QUARTERLY RESPIROMETER TEST 3 OF 5

BUILDING 986 POL LABORATORY

SOIL VAPOR EXTRACTION AND BIO-VENTING OPERATIONS AND MAINTENANCE

FORT RICHARDSON, ALASKA
CONTRACT NO. DACA85-01-P-0080

Prepared for:

U.S. Army Corps of Engineers, Alaska District
CEPOA-PM-M-A
P. O. Box 6898
Elmendorf AFB, Alaska 99506-6898

Prepared By:

AGVIQ
AGVIQ ENVIRONMENTAL SERVICES

AGVIQ, Inc.
2121 Abbott Road Suite 100
Anchorage, Alaska 99507

Project #200110

October 2002

OPERATIONAL MONITORING

AGVIQ, Inc. inspected the soil vapor extraction (VE) and bio-venting (BV) system for proper operational parameters. The system appeared to be operating normally, as designed and was tested as initially configured. Power indicators and alarms were operational. The system airflow was free flowing, did not have excessive vacuum, the lower explosive limit (LEL) concentrations were low and the condensate tank was empty and unobstructed.

RESPIROMETER TESTING

Since the VE/BV system re-start on April 22, 2002, AGVIQ has performed three operational monitoring events at the Building 986 POL Lab. During each of these events, initial soil vapor readings were collected from three (3) monitoring points (MP-1, MP-2 and MP-3). Readings using a Combustible Gas Indicator (CGI) were collected from each of the monitoring points. The first two events took place on May 15 and June 12, 2002. The third monitoring event occurred on July 26, 2002 in conjunction with the quarterly respirometer testing. These monthly monitoring events consisted of soil vapor readings and airflow rates (CFM) and vacuum (inches of H2O) were measured from each vent well. The concentrations of volatiles (ppm) were measured with a calibrated photo-ionization detector (PID) from each vent well at the VE manifold. On July 26, 2002 the third respiration testing of this yearly sequence of O & M activities was performed for a period of eight (8) days. Prior to shutting off the blower for the respirometer test; the VE system was configured to extract air from VE wells 1 and 2, an initial effluent sample was collected, and initial soil vapor readings were collected from three (3) monitoring points. VE well 3 was adjusted from approx. 5% open to 100% open. Soil vapor readings were also collected daily over the next seven (7) days and the blower was restarted on August 2, 2002.

ANALYTICAL SAMPLING PROGRAM

Effluent Sampling

Effluent samples were collected from the VE system exhaust stack, prior to shutdown, to estimate hydrocarbon-mass removal rates as configured. The samples were collected from the exhaust stack using laboratory-prepared 1-liter stainless steel canisters. The samples were sent to CT&E of Anchorage, Alaska. The effluent samples were analyzed for the following parameters:

- Benzene, Toluene, Ethylbenzene and Xylenes (BTEX) by EPA 8021B
- Gasoline Range Organics (GRO) by AK 101; and
- Methane, carbon dioxide, oxygen and nitrogen by ASTM D-1945

FINDINGS

Effluent Sampling

The reported analytical results for GRO and BTEX constituents in the exhaust air sample were undetectable (Table 1) at levels stated in the report. The air sample analytical results indicate that the percent levels of oxygen and nitrogen are similar to the concentrations found in the atmosphere. The methane and carbon dioxide results were similar to the previous respirometer test (Table 1). The concentrations of volatiles in the exhaust air at the time of sample collection were low (Table 2). All of the analytical results from the effluent air samples collected during the respirometer sampling event are presented in Appendix A.

Monitoring Events

The CGI results from the monitoring events are presented in Appendix B. The readings at MP-1 suggest biological activity due to the decrease in oxygen and the increase in carbon dioxide, during the extent of the monitoring period. This trend is greater at 20 ft bgs than at 10 ft bgs. This implies that biological activity may be occurring in the vicinity of MP-1 and a significantly higher amount of activity may be taking place at the greater depth. MP-1 is located in the vicinity of the former dry well (Appendix C).

The readings from MP-2 also exhibited evidence of biological activity. However, there was less evidence of biological activity seen at 10 ft bgs, than was exhibited at the same depth at MP-1. Evidence of a considerably higher amount of microbial activity is seen at the 20 ft bgs depth at this location.

MP-3 is located outside of the main contaminated area at the former dry well area. Very little activity was observed at both depths in this location.

To assist in assessing the VE/BV system performance, the airflow rates (CFM) and vacuum (inches of H_2O) were measured from each vent well and concentrations of volatiles (ppm) were measured from each vent well at the exhaust manifold. The airflow rates measured at the VE blower during the third respirometer test ranged between 14 and 26 CFM and the applied vacuum levels at the VE blower ranged between 4 and 19 inches of H_2O. The concentration of volatiles ranged between 0.1 and 3.6 ppm. The airflow, vacuum and concentration of volatiles results for all three monitoring events are listed in Tables 2-4.

CONCLUSION

Review of the monitoring and analytical data indicates that the VE/BV system is actively remediating the subsurface soils in the vicinity of the former dry well located at Building 986. The observations indicate that the remediation is progressing by two processes: bioremediation through the utilization of oxygen in the soil gas and, to a lesser degree,

physical removal of hydrocarbon vapors. The physical removal is diminished due to the age of the system and remedial process.

Evidence of bioremediation and physical removal is obtained through sampling and analysis of the extracted soil gas. Analysis of the VE system effluent for petroleum hydrocarbons indicates that the VE system is successfully extracting contaminants. The presence of elevated CO2 concentrations in the soil gas analyzed from the VE system exhaust stack may be an indication of hydrocarbon biodegradation in the site soils. In addition, oxygen concentrations in the soil gas indicate that the oxygen is not currently limiting hydrocarbon biodegradation. Similarly, the data collected from the three soil gas monitoring points indicate by the increase in CO2 concentrations (Appendix D) and significant decrease in O2 concentrations (Appendix E) that biodegradation is occurring in the soils at the site where contamination was found.

Based on the monthly monitoring, respirometer, and analytical test data, the system operational configuration was not changed. The system was configured as listed in Table 4 - Soil Vapor Extraction & Bio-Venting System Operational Data – July 2002.

TABLE 1

AIR SAMPLE ANALYTICAL RESULTS

	---------- PARAMETERS ----------										
SAMPLE ID	**GRO** ppm	**BTEX** ppm	**Benzene** ppm	**Toluene** ppm	**Ethylbenzene** ppm	**P & M-Xylene** ppm	**O-Xylene** ppm	**Oxygen** %	**Nitrogen** %	**Methane** %	**Carbon Dioxide** %
Exhaust 02FRA005AG	U	U	U	U	U	U	U	N/A	N/A	N/A	N/A
Exhaust 02FRA006AG	N/A	N/A	N/A	N/A	N/A	N/A	N/A	16	83	U	0.81

Note:
GRO = Gasoline Range Organics
BTEX = Benzene, Toluene, Ethylbenzene and Total Xylenes
U = Undetectable as listed in the analytical report
N/A = Not Applicable as listed in the analytical report
ppm = parts per million by volume
% = percent by volume

TABLE 2

SOIL VAPOR EXTRACTION & BIO-VENTING SYSTEM OPERATIONAL DATA – MAY 2002

---------- PARAMETERS ----------

LOCATION	AIR FLOW (CFM)	VACUUM (inches of H_2O)	CONCENTRATION OF VOLATILES (ppm)	% WELLS OPEN
VE - 1	15	14	1.9	100 %
VE - 2	16	16	2.7	100 %
VE – 3	21	14	3.5	< 5 %
EXHAUST STACK	24	4	3.6	N/A

Note:
CFM = Cubic Feet per Minute
ppm = Parts Per Million
N/A = Not applicable

TABLE 3

SOIL VAPOR EXTRACTION & BIO-VENTING SYSTEM OPERATIONAL DATA – JUNE 2002

---------- PARAMETERS ----------

LOCATION	AIR FLOW (CFM)	VACUUM (inches of H_2O)	CONCENTRATION OF VOLATILES (ppm)	% WELLS OPEN
VE - 1	16	18	1.6	100 %
VE - 2	18	14	3.1	100 %
VE – 3	24	12	3.6	5 %
EXHAUST STACK	26	5	3.4	N/A

Note:
CFM = Cubic Feet per Minute
ppm = Parts Per Million
N/A = Not applicable

TABLE 4

SOIL VAPOR EXTRACTION & BIO-VENTING SYSTEM OPERATIONAL DATA – JULY 2002

---------- PARAMETERS ----------

LOCATION	AIR FLOW (CFM)	VACUUM (inches of H_2O)	CONCENTRATION OF VOLATILES (ppm)	% WELLS OPEN
VE - 1	21	19	0.1	100 %
VE - 2	16	17	1.6	100 %
VE – 3	14	17	1.1	100 %
EXHAUST STACK	24	8	2.2	N/A

Note:
CFM = Cubic Feet per Minute
ppm = Parts Per Million
N/A = Not applicable

Appendix A

Laboratory Analytical Results

CT&E Environmental Services Inc.

200 W. Potter Drive
Anchorage, AK 99518-1605
Tel: (907) 562-2343
Fax: (907) 561-5301
Web: http://www.cteesi.com

Darrin Lawless
AGVIQ Inc.
2121 Abbott Road Suite 100
Anchorage, AK 995074453

Work Order:	1024677
	Bldg 986 FRA BV S E 5020011
Client:	AGVIQ Inc.
Report Date:	September 05, 2002

Enclosed are the analytical results associated with the above workorder.

As required by the state of Alaska and the USEPA, a formal Quality Assurance/Quality Control Program is maintained by CT&E. A copy of our Quality Control Manual that outlines this program is available at your request.

Except as specifically noted, all statements and data in this report are in conformance to the provisions set forth in our Quality Assurance Program Plan.

If you have any questions regarding this report or if we can be of any other assistance, please call your CT&E Project Manager at (907) 562-2343.

The following descriptors may be found on your report which will serve to further qualify the data.

U	Indicates the analyte was analyzed for but not detected.
F	Indicates an estimated value that falls below PQL, but is greater than the MDL.
B	Indicates the analyte is found in the blank associated with the sample.
*	The analyte has exceeded allowable limits.
GT	Greater Than
D	Secondary Dilution
LT	Less Than
!	Surrogate out of range

CT&E Environmental Services Inc.

CT&E Ref.#	1024677001	**All Dates/Times are Alaska Standard Time**	
Client Name	AGVIQ Inc.	**Printed Date/Time**	09/05/2002 12:25
Project Name/#	Bldg 986 FRA BV S E 5020011	**Collected Date/Time**	07/26/2002 11:02
Client Sample ID	02FRA005AG	**Received Date/Time**	07/26/2002 17:00
Matrix	Gas & Air	**Technical Director**	Stephen C. Ede
Ordered By		**Released By**	JW Winidebank

Sample Remarks:

Parameter	Results	PQL	Units	Method	Allowable Limits	Prep Date	Analysis Date	Init
Volatile Fuels Department								
Gasoline Range Organics	20.0 U	20.0	ppm	CTE 8015M/8021B		07/30/02	07/30/02	PFL
Benzene	0.780 U	0.780	ppm	CTE 8015M/8021B		07/30/02	07/30/02	PFL
Toluene	0.660 U	0.660	ppm	CTE 8015M/8021B		07/30/02	07/30/02	PFL
Ethylbenzene	0.580 U	0.580	ppm	CTE 8015M/8021B		07/30/02	07/30/02	PFL
P & M -Xylene	0.580 U	0.580	ppm	CTE 8015M/8021B		07/30/02	07/30/02	PFL
o-Xylene	0.580 U	0.580	ppm	CTE 8015M/8021B		07/30/02	07/30/02	PFL
rogates								
1,4-Difluorobenzene <Surr>	90.4		%	CTE 8015M/8021B	60-120	07/30/02	07/30/02	PFL
4-Bromofluorobenzene <Surr>	89.5		%	CTE 8015M/8021B	50-150	07/30/02	07/30/02	PFL

AIR TOXICS LTD.

AN ENVIRONMENTAL ANALYTICAL LABORATORY

Air Toxics Ltd. Introduces the Electronic Report

Thank you for choosing Air Toxics Ltd. To better serve our customers, we are providing your report by e-mail. This document is provided in Portable Document Format which can be viewed with Acrobat Reader by Adobe.

This electronic report includes the following:

- Work order Summary;
- Laboratory Narrative;
- Results; and
- Chain of Custody (copy).

180 BLUE RAVINE ROAD, SUITE B FOLSOM, CA - 95630

(916) 985-1000 .FAX (916) 985-1020
Hours 8:00 A.M to 6:00 P.M. Pacific
E-mail to:samplereceiving@airtoxics.com

@ AIR TOXICS LTD.

AN ENVIRONMENTAL ANALYTICAL LABORATORY

WORK ORDER #: 0208145

Work Order Summary

CLIENT:	Ms. Rhonda Strucher CT & E 200 West Potter Anchorage, AK 99518	**BILL TO:**	Ms. Rhonda Strucher CT & E 200 West Potter Anchorage, AK 99518
PHONE:	907-562-2343	**P.O. #**	
FAX:	907-561-5301	**PROJECT #**	
DATE RECEIVED:	8/6/02	**CONTACT:**	Lisa Argento
DATE COMPLETED:	8/19/02		

FRACTION #	NAME	TEST	RECEIPT VAC./PRES.
01A	1024677002 (02FRA006AG)	Modified ASTM D-1945	0.0 "Hg
02A	Lab Blank	Modified ASTM D-1945	NA
03A	LCS	Modified ASTM D-1945	NA

CERTIFIED BY: _____ DATE: 08/19/02

Laboratory Director

Certification numbers: CA NELAP - 02110CA, NY NELAP - 11291, UT NELAP - 9166389892, LA NELAP/LELAP- AI 30763
Name of Accrediting Agency: NELAP/Florida Department of Health, Scope of Application: Clean Air Act,
Accreditation number: E87680, Effective date: 07/01/02, Expiration date: 06/30/03

Air Toxics Ltd. certifies that the test results contained in this report meet all requirements of the NELAC standards

180 BLUE RAVINE ROAD, SUITE B FOLSOM, CA - 95630
(916) 985-1000 , (800) 985-5955 , FAX (916) 985-1020

LABORATORY NARRATIVE
ASTM D-1945 Modified
CT & E
Workorder# 0208145

One Sample Cylinder sample was received on August 06, 2002. The laboratory performed analysis via Modified ASTM Method D-1945 for Methane and fixed gases in air using GC/FID or GC/TCD. The method involves direct injection of up to 1.0 mL of sample. With the exception of analyses conducted in accordance with AFCEE 3.0, all reported compound quantifications were calculated from response factors derived from the first Continuing Calibration Verification of each relevant analytical batch. See the data sheets for the reporting limits for each compound.

Requirement	*ASTM D-1945*	*ATL Modifications*
Quantification based on average response factor in the Initial Calibration.	NELAC Standard 5.9.4.2.1(c)	With the exception of samples analyzed under AFCEE 3.0 protocol, all quantification based on the response factor derived from the first Continuing Calibration Verification of each relevant analytical batch.

Receiving Notes

There were no receiving discrepancies.

Analytical Notes

Since Nitrogen is used to pressurize samples, the reported Nitrogen values are calculated by adding all the sample components and subtracting from 100%.

Definition of Data Qualifying Flags

Seven qualifiers may have been used on the data analysis sheets and indicate as follows:
B - Compound present in laboratory blank greater than reporting limit.
J - Estimated value.
E - Exceeds instrument calibration range.
S - Saturated peak.
Q - Exceeds quality control limits.
U - Compound analyzed for but not detected above the detection limit.
M - Reported value may be biased due to apparent matrix interferences.

File extensions may have been used on the data analysis sheets and indicates as follows:
a-File was requantified
b-File was quantified by a second column and detector
r1-File was requantified for the purpose of reissue

AIR TOXICS LTD.

SAMPLE NAME: 1024677002 (02FRA006AG)

ID#: 0208145-01A

MODIFIED NATURAL GAS ANALYSIS BY ASTM D-1945

File Name:	1080912	Date of Collection:	7/26/02
Dil. Factor:	2.02	Date of Analysis:	8/9/02

Compound	Rpt. Limit (%)	Amount (%)
Oxygen	0.20	16
Nitrogen	0.20	83
Methane	0.00020	Not Detected
Carbon Dioxide	0.0020	0.81

Container Type: Sample Cylinder

AIR TOXICS LTD.

SAMPLE NAME: Lab Blank

ID#: 0208145-02A

MODIFIED NATURAL GAS ANALYSIS BY ASTM D-1945

File Name:	30#0905	Date of Collection:	NA
Dil. Factor:	1.00	Date of Analysis:	8/9/02

Compound	Rpt. Limit (%)	Amount (%)
Oxygen	0.10	Not Detected
Nitrogen	0.10	Not Detected
Methane	0.00010	Not Detected
Carbon Dioxide	0.0010	Not Detected

Container Type: NA - Not Applicable

AIR TOXICS LTD.

SAMPLE NAME: LCS

ID#: 0208145-03A

MODIFIED NATURAL GAS ANALYSIS BY ASTM D-1945

File Name:	3080904	Date of Collection: NA	
Dil. Factor:	1.00	Date of Analysis: 8/9/02	

Compound	Rpt. Limit (%)	%Recovery
Oxygen	0.10	104
Nitrogen	0.10	102
Methane	0.00010	104
Carbon Dioxide	0.0010	104

Container Type: NA - Not Applicable

AGVIQ
2121Abbott Rd. Suite 100
Anchorage, Alaska 99507
phone (907) 341-6299
fax (907) 341-6256

CHAIN OF CUSTODY/LABORATORY ANALYSIS REQUEST

Date 7/26/02 Page 1 of 1 Cooler # COC#

Client AGVIQ Inc	Sample Conditions
Project Site: Bldg. 986 FRA	Sampled by: PBD Seal #
Sampling Company: AGVIQ Inc	Seal intact upon receipt by sampling company? Yes No
Sampling Site: BV System Exhaust	Condition of contents:
Project Manager: Darrin Lawless	Sealed for Shipping by:
Team Leader: Scott Kendall	Initial contents temp(C):
Project #: 5020011	Sampling status: Continuing unit:
Receiving Lab: CTEE	Seal intact upon receipt by laboratory? Yes No
Address:	Contents temp upon receipt:
Purchase Order # DACA-85-01-P-0080	Condition of contents:

Date	Time	Location ID	Sample ID	Matrix	LabID	DRO AK102	GRO/BTEX AK101/EPA 8021B	Total Organic Carbon EPA 5310B	CH4, CO2, O2, N2 ASTM 1945		Grain Size Dist. ASTM D422					Number of Containers	Comments:
7/26/02	1102	Exhaust	02FRA005AG	Air	(1)A		X									1	1024677
7/26/02	1108	Exhaust	02FRA006AG	Air	(2)A				X							1	

Relinquished by:	Relinquished by:	Relinquished by:
Signature	Signature	Signature
Printed Name Paul B. Davis	Printed Name	Printed Name
Firm AGVIQ, Inc	Firm	Firm
Date/Time 7/26/02 1700	Date/Time	Date/Time
Received by:	**Received by:**	**Received by:**
Signature	Signature	Signature
Printed Name	Printed Name	Printed Name ROBERT TAYLOR
Firm	Firm	Firm CTEC
Date/Time	Date/Time	Date/Time 7/26/02 1750

Turnaround Time Required

___Standard (30 days)

___24 hr. ___48 hr.

___3-5 days ___7 days

___14 days ___days

Provide verbal preliminary results?
___Yes ___No

Provide FAX preliminary results? ___Yes ___No

Requested report date _____

EDF data required?
___Yes ___No

Shipping Details

Delivered to shipper by: AGVIQ Inc

Method of shipment: Hand Delivered Airbill #

Received for lab: Signed:

Special Instructions/Comments:

COE Data Deliverables

CT&E Environmental Services Inc.

SAMPLE RECEIPT FORM

CT&E WO **1024677**

Yes	No		
	✓	Are samples **RUSH**, priority, or *within 72 hrs.* of **hold time**?	
		If yes have you done *e-mail notification*?	
	✓	Are samples *within 24 hrs.* of **hold time** or **due date**?	
		If yes, have you *spoken with* Supervisor?	
		Archiving bottles – if required, are they properly marked?	
	✓	Are there any **problems** (e.g., ids, analyses)?	
		Were samples preserved correctly and pH verified?	
		Has Project Manager been notified of problems?	
	✓	Is this a DOD project? (USACE, Navy, AFCEE):	
		If yes, complete page 2 of Sample Receipt Form	
✓		Will a **data package** be required?	LEVEL II
	✓	If this is for PWS, provide **PWSID**.	
		Is there a **quote** for this project?	
	✓	Will **courier** charges apply?	
		Method of payment?	

Due Date: 8/6/02
Received Date/Time: 7/26/02 1700
Received Temperature*: AMBIENT
Thermometer ID: NONE

Cooler ID	Temp Blank	Cooler Temp

Matrix of each Sample:

4	"	#1-2
	"	
	"	
	"	
	"	
	"	
	Trip Blank	
	BMS/BMSD	

Completed by (sign): Forest Taylor **(print):** FOREST TAYLOR

Notes:

Additional Sample Remarks

_____ Extra Sample Volume?
_____ Limited Sample Volume?
_____ Field pres'd for volatiles?
_____ Field-filtered for dissolved? _____
_____ Lab-filtered for dissolved? _____
_____ Ref Lab required? _____

# of each Container Received:

_____ 950 ml amber unpres'd
_____ 950 ml amber w / HCl
_____ 500 ml amber w / H_2SO_4
_____ 1L cubies unpres'd
_____ 1L Cubitainers w / HNO_3
_____ 1L Cubitainers w / H_2SO_4
_____ 1L Cubitainers w / NaOH + ZnAc
_____ 250 mL Nalgene NaOH
_____ 120 ml coli bottles
_____ 60 ml Nalgene unpres'd
_____ 60 mL Nalgene w/ H_2SO_4
_____ 8 oz amber unpres'd
_____ 4 oz amber unpres'd
_____ 4 oz w / septa w / MeOH
_____ 40 ml vials w / HCl
_____ 40 mL ascorbic acid + HCl

2 Other (specify) SS CYLINDER
_____ Other (specify) _____
_____ Other (specify) _____
_____ Other (specify) _____

TO BE COMPLETED IN ANCHORAGE UPON ARRIVAL FROM FAIRBANKS:
DATE / TIME: _____
COOLER AND TEMP BLANK READINGS*

Cooler ID	Temp Blank	Cooler	Cooler ID	Temp Blank	Cooler

CUSTODY SEALS INTACT: YES / NO #/WHERE: _____
COMPLETED BY (INITIAL): _____

Log-in proofed by: _____

*Temperature readings include thermometer correction factors.

Form F004r04 (Revised 12/28/01)

CT&E Environmental Services Inc.

SAMPLE RECEIPT FORM

CT&E W. 1024677

The following *must* be completed for *all* DOD projects (AFCEE, Navy, and USACE)

Yes	No		
	✓	Is received temperature 4 ± 2°C?	
		Exceptions:	Samples/Analyses affected: None
	✓	Rad Screen performed?	
		Result:	
	✓	Was there an airbill, etc.? Note #:	
	✓	Was cooler sealed with custody seals? Fax'd to COE?	
		# / where:	
N/A		Were seals intact upon arrival?	
✓		Was there a COC with cooler?	
✓		Was the COC filled out properly?	
✓		Did the COC indicate ACOE / AFCEE project? (if applicable)	
✓		Did the COC and samples correspond?	
N/A		Were all samples packed to prevent breakage?	
		packing material:	
✓		Were all samples unbroken and clearly labeled?	
	✓	Were all samples sealed in separate plastic bags?	
N/A		Were all bottles for volatiles free of headspace?	
✓		Were correct container / sample sizes submitted?	
✓		Is sample condition good?	
		Was client notified of problems? (specify below)	

Individual contacted: _____

Date / Time: _____ Phone / Fax: _____

Completed by (sign): Forest Taylor **(print):** FOREST TAYLOR

Log-in proofed by: _____

Form F004Ar01 (Revised 12/28/01)

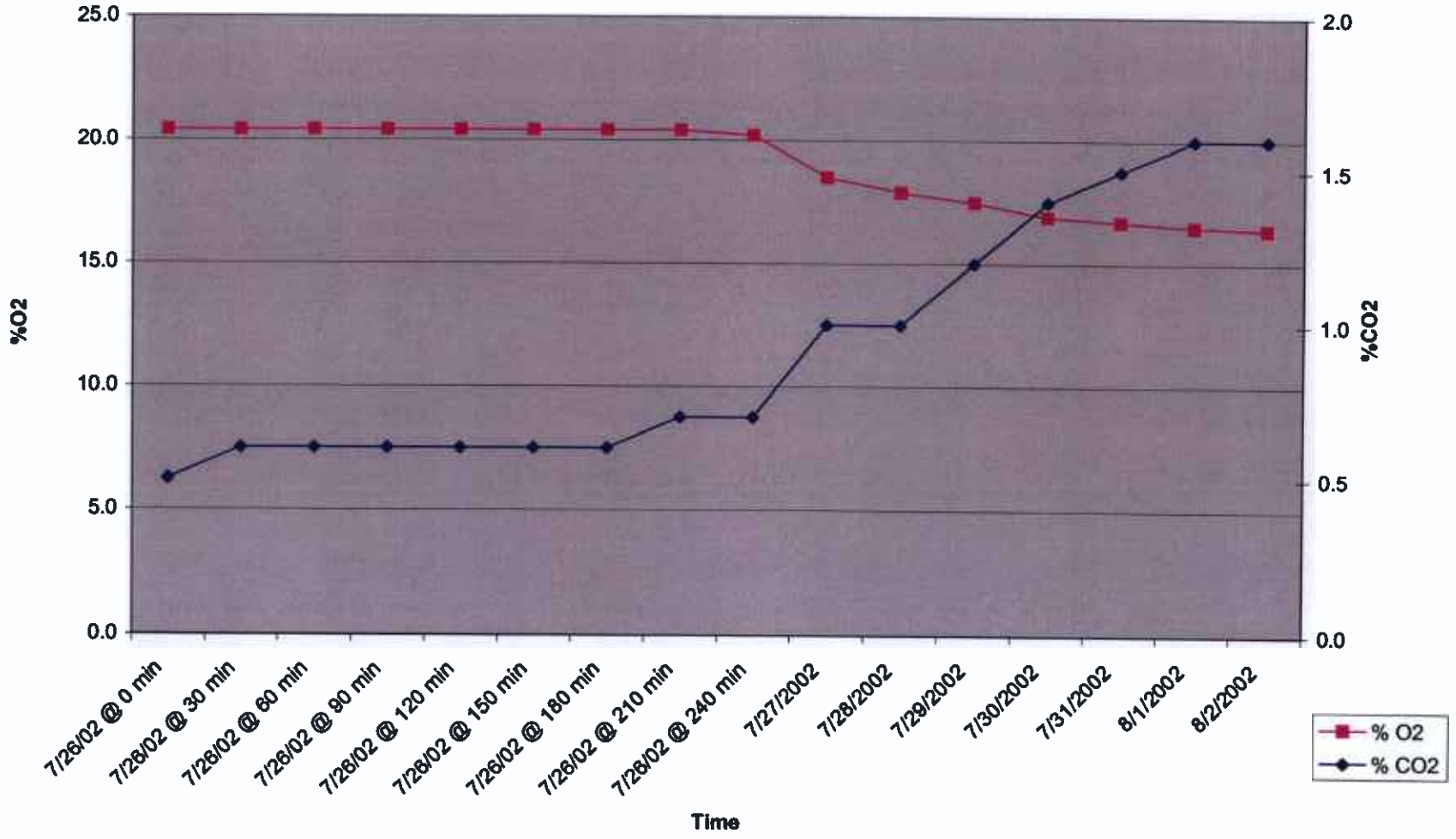
Appendix B

Combustible Gas Indicator Results From Quarterly Respirometer Test 3 of 5

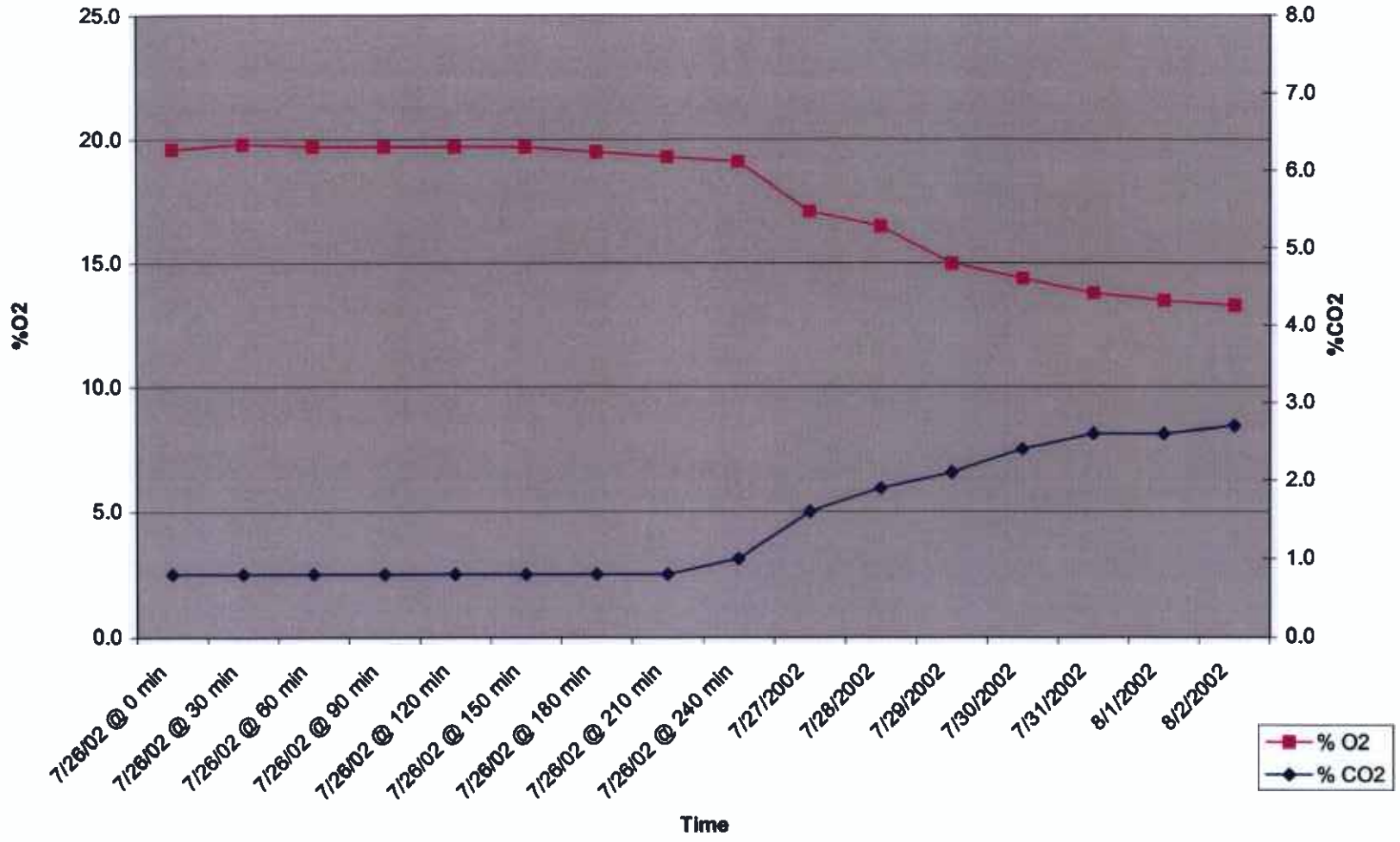
	MP - 1				MP - 2				MP - 3			
DATE	10 ft bgs (Blue)		20 ft bgs (Green)		10 ft bgs (Blue)		20 ft bgs (Green)		10 ft bgs (Blue)		20 ft bgs (Green)	
	% CO_2	% O_2	% CO_2	% O_2	% CO_2	% O_2	% CO_2	% O_2	% CO_2	% O_2	% CO_2	% O_2
5/15/2002	0.3	20.8	0.9	19.8	0.1	20.8	0.2	20.7	0.1	20.8	0.0	20.9
6/12/2002	0.4	20.9	0.8	20.3	0.2	20.9	0.4	20.9	0.4	20.9	0.2	20.8
7/26/02 @ 0 min	0.5	20.4	0.8	19.6	0.2	20.9	0.3	20.5	0.0	20.9	0.2	20.6
7/26/02 @ 30 min	0.6	20.4	0.8	19.8	0.2	20.8	0.4	20.4	0.2	20.7	0.2	20.7
7/26/02 @ 60 min	0.6	20.4	0.8	19.7	0.2	20.8	0.4	20.3	0.2	20.8	0.2	20.6
7/26/02 @ 90 min	0.6	20.4	0.8	19.7	0.2	20.8	0.4	20.3	0.2	20.8	0.2	20.7
7/26/02 @ 120 min	0.6	20.4	0.8	19.7	0.2	20.8	0.4	20.0	0.2	20.8	0.2	20.7
7/26/02 @ 150 min	0.6	20.4	0.8	19.7	0.2	20.8	0.4	19.8	0.2	20.7	0.2	20.6
7/26/02 @ 180 min	0.6	20.4	0.8	19.5	0.2	20.8	0.5	19.8	0.1	20.7	0.2	20.6
7/26/02 @ 210 min	0.7	20.4	0.8	19.3	0.2	20.8	0.5	19.8	0.2	20.7	0.2	20.6
7/26/02 @ 240 min	0.7	20.2	1.0	19.1	0.2	20.8	0.5	19.7	0.2	20.7	0.2	20.6
7/27/2002	1.0	18.5	1.6	17.1	0.2	20.6	0.6	17.0	0.2	20.5	0.3	20.4
7/28/2002	1.0	17.9	1.9	16.5	0.2	20.6	0.6	16.6	0.2	20.6	0.2	20.2
7/29/2002	1.2	17.5	2.1	15.0	0.2	20.6	0.8	15.9	0.2	20.5	0.2	20.0
7/30/2002	1.4	16.9	2.4	14.4	0.2	20.6	1.0	15.6	0.4	20.4	0.2	20.1
7/31/2002	1.5	16.7	2.6	13.8	0.2	20.4	1.3	14.0	0.4	20.2	0.2	20.0
8/1/2002	1.6	16.5	2.6	13.5	0.2	20.4	1.5	13.9	0.4	20.2	0.2	20.0
8/2/2002	1.6	16.4	2.7	13.3	0.2	20.4	1.6	13.9	0.4	20.2	0.2	20.0

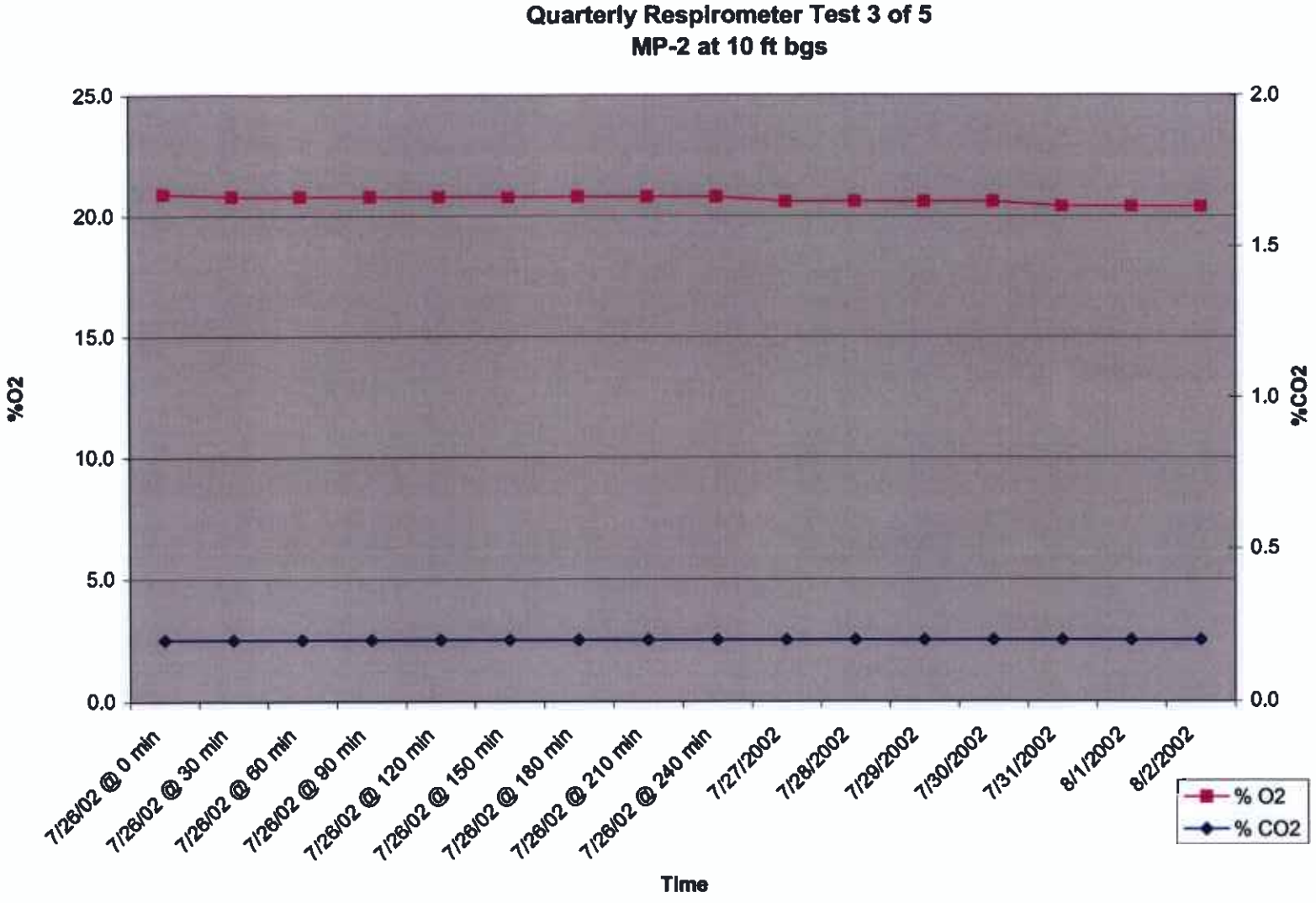
Note:
MP = monitoring point
ft = feet
bgs = below ground surface

Quarterly Respirometer Test 3 of 5
MP-1 at 10 ft bgs

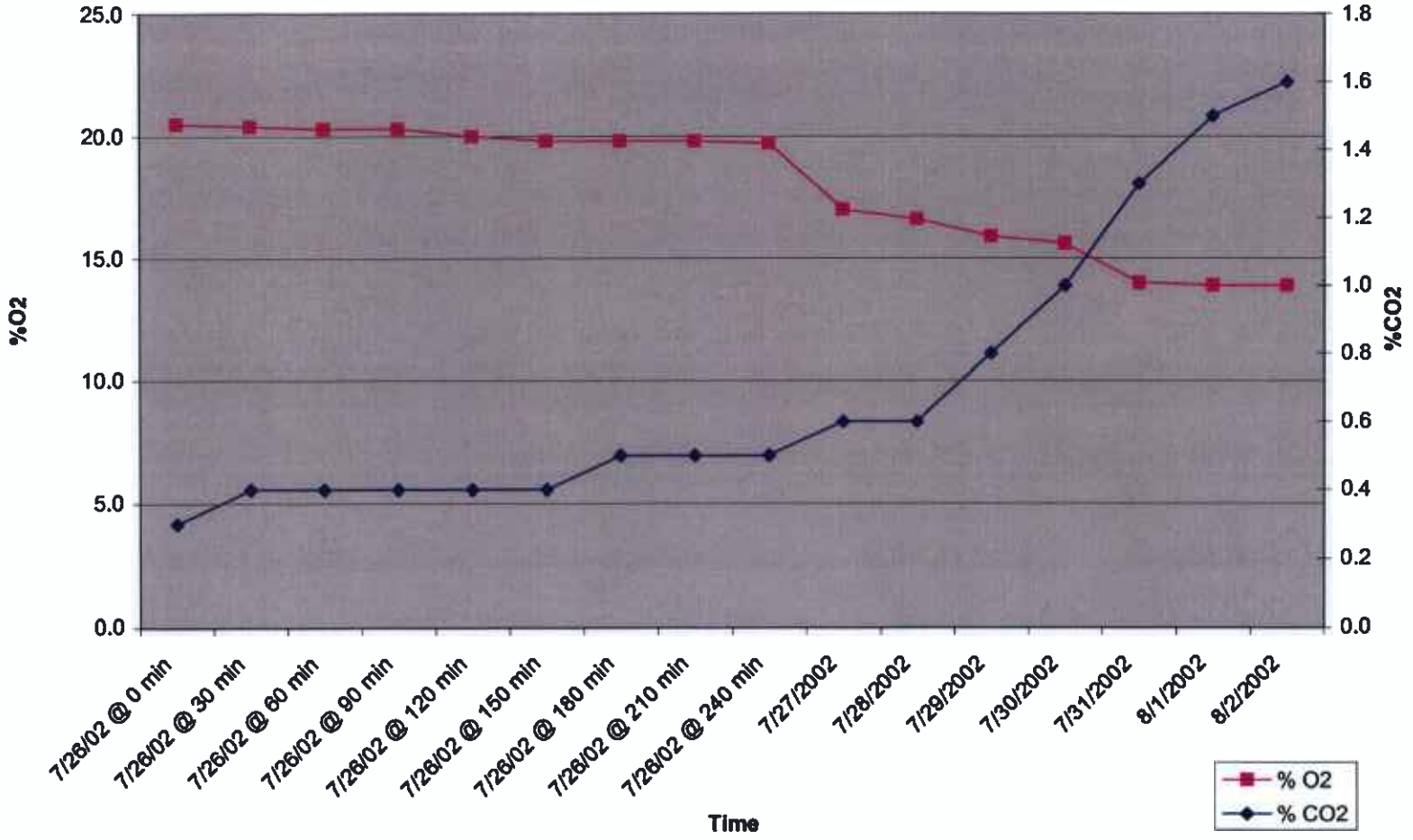


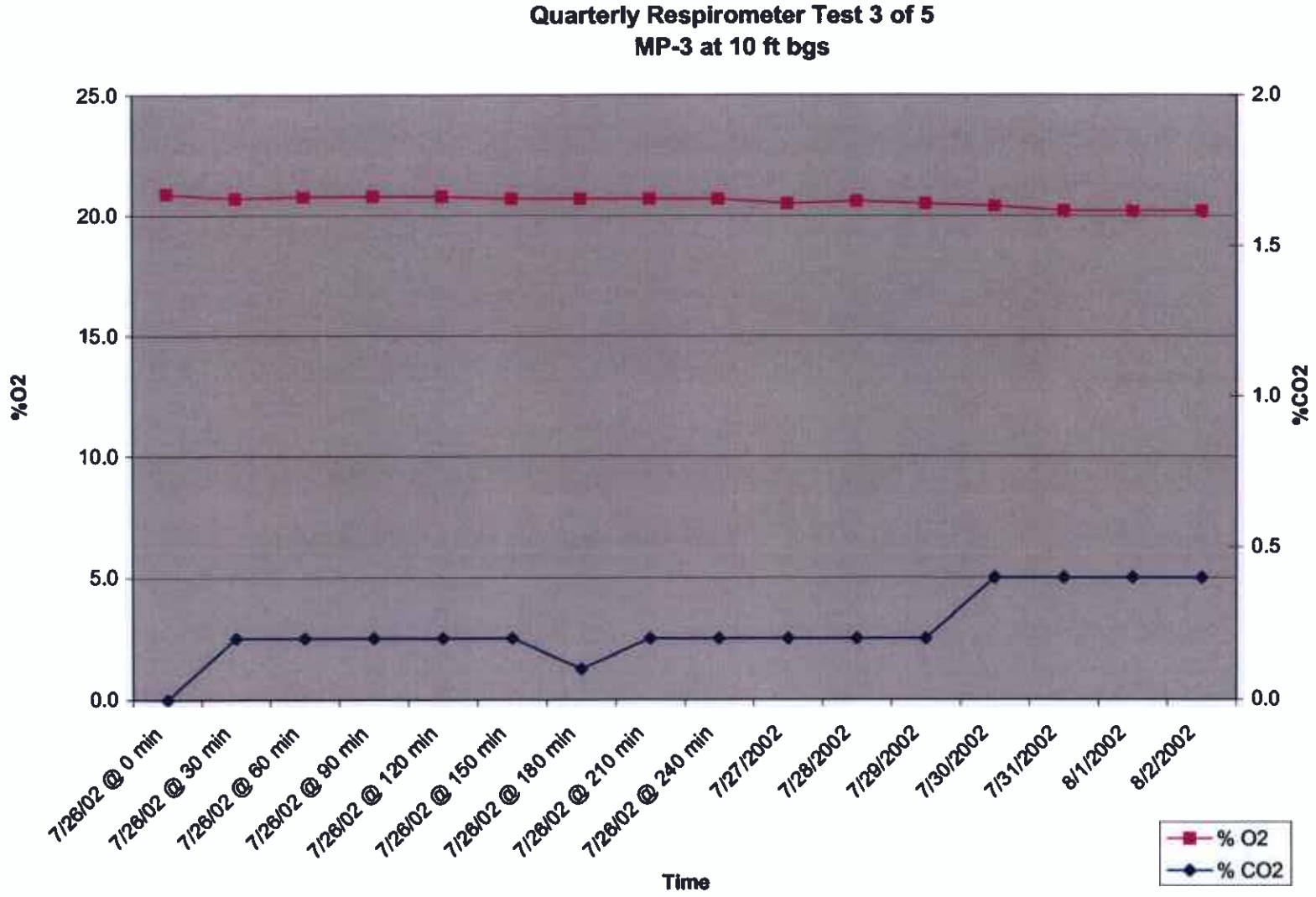
Quarterly Respirometer Test 3 of 5
MP-1 at 20 ft bgs

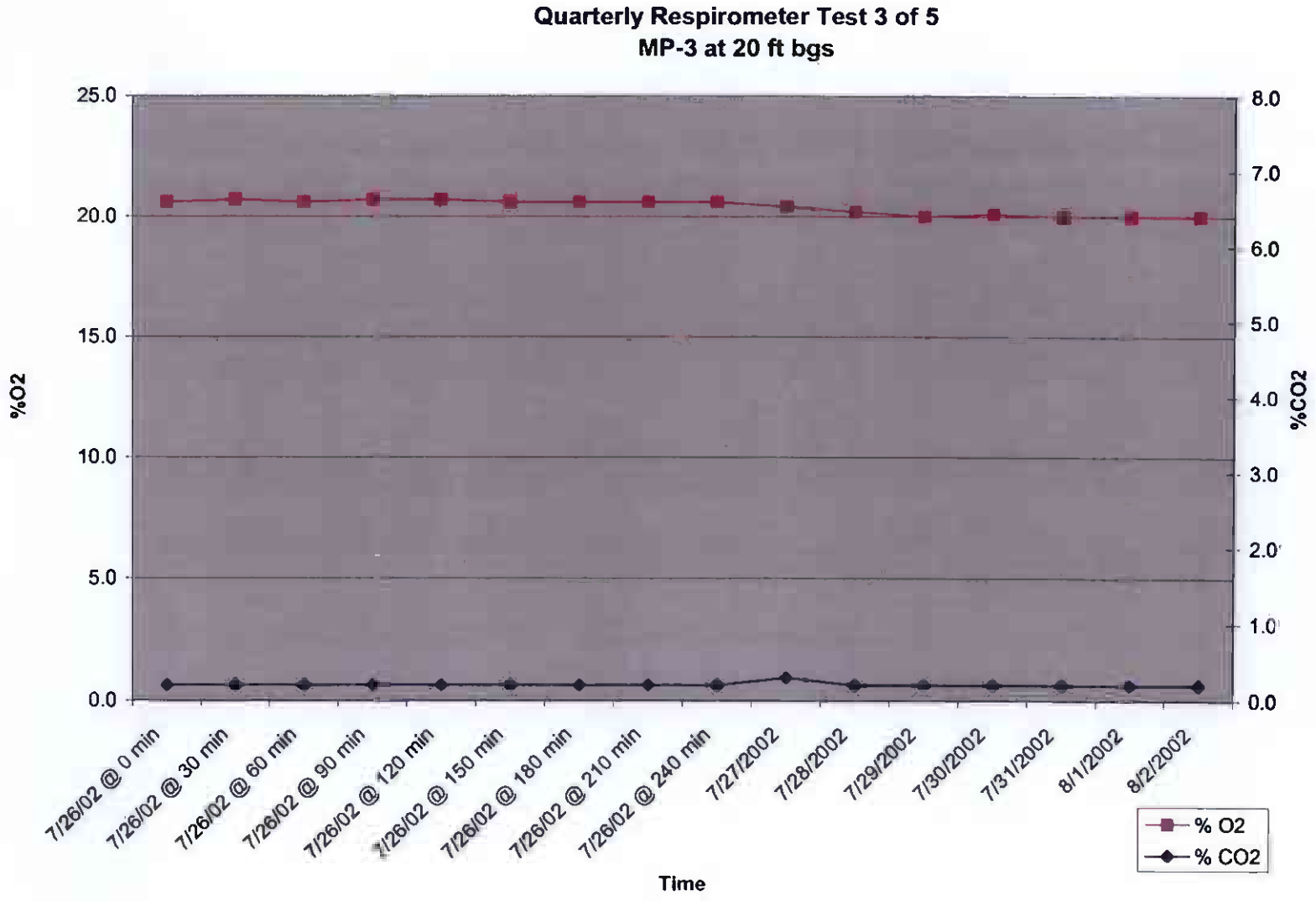



Quarterly Respirometer Test 3 of 5
MP-2 at 10 ft bgs
%O2
%CO2
25.0
20.0
15.0
10.0
5.0
0.0
2.0
1.5
1.0
0.5
0.0
7/26/02 @ 0 min
7/26/02 @ 30 min
7/26/02 @ 60 min
7/26/02 @ 90 min
7/26/02 @ 120 min
7/26/02 @ 150 min
7/26/02 @ 180 min
7/26/02 @ 210 min
7/26/02 @ 240 min
7/27/2002
7/28/2002
7/29/2002
7/30/2002
7/31/2002
8/1/2002
8/2/2002
Time
% O2
% CO2

Quarterly Respirometer Test 3 of 5
MP-2 at 20 ft bgs

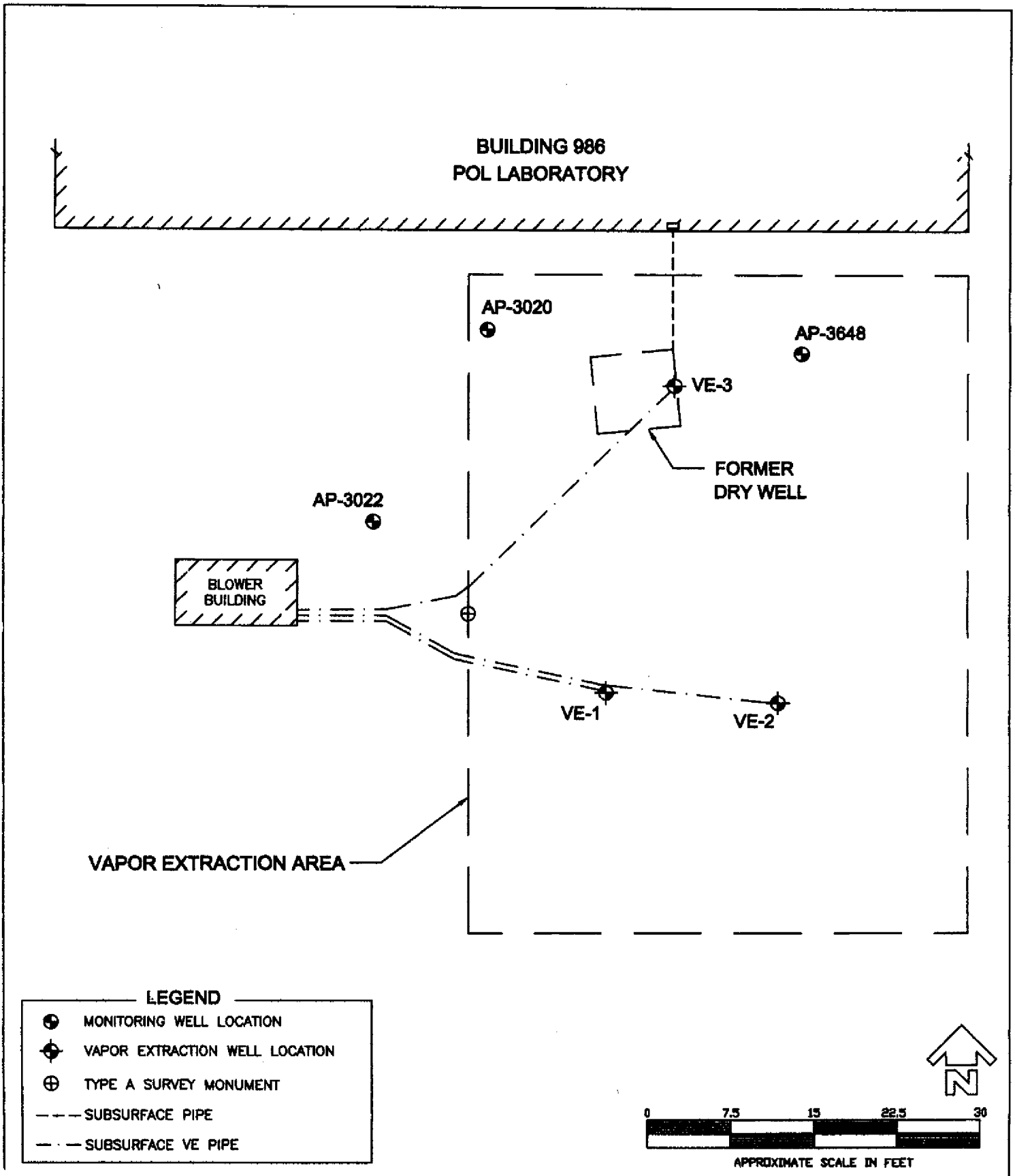



Quarterly Respirometer Test 3 of 5
MP-3 at 10 ft bgs
%O2
%CO2
25.0
20.0
15.0
10.0
5.0
0.0
2.0
1.5
1.0
0.5
0.0
7/26/02 @ 0 min
7/26/02 @ 30 min
7/26/02 @ 60 min
7/26/02 @ 90 min
7/26/02 @ 120 min
7/26/02 @ 150 min
7/26/02 @ 180 min
7/26/02 @ 210 min
7/26/02 @ 240 min
7/27/2002
7/28/2002
7/29/2002
7/30/2002
7/31/2002
8/1/2002
8/2/2002
Time
% O2
% CO2


Quarterly Respirometer Test 3 of 5
MP-3 at 20 ft bgs
%O2
%CO2
25.0
20.0
15.0
10.0
5.0
0.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
7/26/02 @ 0 min
7/26/02 @ 30 min
7/26/02 @ 60 min
7/26/02 @ 90 min
7/26/02 @ 120 min
7/26/02 @ 150 min
7/26/02 @ 180 min
7/26/02 @ 210 min
7/26/02 @ 240 min
7/27/2002
7/28/2002
7/29/2002
7/30/2002
7/31/2002
8/1/2002
8/2/2002
Time
% O2
% CO2

Appendix C

Site map



AECOM
8181 Abbott Road
Anchorage, Alaska
99507-4450

DATE DEC. 2001
DWN. TWS
CKD. DML
REV. 1
CONTRACT. No. DACA65-01-P-0080

FORT RICHARDSON, ALASKA
BUILDING 986 OPERATION & MAINTENANCE

SITE LAYOUT MAP

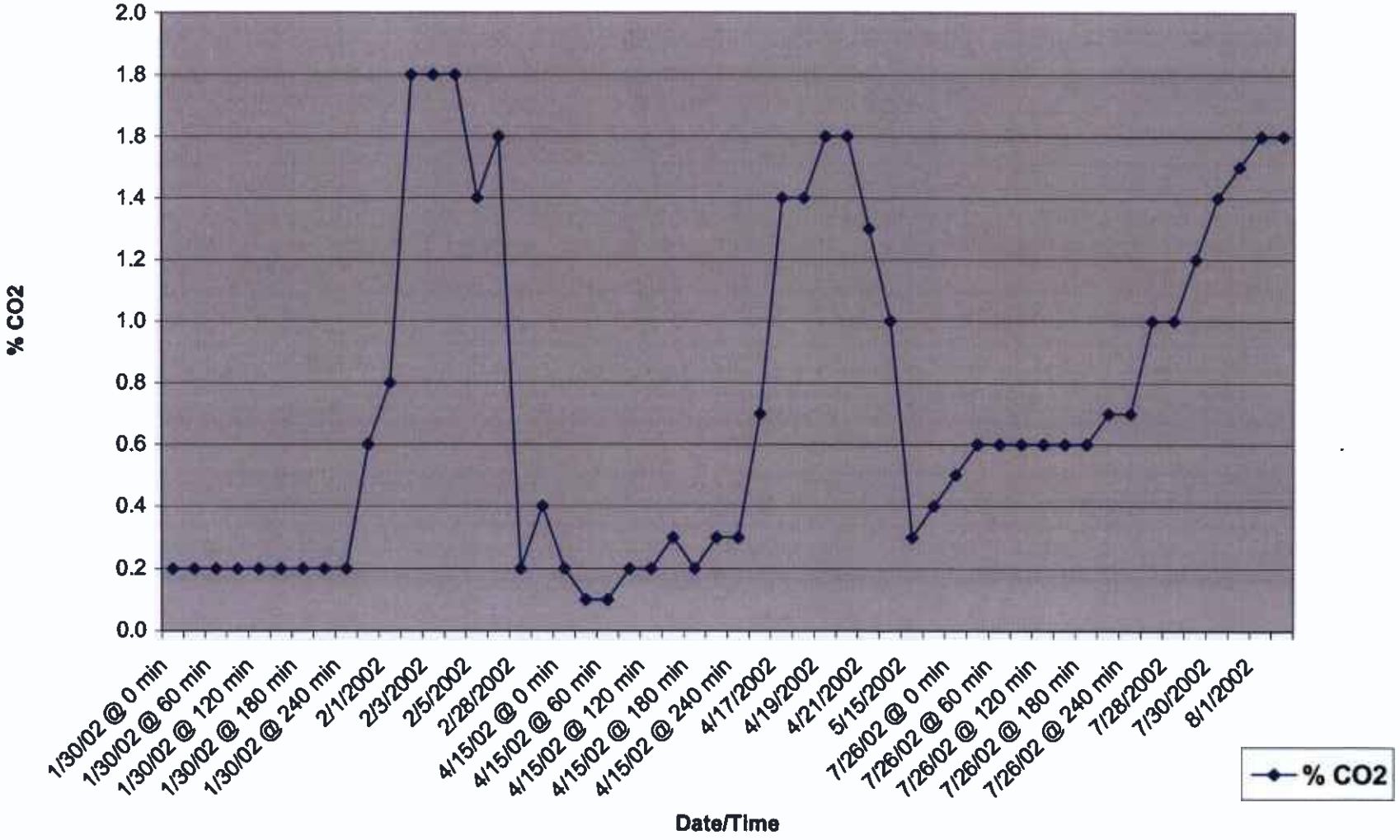
FIGURE
2

Appendix D

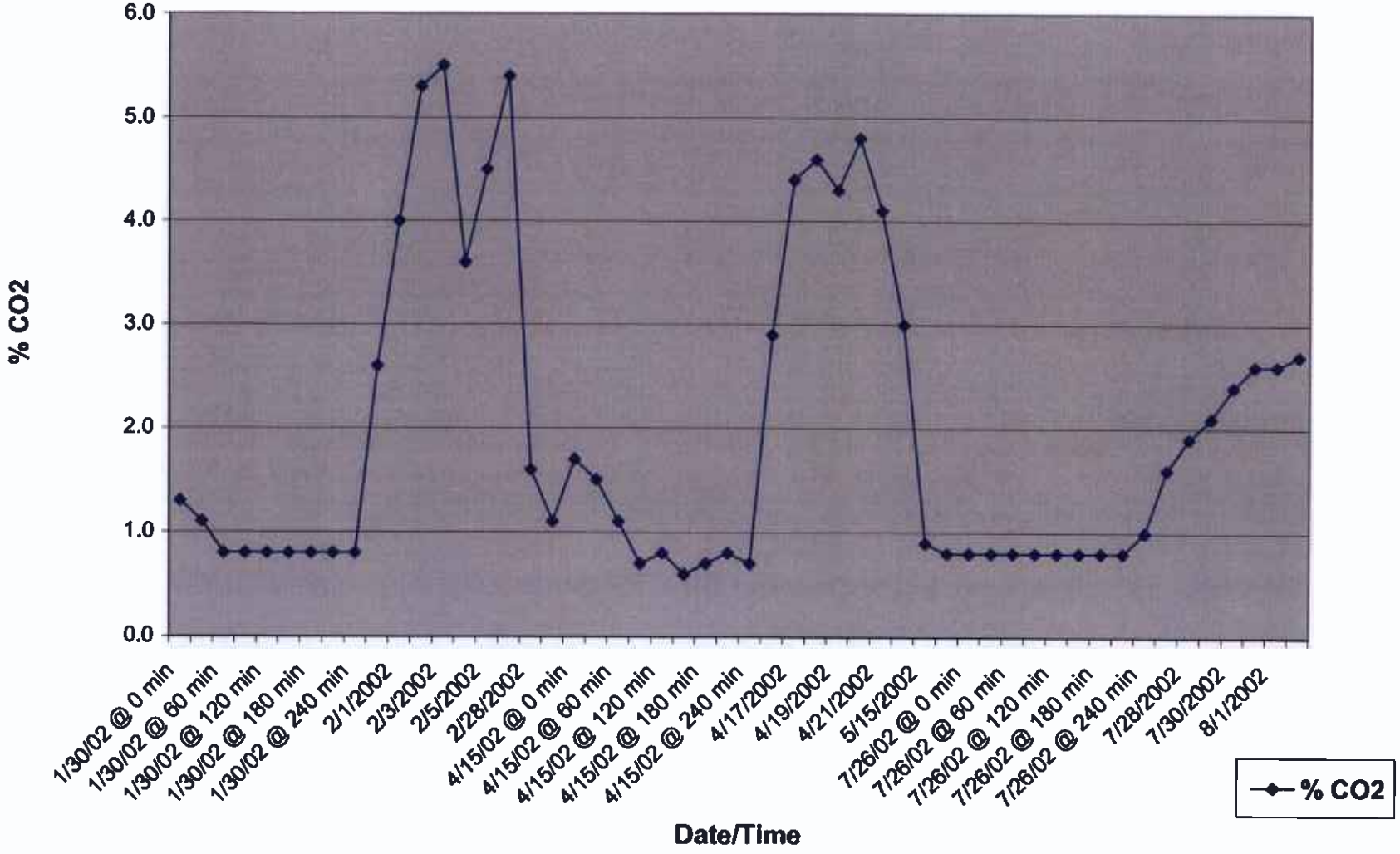
Carbon Dioxide Comparison

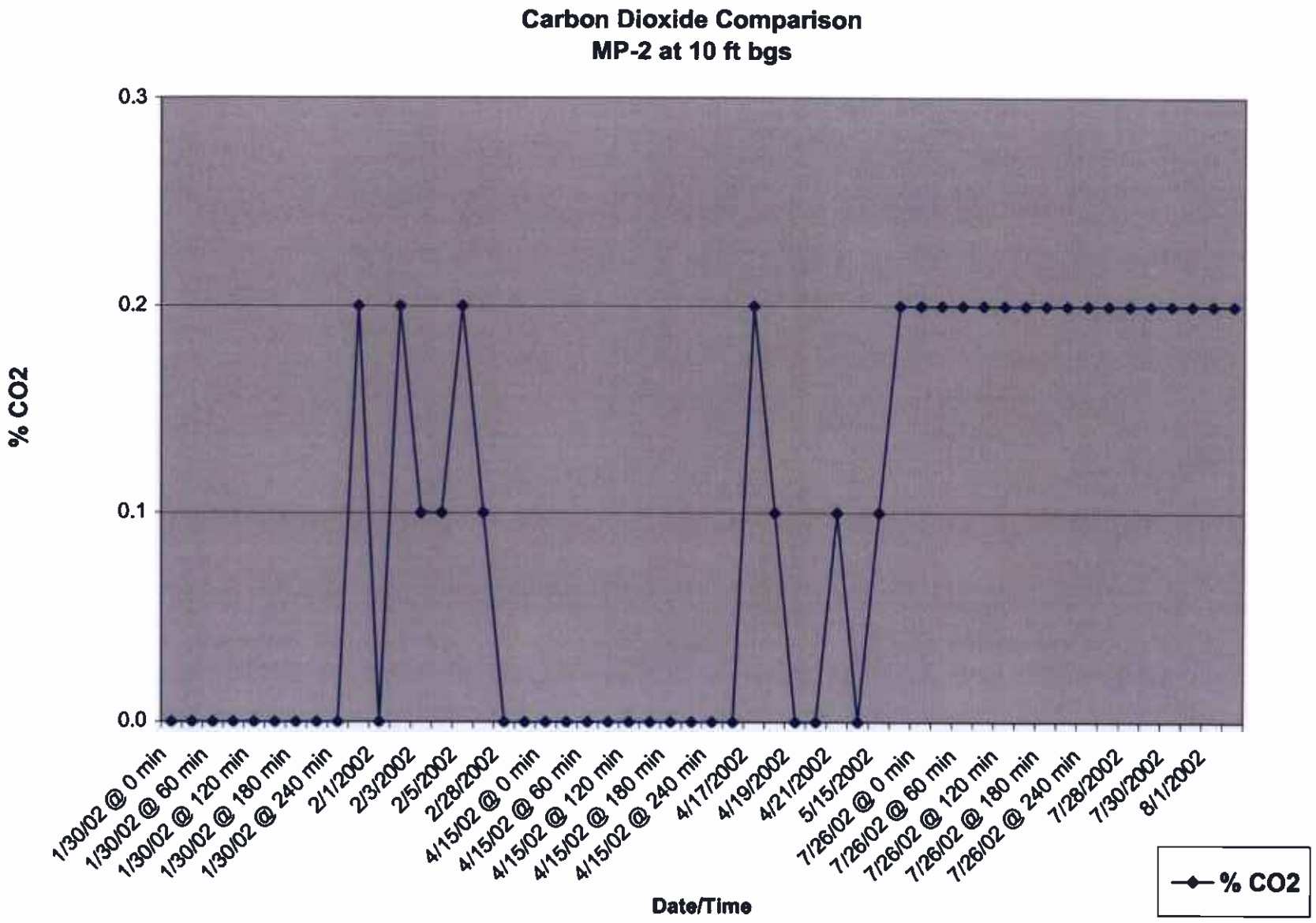
DATE	MP - 1		MP - 2		MP - 3	
	10 ft bgs (Blue)	20 ft bgs (Green)	10 ft bgs (Blue)	20 ft bgs (Green)	10 ft bgs (Blue)	20 ft bgs (Green)
	% CO_2	% CO_2	% CO_2	%CO_2	% CO_2	% CO_2
1/30/02 @ 0 min	0.2	1.3	0.0	0.6	0.0	0.1
1/30/02 @ 30 min	0.2	1.1	0.0	0.6	0.0	0.0
1/30/02 @ 60 min	0.2	0.8	0.0	0.6	0.0	0.0
1/30/02 @ 90 min	0.2	0.8	0.0	0.8	0.0	0.2
1/30/02 @ 120 min	0.2	0.8	0.0	0.8	0.0	0.1
1/30/02 @ 150 min	0.2	0.8	0.0	0.8	0.0	0.1
1/30/02 @ 180 min	0.2	0.8	0.0	1.0	0.0	0.1
1/30/02 @ 210 min	0.2	0.8	0.0	1.2	0.0	0.2
1/30/02 @ 240 min	0.2	0.8	0.0	1.4	0.0	0.2
1/31/2002	0.6	2.6	0.2	3.0	0.2	0.2
2/1/2002	0.8	4.0	0.0	3.6	0.0	0.2
2/2/2002	1.8	5.3	0.2	3.7	0.0	0.4
2/3/2002	1.8	5.5	0.1	4.8	0.0	0.4
2/4/2002	1.8	3.6	0.1	5.0	0.2	0.5
2/5/2002	1.4	4.5	0.2	5.6	0.1	0.4
2/6/2002	1.6	5.4	0.1	6.8	0.2	0.4
2/28/2002	0.2	1.6	0.0	0.4	0.0	0.0
3/28/2002	0.4	1.1	0.0	0.4	0.0	0.1
4/15/02 @ 0 min	0.2	1.7	0.0	0.4	0.0	0.0
4/15/02 @ 30 min	0.1	1.5	0.0	0.4	0.0	0.0
4/15/02 @ 60 min	0.1	1.1	0.0	0.6	0.0	0.0
4/15/02 @ 90 min	0.2	0.7	0.0	0.6	0.0	0.1
4/15/02 @ 120 min	0.2	0.8	0.0	0.6	0.0	0.2
4/15/02 @ 150 min	0.3	0.6	0.0	0.7	0.0	0.1
4/15/02 @ 180 min	0.2	0.7	0.0	0.8	0.0	0.2
4/15/02 @ 210 min	0.3	0.8	0.0	1.0	0.0	0.2
4/15/02 @ 240 min	0.3	0.7	0.0	1.2	0.0	0.2
4/16/2002	0.7	2.9	0.0	2.7	0.0	0.3
4/17/2002	1.4	4.4	0.2	3.4	0.0	0.3
4/18/2002	1.4	4.6	0.1	4.2	0.0	0.4
4/19/2002	1.6	4.3	0.0	3.8	0.1	0.3
4/20/2002	1.6	4.8	0.0	3.0	0.0	0.2
4/21/2002	1.3	4.1	0.1	3.5	0.0	0.4
4/22/2002	1.0	3.0	0.0	3.8	0.0	0.2
5/15/2002	0.3	0.9	0.1	0.2	0.1	0.0
6/12/2002	0.4	0.8	0.2	0.4	0.4	0.2
7/26/02 @ 0 min	0.5	0.8	0.2	0.3	0.0	0.2
7/26/02 @ 30 min	0.6	0.8	0.2	0.4	0.2	0.2
7/26/02 @ 60 min	0.6	0.8	0.2	0.4	0.2	0.2
7/26/02 @ 90 min	0.6	0.8	0.2	0.4	0.2	0.2
7/26/02 @ 120 min	0.6	0.8	0.2	0.4	0.2	0.2
7/26/02 @ 150 min	0.6	0.8	0.2	0.4	0.2	0.2
7/26/02 @ 180 min	0.6	0.8	0.2	0.5	0.1	0.2
7/26/02 @ 210 min	0.7	0.8	0.2	0.5	0.2	0.2
7/26/02 @ 240 min	0.7	1.0	0.2	0.5	0.2	0.2
7/27/2002	1.0	1.6	0.2	0.6	0.2	0.3
7/28/2002	1.0	1.9	0.2	0.6	0.2	0.2
7/29/2002	1.2	2.1	0.2	0.8	0.2	0.2
7/30/2002	1.4	2.4	0.2	1.0	0.4	0.2
7/31/2002	1.5	2.6	0.2	1.3	0.4	0.2
8/1/2002	1.6	2.6	0.2	1.5	0.4	0.2
8/2/2002	1.6	2.7	0.2	1.6	0.4	0.2

Carbon Dioxide Comparison
MP-1 at 10 ft bgs

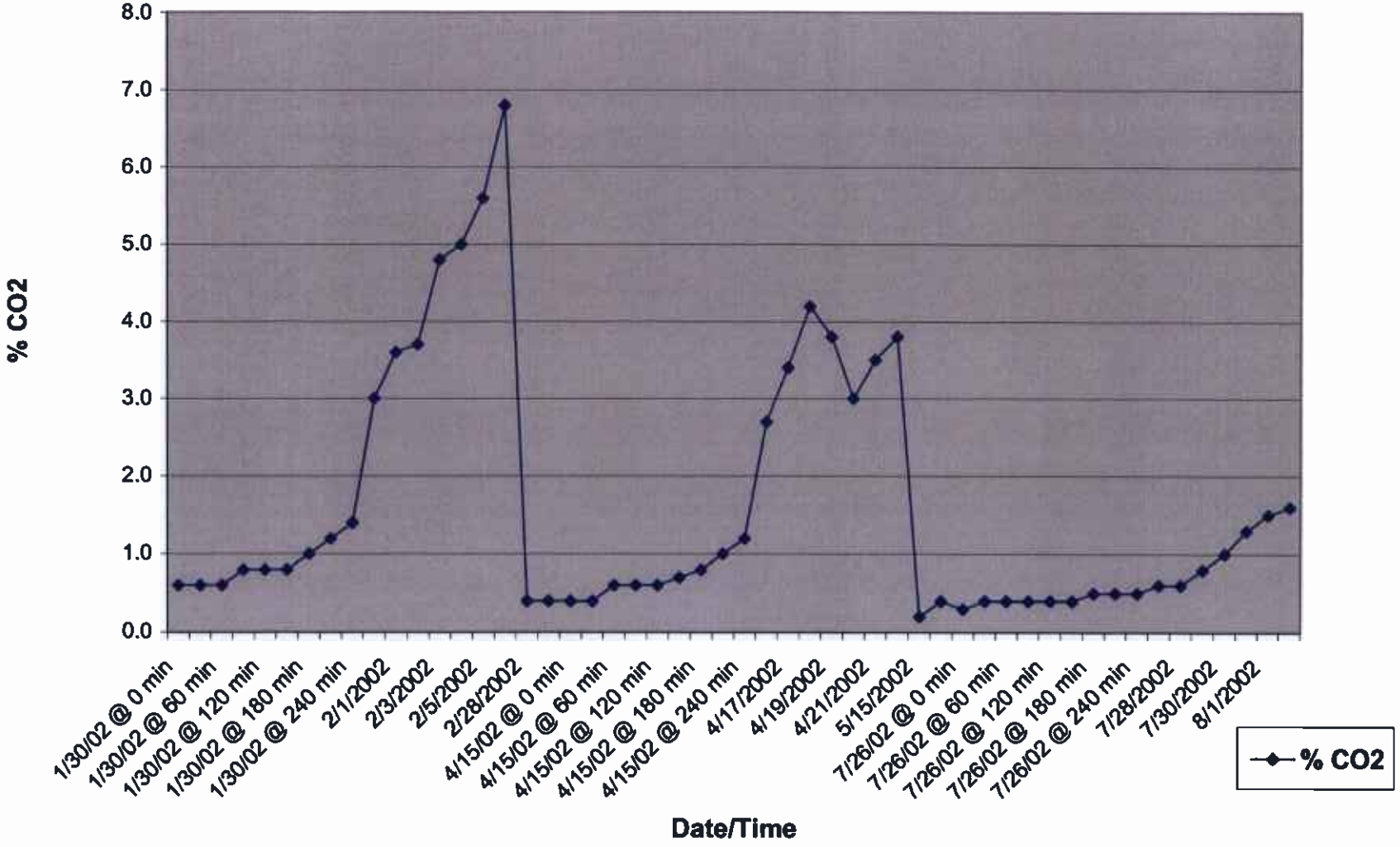


Carbon Dioxide Comparison
MP-1 at 20 ft bgs

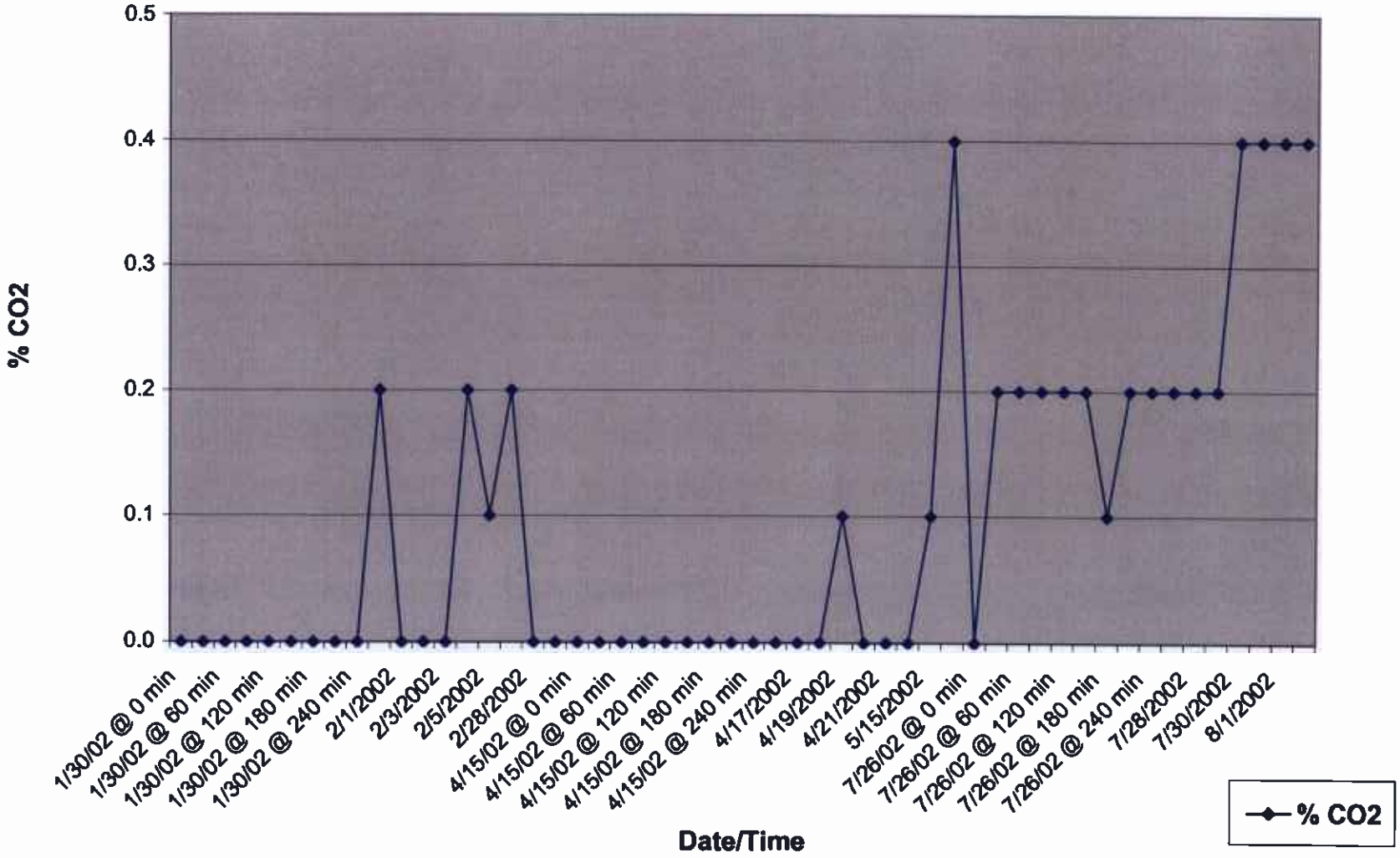


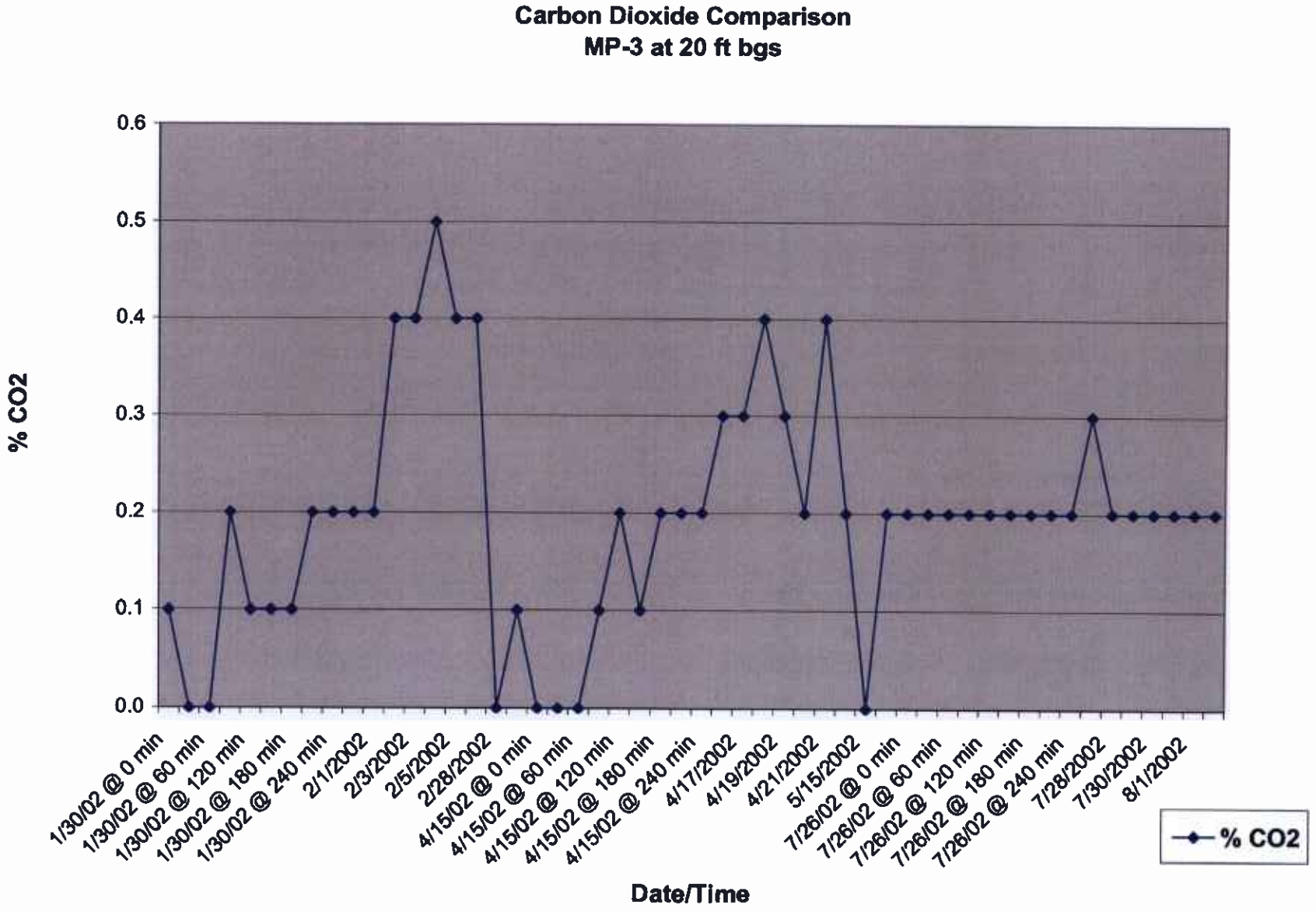

Carbon Dioxide Comparison
MP-2 at 10 ft bgs
% CO2
0.3
0.2
0.1
0.0
1/30/02 @ 0 min
1/30/02 @ 60 min
1/30/02 @ 120 min
1/30/02 @ 180 min
1/30/02 @ 240 min
2/1/2002
2/3/2002
2/5/2002
2/28/2002
4/15/02 @ 0 min
4/15/02 @ 60 min
4/15/02 @ 120 min
4/15/02 @ 180 min
4/15/02 @ 240 min
4/17/2002
4/19/2002
4/21/2002
5/15/2002
7/26/02 @ 0 min
7/26/02 @ 60 min
7/26/02 @ 120 min
7/26/02 @ 180 min
7/26/02 @ 240 min
7/28/2002
7/30/2002
8/1/2002
Date/Time
% CO2

Carbon Dioxide Comparison
MP-2 at 20 ft bgs



Carbon Dioxide Comparison
MP-3 at 10 ft bgs

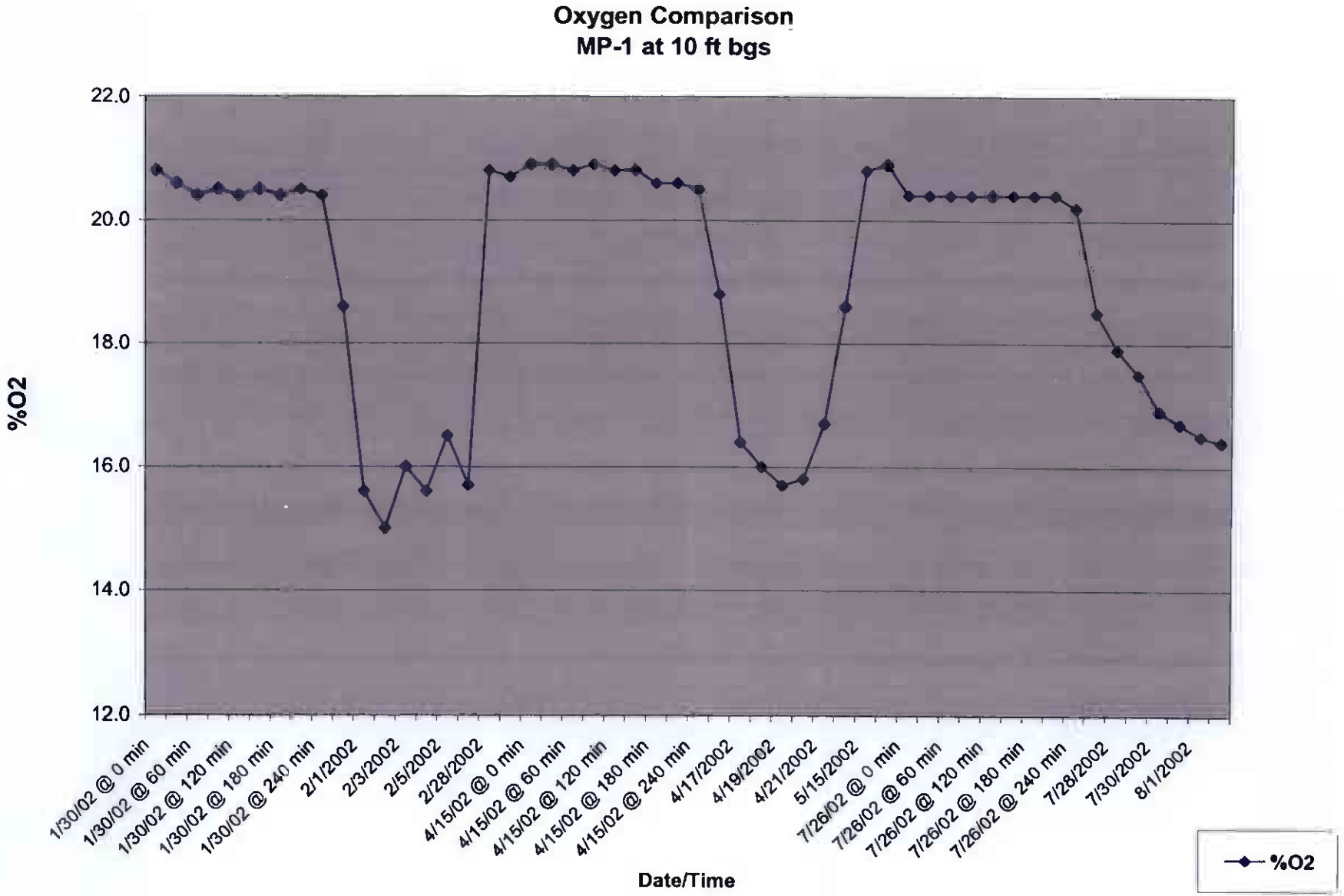


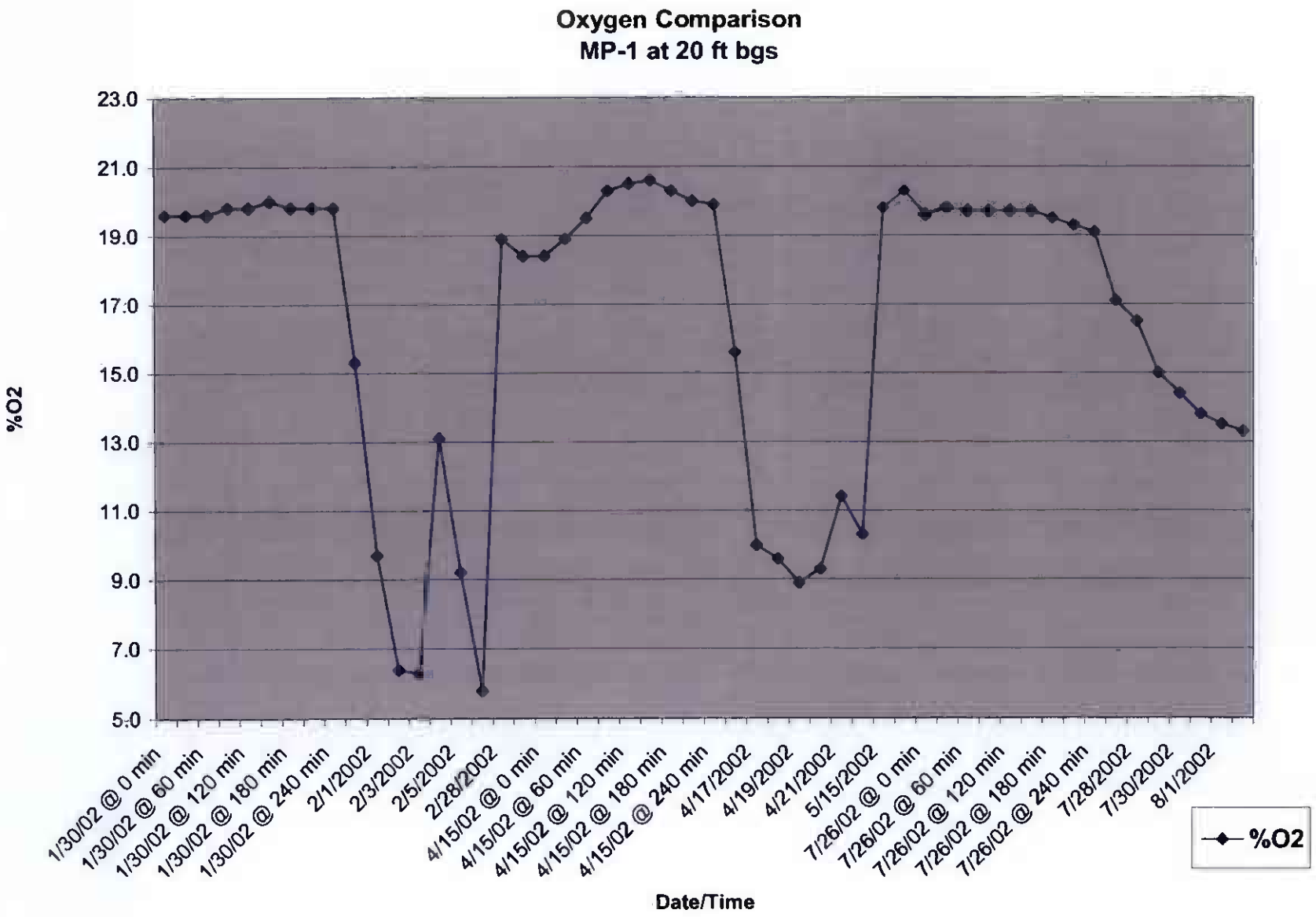

Carbon Dioxide Comparison
MP-3 at 20 ft bgs
% CO2
0.6
0.5
0.4
0.3
0.2
0.1
0.0
1/30/02 @ 0 min
1/30/02 @ 60 min
1/30/02 @ 120 min
1/30/02 @ 180 min
1/30/02 @ 240 min
2/1/2002
2/3/2002
2/5/2002
2/28/2002
4/15/02 @ 0 min
4/15/02 @ 60 min
4/15/02 @ 120 min
4/15/02 @ 180 min
4/15/02 @ 240 min
4/17/2002
4/19/2002
4/21/2002
5/15/2002
7/26/02 @ 0 min
7/26/02 @ 60 min
7/26/02 @ 120 min
7/26/02 @ 180 min
7/26/02 @ 240 min
7/28/2002
7/30/2002
8/1/2002
% CO2
Date/Time

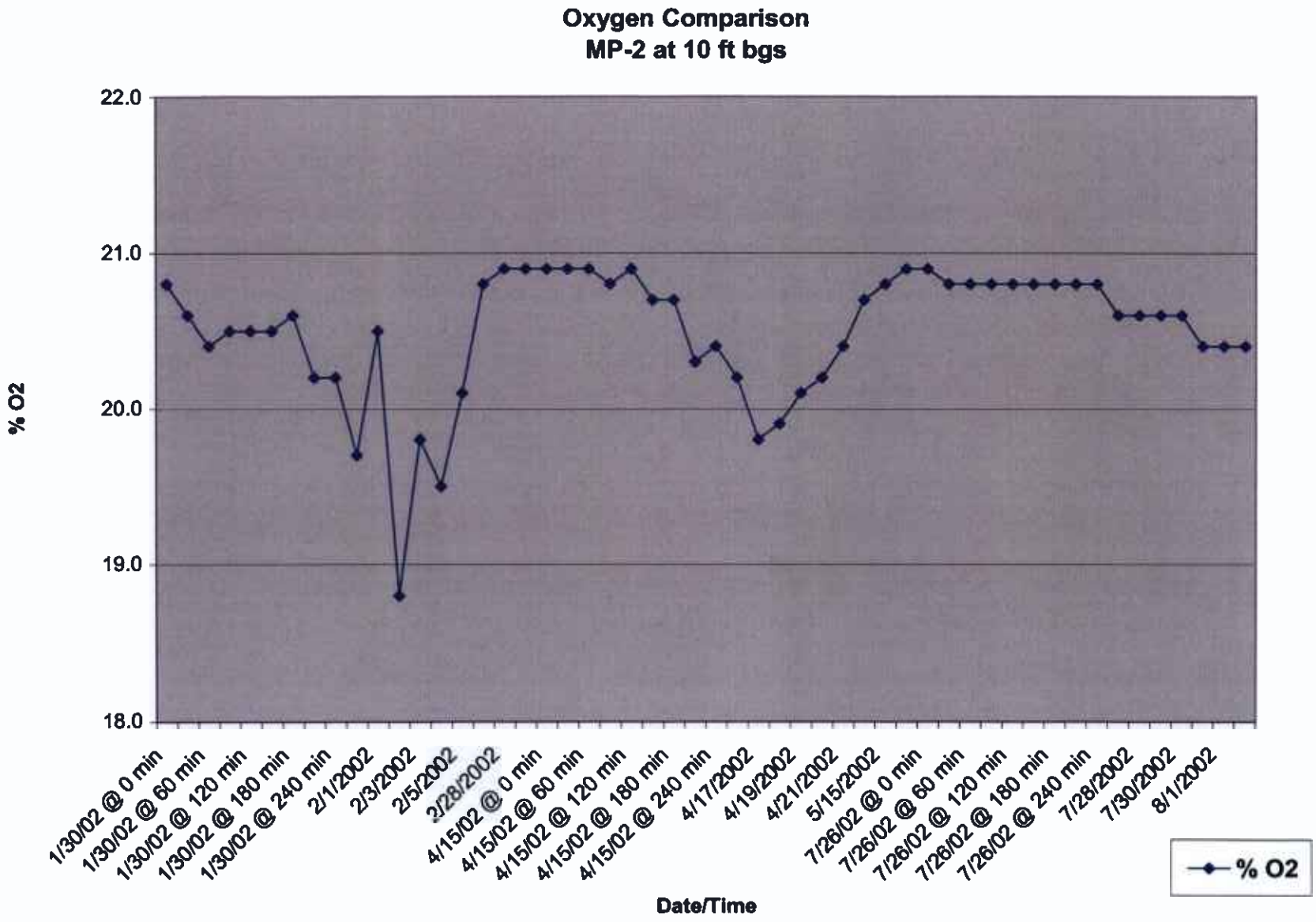
Appendix E

Oxygen Comparison

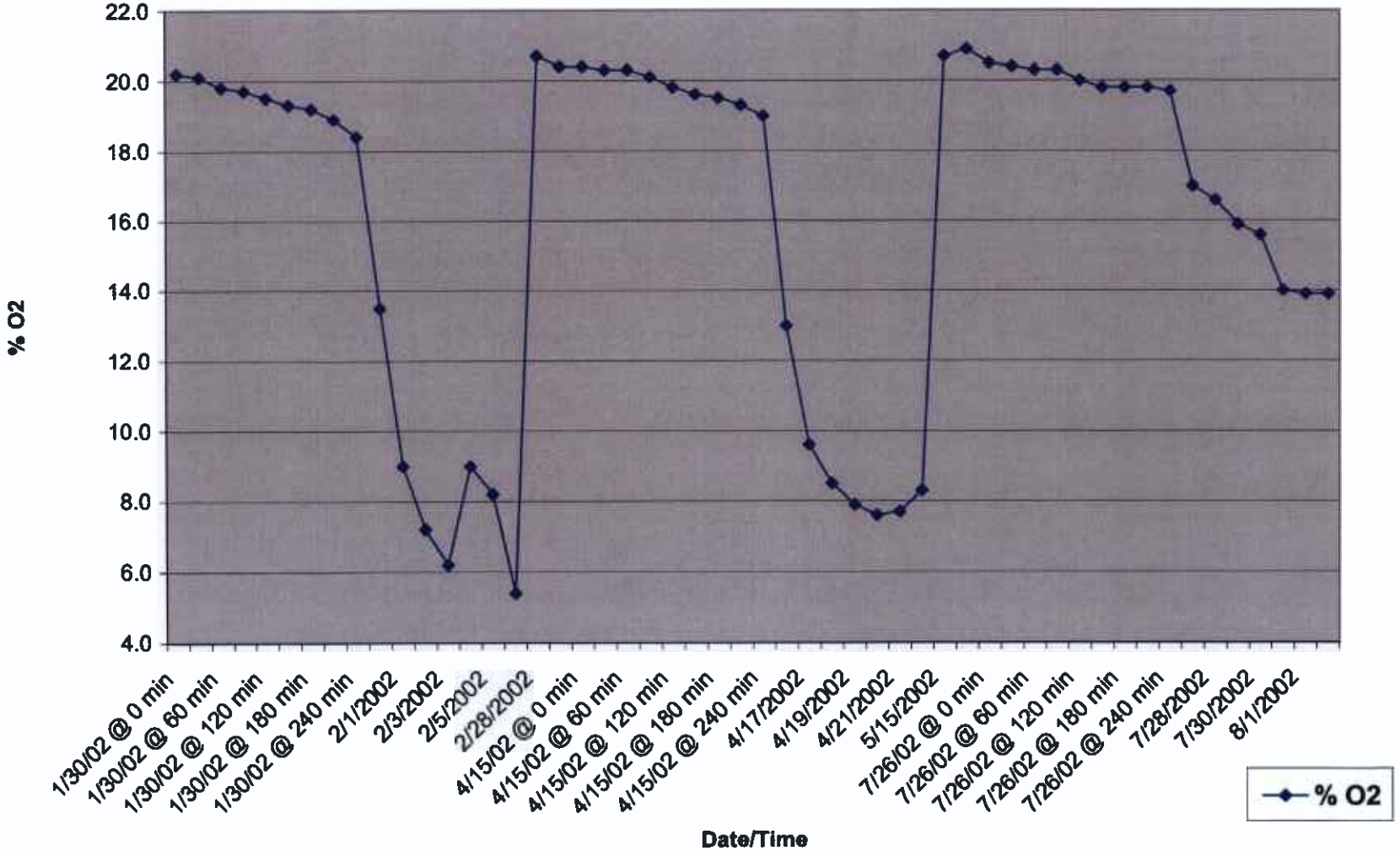
DATE	MP - 1		MP - 2		MP - 3	
	10 ft bgs (Blue)	20 ft bgs (Green)	10 ft bgs (Blue)	20 ft bgs (Green)	10 ft bgs (Blue)	20 ft bgs (Green)
	% O_2	% O_2	% O_2	% O_2	% O_2	% O_2
1/30/02 @ 0 min	20.8	19.6	20.8	20.2	20.9	20.9
1/30/02 @ 30 min	20.6	19.6	20.6	20.1	20.7	20.7
1/30/02 @ 60 min	20.4	19.6	20.4	19.8	20.7	20.6
1/30/02 @ 90 min	20.5	19.8	20.5	19.7	20.8	20.7
1/30/02 @ 120 min	20.4	19.8	20.5	19.5	20.8	20.7
1/30/02 @ 150 min	20.5	20.0	20.5	19.3	20.8	20.7
1/30/02 @ 180 min	20.4	19.8	20.6	19.2	20.8	20.7
1/30/02 @ 210 min	20.5	19.8	20.2	18.9	20.9	20.6
1/30/02 @ 240 min	20.4	19.8	20.2	18.4	20.7	20.5
1/31/2002	18.6	15.3	19.7	13.5	20.9	20.9
2/1/2002	15.6	9.7	20.5	9.0	20.2	18.9
2/2/2002	15.0	6.4	18.8	7.2	19.6	19.8
2/3/2002	16.0	6.3	19.8	6.2	20.9	20.7
2/4/2002	15.6	13.1	19.5	9.0	20.3	19.7
2/5/2002	16.5	9.2	20.1	8.2	20.4	19.3
2/6/2002	15.7	5.8	20.8	5.4	20.9	20.4
2/28/2002	20.8	18.9	20.9	20.7	20.9	20.9
3/28/2002	20.7	18.4	20.9	20.4	20.9	20.9
4/15/02 @ 0 min	20.9	18.4	20.9	20.4	20.9	20.9
4/15/02 @ 30 min	20.9	18.9	20.9	20.3	20.9	20.9
4/15/02 @ 60 min	20.8	19.5	20.9	20.3	20.9	20.9
4/15/02 @ 90 min	20.9	20.3	20.8	20.1	20.8	20.9
4/15/02 @ 120 min	20.8	20.5	20.9	19.8	20.8	20.9
4/15/02 @ 150 min	20.8	20.6	20.7	19.6	20.8	20.8
4/15/02 @ 180 min	20.6	20.3	20.7	19.5	20.7	20.6
4/15/02 @ 210 min	20.6	20.0	20.3	19.3	20.8	20.7
4/15/02 @ 240 min	20.5	19.9	20.4	19.0	20.8	20.6
4/16/2002	18.8	15.6	20.2	13.0	20.8	20.0
4/17/2002	16.4	10.0	19.8	9.6	20.7	19.7
4/18/2002	16.0	9.6	19.9	8.5	20.8	19.6
4/19/2002	15.7	8.9	20.1	7.9	20.7	20.1
4/20/2002	15.8	9.3	20.2	7.6	20.8	20.7
4/21/2002	16.7	11.4	20.4	7.7	20.6	19.9
4/22/2002	18.6	10.3	20.7	8.3	20.9	20.2
5/15/2002	20.8	19.8	20.8	20.7	20.8	20.9
6/12/2002	20.9	20.3	20.9	20.9	20.9	20.8
7/26/02 @ 0 min	20.4	19.6	20.9	20.5	20.9	20.6
7/26/02 @ 30 min	20.4	19.8	20.8	20.4	20.7	20.7
7/26/02 @ 60 min	20.4	19.7	20.8	20.3	20.8	20.6
7/26/02 @ 90 min	20.4	19.7	20.8	20.3	20.8	20.7
7/26/02 @ 120 min	20.4	19.7	20.8	20.0	20.8	20.7
7/26/02 @ 150 min	20.4	19.7	20.8	19.8	20.7	20.6
7/26/02 @ 180 min	20.4	19.5	20.8	19.8	20.7	20.6
7/26/02 @ 210 min	20.4	19.3	20.8	19.8	20.7	20.6
7/26/02 @ 240 min	20.2	19.1	20.8	19.7	20.7	20.6
7/27/2002	18.5	17.1	20.6	17.0	20.5	20.4
7/28/2002	17.9	16.5	20.6	16.6	20.6	20.2
7/29/2002	17.5	15.0	20.6	15.9	20.5	20.0
7/30/2002	16.9	14.4	20.6	15.6	20.4	20.1
7/31/2002	16.7	13.8	20.4	14.0	20.2	20.0
8/1/2002	16.5	13.5	20.4	13.9	20.2	20.0
8/2/2002	16.4	13.3	20.4	13.9	20.2	20.0

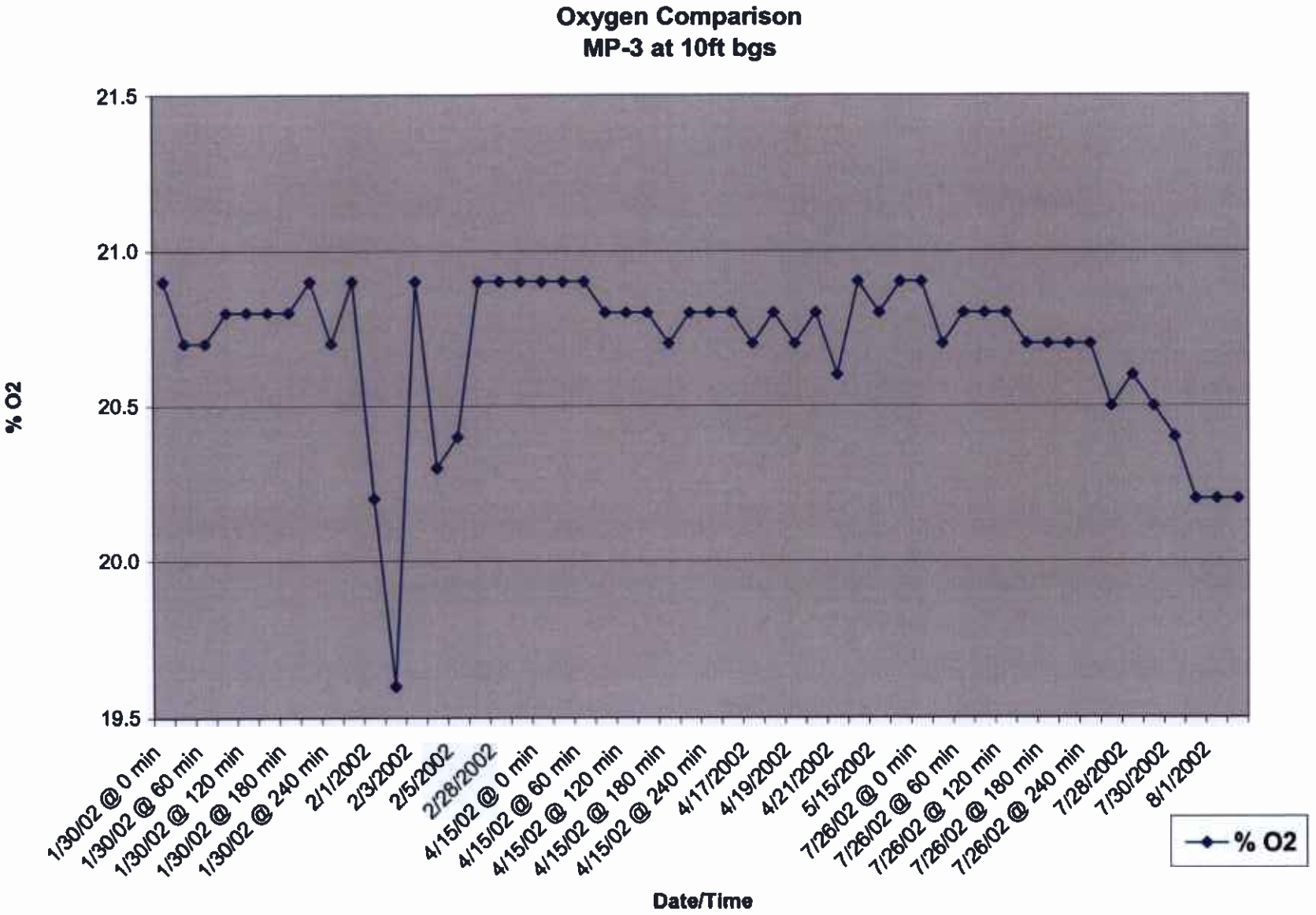

Oxygen Comparison
MP-1 at 10 ft bgs
%O2
22.0
20.0
18.0
16.0
14.0
12.0
1/30/02 @ 0 min
1/30/02 @ 60 min
1/30/02 @ 120 min
1/30/02 @ 180 min
1/30/02 @ 240 min
2/1/2002
2/3/2002
2/5/2002
2/28/2002
4/15/02 @ 0 min
4/15/02 @ 60 min
4/15/02 @ 120 min
4/15/02 @ 180 min
4/15/02 @ 240 min
4/17/2002
4/19/2002
4/21/2002
5/15/2002
7/26/02 @ 0 min
7/26/02 @ 60 min
7/26/02 @ 120 min
7/26/02 @ 180 min
7/26/02 @ 240 min
7/28/2002
7/30/2002
8/1/2002
Date/Time
%O2

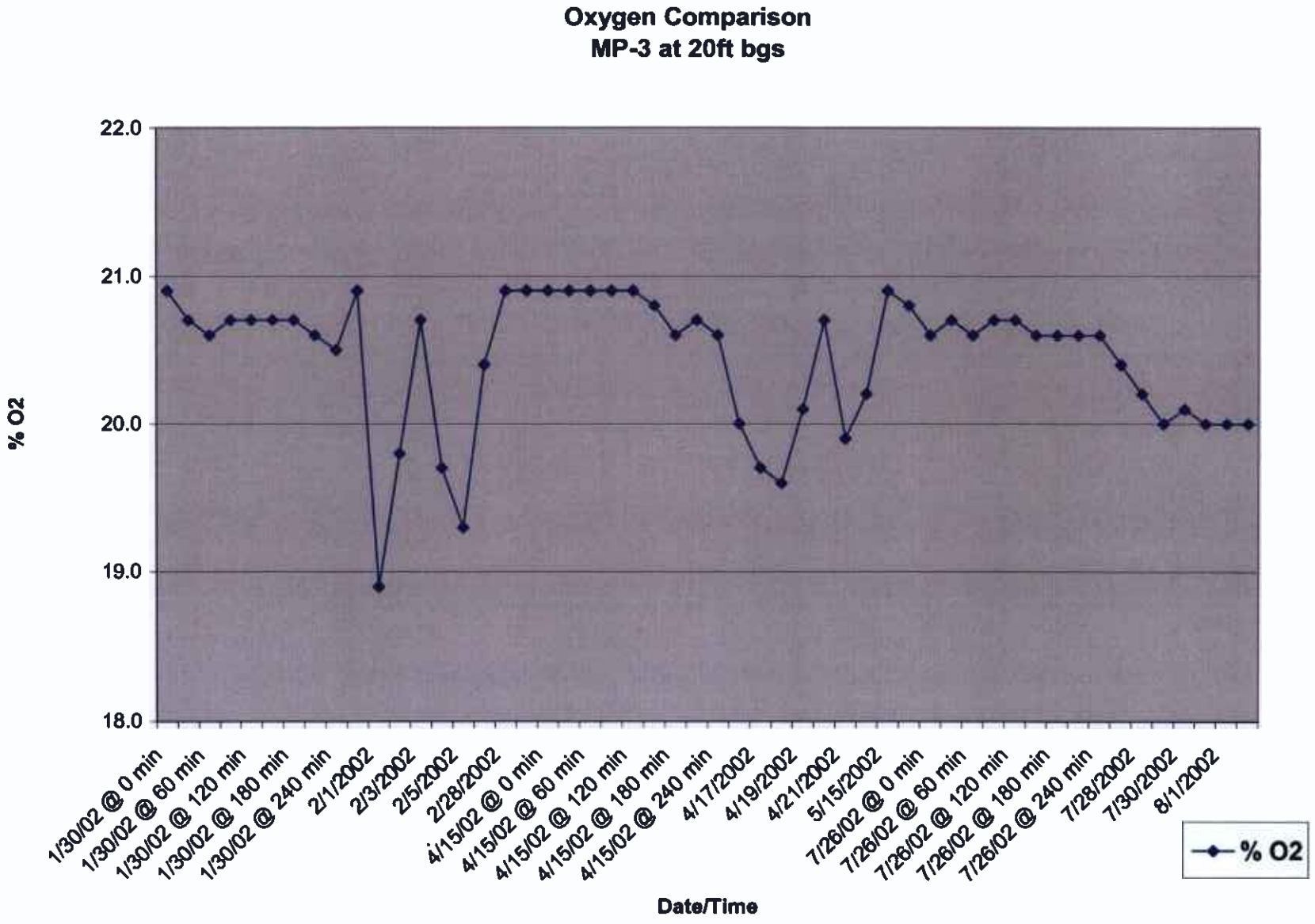

Oxygen Comparison
MP-1 at 20 ft bgs
%O2
23.0
21.0
19.0
17.0
15.0
13.0
11.0
9.0
7.0
5.0
1/30/02 @ 0 min
1/30/02 @ 60 min
1/30/02 @ 120 min
1/30/02 @ 180 min
1/30/02 @ 240 min
2/1/2002
2/3/2002
2/5/2002
2/28/2002
4/15/02 @ 0 min
4/15/02 @ 60 min
4/15/02 @ 120 min
4/15/02 @ 180 min
4/15/02 @ 240 min
4/17/2002
4/19/2002
4/21/2002
5/15/2002
7/26/02 @ 0 min
7/26/02 @ 60 min
7/26/02 @ 120 min
7/26/02 @ 180 min
7/26/02 @ 240 min
7/28/2002
7/30/2002
8/1/2002
Date/Time
%O2


Oxygen Comparison
MP-2 at 10 ft bgs
% O2
22.0
21.0
20.0
19.0
18.0
1/30/02 @ 0 min
1/30/02 @ 60 min
1/30/02 @ 120 min
1/30/02 @ 180 min
1/30/02 @ 240 min
2/1/2002
2/3/2002
2/5/2002
2/28/2002
4/15/02 @ 0 min
4/15/02 @ 60 min
4/15/02 @ 120 min
4/15/02 @ 180 min
4/15/02 @ 240 min
4/17/2002
4/19/2002
4/21/2002
5/15/2002
7/26/02 @ 0 min
7/26/02 @ 60 min
7/26/02 @ 120 min
7/26/02 @ 180 min
7/26/02 @ 240 min
7/28/2002
7/30/2002
8/1/2002
% O2
Date/Time

Oxygen Comparison
MP-2 at 20 ft bgs




Oxygen Comparison
MP-3 at 10ft bgs
% O2
21.5
21.0
20.5
20.0
19.5
1/30/02 @ 0 min
1/30/02 @ 60 min
1/30/02 @ 120 min
1/30/02 @ 180 min
1/30/02 @ 240 min
2/1/2002
2/3/2002
2/5/2002
2/28/2002
4/15/02 @ 0 min
4/15/02 @ 60 min
4/15/02 @ 120 min
4/15/02 @ 180 min
4/15/02 @ 240 min
4/17/2002
4/19/2002
4/21/2002
5/15/2002
7/26/02 @ 0 min
7/26/02 @ 60 min
7/26/02 @ 120 min
7/26/02 @ 180 min
7/26/02 @ 240 min
7/28/2002
7/30/2002
8/1/2002
% O2
Date/Time


Oxygen Comparison
MP-3 at 20ft bgs
% O2
22.0
21.0
20.0
19.0
18.0
1/30/02 @ 0 min
1/30/02 @ 60 min
1/30/02 @ 120 min
1/30/02 @ 180 min
1/30/02 @ 240 min
2/1/2002
2/3/2002
2/5/2002
2/28/2002
4/15/02 @ 0 min
4/15/02 @ 60 min
4/15/02 @ 120 min
4/15/02 @ 180 min
4/15/02 @ 240 min
4/17/2002
4/19/2002
4/21/2002
5/15/2002
7/26/02 @ 0 min
7/26/02 @ 60 min
7/26/02 @ 120 min
7/26/02 @ 180 min
7/26/02 @ 240 min
7/28/2002
7/30/2002
8/1/2002
% O2
Date/Time