Operating & Maintenance Costs

B.F. Recycle System
Incremental Operating Costs.

Tower Fan
(From Marley Engineering Bulletin
9- 75HP Fans.

Horsepower requirements for Hotwell pumps.

$$H.P = \frac{50,000 \text{ gpm} \times 35 \text{ ft Head} \times 8.35 \text{ \#/gal}}{.7 \times 53,000 \text{ ft lbs./min.}}$$

= 632 H.P.
converting to KW
Total = 632 × .74 = 468 KW.

Total incremental KW.

9×75 × .74 = 500 KW.

500 KW + 468 KW = 968 KW.

Yearly KWH consumption.
Pumps.
1498 × 24 × 365 = 4 36 24 80 KWH
Tower
Fans operating 75% of year.
500 × 24 × 365 × .75 = 32 85 000 KWH

Total 4 36 24 80

Finished Tonnage.

Co - 19,500,000 Tons.
Gary 5,400,000 Tons.

U.S.S. - 1976 Total income before taxes = $518 million
Income from steel mfg = $165 million

Gary's earnings = $\frac{5.4}{19.5} \times 165 = \$45.69$

Alkaline-Chlorination Plant

O & M Costs / year

Chemicals	1,695,393
Labor	210,240
Power	123,166
Misc. -	100,000
	2,128,793

60

Cost Summary – Gary Works.

Capital Expense ($70,000,000 Projected)

(1) Blast Fce Recycle System	$35,000,000
(2) Alkaline Blowdown Treatment	$20,000,000
(3) Bar & Structural Waste Pickle Liquor Disposal	$12,000,000
(4) Electrolytic Tinning Lines	$ 1,500,000
(5) Tin Mill Chrome Control	$ 1,500,000
Total	$70,000,000

Operating & Maintenance Yearly cost.

10/1/79	(1) Blast Fce Recycle System	$ 237,295
8/1/80	(2) Alkaline Blowdown Treat.	2,128,793
1/1/79	(3) Bar & Structural Pickle Liquor.	174,000
4/1/79	(4) Electrolytic Tinning Line.	(-) 250,000
4/1/79	(5) Tin Mill Chrome Control.	(-) 150,000
Total		$ 2,540,088
Less		400,000
Net O & M Costs.		$ 2,140,000

Paying to U.S.S
Operating & Maintenance.

July 1, 1977 to June 30, 1978	$2,140,000
July 1, 1978 to Jan 1, 1979	$1,070,000
Jan 1, 1979 to Apr 1, 1979	491,522
Apr 1, 1979 to July 1, 1979	591,522
July 1, 1979 to Oct 1, 1979	591,522
Oct 1, 1979 to Aug 1, 1980	1,773,994
Total	$6,658,560

B.F.

1) Cooling Water Fac	10,100,000
2) Clar Fac.	4,000,000
3) Recycle Water Main.	9,300,000
4) Utilities.	600,000
5) Ind. Sewer (clean)	740,000
6) Chemical Feed	120,000
7) Elect. Power Dist.	2,600,000
8) Wash & Locker	600,000
9) Office Complex	100,000
10) San. Sewer	20,000
11) Dismantle, Move & Reinst	310,000
	28,500,000
Forward Esc	2,000,000
	30,500,000

A-C

Elec Equip.	827,000
Pres. Filt.	4,400,000
Car Absorb	2,000,000
Utilit.	806,000
Sub total	12,603,400
Engr.	770,000
Cond.	2,126,000
	15,500,000

Power

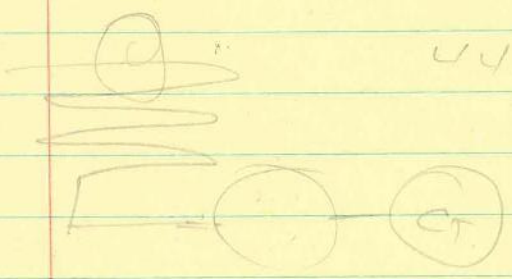
Avg. 18.90 MKWH.

Based — 881 H.P.

2700

1.6

√44 $881 = \frac{4,000,000}{1440} \times \frac{8.34}{33,000} \times 2.31 \times$



Inflation Costs.

12,000,000 × .06 × 1.5	=	1,080,000
3,000,000 × .06 × 1.75	=	315,000
20,000,000 × .06 × (37/12)	=	3,700,000
35,000 000 × .06 × (27/12)	=	4,725,000
		$ 9,820 000
		9,124 416

3v Fin. Par. $ 9,124416

695,584

9,124 416
6,658 560
15,782,976 ×

9 820 000
9,785,445
$ 34,555

31,

B&S.

Arch total	186,000
Engr.	120,000
Cont.	135,000
	1,450,000

Tinning lines.

Arch. total	433,800
Engr. & Cont.	232,000
Grand total	1,450,000

Chemn Cont.

Arch total	844,250
Engr. & Cont.	227,000
Grand total	1,600,000

Coke Plant.

Elect. Power	2,763,000
2c cap A-C	3,700,000
Engr.	900,000
Cont.	1,926,000
	$17,600,000

Procedure

1. Grouped pollution work into five basic groups.
2. Apportioned the $70,000,000 into five costs.
3. Estimated the O&M costs as follows:
   (a) From chrome savings per day.
   (b) From phenol savings per day.
   (c) From manpower required plus assessment of misc costs.
   (d) From chemical consumption, power requirements and manpower
   (e) From change in chemical requirement, manpower and power.
4. Yearly projected costs were applied from July 1, 1977 until compliance date.
5. Cost of money - interest at 5 3/4%
6. Projected Bay Works net income before taxes.
   After taxes. $31 million.

	Appraised Facility Inv.	Ind Oper	Amort & Fin	Grand total
#1	Blast fee			
	30,300	3,922.6	3474.7	7397.3
#2	Blowdown treatment			
	15,500	2,792.1	1,777.5	4,569.6
#3	Bar & Stainless Waste Pickle Liquor Disposal			
	14,450	176.1	166.3	342.4
#4	Electrolytic Tinning Line			
	1,450	(321)	166.3	(154.7)
#5	Tin Mill Chrome Control			
	1,600	155	183.5	338.5
#6	Reduce Cont. from Coke Plant.			
	17,600	1,964.8	2018.3	3983.1

Interest 8% per 15 years.

Total amortization and financing
~~$285,719 (.19047 x15)~~ includes interest of
119,619 ($285,719 less 166,100 ~~financing~~

(Amor & fin x15) includes interest of
~~amor~~ & fin x15 less principal.

Chlorine 6,789 NT @ $125.50 NT $.06x5/#
Sodium Hydroxide 5723.2 NT @ $97.58 NT $.048/#
Act. Carbon Granules 55.3 NT at $1100 NT $0.55/#
Regeneration $87,372

Labor Costs

1 - Operator equivalent
1 - Instrument Man. equivalent.

2 × 24 × 365 × $12 = $210,240

Total Oper Costs.

Chemicals	$1,695,393
Labor	210,240
Pumping	123,166
	2,028,799

Blowdown Treatment - Alkaline Chlorination

Data from

Chlorine cost = $125 NT = $.0625/#

Sodium Hydroxide cost = $97.58 = $.048/#

Act Carbon cost = $1100 = $0.55/#

Regeneration cost = $90,000/yr.

Chemical costs.

Cl.	58 168 #/Day × $.0625/#	× 365	= 1,326 957
Sul.	12 455 #/Day × $.048/#	× 365	= 218 211
C.	300 #/Day × $0.55/#	× 365	= 60 225
Regeneration Cost			90,000
			1,695,393

Pumping costs.

Flow = 4,000,000 gpgd = 2777 gpm

Head =

$$H.P = \frac{4,000,000}{1440} \times 8.34 \times \frac{}{33,000} = 81$$

Total 1000 HP operating.

KW = .74 × 81 HP =

60 KW × 24 × 365

@ / KWH

740 KWH × 24 × 365 = 6 482400

6 482400 × .019 = $123166

phenol-sulphonic acid

stannous sulphate and
phenolsulphonic acid

Savings in Polyelectrolytes.

Existing once thru system at an effluent suspended solids concentration of 18 mg/l. This is accomplished thru the use of polyelectrolytes.

Present cost estimated from J.E. McD data.

60,000 gpm flow at about 15 mg/l

Cost = $1100 /day.

Recycle System recirculating flow rate = 42,000 gpm.

$$\text{Many Present Cost} = \frac{42,000}{60,000} \times 1100 = \$770 \text{ /day.}$$

Present use of polyelectrolytes can be eliminated because system can be operated at about 5 mg/l at no use of electrolytes.

Acid presently used to adjust pH to 8.5 to 8.0. Additional acid may be required.

Therefore assume only 75% of the poly cost will be saved.

Yearly savings are

$$\$770 \text{ /day} \times .75 \times 365 = \$210\,787 \text{ /year}$$

Incremental Labor Costs.

Present system is manned.

Recycle system will add two operating facilities.

Assume equivalent of 1 man per turn

Yearly cost =
1 man × 24 Hr × 365 day @ $12/Hr =

$105,120 per year.

Yearly operating cost for recycle system.

Power costs
Pumping = 43624
Cooling tower = 32850
$76,474

Labor = 105,120
Total increase 181594

Less Chemical savings
210,787

Net change in operating cost.

Savings $29,193

Cost to Recycle System Operating Cost.

Labor - 1 additional man

yearly cost = 1 man × 24 × 365 @ $12/Hr =
$105,120/year.

Power costs =
Pumping = 4362400 KWH/year
3285000 KWH/year
7,647,400 KWH/year.

Costs @ $0.019/KWH =

7647,400 × $0.019 = $145,300

Additional chemicals.
Biocide 4200 × 12 = 50,400
Corrosion Inhibitor 8850 × 12 = 106 200
$156 600

Less chemicals saved.
Present chemical cost $500/day
for operating at 18 mg/l.
Decreased to $50/day for 50 mg/l.
450 × 365 @ - $169 725/yr.

Net change in operating cost
Labor $105,120
Power 145,300
Add. Chemicals 156,600
407,020
Less chemical saved. 169 725
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