TABLE B1 Typical Dry Gas Analyses

Type	Analysis (vol. %—excluding water vapor)									
	CO_2	O_2	N_2	CO	H_2	CH_4	C_2H_6	C_3H_8	C_4H_{10}	C_5H_{12}+
Natural gas	6.5					77.5	16.0			
Natural gas, dry*	0.2		0.6			99.2				
Natural gas, wet*	1.1					87.0	4.1	2.6	2.0	3.4
Natural gas, sour†	(H_2S 6.4)					58.7	16.5	9.9	5.0	3.5
Butane							2.0	3.5	75.4 *n*-butane 18.1 isobutane	
									Illuminants	
Reformed refinery oil	2.3	0.7	4.9	20.8	49.8	12.3	5.5	5.5	3.7	
Coal gas, by-product	2.1	0.4	4.4	13.5	51.9	24.3			3.4	
Producer gas	4.5	0.6	50.9	27.0	14.0	3.0				
Blast furnace gas	5.4	0.7	8.3	37.0	47.3	1.3				
Sewage gas	22.0		6.0		2.0	68.0				

*Dry gas contains much less propane (C_3H_8) and higher hydrocarbons than wet gas does.
†*Sour* implies that the gas contains significant amounts of hydrogen sulfide.
SOURCE: *Fuel Flue Gases*, American Gas Association, New York, 1941, p. 20.

TABLE B2 Ultimate Analysis of Petroleum Crude

Type	Sp Gr	At °C	Weight %				
			C	H	N	O	S
Pennsylvania	0.862	15	85.5	14.2			
Humbolt, Kan.	0.921		85.6	12.4			0.37
Beaumont, Tex.	0.91		85.7	11.0	2.61		0.70
Mexico	0.97	15	83.0	11.0	1.7		
Báku USSR	0.897		86.5	12.0		1.5	

SOURCE: Data from W.L. Nelson, *Petroleum Refinery Engineering*, 4th ed., McGraw-Hill, New York, 1958.

TABLE B3 Chemical Analyses of Various Wastes

Material	Raw paper	Charred paper	Tire rubber	Dry sewage sludge	Charred sewage sludge	Charred animal manure	Garbage composite *A*	Garbage composite *B*
Moisture	3.8	0.8	0.5	13.6	1.2	0.0	3.4	12.3
Hydrogen*	6.9	3.1	4.3	6.7	1.4	5.4	6.6	7.0
Carbon	45.8	84.9	86.5	28.7	48.6	41.2	57.3	44.4
Nitrogen	—	0.1	—	2.6	3.7	1.5	0.5	0.4
Oxygen*	46.8	8.5	4.6	26.5	—	26.0	22.1	42.1
Sulfur	0.1	0.1	1.2	0.6	—	0.4	0.4	0.2
Ash	0.4	2.5	3.4	34.9	45.7	25.5	10.2	5.9

* The hydrogen and oxygen values reflect that due to both the presence of water and that contained within the moisture-free material.

TABLE B4 Refinery Biological Treatment

	Ranges reported*
Chlorides (mg/L)	200–960
COD (mg/L)	140–640
BOD_5 (mg/L)	97–280
Suspended solids (mg/L)	80–450
Alkalinity (mg/L as $CaCO_3$)	77–210
Temperature, (°F)	69–100
Ammonia, nitrogen (mg/L)	56–120
Oil (mg/L)	23–130
Phosphate (mg/L)	20–97
Phenolics (mg/L)	7.6–61
pH	7.1–9.5
Sulfides (mg/L)	1.3–38
Chromium (mg/L)	0.3–0.7

*Values are the averages of the minima and maxima reported by 12 refineries treating total effluent. Individual plants have reported data well outside many of these ranges.

SOURCE: *Manual on Disposal of Refinery Wastes*, American Petroleum Institute, New York, 1969, pp. 2–4.

TABLE B5 Higher Heating Value of Municipal Refuse (kJ/kg)

Refuse component	As delivered	Dry basis	Refuse component	As delivered	Dry basis
Lawn grass	4,780	19,320	Average	—	20,050
Meat scraps, cooked	32,260	32,260	Mail	14,150	14,820
Newspaper	18,530	19,710	Cardboard	16,370	17,260
Shrub cuttings	6,290	20,300	Ripe tree leaves	18,550	20,610
Vegetable food waste	4,170	19,220	Magazine	12,210	12,730

TABLE B6 Calorie Counts in Various Foods

Food	Portion	Kilo-calories	Food	Portion	Kilo-calories
Beer	12 oz	165	Orange juice	½ glass	56
Chicken, broiled	½	308	Soft drink	1 can	73
Coffee	1 cup	0	Toast	2 pieces	120
Martini	1 oz	168	Trout	1 lb	224

TABLE B7 Higher Heating

Class	kJ/kg	Btu/lb
Meta-anthracite	26,680	11,480
Anthracite	33,110	14,250
Low-volatile bituminous	35,370	15,220
High-volatile bituminous	27,790	11,960
Subituminous	23,330	10,040
Lignite	17,290	7,440

TABLE B8 Heating Values of Fuels

Class	Btu/gal
Kerosene	134,000
No. 2 burner fuel oil	140,000
No. 4 heavy fuel oil	144,000
No. 5 heavy fuel oil	150,000
No. 6 heavy fuel oil, 2.7% sulfur	152,000
No. 6 heavy fuel oil, 0.3% sulfur	143,800
natural gas	*1,000
liquefied butane	103,300
liquefied propane	91,6000

*10^3 Btu/ft^3 at SCNGI

TABLE B9 Elemental Compositions and Heating Values of Raw and Hydrotreated Coal Liquids

	Boiling range (°C)	Specific gravity	Heating value, (kJ/kg)	H	C	O	S	N
liquid organic liquid	65-205	0.847	42212	11.33	83.77	4.0	0.60	0.30
liquid organic liquid	110-230	0.918	40068	9.93	84.44	5.0	0.40	0.23
SRC-Illinois No. 6 coal	340+	1.184	37090	5.72	88.50	3.5	0.57	1.71
distillate–syncrude mode	190-350	0.968	42056	9.14	88.87	1.5	0.10	0.39
fuel oil–Illinois No. 6 coal	260+		40498	7.94	88.77	2.1	0.42	0.77
distillate syncrude	180-330	0.942	43326	10.46	89.12	0.3	<0.01	0.12

Source: R. H. Heck and M. J. Dabkowski, "Heating Value Correlation for Coal," *Ind. Eng. Chem. Res*, **27**, 1922 (1988).