

XI. APPENDIX IV

CO EXPOSURE DATA

The exposure data contained in this appendix result from programming the equation introduced by Coburn¹²¹ that relates environmental CO exposure to bodily uptake. The Coburn equation:

$$\frac{\frac{[\text{COHb}]_t P_{\text{CO}_2}}{[\text{O}_2\text{Hb}]M} - V_{\text{CO}} \left[\frac{1}{D_L} + \frac{P_B - P_{\text{H}_2\text{O}}}{V_A} \right] - P_{\text{I CO}}}{\frac{[\text{COHb}]_0 P_{\text{CO}_2}}{[\text{O}_2\text{Hb}]M} - V_{\text{CO}} \left[\frac{1}{D_L} + \frac{P_B - P_{\text{H}_2\text{O}}}{V_A} \right] - P_{\text{I CO}}} = e^{-\frac{P_{\text{CO}_2} t}{M V_b [\text{O}_2\text{Hb}] \left[\frac{1}{D_L} + \frac{713}{V_A} \right]}}$$

has been rearranged for programming as follows:

$$\text{CO in air (ppm)} = \frac{1316 [(AC - V_{\text{CO}}B + a (V_{\text{CO}}B - AD)]}{1 - a}$$

$$\text{Where } A = \frac{P_C - O_2}{M[\text{O}_2\text{Hb}]}$$

$$B = \frac{1}{D_L} + \frac{P_L}{V_A}$$

C = [COHb]_t = COHb concentration (ml CO/ml blood) at time t.

D = [COHb]₀ = "background" COHb (ml CO/ml blood) at time = 0.

V_{CO} = Rate of endogenous CO production (ml/min)

$$a = e^{-\frac{tA}{V_b B}}$$

V_b = blood volume

P_C - O₂ = PO₂ in capillaries (mm Hg)

[O₂Hb] = oxyhemoglobin conc. (ml/ml blood)

M = CO/O₂ affinity for Hb

D_L = diffusion rate of CO through lungs (ml/min/mm Hg)

P_L = dry barometric pressure in lungs (mm Hg)

V_A = ventilation rate (ml/min)

Assumptions (Constants)

$D = 0.0015$; (0.75%)

$V_{CO} = 0.007$ ml/min

$V_b = 5500$ ml

$P_C - O_2 = 100$ mm Hg

$[O_2Hb] = 0.2$ ml/ml blood

$M = 218$

$P_L = 713$ mm Hg

Assumptions (Variables)

		<u>Sedentary</u>	<u>Light Work</u>	<u>Heavy Work</u>
D_L	=	30	40	60
V_A	=	6,000	18,000	30,000

Based upon the above assumptions, the predicted environmental CO values and lengths of exposure necessary to reach 5 percent COHb for various combinations of pulmonary diffusion rate (D_L) and alveolar ventilation rate (V_A) are given on the following pages.

D_L (ml/min/mm Hg)	V_A (ml/min)	CO (ppm)	Time (min)	COHb			
30.0	6000.0	35.0	10.0	0.907			
			30.0	1.208			
			60.0	1.629			
			90.0	2.016			
			120.0	2.371			
			180.0	2.996			
			240.0	3.521			
			300.0	3.960			
			360.0	4.328			
			420.0	4.635			
			480.0	4.891			
			1440.0	6.185			
			40.0	10000.0	35.0	10.0	0.977
				30.0		1.404	
60.0	1.982						
90.0	2.492						
120.0	2.943						
180.0	3.692						
240.0	4.268						
300.0	4.712						
360.0	5.053						
420.0	5.315						
480.0	5.517						
1440.0	6.224						
60.0	18000.0	35.0		10.0		1.112	
	30.0			1.770			
	60.0		2.606				
	90.0		3.288				
	120.0		3.842				
	180.0		4.663				
	240.0		5.193				
	300.0		5.539				
	360.0		5.765				
	420.0		5.913				
	480.0		6.010				
	1440.0		6.208				
			30000.0	35.0	10.0	1.317	
			30.0		2.291		
60.0		3.409					
90.0		4.210					
120.0		4.781					
180.0		5.490					
240.0		5.837					
300.0		6.012					
360.0		6.102					
420.0		6.148					
480.0		6.172					
1440.0		6.199					

D_L (ml/min/mm Hg)	V_A (ml/min)	Time (min)	CO (ppm)
30.00	4000.00	10.0	1085.96
30.00	4000.00	20.0	549.99
30.00	4000.00	30.0	371.36
30.00	4000.00	40.0	282.07
30.00	4000.00	50.0	228.50
30.00	4000.00	60.0	192.81
30.00	4000.00	90.0	133.37
30.00	4000.00	120.0	103.71
30.00	4000.00	150.0	85.95
30.00	4000.00	180.0	74.16
30.00	4000.00	210.0	65.76
30.00	4000.00	240.0	59.50
30.00	4000.00	270.0	54.65
30.00	4000.00	300.0	50.79
30.00	4000.00	330.0	47.65
30.00	4000.00	360.0	45.06
30.00	4000.00	390.0	42.88
30.00	4000.00	420.0	41.03
30.00	4000.00	450.0	39.43
30.00	4000.00	480.0	38.06
30.00	5000.00	10.0	905.67
30.00	5000.00	20.0	460.02
30.00	5000.00	30.0	311.51
30.00	5000.00	40.0	237.27
30.00	5000.00	50.0	192.75
30.00	5000.00	60.0	163.08
30.00	5000.00	90.0	113.70
30.00	5000.00	120.0	89.07
30.00	5000.00	150.0	74.36
30.00	5000.00	180.0	64.59
30.00	5000.00	210.0	57.65
30.00	5000.00	240.0	52.48
30.00	5000.00	270.0	48.49
30.00	5000.00	300.0	45.32
30.00	5000.00	330.0	42.76
30.00	5000.00	360.0	40.64
30.00	5000.00	390.0	38.87
30.00	5000.00	420.0	37.37
30.00	5000.00	450.0	36.08
30.00	5000.00	480.0	34.97

D_L (ml/min/mm Hg)	V_A (ml/min)	Time (min)	CO (ppm)
30.00	6000.00	10.0	785.48
30.00	6000.00	20.0	400.05
30.00	6000.00	30.0	271.61
30.00	6000.00	40.0	207.41
30.00	6000.00	50.0	168.92
30.00	6000.00	60.0	143.27
30.00	6000.00	90.0	100.60
30.00	6000.00	120.0	79.35
30.00	6000.00	150.0	66.65
30.00	6000.00	180.0	58.25
30.00	6000.00	210.0	52.28
30.00	6000.00	240.0	47.85
30.00	6000.00	270.0	44.44
30.00	6000.00	300.0	41.74
30.00	6000.00	330.0	39.56
30.00	6000.00	360.0	37.76
30.00	6000.00	390.0	36.26
30.00	6000.00	420.0	35.00
30.00	6000.00	450.0	33.93
30.00	6000.00	480.0	33.00
30.00	7000.00	10.0	699.63
30.00	7000.00	20.0	357.21
30.00	7000.00	30.0	243.11
30.00	7000.00	40.0	186.09
30.00	7000.00	50.0	151.91
30.00	7000.00	60.0	129.13
30.00	7000.00	90.0	91.26
30.00	7000.00	120.0	72.41
30.00	7000.00	150.0	61.18
30.00	7000.00	180.0	53.74
30.00	7000.00	210.0	48.48
30.00	7000.00	240.0	44.58
30.00	7000.00	270.0	41.58
30.00	7000.00	300.0	39.22
30.00	7000.00	330.0	37.32
30.00	7000.00	360.0	35.75
30.00	7000.00	390.0	34.46
30.00	7000.00	420.0	33.37
30.00	7000.00	450.0	32.45
30.00	7000.00	480.0	31.66

D_L (ml/min/mm Hg)	V_A (ml/min)	Time (min)	CO (ppm)
30.00	8000.00	10.0	635.25
30.00	8000.00	20.0	325.09
30.00	8000.00	30.0	221.75
30.00	8000.00	40.0	170.11
30.00	8000.00	50.0	139.15
30.00	8000.00	60.0	118.54
30.00	8000.00	90.0	84.27
30.00	8000.00	120.0	67.23
30.00	8000.00	150.0	57.08
30.00	8000.00	180.0	50.39
30.00	8000.00	210.0	45.66
30.00	8000.00	240.0	42.16
30.00	8000.00	270.0	39.47
30.00	8000.00	300.0	37.36
30.00	8000.00	330.0	35.67
30.00	8000.00	360.0	34.29
30.00	8000.00	390.0	33.14
30.00	8000.00	420.0	32.19
30.00	8000.00	450.0	31.38
30.00	8000.00	480.0	30.69
30.00	9000.00	10.0	585.17
30.00	9000.00	20.0	300.10
30.00	9000.00	30.0	205.13
30.00	9000.00	40.0	157.68
30.00	9000.00	50.0	129.24
30.00	9000.00	60.0	110.30
30.00	9000.00	90.0	78.84
30.00	9000.00	120.0	63.21
30.00	9000.00	150.0	53.92
30.00	9000.00	180.0	47.79
30.00	9000.00	210.0	43.48
30.00	9000.00	240.0	40.29
30.00	9000.00	270.0	37.86
30.00	9000.00	300.0	35.95
30.00	9000.00	330.0	34.42
30.00	9000.00	360.0	33.18
30.00	9000.00	390.0	32.15
30.00	9000.00	420.0	31.30
30.00	9000.00	450.0	30.58
30.00	9000.00	480.0	29.98

D_L (ml/min/mm Hg)	V_A (ml/min)	Time (min)	CO (ppm)
30.00	10000.00	10.0	545.11
30.00	10000.00	20.0	280.12
30.00	10000.00	30.0	191.84
30.00	10000.00	40.0	147.74
30.00	10000.00	50.0	121.31
30.00	10000.00	60.0	103.72
30.00	10000.00	90.0	74.50
30.00	10000.00	120.0	60.00
30.00	10000.00	150.0	51.39
30.00	10000.00	180.0	45.73
30.00	10000.00	210.0	41.75
30.00	10000.00	240.0	38.82
30.00	10000.00	270.0	36.58
30.00	10000.00	300.0	34.83
30.00	10000.00	330.0	33.44
30.00	10000.00	360.0	32.31
30.00	10000.00	390.0	31.39
30.00	10000.00	420.0	30.62
30.00	10000.00	450.0	29.98
30.00	10000.00	480.0	29.43
30.00	11000.00	10.0	512.33
30.00	11000.00	20.0	263.77
30.00	11000.00	30.0	180.97
30.00	11000.00	40.0	139.61
30.00	11000.00	50.0	114.83
30.00	11000.00	60.0	98.33
30.00	11000.00	90.0	70.95
30.00	11000.00	120.0	57.39
30.00	11000.00	150.0	49.34
30.00	11000.00	180.0	44.06
30.00	11000.00	210.0	40.35
30.00	11000.00	240.0	37.62
30.00	11000.00	270.0	35.55
30.00	11000.00	300.0	33.94
30.00	11000.00	330.0	32.66
30.00	11000.00	360.0	31.62
30.00	11000.00	390.0	30.78
30.00	11000.00	420.0	30.08
30.00	11000.00	450.0	29.50
30.00	11000.00	480.0	29.01

D _L (ml/min/mm Hg)	V _A (ml/min)	Time (min)	CO (ppm)
30.00	12000.00	10.0	485.02
30.00	12000.00	20.0	250.14
30.00	12000.00	30.0	171.91
30.00	12000.00	40.0	132.84
30.00	12000.00	50.0	109.43
30.00	12000.00	60.0	93.85
30.00	12000.00	90.0	68.01
30.00	12000.00	120.0	55.21
30.00	12000.00	150.0	47.64
30.00	12000.00	180.0	42.67
30.00	12000.00	210.0	39.19
30.00	12000.00	240.0	36.64
30.00	12000.00	270.0	34.71
30.00	12000.00	300.0	33.21
30.00	12000.00	330.0	32.02
30.00	12000.00	360.0	31.07
30.00	12000.00	390.0	30.29
30.00	12000.00	420.0	29.65
30.00	12000.00	450.0	29.12
30.00	12000.00	480.0	28.67
30.00	13000.00	10.0	461.91
30.00	13000.00	20.0	238.62
30.00	13000.00	30.0	164.25
30.00	13000.00	40.0	127.11
30.00	13000.00	50.0	104.86
30.00	13000.00	60.0	90.06
30.00	13000.00	90.0	65.52
30.00	13000.00	120.0	53.38
30.00	13000.00	150.0	46.20
30.00	13000.00	180.0	41.50
30.00	13000.00	210.0	38.22
30.00	13000.00	240.0	35.82
30.00	13000.00	270.0	34.01
30.00	13000.00	300.0	32.60
30.00	13000.00	330.0	31.49
30.00	13000.00	360.0	30.61
30.00	13000.00	390.0	29.89
30.00	13000.00	420.0	29.29
30.00	13000.00	450.0	28.81
30.00	13000.00	480.0	28.40

D_L (ml/min/mm Hg)	V_A (ml/min)	Time (min)	CO (ppm)
30.00	14000.00	10.0	442.10
30.00	14000.00	20.0	228.74
30.00	14000.00	30.0	157.68
30.00	14000.00	40.0	122.20
30.00	14000.00	50.0	100.95
30.00	14000.00	60.0	86.82
30.00	14000.00	90.0	63.38
30.00	14000.00	120.0	51.81
30.00	14000.00	150.0	44.98
30.00	14000.00	180.0	40.51
30.00	14000.00	210.0	37.40
30.00	14000.00	240.0	35.13
30.00	14000.00	270.0	33.41
30.00	14000.00	300.0	32.09
30.00	14000.00	330.0	31.05
30.00	14000.00	360.0	30.22
30.00	14000.00	390.0	29.55
30.00	14000.00	420.0	29.00
30.00	14000.00	450.0	28.55
30.00	14000.00	480.0	28.18
40.00	14000.00	10.0	399.97
40.00	14000.00	20.0	207.72
40.00	14000.00	30.0	143.72
40.00	14000.00	40.0	111.76
40.00	14000.00	50.0	92.63
40.00	14000.00	60.0	79.92
40.00	14000.00	90.0	58.86
40.00	14000.00	120.0	48.49
40.00	14000.00	150.0	42.39
40.00	14000.00	180.0	38.42
40.00	14000.00	210.0	35.67
40.00	14000.00	240.0	33.68
40.00	14000.00	270.0	32.18
40.00	14000.00	300.0	31.04
40.00	14000.00	330.0	30.15
40.00	14000.00	360.0	29.44
40.00	14000.00	390.0	28.88
40.00	14000.00	420.0	28.42
40.00	14000.00	450.0	28.05
40.00	14000.00	480.0	27.75

D _L (ml/min/mm Hg)	V _A (ml/min)	Time (min)	CO (ppm)
30.00	15000.00	10.0	424.93
30.00	15000.00	20.0	220.18
30.00	15000.00	30.0	151.99
30.00	15000.00	40.0	117.95
30.00	15000.00	50.0	97.56
30.00	15000.00	60.0	84.00
30.00	15000.00	90.0	61.54
30.00	15000.00	120.0	50.45
30.00	15000.00	150.0	43.92
30.00	15000.00	180.0	39.66
30.00	15000.00	210.0	36.69
30.00	15000.00	240.0	34.53
30.00	15000.00	270.0	32.91
30.00	15000.00	300.0	31.66
30.00	15000.00	330.0	30.68
30.00	15000.00	360.0	29.90
30.00	15000.00	390.0	29.27
30.00	15000.00	420.0	28.76
30.00	15000.00	450.0	28.34
30.00	15000.00	480.0	28.00
40.00	15000.00	10.0	382.80
40.00	15000.00	20.0	199.17
40.00	15000.00	30.0	138.03
40.00	15000.00	40.0	107.51
40.00	15000.00	50.0	89.25
40.00	15000.00	60.0	77.11
40.00	15000.00	90.0	57.03
40.00	15000.00	120.0	47.15
40.00	15000.00	150.0	41.35
40.00	15000.00	180.0	37.58
40.00	15000.00	210.0	34.98
40.00	15000.00	240.0	33.10
40.00	15000.00	270.0	31.70
40.00	15000.00	300.0	30.63
40.00	15000.00	330.0	29.80
40.00	15000.00	360.0	29.14
40.00	15000.00	390.0	28.62
40.00	15000.00	420.0	28.20
40.00	15000.00	450.0	27.86
40.00	15000.00	480.0	27.59

D_L (ml/min/mm Hg)	V_A (ml/min)	Time (min)	CO (ppm)
30.00	16000.00	10.0	409.91
30.00	16000.00	20.0	212.69
30.00	16000.00	30.0	147.01
30.00	16000.00	40.0	114.23
30.00	16000.00	50.0	94.60
30.00	16000.00	60.0	81.54
30.00	16000.00	90.0	59.93
30.00	16000.00	120.0	49.27
30.00	16000.00	150.0	43.00
30.00	16000.00	180.0	38.91
30.00	16000.00	210.0	36.07
30.00	16000.00	240.0	34.01
30.00	16000.00	270.0	32.47
30.00	16000.00	300.0	31.28
30.00	16000.00	330.0	30.36
30.00	16000.00	360.0	29.62
30.00	16000.00	390.0	29.03
30.00	16000.00	420.0	28.55
30.00	16000.00	450.0	28.16
30.00	16000.00	480.0	27.85
40.00	16000.00	10.0	367.78
40.00	16000.00	20.0	191.68
40.00	16000.00	30.0	133.05
40.00	16000.00	40.0	103.80
40.00	16000.00	50.0	86.29
40.00	16000.00	60.0	74.66
40.00	16000.00	90.0	55.42
40.00	16000.00	120.0	45.98
40.00	16000.00	150.0	40.44
40.00	16000.00	180.0	36.86
40.00	16000.00	210.0	34.38
40.00	16000.00	240.0	32.60
40.00	16000.00	270.0	31.28
40.00	16000.00	300.0	30.27
40.00	16000.00	330.0	29.50
40.00	16000.00	360.0	28.89
40.00	16000.00	390.0	28.40
40.00	16000.00	420.0	28.02
40.00	16000.00	450.0	27.71
40.00	16000.00	480.0	27.46

D_L (ml/min/mm Hg)	V_A (ml/min)	Time (min)	CO (ppm)
40.00	17000.00	10.0	354.53
40.00	17000.00	20.0	185.07
40.00	17000.00	30.0	128.66
40.00	17000.00	40.0	100.52
40.00	17000.00	50.0	83.68
40.00	17000.00	60.0	72.50
40.00	17000.00	90.0	54.01
40.00	17000.00	120.0	44.95
40.00	17000.00	150.0	39.64
40.00	17000.00	180.0	36.22
40.00	17000.00	210.0	33.86
40.00	17000.00	240.0	32.17
40.00	17000.00	270.0	30.92
40.00	17000.00	300.0	29.97
40.00	17000.00	330.0	29.24
40.00	17000.00	360.0	28.67
40.00	17000.00	390.0	28.22
40.00	17000.00	420.0	27.86
40.00	17000.00	450.0	27.58
40.00	17000.00	480.0	27.35
40.00	18000.00	10.0	342.75
40.00	18000.00	20.0	179.20
40.00	18000.00	30.0	124.76
40.00	18000.00	40.0	97.61
40.00	18000.00	50.0	81.36
40.00	18000.00	60.0	70.58
40.00	18000.00	90.0	52.76
40.00	18000.00	120.0	44.04
40.00	18000.00	150.0	38.94
40.00	18000.00	180.0	35.66
40.00	18000.00	210.0	33.41
40.00	18000.00	240.0	31.79
40.00	18000.00	270.0	30.60
40.00	18000.00	300.0	29.71
40.00	18000.00	330.0	29.02
40.00	18000.00	360.0	28.48
40.00	18000.00	390.0	28.07
40.00	18000.00	420.0	27.73
40.00	18000.00	450.0	27.47
40.00	18000.00	480.0	27.26

D _L (ml/min/mm Hg)	V _A (ml/min)	Time (min)	CO (ppm)
40.00	19000.00	10.0	332.21
40.00	19000.00	20.0	173.94
40.00	19000.00	30.0	121.27
40.00	19000.00	40.0	95.00
40.00	19000.00	50.0	79.29
40.00	19000.00	60.0	68.86
40.00	19000.00	90.0	51.64
40.00	19000.00	120.0	43.22
40.00	19000.00	150.0	38.32
40.00	19000.00	180.0	35.16
40.00	19000.00	210.0	33.00
40.00	19000.00	240.0	31.46
40.00	19000.00	270.0	30.33
40.00	19000.00	300.0	29.48
40.00	19000.00	330.0	28.83
40.00	19000.00	360.0	28.32
40.00	19000.00	390.0	27.93
40.00	19000.00	420.0	27.62
40.00	19000.00	450.0	27.38
40.00	19000.00	480.0	27.18
40.00	20000.00	10.0	322.73
40.00	20000.00	20.0	169.21
40.00	20000.00	30.0	118.13
40.00	20000.00	40.0	92.66
40.00	20000.00	50.0	77.43
40.00	20000.00	60.0	67.32
40.00	20000.00	90.0	50.64
40.00	20000.00	120.0	42.49
40.00	20000.00	150.0	37.76
40.00	20000.00	180.0	34.72
40.00	20000.00	210.0	32.64
40.00	20000.00	240.0	31.17
40.00	20000.00	270.0	30.08
40.00	20000.00	300.0	29.27
40.00	20000.00	330.0	28.66
40.00	20000.00	360.0	28.18
40.00	20000.00	390.0	27.82
40.00	20000.00	420.0	27.53
40.00	20000.00	450.0	27.30
40.00	20000.00	480.0	27.12

D _L (ml/min/mm Hg)	V _A (ml/min)	Time (min)	CO (ppm)
50.00	20000.00	10.0	297.45
50.00	20000.00	20.0	156.62
50.00	20000.00	30.0	109.77
50.00	20000.00	40.0	86.42
50.00	20000.00	50.0	72.47
50.00	20000.00	60.0	63.21
50.00	20000.00	90.0	47.98
50.00	20000.00	120.0	40.57
50.00	20000.00	150.0	36.28
50.00	20000.00	180.0	33.55
50.00	20000.00	210.0	31.70
50.00	20000.00	240.0	30.40
50.00	20000.00	270.0	29.46
50.00	20000.00	300.0	28.76
50.00	20000.00	330.0	28.24
50.00	20000.00	360.0	27.84
50.00	20000.00	390.0	27.53
50.00	20000.00	420.0	27.30
50.00	20000.00	450.0	27.11
50.00	20000.00	480.0	26.97
40.00	21000.00	10.0	314.14
40.00	21000.00	20.0	164.94
40.00	21000.00	30.0	115.29
40.00	21000.00	40.0	90.54
40.00	21000.00	50.0	75.74
40.00	21000.00	60.0	65.92
40.00	21000.00	90.0	49.73
40.00	21000.00	120.0	41.84
40.00	21000.00	150.0	37.25
40.00	21000.00	180.0	34.32
40.00	21000.00	210.0	32.32
40.00	21000.00	240.0	30.90
40.00	21000.00	270.0	29.87
40.00	21000.00	300.0	29.10
40.00	21000.00	330.0	28.51
40.00	21000.00	360.0	28.06
40.00	21000.00	390.0	27.71
40.00	21000.00	420.0	27.44
40.00	21000.00	450.0	27.23
40.00	21000.00	480.0	27.07

D _L (ml/min/mm Hg)	V _A (ml/min)	Time (min)	CO (ppm)
50.00	21000.00	10.0	288.87
50.00	21000.00	20.0	152.34
50.00	21000.00	30.0	106.93
50.00	21000.00	40.0	84.30
50.00	21000.00	50.0	70.78
50.00	21000.00	60.0	61.82
50.00	21000.00	90.0	47.08
50.00	21000.00	120.0	39.92
50.00	21000.00	150.0	35.79
50.00	21000.00	180.0	33.16
50.00	21000.00	210.0	31.39
50.00	21000.00	240.0	30.15
50.00	21000.00	270.0	29.26
50.00	21000.00	300.0	28.59
50.00	21000.00	330.0	28.10
50.00	21000.00	360.0	27.73
50.00	21000.00	390.0	27.44
50.00	21000.00	420.0	27.22
50.00	21000.00	450.0	27.06
50.00	21000.00	480.0	26.93
40.00	22000.00	10.0	306.34
40.00	22000.00	20.0	161.05
40.00	22000.00	30.0	112.71
40.00	22000.00	40.0	88.61
40.00	22000.00	50.0	74.21
40.00	22000.00	60.0	64.66
40.00	22000.00	90.0	48.91
40.00	22000.00	120.0	41.24
40.00	22000.00	150.0	36.80
40.00	22000.00	180.0	33.96
40.00	22000.00	210.0	32.03
40.00	22000.00	240.0	30.67
40.00	22000.00	270.0	29.67
40.00	22000.00	300.0	28.94
40.00	22000.00	330.0	28.38
40.00	22000.00	360.0	27.95
40.00	22000.00	390.0	27.63
40.00	22000.00	420.0	27.37
40.00	22000.00	450.0	27.17
40.00	22000.00	480.0	27.02

D_L (ml/min/mm Hg)	V_A (ml/min)	Time (min)	CO (ppm)
50.00	22000.00	10.0	281.07
50.00	22000.00	20.0	148.46
50.00	22000.00	30.0	104.35
50.00	22000.00	40.0	82.38
50.00	22000.00	50.0	69.26
50.00	22000.00	60.0	60.56
50.00	22000.00	90.0	46.26
50.00	22000.00	120.0	39.33
50.00	22000.00	150.0	35.34
50.00	22000.00	180.0	32.82
50.00	22000.00	210.0	31.12
50.00	22000.00	240.0	29.93
50.00	22000.00	270.0	29.07
50.00	22000.00	300.0	28.45
50.00	22000.00	330.0	27.98
50.00	22000.00	360.0	27.63
50.00	22000.00	390.0	27.37
50.00	22000.00	420.0	27.16
50.00	22000.00	450.0	27.01
50.00	22000.00	480.0	26.89
40.00	23000.00	10.0	299.22
40.00	23000.00	20.0	157.50
40.00	23000.00	30.0	110.36
40.00	23000.00	40.0	86.86
40.00	23000.00	50.0	72.81
40.00	23000.00	60.0	63.50
40.00	23000.00	90.0	48.16
40.00	23000.00	120.0	40.70
40.00	23000.00	150.0	36.38
40.00	23000.00	180.0	33.63
40.00	23000.00	210.0	31.77
40.00	23000.00	240.0	30.45
40.00	23000.00	270.0	29.50
40.00	23000.00	300.0	28.79
40.00	23000.00	330.0	28.26
40.00	23000.00	360.0	27.86
40.00	23000.00	390.0	27.55
40.00	23000.00	420.0	27.31
40.00	23000.00	450.0	27.12
40.00	23000.00	480.0	26.98

D _L (ml/min/mm Hg)	V _A (ml/min)	Time (min)	CO (ppm)
50.00	23000.00	10.0	273.95
50.00	23000.00	20.0	144.91
50.00	23000.00	30.0	102.00
50.00	23000.00	40.0	80.63
50.00	23000.00	50.0	67.86
50.00	23000.00	60.0	59.41
50.00	23000.00	90.0	45.52
50.00	23000.00	120.0	38.80
50.00	23000.00	150.0	34.94
50.00	23000.00	180.0	32.50
50.00	23000.00	210.0	30.87
50.00	23000.00	240.0	29.73
50.00	23000.00	270.0	28.91
50.00	23000.00	300.0	28.32
50.00	23000.00	330.0	27.88
50.00	23000.00	360.0	27.55
50.00	23000.00	390.0	27.30
50.00	23000.00	420.0	27.11
50.00	23000.00	450.0	26.97
50.00	23000.00	480.0	26.86
40.00	24000.00	10.0	292.69
40.00	24000.00	20.0	154.25
40.00	24000.00	30.0	108.20
40.00	24000.00	40.0	85.25
40.00	24000.00	50.0	71.53
40.00	24000.00	60.0	62.44
40.00	24000.00	90.0	47.48
40.00	24000.00	120.0	40.21
40.00	24000.00	150.0	36.01
40.00	24000.00	180.0	33.34
40.00	24000.00	210.0	31.53
40.00	24000.00	240.0	30.26
40.00	24000.00	270.0	29.35
40.00	24000.00	300.0	28.67
40.00	24000.00	330.0	28.16
40.00	24000.00	360.0	27.78
40.00	24000.00	390.0	27.48
40.00	24000.00	420.0	27.26
40.00	24000.00	450.0	27.08
40.00	24000.00	480.0	26.95

D_L (ml/min/mm Hg)	V_A (ml/min)	Time (min)	CO (ppm)
50.00	24000.00	10.0	267.42
50.00	24000.00	20.0	141.66
50.00	24000.00	30.0	99.84
50.00	24000.00	40.0	79.02
50.00	24000.00	50.0	66.59
50.00	24000.00	60.0	58.35
50.00	24000.00	90.0	44.84
50.00	24000.00	120.0	38.31
50.00	24000.00	150.0	34.57
50.00	24000.00	180.0	32.22
50.00	24000.00	210.0	30.64
50.00	24000.00	240.0	29.55
50.00	24000.00	270.0	28.77
50.00	24000.00	300.0	28.20
50.00	24000.00	330.0	27.79
50.00	24000.00	360.0	27.48
50.00	24000.00	390.0	27.24
50.00	24000.00	420.0	27.07
50.00	24000.00	450.0	26.93
50.00	24000.00	480.0	26.83
40.00	25000.00	10.0	286.68
40.00	25000.00	20.0	151.25
40.00	25000.00	30.0	106.21
40.00	25000.00	40.0	83.76
40.00	25000.00	50.0	70.36
40.00	25000.00	60.0	61.47
40.00	25000.00	90.0	46.85
40.00	25000.00	120.0	39.76
40.00	25000.00	150.0	35.66
40.00	25000.00	180.0	33.07
40.00	25000.00	210.0	31.32
40.00	25000.00	240.0	30.09
40.00	25000.00	270.0	29.20
40.00	25000.00	300.0	28.55
40.00	25000.00	330.0	28.07
40.00	25000.00	360.0	27.70
40.00	25000.00	390.0	27.42
40.00	25000.00	420.0	27.21
40.00	25000.00	450.0	27.04
40.00	25000.00	480.0	26.92

D _L (ml/min/mm Hg)	V _A (ml/min)	Time (min)	CO (ppm)
50.00	25000.00	10.0	261.41
50.00	25000.00	20.0	138.66
50.00	25000.00	30.0	97.86
50.00	25000.00	40.0	77.54
50.00	25000.00	50.0	65.41
50.00	25000.00	60.0	57.38
50.00	25000.00	90.0	44.22
50.00	25000.00	120.0	37.87
50.00	25000.00	150.0	34.24
50.00	25000.00	180.0	31.96
50.00	25000.00	210.0	30.44
50.00	25000.00	240.0	29.39
50.00	25000.00	270.0	28.64
50.00	25000.00	300.0	28.10
50.00	25000.00	330.0	27.70
50.00	25000.00	360.0	27.41
50.00	25000.00	390.0	27.19
50.00	25000.00	420.0	27.03
50.00	25000.00	450.0	26.90
50.00	25000.00	480.0	26.81
50.00	26000.00	10.0	255.87
50.00	26000.00	20.0	135.90
50.00	26000.00	30.0	96.03
50.00	26000.00	40.0	76.18
50.00	26000.00	50.0	64.33
50.00	26000.00	60.0	56.49
50.00	26000.00	90.0	43.64
50.00	26000.00	120.0	37.46
50.00	26000.00	150.0	33.93
50.00	26000.00	180.0	31.72
50.00	26000.00	210.0	30.25
50.00	26000.00	240.0	29.24
50.00	26000.00	270.0	28.52
50.00	26000.00	300.0	28.01
50.00	26000.00	330.0	27.63
50.00	26000.00	360.0	27.35
50.00	26000.00	390.0	27.15
50.00	26000.00	420.0	26.99
50.00	26000.00	450.0	26.88
50.00	26000.00	480.0	26.79

D_L (ml/min/mm Hg)	V_A (ml/min)	Time (min)	CO (ppm)
50.00	27000.00	10.0	250.74
50.00	27000.00	20.0	133.35
50.00	27000.00	30.0	94.33
50.00	27000.00	40.0	74.91
50.00	27000.00	50.0	63.33
50.00	27000.00	60.0	55.66
50.00	27000.00	90.0	43.11
50.00	27000.00	120.0	37.08
50.00	27000.00	150.0	33.65
50.00	27000.00	180.0	31.50
50.00	27000.00	210.0	30.08
50.00	27000.00	240.0	29.10
50.00	27000.00	270.0	28.42
50.00	27000.00	300.0	27.92
50.00	27000.00	330.0	27.57
50.00	27000.00	360.0	27.30
50.00	27000.00	390.0	27.11
50.00	27000.00	420.0	26.97
50.00	27000.00	450.0	26.86
50.00	27000.00	480.0	26.78
50.00	28000.00	10.0	245.97
50.00	28000.00	20.0	130.97
50.00	28000.00	30.0	92.76
50.00	28000.00	40.0	73.74
50.00	28000.00	50.0	62.40
50.00	28000.00	60.0	54.90
50.00	28000.00	90.0	42.62
50.00	28000.00	120.0	36.73
50.00	28000.00	150.0	33.39
50.00	28000.00	180.0	31.30
50.00	28000.00	210.0	29.92
50.00	28000.00	240.0	28.98
50.00	28000.00	270.0	28.32
50.00	28000.00	300.0	27.85
50.00	28000.00	330.0	27.51
50.00	28000.00	360.0	27.26
50.00	28000.00	390.0	27.07
50.00	28000.00	420.0	26.94
50.00	28000.00	450.0	26.84
50.00	28000.00	480.0	26.76

D_L (ml/min/mm Hg)	V_A (ml/min)	Time (min)	CO (ppm)
50.00	29000.00	10.0	241.53
50.00	29000.00	20.0	128.76
50.00	29000.00	30.0	91.30
50.00	29000.00	40.0	72.65
50.00	29000.00	50.0	61.54
50.00	29000.00	60.0	54.19
50.00	29000.00	90.0	42.17
50.00	29000.00	120.0	36.41
50.00	29000.00	150.0	33.15
50.00	29000.00	180.0	31.12
50.00	29000.00	210.0	29.78
50.00	29000.00	240.0	28.87
50.00	29000.00	270.0	28.23
50.00	29000.00	300.0	27.78
50.00	29000.00	330.0	27.45
50.00	29000.00	360.0	27.22
50.00	29000.00	390.0	27.04
50.00	29000.00	420.0	26.92
50.00	29000.00	450.0	26.82
50.00	29000.00	480.0	26.75
50.00	30000.00	10.0	237.39
50.00	30000.00	20.0	126.70
50.00	30000.00	30.0	89.93
50.00	30000.00	40.0	71.63
50.00	30000.00	50.0	60.73
50.00	30000.00	60.0	53.52
50.00	30000.00	90.0	41.74
50.00	30000.00	120.0	36.11
50.00	30000.00	150.0	32.92
50.00	30000.00	180.0	30.95
50.00	30000.00	210.0	29.65
50.00	30000.00	240.0	28.77
50.00	30000.00	270.0	28.15
50.00	30000.00	300.0	27.72
50.00	30000.00	330.0	27.41
50.00	30000.00	360.0	27.18
50.00	30000.00	390.0	27.02
50.00	30000.00	420.0	26.90
50.00	30000.00	450.0	26.81
50.00	30000.00	480.0	26.74

TABLE II
 CARBON MONOXIDE EMISSION ESTIMATES - 1968⁴

Source	Emissions, 10 ⁶ tons/yr	Emission factor
Industrial processes		
Foundries		
Controlled (with afterburners)	0.2	10 lb CO/ton of charge
Uncontrolled	3.1	250 lb CO/ton of charge
Petroleum Refineries		
Fluid catalytic crackers	2.0	13.7 lb CO/bbl of fresh feed
Fluid coking	0.2	30 lb CO/bbl of fresh feed
Moving-bed catalytic crackers	0.2	3.8 lb CO/bbl of fresh feed
Kraft pulp mills	2.6	215 lb CO/ton of product
Carbon black		
Furnace	0.30	560 lb CO/ton of product
Channel	0.05 ^d	
Thermal	0.01	47 lb CO/ton of product
Steel mills		
Beehive coke ovens	0.02	4.5% of exhaust gas by volume
Basic oxygen furnaces	0.1	3.2% of exhaust gas by volume
Sintering	2.4	500 ft ³ /ton
Formaldehyde	0.03	100 lb CO/ton of product

TABLE I
PHYSICAL CHARACTERISTICS OF CO⁴

Molecular weight	28.01
Melting point	-207°C
Boiling point	-192°C
Specific gravity relative to air	0.968
Density	
At 0°C, 760 mm Hg	1.25 g/liter
At 25°C, 760 mm Hg	1.15 g/liter
Explosive limits in air	12.5 to 74.2% (volume)
Solubility ^a	
At 0°C	3.54 ml/100 ml water
At 25°C	2.14 ml/100 ml water
Conversion factors	
At 0°C, 760 mm Hg	1 mg/m ³ = 0.800 ppm 1 ppm = 1.250 mg/m ³
At 25°C, 760 mm Hg	1 mg/m ³ = 0.874 ppm 1 ppm = 1.145 mg/m ³

^aVolume of CO indicated is at 0°C, 760 mm Hg.

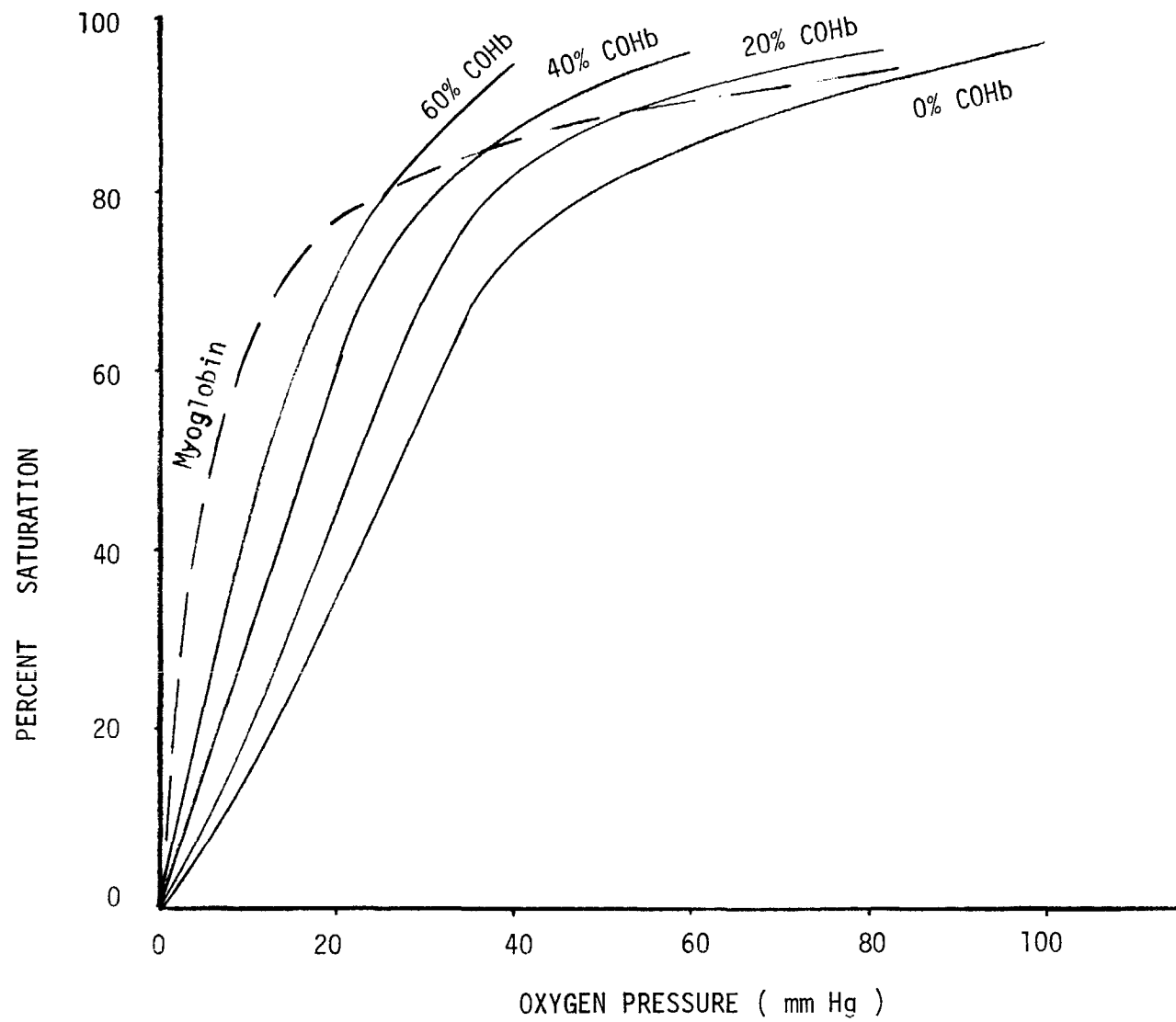
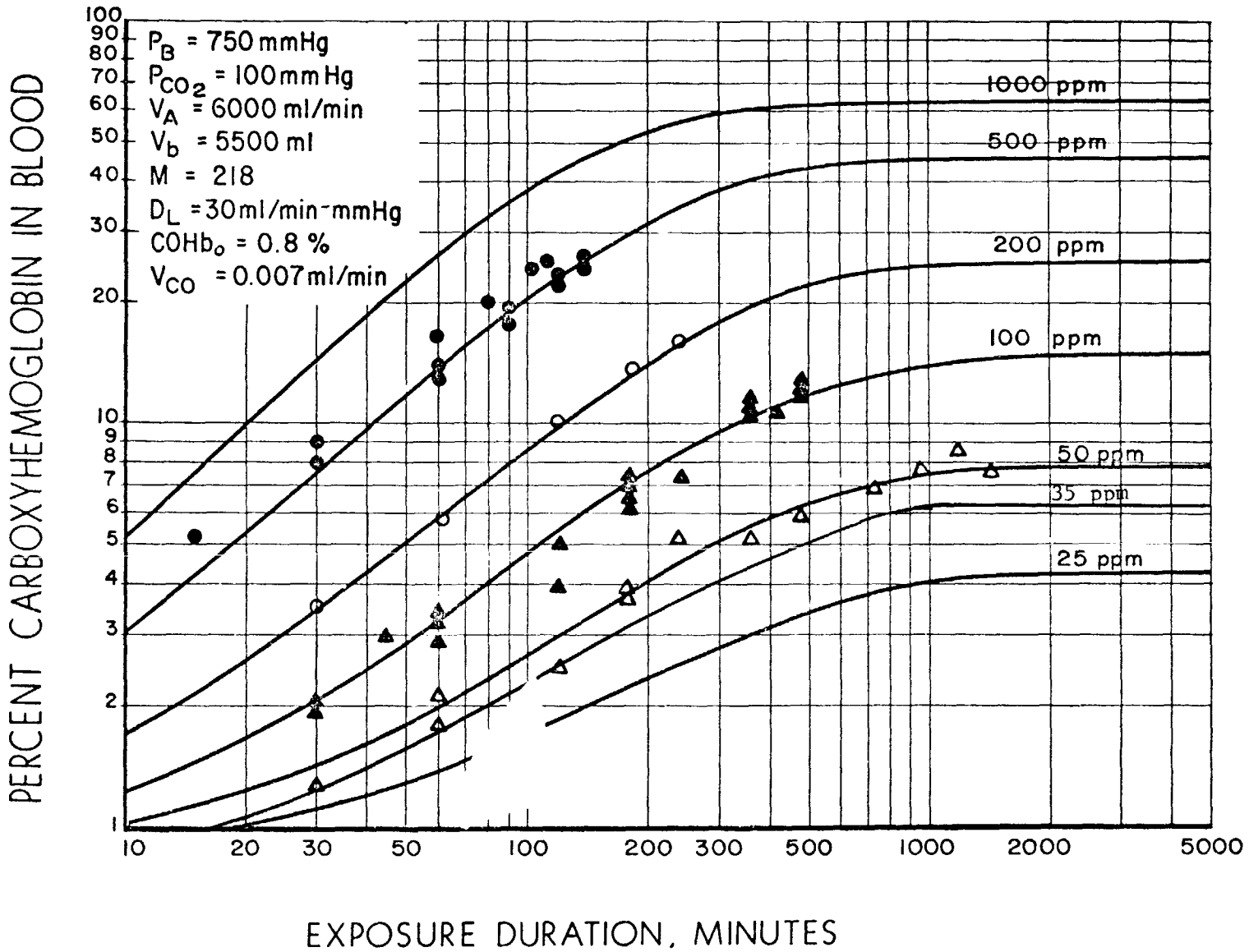


Fig 1 -- Oxyhemoglobin Dissociation Curve

Figure 2

ABSORPTION OF CARBON MONOXIDE



Stewart, R. D., et al: Experimental Human Exposure to Carbon Monoxide. Arch. Environ. Health. 21:154-164, 1970.

