FACTORS LEADING TO CLOSURE OF THE TACOMA SMELTER

R. Coughlin
U.S. Environmental Protection Agency
Region 10, Seattle, Washington

March 1985

FACTORS LEADING TO CLOSURE OF THE TACOMA SMELTER

Executive Summary

The announcement by ASARCO that its Tacoma, Washington, copper smelter would close permanently in 1985 raised the issue of the degree to which environmental regulation contributed to the closure decision, since the smelter had been the source of continuous negotiation and litigation between ASARCO and local, state and federal environmental regulators. This paper analyzes the situation of the smelter, utilizing publicly available information* to attempt to determine the circumstances that resulted in closure.

Principal findings:

1) The Industry: Although world demand for copper has been growing, domestic consumption and mine production have dropped. Growth of smelting capacity in producing nations and integration of domestic production have resulted in substantial excess U.S. smelting capacity. Prices have been falling since 1979, and U.S. producers are often at a disadvantage in competing for concentrates with newer, larger smelters abroad.

2) The Firm: ASARCO, formerly predominantly a custom smelter with broad foreign interests, has been integrating its production processes, emphasizing its U.S. production role, reducing and modernizing its capacity. Consolidation of three copper refining operations in a single new plant and the modernization and expansion of its integrated Hayden, Arizona, copper smelter are major components of the altered operating strategy.

3) The Tacoma Smelter: The last of the nation's tidewater smelters, the Tacoma plant survived primarily by smelting foreign concentrates that were too contaminated to be accepted by others and by processing southwestern concentrates in excess of the capacity of ASARCO's Hayden and El Paso plants. Closure of a Peruvian mine, diversion of a Philippine mine's concentrates to an indigenous smelter and expansion of the Hayden plant have substantially stripped the Tacoma smelter of its previous sources of feedstocks.

4) Environmental Regulation: Although substantial investment would have been necessary to bring the Tacoma smelter into conformity with environmental regulations, ASARCO negotiated and delayed compliance until loss of contaminated foreign concentrates and completion of new capacity at Hayden made the plant redundant. The fact that the replacement capacity includes state of the art pollution controls supports the judgment that it was the location of the plant relative to feedstock sources and not environmental regulation that led to the Tacoma closure.

---

*Sources used for this paper are described on page 20.

The Industry

Since the imposition of the Arab oil embargo in the fourth quarter of 1973 the U.S. copper industry--like much of domestic heavy industry--has undergone a series of spasms of consolidation and contraction. The two largest firms, Kennecott and Anaconda, and smaller Cyprus Mines as well, have simply disappeared, becoming minor adjuncts of cash rich petroleum firms. A majority of smelters and of major mines have operated intermittently or have been idle since 1980. The erosion of the industry is outlined in its production record.

Table 1
Copper Production, 1972-1983

		Production, in 100 Metric Tons		
		Source		
Year	Refined Copper	Domestic Ore	Foreign Ore	Scrap
1972	2052.9	1527.6	175.3	350.0
1973	2102.2	1543.9	154.7	403.6
1974	1942.4	1291.7	212.5	438.2
1975	1612.2	1169.3	142.9	300.0
1976	1720.3	1293.4	106.0	320.9
1977	1691.1	1282.7	77.5	330.9
1978	1805.5	1280.8	112.9	411.8
1979	2091.0	1411.5	103.9	575.6
1980	1783.9	1121.9	89.0	573.0
1981	2175.9	1430.2	113.8	631.9
1982	1797.2	1064.8	162.2	570.2
1983	1752.5*	1003.7	178.8	NA
Smoothed Annual Shift	-8.1(r= -.16)	-31.4(r= -.65)	-2.9(r= -.25)	27.8(r=.77)
Mean rate of Shift	-.7%	-2.7%	4.0%	6.7%

* Scrap estimated to be 570

It is difficult to associate the general decline in domestic copper production with specific configurations of physical capital. The Bureau of Mines reports that the industry consists of thirty-five principal mines that account for over 98% of production, fifteen primary smelters, thirty-three refiners, and forty-three secondary smelters or smelter-refineries. But the metals industries are notoriously sensitive to price fluctuation, and price-induced intermittance is a prime characteristic of copper production schedules. At any given time a substantial portion of the industry's physical capital may be idle. The operational status of capital is, then, a matter of intense interest to competitors, labor, and government. Thus the knowledge that a particular plant or mine is idle or working at a given moment is an indifferent guide to its future, and reported sources of idleness are to be received with reservations.

It should be recognized, then, that the Bureau of Mines catalog of the industry is no more than an approximation of potential capacity at conditions of high prices and maximum output at any time in the last decade. A portion of currently idle mines, smelters, and refiners will probably never return to production. Mines, once closed, flood and collapse. Factories deteriorate, become obsolete. The Bureau of Mines' appraisal gives us at best the outside limits of capacity rather than current effective capacity.

What is certain in the case of mines is that inventoried domestic capacity of 1.8 million tons of copper per year has been substantially unchanged over the last decade and a half, while the utilization rate has been declining irregularly but persistently.

Table 2
Mine Production of Copper and Utilization Rate

	U.S. Production		
Year	100 Metric tons	Percent Utilization	Indicated Capacity
1970	1560	93	1700
1971	1381	80	1700
1972	1510	88	1700
1973	1559	86	1800
1974	1449	80	1800
1975	1282	71	1800
1976	1457	80	1800
1977	1364	75	1800
1978	1358	75	1800
1979	1444	78	1850
1980	1181	64	1850
1981	1538	89	1700
1982	1140	65	1700
1983	1046	60	1700
Smoothed Annual Shift	-26(r= -.66)	-1.6(r= -.69)	

Mining capacity is at best a flexible datum, composed from judgments concerning fixed capital in place, metals concentrations, and metals price. Capacity can increase rapidly in response to price change or exploration, but the degree to which it contracts as a consequence of adverse price experience or depletion is uncertain. The experience of the last decade has been such that one must approach the Bureau of Mines estimate of domestic copper mining capacity with caution. What is interpreted as a decline in rate of utilization may in some degree represent a permanent--or at least long range--reduction in U.S. copper mining capacity.

That is unquestionably true of the Bureau's tally of fifteen U.S. copper smelters. Last year (1983) only six of the fifteen operated without some extended period of shutdown and none operated at rates approaching capacity. The experience of the 1980's, to date, has been that little more than half of domestic copper smelting capacity has been required to fully satisfy U.S. demand for copper. Indeed, even at curtailed production rates, inventories appear to have expanded. Though the U.S. Department of Commerce no longer routinely reports inventory levels, stocks of refined copper, making use of the last information available, climbed from 243,000 metric tons in November 1979 to 688,000 tons in November 1982 in the face of declining output.

A review of the production status of the fifteen domestic smelters at January 1, 1983, reveals distinctly the current excess of capacity among those smelters.

Table 3
Production Status of U.S. Smelters at 1-1-1983

Firm	Location		Annual Capacity Metric Tons: Active	Idle	
ASARCO	El Paso	TX	100,000		
	Hayden	AZ	100,000	130,000	(includes expansion in progress)
	Tacoma	WA	100,000		
Anaconda	Anaconda	MT		200,000	(partially dismantled)
Cities Service	Copperhill	TN		16,000	
Inspiration	Miami	AZ		150,000	
Magma	San Manuel	AZ	200,000		
Kennecott	McGill	NV	78,000		
	Hurley	NM		80,000	
	Hayden	AZ	80,000		
	Garfield	UT	300,000		
Phelps Dodge	Douglas	AZ		90,000	
	Morenci	AZ		196,000	
	Ajo	AZ		77,000	
White Pine	White Pine	MI	85,000		
Total			1,043,000	939,000	

Trade and Price Considerations

It would be a mistake to review the circumstances of any element of the domestic copper industry in isolation. Copper is actively traded in international markets, and the conditions that have created contemporary excess domestic capacity trace in large measure to the evolution of the world copper industry.

The formation of that industry was well under way by the turn of the century. European firms aggressively developed overseas mining concessions, primarily in Africa but also in Latin America and the Orient. Similarly, U.S. firms, spearheaded by the Guggenheim interests, moved massively into Latin America mining and more modestly into the Philippines. The ventures were classically colonial. A substantial share of mines and concentrators were located in what we have come to call the Third World. Smelters, refineries, and fabricating plants were restricted to the mother countries. Thus the U.S. and western European nations developed metallurgical and metal working capacities far in excess of local mining's feedstock potential. Metallurgical factories were typically on tidewater, emplaced to receive concentrate shipments from abroad.

The system survived World War I, which scarcely affected the integrity of European and North American physical capital, but began to come apart after World War II, when a great part of Europe's industrial base had to be restored or replaced. Raw materials, skilled labor, and energy were all in short supply. As a consequence, European metals firms--notably The Rhodesian Selection Trust, Roan Antelope, and Union Miniere du Haute Katanga--abandoned traditional patterns of distributed production and began to integrate in expanding African copper production. Several smelters, more efficient and larger than any in Europe, were constructed in the early 1950's. Smelter expansion continued after the collapse of colonial regimes, and in the sixties broad investments in refineries followed.

U.S. mining firms adopted a similar pattern in Latin America. The host nation supplied resources and a share of capital, the U.S. firms provided additional capital, management, and technical skills. Latin American smelting capacity swelled through the 1950's and 1960's, as did refining capacity after about a ten year lag.

Though the largest share of worldwide expansion in copper production was based on established African and Latin American mining areas, it was by no means restricted to them. In Eastern Europe both the Soviet Union and its satellites added significantly to all phases of the copper production cycle. And in Asia, Japan, an insignificant factor in world copper production before World War II, built a group of smelters and refineries--based primarily on Australian and Philipine concentrate shipments--that not only gave her production parity with the U.S., U.S.S.R., and Chile, but also established the current state of the art in copper metallurgy.

The U.S. was largely isolated from postwar growth of copper output and consumption. Output has been virtually static for three decades, demonstrating no growth and shifting only with business cycle vagaries. Aluminum, plastics, ceramics provided substitutes for copper in its major markets--construction, transportation, and electrical and electronic applications. Miniaturization and metallurgical improvements also constrained growth by reducing the amount of copper required in many of its applications.

The industry evolved in the direction of integration, smelters and refiners expanding in southwestern states where the dominant mines are located; while the tidewater toll and custom smelters and refiners were allowed to become obsolete, their effective capacity dwindling.

Though it did not grow, neither did the U.S. copper industry suffer in those years between 1946 and 1973. Metallurgical capacity throughout the period exceeded mine production; and since the smelting and refining abilities of third world nations consistently lagged mining expansion, a steady supply of imported concentrates could be counted on to keep American smelters in operation. Further, a two tier price system was developed to sustain U.S. copper consumption. Where most of the world--planned as well as market economies--planned and operated copper

Table 4
Comparative Growth of Copper Output

	Mine Production 1000 Metric Tons			Percent of World Total		
	Mean,1955-59	1964	1983	1955-59	1964	1983
U.S.	909	1133	1050	26.4	23.0	13.2
Canada	324	450	600	9.4	9.1	7.5
Chile	485	632	1250	14.1	12.8	15.7
Peru	50	175	330	1.5	3.6	4.2
Philipines	36	61	320	1.0	1.2	4.0
Zaire	250	278	490	7.3	5.6	6.2
Zambia	429	674	580	12.5	13.7	7.3
Other Market States	468	596	1280	13.6	12.1	16.1
Poland	8	15	350	0.2	0.3	4.4
USSR	400	700	1000	11.6	14.2	12.6
Other Planned States	86	213	460	2.5	4.3	5.8
World Total	3445	4927	7960			

	Smelter Output 1000 Metric Tons			Percent of World Total		
U.S.	987	1217	1021	27.3	23.3	12.5
Oth. N. America	375	422	482	10.4	8.1	5.9
Chile	456	587	1047	12.6	11.2	12.8
Oth. S. America	37	155	338	1.0	3.0	4.2
U.K./W. Europe	363	451	612	10.0	8.6	7.5
Australia	55	81	180	1.5	1.6	2.2
Japan	112	283	1045	3.1	5.4	12.8
Oth. Asia/Oceanica	67	150	449	1.9	2.9	5.5
USSR	400	700	1095	11.1	13.4	13.4
Oth. E. Europe	66	140	577	1.8	2.7	7.1
Zaire	250	278	466	6.9	5.3	5.7
Zambia	418	644	585	11.6	12.3	7.2
Other Africa	55	117	258	1.5	2.2	3.2
World Total	3618	5227	8153			

industries on the highly variable basis of auction transactions conducted on the London Metal Exchange, administered pricing("the domestic producers' price") was employed by U.S. copper firms to provide a relatively stable basis for decisions of copper producers and consumers alike.

The domestic producers' price was for more than twenty years the cornerstone of American copper policy, and the measure of U.S. dominance in world copper production. The largest consumer of copper, the U.S. was also--and by a substantial margin--the largest producer at the end of World War II. Its mines were entirely capable of supplying internal demand for copper: its metallurgical plants could process all of that domestic consumption requirement and a substantial fraction of the rest of the world's need. As world production soared, prices shifted erratically to reflect stages of the business cycle and the series of sequential supply plateaus caused by the intermittent appearance of a new smelter some place in the world. The American industry and its customers operated in an environment relatively free of price uncertainty. The prevailing administered price was characteristically lower than the world price, though in periods of sharp price breaks it floated above the world price. The effect was to discourage substitutions and to steer capital toward the higher, if less certain, returns available abroad. Thus the domestic industry and its customers enjoyed relative stability. Individual metals firms were able to participate in the demand growth and higher returns available abroad through direct foreign investments and through the provision of toll smelting services.

The system collapsed from the price effects of the Arab oil embargo.

When OPEC increased the price of crude petroleum by an order of magnitude at the same time that cutoff of Arab oil made it possible to enforce the new price regime, the whole world's price structure rapidly shifted upward.

The reactions occurred in series. When oil's price rose, the price of alternative fuels moved up immediately. Prices of coal and natural gas went up even faster than the price of petroleum, as producers and exporting nations exploited the initial shortage of oil to implement a policy of BTU-parity.

Increased energy costs drove the prices required to produce and transport every conceivable manufactured good upward. Incremental costs, and consequent price movements, were greatest in first stage production of raw materials, where the relative cost of energy was greatest, as compared to the cost of labor and/or capital in place. Agricultural products, timber, and--especially--metals posted almost weekly price increases from the fourth quarter of 1973 into the third quarter of the next year.

Industrial consumers, seeking to protect themselves from the effects of rising prices, built inventory without regard to short term demand, seeking to accumulate raw materials in advance of price increases. The years 1973 and 1974 produced unparalleled profits for producers of copper and other industrial commodities, as the artificial demand induced by inflation kept mines and plants operating at capacity, and prices escalated in the absence of competitive constraints.

The bubble burst in the fourth quarter of 1974. Incomes had not inflated to match prices, so final demand began to fade. Swollen inventories necessitated production cutbacks and layoffs. The recession was sudden, steep, and world wide. Copper and other first stage producers were hardest hit. Inventories were excessive at every stage of the production/exchange process, and the inventory reduction mechanism took longest to work its way back to primary producers. Price cutting was widespread in 1975. U.S. copper producers were, for the first time in the postwar period, significantly affected by foreign price reductions; and the domestic producers' price became an effective casualty of inflation. Foreign sources of refined copper had simply become too abundant not to affect the metal's American consumer's choice.

Prices moved upward once more in 1976 as western economies began to work their way out of recession, but it was no longer the runaway raw materials inflation of 1973-74 that prevailed during the relative prosperity of 1976-79. OPEC posted annual price increases that were relatively modest until the Iranian revolution induced fear of shortage and a second petroleum price explosion in 1979. Interest rates rose uninterruptedly, in part as a consequence of inflationary expectations and demand for funds, in part as a consequence of deliberate monetary policy. So energy and capital costs were rising. But the copper price changes engendered by those rising costs were less than proportionate.

A new factor had been introduced into the inflationary price formation equation after 1975.

Massive capital infusions during the period of raw materials inflation had greatly enhanced international capacity to mine and smelt copper. Much of that capacity had come on stream in economies that produced the metal entirely for export. Faced with persistent inflation of interest charges on the international loans they had to float to secure the foreign exchange they required to purchase--at rising prices--the petroleum necessary to fuel their societies, Peru, Zambia, Zaire, and especially Chile, failed to pass on increasing costs, or actually cut prices, in order to hold their copper markets.

Thus the industry has suffered since 1975 from a condition of persistent relative price weakness stemming from worldwide excess capacity and competition affected by exchange imbalance. And the effects on all elements of the domestic industry have been severe.

Traditionally, the burdens and opportunities of price risk have devolved principally on mining. As prices fell, the less efficient mines, or the ones with lower metals concentrations, stopped operating when the price they received for copper became less than the variable costs of production. When curtailed output caused consumers to once more bid up prices, production could resume. Smelting and refining operated as service industries with prices fixed by production costs, and those prices were largely unaffected by metals prices. Operating profits in metallurgical processing varied according to the volume of metal presented for processing, not according to its price. As a consequence, revenues were far more stable than for mining, closures less frequent and of shorter duration.

Two characteristics of the international copper market since 1975 have acted to dissolve the relatively protected status of U.S. metallurgical processing.

Mines in third world nations have continued to produce at near capacity levels--and Chile had increased its output--through the period of falling prices. The abundant supply on world markets has protracted the closure of American mines, and has forced additional mines to close, since production has never dropped sufficiently to allow prices to recover.

The adverse effect on smelters of this sustained reduction of domestic feedstocks had been amplified by the second novel feature of the contemporary condition of excess supply and falling prices. For the first time in history copper mining nations have more than sufficient indigenous smelting capacity. As a consequence, concentrate imports have not been available to offset the loss of domestic feedstocks. To the contrary, there is competition among smelting firms and nations for the available concentrate supply. And U.S. smelters are at a distinct disadvantage in head to head competition with newer, more efficient, foreign smelters. So concentrate imports have fallen, and for the first time, some American mines are shipping their concentrates abroad.

And so there had been a fundamental change in the U.S. posture toward copper. Historically, the U.S. imported ore and concentrates, exported refined copper. By the late 1960's the growth of foreign metallurgical processing industries had brought about an approximate balance in trade of refined copper, but we remained a net importer of concentrates. Within the last decade the historical relationship had been reversed. Today the U.S. is on balance an exporter of concentrates, and importer of refined copper.

As table 5 demonstrates, the effect on copper prices of the fierce international competition after 1979 has been extreme.

Table 5
Mean Annual U.S. Copper Price, 1972 - 1983 vs. Index of Prices of Industrial Commodities.

Year	Copper, cents per pound	Industrial Commodities, 1967=100
1972	51.2	117.9
1973	59.5	125.9
1974	77.3	153.8
1975	64.2	171.5
1976	69.6	182.4
1977	66.8	195.1
1978	66.5	209.4
1979	93.3	236.5
1980	102.4	274.8
1981	85.1	304.1
1982	74.3	312.3
1983	79.3	315.8

For the full twelve year period the two price series are positively correlated ($r = .68$), their relationship such that a one point rise in commodity prices was associated with 0.14¢ per pound rise in the price of copper. If both series are reduced to index numbers with a common base year of 1972 for the sake of comparability, the correlation is such that each one dollar increase in the overall price of industrial commodities includes only a thirty-two cent copper price increase.

But, as the discussion above argues, the period under observation includes three distinct sub-periods with very different copper price increase characteristics.

Over the years 1972-1974, with commodity prices generally escalating, the correlation between movements in the price of copper and industrial commodities generally was positive and compelling ($r = .99$), such that each one point move on the index of industrial commodity prices was matched by a 0.7 per pound shift in copper prices. On an equivalency basis, the price of copper rose $1.62 for each one dollar rise in commodity prices.

In the years between 1974 and 1979 that positive correlation weakened ($r = .51$), and the accommodation of copper prices to other price movements was softer. A point shift in the index was associated with a less than 0.2¢ per pound corresponding shift in the price of copper, the equivalent of 44¢ per dollar of general price movement.

Since 1979 the correlation has been negative ($r = -.72$). Copper's price has tended to fall almost a quarter of a cent a pound with each point rise in the commodity price index. Expressed as equivalents, the relationship has been such that each one dollar rise in average price of commodities has included a 56¢ drop in the price of copper.

Table 6
U.S. Trade Balance in Commodity Copper

Year	1000 Metric Tons Contained Copper					
	Refined Copper			Concentrate & Scrap		
	Imports	Exports	Net Exports	Imports	Exports	Net Imports
1972	189.8	182.7	-7.1	233.8	85.0	148.8
1973	199.9	189.4	-10.5	225.7	152.6	73.1
1974	313.6	126.5	-187.1	294.1	183.4	110.7
1975	146.8	172.4	25.6	183.2	158.7	24.5
1976	384.1	113.1	-271.0	163.3	136.9	26.4
1977	394.0	52.7	-341.3	134.1	167.6	-33.5
1978	463.4	109.3	-354.1	154.1	212.3	-58.2
1979	217.9	80.5	-137.4	123.4	228.3	-104.9
1980	431.8	17.4	-414.4	88.5	312.7	-224.2
1981	359.3	28.1	-331.2	143.2	312.5	-169.3
1982	259.8	35.0	-224.8	258.9	346.1	-87.2
1983	486.4	87.5	-398.9	228.3	189.7	38.6
Smoothed Annual Shift			-31.7 (r= -.72)			-21.9(r= -.70)

The Firm

ASARCO, originally the American Smelting and Refining Co., was formed in 1899 by the consolidation of several U.S. metallurgical firms. It was the heyday of the giant trusts; and ASARCO, under Guggenheim sponsorship was apparently an effort to create the same sort of industry dominance in non-ferrous metals that Andrew Carnegie's U.S. Steel Co. had achieved in steel.

The world's largest non-ferrous metals firm at its birth, ASARCO used joint ventures and portfolio investment to extend its influence into metal fabricating and mining. In the process it established effective price leadership in U.S. markets for lead, zinc, and copper.

ASARCO's preeminence began to fade after the second World War, as changes in the economics of metals made toll and custom smelting a less commanding base. Integrated production--of copper in the American southwest, in Africa, in Latin America, and of lead in the Missouri lead belt--made the role of custom smelting increasingly marginal. Availability of feedstocks became relatively uncertain, and ability to dictate price was curtailed.

As a consequence, ASARCO has guided its investments over the last three decades in a manner designed to reposition its capital in conformity with the realities of contemporary metals markets. Participation in mining--initially abroad, and more currently in the U.S.--has gradually reduced dependance on custom smelting. The firm has withdrawn from its place in domestic metal fabricating. New smelter capacity has been brought on stream in mining areas and, one by one, the old tidewater smelters and refineries have been closed.

At this time ASARCO remains the world's largest custom smelting firm; but it is also a major presence in mining. In 1983 ASARCO--directly, and through its share of associates' production--accounted for 14% of free world mine output of silver, 8% of copper, 11% of lead, and 9% of zinc. The firm's assets include a lead smelter at East Helena, Montana, a lead refinery at Omaha, Nebraska, a lead smelter-refiner at Glover, Missouri, a zinc refinery at Corpus Christi, Texas, a Denver, Colorado, refiner of cadmium and high purity metals, copper smelters at Hayden, Arizona and El Paso, Texas, and a copper refinery at Amarillo, Texas. Its U.S. mining properties produce silver, copper, lead, zinc, gold, asbestos, coal, limestone, and aggregates. Through subsidiaries Federated Metals Corp., Lone Star Lead Construction Corp., and Federated Genco Ltd., ASARCO is active in scrap metals and recyling in both the U.S. and Canada.

ASARCO is engaged in foreign metals enterprises on three continents through affiliates. Mexico Desarrollo Industrial Minero SA, 34% owned, operates five Mexican metallurgical plants and eleven mines that produce copper, lead, zinc, silver, gold, coal, and fluorspar. Southern Peru Copper Corp, 52.3% owned, mines copper, silver, and molybdenum and operates a copper smelter. And ASARCO's 44% participation in MIM Holdings LTD. gives it an entree into Australian coal, copper, lead, zinc, silver, iron and nickel mining and a copper refinery, as well as English lead and silver refining and secondary lead production, a West German zinc refinery and zinc products plant.

The firm's financial record over the past decade is mediocre, mirroring all of the difficulties that other metals producers have encountered. Though operations, like those of all metals firms, were highly profitable in 1973 and 1974, dependance on toll business dampened ASARCO's participation in the profits of raw materials inflation. Metals firms generally were posting cash returns on investment in the area of 25%, and net cash returns on equity above 30% were not uncommon; but ASARCO's earning power was roughly ten percentage points lower.

In theory ASARCO's situation as a primarily custom smelting firm should have partially insulated it against the price level risk that depressed its competitors' earnings after 1974. In fact, ASARCO's reliance on custom smelting for a large portion of its revenues did not protect it from the ill fortunes of the industry. ASARCO mines did no better than others, while declining output of lead and copper cut into custom smelting revenues. Combined net incomes of the four years 1975 through 1978 was distinctly below that of the single year 1974. In 1977, largely as a consequence of writeoffs from abandonment of the Granduc Mine, ASARCO experienced its first deficit since the Great Depression. And while earning power recovered brilliantly in 1979 and 1980, the next three years brought a return to sub-standard profits, including a second deficit in six years in 1982.

ASARCO's poor operating experience in the last decade can not be ascribed entirely to the general ills that have plagued the non-ferrous metals industries. In part at least, it was the consequence of the implementation of definite management decisions involving major capital alterations that were intended to bolster long term profitability. Several low profit mines were abandoned, and a long range investment program that involved a substantial increase in indebtedness--from $134 million in 1974 to $490 million in 1983--was undertaken.

The principal element of the investment program was major alteration of copper production. In 1976 ASARCO entered into a joint venture with Anamax--held in equal shares by Anaconda and AMAX--to expand Arizona mining operations. Construction of a grass roots copper refinery at Amarillo, Texas allowed the consolidation of refinery operations previously divided among three tidewater sites (Perth Amboy, Baltimore, Tacoma), and the closure of the old plants. With the completion of the Amarillo plant, ASARCO embarked on a major alteration of its Hayden, Arizona, smelter. That project--including installation of an oxygen flash smelting furnace, augmentation of production capacity by 35,000 tons per year, and installation of state of the art air pollution controls--was completed in October 1983 and brought on stream the next month.

In sum, what has been done to the firm in the last ten years has changed it radically. Domestic mining has been strengthened, Copper smelting and refining capacity has been reduced and modernized. ASARCO has become smaller, more efficient, more fully integrated, less involved in foreign mining and international markets.

Table 7

ASARCO Simplified Financial Situation, 1974 - 1983

Millions of Dollars

	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
Total Assets	1329.7	1474.5	1543.7	1529.6	1622.6	1969.7	2044.8	2092.8	2153.1	2227.1
Current Liabilities	(244.2)	(173.8)	(163.5)	(197.8)	(215.5)	(403.8)	(278.4)	(383.0)	(432.5)	(403.2)
Total Investment	1085.5	1300.7	1390.2	1331.8	1407.1	1565.9	1766.4	1709.8	1720.6	1823.9
Long Term Debt	(133.6)	(358.0)	(414.3)	(406.7)	(352.7)	(306.0)	(277.6)	(388.1)	(481.6)	(400.1)
Net Worth	951.9	942.7	975.9	925.1	1054.4	1259.9	1488.8	1321.7	1239.0	13333.8
Net Income	130.4	25.4	42.3	(29.5)	49.5	259.1	237.3	50.0	(74.1)	58.3
Interest Expense	11.4	22.7	33.9	37.0	38.4	29.9	19.99	31.7	46.9	38.4
Non-Cash Expenses										
Depreciation	34.9	36.5	50.7	52.6	54.5	56.1	49.4	58.4	60.9	55.0
Write-offs	-	20.5	-	39.0	10.0	-	-	-	35.4	-
Deferred Taxes	NA	14.9	NA	5.4	22.3	57.7	NA	NA	(15.1)	16.1
Cash Return	176.7	120.0	126.9	74.5	174.7	402.8	306.6	140.1	54.0	147.8

Rates of Return

	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
Net Income/ Net Worth	.137	.027	.043	(.032)	.047	.206	.159	.038	(.060)	.044
Cash Income/ Investment	.163	.092	.091	.056	.124	.257	.174	.082	.031	.081
Net Cash/ Net Worth	.174	.103	.095	.041	.129	.296	.193	.082	.006	.082

The Plant

Built just after the turn of the century as a lead smelter and converted to copper smelting in 1912, ASARCO's Tacoma facility is the last of the nation's tidewater smelters.

With a charge capacity of about 400,000 tons a year and a production capacity of 100,000 tons of blister copper, the Tacoma smelter is adequately sized to function in contemporary metal markets. But its distance from raw materials sources put it at a distinct competitive disadvantage.

The smelter survived by finding a specialized operational niche, one that gave it for years a certain distance from, and advantage over, other plants.

From its first days as a copper smelter the Tacoma plant has had an association with Philippine copper mining. Between the two World Wars it was probably the principal source of smelting for all Philippine copper. And though ASARCO did not share in the ten-fold expansion of Philippine copper mining after World War II--growth was taken up by Japanese smelters--the Tacoma establishment continued to serve as the only outlet for the production of the great Lepanto Mine. Lepanto's annual output is substantial, but its ores contain such high concentrations of sulfur and arsenic that smelters other than the one at Tacoma have been unwilling to process them.

To supplement the concentrate supply from the Lepanto Mine the Tacoma smelter drew on similarly contaminated concentrates from the Northern Peru Mine. Together the two foreign sources accounted for a third to a half of Tacoma's feedstocks for many years. They were the principal reason that the obsolete facility remained operative, and they formed a uniquely profitable base for operations. For, though the cost of smelting their contaminated concentrates was high, their captive status made it possible for ASARCO to pass through to the mines the full cost of such processing, regardless of the general state of competition in custom smelting markets. Further, by recovering and selling arsenic contained in the concentrates, ASARCO secured for itself a source of incremental revenues.

Though the Lepanto and Northern Peru mines formed the Tacoma smelter's base, they did not in themselves constitute an adequate raw materials supply for a plant of its size. The largest single source of concentrates for some years has been Pennzoil's Duval Mine in Arizona. But Duval's high quality concentrates give ASARCO no market advantage--indeed, transportation costs to Tacoma put the smelters at a disadvantage in bidding for the Duval concentrates. To supplement charges available from the three principal suppliers, Tacoma had smelted scrap and ores and concentrates available from minor regional sources, and has reprocessed some of the wastes of lead smelters in Idaho and Montana and copper smelters in Montana and Nevada.

Its specialized role did not shield the Tacoma smelter from the recent vicissitudes of the world copper market. Smelter throughput has not approached the preferred operation rate since 1974, and has probably been in the area of 50% of capacity over the last five years. (Plant production records since 1980 have not been made available.) The consequence has been steady erosion of earning power of the facility, long term withdrawal of capital, and the realization of the long deferred decision to close the plant.

The definition of those conditions as they became evident in financial statements is attempted in Table 8. The table must be used with caution. No publically available data are available for years after 1980. ASARCO (like many firms) is intensely secretive about individual plant data. Thus the material supplied for public purposes has invariably been selected and aggregated for the particular purpose, lacks detail, and is undocumented. These data assembled from ASARCO public submissions may, then, be presumed to be accurate, but not necessarily correct; in that we have no knowledge of how the basic material was assembled, or what was left out. Still, they serve our purpose.

Table 8
Generalized Financial Statement For Tacoma Smelter

	1974	1975	1976	1977	1978	1979	1980
Inventories	81,715	58,656	59,785	70,610	32,816	51,031	35,541
Other Current Assets	4,309	7,718	7,703	4,741	7,127	7,917	10
Current Assets	86,024	66,374	67,488	75,351	39,943	58,948	35,551
Net Plant	32,855	32,679	30,659	31,783	32,572	32,132	25,285
Other Assets	181	24	126	58	-	741	89
Total Assets	119,060	99,077	98,273	107,192	72,515	91,821	60,925
Current Liabilities	33,343	31,588	26,220	28,962	23,116	73,674	30,833
Total Investment	85,717	67,489	72,053	78,230	49,399	18,147	30,092
L. T. Debt*	20,037	12,913	15,524	16,307	6,961	8,152	11,583
Net Worth	65,680	54,576	56,529	61,923	42,438	9,995	18,509
Net Income	1,732	1,833	2,842	1,607	103	432	(5,324)
Noncash Charges	2,000E	2,059	2,516	2,501	2,444	2,424	8,959
Interest	3,056	617	885	912	-	-	22
Deferred Taxes	1,457	1,782	1,230	150	55	922	1,732
Cash Return	8,245	6,291	7,473	5,170	2,602	3,778	5,389
Cash/Investment	.096	.093	.104	.066	.053	.208	.179
Net Cash	5,189	5,674	6,588	4,258	2,602	3,778	5,389
Net/Net Worth	.079	.104	.117	.069	.061	.378	.291

* includes tax deferrals & other long term liabilities

What they reveal is a progressive reduction in cash return from operations in the late 1970's. (Though tax effects of write-offs and the transfer of metal inventories with closure of the refinery produced non-recurring cash benefits in 1979 and 1980). Return on invested capital was clearly substandard through most of the period. Perhaps more meaningful, since the bulk of the capital was tied up in inventory, cash rate of return on fixed capital dropped irregularly but persistently. Management, clearly convinced of the marginal status of the plant even in the period of raw materials inflation, made no meaningful additions to fixed capital over the period, total additions to net plant failing to cover cumulative depreciation, even before the write-off of the refinery.

The circumstances that made the failing profitability of the Tacoma plant terminate in closure go beyond the general weakness of copper markets. Fundamental changes in the smelter's operating environment and the management philosophy of the firm were involved in the decision.

First of the series of assaults on the viability of the Tacoma smelter was the closure of the Northern Peru Mine in 1975. With the mine played out, the plant lost about an eighth of its normal supply of feedstock. More important, that supply was a portion of its captive base, and could only be replaced by actively bidding against lower cost and more modern smelters closer to any potential source of supply. In effect, Tacoma had lost irretrievably access to a significant portion of its raw material needs.

The next year a consortium of Philippine mining firms, the Philippine Government, and several Japanese trading firms announced plans to construct a Philippine copper smelter. Delayed by financial considerations and a weak copper market, the plant was slow to come on line; but it was completed and began producing in the spring of 1983. The complex includes an arsenic roaster, so is capable of processing the output of the Lepanto Mine.

The Philippine smelter unquestionably sealed the doom of the Tacoma Plant. The importance of the Lepanto Mine to Tacoma may be gathered from the distribution of the smelter's feedstocks in production depressed 1979 (c.f. Table 9), when 26% of its smelter charge originated in the Philippines, 52% in Arizona. With a quarter of its raw materials eliminated--the quarter, moreover, for which it had a production cost advantage--and with other smelters holding a transportation cost advantage in the case of at least half of its raw materials, the Tacoma smelter had no reason to exist.

ASARCO corporate policy, certainly influenced in part by knowledge of the prospective loss of Northern Peru and Lepanto concentrates, adopted a basic shift in the firm's copper activities during the 1970's, one that dictated abandonment of the Tacoma operation. The changes are revealed, in stages, in the series of Chairman's letters to stockholders in the annual reports of the late 1970's and early 1980's.

Table 9
Origin of Raw Material for the Tacoma Smelter, 1979

Origin	Material Type	Short Tons	Transportation Method
United States			
Alaska	Concentrates, Ore	43	Ship
Arizona	Concentrates, Ore	120,324	Rail
California	Concentrates, Ore	3,981	Rail
Colorado	Concentrates, Ore	10,241	Rail
Idaho	Concentrates, Ore, Pyrites	9,361	Rail
Michigan	Concentrates, Ore	302	Rail
Nevada	Concentrates, Precipitates	995	Rail or Truck
Oregon	Concentrates, Ore	1,674	Rail or Truck
		146,921	
Foreign			
Chile	Concentrates, Ore	2,908	Ship
Canada	Concentrates, Ore Precipitates	3,321	Barge, Rail, or Truck
Peru	Concentrates, Ore Blister	5,197	Ship
Philippine Islands	Concentrates, Ore	60,802	Ship
		72,228	
Other Smelter			
Anaconda	Flue Dust Sludge	1,972	Rail
ASARCO Plants			
East Helena	Matte, Speiss	3,792	Rail
Amarillo	Cathodes, Sludge	343	Rail
Secondary	Scrap	7,667	Rail or Truck
Total All Sources		232,923	

Data from: Labbe 1980 reported in variance application to PSAPCA

Investment in domestic mining and domestic exploration activities was stepped up, foreign mining ventures were deemphasized.

Construction began in the mid 1970's of a huge, state of the art copper refinery at Amarillo, Texas, one that afforded equal access to smelters in the Southwestern states and, through Gulf Coast ports, to potential foreign customers. At its completion, ASARCO closed refineries at Baltimore and Perth Amboy immediately. Within a year, the Tacoma refinery was closed, consolidating the firm's copper refining in a single plant. Significantly for the future of the Tacoma smelter, the capacity of the single refinery was roughly 50,000 tons per year less than the aggregate capacity of the plants it superseded and less than ASARCO's total smelting capacity.

Upon the completion of the refinery the firm entered the second phase of modernizing its copper manufacturing plant. Between 1979 and 1983 ASARCO extensively modified its Hayden smelter, installing oxygen flash smelting and adding 50,000 tons per year to its capacity. The Tacoma smelter was kept in operation during the reconstruction at Hayden; however after the Hayden smelter came on-line, the limited availability of Lepanto ore was the only conceivable reason for continuing operation of the smelter at Tacoma.

In the spring of 1984 the Hayden improvements were completed. Within six months the intention to close the Tacoma smelter was announced. ASARCO has made it clear that its future copper production activities would be based on tight control of variable costs through reduction of employment and energy inputs, would be more concentrated geographically and represent a closer approach to integration, and would stress tighter control of raw material supplies and market outlets by deemphasis of foreign operations.

Environmental Regulation

The influence of environmental regulation on the resolution of the fate of the Tacoma smelter has been insignificant. That conclusion may be difficult to credit in view of the substantial sums that regulatory agencies--OSHA, EPA, PSAPCA--have demanded that ASARCO invest in its Tacoma plant in order to comply with their laws. It certainly does not seem to conform to the fact of ten years of intense, often acrimonious, negotiation and litigation between ASARCO and those agencies. But in the light of hindsight, it is plain that ASARCO was never effectively inconvenienced by the regulations, and that regulatory requirements played no meaningful part in the closure decision.

EPA has estimated that it would require an investment of about $65 million of 1980 purchasing power to bring the Tacoma smelter into conformance with State standards for SO_x and EPA and OSHA standards for arsenic emissions. ASARCO management put the sum $100 million higher. The estimates may not be in disagreement. EPA's number refers to the cost of specific engineering constructs required to achieve a limited purpose. ASARCO advanced its number in the impeccable financial logic that if it were to make the capital commitment required by the regulators, it would be necessary to rework the total smelter production system to produce a factory efficient enough to justify the investment. (ASARCO's estimate, in fact, was the amount actually devoted to modernizing the Hayden smelter--including installation of state of the art pollution controls.)

It was probably clear to ASARCO's managers no later than 1976 that there were considerable uncertainties associated with investments of the indicated magnitude at Tacoma. ASARCO's long range plan called for transferring production from Baltimore, Perth Amboy and Tacoma to Amarillo and Hayden-- that is, from the places where raw materials had been available in the past to the places where they would become available. It needed Tacoma to sustain production until that capital deployment had been completed. But after the loss of Lepanto feedstocks, the Tacoma plant was redundant.

And so the firm played out a decade long process of procedural delay, raising the real prospect of plant closure repeatedly, but effectively postponing the necessity to install capital that would have to be written off at a loss. ASARCO eventually achieved compliance with the environmental laws--but it did so in Arizona, not in Tacoma.

A Note on Sources

With the exception of limited financial statements (summarized in Table 8) provided directly by ASARCO, the paper was prepared from secondary sources.

Moody's Industrial Manual for years 1974 through 1983 was the source of most material about the firm.

U.S. Bureau of Mines Minerals Yearbook for years 1964, 1968 and 1974 through 1983 provided the bulk of background information about the industry. Various issues of the Survey of Current Business for all years since 1974 were the source of information on price, production and raw materials sources.

Dames & Moore, September 1981 "Environmental Impact Statement" on the question of a waiver from PSAPCA SO_2 controls; A. D. Little "Economic Impact of Incremental Pollution Control at ASARCO's Tacoma Smelter", July, 1977, with various unpublished working papers; and the docket for New Source Performance Standards for Arsenic Producers provided specific information on the Tacoma plant.

Useful background was provided by A. D. Little, "Economic Impact of Environmental Regulations on the U.S. Copper Industry", January, 1978; J.M. Heineke "Demand for Refined Lead", in the Review of Economics and Statistics (1976?); and Janson, Maclean and Wright Financial Reporting and Tax Practices in Non-Ferrous Mining.

The analyst has actively monitored the status of the Tacoma Smelter over the last twelve years as the Seattle Regional Economist for EPA. He served on the Administrator's Smelter Task Force to devise the measures to implement specific economic hardship legislation to assist the non-ferrous smelting industry. With D. Hale and F. Pisano he developed and interpreted a set of computerized price, quantity, raw material source scenarios to test the capacity of the Tacoma smelter to accommodate to OSHA and EPA regulations.