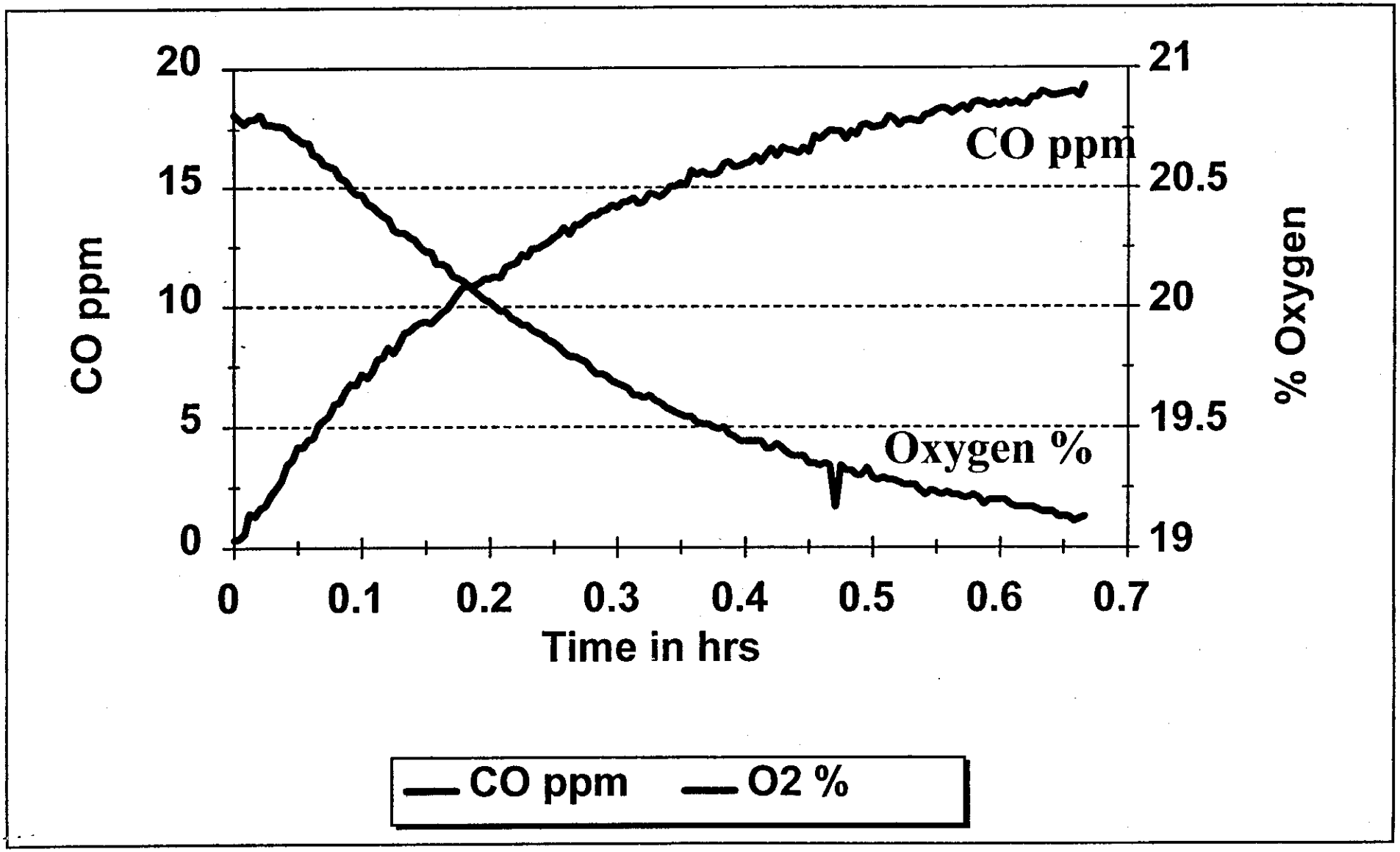
5-8,000 BTU Range; 1.85 ACH



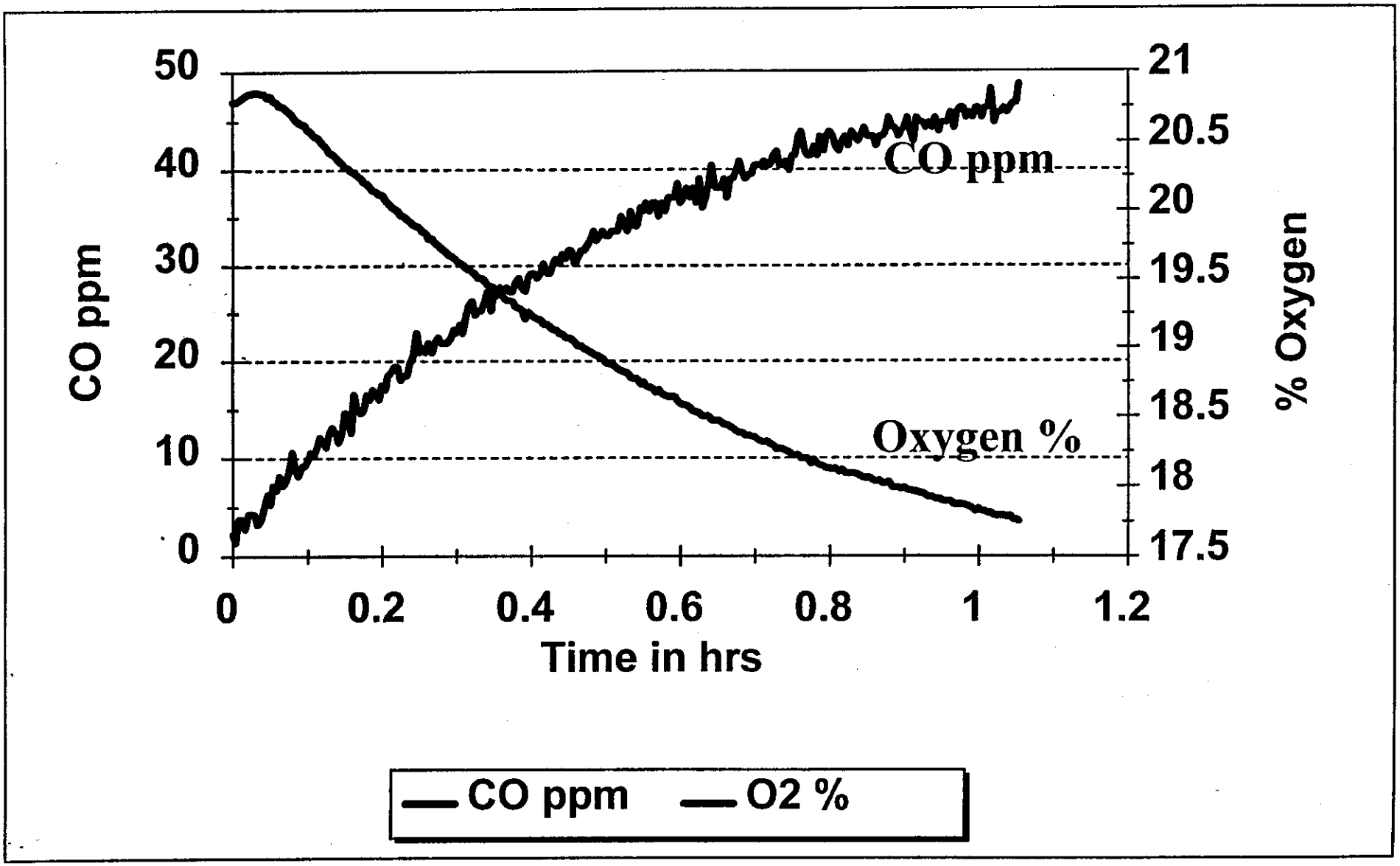
5-8,000 BTU Range; 0 ACH



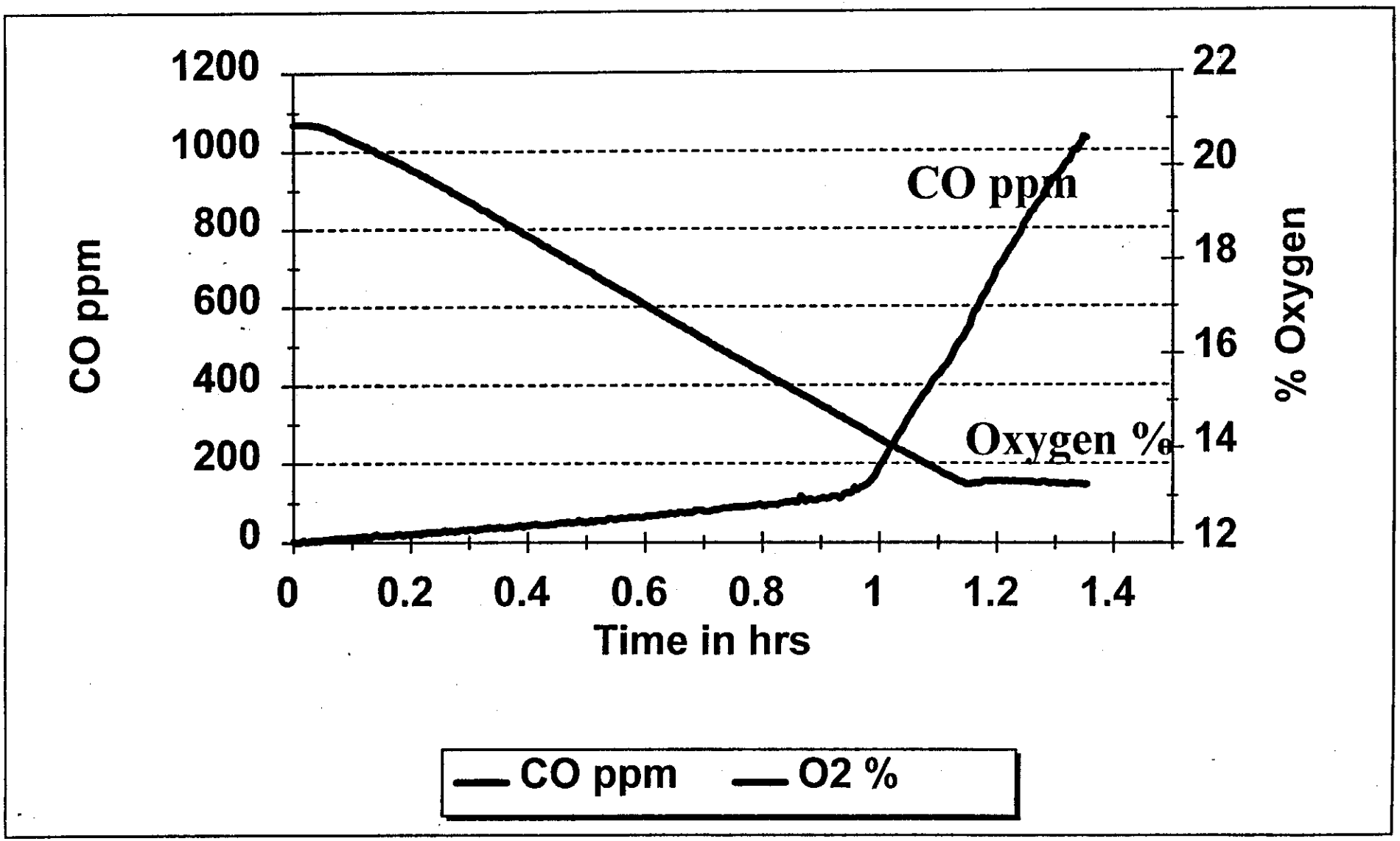
3-5,000 BTU Range; 3.89 ACH



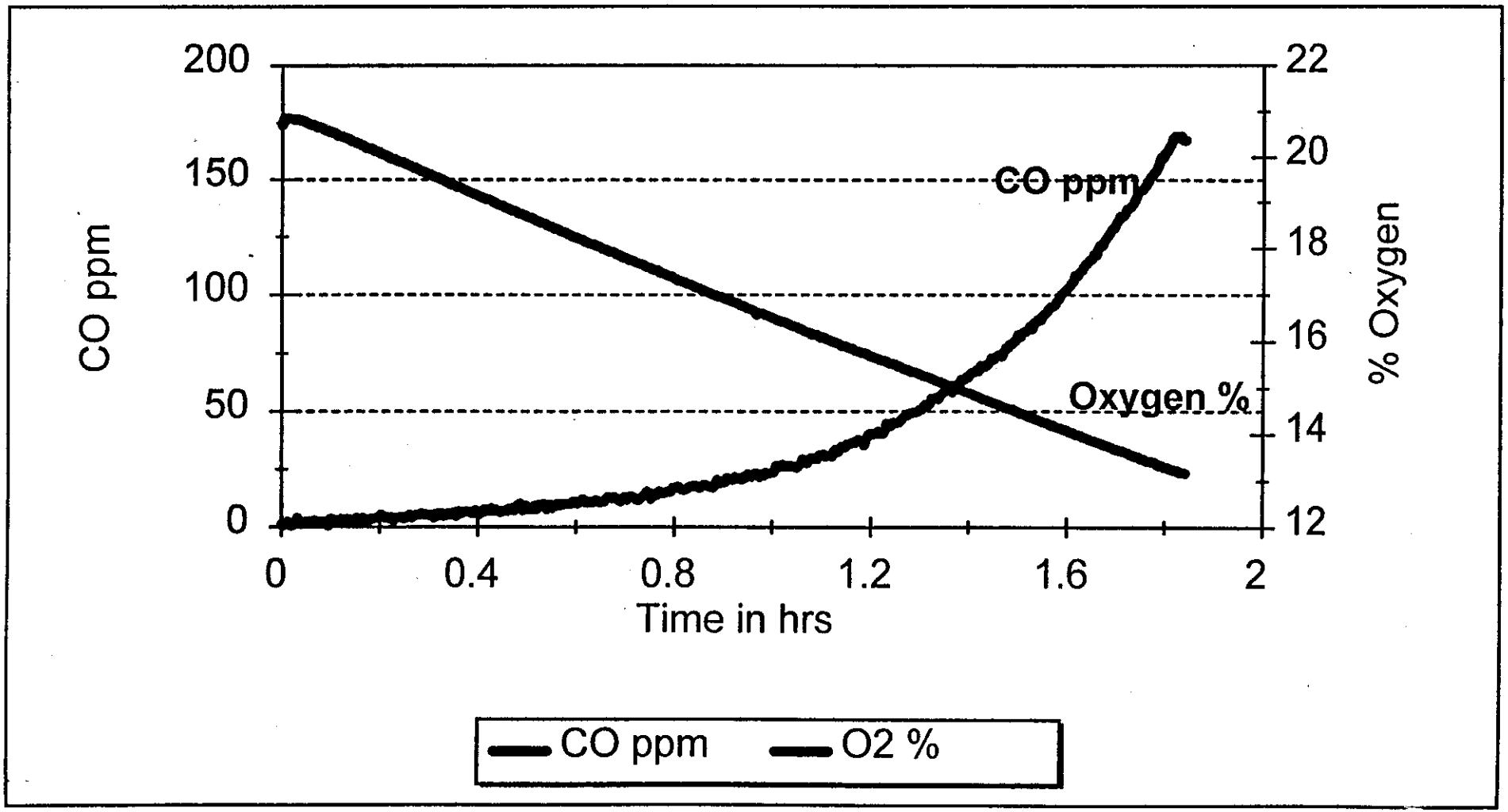
3-5,000 BTU Range; 1.91 ACH



3-5,000 BTU Range; 0 ACH



Under 3,000 BTU; 0 ACH



Preliminary Tent and Vehicle Testing

- Enclosures tested
- Procedures
- Results

Air Exchange Rate Test Procedure

- Air exchange rate tracked using sulfur hexaflouride (SF6)
- SF6 injected into enclosure
- Decay rate tracked using Autotrac 101
- Air exchange rate calculated from decay rate
  - ACH = Ln(Concentration / Initial Concentration) / Time

Preliminary Tent Air Exchange Results

• Large Dome	Dry Windy	19 ACH
• Small Dome	Rain	17-12 ACH
• Cabin Tent	Rain	11-7 ACH
• Large Dome	Snowy	7.5 ACH
• Large Dome	Rain	1.0 ACH

Preliminary Vehicle Air Exchange Results

• Truck Shell	Windy	11 ACH
• Minivan	Cold	1.5 ACH
• Full Size Van	Snow	1.2-1.7 ACH
• Conversion Van	Windy	1.8 ACH

Future CPSC Testing

- Heaters
- Tents
- Vehicles

Future Heater Testing

- Heaters from all manufacturers
- 0 ACH testing for comparison to standard
- Simulation of vehicle and tent volumes and air exchange rates

Future Air Exchange Rate Testing

- Testing of tents
  - Canvas tents
  - Cloth tents
  - Icy conditions
  - Wet/Rainy conditions
- Testing of vehicles
  - Campers and trailers
  - Truck and camper shells

Interpretation of Results

- Standard weaknesses
- Suggested improvements

Preliminary Camping Heater Results

- Two of four failed
- One marginal
- One passed

CO Concentration at 19.4%, 15.1% and 16% Oxygen

Heater	Zero ACH CO ppm @ 19.4% Oxygen	Zero ACH CO ppm @ 15.1% Oxygen	Zero ACH CO ppm @ 16% Oxygen
10,000+ BTU	51	310	193
5 - 8,000 BTU	340	1246	1030
3 - 5,000 BTU	39	153	121
Under 3,000	5	58	32

Voluntary Standard Weaknesses

- Products not being certified
- Heaters can operate below 15.1% oxygen
- 250 ppm CO at 15.1% oxygen is not appropriate
- Labeling not effective

CPSC Staff Suggestions

- CO concentration never exceeds 65 ppm.
- Test until CO concentration equalizes or heater extinguishes.
- Oxygen concentration should not fall below 16%.
- Heaters should be certified.