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APPENDIX I: TABLES

Table 1. Major Slurry Pipelines in the World
(From Thompson and Aude [22])

Slurry material	System	Length (miles)	Diameter (inches)	Annual throughput (million tons/year)	Initial operation	Type of pump	Manufacturer
Coal*	Consolidation, Ohio	108	10	1.3	1957	Double acting Duplex piston	Wilson-Snyder
	Black Mesa, Arizona	273	18	4.8	1970	Double acting Duplex piston	Wilson-Snyder
	Belovo-Novosibirsk, USSR	155	N/A	N/A	N/A	N/A	N/A
Limestone	Calaveras, California	17	7	1.5	1971	Double acting Duplex piston	Continental-Emsco
	Rugby, England	57	10	1.7	1964	Double acting Duplex piston	Armco Steel
						Single acting Triplex piston	Wilson-Snyder
	Voest Alpine, Trinidad	N/A	N/A	N/A	N/A	Double acting Duplex piston	Continental-Emsco
	Trinidad	6	8	0.6	1959	Double acting Duplex piston	Wilson-Snyder
	Gladstone, Australia	15	8	1.8	1981	Double acting Duplex piston	Wilson-Snyder
Copper concentrate	Bougainville	17	6	1.0	1972	Vertical triplex plunger	Ingersoll-Rand/ Aldrich
	West Irian	69	4	0.3	1972	Vertical triplex plunger	Ingersoll-Rand/ Aldrich
	KBI, Turkey	40	5	1.0	1973	Triplex plunger	Wilson-Snyder
	Pinto Valley, Arizona	11	4	0.4	1974	Triplex plunger	Ingersoll-Rand/ Aldrich
Iron concentrate	Savage River, Tasmania	53	9	2.3	1967	Triplex plunger	Wilson-Snyder
	Waipipi, New Zealand (Land)	4	8	1.0	1971	Centrifugal	Allen Sherman Hoff
	(Offshore)	1.3	12	1.0	1971	Centrifugal	Hazleton/Barrett Haentjens
	Pena Colorada, Mexico	30	9	1.8	1974	Centrifugal	Joy
	Las Truchas, Mexico	17	10	1.5	1976	Triplex plunger	Ingersoll-Rand/ Aldrich
	Sierra Grande, Argentina	20	8	2.1	1976	Triplex plunger	Ingersoll-Rand/ Aldrich
	Samarco, Brazil	245	20	12.0	1977	Triplex plunger	Wilson-Snyder
	Chongin, North Korea	61	N/A	4.5	1975	N/A	N/A
	Kudremukh, India	44	18	7.5	1980	Centrifugal	Allis Chalmers
	La Perla-Hercules, Mexico	53/183	8/14	4.5	1982	Triplex plunger	Continental-Emsco
Gilsonite	American Gilsonite, Utah	72	6	0.4	1957	Double acting Duplex plunger	Wilson-Snyder
Copper tailings	Japan	44	12	0.6	1968	Double acting Duplex piston	Mars
Nickel refinery tailings	Western Mining, Australia	4.3	4	0.1	1970	Triplex plunger	Ingersoll-Rand/ Aldrich
Phosphate concentrate	Valep, Brazil	74	9	2.0	1978	Triplex plunger	Continental-Emsco
	Goiasfertil, Brazil	9	6	0.9	1981	Triplex plunger	Wilson-Snyder
Kaolin	Freeport, Georgia	24	10	N/A	1976	Double acting Duplex piston	Wilson-Snyder

Table 2. Summary of Scenarios

Assumptions		Scenario Number															
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	Coal Log Fab. Method	compaction	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
2	Coal Log Fab. Rate (ft/sec)	0.2	0.4	0.1	0.2	"	"	"	"	"	"	"	"	"	"	"	"
3	Coal Log Sealing	Yes	"	"	No	Yes	"	"	"	"	"	"	"	"	"	"	"
4	Spec. Grav. of Coal Logs	1.20	"	"	1.35	1.05	1.10	1.20	"	"	"	"	"	"	"	"	"
5	Type of Pumps	Pos. Disp.	"	"	"	"	"	"	"	Centri.	Pos. Disp.	"	"	"	"	"	"
6	Max. Oper. Press. (psig)	1,500	"	"	"	"	"	2,000	1,000	500	1,500	"	"	"	1,000	1,500	"
7	Type of Water	Brackish	"	"	"	"	"	"	"	"	"	Fresh	Brackish	"	"	"	"
8	Coal Log Train Lgth. (100 V_o)	2	"	"	"	"	"	"	"	"	"	"	1	4	2	"	"
9	New or Existing Pipe	New	"	"	"	"	"	"	"	"	"	"	"	"	Existing	New	"
10	Linefill Rate	90%	"	"	"	"	"	"	"	"	"	"	"	"	"	80%	90%
11	System Availability	90%	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
12	Drag Reducing Agent	No	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
13	Pigs	No	"	"	"	"	"	"	"	"	Yes	No	"	"	"	"	"
14	Deaeration	Yes	"	"	"	"	"	"	"	"	"	"	"	"	"	"	No
15	Binder Amount	0	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
16	Duplicate Lock/Pump	No	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
17	Fluid Used	Water	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
18	Econ. Life for System	30 yrs.	"	"	"	"	"	"	"	"	"	"	"	"	15 yrs.	30 yrs.	"
19	Investment Return Rate	15%	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
20	Discount Rate	8%	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
21	Equity Rate	1.0	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
22	Inflation Rate	6%	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
23	Electricity Escal. Rate	7%	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
24	Fuel Escal. Rate	8%	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"

Fixed!

Table 2. (continued)

	Assumptions	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
1	Coal Log Fab. Method	compaction	"	"	Low-cost Extruder	"	"	High-cost Extruder	compaction	"	"	"	"	"	"	"	"
2	Coal Log Fab. Rate (ft/sec)	0.2	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
3	Coal Log Sealing	Yes	No	Yes	"	"	"	"	"	No	Yes	"	"	"	"	"	"
4	Spec. Grav. of Coal Logs	1.20	1.35	1.10	"	"	"	"	1.20	1.35	1.20	"	"	"	"	"	"
5	Type of Pumps	Pos. Disp.	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
6	Max. Oper. Press. (psig)	1,500	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
7	Type of Water	Brackish	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
8	Coal Log Train Lgth. (100 V_o)	2	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
9	New or Existing Pipe	New	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
10	Linefill Rate	90%	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
11	System Availability	90%	"	"	"	"	"	"	95%	90%	"	"	"	"	"	"	"
12	Drag Reducing Agent	Yes	"	"	No	"	"	"	"	"	"	"	"	"	"	"	"
13	Pigs	No	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
14	Deaeration	Yes	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
15	Binder Amount	0	"	"	1%	3%	5%	1%	0	"	"	"	"	"	"	"	"
16	Duplicate Lock/Pump	No	"	"	"	"	"	"	Yes	No	"	"	"	"	"	"	"
17	Fluid Used	Water	"	"	"	"	"	"	"	Slurry	Water	"	"	"	"	"	"
18	Econ. Life for System	30 yrs.	"	"	"	"	"	"	"	"	Some parts 30 yrs. others 15 yrs.	30 yrs.	"	"	"	"	Some parts 45 yrs. others 15 yrs.
19	Investment Return Rate	15%	"	"	"	"	"	"	"	"	"	30%	15%	"	"	"	"
20	Discount Rate	8%	"	"	"	"	"	"	"	"	"	"	"	"	6%	8%	"
21	Equity Rate	1.0	"	"	"	"	"	"	"	"	"	"	0.6	0	"	"	1.0
22	Inflation Rate	6%	"	"	"	"	"	"	"	"	"	"	"	"	"	5%	6%
23	Electricity Escal. Rate	7%	"	"	"	"	"	"	"	"	"	"	"	"	"	6%	7%
24	Fuel Escal. Rate	8%	"	"	"	"	"	"	"	"	"	"	"	"	"	7%	8%

Table 3. Key Parameters of CLP Systems Analyzed

Pipe Diameter	Lift-Off Velocity	Aspect Ratio	Diameter Ratio	Pressure, Δp_L (10^3 psi/100 mi)		Power, P (MW/100 mi)		Linefill 0.8 Throughput		Linefill 0.9 Throughput	
				Without Polymer	With Polymer	Without Polymer	With Polymer	Water Q_w	Coal Q_c	Water Q_w	Coal Q_c
D (in) (1)	V_L (fps) (2)	a (3)	k (4)	(5)	(6)	(7)	(8)	(cfs) (9)	(MT/yr) (10)	(cfs) (11)	(MT/yr) (12)
				Specific Gravity S = 1.05							
4	5.20	4.12	0.85	7.72	2.32	0.91	0.27	0.19	0.27	0.16	0.30
6	5.60	3.35	0.86	5.40	1.62	1.55	0.46	0.45	0.67	0.37	0.75
8	6.00	3.05	0.87	4.33	1.30	2.36	0.71	0.83	1.31	0.67	1.47
10	6.40	2.96	0.88	3.74	1.12	3.40	1.02	1.33	2.23	1.06	2.51
12	6.80	2.99	0.89	3.36	1.01	4.68	1.40	1.96	3.49	1.53	3.92
14	7.20	3.11	0.90	3.12	0.93	6.25	1.87	2.71	5.14	2.09	5.78
16	7.60	3.31	0.91	2.94	0.88	8.14	2.44	3.58	7.24	2.70	8.14
18	8.00	3.61	0.92	2.82	0.85	10.38	3.12	4.56	9.86	3.37	11.09
20	8.40	4.03	0.93	2.73	0.82	13.03	3.91	5.65	13.06	4.06	14.69
				Specific Gravity S = 1.1							
4	5.0	1.90	0.85	7.18	2.16	0.82	0.24	0.18	0.27	0.15	0.31
6	5.5	1.62	0.86	5.22	1.57	1.47	0.44	0.44	0.69	0.36	0.78
8	6.0	1.53	0.87	4.33	1.30	2.36	0.71	0.83	1.37	0.67	1.54
10	6.5	1.53	0.88	3.85	1.15	3.55	1.07	1.35	2.37	1.07	2.67
12	7.0	1.59	0.89	3.56	1.07	5.09	1.53	2.01	3.76	1.58	4.23
14	7.5	1.69	0.90	3.37	1.01	7.04	2.11	2.82	5.61	2.17	6.31
16	8.0	1.84	0.91	3.25	0.97	9.45	2.84	3.77	7.98	2.85	8.98
18	8.5	2.04	0.92	3.17	0.95	12.40	3.72	4.85	10.97	3.58	12.34
20	9.0	2.32	0.93	3.12	0.94	15.95	4.79	6.05	14.66	4.35	16.49
				Specific Gravity S = 1.2							
4	6.0	1.37	0.85	10.09	3.03	1.38	0.41	0.22	0.36	0.18	0.40
6	6.8	1.24	0.86	7.78	2.33	2.71	0.81	0.55	0.93	0.45	1.05
8	7.8	1.29	0.87	7.12	2.14	5.05	1.52	1.07	1.94	0.87	2.18
10	8.2	1.22	0.88	5.99	1.80	6.97	2.09	1.70	3.26	1.36	3.67
12	8.8	1.25	0.89	5.50	1.65	9.90	2.97	2.53	5.15	1.98	5.80
14	9.2	1.27	0.90	4.98	1.49	12.76	3.83	3.46	7.50	2.67	8.44
16	9.4	1.27	0.91	4.43	1.33	15.12	4.54	4.43	10.23	3.34	11.51
18	9.7	1.33	0.92	4.08	1.23	18.23	5.47	5.53	13.66	4.08	15.37
20	10.0	1.43	0.93	3.82	1.15	21.70	6.51	6.72	17.77	4.83	19.99
				Specific Gravity S = 1.35							
4	7.5	1.22	0.85	15.37	4.61	2.62	0.79	0.28	0.50	0.23	0.56
6	9.0	1.24	0.86	13.27	3.98	6.11	1.83	0.72	1.38	0.59	1.56
8	10.0	1.21	0.87	11.46	3.44	10.42	3.12	1.38	2.80	1.11	3.15
10	10.8	1.21	0.88	10.15	3.05	15.58	4.67	2.24	4.83	1.79	5.44
12	11.5	1.22	0.89	9.21	2.76	21.66	6.50	3.31	7.58	2.59	8.53
14	12.0	1.24	0.90	8.31	2.49	27.76	8.33	4.52	11.01	3.48	12.38
16	12.2	1.22	0.91	7.32	2.19	32.45	9.74	5.75	14.94	4.34	16.81
18	12.3	1.22	0.92	6.46	1.94	36.55	10.97	7.02	19.49	5.18	21.92
20	12.4	1.26	0.93	5.79	1.74	40.76	12.23	8.33	24.78	5.99	27.88

Table 4. Distance between Booster Stations in Miles for CLP Systems with Different Operating Pressures.

Pipe Diameter	Without Polymer Operating Pressure (psi)				With Polymer Operating Pressure (psi)			
D (in)	500	1000	1500	2000	500	1000	1500	2000
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
				Specific Gravity S = 1.05				
4	6	12	19	25	20	41	63	85
6	8	17	27	36	29	59	90	121
8	10	22	33	45	36	74	113	151
10	12	25	39	52	41	86	131	175
12	13	28	43	58	46	96	145	195
14	15	31	47	63	50	103	157	210
16	15	32	49	66	53	109	166	223
18	16	34	52	69	55	114	173	232
20	17	35	53	72	57	118	179	240
				Specific Gravity S = 1.1				
4	6	13	20	27	21	45	68	91
6	9	18	28	37	30	61	93	125
8	10	22	33	45	36	74	113	151
10	12	25	38	51	40	84	127	170
12	13	27	41	55	44	90	137	184
14	13	28	43	58	46	95	145	194
16	14	29	45	60	48	99	150	202
18	14	30	46	62	49	102	154	207
20	15	31	47	63	50	103	157	210
				Specific Gravity S = 1.2				
4	4	9	14	19	15	32	48	65
6	6	12	18	25	20	41	62	84
8	6	13	20	27	22	45	68	92
10	7	16	24	32	26	54	81	109
12	8	17	26	35	28	58	89	119
14	9	19	29	39	31	64	98	131
16	10	21	33	44	35	73	110	148
18	11	23	36	48	38	79	120	160
20	12	25	38	51	41	84	128	171
				Specific Gravity S = 1.35				
4	3	6	9	12	10	21	31	42
6	3	7	11	14	11	24	36	49
8	4	8	12	17	13	28	42	57
10	4	9	14	19	15	31	48	64
12	5	10	15	21	17	35	53	71
14	5	11	17	23	18	38	58	79
16	6	13	20	26	21	44	67	89
18	7	15	22	30	24	50	75	101
20	8	16	25	34	27	55	84	113

Table 5. Key Parameters of CLP Systems Using Slurry to Suspend Logs

Pipe Diameter D (in)	Lift-Off Velocity V_L (fps)	Aspect Ratio a	Diameter Ratio k	Pressure, Δp_c (10^3 psi/100 mi) Without Polymer	Power, P (MW/100 mi) Without Polymer	Linefill 0.8 Throughput Water Q_w (cfs)	Linefill 0.8 Throughput Coal Q_c (MT/yr)	Linefill 0.9 Throughput Water Q_w (cfs)	Linefill 0.9 Throughput Coal Q_c (MT/yr)	Spacing Between Booster Stations in Miles Without Polymer 500 psi	1000 psi	1500 psi	2000 psi
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Specific Gravity S = 1.35; Density Ratio ε = 1.125													
4	6.0	2.19	0.85	15.35	2.09	0.11	0.44	0.09	0.47	3	6	9	12
6	6.2	1.65	0.86	6.88	2.18	0.25	1.04	0.20	1.09	6	14	21	28
8	6.4	1.39	0.87	5.24	3.05	0.44	1.93	0.36	2.03	8	18	28	37
10	6.8	1.34	0.88	4.18	4.04	0.71	3.23	0.56	3.41	11	23	35	47
12	7.0	1.27	0.89	3.83	5.48	1.01	4.83	0.79	5.10	12	25	38	51
14	7.2	1.25	0.90	3.79	7.59	1.35	6.84	1.04	7.22	12	25	38	52
16	7.4	1.26	0.91	3.50	9.42	1.74	9.27	1.32	9.79	13	27	41	56
18	7.6	1.31	0.92	3.23	11.29	2.17	12.17	1.60	12.86	14	30	45	61
20	7.8	1.39	0.93	3.11	13.79	2.62	15.57	1.89	16.47	15	31	47	63

Table 6. Capital Costs for Inlet Facilities (8-inch CLP, Scenario 1)

Item	Cost ($)
Intake Tank	$ 333,333
Building	888,889
Land	100,000
Intake Pipe	226,597
Valves	790,434
Inlet Pumps	115,468
Conveyors	355,974
Extruders	0
Compaction Machine	5,639,253
Coating Chamber	300,037
Mixers	0
Binder Heating Tanks	0
Substation	84,503
Deaeration Equipment	157,081
Additional Inlet Equipment	2,000,000
Access Road	1,000,000
Pigs	0
Total Capital Cost for Inlet	$ 15,342,152

Table 7. Capital Costs for Outlet Facilities (8-inch CLP, Scenario 1)

Item	Cost ($)
Sedimentation Tank	$ 358,054
Flocculation Tank	58,762
Land	2,171
Conveyors	32,619
Crushers	239,794
Building	160,000
Automatic Control	100,000
Dewatering Centrifuge	197,004
Other Outlet Equipment	1,000,000
Total Capital Cost for Outlet	$ 2,679,704

Table 8. Capital Costs for Each Booster Station (8-inch CLP, Scenario 1)

Item	Cost ($)
Water Storage Reservoir	$ 43,500
Pumps	610,127
Valves	434,739
Pipe	215,806
Building	106,667
Land	10,000
Automatic Control Equipment	100,000
Substation	31,762
Access Road	1,000,000
Total Capital Cost for Each Booster Station	$ 3,187,937

Table 9. Capital Costs for Pipeline (8-inch CLP, Scenario 1)

Item	Cost ($ / Mile)
Steel Pipe, Construction, and Right-of-Way	$ 182,606
Capital Cost for Each Mile of Pipeline	182,606
Capital Cost for the 100-Mile Pipeline	$ 18,260,600

Table 10. O/M Costs for Inlet Facilities (8-inch CLP, Scenario 1) for First Year

Item	Cost ($)
Binder	$ 0
Electricity	2,024,742
Water	507,453
Salary & Wages	1,121,476
Crushing	461,288
Polymer	0
Pigs	0
Communication Lines	460,000
Coal Heating	1,524,119
Other	530,016
Total First-Year O/M Cost for Inlet	$ 6,629,094

Table 11. O/M Costs for Outlet Facilities (8-inch CLP, Scenario 1) for First Year

Item	Cost ($)
Flocculants	$ 884
Electricity	117,339
Salary & Wages	146,934
Other	76,667
Total First-Year O/M Cost for Outlet	$ 341,824

Table 12. O/M Costs for Each Booster Station (8-inch CLP, Scenario 1) for First Year

Item	Cost ($)
Electricity	393,363
Salary & Wages	82,608
Materials/Supply	61,333
Polymer	0
Total First-Year O/M Cost for Each Booster Station	$ 537,304

Table 13. Total System Capital Costs (8-inch CLP / 100 Miles)
(Scenario 1)

Item	Cost (Million dollars per 100 miles)
Inlet Facilities	15.34
Outlet Facilities	2.68
Booster Stations (Need 4)	12.71
Pipeline (100 Miles)	18.26
TOTAL CAPITAL COST	48.99

Table 14. Total Annual System O/M Costs for First Year
(8-inch CLP / 100 Miles)
(Scenario 1)

Item	Cost (Million dollars per 100 miles)
Inlet Facilities	6.63
Outlet Facilities	0.34
Booster Stations (Need 4)	2.15
Pipeline Right-of-Way Maintenance	0.18
TOTAL O/M COST	9.30

Table 15. Computation of Life-Cycle Cost, Unit Cost, and Freight Rate for Transportation of Coal by CLP (Scenario 1: standard scenario)

Pipe Diameter (in): 8.0
Throughput of Coal (MT/yr): 1.96
Length of Pipeline (mi): 100.0
Capital Cost ($M): 48.8

year	Energy[1] ($M)	Other O/M Cost[2] ($M)	Property Tax & Insurance[3] ($M)	Depreciation[4] ($M)	Return[5] ($M)	Taxes[6] ($M)	Total Annual Cost[7] ($M)	Unit Cost[8] U ($/T)	Present Value Unit Cost[9], U_p ($/T)
1	3.728	5.584	1.220	1.627	7.323	2.709	22.192	11.311	10.473
2	3.988	5.919	1.220	1.627	7.079	2.619	22.453	11.444	9.811
3	4.268	6.274	1.220	1.627	6.835	2.529	22.753	11.597	9.206
4	4.566	6.651	1.220	1.627	6.590	2.438	23.094	11.771	8.652
5	4.886	7.050	1.220	1.627	6.346	2.348	23.478	11.966	8.144
6	5.228	7.473	1.220	1.627	6.102	2.258	23.909	12.186	7.679
7	5.594	7.921	1.220	1.627	5.858	2.168	24.389	12.431	7.253
8	5.986	8.397	1.220	1.627	5.614	2.077	24.921	12.702	6.862
9	6.405	8.900	1.220	1.627	5.370	1.987	25.510	13.002	6.504
10	6.853	9.434	1.220	1.627	5.126	1.897	26.158	13.332	6.175
11	7.333	10.000	1.220	1.627	4.882	1.806	26.869	13.695	5.873
12	7.846	10.600	1.220	1.627	4.638	1.716	27.648	14.092	5.596
13	8.395	11.236	1.220	1.627	4.394	1.626	28.499	14.525	5.341
14	8.983	11.911	1.220	1.627	4.150	1.535	29.426	14.998	5.106
15	9.612	12.625	1.220	1.627	3.905	1.445	30.435	15.512	4.890
16	10.284	13.383	1.220	1.627	3.661	1.355	31.531	16.071	4.691
17	11.004	14.186	1.220	1.627	3.417	1.264	32.719	16.677	4.507
18	11.775	15.037	1.220	1.627	3.173	1.174	34.006	17.333	4.337
19	12.599	15.939	1.220	1.627	2.929	1.084	35.399	18.042	4.181
20	13.481	16.895	1.220	1.627	2.685	0.993	36.902	18.809	4.035
21	14.424	17.909	1.220	1.627	2.441	0.903	38.525	19.636	3.901
22	15.434	18.984	1.220	1.627	2.197	0.813	40.275	20.528	3.776
23	16.514	20.123	1.220	1.627	1.953	0.723	42.160	21.488	3.660
24	17.670	21.330	1.220	1.627	1.709	0.632	44.189	22.523	3.552
25	18.907	22.610	1.220	1.627	1.465	0.542	46.372	23.635	3.451
26	20.231	23.967	1.220	1.627	1.220	0.452	48.717	24.830	3.357
27	21.647	25.405	1.220	1.627	0.976	0.361	51.237	26.115	3.269
28	23.162	26.929	1.220	1.627	0.732	0.271	53.942	27.493	3.187
29	24.784	28.545	1.220	1.627	0.488	0.181	56.845	28.973	3.110
30	26.519	30.257	1.220	1.627	0.244	0.090	59.958	30.560	3.037

Average Above: U_o = 5.4540 $/T
Freight Rate = U_o/L = 0.0545 $/TM

Note: $M = million dollars; $/T = dollars per ton of coal transported; $/TM = dollars per ton per mile of transportation.

1. Energy (electricity) cost is escalated at a 7% rate.
2. Other O/M Cost is escalated at a 6% rate.
3. Property tax and insurance is based on 2.5% of the total capital cost.
4. Capital is depreciated linearly over 30 years, same for each year.
5. Return is based on 15% interest.
6. Corporate income tax is based on 37% annual income.
7. The total annual cost is the sum of items 1 through 6.
8. The unit cost is the total annual cost divided by the throughput of coal.
9. Average present value is determined by using an 8% discount rate.

APPENDIX II: FIGURES

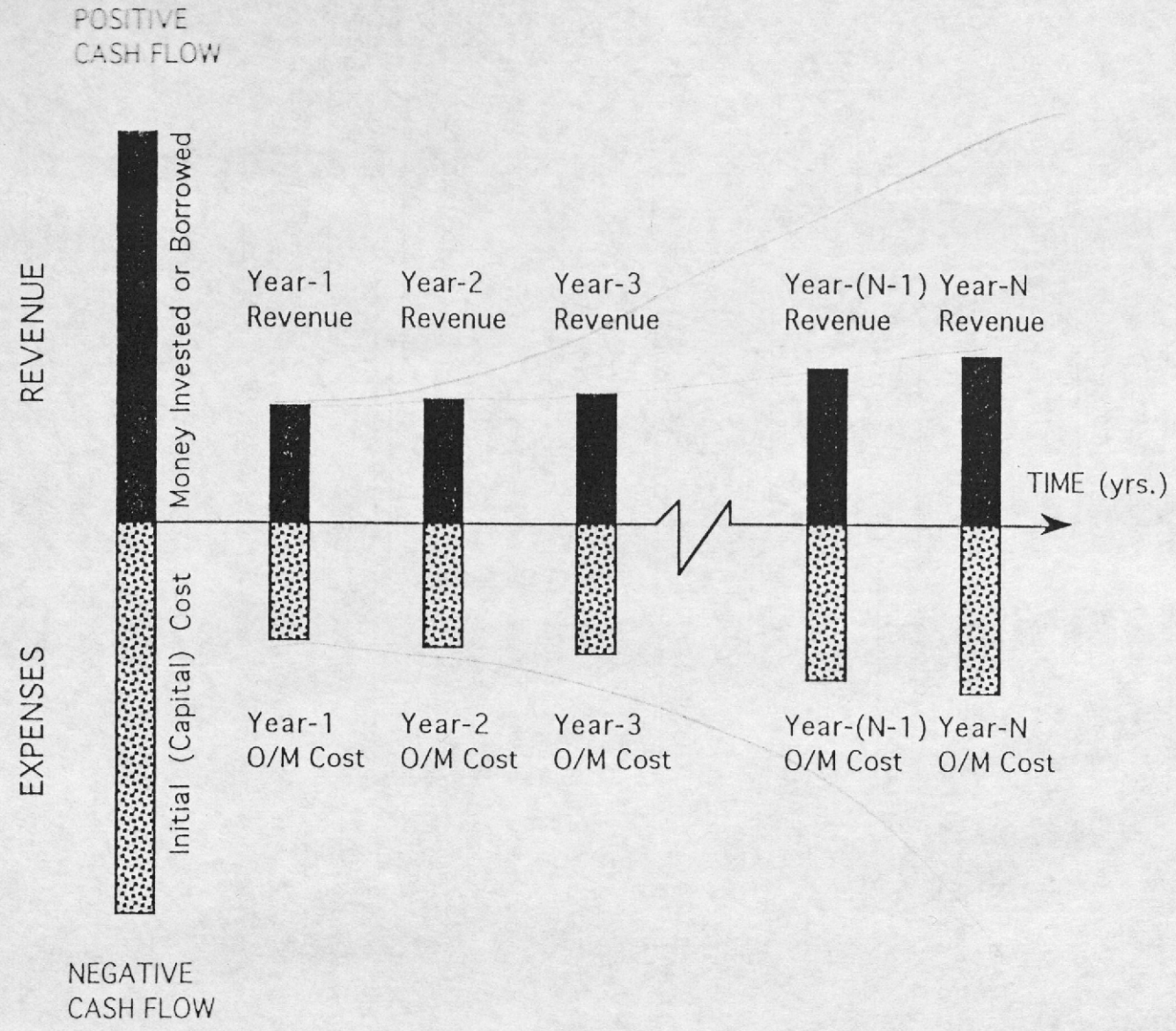


Fig. 1. Cash-Flow Diagram Used in Life Cycle Cost Analysis of Coal Log Pipeline

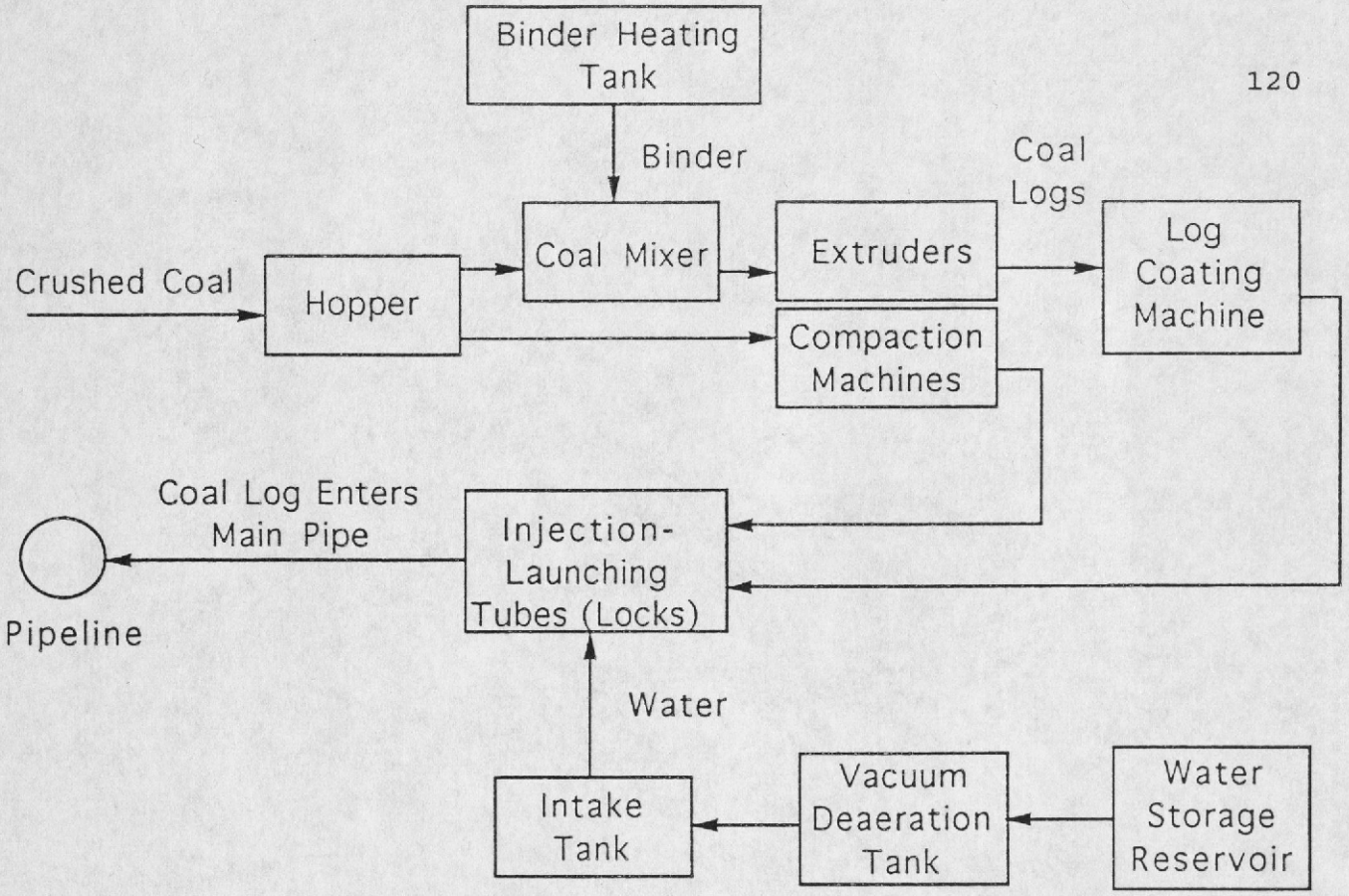


Fig. 2. Inlet Facilities and Process for CLP

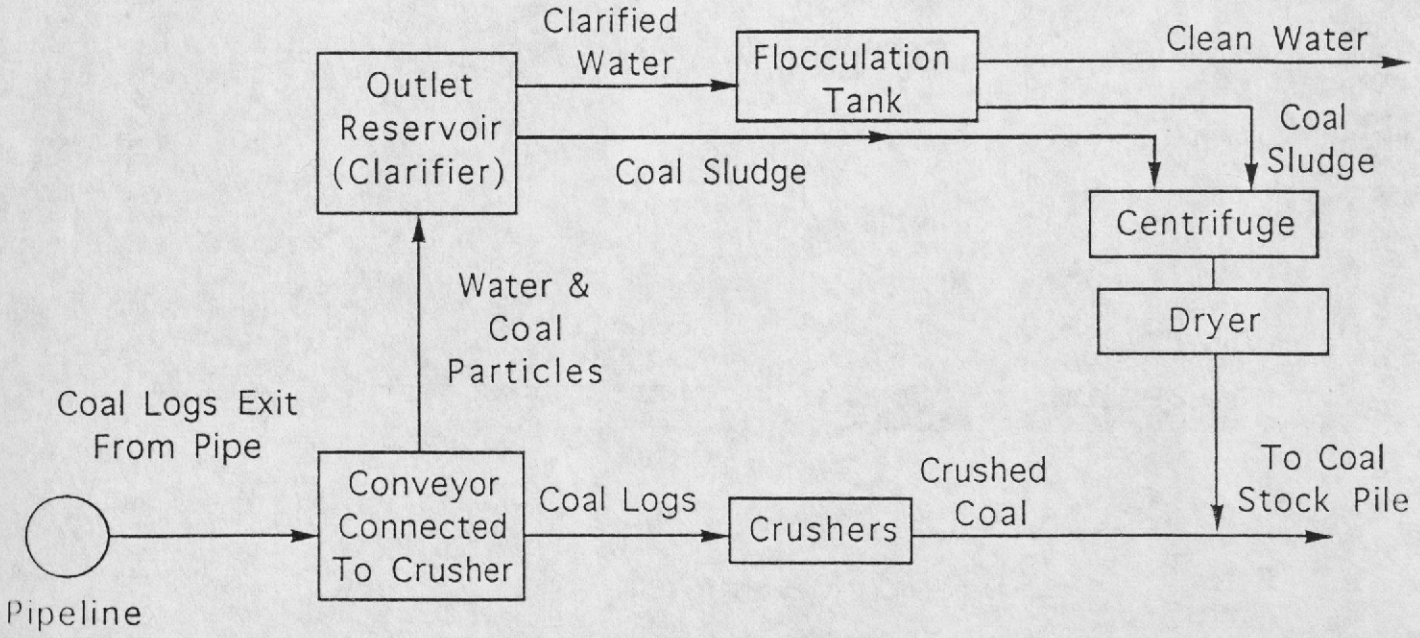


Fig. 3. Outlet Facilities and Process for CLP

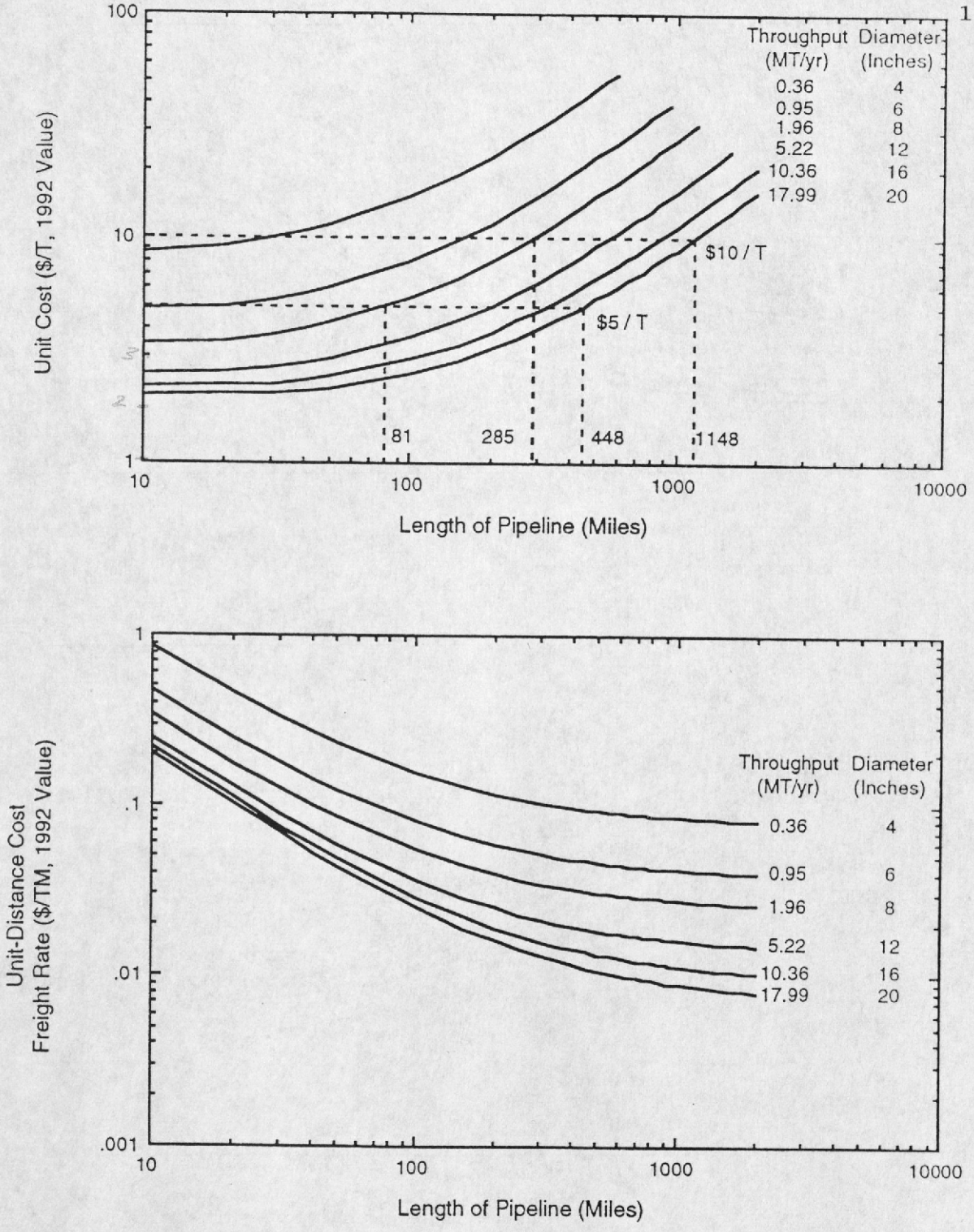
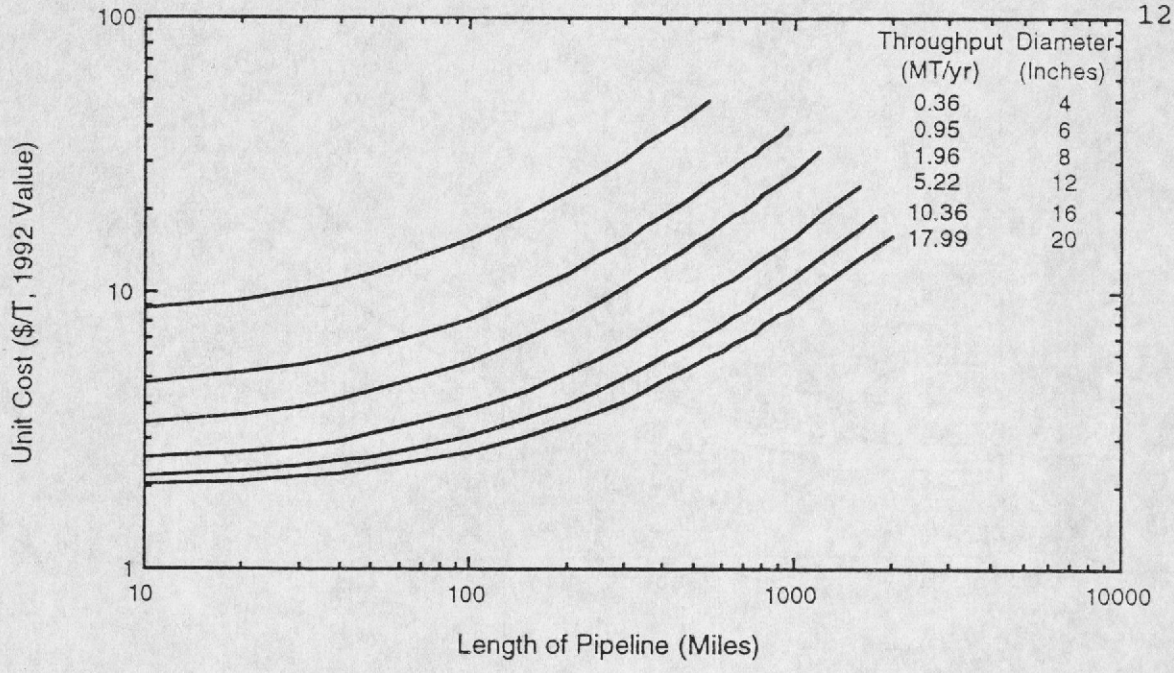


Fig. 4. Unit Cost and Unit-Distance Cost for CLP Transportation of Coal: Scenario 1 (standard scenario)



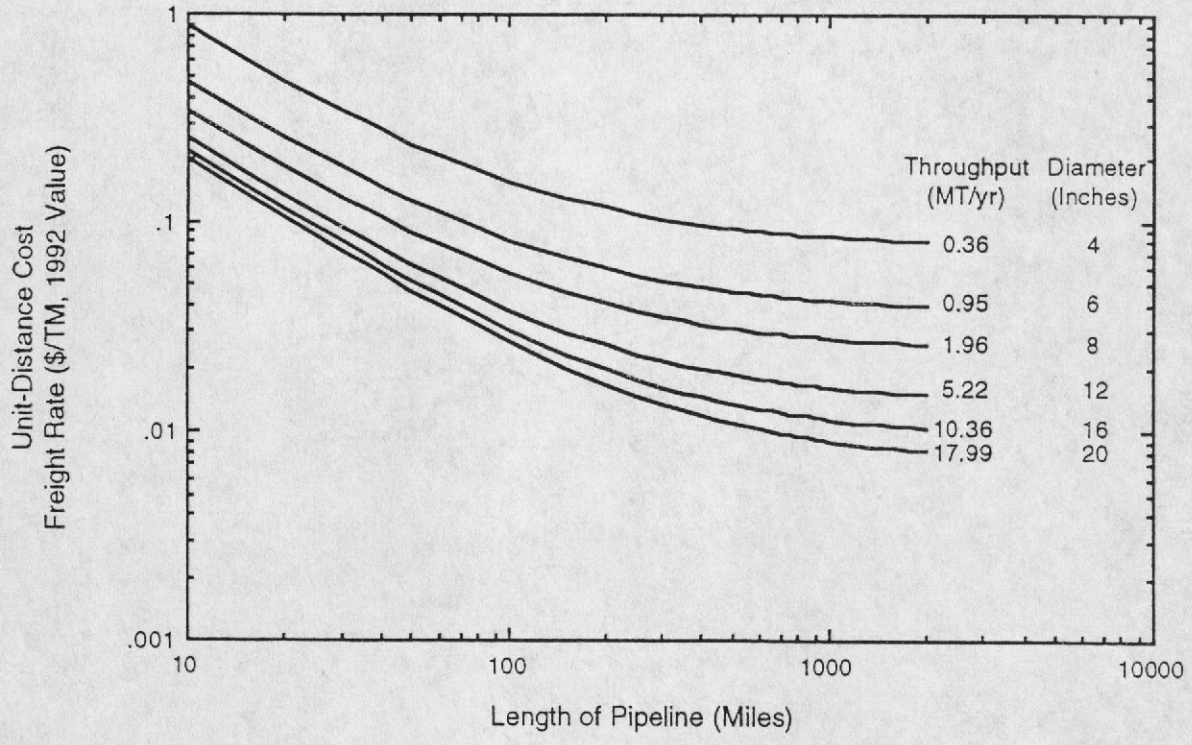


Fig. 5. Unit Cost and Unit-Distance Cost for CLP Transportation of Coal: Scenario 2

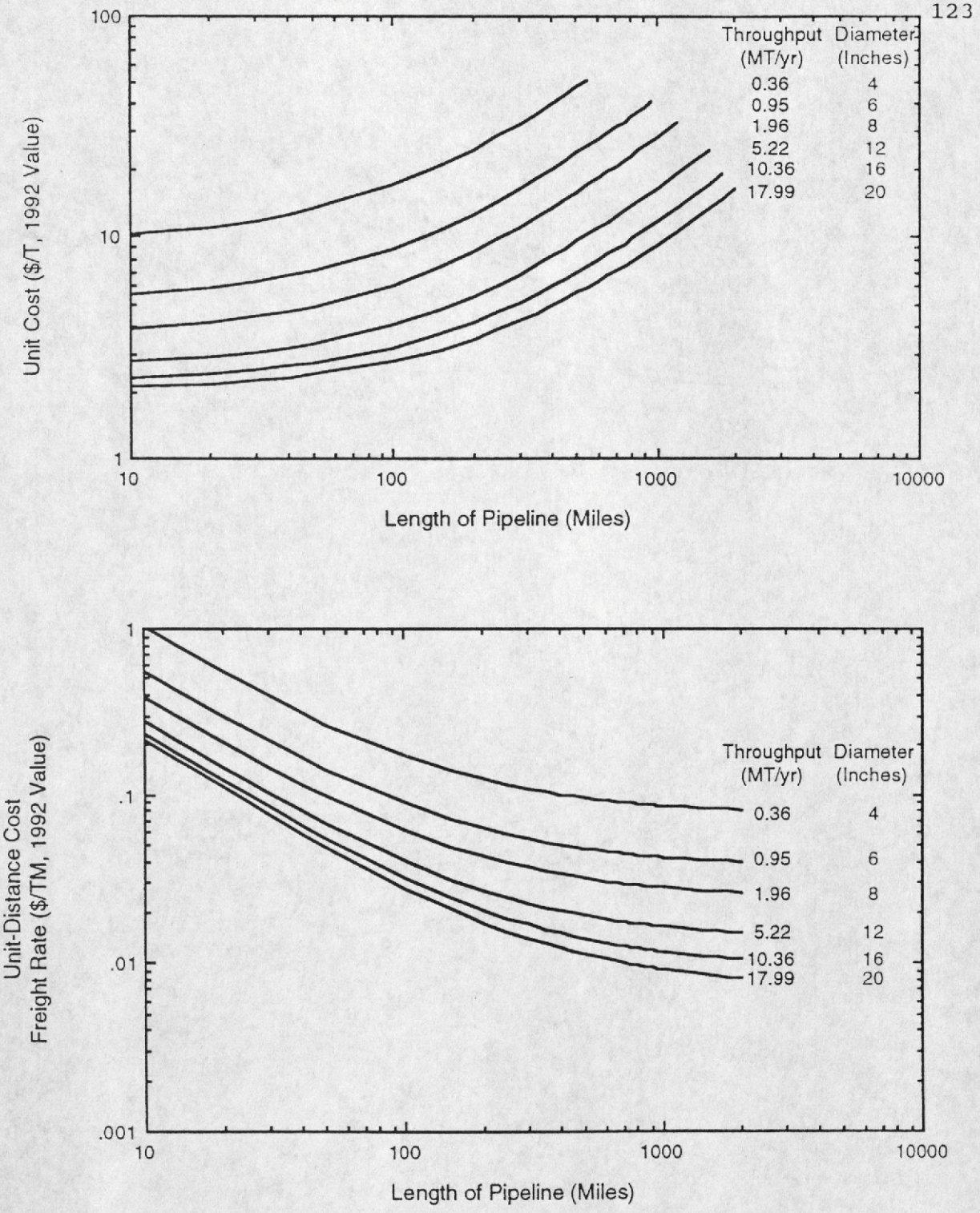
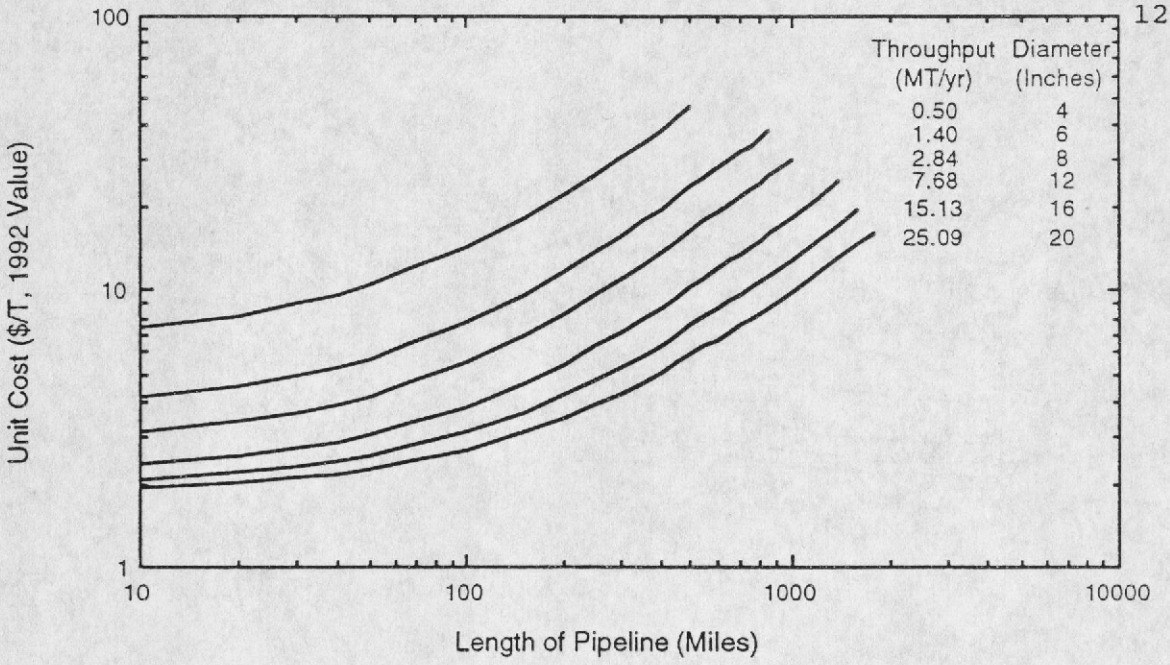


Fig. 6. Unit Cost and Unit-Distance Cost for CLP Transportation of Coal: Scenario 3



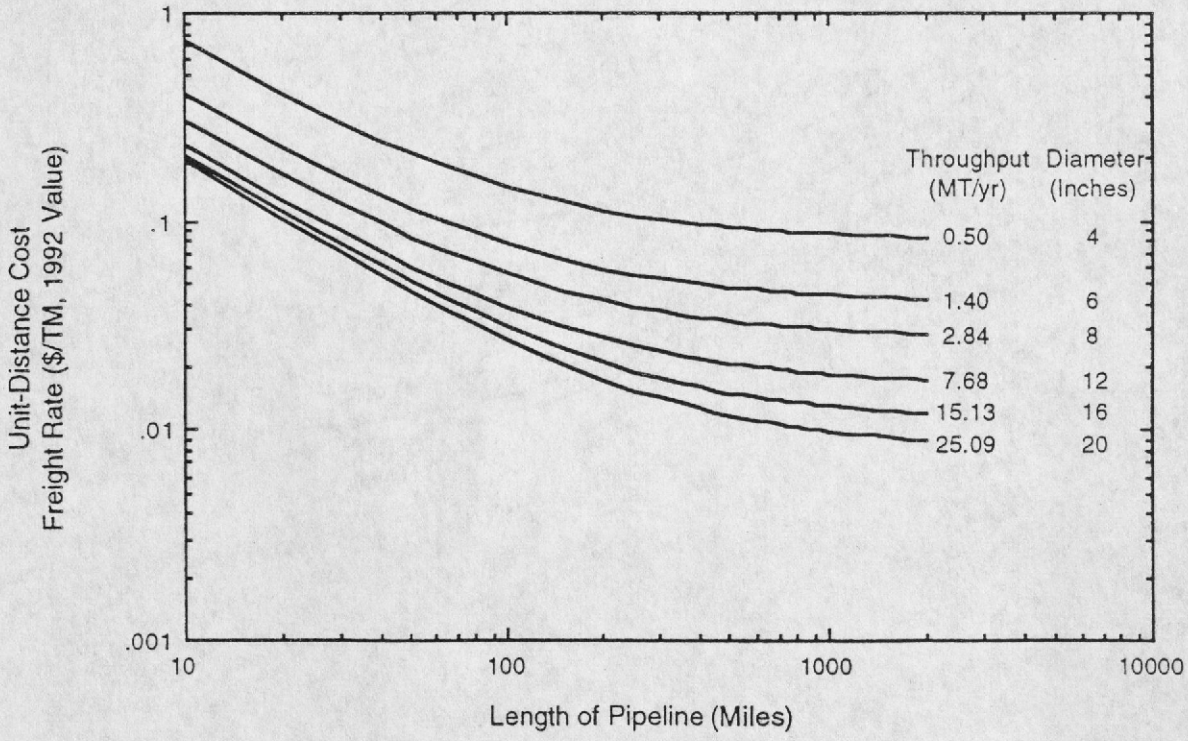


Fig. 7. Unit Cost and Unit-Distance Cost for CLP Transportation of Coal: Scenario 4

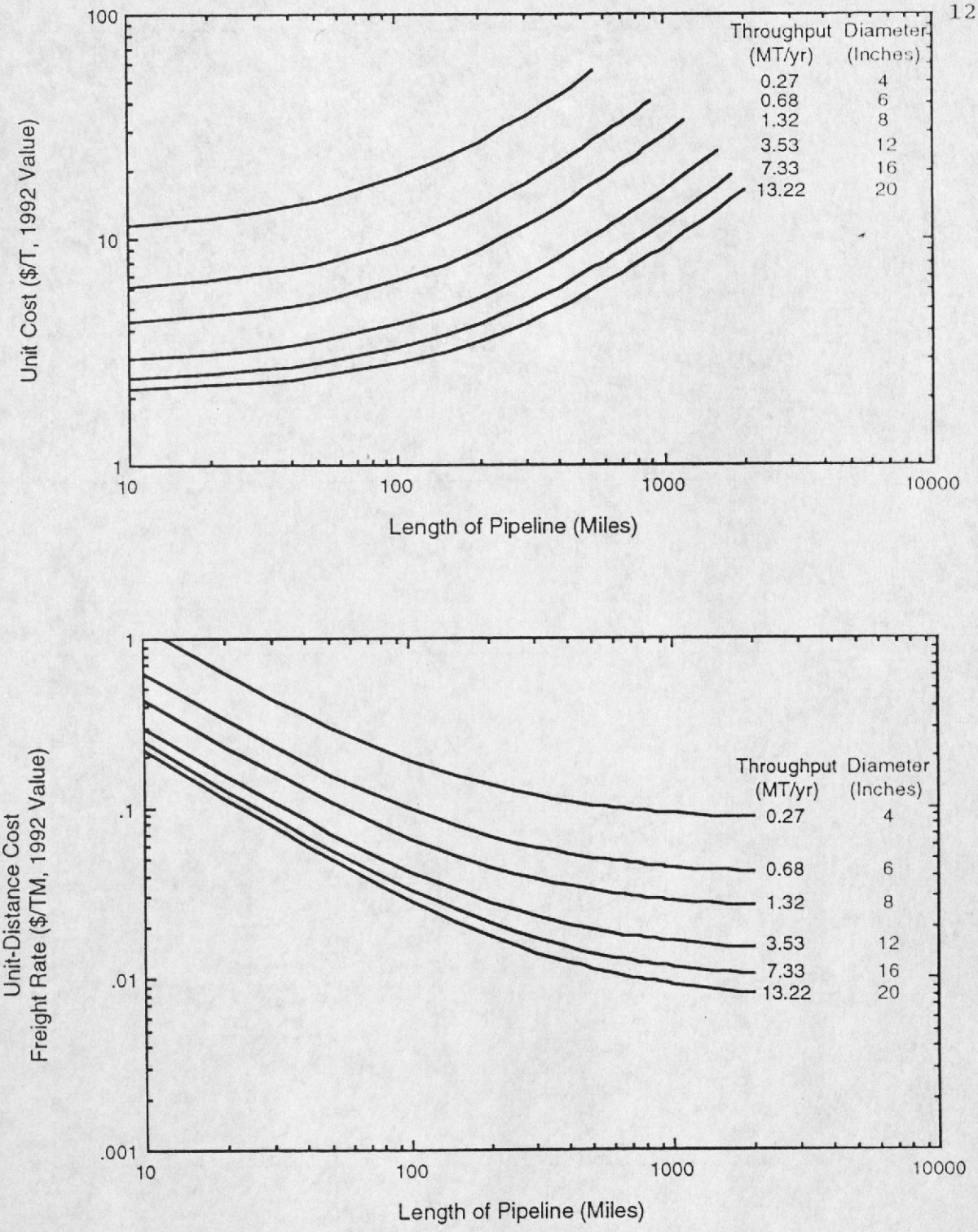
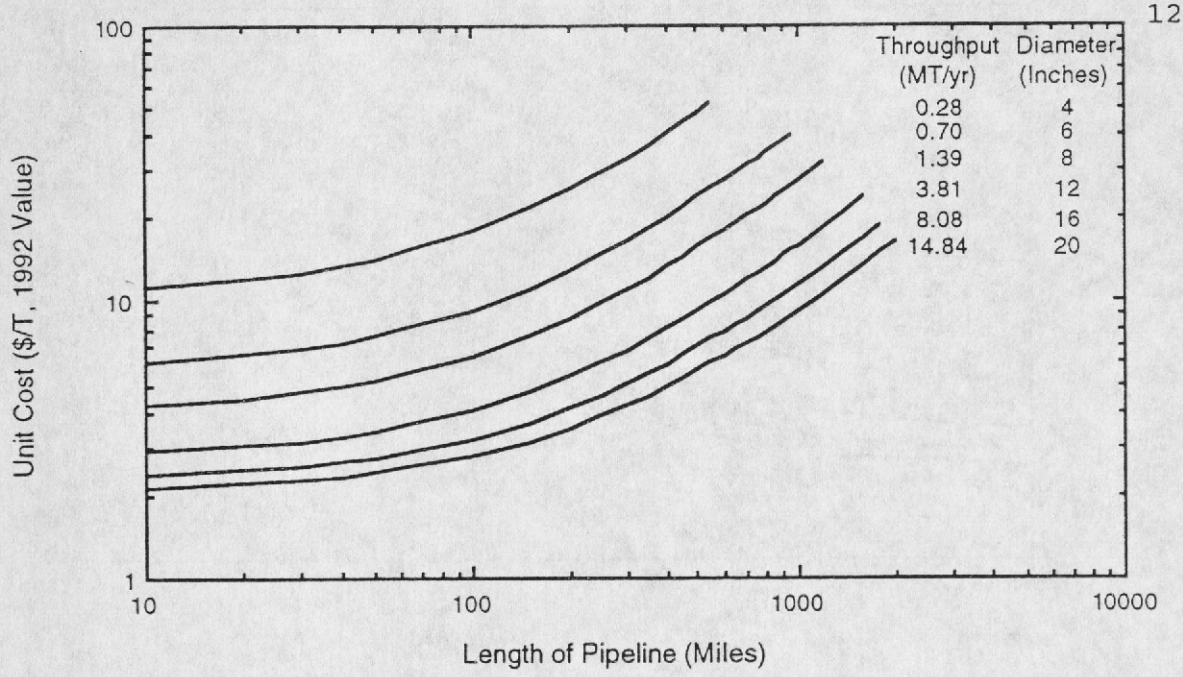


Fig. 8. Unit Cost and Unit-Distance Cost for CLP Transportation of Coal: Scenario 5



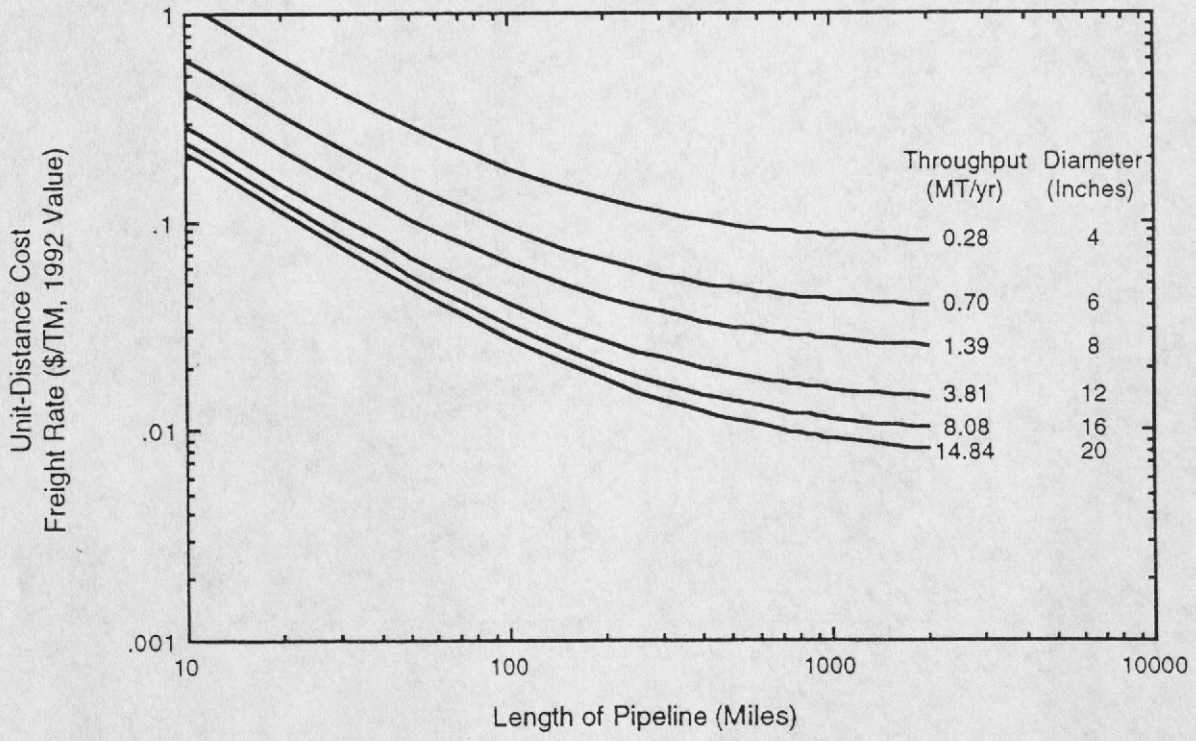
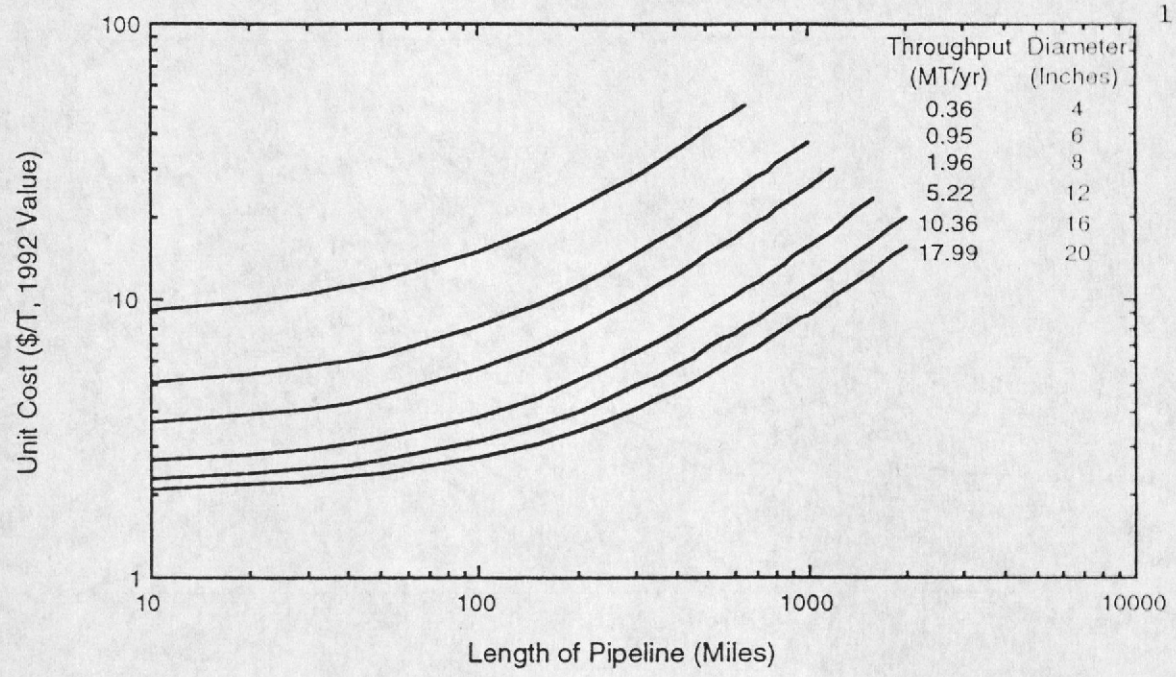


Fig. 9. Unit Cost and Unit-Distance Cost for CLP Transportation of Coal: Scenario 6



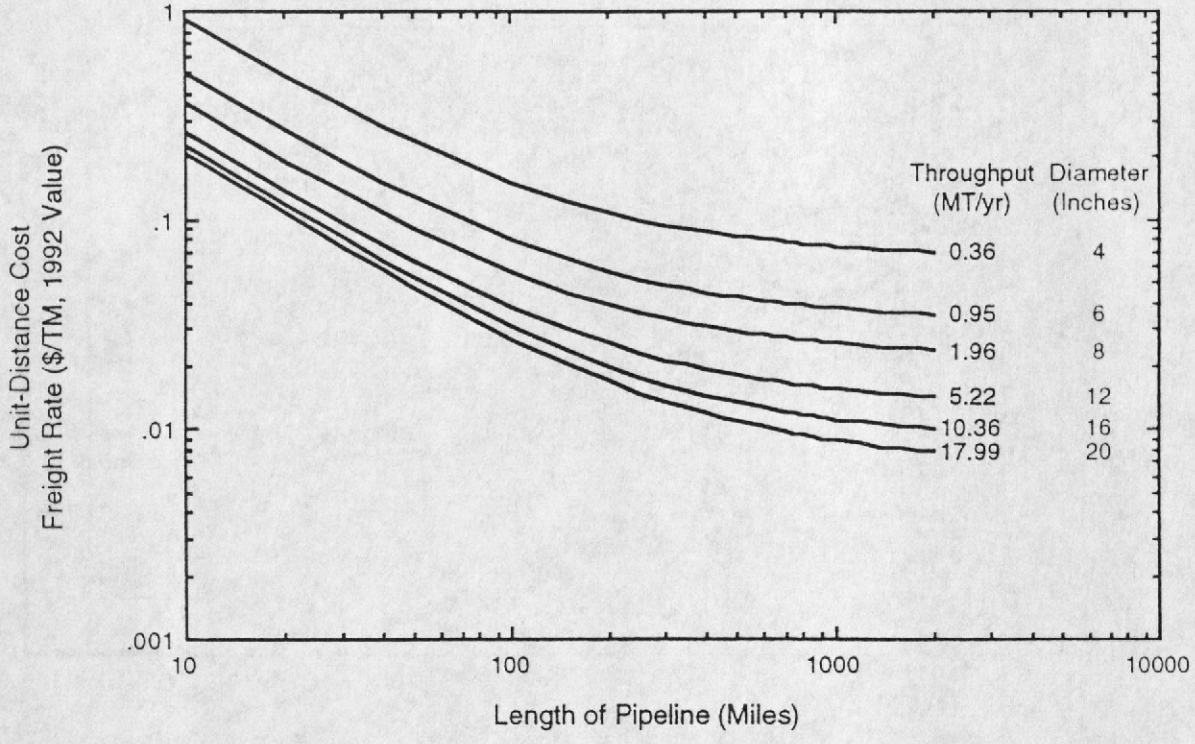
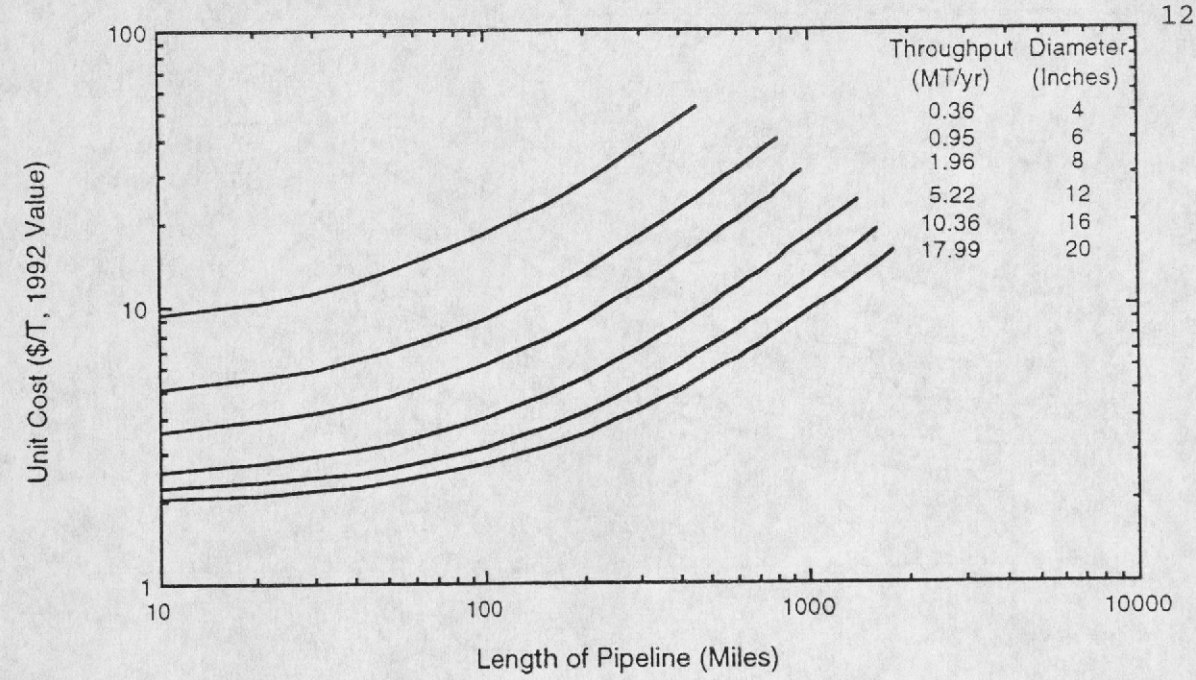


Fig. 10. Unit Cost and Unit-Distance Cost for CLP Transportation of Coal: Scenario 7



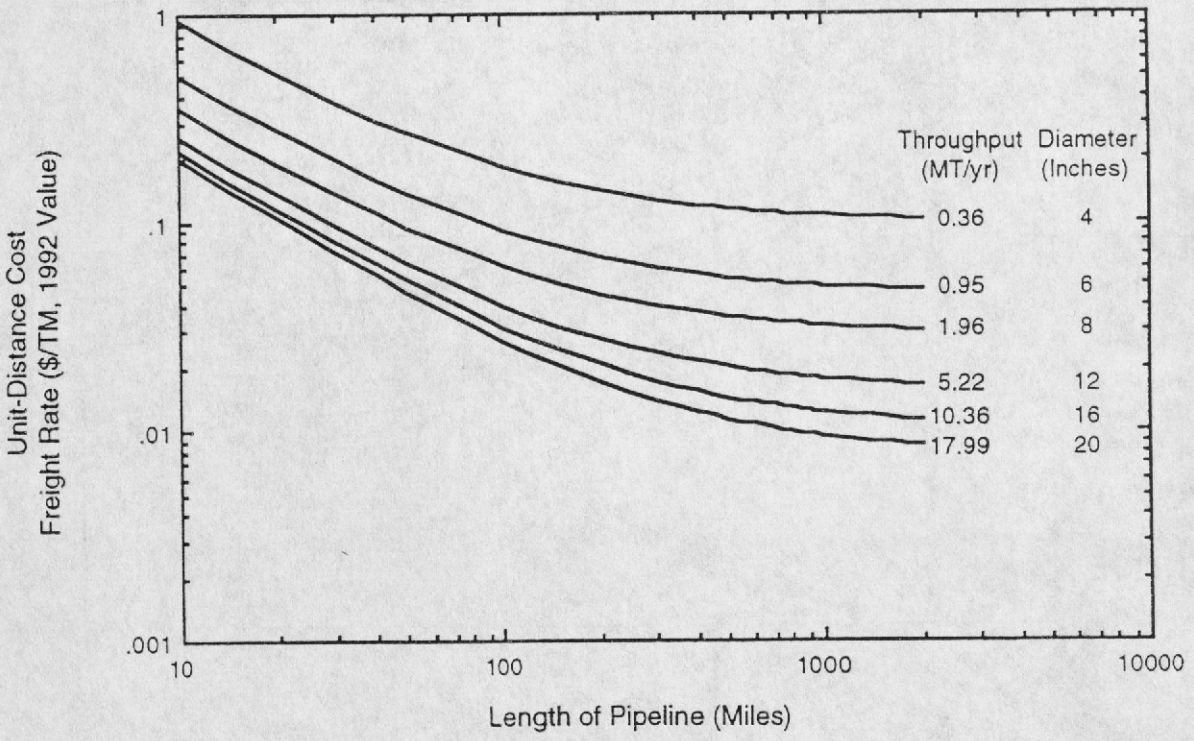
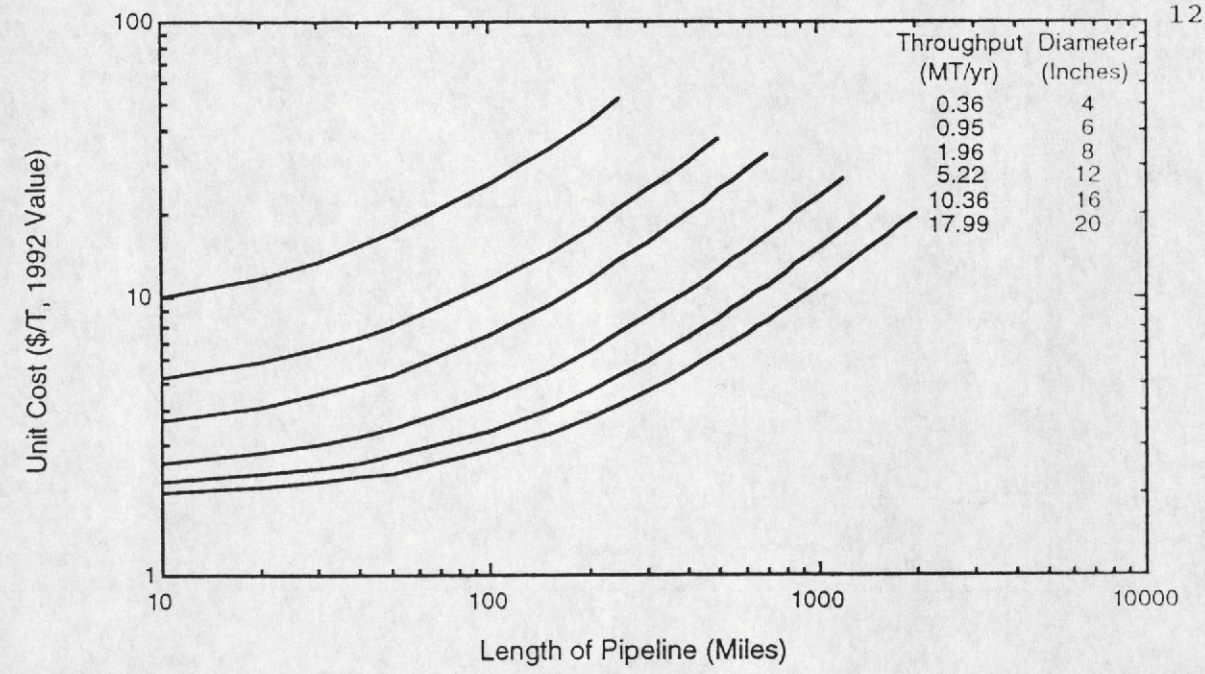


Fig. 11. Unit Cost and Unit-Distance Cost for CLP Transportation of Coal: Scenario 8



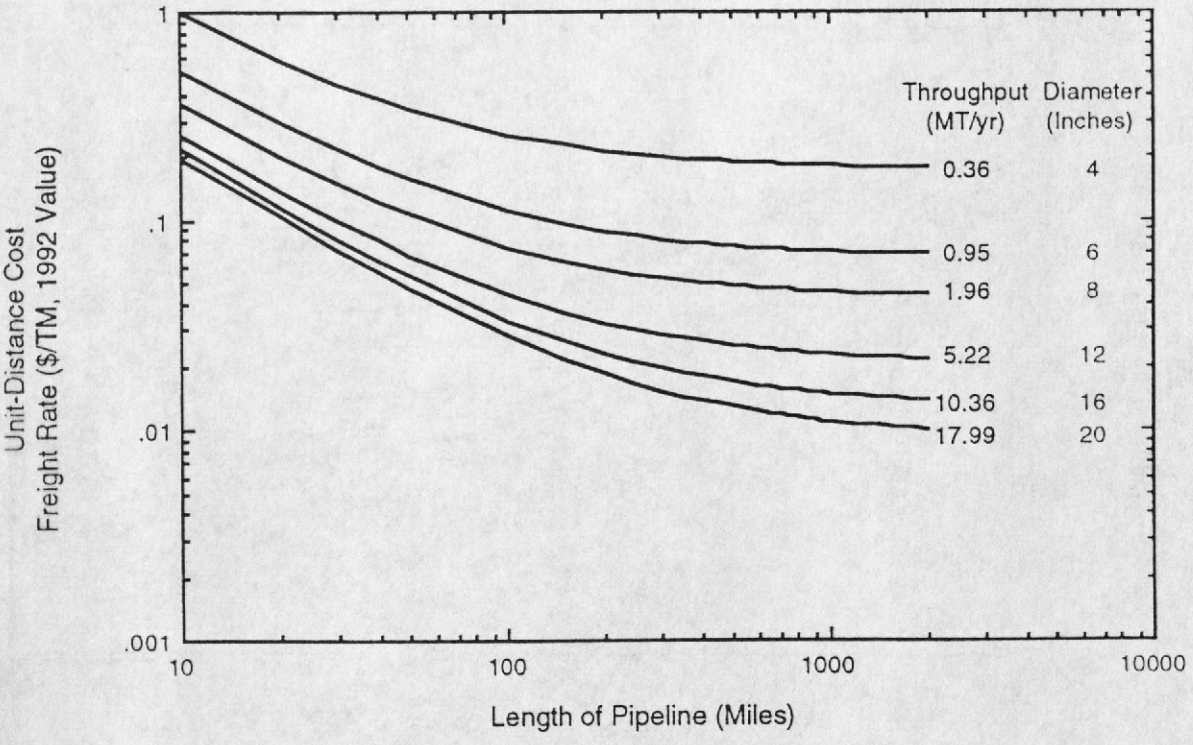


Fig. 12. Unit Cost and Unit-Distance Cost for CLP Transportation of Coal: Scenario 9

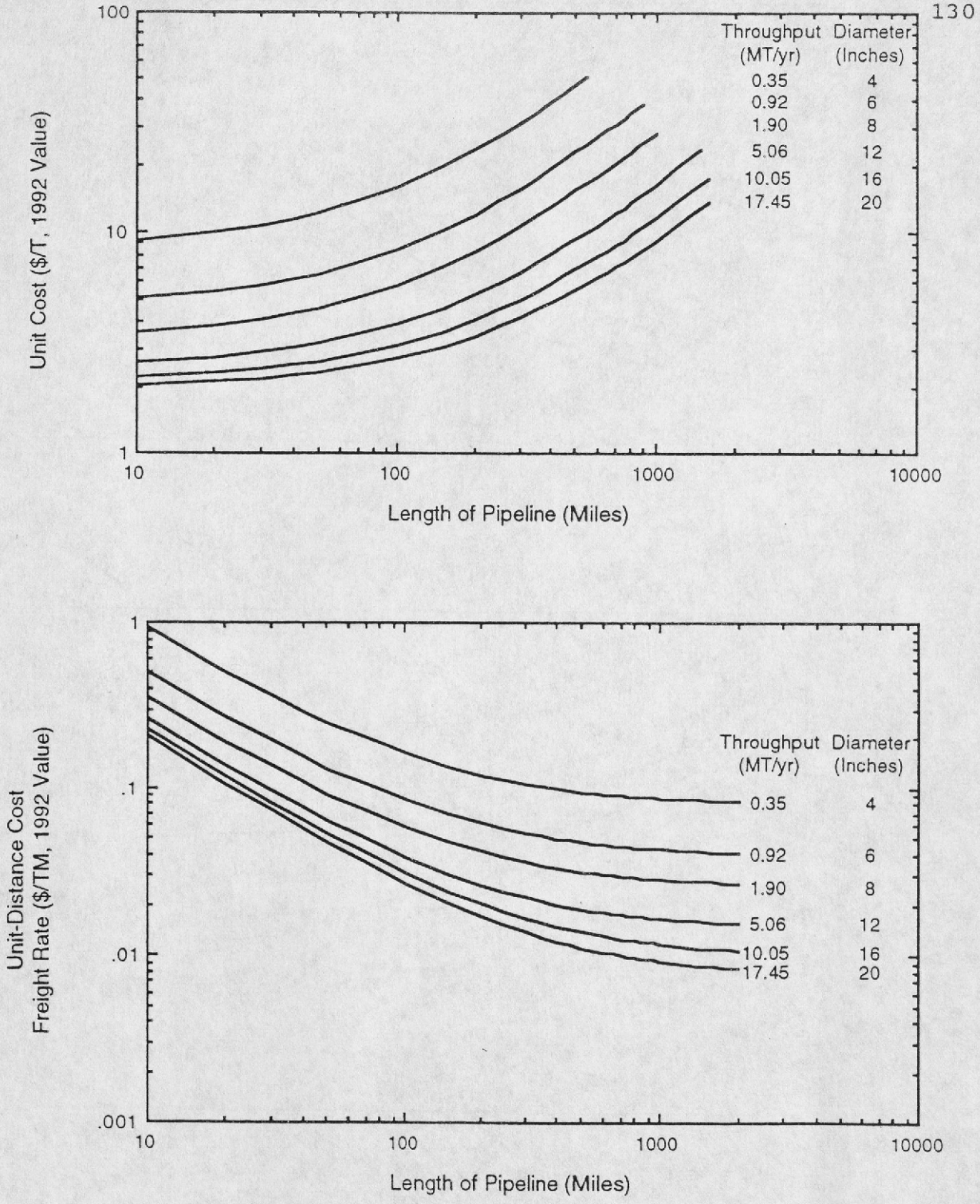


Fig. 13. Unit Cost and Unit-Distance Cost for CLP Transportation of Coal: Scenario 10

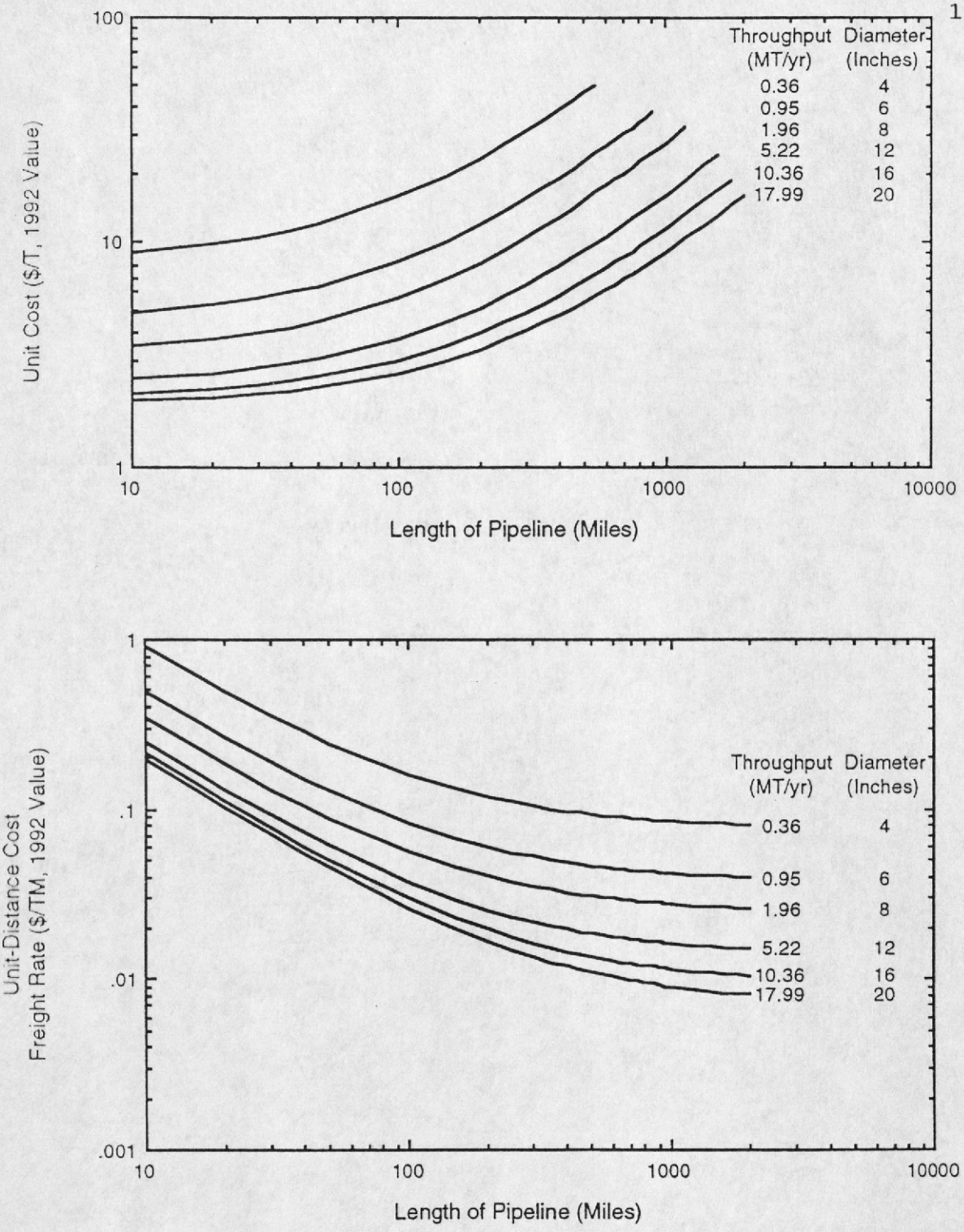
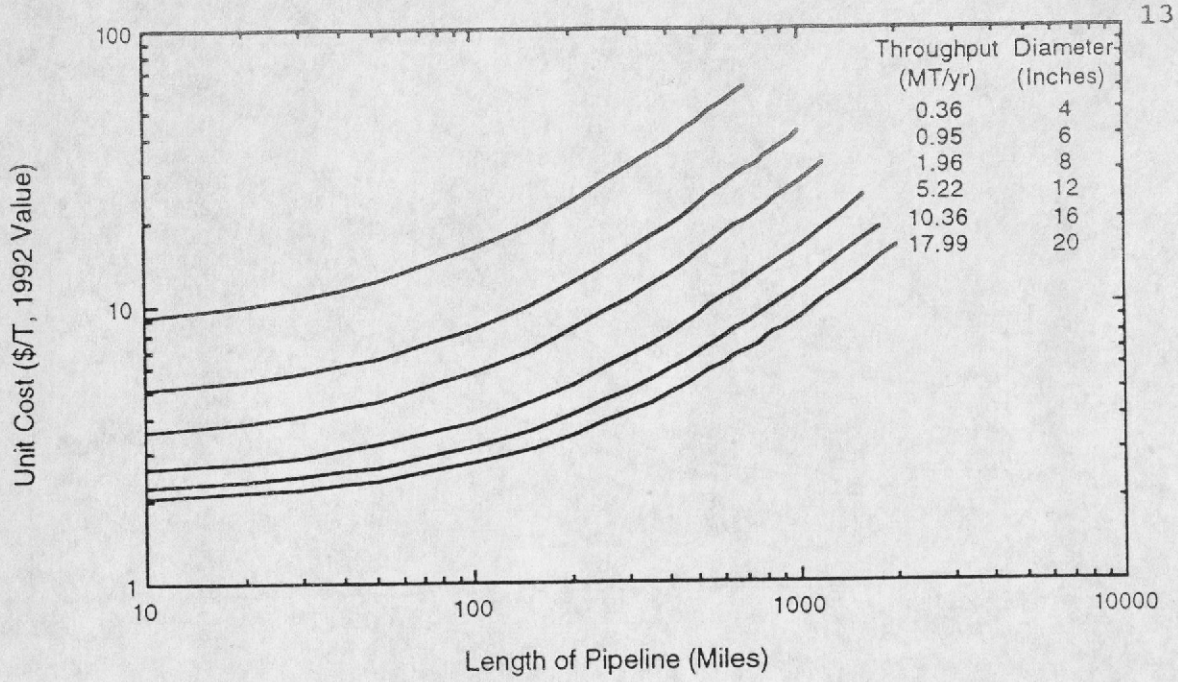


Fig. 14. Unit Cost and Unit-Distance Cost for CLP Transportation of Coal: Scenario 11



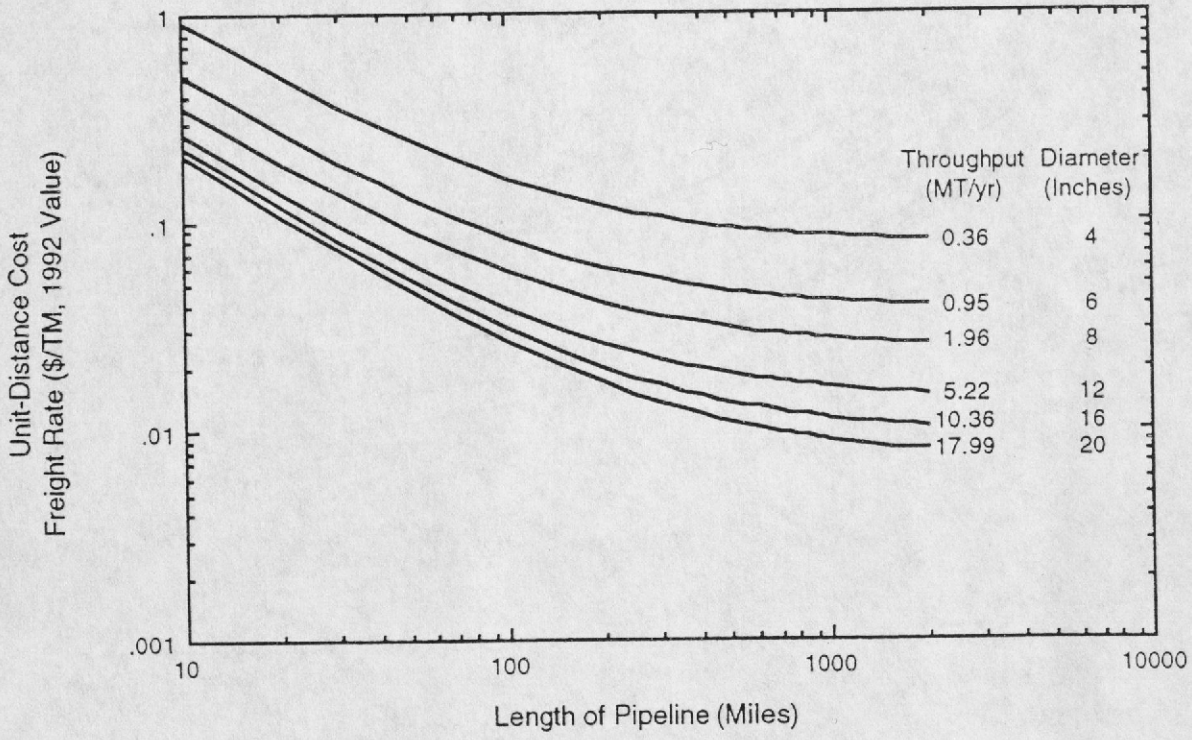
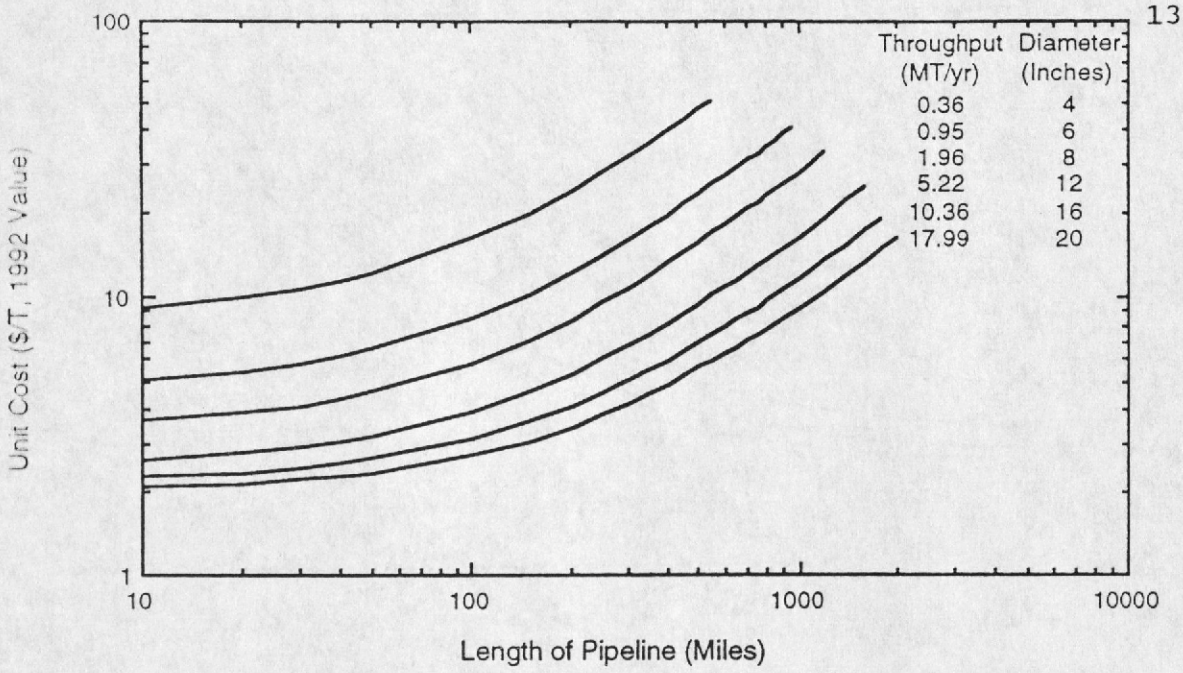


Fig. 15. Unit Cost and Unit-Distance Cost for CLP Transportation of Coal: Scenario 12



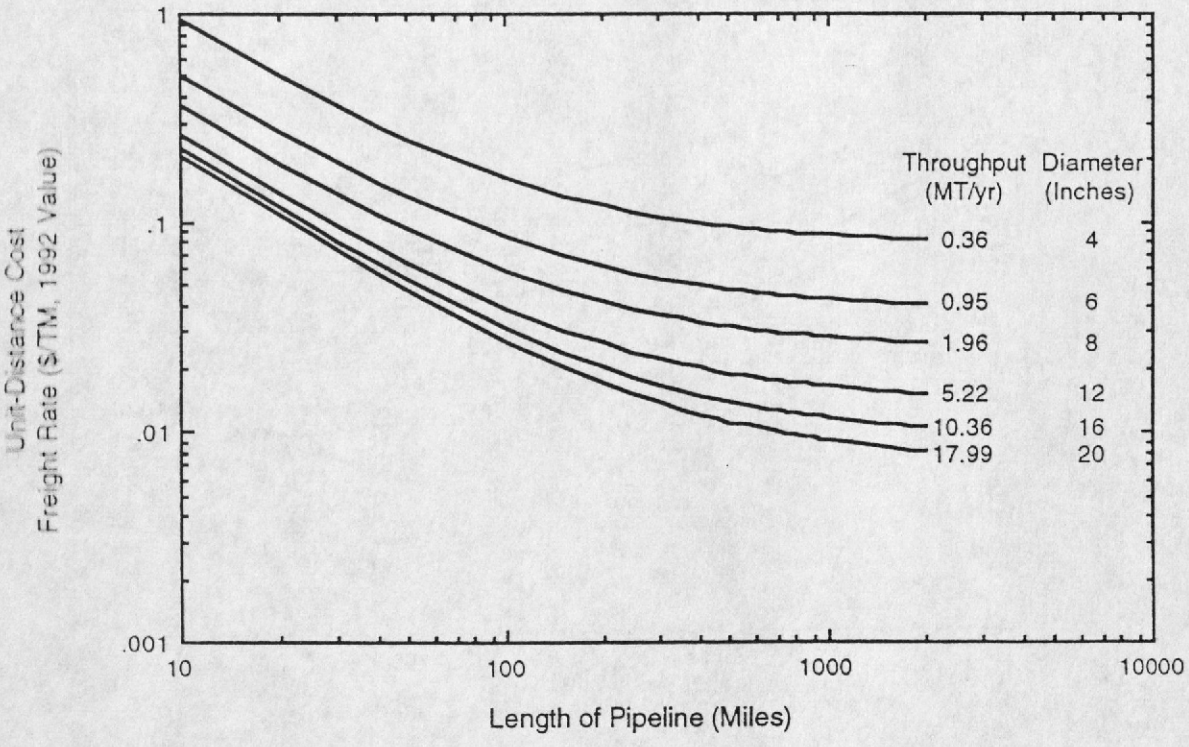
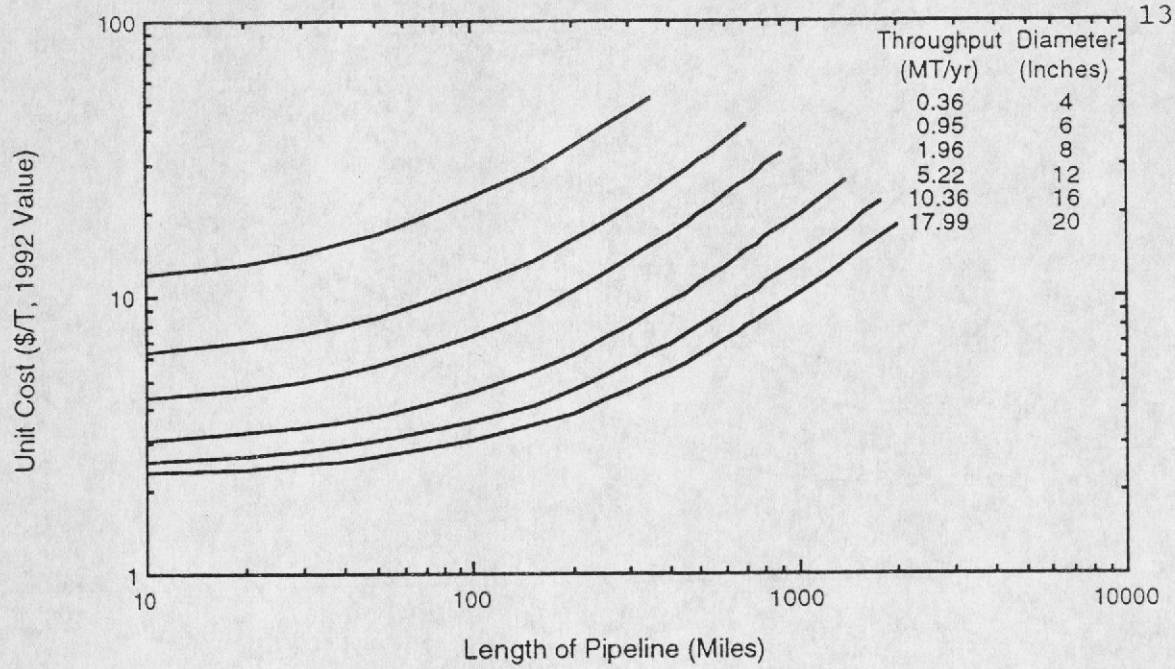


Fig. 16. Unit Cost and Unit-Distance Cost for CLP Transportation of Coal: Scenario 13



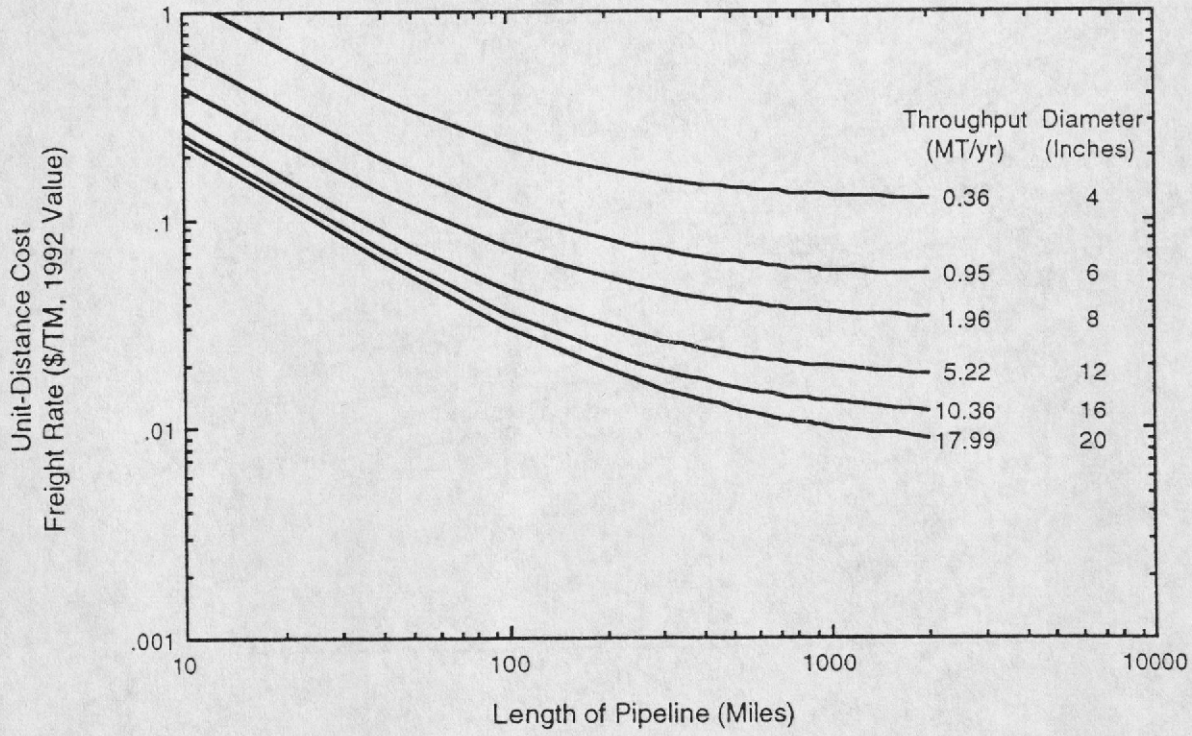
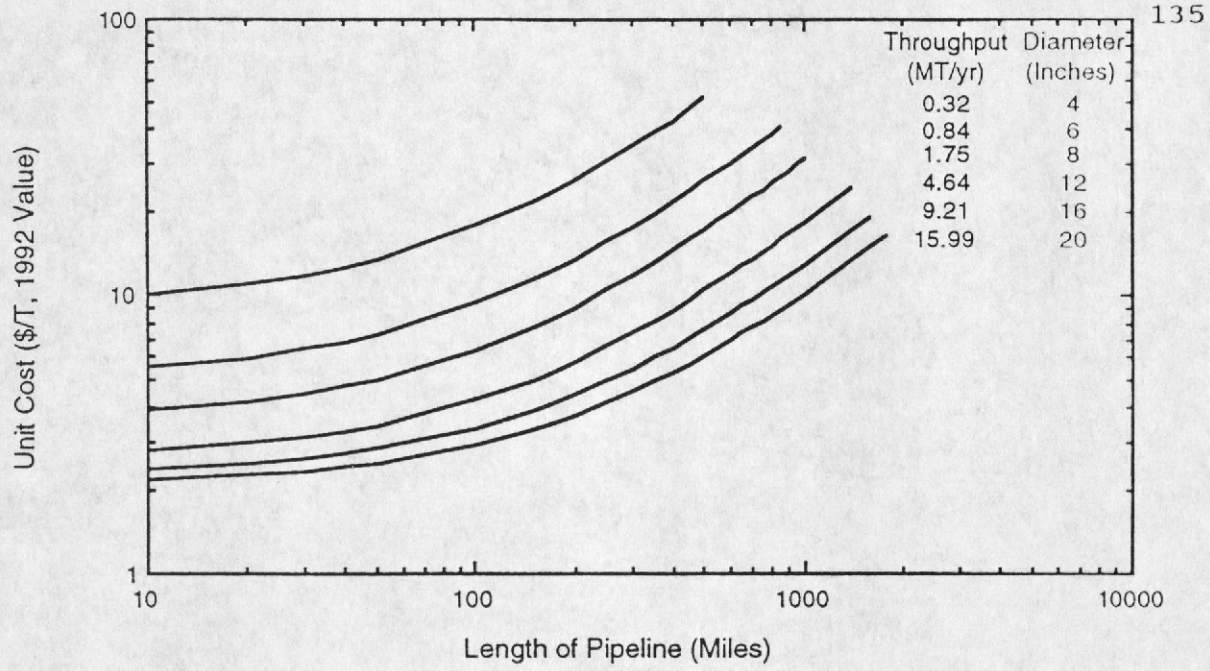


Fig. 17. Unit Cost and Unit-Distance Cost for CLP Transportation of Coal: Scenario 14



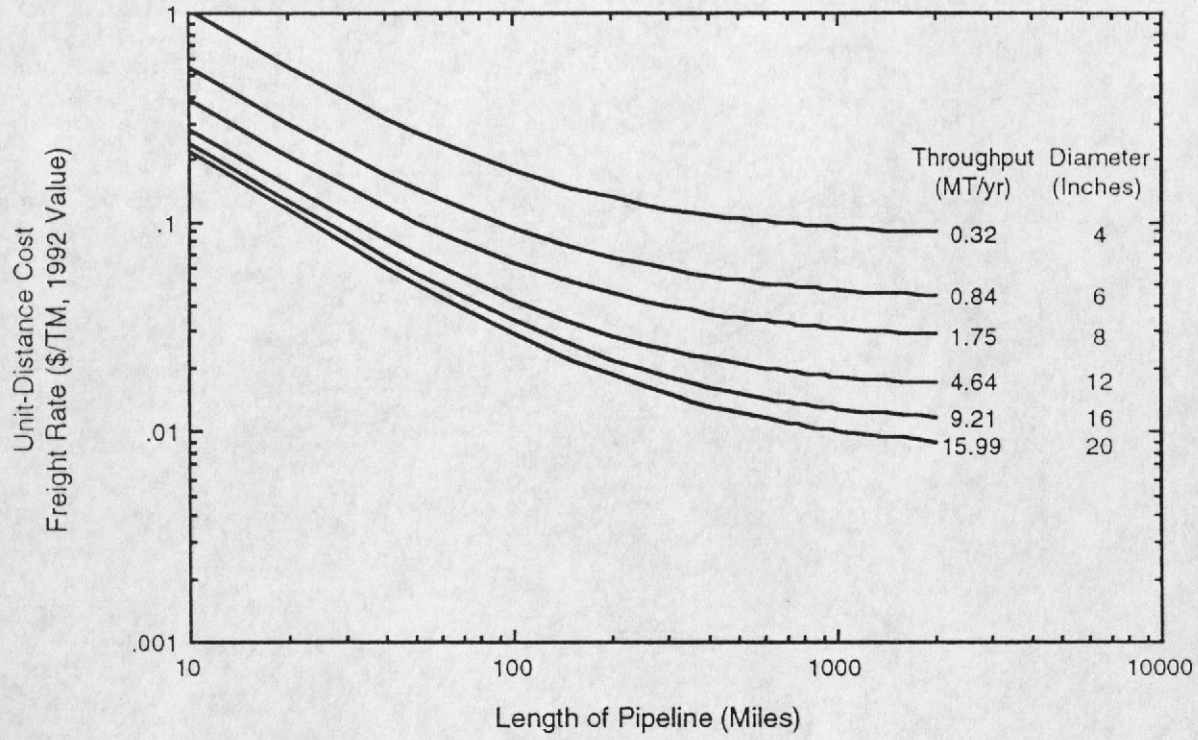
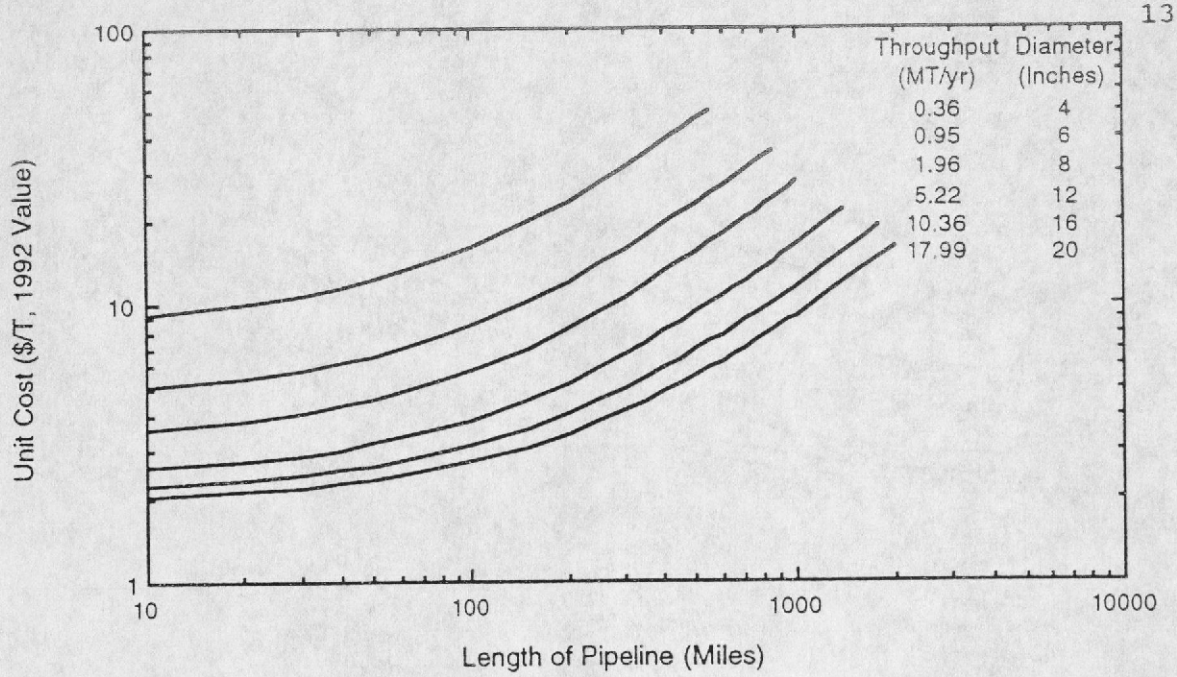


Fig. 18. Unit Cost and Unit-Distance Cost for CLP Transportation of Coal: Scenario 15



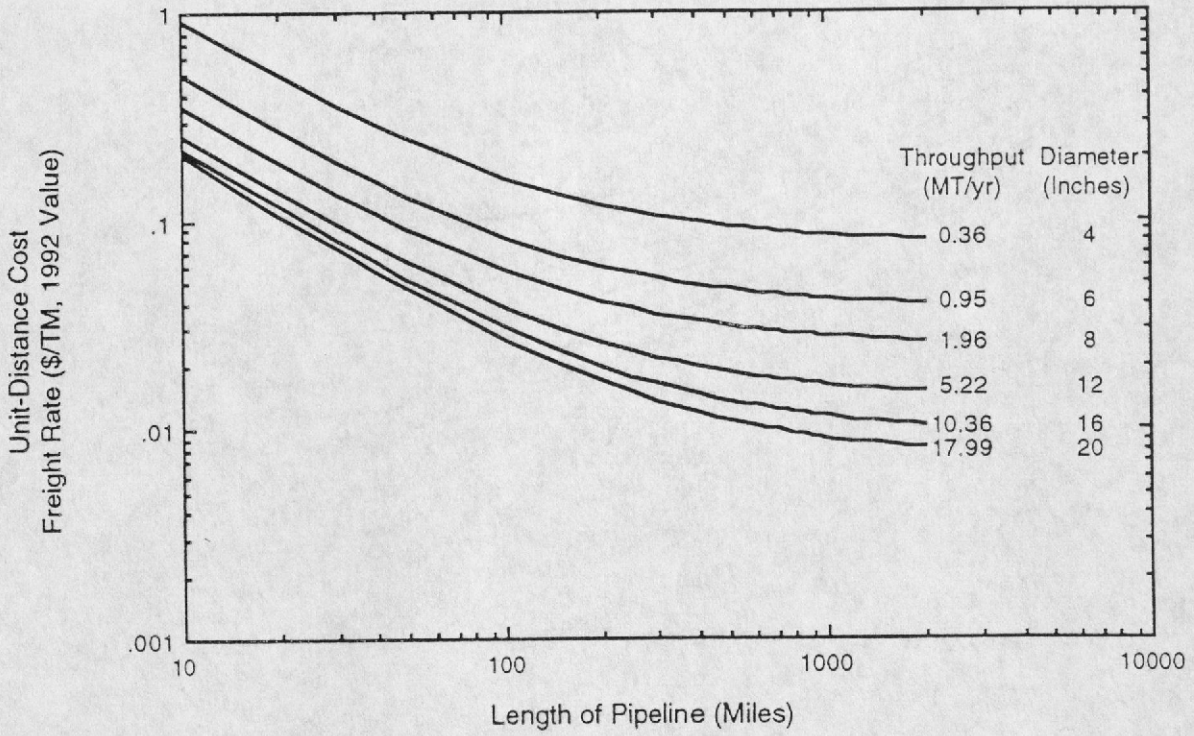


Fig. 19. Unit Cost and Unit-Distance Cost for CLP Transportation of Coal: Scenario 16

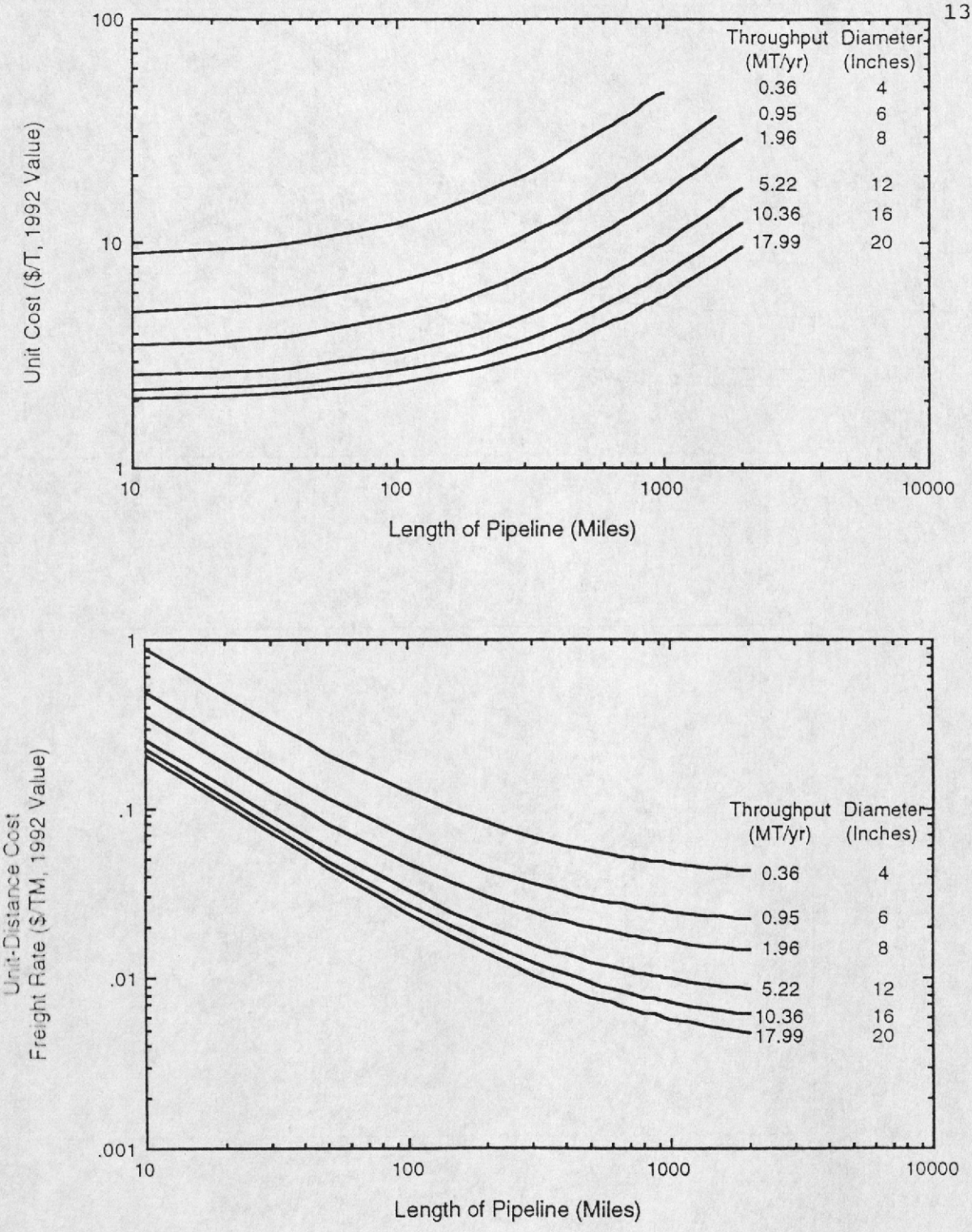
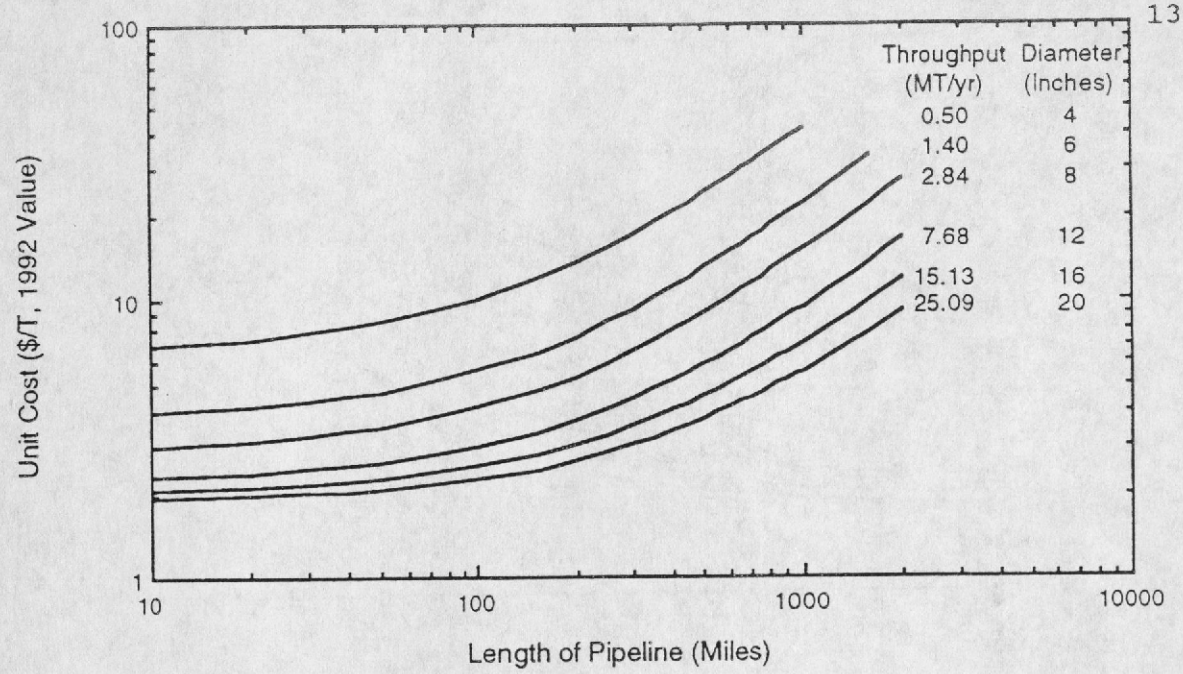


Fig. 20. Unit Cost and Unit-Distance Cost for CLP Transportation of Coal: Scenario 17



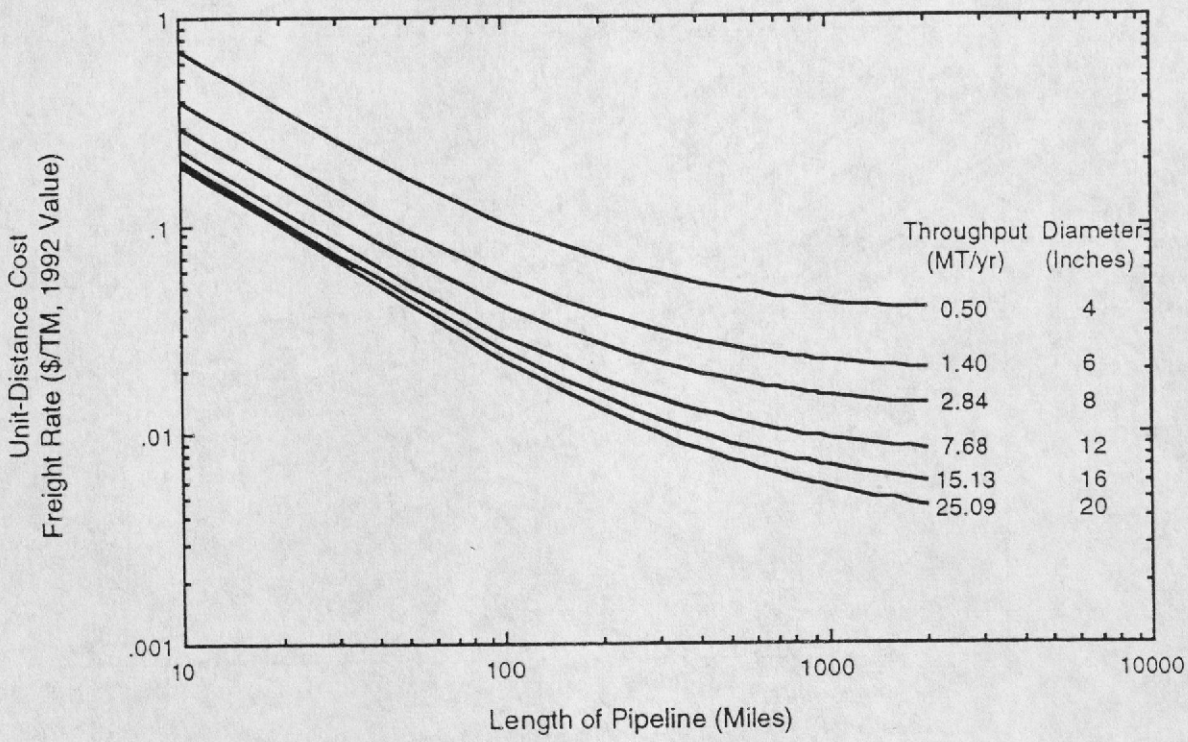
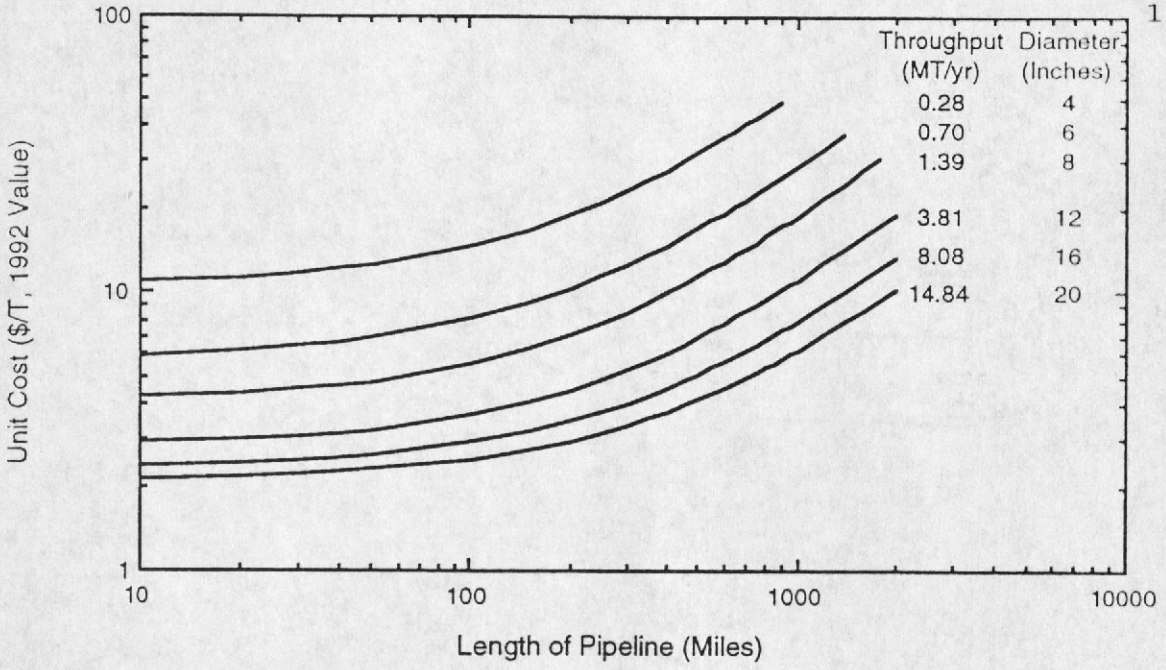


Fig. 21. Unit Cost and Unit-Distance Cost for CLP Transportation of Coal: Scenario 18



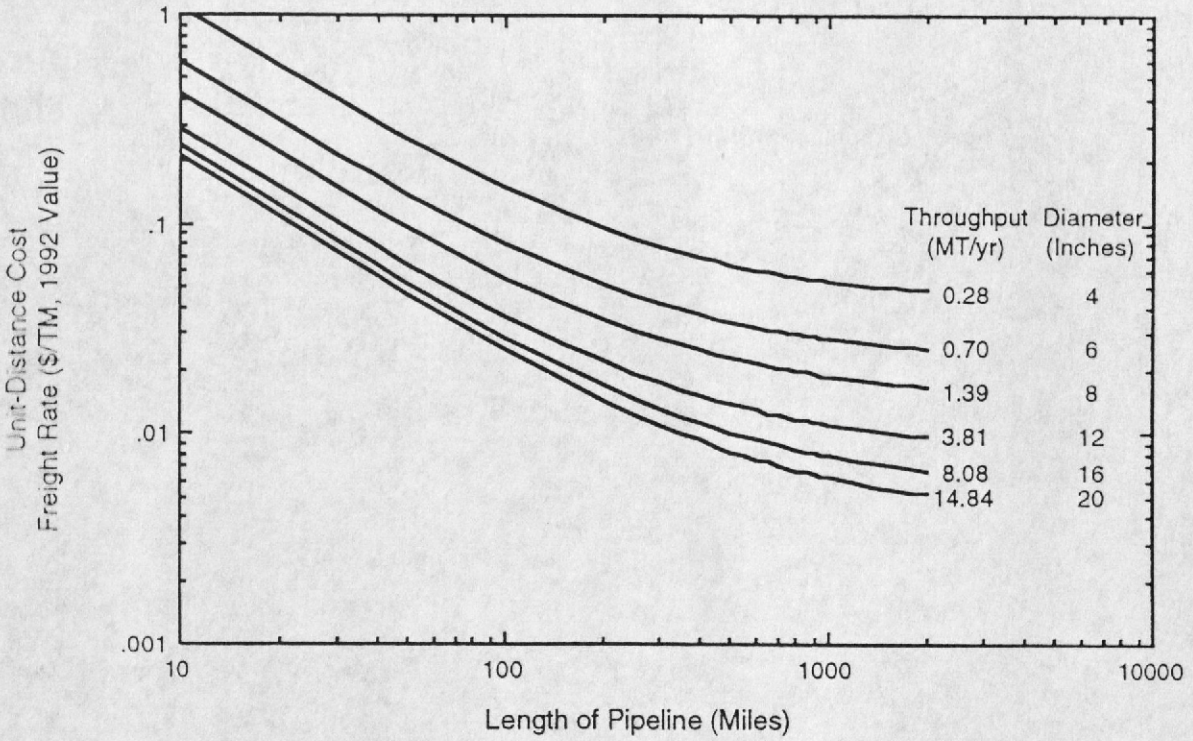
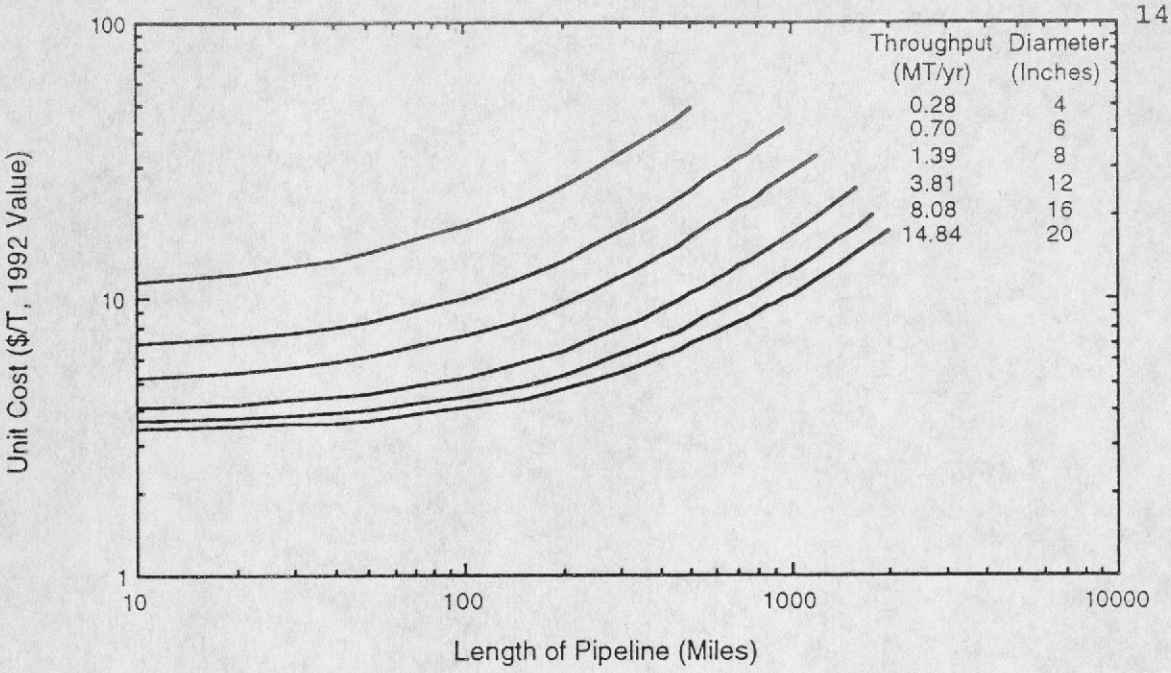


Fig. 22. Unit Cost and Unit-Distance Cost for CLP Transportation of Coal: Scenario 19



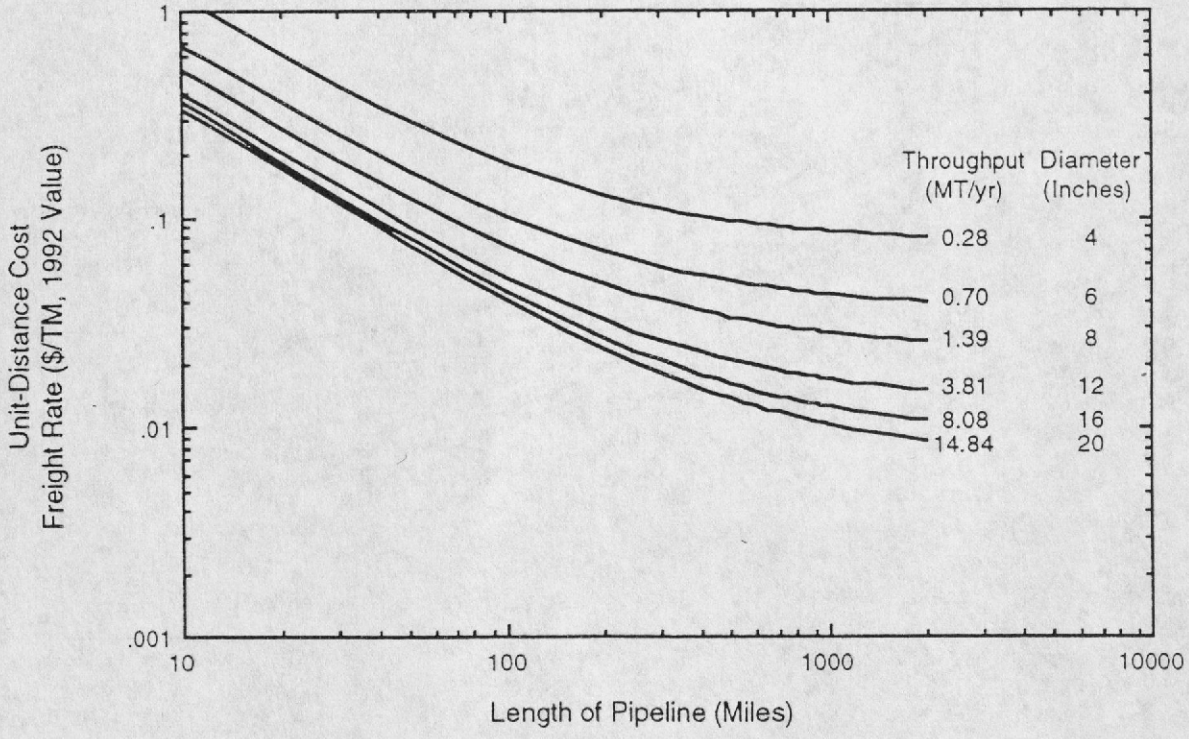
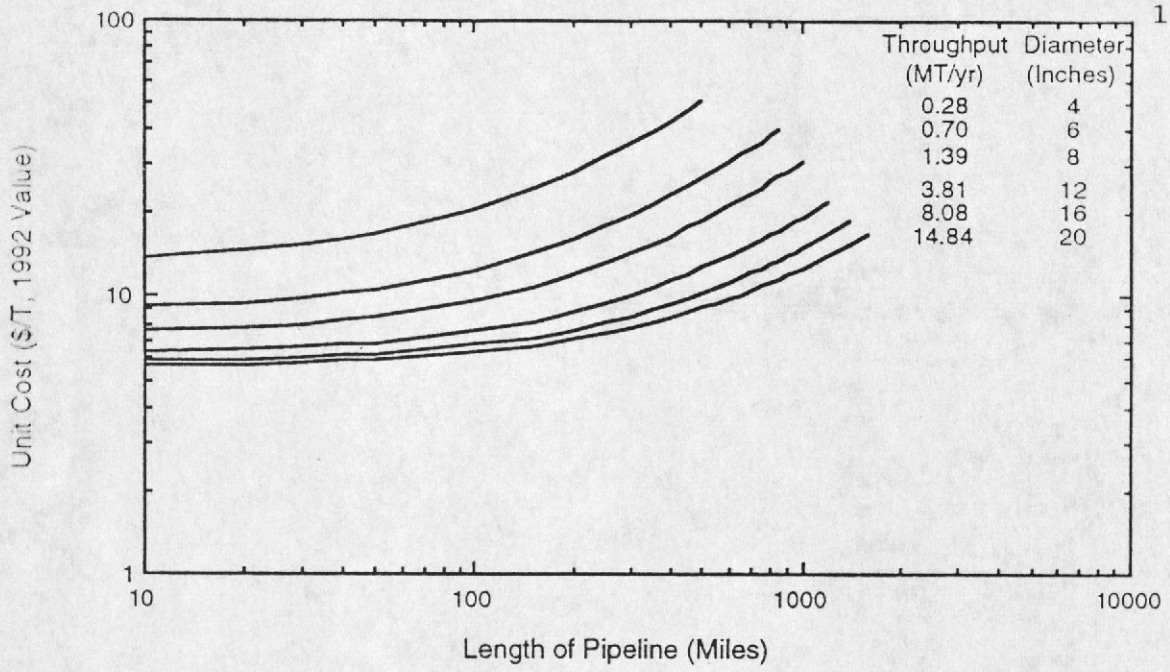


Fig. 23. Unit Cost and Unit-Distance Cost for CLP Transportation of Coal: Scenario 20



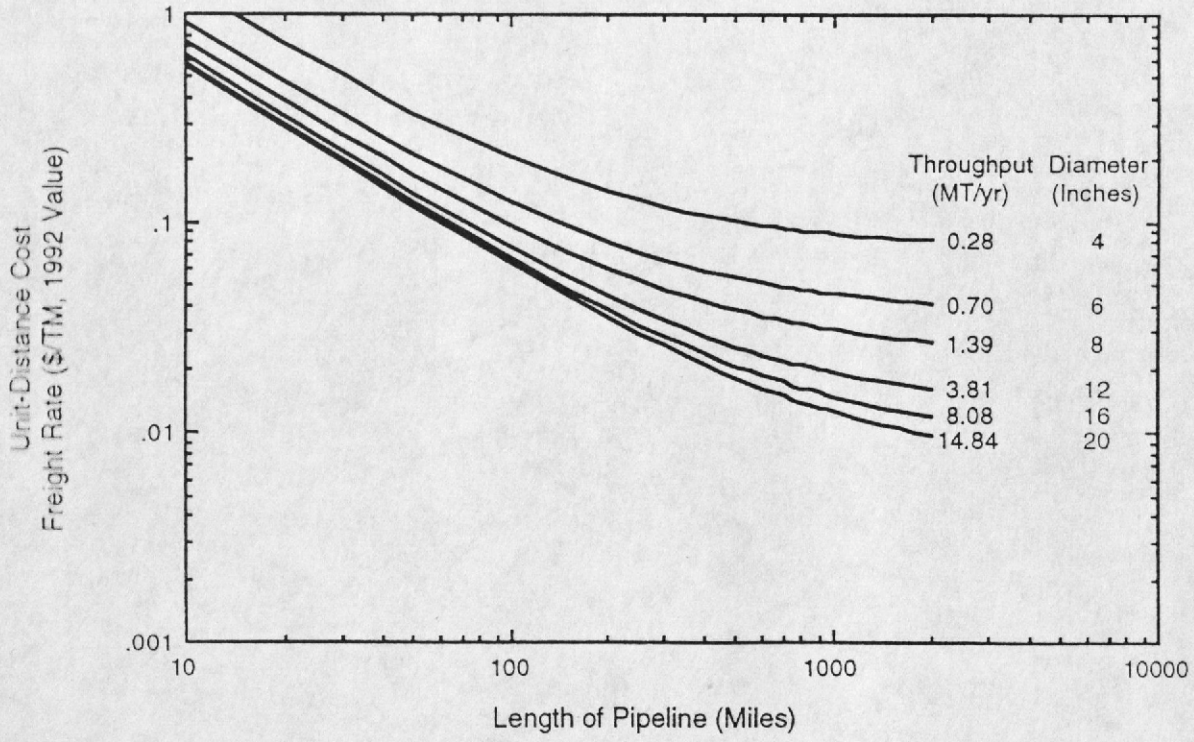


Fig. 24. Unit Cost and Unit-Distance Cost for CLP Transportation of Coal: Scenario 21

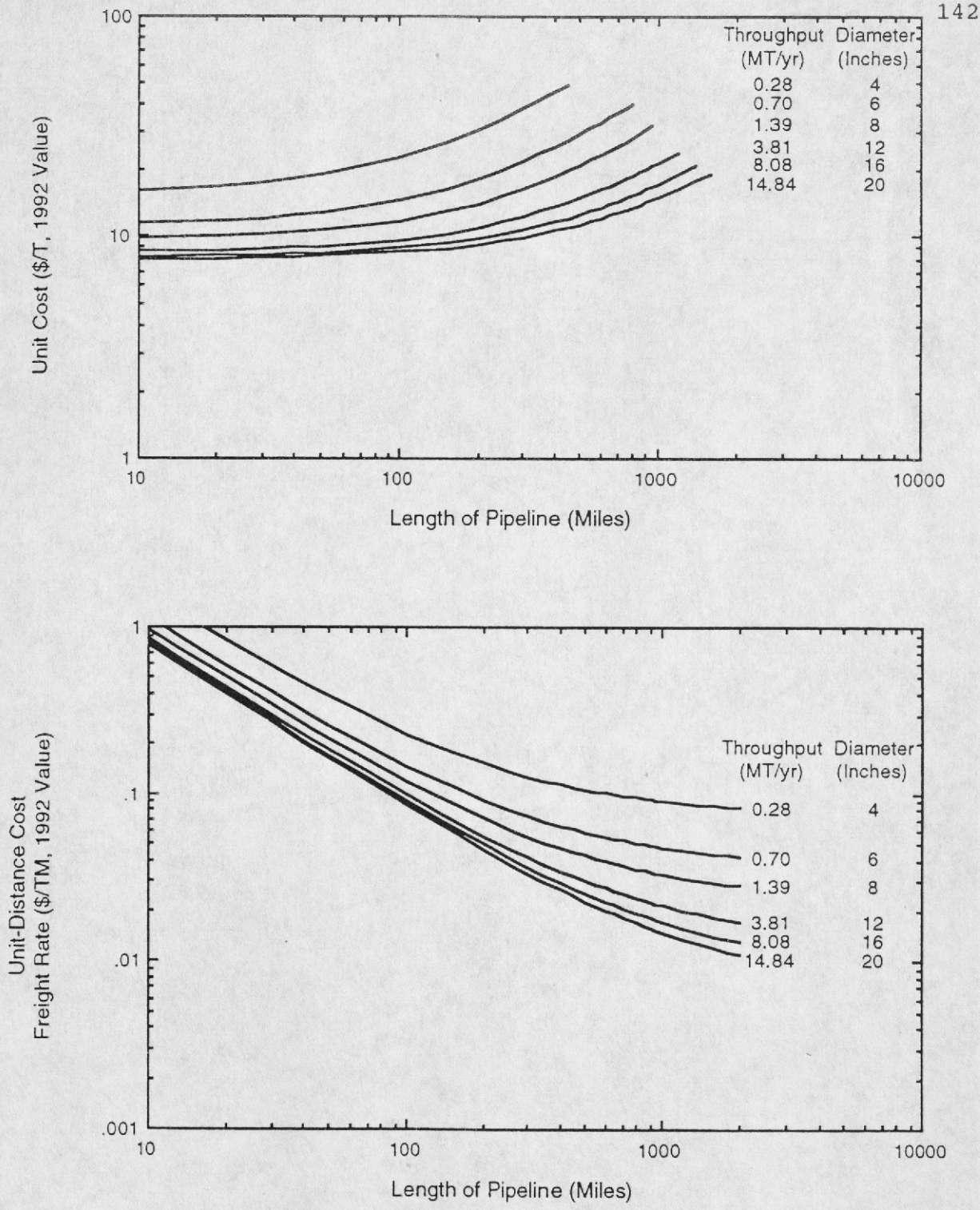
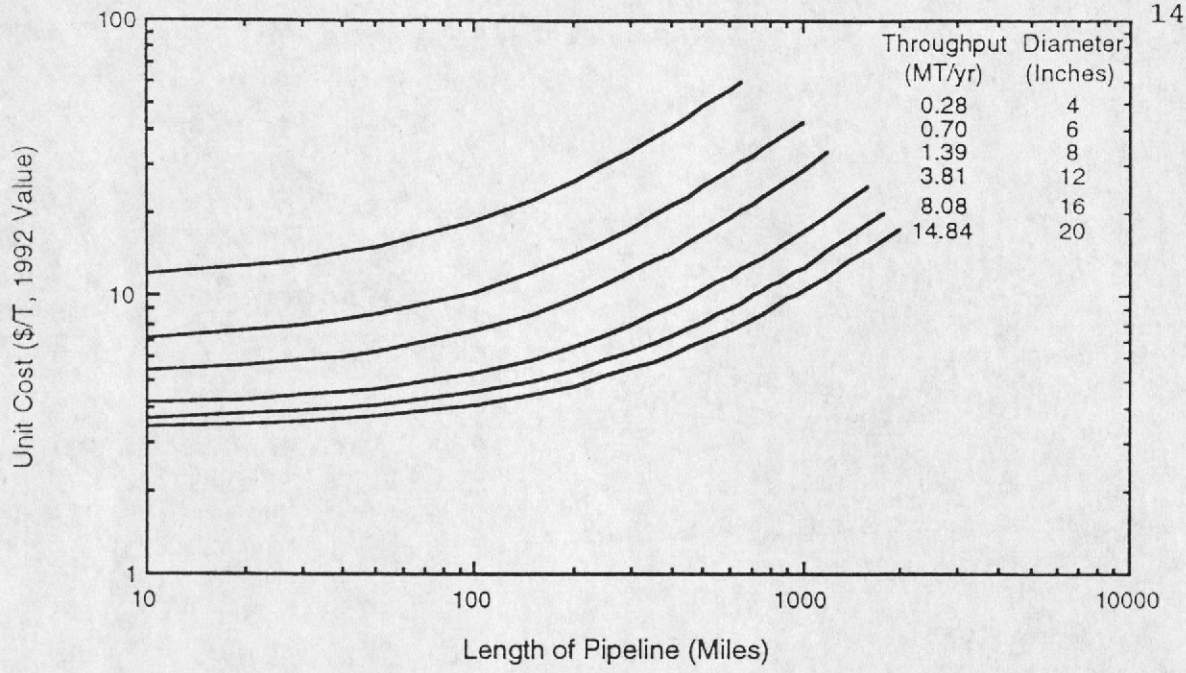


Fig. 25. Unit Cost and Unit-Distance Cost for CLP Transportation of Coal: Scenario 22



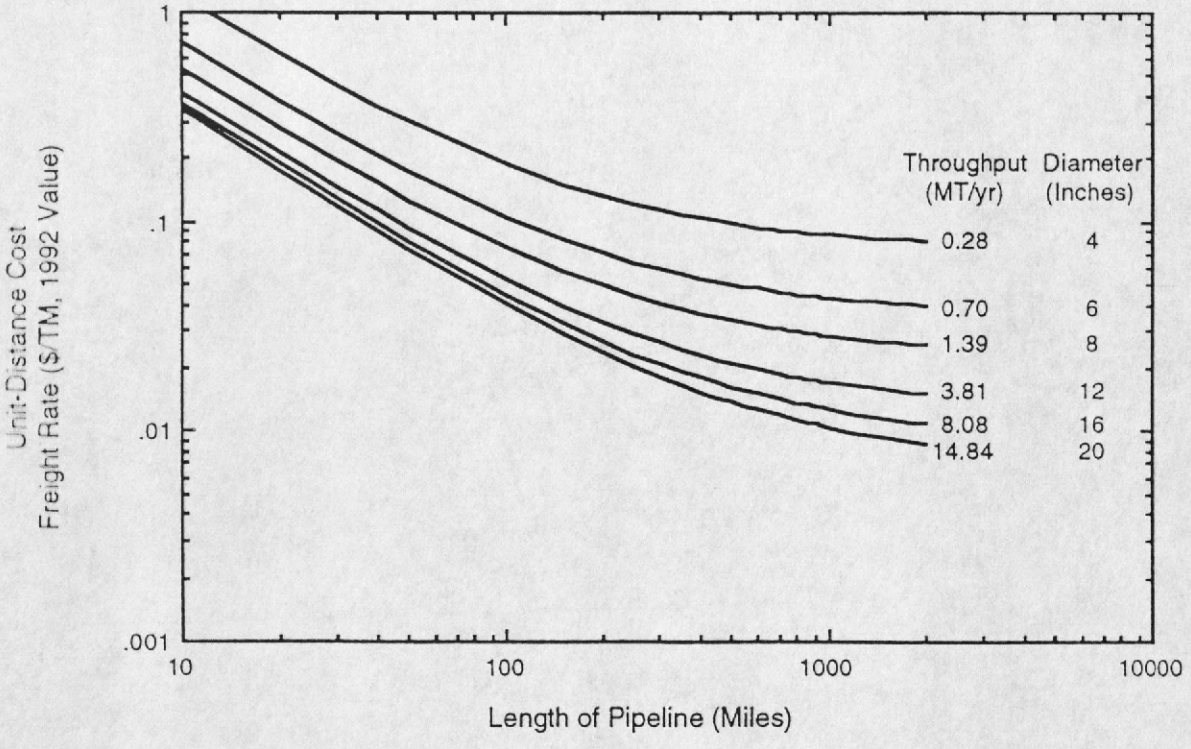
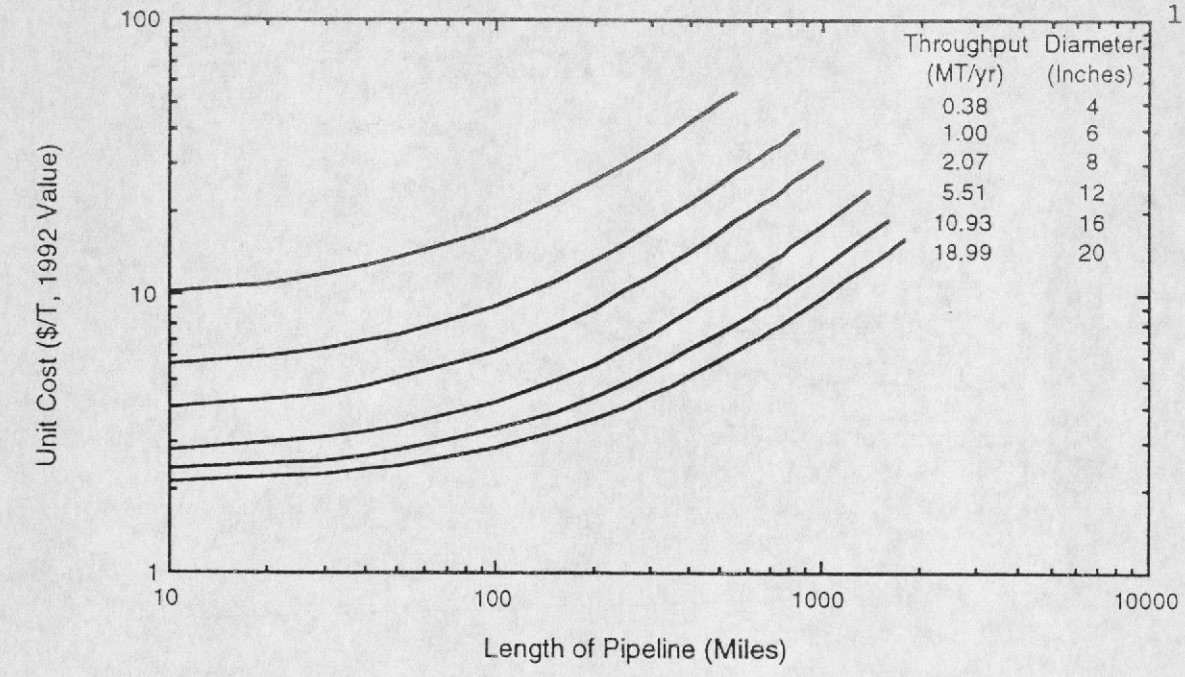


Fig. 26. Unit Cost and Unit-Distance Cost for CLP Transportation of Coal: Scenario 23



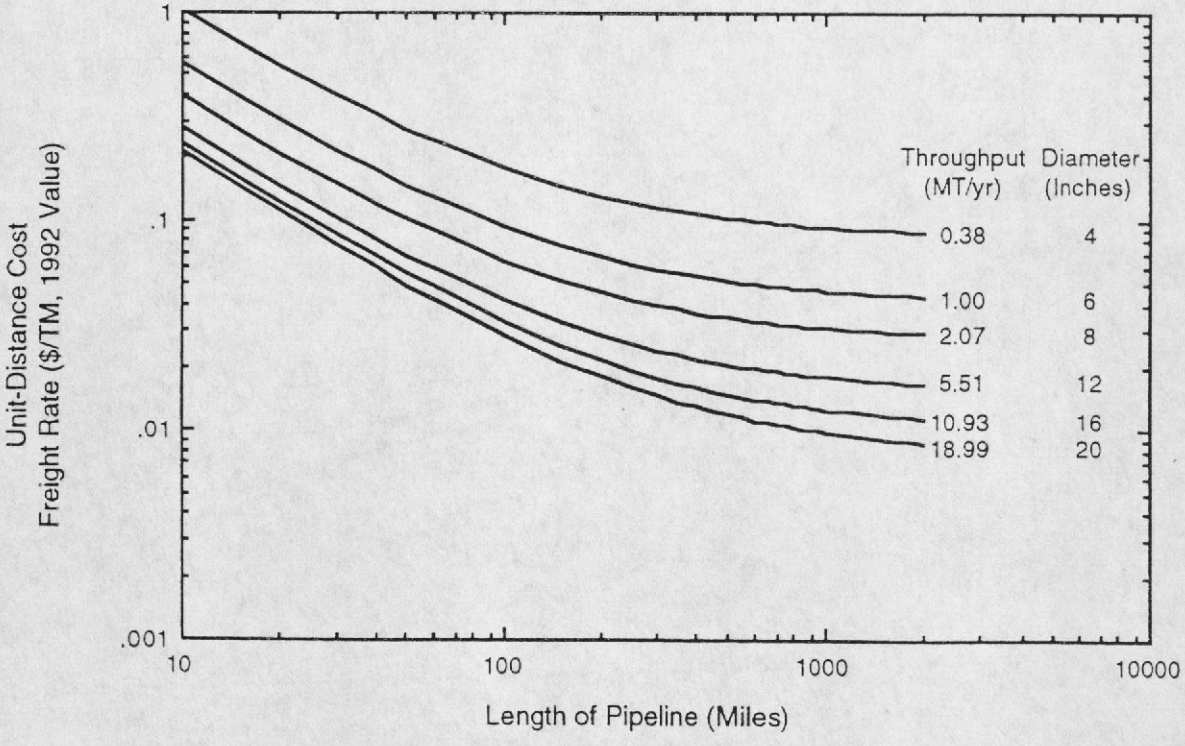
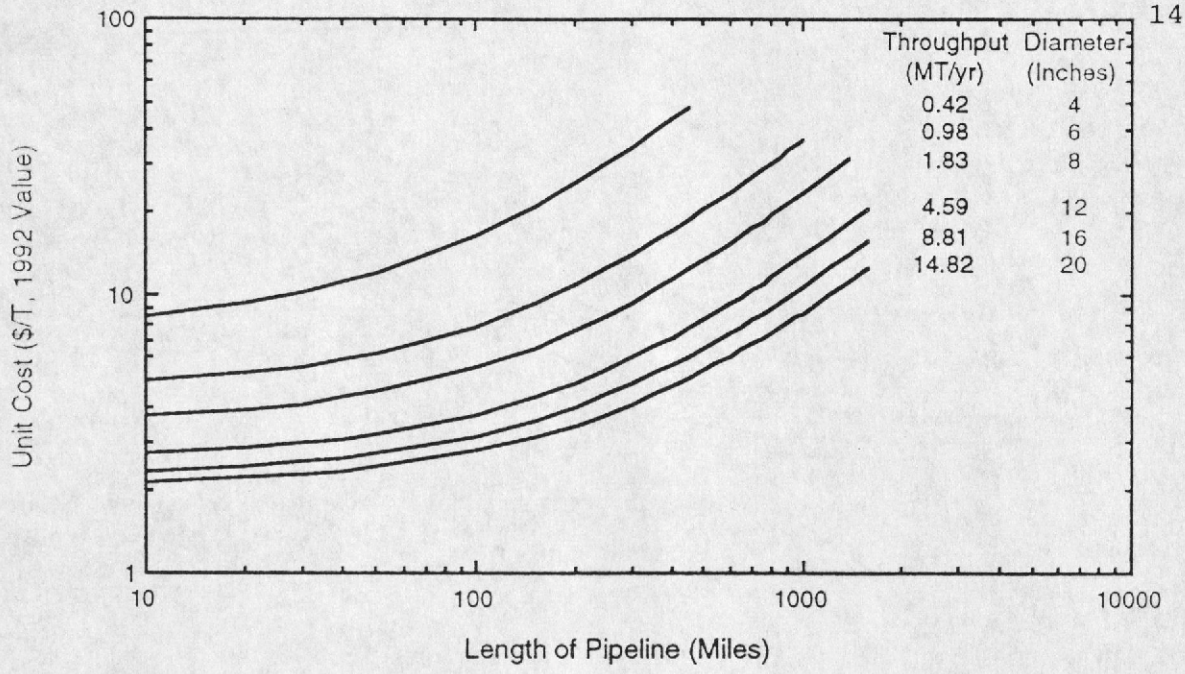


Fig. 27. Unit Cost and Unit-Distance Cost for CLP Transportation of Coal: Scenario 24



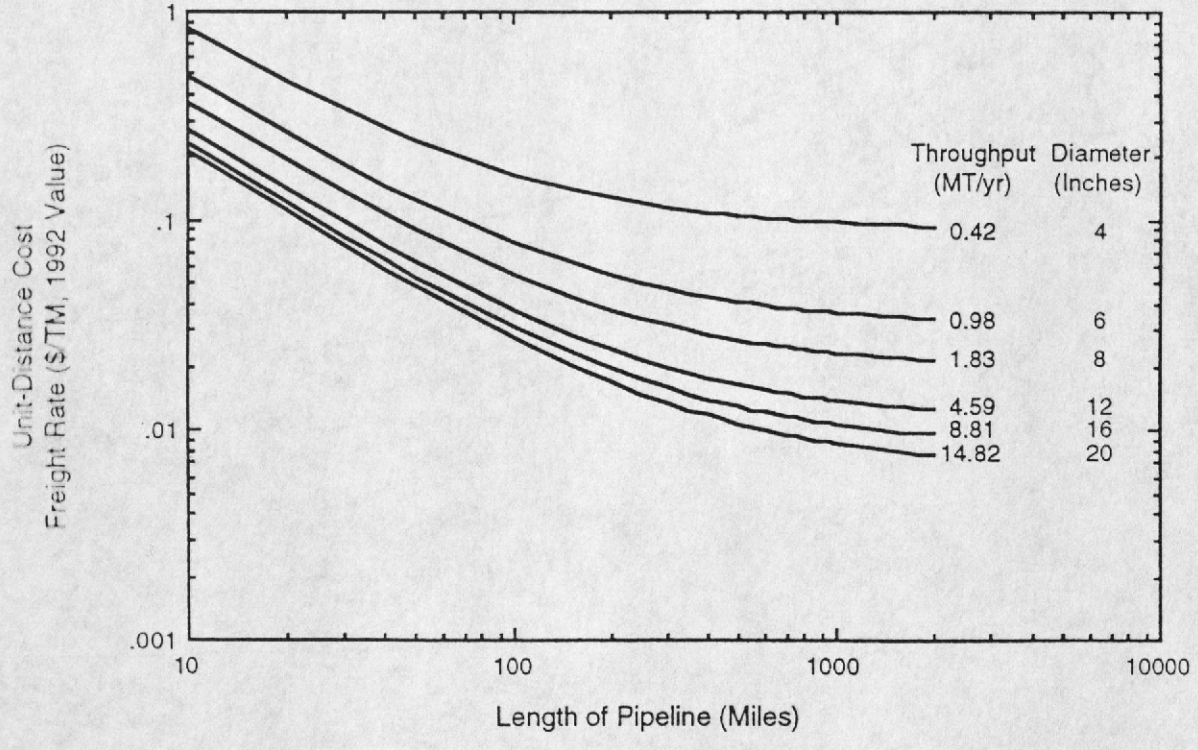


Fig. 28. Unit Cost and Unit-Distance Cost for CLP Transportation of Coal: Scenario 25

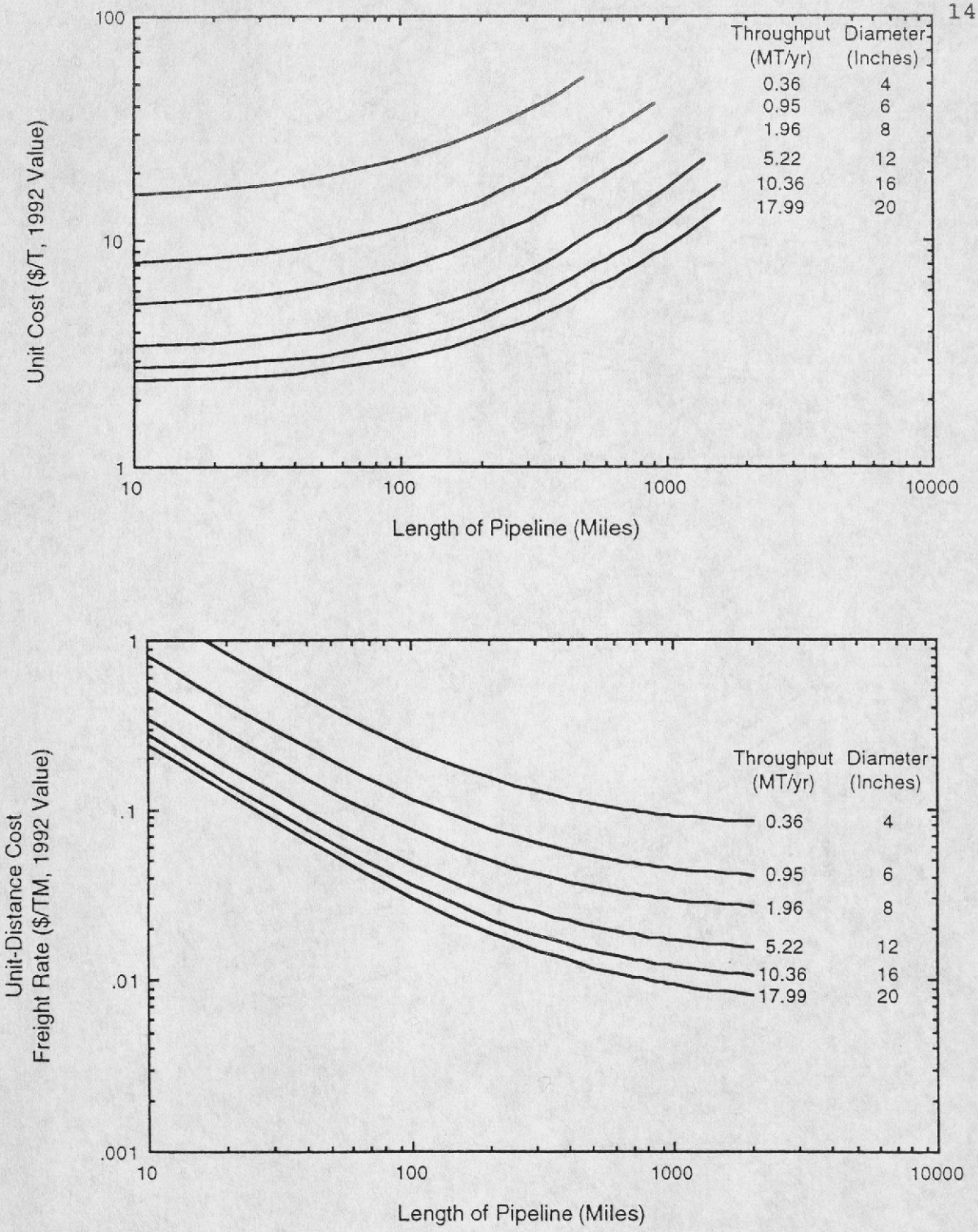


Fig. 29. Unit Cost and Unit-Distance Cost for CLP Transportation of Coal: Scenario 26

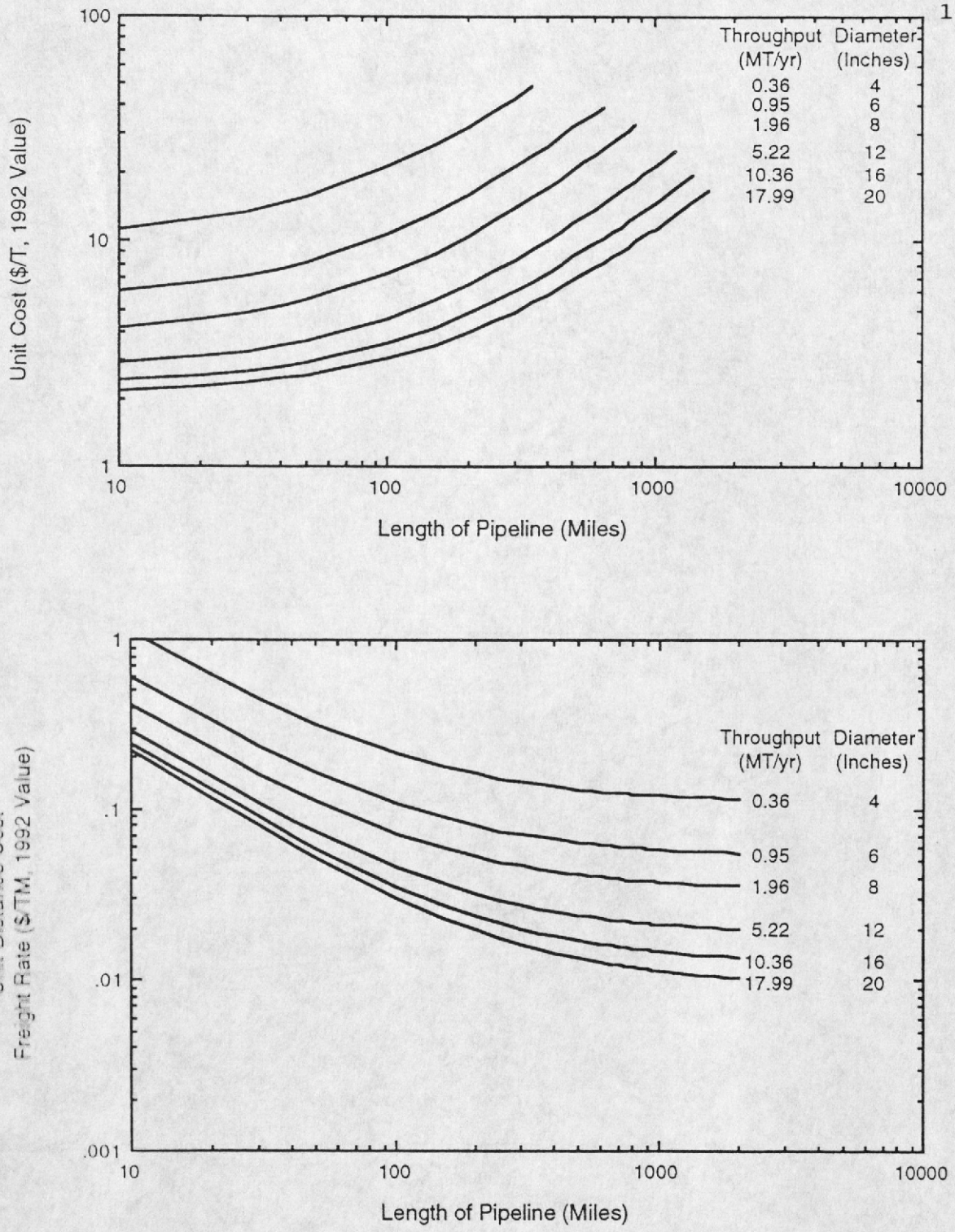


Fig. 30. Unit Cost and Unit-Distance Cost for CLP Transportation of Coal: Scenario 27

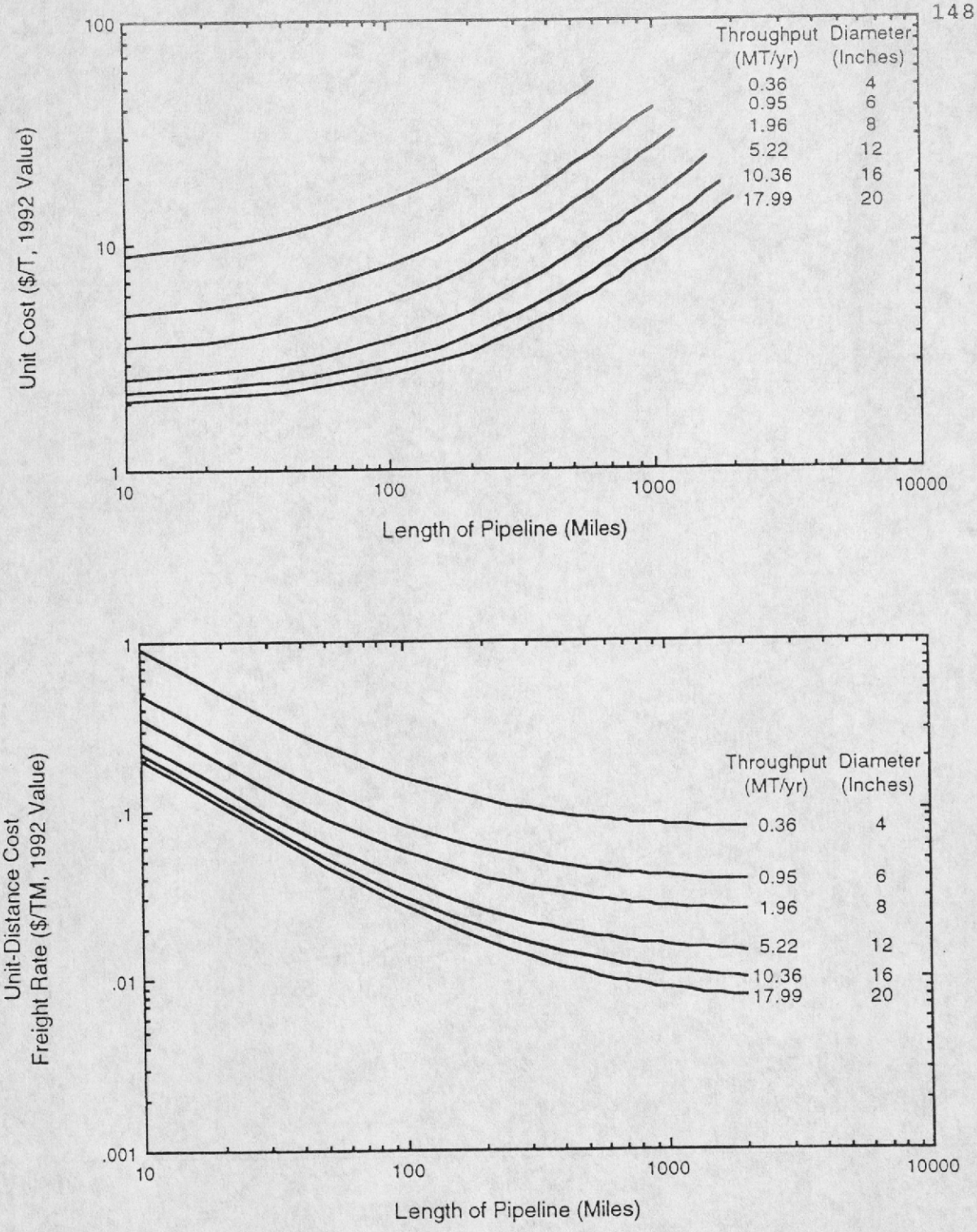
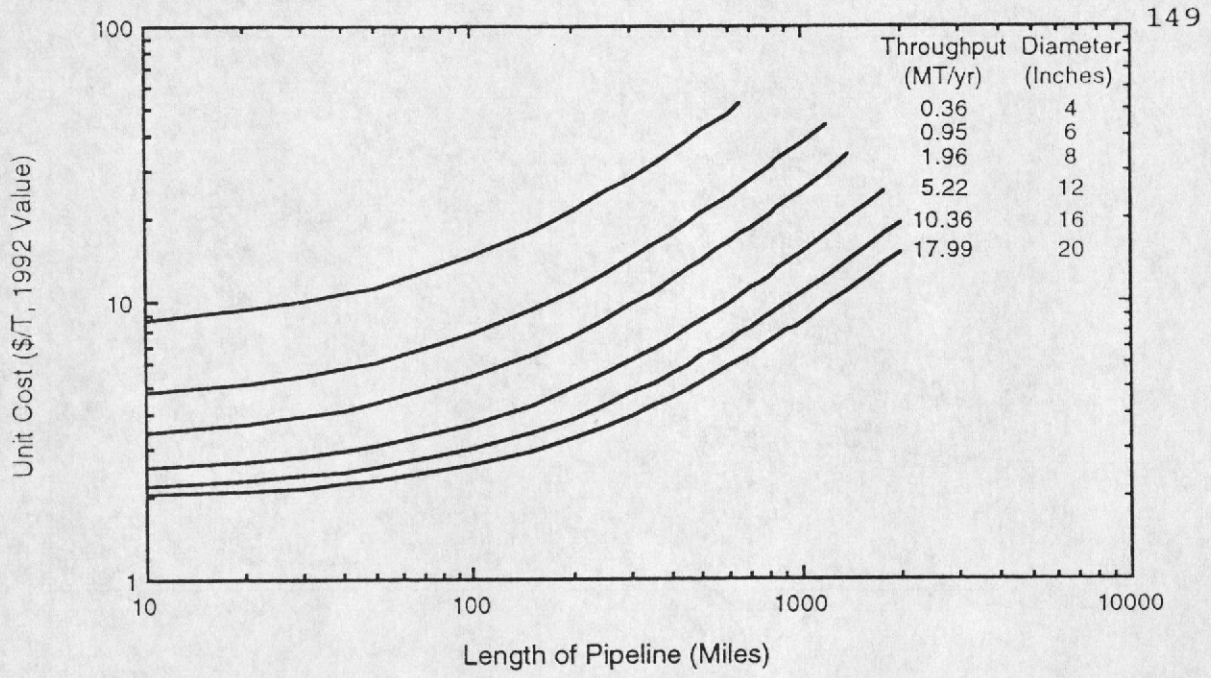


Fig. 31. Unit Cost and Unit-Distance Cost for CLP Transportation of Coal: Scenario 28



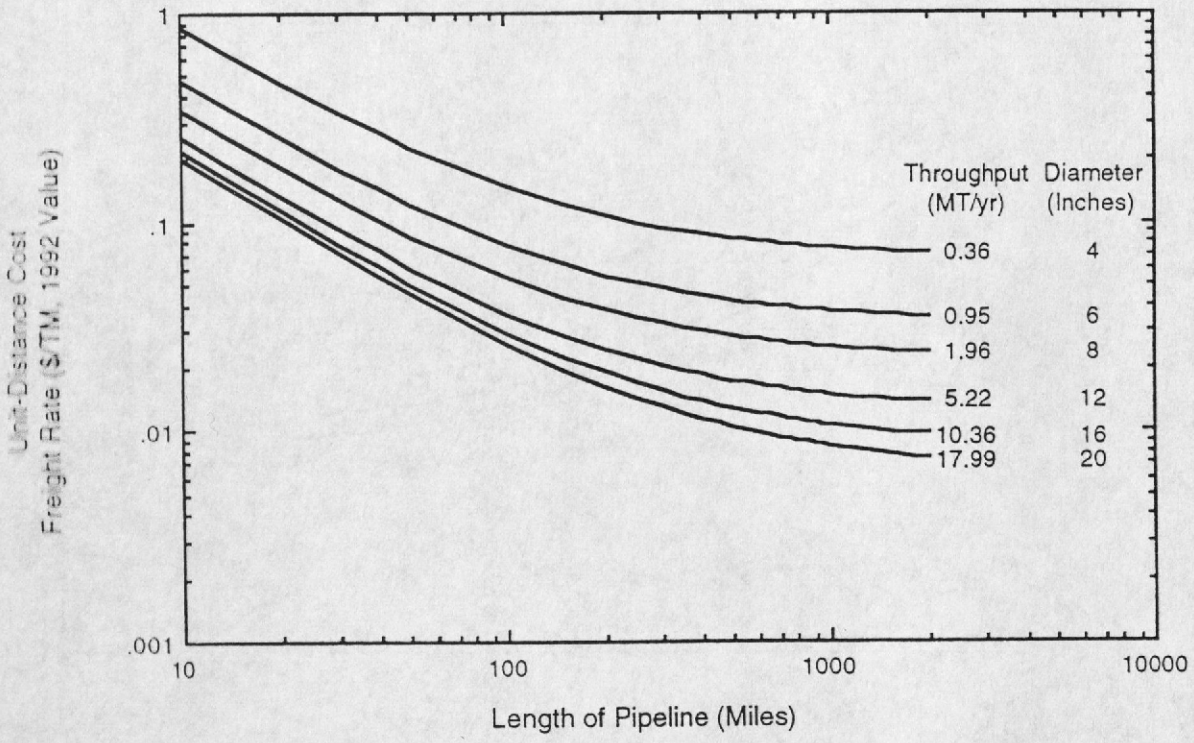


Fig. 32. Unit Cost and Unit-Distance Cost for CLP Transportation of Coal: Scenario 29

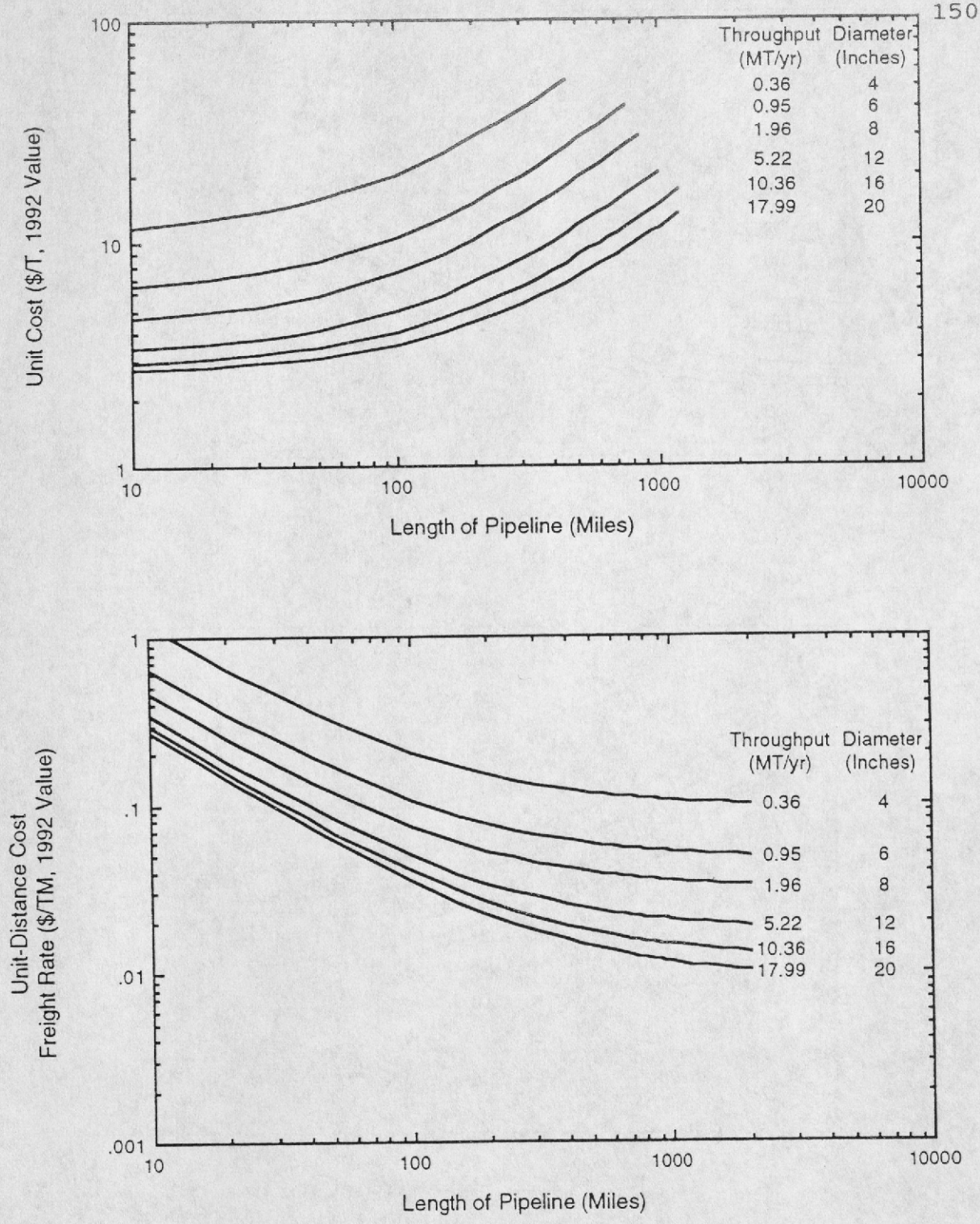


Fig. 33. Unit Cost and Unit-Distance Cost for CLP Transportation of Coal: Scenario 30

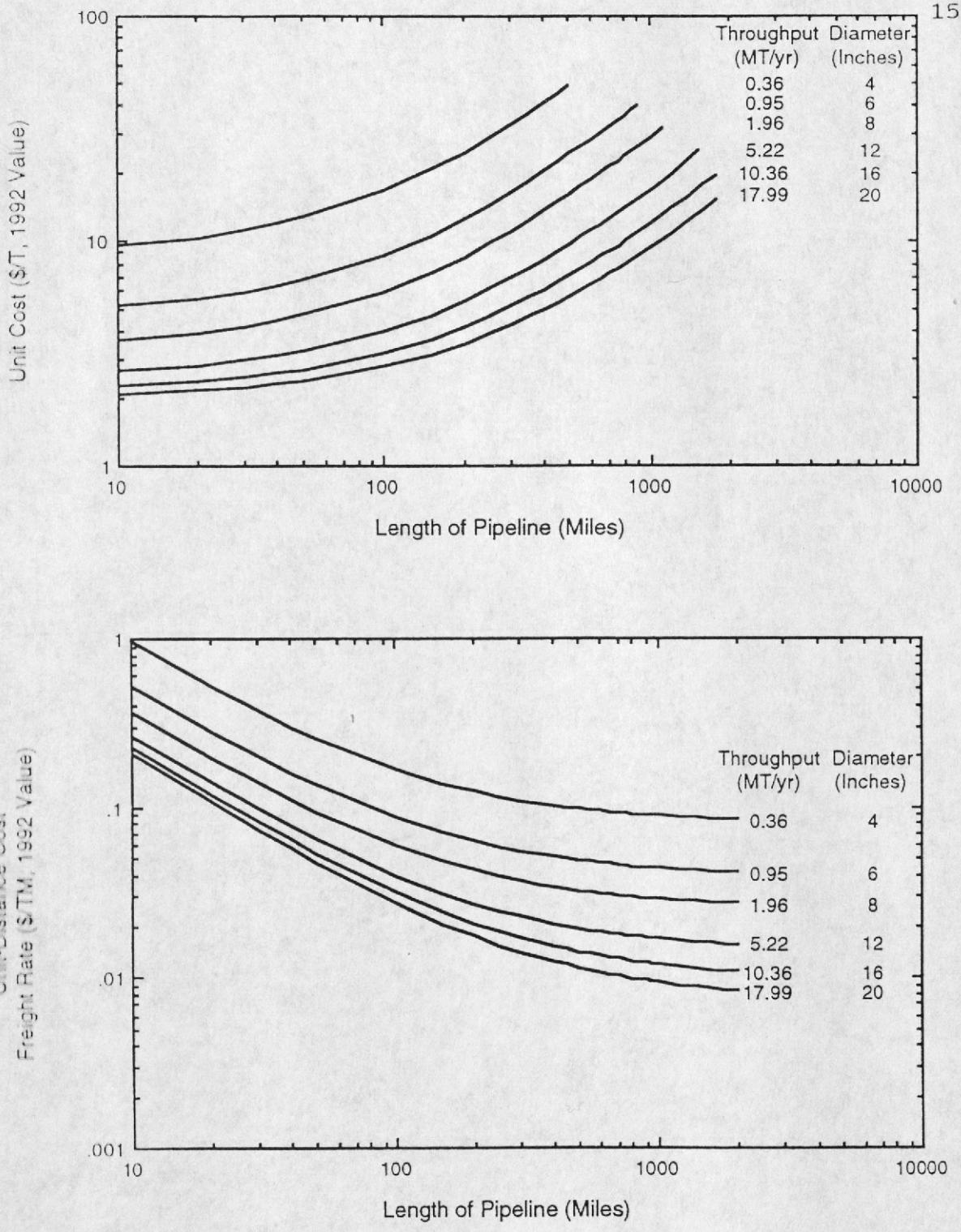


Fig. 34. Unit Cost and Unit-Distance Cost for CLP Transportation of Coal: Scenario 31

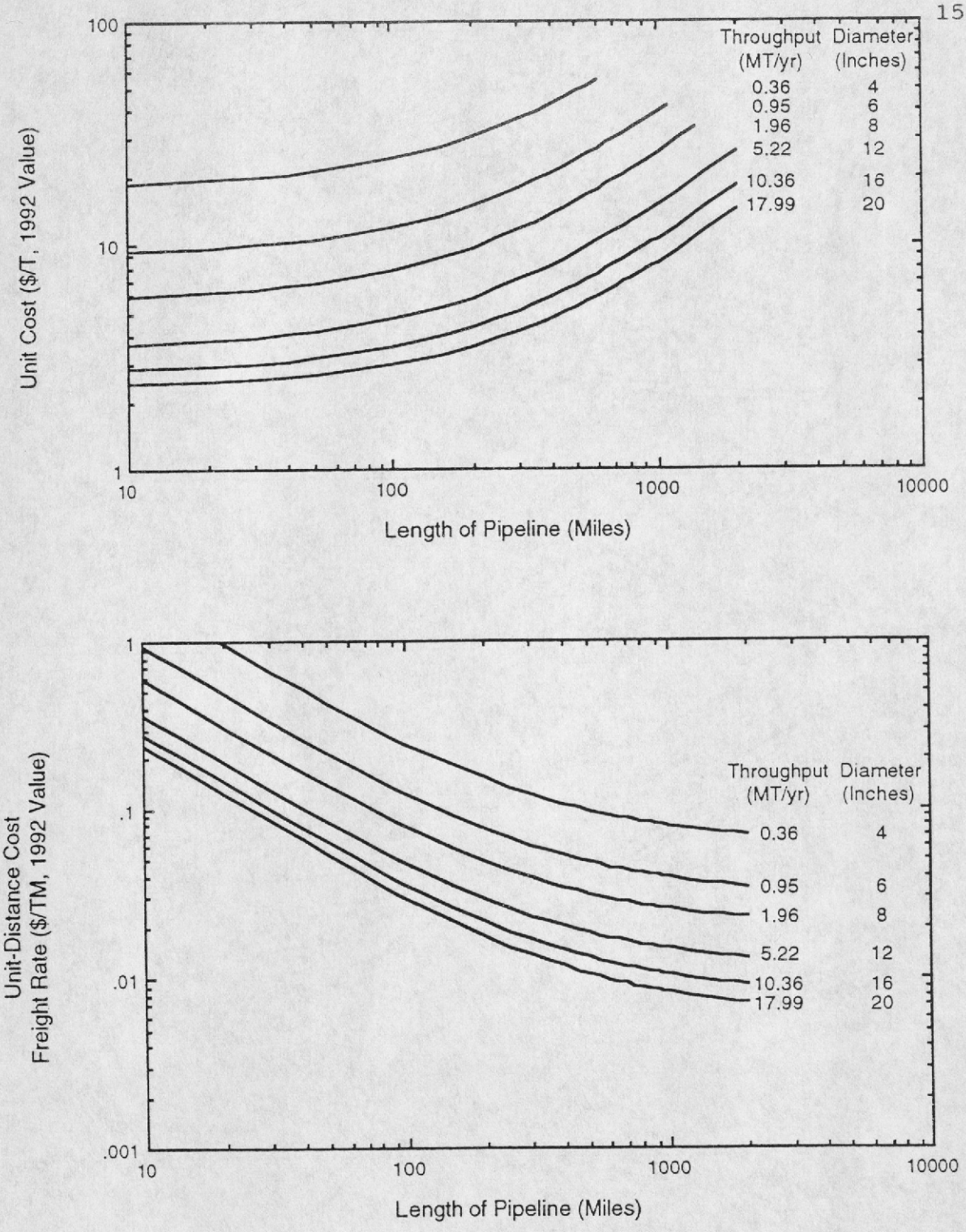


Fig. 35. Unit Cost and Unit-Distance Cost for CLP Transportation of Coal: Scenario 32

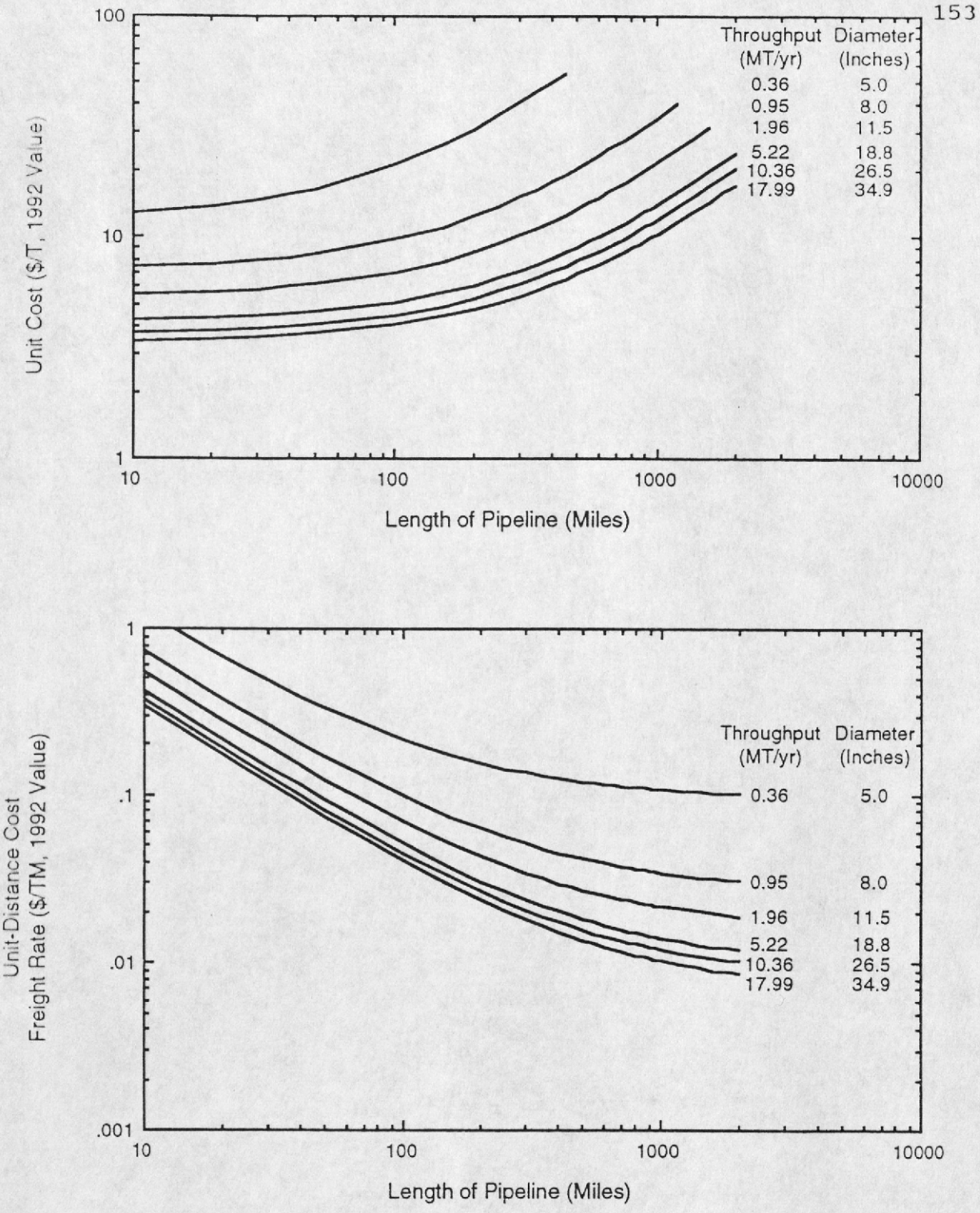


Fig. 36. Unit Cost and Unit-Distance Cost for Transportation of Coal by Slurry Pipeline

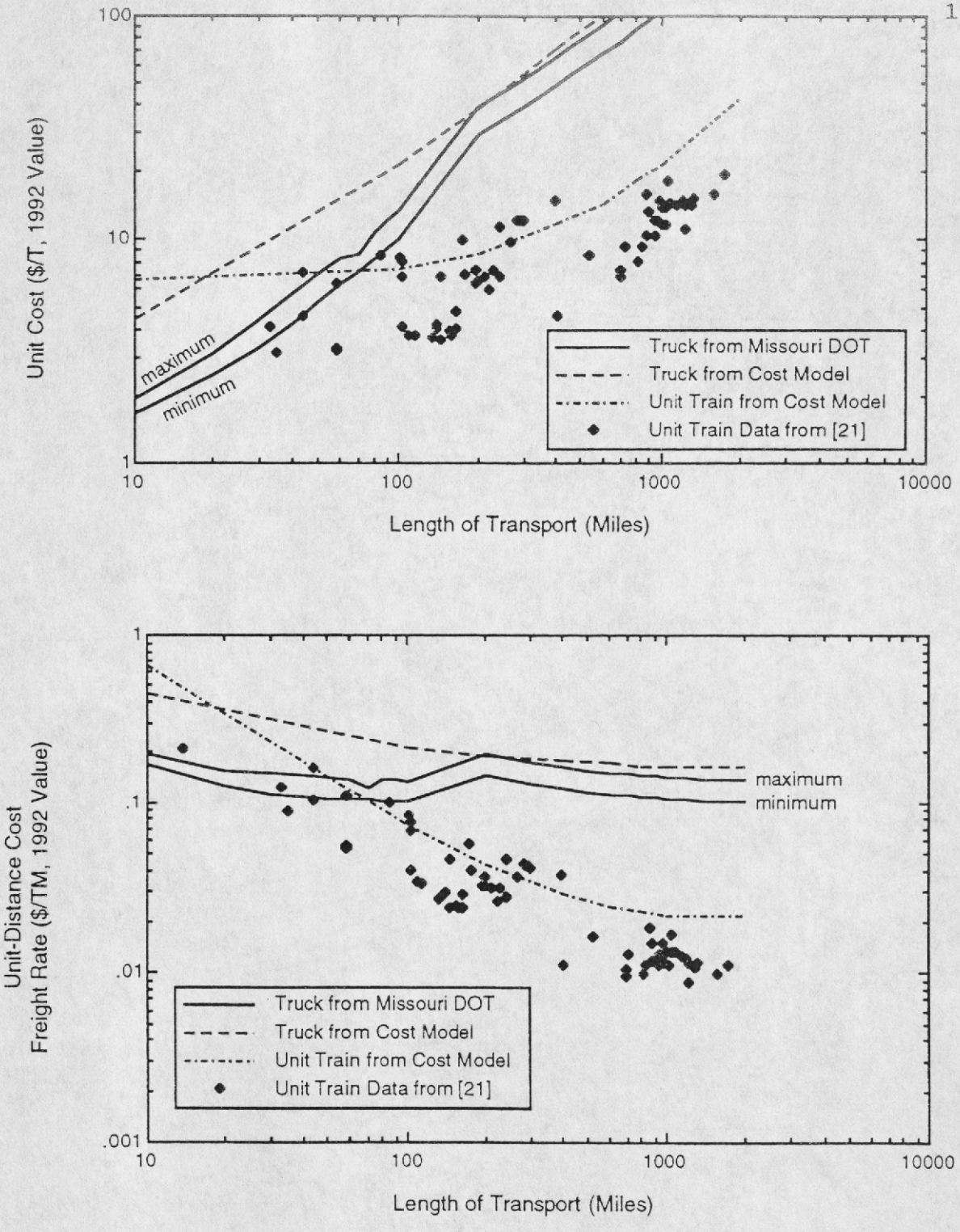


Fig. 37. Unit Cost and Unit-Distance Cost for Transportation of Coal by Truck and Unit Train

Note: Appendices III through VI contain background information needed by those few individuals who must know all the details of this report. They are printed as Volume 2 of this report. When needing a copy of Volume 2, one should contact Dr. Henry Liu, Capsule Pipeline Research Center, University of Missouri-Columbia. Due to the proprietary nature of this study, only sponsors and potential future sponsors of the Center's research will have access to this report.

ECONOMIC ANALYSIS OF COAL LOG PIPELINE TRANSPORTATION OF COAL

Volume 2: Appendices

by

Henry Liu, Robert Zuniga and James L. Richards

Capsule Pipeline Research Center (CPRC)
University of Missouri-Columbia

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