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Compliments of

A S A R C O   INCORPORATED

TACOMA PLANT

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ASARCO

L. W. LINDQUIST
Manager

Enclosed you will find information about the Tacoma Plant of ASARCO Incorporated, formerly AMERICAN SMELTING AND REFINING COMPANY. Our new name was official on April 23, 1976. The statistics, resume' of the plant's history, etc. might interest you in regard to the plant's total value to the West Coast

There are about 600 persons employed at the Tacoma Plant when we are in full operation. We operate 24 hours a day, seven days a week. The plant covers approximately 95 acres of land.

About 300 tons of anode copper is produced in a day at Tacoma when we are in full operation. This material is shipped to ASARCO's Copper Refinery in Amarillo, Texas.

There is a film at the Library of the Tacoma Public Schools called "THE CHALLENGE IN THE EARTH" which was produced by ASARCO for our 75th Anniversary in the fall of 1974. This film is available and is being used extensively through the schools for environmental projects.

ASARCO Incorporated P.O. Box 1677 Tacoma, Wa 98401 (206) 759-3551

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ASARCO

** TACOMA PLANT **

Asarco's efforts and accomplishments in the improvement of the quality of the environment in the vicinity of the Tacoma Smelter predate the public and governmental concern of the past few years.

A tall stack was built in 1917 to provide greater dispersion of emissions. Also in that year, electrostatic precipitators were installed in the flues leading to the stack for the purpose of reducing to a great degree the amount of particulates being emitted from the stack. The efficiency of the precipitators has been increased over the years as improved technology became available. At present, over 99.5% of the particulate is removed from the stack gases.

A sulfuric acid plant was added in 1948. The purpose of this facility is to reduce the amount of sulfur dioxide being emitted. Until recent improvements were made, this acid plant removed about 17% of the sulfur dioxide generated in the smelting process.

Our current comprehensive control program began in 1969 with the establishment of a meteorologically based curtailment program. This was followed by construction of a liquid sulfur dioxide plant and increased capacity of the acid plant. These facilities now remove about 45% of the sulfur dioxide produced which would otherwise be emitted from the stack. In addition to these major efforts in sulfur dioxide control, several other steps have been taken to reduce particulate emissions, especially those of arsenic.

Since 1969, Asarco has spent about 32 million dollars on air and water pollution control at its Tacoma Plant. Enclosed is a graphic display of these efforts in air pollution control.

As you probably know, the Board of Directors of the Puget Sound Air Pollution Control Agency on February 19, 1976, granted Asarco a variance for several sources of emissions for differing periods of time. This variance concerns particulate emissions, especially those involving arsenic, and the emission of sulfur dioxide. The portion of the variance pertaining to sulfur dioxide expires on December 31, 1980. The portions pertaining primarily to arsenic emissions cover periods of 24 and 32 months.

Various legal challenges of the five-year variance resulted in a determination by the State Supreme Court in December 1979 to remand the variance request to the Puget Sound Air Pollution Control Agency for preparation of an Environmental Impact Statement. This is currently being done.

As a condition to the variance, Asarco has committed 7.0 million dollars for the installation of facilities to increase the control of particulate emissions from the main stack and other emission points. This sum represents five years of plant profits based on the average annual earnings over the past ten years.

Asarco also agreed to the following:

Continue operation of its meteorologically based curtailment program.

Subsequently expand the sulfur dioxide and particulate monitoring programs.

Support and conduct several studies concerning possible health effects of the smelter emissions.

Enclosed is more detailed outline of pollution control steps to be taken over the next five years.

The refining facilities were suspended January 26, 1979. The suspension came after two years of severely reduced copper refining operations due to the lack of an adequate supply of raw material and dramatic cost increases, resulting in part from excessively costly environmental requirements. The refinery, which began operation in 1913, at times produced as much as 10 percent of the U. S. supply of refined copper.

** ASARCO PROPOSAL **

On Friday, December 5, 1975, Asarco submitted to the Puget Sound Air Pollution Control Agency (PSAPCA) a request for variance from that Agency's regulations relating to visual, particulate and arsenic emissions, as well as sulfur dioxide emissions. Along with the request for variance, the company has submitted a substantial pollution control program.

The pollution control program submitted to PSAPCA has as its goals two major objectives:

1. Bring the smelter into compliance with PSAPCA's regulations.

2. Improve working conditions of Asarco employees in Tacoma.

The key to the proposed Asarco pollution control program is the installation of a 100,000-cubic-foot baghouse to capture and clean gases from the roaster operation. The baghouse will reduce particulate emissions from that source by 50%.

With the installation of the baghouse, two of the electrostatic precipitators will be used to clean gases from the reverberatory furnace instead of the one which is presently used. Such a diversion of gases will increase particulate capture from the reverberatory furnace by another 50%.

Additionally, a single electrostatic precipitator will be made available to clean gases from the three anode furnaces, completely eliminating emissions from the anode furnace stacks.

Although not part of Asarco's variance request, the company is also installing a 38,000-cubic-foot per minute baghouse on the arsenic plant. The baghouse will further reduce arsenical particulates emitted from the smelter's main stack.

Completion of the various parts of Asarco's pollution control programs is expected to stretch out over the next three years. The time frame for the requested variances ranges from 24 months to five years.

In asking for variance from PSAPCA's sulfur dioxide emissions standard, Asarco pledged to continue its meteorological program, recognized nationally as the most advanced of its type.

Increased capture of sulfur oxides by means of an electric smelter, however, has been ruled out by the company. It is simply not economically possible.

* * * * *

** ADVANTAGES TO EMPLOYEES AND SURROUNDING COMMUNITY **

While the pollution control program submitted to PSAPCA obviously benefits the surrounding community through its reduction of emissions from the main stack and low level sources, of equal significance is the improvement of air within the plant as well as outside of the plant resulting from the proposed baghouse system.

The automatically controlled draft on the roasters will eliminate fugitive emissions from the roasters. The large brick flue now in use at the discharge end of the roasters will be eliminated with the installation of the roaster baghouse. Hence, the dirty job of cleaning and handling dust deposited in the flues and the transfer of such dust through the plant will no longer be necessary, again reducing arsenic emissions in the plant and improving ambient air both inside and outside the plant.

** ASARCO POSITION **

Asarco feels it has made great strides in its pollution control program over the years. It will continue to do so as long as the smelter is allowed to remain in operation. The company has submitted its pollution control package to PSAPCA in good faith, despite impending OSHA regulations.

The cost of Asarco's proposed pollution controls is seven million dollars to be spent over the next three years. That figure represents approximately five times the smelter's average annual earnings for the past ten years. Economically, Asarco can do no more than what it has proposed to PSAPCA. It is Asarco's hope that PSAPCA will weigh what the company has done in the past toward pollution controls and what it intends to do in light of the smelter's financial capability.

Asarco estimates that by 1980, when all of the smelter's present and proposed pollution control devices are in operation, total emissions from the main stack, including arsenic emissions, will be reduced approximately 90% from 1971 levels. Additionally, low level arsenic emissions will be reduced by 80% over the same time period.

The strides that have been made, coupled with further progress represented by the pollution control program submitted to PSAPCA, is the basis of Asarco's request for variance. For that reason, it is particularly important for each employee to know what gains have and will be made. Attached are graphic illustrations indicating progress from 1971 through 1980, for your inspection.

* * * * *

Reduction of Suspended Particulate Emissions

T.P.D. (TONS PER DAY)

IN STACK

Reduction of

89% Arsenic Trioxide

90% Total Particulate Emissions

By 1978

1971
1.39 Arsenic Trioxide
2.66 Total (TPD)

1975
0.29 Arsenic Trioxide
0.55 Total (TPD)

1978
0.15 Arsenic Trioxide
0.27 Total (TPD)

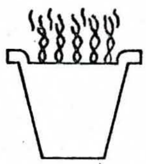
ANODE FURNACES

Reduction of

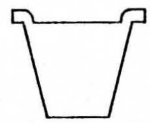
100% Arsenic Trioxide

100% Total Particulate Emissions

By 1979



1975
0.08 Arsenic Trioxide
0.42 Total (TPD)



1979
0 Arsenic Trioxide
0 Total (TPD)

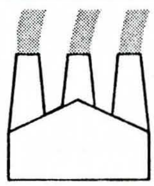
CONVERTER BUILDING

Reduction of

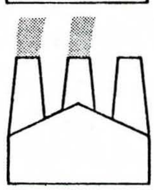
50% Arsenic Trioxide

28% Total Particulate Emissions

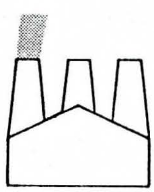
By 1977



1971
Emissions Were Not Measured



1975
0.04 Arsenic Trioxide
0.68 Total (TPD)



1977
0.02 Arsenic Trioxide
0.49 Total (TPD)

ALL LOW-LEVEL AREAS

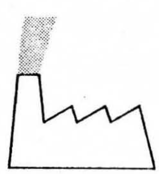
Includes Anode Furnaces and Converter Building

Reduction of

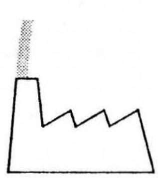
80% Arsenic Trioxide

64% Total Particulate Emissions

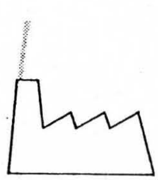
By 1979



1971
0.81 Arsenic Trioxide
3.52 Total (TPD)



1975
0.25 Arsenic Trioxide
1.86 Total (TPD)



1979
0.16 Arsenic Trioxide
1.25 Total

** POLLUTION CONTROL FACILITIES **

COTTRELL ELECTROSTATIC PRECIPITATORS

First installed in 1915 for removal of particulate matter in the smoke stream. This installation has been modernized many times over the years and is 99.5% efficient.

SULPHURIC ACID PLANT

Built in 1948 at a cost of $2,500,000 which produces 100 tons of acid per day removing 17% of process sulfur.

LIQUID SULFUR DIOXIDE PLANT

Built in 1974 at a cost of over $18,000,000. This plant is producing more sulfur dioxide gas, compressed to a liquid form at a rate of 150 tons per day, removing 45-50% of the process sulfur.

SEWERAGE COLLECTING SYSTEM

Constructed in 1971 at a cost of $300,000 was tied into City of Tacoma's system when the primary treatment plant on Ruston Way was completed.

PROCESS WATER RECIRCULATION SYSTEM

Built in 1974 at a cost of $1,700,000. This was designed to recyle all process water to prevent discharge into Puget Sound.

COTTRELL DUST HANDLING SYSTEM

Installed in 1975 at a cost of over $780,000.

GODFREY ROASTERS AND METALLIC ARSENIC BAGHOUSE

Installed in 1976 for processing gases at an approximate cost of $334,000.

HERRESHOFF ROASTER BAGHOUSE

Installed in 1978 for processing roaster gases at a cost of $5,000,000.

ANODE EMISSION CONTROL SYSTEM

Installed in 1979 for processing all anode gases at a cost of $1,200,000.

It is Asarco's goal to attain the highest degree of pollution capturing facilities possible. Toward this end, between 28 and 30 million dollars have been and will be spent through the end of 1979. Our construction and modernization program has been geared to compliance with the Clean Air Act of 1971 and the Occupational Safety and Health Administration Act of 1978.

Following is a list of projects completed as of 1979, plus a further list of projects to be completed by the end of 1980. The health and welfare of our employees is our chief concern, and much has been accomplished in the past 10 years in this area.

Pollution Control Projects

HERRESHOFF ROASTER BAGHOUSE SYSTEM

METEOROLOGICAL CONTROL SYSTEM EXPANSION

LUNCHROOMS, CHANGEROOM, CLEANROOMS:

- Boiler Room
- Reverberatory Department
- Converter Department
- Main Cottrell Department
- Steel Shop
- Main Changehouse and Lunchroom
- Metallic Arsenic Plant Operating Room
- Arsenic Blender Control Room
- Roaster Scalehouse Clean Area
- Arsenic Plant Clean Area

VENTILATION SYSTEMS:

- Converter Crane Cabs - Two
- Arsenic Kitchen Drag Conveyor
- Machine Shop
- Larry Car at Reverberatory Department

ANODE DEPARTMENT EMISSION CONTROL

ROASTER PLANT VACUUM SYSTEM

GODFREY CALCINE CONVEYING SYSTEM ENCLOSURE

RESPIRATOR CLEANING AND TESTING STATION

PLANT LAUNDRY MODIFICATION

ACID SPILL CONTAINMENT FACILITIES

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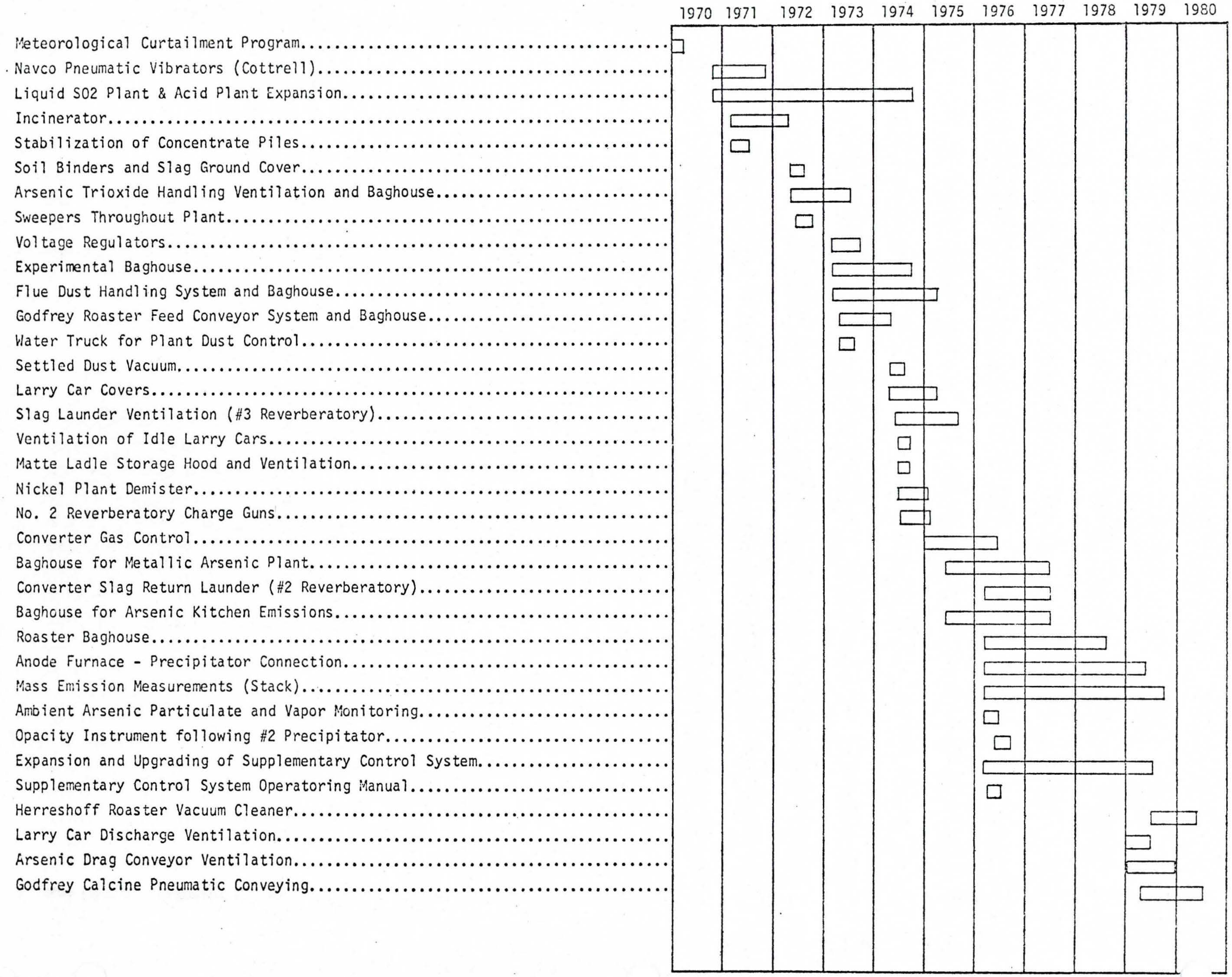
ASARCO Incorporated
TACOMA PLANT AIR POLLUTION CONTROL PROJECTS



**ASARCO INTERMITTENT CONTROL SYSTEM **

The Intermittent Control System is staffed by six meteorologists and one system analyst/instrument technician. The Emission Control Center is manned continuously.

In order to meet the stringent local ambient sulfur dioxide standards of low concentrations for short periods of time, the control program is normally a sequence of events which follow a daily local weather pattern. The normal day begins with a surface-based, relatively stable layer of air which may or may not contain the smelter plume. The problem is to anticipate the degree and altitude to which this layer will become unstable, and the time and degree smelting operations must be curtailed to maintain ground level sulfur dioxide concentrations below ambient standards if the mixing reaches the plume.

This involves forecasting the surface temperature at which the mixing will reach the plume, the time this temperature will occur, wind speeds at the surface and aloft at the onset of mixing, and the effect that the mixing will have on the winds near the surface and through the layer containing the plume. Of particular interest as the diurnal heating progresses is the movement inland of a series of cooler, shallow air masses from over the local water surfaces to the east, north and west, and their influence on the plume. As the surface heating and resulting mixing progresses, curtailment of production is further adjusted to meet anticipated and actual atmospheric conditions.

The intermediate phase of the daily program is to predict the degree of mixing, surface and plume level wind flow, and degree of curtailment required as the layer containing the plume approaches neutral stability. Critical meteorological aspects of this phase are turbulence caused by wind shear and stability fluctuation resulting from the influence of cooler marine air masses.

The final forecast problem involves the progression of evening cooling and the establishment again of a relatively stable atmosphere below the plume.

Variations in the normal daily cycle of atmospheric mixing must also be anticipated and considered in curtailment decisions. These variations occur as the result of changes in the regional or synoptic meteorological situation which affect local stability and wind flow.

Special attention is given to forecasting and recognizing conditions which indicate the potential for air stagnation episodes. During such an episode, curtailment action is taken as required to prevent an excessive accumulation of sulfur dioxide. As required by the Department of Ecology, State of Washington, specified minimum curtailment levels must be maintained during each stage of an officially declared air pollution episode. Additional curtailment action is taken as indicated by anticipated and actual conditions.

The initial daily curtailment forecast is made by utilizing all data available and is generally influenced by maps and forecasts received by facsimile recorder, but the primary bases are upper air forecasts and soundings received by teletype, weather and plume observations, analysis of a surface weather map encompassing Washington, Oregon and southern British Columbia and plotted with data received by teletype from all reporting stations within the map area, and continuous acoustic sounding.

Forecast updating is continuous throughout the day. The meteorological information used gradually shifts from that of a relatively broad scale to information received from the local monitoring systems, sky and plume observations, local upper air temperture and wind soundings and continuous acoustic sounding. Additional surface weather maps are plotted as necessary but at least every three hours.

In addition to emissions from the smelter stack, the Control Program addresses the problem of reducing the impact of fugitive emissions on the air quality in the Smelter's area of responsibility. Such emissions can be the result of both normal smelter operations and upset conditions. This portion of the Control Program consists of non-meteorological and a meteorological component. The non-meteorological component is comprised of the requirements that the SCS meteorologist have an adequate knowledge of smelter operations (especially those which are a potential source of fugitive emissions under both normal and upset conditions), be fully informed concerning the current and projected status of smelter operations and be watchful for visible emissions.

The meteorological component involves the measurement, interpretation and forecasting of the meteorological conditions in the relatively shallow layer of the atmosphere in which the fugitive emissions are contained. This layer may extend to the height of the stack plume but generally does not. The stable conditions conducive to air quality problems resulting from fugitive emissions, and especially the accumulation of these emissions, are not a threat to the plume. Meteorological elements considered are measured temperature differences (both horizontal and vertical), local wind speeds and directions, indications of low-altitude temperature discontinuities and wind shear and sky conditions as observed by the meteorolog

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** FACT SHEET ON ASARCO's TACOMA COPPER SMELTER **

DESCRIPTION OF THE PLANT

Asarco's Tacoma Copper Smelter is located at Ruston on Puget Sound adjacent to the northwest boundary of Tacoma, Washington. The first smelter on the site commenced operation in 1889 and operations have been continuous since that date.

The plant provides about 7% of the domestic smelting capacity for copper-bearing raw materials. Its annual production currently is about as follows:

Anode Copper.	72,000 Tons
Arsenic Trioxide.	8,400 Tons
Metallic Arsenic.	750,000 Pounds
Tellurium	50,000 Pounds
Selenium.	50,000 Pounds
Gold.	110,000 Ounces
Silver.	7,000,000 Ounces
Sulfuric Acid	30,000 Tons
Liquid Sulfur Dioxide . . .	32,500 Tons

The arsenic trioxide, metallic arsenic, sulfuric acid and liquid sulfur dioxide are finished products sold directly to industry. The other products listed above are contained in anodes. All anodes from our plant are shipped to Amarillo, Texas, where they are refined and delivered to industry.

The Tacoma Plant includes the only facility in the United States for production of arsenic, which is widely used in agriculture (as pesticides, fungicides, and herbicides), by the glass industry and in metallurgy.

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Sources of Raw Materials

In 1979, 40% of the Tacoma Plant's intake in terms of copper content was derived from imported ores and concentrates, principally from the Philippines, Canada and Peru. The balance came from mines in the States of Arizona, California, Colorado, Idaho, Nevada and Washington. Copper scrap and precious metal scrap receipts are generated primarily in the Pacific Coast States.

In 1979, about 70% of Tacoma's copper intake was contained in materials received from mines and plants owned by Asarco and from by-products and semi-processed products from plants in Montana, Texas, and Arizona. The balance of 30% came from mines and plants owned by others in the Southwest United States and the Philippines.

Importance of the Plant in the Nonferrous Metals Industry

The Tacoma Plant is unique in the domestic nonferrous industry. It is the only plant in the United States, and one of the few in the world, which is equipped to smelt copper-bearing ores, residues and by-products which contain substantial amounts of impurities. Such impurities are not consistent with the metallurgy practiced at most plants.

The Tacoma Plant is an integral part of the interrelated nonferrous smelting and refining complex operated by ASARCO Incorporated.

Because Asarco has copper smelters and refineries, lead smelters and refineries and zinc plants, together with ancillary by-product processing and producing installations, it is able to treat all kinds of metallurgically difficult products, by-products and residues.

All processing plants in the nonferrous metal industry produce valuable products and/or by-products containing metals other than the one of primary concern, and Asarco has been a traditional outlet for such material that could not be treated at the originating facility.

Also because of this complex of facilities, and long acquired knowhow and expertise, Asarco has been able to provide a market for metallurgically difficult nonferrous ores and concentrates. For many of these industry-generated by-products and refractory ores and concentrates, there is no economically feasible alternative processing facility in the world.

The Tacoma Plant is part of this metallurgical complex and its loss would, therefore, affect not only the mines which ship copper concentrates directly to Tacoma, but it would have an adverse impact on the nonferrous metal industry as a whole, including silver, lead and zinc mines and plants and other copper plants owned both by Asarco and others.

TACOMA IS A SERVICE PLANT

In 1975, 36% of its intake consisted of raw materials purchased from and processed for other.

Since it is a service plant, its only income is from the smelting and refining charges paid by the mines and other nonferrous plants shipping their products to the smelter. Ore purchase contracts, which are standard in the industry, provide for payment on the basis of the market value of the contained metals less a service charge for smelting, refining, and (except with respect to toll contracts) marketing the refined metal and financing the material during processing.

Since the only income to the plant comes from these service charges, increased costs relating to the construction and operation of pollution control facilities must be paid by the mines and plants shipping to Tacoma.

UNION AFFILIATIONS

Employees of the plant are represented by two unions:

The production workers are represented by United Steelworkers of America, AFL-CIO, Local No. 25.

Office and Chemical Laboratory employees are members of Automotive and Special Services Union, Local No. 461 (Teamsters Union).

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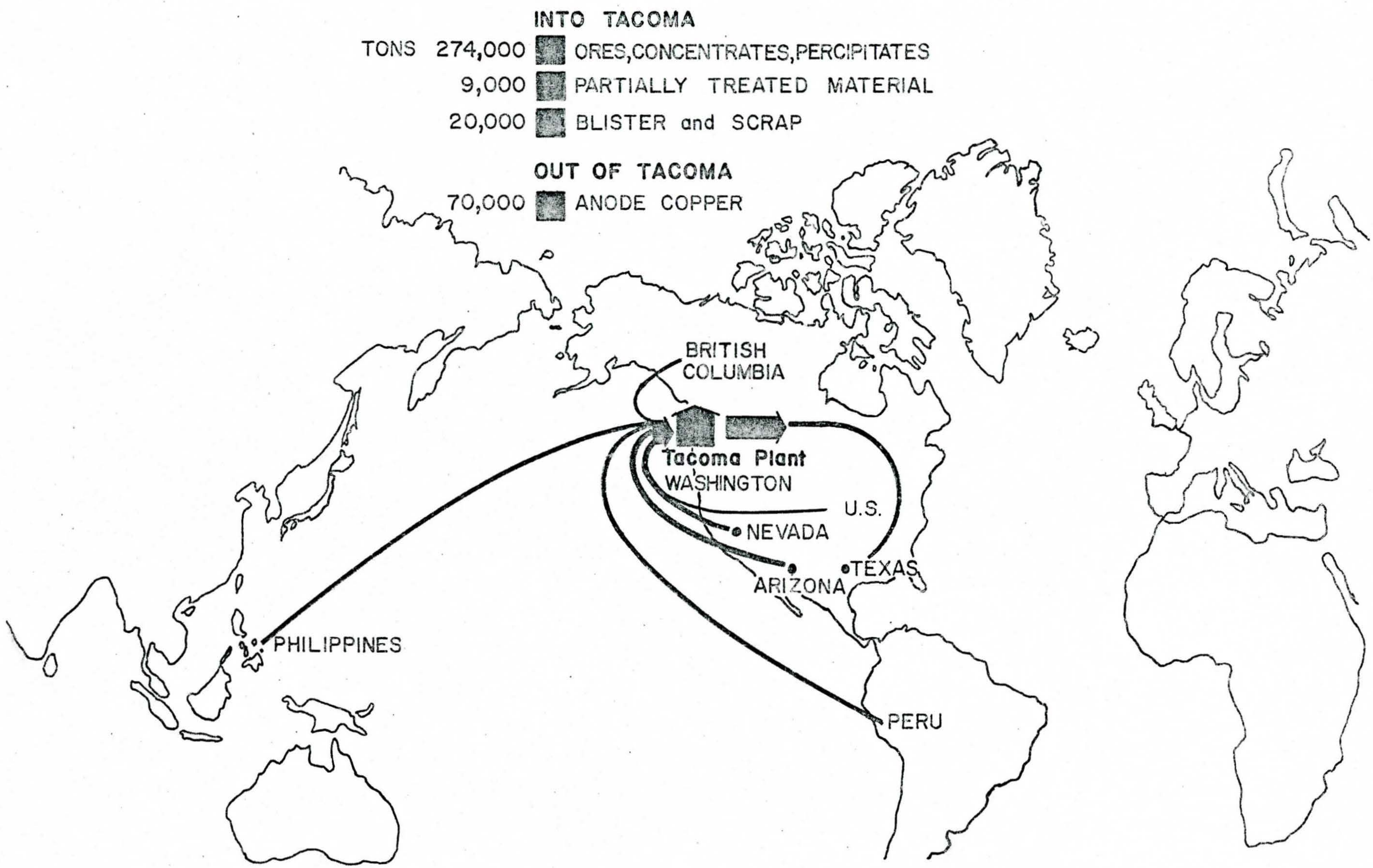
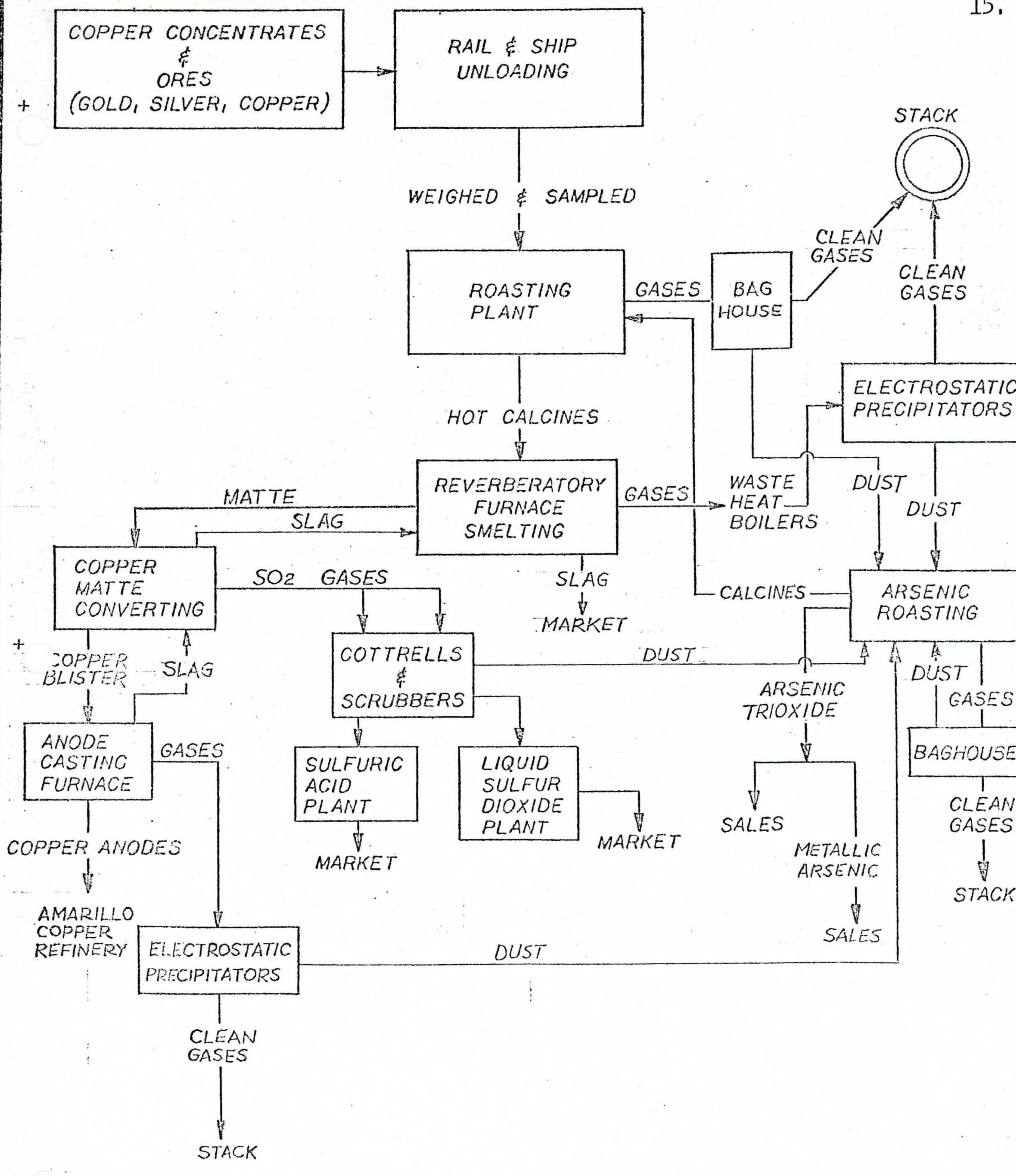
Tacoma Plant / Shipments (1980)





DRAWN GRISSOM	10-10-77	TACOMA PLANT	ASARCO Incorporated TACOMA PLANT
TRACED		FLOW DIAGRAM	
CHECKED		⚠1 REVISED 2-19-80	SCALE
APPR.		⚠2 REVISED 7-24-80	12710-L

** HISTORY OF ASARCO TACOMA SMELTER **

(For the Period 1890 - 1965)

Commencement Bay is a U-shaped section of lower Puget Sound. It is an excellent harbor deep enough for ocean-going vessels and is well sheltered. Most of you know the geography of the Sound, but at a risk of boring you, let's take a quick look. The southwest shore of Commencement Bay is six miles in length as compared with the northeast leg, which is three miles long. The Tacoma Smelter is situated one mile south of the tip of the southwest leg of the "U". Farther north and occupying the whole point of land is Point Defiance Park, noted for its beaches, boat facilities, flowers, trees and shrubs.

Access to the seven seas has been a potent factor in the plant's development. Some of the men who chose its site may have foreseen that seaborne cargoes of ores and concentrates, produced at widely separated operations, would be discharged at this plant's wharves for recovery of the contained metals. However, they could have hardly foreseen the number of faraway, foreign places from which the Tacoma Plant would receive its raw materials.

Ores and concentrates come into Commencement Bay from Eastern Canada, South American, Australia, the Philippines, the Isle of Cyprus, and Cuba. You can get the complete list in the index of the school geographies. The intake by rail includes tonnage from all the coast states, California, Utah, Idaho, our own state, Montana, and our neighbor to the north, the Provice of British Columbia.

In the early 1880's the Northern Pacific Railroad began building westward from St. Paul toward tidewater in the Puget Sound area. The Coeur d'Alene Mines were being developed, as were those of the Republic District. Prospecting in the Cascade Range was in full swing.

In 1887 we find references in the press to a contemplated "large smelting works" to be built in Tacoma by a millionaire from St. Paul, Dennis Ryan. W. R. Rust, an ore buyer from Aspec, Colorado, looked over the possibilities that year. He evidently decided it was too soon to start such a business, for he returned to Aspen again. He came back to stay in Tacoma two years later. In the meantime, Ryan organized his company, and construction of a plant for smelting lead ores from the Coeur d'Alene Mines and irony ores from Alaska was accomplished.

We find in the Tacoma News in September, 1889, the following item:

"The new Ryan Smelter is now ready for business. Everything about the smelter is in fine condition, and fires were lighted yesterday for the first time. Operations will begin inside of thirty days. Dennis Ryan of St. Paul, who is mainly interested in the plant, is expected to arrive in this city within ten days."

These must have been fires to dry the brickwork, because no actual operations or production were noted in the papers in that year. Later, in 1889, W. R. Rust returned and affiliated with Ryan's Tacoma Milling and Smelting Company. He also recognized the possibility of bringing together the high lead ores of the Coeur d'Alenes and the iron flux ore from the Alaska Treadwell Mine at Juneau, Alaska. Coke was available within thirty miles of Tacoma, and limerock from the San Juan Islands could be transported cheaply by scow.

The first receipts of the new plant were 132 tons of ore from a gold mine. On September 15, 1890, the charges were made to the lead plant. On September 27, 1890, the Steamer "Queen" loaded the first shipment of lead bullion for San Francisco. It consisted of 23 tons of lead bars valued at $9,971. Fifty men were employed at the works, and they produced five tons of lead per day.

During the next decade, the operation was maintained on an even keel. It survived the financial disturbances in 1892 and 1897. In that time, two roasters and bunkers for them were constructed. A briquetting machine and sheltering building were erected. Three new blast furnaces and an electric power installation were included in new improvements.

We now reach a point in the Tacoma Smelter's history where American Smelting and Refining Company enters the picture. Henry H. Rogers and his associate organized Asarco in April, 1899, in New Jersey. At that time, its holdings included sixteen primary smelters, eighteen refineries, and a number of small relatively unimportant mining properties. Included in this original group were five smelters which are still operating. Plants at El Paso, East Helena, Omaha, the Globe Plant at Denver and the Arkansas Valley Plant at Leadville make up this list. It is rather unusual that these smelters have kept operating at their original sites for such a long period.

The first president of Asarco was E. W. Nash, his executive committee including Henry H. Rogers, John G. Moore, Leonard Lewisohn, and Barton Sewell. In the Company's infancy it was beset by lack of money. The executive committee, seeking ways and means of cutting costs, consolidated several operations and shut down others. Competition was very keen.

Among their competitors was the firm of Meyer Guggenheim and Sons, who were expanding their smelting and refining business. Their ventures were sound and profitable. In March of 1900 the Board of the American Smelting and Refining Company appointed their president and vice-president as a committee of two to determine on what sort of basis they could acquire the Guggenheim plants and goodwill. The Guggenheim's were not too receptive in the preliminary stages of the negotiations. Rogers and Lewisohn of the American Smelting and Refining Company's board took a dim view of the proceedings. After prolonged backing and filling, the negotiations were finalized. In addition to the consolidated group of its own operations, American Smelting and Refining Company took over plants at Perth Amboy, Monterrey, Mexico, and the Federal Plant at Alton, Illinois. It also acquired sixteen important mining properties. As M. Guggenheim and Sons were the stronger financially of the two groups, they acquired the larger block of stock and were dominant on the new board of American Smelting and Refining Company. The family provided leadership for the company from 1901 to 1941. During these years the Company built copper smelters at Hayden, Arizona and El Paso, Texas. At Garfield, Utah, they constructed the plant which treats the output from Kennecott's open pit at Bingham. A lead smelter was built at Murray, Utah. The Baltimore Plant was acquired.

It is interesting to discover that Bernard M. Baruch conducted the negotiations by which American Smelting and Refining Company purchased the Selby Plant, a lead smelter across the Bay from San Francisco, and our own Tacoma Smelter in 1905.

As a plant of the American Smelting and Refining Company, Tacoma has seen many changes. At the turn of the century, as you well know, gold prospectors discovered copper properties in Alaska and British Columbia. Lead receipts from the Coeur d' Alenes declined and copper ores made their way to the plant in such tonnages as to demand attention.

The "Annual Report of Washington Geological Survey" of 1901 notes that the plant had three lead furnaxes, whose combined capacity was about 400 tons per day, and one small copper blast furnace. It also reports a new copper blast furnace of about 200 tons daily capacity would be ready by May, 1902. The report sketches details of the smelting process and the plant equipment, mentioning particularly that power for the plant was from the Snoqualmie Falls Power Company transmitted at 22,000 volts. The total load was 460 horsepower.

In Alaska, the Beatson Mine near the Kennecott Property, commenced copper ore shipments in 1901. Prior to 1902, one of the lead blast furnaces was used to smelt the copper ores to a matte and was called a copper blast furnace. In 1902, a blast furnace especially designed to smelt copper ores was completed; a converter was constructed, and converting the copper matte was first accomplished in that year. The blister was shipped to the East Coast to a refinery for treatment until 1905. After this, part of the blister was shipped to American Smelting and Refining Company's Perth Amboy Plant for refining.

In 1904, construction of an electrolytic refinery was begun at Tacoma. Before its completion, the plant had become a part of the larger Company. The project was pushed because of the opportunity of selling copper in Eastern Asia, and casting facilities were constructed as a necessary adjunct. The first shipment of ingots and ingot bars was made in May, 1905.

In the decade beginning in 1900, milling practice showed a marked improvement. More and more concentrating was done at the mines. Increase in concentrate receipts meant trouble because of the finely ground minerals. In the lead side of the plant, these fine concentrates were satisfactorily handled by the sintering equipment whereby the particles were partially fused into chunks. These ceased to be even a minor problem with cessation of the Coeur d'Alene shipments in 1911 and the resultant closing down of the lead plant.

The fine copper concentrates continued to give trouble. Various measures to agglomerate them were tried. Finally, a brick machine was used to turn out bricks of concentrates and binder. The blocks were used in the copper blast furnaces until these were shut down in 1930.

Beginning in 1913 and extending through 1917, a very extensive construction program was followed. During this period, practically the whole plant was rebuilt. To list a few items; a third copper blast furnace was added, a reverberatory furnace to handle the fine concentrates was built with six Herreshoff roasters as necessary equipment for its operation, as well as two additional converters to handle the matte produced. The original electrolytic tankhouse was enlarged and two new ones added. Receiving and storage facilities were mechanized.

At this time the stack on the hill was built. It is a landmark which originally towered 571 feet above the base. Later, due to deterioration of the terra cotta cap, it was shortened to 562 feet. One of the first industrial electrostatic precipitators was built to trap the fine ore particles carried by the smoke stream before it enters the stack. Subsequently, two other large units have been added. Much of this improvement and additional facilities were occasioned by the requirements of furnace capacity to treat the tonnage from the Kennecott Mine on the Copper River in Alaska.

The next important improvement was the building of a new ore receiving wharf in 1923. This included erection of two large Gantry cranes which travel along the wharf and dig ore from the holds of ships. They discharge onto conveyor belts running the length of the wharf, which carry the ore to weighing and sampling hoppers and thence to either the crushing plant, or in the case of concentrates, to weighing and then both ore and concentrates to storage.

Decrease in coarse ore receipts and increase in the finely ground concentrates gradually brought about the necessity of adding a second reverberatory furnace. This was built in 1929. Blast furnace smelting operations were discontinued in 1930. Coarse ore, formerly handled by the blast furnaces, is crushed and smelted in the reverberatories.

During the twenties and until 1931, new records in the tonnage treated were set. By contrast, in the depression year of 1933, the plant handled the smallest tonnage since it was taken over by the parent company in 1905.

Gradually, as the depression wore itself out, tonnages increased each year until the plant now treats about 400,000 tons annually.

In order to combat rising costs, the management has endeavored to utilize more and more mechanization. If costs rise, it follows that good ore becomes waste rock. In 1948 a program of modernizing the ore receiving, sampling and storage facilities was begun. Complete in 1950, the program was aimed at leveling costs in a period when inflation was rampant.

As I have told you, we receive about 400,000 tons of ores and concentrates annually. Ores are crushed and samples are cut mechanically. Then the crushed materials are transported to storage by belts. Proper mixing of the correct proportion of different types of materials follows to produce a charge that will smelt as easily as possible and result in the desired matte and slag.

The charge is roasted to preheat it and prepare it for smelting. The actual smelting, which is accomplished in a reverberatory furnace, is a melting process forming matte, a copper-iron-sulfur mixture, which settles to the bottom. As it settles it gathers any gold and silver contained in the charge. The slag floats on the matte and is skimmed off and wasted. Much of the area on which the plant is built was formed by slag. The Tacoma Yacht Club breakwater was built of this waste material.

The matte is tapped from the low point in the furnace and air blown through it in a converter. Siliceous ore is added and slags the iron off, leaving the blister copper which retains the gold and silver.

After purification in the anode furnace, the hot copper is cast into shapes called anodes, which are placed in the sulfuric acid-copper sulfate baths in the tanks in the electrolytic refinery.

In between these anodes are hung starting sheets of pure copper. The current dissolves the copper from the anodes and deposits it in nearly pure form on the starting sheets called cathodes. The gold and silver with all but a trace of impurity metals drop to the bottom of the tanks in the form of black slimes.

The pure copper cathodes are remelted and cast into commercial shapes. The slimes are smelted in a special small furnace to a gold and silver bar called dore'. These are shipped to the Selby Plant*where the gold and silver are parted and sold.

Through the life of the Tacoma Plant, there have been very few times when the big furnaces were down, other than for repairs. Labor relations have been good. There are about 126 men in the plant who have worked over twenty-five years for the Company, and the average service of all is about twelve years.

Some few statistics may interest you. Fuel oil used in 1955 amounted to 475,000 barrels. The electrical load was about 10,000 horsepower, and the annual payroll was five million, three hundred thousand dollars. There was an average of 1,040 employees working at the plant. The refinery capacity is about 110,000 tons of copper per year.

*Selby closed in 1972

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Puget Sound National Bank

PROFILES OF PROGRESS

MAY, 1972 A MONTHLY, TACOMA-PIERCE COUNTY BUSINESS REPORT

ASARCO SMELTER ONE OF AREA'S OLDEST, LARGEST AND MOST IMPORTANT INDUSTRIES

At the base of Tacoma's most prominent landmark, the 565 foot high smelter stack of the American Smelting and Refining Company, skilled metallurgists and craftsmen labor to produce one of the most versatile metals known to man. Copper, which advanced civilization into the Bronze Age, is today used in virtually every engineering, construction and manufacturing industry.

Copper is one of the four principal products produced by ASARCO, the others are silver, lead, and zinc. ASARCO, with assets approaching $1 billion, is one of the nation's leading producers of these metals. The firm produced over 406,500 tons of copper last year, more than 56 million troy ounces of silver, nearly 189,000 tons of lead and a little more than 133,700 tons of zinc.

Tacoma's is the smallest of the three copper refineries operated by ASARCO. Production of the firm's Baltimore refinery last year was 175,000 tons; production at the Perth Amboy, New Jersey plant was 122,000 tons; while Tacoma produced a "mere" 108,000 tons.

INDUSTRY PROBLEMS

Copper production for ASARCO has not been without its problems in recent years. The price of refined copper has dropped from a high of nearly 80 cents per pound in early 1969 to less than 50 cents per pound at the end of 1971. Operations at all three ASARCO smelters and refineries were interrupted by two-month-long strikes last year. And minimizing air and water pollution at copper smelting and refining installations has constituted a major problem for the company. ASARCO's computerized weather monitoring system, for example, which curtails smelting during adverse meteorological conditions, resulted in production losses of 31,000 tons of copper at the El Paso and Tacoma smelters last year.

Despite these set-backs, the smelter has remained in near continuous operation since the first smelting operations at the site commenced in 1889. At that time, the operation existed as a "custom smelter" to process lead, gold and silver ores mined in the Pacific Northwest. The smelter was financed by several Tacoma businessmen so that area miners could convert their raw material to cash without having to construct individual processing plants or ship their ores to distant points. In 1905 the plant was acquired by the American Smelting and Refining Company. The discovery of rich sources of copper in Alaska, British Columbia and elsewhere in the Pacific Northwest at the turn of the century relegated lead, gold and silver to lesser importance. Copper continues to be the principal product here, although gold, silver, arsenic, nickel sulfate and sulfuric acid are by-products of substantial value. In fact, the Tacoma operation produces 19 percent of the gold and 17 percent of the silver produced annually in the United States.

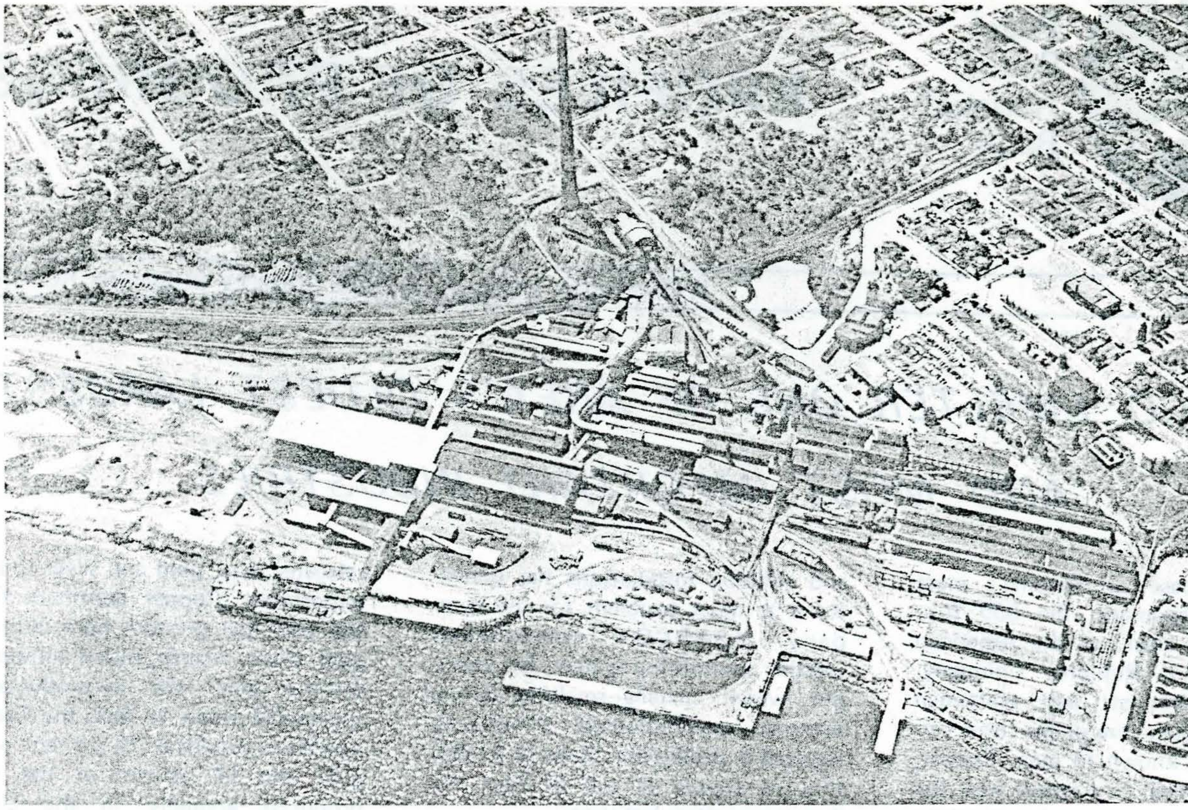
THREE STEP PROCESS

There are three primary steps in the production of copper at the Tacoma smelter: roasting, smelting and refining.

In roasting, a combination of raw materials (crude ore, concentrate, and copper bearing scrap) are combined with other materials (largely silica sand and limerock) and ignited with gas burners. A certain amount of the sulfur is oxidized and the whole mass is preheated in preparation for step two.

In the smelting process, the preheated material is added to and

(Please turn to page 2)



Aerial view of sprawling ASARCO smelting and refining plant at the entrance of Tacoma's Commencement Bay. New $16 million liquid sulfur dioxide plant will be built in the area at left center of photo between railroad tracks and light colored roof. Construction will begin this summer.

(ASARCO cont.)

quickly melted in the 2,750 degree reverberatory furnace. Once molten, the copper and the iron combine with sulfur to form copper sulfide and iron sulfide which sinks to the bottom, along with gold, silver and other metals. This is drained off, and, now assaying at about 45 percent copper, is sent on for refining.

Refining consists of two phases: oxidizing with more heat and air and electrolytic refining, a process somewhat like electroplating. The end product is 99.95 percent pure copper, ready for manufacturing into wire, bus bars, and other copper products.

Only about 15 percent of the copper ore intake at the Tacoma smelter is in materials from mines and plants owned by ASARCO – the balance is from outside firms. Sixty five percent of the total intake is from the Western States of Alaska, Arizona, California, Colorado, Idaho, Nevada, and Washington.

UNIQUE OPERATION

The Tacoma plant serves a unique function in the non-ferrous metal producing industry. It is the only plant in the United States and one of the few in the world which is equipped to smelt and refine copper bearing ores, residues and by products which contain substantial amounts of impurities. Such impurities are not consistent with the metallurgy practiced at most other plants.

The Tacoma smelter is one of significant importance to the Pierce County area economy. The firm employs 1,080 persons at a payroll of nearly $9 million annually. The company pays more than $5 million per year in freight costs, buys another five plus million dollars in goods and services and pays well over half a million dollars in state and local taxes.

The Tacoma smelter and refinery uses about 90 million kilowatt-hours of electricity each year; 300,000 barrels of fuel oil and 12,000 tons of limerock.

PROGRESS

New manager at "The Smelter" is soft-spoken Armand L. Labbe, Jr., who comes to Tacoma from ASARCO's plant at Crocket, California.

Labbe talks confidently about the future of ASARCO's Tacoma plant. "We just completed an expansion of our electrolytic copper refinery which increased the capacity of that operation by nearly 30 percent.

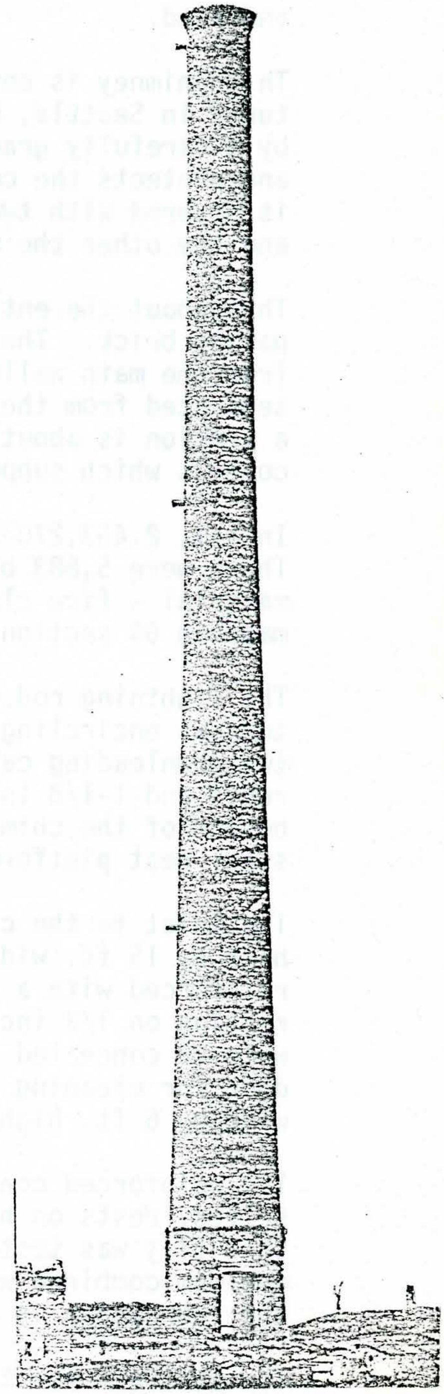
"On top of that, engineering is complete and equipment is being purchased for construction of a $16.1 million liquid sulfur dioxide plant, which we'll start building this summer. The plant will increase the recovery of the smelter's gaseous sulfur dioxide emissions from 17 percent to 51 percent and produce saleable liquid sulfur dioxide at the same time.

"And we'll soon begin construction of a $2 million waste water treatment plant to treat all process and surface water throughout the smelter complex.

"We plan on being in the area for awhile," Labbe said. "You don't make the kind of investment we're planning to make here unless you can expect to recover it."

ASARCO Incorporated
Tacoma Plant

THE STACK
Built by CUSTODIS in 1917 for
American Smelting and Refining Company
Rectangular Paving Brick



Height - 571 Feet
Inside Top Diameter - 25 Feet
Outside Bottom Diameter of Round Column-
49 Feet-5 1/4 Inches
Outside Diameter Across Flats of Octagon Base-
50 Feet-2 Inches
Top Wall Thickness-13-1/2 Inches
Bottom Wall Thickness-61 Inches
Lining-Entire Height Above Foundations
Weight Above Foundation-12,700 Tons

The specified Requirements of this chimney were that the wind pressure should be figured at 25# per sq. ft. of projected area, the weight of the brickwork should be figured at 130# per sq. ft., the maximum allowable load to be taken at 320# per sq. in. and no tension allowed in any section of the chimney. The maximum inside temperature was specified at 800° F. and the chimney and lining constructed to be resistant to acid fumes or gases.

At 350° F. average temperature, the theoretical draft is 2.77 inches of water at the dampers and the capacity of the chimney is 630,000 cu. ft. of gas per minute. The total height is made up of 50 ft. of brick base, octagon in section, and 521 ft. of brick column, round in section.

Calculations were based on the theory that a chimney within the elastic limits of the materials acts as a cantilever beam. At any horizontal section, the deat weight of the superimposed brickwork creats a uniform loading. When a wind of a given velocity blows against the chimney it exerts a force which tends to push the shaft over in the direction of the wind. This increases the intensity of the dead weight pressure on the lee side and decreases it on the windward side. Consequently, if there is to be no tension the dead weight must be sufficient to entirely offset the sind pressure in any horizontal section.

The octagon base is plumb and of uniform wall thickness for its height of 50 feet. The column is tapered with five different tapers, the largest taper being at the bottom and the smallest at the top. It is constructed in ten sections of an average height of about 52 feet each. The walls range in thickness from 56 1/2 inches at the bottom of the column to 13-1/2 inches at the top. The bonding is effected by alternate courses of headers and stretchers. The brick are laid in a mortar composed of cement, fire clay and sand.

This chimney is constructed of ordinary rectangular paving brick manufactured in Seattle, Washington. The imperviousness of the mortar is effected by a carefully graded mixture of fire clay and sand. This mixture covers and protects the cement which is used to effect the bond. The extreme top is ocvered with two overlapping terra cotta caps, one covering the lining and the other the main chimney walls.

Throughout the entire height, the chimney is lined, also with rectangular paving brick. The lining is built in sections supported on corbels projecting from the main walls of the chimney. The lining is 4-1/2 inches thick and separated from the main walls by a 2 inch air space; the average height of a section is about 27 ft. Lead aprons 1/4 inch thick cover and protect the corbels which support the several sections.

In all, 2,453,270 paving bricks were used of which 26,900 were in the lining. There were 5,683 bbls. of cement used in the mortar and 2,800 tons of silicious material - fire clay and sand. The inner of the two terra cotta caps was made in 64 sections and the outer, in 70 sections.

The lightning rod consists of 8 points spaced around the periphery of the top, an encircling band around and underneath the corbels of the head and two downleading cables. There is an outside ladder of 3/4 inch round steel rungs and 1-1/8 inch round steel guards opposite every other rung, from the bottom of the chimney to the top. At 190 ft. intervals, there are structural steel rest platforms.

The inlet to the chimney for the gases is by two openings at grade, 30 ft. high by 15 ft. wide, at 180 degrees. The brickwork above each opening is reinforced with a number of 12 inch I beams at 40 lbs. per ft., 20 ft. long, resting on 1/2 inch steel plates. Horizontally, the chimney is reinforced with 26 concealed steel bands, 3 inches x 1/4 inches in section. The steel door for cleaning and entry of persons in the bottom of the chimney is 3 ft. wide by 6 ft. high.

The reinforced concrete foundations, which was installed by the owners themselves, rests on hard clay 30 ft. below grade. While the bearing power of this clay was tested to considerably in excess of 3 tons per sq. ft., the maximum combined wind and dead load was limited to that amount. The top of the foundation is approximately level with finished grade.

The contract for this chimney was placed during the World War - on February 1, 1917. The foundation was installed during the early summer and the brickwork started the end of June. The chimney was completed and delivered to the owners December 22, 1917.

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