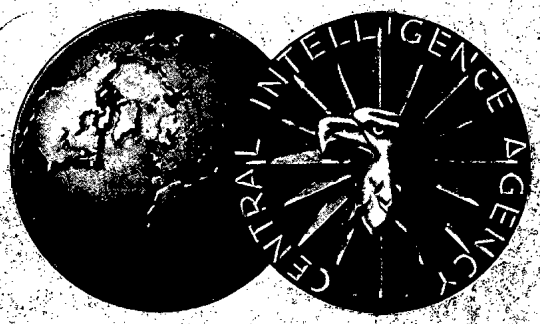
FOR THE DEPUTY DIRECTOR,
JOINT INTELLIGENCE GROUP, JOINT STAFF

~~CONFIDENTIAL~~

401
820A6

A SURVEY OF THE WORLD MERCURY SITUATION



SR-28

Published 4 February 1949

CENTRAL INTELLIGENCE AGENCY

~~CONFIDENTIAL~~

WARNING

This document contains information affecting the national defense of the United States within the meaning of the Espionage Act, 50 U.S.C., 31 and 32, as amended. Its transmission or the revelation of its contents in any manner to an unauthorized person is prohibited by law.

Declassified and Approved For Release 2013/01/29 : CIA-RDP78-01617A001600060001-7

DISSEMINATION NOTICE

1. This copy of this publication is for the information and use of the recipient designated on the front cover and of individuals under the jurisdiction of the recipient's office who require the information for the performance of their official duties. Further dissemination elsewhere in the department to other offices which require the information for the performance of official duties may be authorized by the following:

   a. Special Assistant to the Secretary of State for Research and Intelligence, for the Department of State

   b. Director of Intelligence, GS, USA, for the Department of the Army

   c. Chief, Naval Intelligence, for the Department of the Navy

   d. Director of Intelligence, USAF, for the Department of the Air Force

   e. Director of Security and Intelligence, AEC, for the Atomic Energy Commission

   f. Deputy Director for Intelligence, Joint Staff, for the Joint Staff

   g. Assistant Director for Collection and Dissemination, CIA, for any other Department or Agency

2. This copy may be either retained or destroyed by burning in accordance with applicable security regulations, or returned to the Central Intelligence Agency by arrangement with the Office of Collection and Dissemination, CIA.

DISTRIBUTION:
Office of the President
National Security Council
National Security Resources Board
Department of State
Office of Secretary of Defense
Department of the Army
Department of the Navy
Department of the Air Force
State-Army-Navy-Air Force Coordinating Committee
Joint Chiefs of Staff
Atomic Energy Commission
Research and Development Board

Published February 1949 CONFIDENTIAL

SR-28

A SURVEY OF THE WORLD MERCURY SITUATION

TABLE OF CONTENTS

TABLES

A SURVEY OF THE WORLD MERCURY SITUATION

SUMMARY

The present US stockpile of 173,519 flasks of mercury is adequate to assure almost a three years' supply at the maximum annual consumption of World War II. In another war, however, the US might consume this supply in two years. The 190 US high-cost mines, closed down in the face of present low prices, provide a sizable strategic reserve but the ore is low grade. In an emergency, if the US guaranteed high prices to producers in the Western Hemisphere, production could be increased substantially as it was during World War II.

The USSR, Czechoslovakia, and Yugoslavia have sufficient supplies for peacetime requirements. In the event of war a stockpile would be needed to meet sudden increases in consumption, and to insure a constant flow to consumers if faced with transport difficulties. It is doubtful if the USSR has a large stockpile; it probably counts on stocks being captured in Spain and Italy if a war should occur. As of August 1948, the combined stocks in Spain and Italy amounted to about 175,000 flasks.

Italy and Spain are the principal world sources of mercury. In normal years they produce seventy to eighty percent of the world's supply. The only other producers of consequence are the US, the USSR, and Mexico.

During the war, the US stimulated the production of mercury. High prices and government assistance caused US production to triple from the year 1939 to 1943; through purchase contracts negotiated by the US, the output of mercury in Mexico, Canada, Chile, and Peru was also increased.

At the end of the war, world consumption fell to its lowest level in several decades. A drop in US consumption, immobilization of Germany and Japan, and large world stocks, deprived Spain and Italy of markets for most of their production. Heavy purchasing, principally by US firms, during the first half of 1948 reduced Spain's stocks considerably.

The future will undoubtedly see a marked increase in the peacetime consumption of mercury. In the US, the new dry cell has provided the largest use. It may eventually have a profound effect on world-wide consumption. The future use of mercury in atomic power plants and other related fields may greatly increase its consumption.

Scientific and military uses make mercury a mineral of great strategic importance. Fortunately the US has more than fulfilled its present stockpile objective. Even so, limited government purchases might be thought advisable because of the present low price ($75 a flask). The present price is low and an increase may be expected because of unexpected heavy purchasing by the United Kingdom and large private purchases in

---

Note: The intelligence organizations of the Departments of State, Navy, and the Air Force have concurred in this report; the Intelligence Division, Department of the Army, had no comment. The information herein is as of November 1948.

the United States. In a future emergency the price might go even higher than it did in 1943, and would necessitate the use of mine labor which could be used for other strategic minerals in short supply. Purchases made now at $56 ($75 less $19 import duty) would also reduce stocks in Italy and Spain which otherwise might fall into the hands of the Soviets.

A SURVEY OF THE WORLD MERCURY SITUATION
WORLD PRODUCTION AND RESERVES

Spain and Italy normally produce more than seventy percent of the world's supply of mercury. The US accounts for fifteen percent, and Mexico, the USSR, and China all but a small amount of the remainder. World production in 1938 totalled about 150,000 flasks. Italy mined 66,752 flasks and Spain 41,409 whereas in earlier years Spain had accounted for about sixty percent of the combined output of the two countries. The US produced 17,991, Mexico 8,519, and the USSR an estimated 8,700 flasks.

Under the impetus of military demands for mercury and consequent rises in the outputs of Spain and Italy, a World War II high was reached in 1941, when the world output reached 275,000 flasks. Italy's output that year reached a peak of 94,160 flasks and Spain, 86,473 flasks. Countries in the Western Hemisphere, however, did not achieve maximum outputs until 1942 and 1943. Axis control of the main sources of mercury prompted intensive effort on the part of US authorities to encourage output in the Western Hemisphere by means of government contracts. These, coupled with high market prices, were responsible for the excellent production records of the US, Mexico, and Canada. The US mined 51,929 flasks in 1943 and achieved its highest annual output since 1872. Mexico produced a high of 32,443 flasks in 1942; Canada's output was increased from six flasks in 1939 to 22,240 flasks in 1943.

Consumption dropped when the war ended and world production decreased to 131,000 flasks in 1945. The large surplus of mercury accumulated during the war depressed the 1947-48 prices to the lowest levels in more than ten years. Canada has stopped operations entirely and the major producers in other countries are operating at an annual rate of approximately half their World War II peak years.

The principal world mercury deposits are those of Almaden in Spain, those of the Monte Amiata district in Italy, and in the Western Hemisphere the zone of late volcanics bordering the Pacific Ocean. Most deposits are roughly veinlike in form, irregular in size, shape, and grade, and rarely extend more than a few hundred feet in depth, although a few have been explored to more than 2,000 feet. The individual ore bodies are usually small. The average grade of ore in the Western Hemisphere averages from .25 to .65 percent compared with 1.4 percent for the large deposits in Italy and six percent for large deposits of Almaden in Spain.

In few cases are reserves "blocked out" for more than a few years operations although the tonnage of indicated and inferred ore may be large. In the US the work of prospectors and producers in searching for and developing mercury deposits has been supplemented by the efforts of the Geological Survey and the Bureau of Mines. This cooperation stimulated the industry considerably during World War II and added large tonnages of mercury to domestic reserves. High prices stimulated exploration for ore and development of mines in all countries outside Spain and Italy, while the capture by German armies of the main source in the USSR, the Nikitoka mines, necessitated exploitation of several new deposits in that country.

The chances of substantially increasing reserves and developing new mines in Spain, Italy, Canada, the USSR, and China appears to be very good. It is true that in the US and Mexico the most promising ground has been well prospected, but it is not exhausted and more ore bodies will be found in known districts. The relative shallow depth, irregular shape, and erratic grade of most of the world's mercury deposits, coupled with the possibility of fluctuating prices and their influence on ore-volume determination, complicate the estimating of reserves. Much of what was considered ore last year is now submarginal at the lower prices now in effect and, therefore, is not commercial ore and could not be called reserves. In the following table practically all of the reserves of Spain, Italy, and possibly Yugoslavia, are commercial whereas all but a few thousand flasks of the total of the remaining countries would be submarginal at present market prices. The US figure includes all mercury that could be mined at prices up to $200 a flask.

TABLE 1—ESTIMATED MEASURED AND INDICATED RESERVES OF MERCURY BY COUNTRIES

COUNTRY	RESERVES (IN FLASKS)
Canada	42,000 [1]
Chile	8,000
China	25,000 [1]
Italy	800,000
Mexico	83,000 [1]
Peru	8,000
Spain	1,000,000
UNITED STATES	228,200
Union of South Africa	.....
USSR	100,000
Yugoslavia	80,000

[1] Very little development work carried out—large inferred reserves at high prices.

ECONOMICS OF MERCURY PRODUCTION

In general the production of mercury does not necessitate a large capital investment for development and equipment. Mercury mines are numerous but most of them are small in size, allowing production to respond rapidly to demand and reduction of output or cessation of activities to follow closely any decrease in sales. Total world production in terms of dollar value is small when compared to copper, lead or zinc, but the importance of mercury is its use in varied and numerous products essential to civilian and military requirements.

Because of the grade and size of their deposits, Spain and Italy could readily supply all world requirements if they were unhampered by tariff or cartel restrictions.

Ingenuity and efficiency in the US have permitted the mining and treatment of a grade of ore lower than that which can be profitably mined in any other country. In Spain recovery methods at Almaden have persisted, with only minor changes, for over

400 years. Labor is wastefully used in Spain and yet costs in Spain in 1937 were about $12.50 a flask while only a few US producers could mine for less than $60. The Siele mine in Italy which was worked on an efficient basis in prewar years had an average cost in 1937 of $3.37 a flask with the average grade of ore 4.75 percent. In recent years inflation and the employment of too large a labor force, have affected Spain and Italy with consequent rises in production costs. Mining at Almaden is continuing with no regard for economy or modern mining methods. The Italian mines are compelled to retain a large labor force regardless of curtailment of production due to the world mercury surplus.

USES

The properties of high specific gravity, fluidity at ordinary temperatures, electrical conductivity and the poisonous effect of its compounds create demands for more than 3,000 uses in widely diversified fields. Most of the mercury consumed is in compounds; only a third is consumed as metal. All uses require reduction of ore to metal since the compounds are made from metallic mercury. Rarely are significant amounts reclaimed in normal times as with most other metals, although this may be done when the mercury dry-cell is marketed in large quantities.

One of the main uses for mercury is in pharmaceuticals where its toxic effect is utilized as an antiseptic; in compounds it inhibits bacterial and parasitic growth. An increasingly important use is in electrical apparatus; in this group the new mercuric oxide dry-cell is the most significant. The mercury dry battery, first produced in the US in 1944, will have a profound effect on world consumption. This new cell will stand up under high humidity and temperatures, will deliver a constant current, has much greater power for its size (nearly five times the ordinary dry-cell), has a long shelf life, and will deliver the same ampere-hours service whether operated continuously or intermittently. Its use has so far been in military equipment (the new variable-time, radio-proximity fuse, "walkie-talkies", and many other signal devices), and in hearing-aids. New uses and more economical methods of production are being developed and large-scale production should result. Other electrical apparatus utilizing important quantities of mercury are mercury-vapor lamps, giving off ultra-violet rays which are used for scientific and medical purposes, fluorescent lights in rectifier tubes, switches and oscillators.

Significant amounts of mercury are used in industrial and control instruments such as thermometers, barometers, tank gages, thermostats, flow meters, gas-pressure gages, gas-analysis apparatus, mercury clutches, and in mercury diffusion pumps that produce the vacuum required for making radio tubes.

Mercury is used in the electrolytic preparation of chlorine and caustic soda and as a catalyst in making acetic acid, ammonia, and various other organic compounds. It is a process material in the making of gasoline, activated carbons, lithopone, hydrochloric acid, hydrogen peroxide, and many other chemicals.

Other important uses are in fulminate used in detonators and percussion caps, in antifouling paints for ship bottoms, in tracer bullets, and in making several gases used in chemical warfare. Mercury is used in agriculture for sprays and seed dis-

infectants. Dental preparations use large amounts of mercury and small amounts are still consumed in amalgamation of free-milling gold ore which formerly was the largest use. Mercury is used in vermilion and for carroting fur felt for hats. The latter use, however, has declined considerably, for some localities have laws prohibiting the use of mercury in making felt because of the danger of poisoning. Mercury-vapor boilers have been used in a few power generating plants, and experimentation in this field is continuing.

SUBSTITUTES

There is little incentive toward substitution in normal times. The amount of mercury required for most purposes is small and its use has little, if any, influence on the price of the finished product. The volume of consumption of mercury is, therefore, little affected by price changes; consumption is rather a function of technical developments in industry, such as in the shift from amalgamation to cyanidation in the recovery of gold from ores, which effected a large decrease in mercury consumption.

The liquid condition which makes mercury applicable for many uses in metallic form is not found in other metals and substitution is difficult. Most of the mercury consumed, however, is used in compounds for which substitutes have been found that could be used under emergency conditions. Lead azide and organic initiators, such as diazo-dinitro-phenol can be substituted for mercury fulminate in explosives. In some detonators tetryl and nitromannite are used, decreasing mercury fulminate consumption. Copper-oxide, chromates, and plastic paints can be used to protect ship bottoms in place of mercury paints. Porcelain and metal powders can be used instead of mercury in many dental preparations. Sulfa-drugs, iodine and other antiseptics, disinfectants and purgatives can be used in place of mercury pharmaceutical compounds. In agricultural preparations copper can be substituted for mercury while potassium chlorate is replacing mercury for making felt. Other processes can be used instead of those utilizing mercury as a catalyst in making high-octane gasoline, synthetic rubber and many other vital products. Substitutes for most of its uses could probably be developed in an emergency but mercury supplies may be more readily available than the substitutes.

THE MERCURY CARTEL

Spain and Italy were supplying all but a small percentage of the world's mercury after World War I. Overproduction, accompanied by wide and frequent fluctuations in prices, developed to the detriment of both countries. On 1 October 1928 these producers first established a mercury cartel under the name of Consorzio Mercureo Europeo. The original purpose of the organization was to regulate production and world price, dispose of large accumulated stocks, with all foreign sales to be made by agents of the cartel. The first agreement was for a ten-year term but was renewed for an additional term of ten years. From 1928-1931 Spain's production quota was to be fifty-five percent of the total sales and after that period Spain was to receive sixty percent of the total, with Italy mining the remaining percentage in each case. During the Spanish Civil War and in World War II the outputs of these countries varied from the

quotas originally agreed to by the cartel. The presidency and central office of the cartel were to alternate annually.

The first sales agency was set up at Lausanne, Switzerland, for the purpose of marketing to all countries except the British Empire, where the British firm of "Roura & Forgas" was to be the cartel's agent. The Lausanne office did not operate successfully and was closed down with "Roura & Forgas" becoming exclusive sales agent for all countries except Italy and Spain. The London firm is believed to have guaranteed to market at least 30,000 flasks a year for three years at a specific price. Later agreements with "Roura & Forgas" sometimes gave a fixed commission on all sales and, in some instances, a share of the profits on sales above a certain number of flasks.

When economic sanctions were imposed on Italy in 1935 because of the Italian invasion of Ethiopia, Spain sold to nations enforcing the embargo while Italian mercury was marketed in the US, Germany, and Japan, which were not parties to the sanctions.

The cartel was dissolved during the Spanish Civil War because of the Italian aid to General Franco, but was resumed early in 1939 with Spain allotted fifty-five percent and the Italian producers forty-five percent of the cartel's sales. "Roura & Forgas" again became exclusive agents but that firm's contract was terminated on 1 January 1940. Consortium Internationale du Mercure was established in May 1940 to handle sales to the western allies, but the US and UK negotiated directly with the Spanish Government in 1942, and thereafter. Deutsche Metallgesellschaft became the exclusive sales agent for countries occupied by the Axis.

After the end of World War II, Mercurio Europeo was again established and agents appointed to represent it all over the world. The cartel recently has been considering appointing a single firm to represent it in world markets, preferably a US concern. According to the present agreement Spain is allocated 61.5 percent of the cartel's sales and is to sell to the US while the Italian producers are allowed 38.5 percent of the total sales. In 1948, however, exports from Spain when compared with those of Italy amount to much more than those allowed by the cartel agreement.

Although the cartel no longer restricts production of its members, it influences production in the rest of the world through policies governing the price of its own output. Prior to World War II the cartel maintained a fair price for mercury. It readily could have forced all other mines in the world to close down by price-cutting, for Spain and Italy are the world's lowest cost producers. If this had been carried out, considerable agitation against the mercury cartel would have been aroused. Therefore, it was beneficial to the cartel's interests to maintain a price which was sufficient to allow a small number of the world's mines to continue to operate. If the cartel were abolished and mercury was sold on a free market, competition between Spain and Italian producers would probably force the price so low in normal years that mines in the rest of the world would not be able to operate.

PRICES

There are two principal centers for marketing mercury—New York and London—with prices conforming closely in prewar and postwar years to that asked by the cartel,

C.I.F. these centers. Since there is a US import duty of $19 per flask, the London price in prewar years was much lower than that of New York, but rarely as much as $19 lower. Long term fluctuations in prices, generally, have been governed by supply and demand, resulting from the peacetime industrial uses to which mercury is put. Occasionally some part of demand for the metal is attributable to speculative buyers attempting to capitalize on war scares or anticipated new industrial uses. Speculative activity has been responsible in part for unusual price fluctuations.

Following World War I, requirements for mercury declined and prices fell accordingly. The lowest point in the US domestic price during this period was reached in the depression year of 1921, when the average annual quotation was equivalent to $46.07 per flask. The London price fell to $43.57 in 1921. Since US mines could no longer operate at these levels, aid was granted to them by way of an increased tariff of twenty-five cents a pound ($19 a flask) in 1922.

The return to greater industrial activity during the later "twenties", particularly in the US, resulted in steadily rising prices. But this was insufficient to account for the sharp advance to an average price in New York of $118.15 per flask in 1927. In this case, as normally, the domestic price followed the foreign price. The high foreign (London) price in 1927 may have been owing in part to an informal agreement between the principal producers in Spain and Italy, and in part to heavy purchases by consuming countries in anticipation of the establishment of the cartel then under consideration.

After the formation of the cartel in 1928, the London price was held at the equivalent of more than $105 a flask until June 1931, in the face of declining world markets and increased world stocks. Subsequently, the world-wide depression carried the London price down to $41.64 in 1933, or to the lowest point for the period from World War I to the present, whereas the New York price fell to $57.93 in 1932. The decline in the world price in 1932-1933 was accentuated by the surpluses produced in the restricted world markets by mines that benefited by the earlier, sustain-price policy of the cartel. Prices gradually increased with only slight fluctuations from 1933 until 1939, when World War II began in Europe.

Following the outbreak of the second world conflict, prices in the US rose sharply. In August 1939, the monthly average was $84.41, and by the middle of September the quoted price had virtually doubled. The gains were attributed, primarily, to fears on the part of the cartel's customers that they would be unable to obtain all of their requirements from either regular or alternate sources. Italy's entrance into the war, in June 1940, left Spain to meet the demands for cartel metal in non-Axis countries, and the fulfillment of such demands presented shipping problems.

The cartel price was advanced from $200 at the beginning of 1940 to $250 in December of that year, considerably above the equivalent price of $201.10 in London. Both prices were above those prevailing in the US, marking a reversal of the usual relationship. It was rumored that the high prices were to enable Spain to repay Germany on favorable terms for reported aid in the Spanish Civil War. The London price rose above that of New York because the UK had to depend on Spain for some of its requirements.

Highest New York price was $202.52, average for January 1942. The O.P.A. established ceiling prices for February 1942 and the New York price averaged $196.35 for 1942 and $195.21 in 1943. It dropped steadily thereafter, and in August 1948 was $75.00 a flask. Official London prices were set in May 1941 at about $194.20, raised to $281.44 in 1943. Control was removed completely in October 1945. In December 1946 the London monthly price was less than that of New York for the first time since May 1942. In August 1948 sellers were quoting a London price of $60.00 a flask.

TARIFFS

The principal world producers of mercury—Spain, Italy, US, Mexico, and the USSR—imposed import duties in prewar years to restrict imports as did certain minor producers—China, Turkey, and India. Duties were levied on mercury imports in Switzerland, Salvador, Nicaragua, Honduras, Cuba, Venezuela, Peru, Bolivia, Uruguay, and Argentina, non-producer countries, for the purpose of raising revenue.

A tariff on imports of mercury has been in effect in the US since 1883. The duty of twenty-five cents per pound, or $19 a flask, imposed first in 1922, is still in effect. Owing to fluctuations in mercury prices this duty represented an ad valorem equivalent of sixty-nine percent in 1932, nineteen percent in 1940, ten percent in 1942-1943, and twenty-four percent in January 1948. The tariff is generally credited with stimulating the domestic mercury industry, and making possible the operation of mines that otherwise would not have been developed.

TABLE 2—UNITED STATES TARIFF ON MERCURY

ACT OF	RATE OF DUTY
1883	10 cents per pound
1890	10 cents per pound
1894	7 cents per pound
1897	7 cents per pound
1909	7 cents per pound
1913	10 percent ad valorem
1922	25 cents per pound
1930	25 cents per pound

THE UNITED STATES

Production, Consumption, and Deposits.

The peak year production was in 1877 when 79,395 flasks of mercury were mined. The output was stimulated by the great demand for mercury by the California gold mines where gold was separated from ores by amalgamation, a method which has been largely replaced by cyanidation. After 1877 there was a general downward trend in output and grade of ore with attendant depletion of many mines.

High prices and government assistance increased the output during both World Wars, reaching a peak of 36,000 tons in World War I, and 51,929 flasks in 1943. With

the cancellation of government aid in 1944 the price declined and so did production. In 1946 domestic production amounted to 25,000 flasks, while in 1947 it was 23,244 flasks. Production fell off to 8,900 flasks during the first half of 1948. Unless there is an increase in the price, it is believed that only one mine will be able to continue operations during the last quarter of this year.

High prices and government assistance during the war effected intensive prospecting and development, resulting in large increases in reserves. Measured reserves are small because measured ore is usually extracted during development. The Bureau of Mines and Geological Survey reported total reserves of the US including Alaska, at 86,000 flasks from ore workable at $100 a flask. An additional 400,000 flasks might be recovered at a price of $300 a flask, which is about 5½ times the present price f.o.b. Cadiz. Approximately an equal amount could be estimated to occur in Canada, Mexico, and other producing countries of the Hemisphere.

(Important United States mines are described in Charts I, II, III, IV, and V of the Appendix.)

California is the main producing state, accounting for more than three-fourths of the production in 1947, with the New Idria mine in San Benito County by far the largest current producer in the country. The New Almaden mine in Santa Clara County is the largest all-time US producer. Nevada, Oregon, Idaho, Arkansas, Arizona, Texas, and Alaska all contributed significant quantities to the nation's total during the war, but are of little importance in normal years. New discoveries of higher-grade ore found during the war at New Idria and other mines increased the average grade of ore mined from 0.25 in 1942 to 0.6 percent in 1947.

In 1938 apparent consumption [1] amounted to about 19,600 flasks. Under the impetus of war and the great demand for mercury, consumption reached 62,429 flasks in 1945, largely because of the great demand for the mercury battery for military purposes. It fell to 31,200 in 1946 with the cancellation of government contracts for mercury products. Returning to a peacetime use pattern, the 1947 total was 35,000 flasks but another rise is expected in 1948, probably to about 38,000 flasks, with the mercury battery responsible for most of the increase. P. R. Mallory & Co., Inc., Indianapolis, Indiana, controls the patents for the manufacture of the new battery. Large scale production for peacetime use is believed to be under way in that company's plant in Tarrytown, New York. A breakdown of US consumption by use is shown in Table 9.

Foreign Trade.

From 1925 to 1939 about thirty percent of the mercury consumed in the US was imported compared to fifty percent in 1946-1947. Chief prewar foreign suppliers were Spain and Italy, whereas Mexico and Canada supplied most of the US imports during the war, except for 1945 when Spain supplied an amount equal to almost ninety percent of that consumed. Most of our future imports are expected to be supplied by Spain and Italy, although 1,500 flasks were imported from Yugoslavia in 1947. General

[1] Apparent consumption equals imports plus production minus exports. Data on mercury consumption have been compiled regularly only since September 1939. The first calendar year figures on which a detailed breakdown is available are those of 1942.

imports from January-July 1948 amounted to 30,615 flasks, of which 21,567 flasks were from Spain.

Re-exports in prewar years were small, but in 1939 and 1940 the US began shipping large amounts of mercury to the UK and to Japan. The USSR requested mercury in 1942-1943 to open its offensive, and 22,313 flasks were shipped under lend-lease.

Present Situation and Future Outlook.

The large surplus of mercury accumulated during the war depressed the 1948 price to the lowest levels in approximately ten years. US consumption reached a nine year low in 1946, when only 31,200 flasks were used by industry, or about half the 1945 peak level. In 1947 US consumption had risen to 35,000 flasks as a result of substantial increases in consumption by P. R. Mallory Co., who in December began to produce the mercury battery for commercial use on a large scale. Domestic production in 1947 was only 23,200 flasks and imports 10,228 flasks compared to an output of 25,348 flasks and imports of 23,062 flasks the previous year. In the first half of 1948 US production was 8,900 flasks, general imports 27,254 flasks, and consumption had risen to 25,700 flasks. Stocks in Spain as of August 1948 approximate 75,000 flasks and about 100,000 flasks have been held in Italy where some purchases have been made by local investors as a hedge against inflation. In view of the large stocks held by the cartel and the diminished world consumption—Germany and Japan, two of the four world's largest consumers, are no longer of importance—prices as of August 1948 have declined to $75 a flask, delivered New York. It is believed that only one US producer will continue to operate at this price, and if the price does not rise during the last quarter of 1948 it may discontinue operations. The cartel can readily lower the price because of its large stocks and the need for US dollars in these countries. It is doubtful, however, if the price will decrease further, in fact a rise may be expected due to Spain's very large sales in the first half of 1948. Consumption in the US is expected to exceed 38,000 flasks in 1948 as a result of increased battery requirements, mercury clutches, and installation of mercury cells for making caustic soda. P. R. Mallory Co. has constructed a plant for the manufacture of batteries at Belfast, Ireland, to supply European requirements for the mercury dry-cell, thereby increasing consumption in that part of the world.

General imports during the first seven months of 1948 have exceeded 30,000 flasks with over 21,000 coming from Spain. General Electric is reported to be the recipient of some of these shipments for a mercury boiler installation. The Mallory Co. is also reported to be purchasing large quantities to take advantage of the low price which is important to the marketing of the mercury dry-cell.

An approximate breakdown on arrivals through July is as follows:

Spain	21,567	
Mexico	2,533	
Italy	1,101	
Yugoslavia	413	
Japan	3,676	
Sweden	75	(re-exports)
Netherlands	1,201	
UK	49	
Total	30,615	(7 months preliminary)

What the future holds, politically and economically, is merely conjectural. If large-scale rearmament begins, and this appears most likely, the price and the output of mercury will substantially increase. The large stocks in Spain and Italy would be purchased quickly by the US, UK, or USSR and submarginal mines would be reopened as the price increased. Formerly Spain and Italy dominated world markets and largely determined the price at which mercury was sold to consumers. In the immediate future Yugoslavia may become an important factor. Its importance as a mercury producer, however, could last but a few years, for reserves at the Idria mine are limited, whereas Spain and Italy are assured of their dominant positions for at least several decades.

Emergency Supply and Demand.

Mercury is one of the few strategic materials of which the US has fulfilled its present stockpile objective. The present stockpile, as of 30 June 1948, is 173,519 flasks compared to a minimum objective of at least 125,000 flasks. The objective is the equivalent of a two-year supply at the 1945 peak year consumption. In the event of another emergency consumption would undoubtedly exceed that of 1945. New military uses are being found for the mercury battery which was first manufactured on a large scale in 1945. Further development of the battery should make it necessary for the US to hold its present stockpile intact. The flow of mercury has returned to prewar channels, Spain and Italy having resumed their position as the chief world suppliers. In the event of an emergency these countries probably would be cut off from the US, or at least present a serious supply problem. The present stockpile may be adequate to assure the US of a plentiful supply until domestic production, and that of Canada, Mexico, and Chile could be stimulated. The stockpile is not adequate to meet US needs during a long war.

There were approximately 200 mines producing in the US during the peak year of World War II, whereas only three or four are still operating at the current price. The high cost producers, closed by low market prices, total a strategic reserve of inestimable benefit to the US in the event of a future emergency. World War II proved the strategic importance of conserving marginal and submarginal deposits and their value at a time when it is difficult or impossible to procure supplies from foreign sources. The meas-

ured, indicated, and inferred reserves of the mines now closed are reported to total 330,000 flasks from ore workable at $195 a flask, and 481,500 flasks from ore workable at $300 a flask. (See Table 10.)

A high price for a definite period may gradually increase the US mine output to about 40,000 flasks annually. Similar contracts with Canadian producers and purchases of the production of all of Mexico's mines at World War II prices, may produce a total annual rate of 60,000 flasks from these two countries within three full years of operation. In foreign countries payments should be made to the small individual operators immediately upon delivery of a shipment to the railroad instead of to brokers who reaped large profits during World War II. Small operators had little capital, could not wait a long time for payment, and were forced to sell at a low price to obtain money to keep operating. Chile's output could be increased to 2,500 flasks by a high price and long term contract. It would take several years, however, before US requirements, as well as those of Canada and the UK, could be supplied by Western Hemisphere production. An increase in the present stockpile by purchases at $50 (duty free) a flask, or lower, in Spain and Italy would be excellent insurance in event of a future emergency. The price would have to be raised to at least $200 a flask in an emergency in order to increase Western Hemisphere production to meet demands, and the time factor of several years would be necessary. The present US price is as low as it was in 1934, 1935, and 1936. It is doubtful if it will fall much lower, in fact, increases over the present price may be expected early in 1949. The difficulties experienced in the US in obtaining labor for mercury and other mines during World War II would be more serious in a future emergency. These and transport problems could be prevented, where mercury is concerned, by purchases made now. Also, a substantial US stockpile would mitigate the control the cartel holds over the domestic market in peacetime.

TABLE 3—UNITED STATES IMPORTS FOR CONSUMPTION BY COUNTRIES OF ORIGIN, 1937-1947

In Flasks of 76 Pounds

COUNTRY	1937	1938	1939	1940	1941	1942	1943	1944	1945	1946	1947 [3]	1948 [5]
Canada	...	...	...	...	785	7,400	15,581	1,565	1,720	[1]	...	...
Chile	...	...	...	...	...	1,409	2,660	982	477	369	120	...
Honduras	...	...	...	...	...	...	...	...	23	...	...	...
Italy	9,832	1,111	336	3	...	...	...	...	...	5,038	1,516	1,101
Mexico	1,533	...	562	128	6,851	30,112	29,457	16,955	10,852	5,360	1,824	2,533
Nicaragua	...	...	...	...	...	20	...	...	...	...	...	...
Peru	...	...	...	...	...	...	107	51	153	...	...	...
Spain	7,042	1,251	2,601	40	104	...	...	...	55,392	3,127	2,161	21,567
Others	510	...	...	[1]	...	...	...	...	...	...	4,607 [4]	5,414 [6]
Total	18,917	2,362	3,499	171	7,740	38,941 [2]	47,805 [2]	19,553	68,617	13,894	10,228	30,615

[1] Less than 1 flask.

[2] Includes following amounts reexported to USSR and not separately classifiable by countries of origin: 1942, 7,461 flasks; 1943, 14,852 flasks.

[3] General imports, preliminary figures.

[4] 3,107 flasks were imported from Japan and 1,500 flasks from Yugoslavia.

[5] 7 months preliminary (general imports).

[6] 3,676 flasks were from Japan, 413 from Yugoslavia, 1,201 from the Netherlands, 49 from United Kingdom, and 75 from Sweden.

SOURCES: Bureau of Mines and Department of Commerce.

TABLE 4—UNITED STATES EXPORTS OF MERCURY, 1937-1947

YEAR	FLASKS
1937	454
1938	713
1939	1,208 [1]
1940	9,617 [2]
1941	2,590 [3]
1942	345 [4]
1943	385 [4]
1944	750
1945	1,038
1946	907
1947	884

[1] Canada received largest amount, 304 flasks.
[2] The largest amounts shipped to individual countries were 5,178 flasks shipped to United Kingdom and 1,598 to Japan.
[3] 598 flasks were shipped to United Kingdom.
[4] In 1942, 7,461 flasks and in 1943, 14,852 flasks were exported to the USSR, but these amounts have been redesignated as "reexports" since they consisted chiefly of imported metal that was reshipped without changing its form.
SOURCE: Bureau of Mines.

SPAIN

The Almaden mine, 150 miles southwest of Madrid, is the most important mercury deposit in the world. The mine has a record of almost continuous operation since 400 B.C. and its reserves are still believed to be the world's largest potential source of mercury. There is no accurate production record for the first 1,900 years of operation but statistics have been recorded since 1500, giving an output of 6,622,434 flasks mined during the last 446 years. However, since the Civil War in Spain, Italy has been the largest mercury producer. The all-time peak year of production for Spain was in 1941 when 86,473 flasks were produced. Almaden accounted for about ninety-eight percent of this total although two other mines were operating. Spain normally consumes less than ten percent of its mercury output, the remainder being exported. Germany was the chief recipient of Spanish exports in prewar years and during the war. The UK received some of its wartime requirements from Spain. Substantial quantities were also purchased by the US, especially in 1945 when 55,392 flasks were imported—a supply equal to one year's requirements at the wartime rate.

The Almaden mine is operated by the Consejo de Administracion de las Minas de Almaden and Arayanes, controlled by the Spanish Treasury. Reports indicate that it is a wasteful operation with no attempts at economy or modern mining and treatment methods with recovery as low as forty-five percent compared to over ninety percent in Italy. Despite this, profits have been large because the ore is very rich, averaging over six percent mercury and making Almaden by far the richest mercury deposit in the world. Labor makes up about eighty percent of the cost, largely because of a false fear of mercury poisoning which makes it necessary to pay workers a full monthly

wage for only working forty-eight hours a month. The mine ceases operations from June through September to allow the employees to farm. Due to wasteful mining and treatment methods coupled with inflation, costs are believed to have risen to the present market price, compared to a cost of about $11 a flask early in the war. With modern mining and milling methods and efficient labor practices, costs could be reduced to $7 a flask or less.

Almaden is over 1,300 feet deep which is unusual, for mercury deposits are normally shallow. The ore has diminished in grade and volume with depth, but reserves have been reported at 250,000 tons of measured ore averaging six to eight percent and at least 650,000 tons of indicated ore averaging two and one-half percent mercury. These deposits represent about one million flasks of mercury or about twenty-five years of operation at a normal rate. Large potential reserves of high grade ore are believed to exist in deposits to the east, along the strike of the formation in which the mercury occurs at Almaden. These deposits occur in the valley of the Rio Valdeazogue but are within the Almaden concession. (For description of Almaden mine see Chart XIII.)

At the end of the war mercury stocks in Spain were reported to total 120,700 flasks. A considerably decreased world consumption and large stocks in other countries made sales difficult even at low prices. In 1947 Spain was unable to sell any mercury to US firms at $65 a flask, plus $19 tariff, until August when a contract for 2,500 flasks was made with P. R. Mallory Company, makers of the mercury battery. This sale was made at $55 a flask, f.o.b. Cadiz. United States producers claim the sale was a violation of the Antidumping Act of 1921. Mallory's agents, Philipp Brothers, requested a reduction in price to make mercury available for experiments conducted in manufacturing the mercury battery for commercial use. The Consejo Almaden agreed to the contract, stating that the size of the order warranted the discount of slightly more than fifteen percent, and that a large new market might be developed by the experiments. About 1,250 flasks were sold to Berk & Company of London at a price of about $60 f.o.b. port, a smaller discount, but a smaller order. Large orders, such as Mallory's, were given substantial discounts in prewar years.

In 1947 Spain's mercury output amounted to 35,420 flasks and exports were 18,172 flasks compared with a 1946 production of 41,481 flasks and exports of 10,946 flasks. During the first six months of 1948 Spanish exports of mercury increased to 52,707 flasks with more than 21,000 flasks shipped to the US. Production for the first half of the year was 6,358 flasks, thus withdrawals of 46,349 were made from stocks which are now believed to total at least 75,000 flasks. Two British firms were reported in July 1948 to have purchased from Spain about 15,000 flasks which is equal to about one year's consumption in the UK.

The following export figures for the period January 1 to June 30, 1948, were released by the Spanish Customs Service in "Estadistica del Commercio Exterior de España":

COUNTRY	NUMBER OF FLASKS EXPORTED
United States	23,000
Canada	6,610
Great Britain, N. Ireland	13,750
Argentina	1,175
Sweden	2,061
Holland	594
Germany	4,870
Denmark	60
Portugal	81
Venezuela	10
Others	14
TOTAL FLASKS	52,225

The total of 52,225 flasks does not agree with the total of 52,707 flasks reported to the US Embassy by Minas de Almaden y Arayanes. Almaden reported exports to the following countries during the first quarter of the year: Switzerland, 98 flasks; Australia, 136 flasks; South Africa, 200 flasks; and India, 202 flasks. These are not included in the Table compiled by the Spanish Customs.

ITALY

For many years Italy has vied with Spain for the position of the world's largest mercury producer. Italy's output of 94,161 flasks in 1941 was the all-time annual peak for any country. Between five and fifteen percent of the country's output is consumed domestically. The all-time peak for exports was reached in 1940 when 73,680 flasks were shipped. Before the war, Germany, the UK, and the US received most of Italy's exports whereas during the war all shipments went to Germany and Japan. The two largest producing mines are the Abbadia San Salvatore and the Solforate del Siele. The Idria mine was ceded to Yugoslavia by the terms of the Paris Peace Treaty at the end of World War II.

The Abbadia and Siele mines, as well as numerous other prospects, are in the Monte Amiata district in Siena and Grosseta Provinces, seventy-five miles north of Rome, within a mineralized area eighteen miles long by six miles wide. Practically all the mines were damaged during the German withdrawal but have since been repaired.

Surface outcrops in the Monte Amiata district were worked by the Etruscans several centuries B.C., but these properties were idle until rediscovered in 1868. The Abbadia San Salvatore mine has been Italy's largest producer except for 1940 and 1941 when it was surpassed by Siele. The Italian government controls fifty-three percent of the shares of the company. Reserves are reported to be large with the ore averaging over one percent mercury. S.A.M.A.,[1] which owns Abbadia San Salvatore, has several other properties which have yet to be developed.

[1] Societa Anomina Mineraria Amiata.

The Siele property is six miles south of the Abbadia and is owned by a private corporation, Stablimento Minerario del Siele, which pays the government an annual concession rent of 10,000 lire plus a royalty of 2,000 lire per flask. Peak year of production for the Siele mine was 1940 when 41,479 flasks were mined compared with 37,777 flasks for the entire US for that year. Average grade of ore mined was 2.87 percent in 1940 and about two percent in 1944. Measured reserves were 225,000 flasks in 1946 while indicated and inferred were several times this figure. All of this is said to be in the Solforate del Siele mine and does not include other properties owned by the company, some of which are now being developed. Siele, as well as Monte Amiata, is a member of the cartel but can withdraw at the end of the year by giving three months' notice.

The Argus mine, near the Siele, is also owned by a private company, Societa Anonima Mineraria Argus of Milan. Maximum annual output has been about 7,000 flasks. The Argus mine is believed to be closed down at the present time because of the low price.

Mining methods in Italy in prewar years were much different from those of Spain. Labor was relatively efficient and methods were economical in Italy. Because of greater efficiency and a high recovery, production costs of mercury in Italy were comparable to those in Spain although the Italian ore was lower grade. In fact, costs at Siele were less than half those of Almaden in 1937. When the war ended, costs (based on dollar equivalents at official exchange rates) in Italy rose near those of Spain due to relatively greater depreciation of the lire and to the government insisting that a full labor force be employed despite a reduced output. Costs could be reduced to $10 a flask at Siele by utilizing the present labor force to its best advantage and with improvements in stoping, placing fill, timbering, loading mine cars, ventilation and haulage.

During 1946, Sr. Armenise, the president of Stablimento del Siele, approached a Canadian company, controlled by US capital, with a proposal to sell a stock interest in the Italian firm. A study of the mine was made by American engineers, who reported favorably, but the companies were unable to come to terms.

When the war ended, stocks in Italy were very small, for the Germans shipped all stocks to Germany before their retreat. With an output of 50,822 flasks in 1946 and 53,984 flasks in 1947, large stocks are being built up since sales have been small. Italian producers were reported to have stocks totalling 90,000 flasks in July 1948 with at least 10,000 flasks held by speculators and consumers. Spain was offering US firms mercury at $54 a flask, f.o.b. Spanish ports, in April 1948, whereas Italian companies were getting $55 to $60 a flask, f.o.b. railhead in Italy. Siele has reduced its output to less than 1,000 flasks per month because of its large stocks; it could produce 4,000 flasks a month if markets were available, whereas Monte Amiata could produce 5,000 flasks a month. Average annual Italian consumption is about 5,800 flasks. The present retort capacity of all Italy is about 5,000 flasks a month, of which 3,200 are at the Amiata plant and 1,800 at Siele.

Although Italy is supposed to receive 38.5 percent of the cartel's sales, exports from Italy in 1948 have been very much smaller than those of Spain. Italian exports of mercury have dropped monthly, stocks have increased, and the July production was

reduced to about 2,800 flasks. The 1948 production is not expected to exceed 29,000 flasks. Monte Amiata and Siele have decreased their respective outputs but these companies are still forced to keep a larger number of workers than are necessary. The two small Italian firms, S. A. Mineraria Argus and Soc. Italiana An. Mercurio, have been hard hit by this crisis. Argus has shut down and dismissed its workers, while the output of SIAM has been severely curtailed. Conferences of industrialists, workers and exporters have been held to determine how the situation can be improved. The Italian Government has assured the industry that it will endeavor to include mercury in future trade agreements in an attempt to reduce stocks. The mercury producers are endeavoring to obtain credit from the government, a reduction in taxes and transport fees, and the right to reduce their labor forces at will. The government is believed to have approved a fifty percent reduction in the labor force and a reduction in output to about 2,200 flasks a month.

(Detailed descriptions of Italian mines are given in Charts Nos. XII and XIII.)

MEXICO

The mine output of mercury increased from 7,376 flasks in 1939 to a peak of 32,443 flasks in 1942. Initial stimulation was the high price being offered by the Japanese. The UK and US were the chief recipients of exports before the war, with small quantities going to South American countries. Japan offered a higher price than the US in 1940 and 1941 and received large quantities. An agreement reached in July 1941 between the US and Mexico provided that the former would obtain the surplus production of certain strategic commodities, including mercury, then placed under export control by the Mexican Government. The US obligated itself to acquire surpluses of metal over and above that sold through regular channels to nations in the Western Hemisphere having export limitations in effect similar to those in Mexico. Toward the end of 1943 demand for mercury eased and prices began to decline, as did mine output. By 1947 production had fallen to about 9,700 flasks with a further drop expected in 1948. At the present low price Mexican producers are finding competition more difficult than in prewar years. Costs and taxes are higher than ever, and it is difficult to continue operating.

Mercury deposits are widely distributed in Mexico. Occurrences have been reported in more than 200 localities scattered through two-thirds of the States of Mexico. There are six major districts: Nuevo Mercurio, Zacatecas; Sain Alto, Zacatecas; Canoas, Zacatecas; Cuarenta, Durango; Huitzuco, Guerrero; and Huahuaxtla, Guerrero. The Nuevo Mercurio district is in the desert country of northern Zacatecas and was discovered in 1940. It was the largest producer during the war, accounting for more than 7,000 flasks annually in peak years. The district is made up of a few low limestone hills in a wide expanse of sand flats. Water has to be shipped forty miles by rail and fifteen miles by truck. Mineralization is largely found at intersections of faults in anticlines. There were sixteen principal mines and fifty smaller mines operating at Nuevo Mercurio during the war with over 200 prospects. Over 900 retort tubes were in operation in Mexico in the early years of the war, but by early 1943 these had been replaced by the newly developed Manfrino and by Herreschoff furnaces.

The ore deposits in the Sain Alto district of western Zacatecas are of two types, fissure fillings in sandstone and shale, and shear zones in rhyolite. Cinnabar occurs in small rich pockets unsuitable to large scale operations and worked best by the local "gambusinos". In the Canoas district of southeast Zacatecas the ore is found in fracture zones in rhyolite. The output from Canoas was relatively small.

The Cuarenta district is located in the semiarid mountain region of northern Durango and was discovered in 1932. The deposits are situated along fault zones in rhyolite and along a tilted contact of granite and conglomerate. Greatest production occurred between 1940 to 1943, when it reached about 3,600 flasks annually. Operations stopped in August 1943 owing to the decrease in the price of mercury.

The Huitzuco group of mines, sixteen miles east of Iguala in Guerrero, was discovered in 1869. The deposits are novel for the ore is livingstonite, a rare mercury-antimony sulfide. The ore occurs in lenses and fissure fillings, and was concentrated by flotation. Mining was discontinued early in 1944 because of the low price of mercury.

The Huahuaxtla mine, about twenty miles north of Iguala in Guerrero, was discovered in 1923; the main ore deposit occurs in a gouge zone between limestone and shale. Production reached 2,000 flasks annually early in the war.

The mercury industry in Mexico is finding it difficult to continue producing at present low prices and the 1948 output has been reduced considerably over that of 1947. Production amounted to 9,698 flasks in 1947 while exports totalled 9,654 flasks, of which 5,578 flasks went to the UK and 2,453 to the US. There is little prospect of improvement or even of maintaining the present position unless the price increases. Mexican mines cannot compete or maintain large production in a completely free market. Only a few mines are continuing operations and these are high grading. Representatives of the cartel recently visited Mexico for the purpose of including Mexican producers in the cartel. It is reported that this plan has been dropped temporarily because it was found that Mexico was not a sufficiently important producer at present because of the low world price.

Mexico has important reserves of mercury which could supply the US with a large part of its requirements in an emergency. Output could readily be increased by a high price and a contract for that country's exportable surplus for a fixed period. The system of purchasing should suit the local conditions in Mexico, that is, payment should be made to individual producers immediately on delivery of a shipment to the nearest railhead, regardless of the small size of the shipment. The small operator in Mexico does not have sufficient capital to wait a long time for payment.

(Descriptions of the individual mines are given in Charts VIII, IX, X, and XI.)

CANADA

Domestic consumption was met by imports of 1,000-2,000 flasks before World War II, domestic production accounting for only six flasks in 1939. The substantial increase in price and the impending shortage of mercury in the Western Hemisphere led to exploration and development of mercury deposits in British Columbia. In 1942 and

1943 the US Government's Metals Reserve Company contracted for the purchase of mercury from the Pinchi Lake Mine of Consolidated Mining and Smelting Company, Ltd., and the Bralorne Takla Mine of Bralorne Mines, Ltd. By 1943 Canadian production reached a peak of 22,240 flasks, the Pinchi Lake mine becoming in that year the largest producer in the Western Hemisphere. The Metals Reserve contract was terminated with Consolidated Mining and Smelting in the fall of 1943 when large stocks began to build up in the US. The Pinchi Lake mine soon produced a large surplus and was closed in July 1944 because there, too, large stocks had been built up and the mine labor was needed at the company's lead mine. From 1940-1944 Pinchi Lake mine yielded 52,600 flasks of mercury valued at $10,000,000.

The Metals Reserve contract with Bralorne ran until September 1944 when that company's newly developed property closed, and Canada did not produce mercury in 1945, 1946, or 1947. Both mines occur in the same belt along a major fault zone, 150 miles long and from 200 to 1,000 feet wide. The potential of this mercury belt is believed to be considerable, but the low price of mercury, the high cost of supplies and transport, and the shortage of mine labor will prevent the mines from reopening. The mercury belt, however, is extremely important to the US and the British Empire as a major source of mercury in an emergency. The output could readily supply the emergency requirements of the UK and Canada and provide large amounts to the US. During an emergency the mercury mines compete with lead, zinc, and other mines for the mine labor in the area.

Canada imported 2,010 flasks in 1946 and 5,430 flasks in 1947. The increase in imports was due to the installation of mercury cells for use in a new caustic soda plant. Aside from this installation Canadian consumption amounted to 2,646 flasks in 1947.

PERU

The Santa Barbara mine, Province of Huancavelica, was first opened by the Spaniards in 1599 to supply the South American Colonies with mercury for amalgamation of gold and silver from their ores. The mine closed in 1839 after producing 1,479,000 flasks of mercury making it one of the world's largest all-time producers. High prices and the attempt to increase the mercury output of the Hemisphere by purchase contracts resulted in the reopening of the Santa Barbara mine and the development of a new mine in the Chonta district. Production reached a World War II peak of 326 flasks in 1943 but mining ceased entirely in 1946.

(For a description of the mines see Chart No. XI.)

CHILE

The mercury produced in Chile is mined with gold at the Punitaqui mine in Ovalle Province. Cinnabar occurs in the northern part of the mine workings. The peak year of production was 1943 when 2,561 flasks were produced as the result of a contract concluded on January 26, 1942, between the US and Chile for 9,000 flasks of Chilian mercury in eighteen months, but this amount was never reached. A new agreement was concluded in August 1943, effective for another twelve months. Prior to 1942

Chile's output was shipped to the UK, Japan, and South America. Production has declined in recent years with the decrease in the price of mercury.

(The Punitaqui mine is described in Chart No. XI.)

UNION OF SOUTH AFRICA

The Monarch Kop mine in the Letaba district of Transvaal was developed with government financial aid and began producing in 1940. By 1943 production reached 1,189 flasks annually, the country was self-sufficient for the first time, and small amounts were exported. Imports from Spain and Italy formerly supplied all domestic requirements, important amounts being consumed in the gold industry. In 1944 the output reached a peak of 1,192 flasks and fell off in subsequent years. The mine recently closed down owing to the low price for mercury and to the exhaustion of developed reserves. (See Chart XIII.)

ALGERIA

Production of Algeria reached 791 flasks in 1940, mined from the Ras-El-Ma deposit in the Department of Constantine. The deposit is small, the ore averages less than 0.5 percent. The entire output is shipped to France. In 1947 the output amounted to 348 flasks. (See Chart XIII.)

GERMANY

In normal years Germany was the second largest consumer of mercury with an average annual consumption of 21,710 flasks for the period 1925-1929 and 18,480 flasks from 1930-1938. With the advent of war German apparent consumption exceeded that of the US by approximately 15,000 flasks in 1938 and by 1940 reached a peak of more than 85,000 flasks. Italy and Spain were the principal sources of supply. Spanish mercury was sent to Germany in payment for a debt owed Germany. German exports were small until 1943 when 5,570 flasks were exported, mainly to Japan.

TABLE 5—MERCURY PRODUCED IN, IMPORTED INTO, AND EXPORTED FROM GERMANY, 1935-44, IN FLASKS OF 76 POUNDS

YEAR	PRODUCTION	IMPORTS	EXPORTS
1935	116	24,918	435
1936	1,102	19,958	348
1937	174	25,904	174
1938	1,363	32,866	58
1939	1,102	24,802	116
1940	870	84,326	87
1941	522	66,457	551
1942	522	49,372	435
1943	...	60,076	5,570
1944	...	24,860	1,363

Germany was the largest consumer of mercury in the world in 1940 and 1941. A large part of this increase resulted from the gradual conversion to mercury cells in the production of chlorine and caustic soda. Increased consumption also resulted from the expansion of synthetic rubber plants, mercury-arc rectifiers, and other electrical devices. The easy availability of mercury to Germany in the prewar period, and the shortage of other vital materials, encouraged its use in new projects and as a substitute for materials in short supply.

The only important mercury deposit in Germany is the Landsberg mine at Obermoschel near Bingen in the Rhein Palatinate. After being idle for nearly a century, the mine was reopened with government assistance in 1934 under the general program for increasing national self-sufficiency in production. The ore averaged 0.2 percent and production costs were correspondingly high. The government expected the mine to produce about 3,500 flasks a year, but peak output was 1,775 flasks produced in 1937. By 1942 only about 522 flasks were mined and the mine closed down, presumably because sufficient mercury was being received from Italy to supply all needs.

At the end of the war large stocks of mercury were found in Germany (all but 9,000 flasks were shipped to the US stockpile. The 9,000 flasks remaining were sold in Belgium.

CZECHOSLOVAKIA

Domestic requirements and a small surplus for exports are normally provided for by the Mariabana and Mernik mines near Vranov and Teplov in Slovakia. Before World War II these mines were owned by a French company. Recent details on the ownership and operation of these mines are lacking. It is probable that they have come under government ownership as a result of the nationalization of Czechoslovakian industry. The 1940 output was 2,582 flasks but is believed to have dropped in subsequent years.

YUGOSLAVIA

At the end of World War II, the terms of the Paris Peace Treaty gave Yugoslavia the Italian territory surrounding Trieste, including the Idria mine which had been ceded to Italy by Austria after World War I. The Idria mine was operated by the Italian government and its production was subject to cartel control until siezed by the Yugoslavs. The mine is now operated by Rudnik Ziveta Sreba, controlled by the Yugoslav government. Idria is one of the largest all-time producers but its reserves are believed to be limited. Prewar production averaged about 8,000-10,000 flasks annually. The mine is reported to be operating at the present time; in fact 1,500 flasks were shipped to the USSR from Yugoslavia in the last querter of 1947, and significant quantities are being shipped to the USSR. Idria is selling small quantities on world markets at prices slightly under those quoted by the cartel. It is doubtful if production could be increased to more than 15,000 flasks per year for reserves are not extensive. Explorations by the Italians at the beginning of the war failed to reveal any new ore bodies.

PRODUCTION OF IDRIA DISTRICT

YEAR	FLASKS
1940	13,800
1941	14,600
1942	11,050
1943	8,400
1944	1,670

TURKEY

There are two principal deposits in Turkey, the Ahirli and Karareis mines both of which are on the Karaburnu Peninsula and are easily accessible by sea. Turkish mercury production increased to 597 flasks a year in 1938, but fell off in subsequent years. During World War II the Turkish army was the principal buyer with small quantities exported to UK, Egypt, and Palestine. The mines have been worked only during periods of high prices. Equipment and methods are primitive while the ore is low grade. The mines are reported to be capable of a substantial increase in output, possibly to 5,000 flasks a year, if crushing equipment, a modern furnace, and a new haulage system were installed.

In 1938 a partnership, the Karareis Mercury Mines Operating Company, Ltd., was formed between Karareis, fifty-five percent government owned, and the Turkish owners of Ahirli. The government then turned over its interests to this company provided the mines were operated according to government regulations.

CHINA

The largest production since 1925 was in 1939 when 4,918 flasks were mined while the peak year of exports was in 1940 when shipments totalled 6,258 flasks. There is a small domestic consumption for amalgamation purposes and in making vermilion and, possibly, fulminate. The Chinese mercury deposits occur within a belt 420 miles long by 180 miles wide, extending from western Hunan southwest through Kweichou, Yunan, and into Kwangsi and Szechuan Provinces. Hunan was the principal producer through 1940 but Kweichou has had the largest output since that time. The mines are small and scattered, with the ore averaging about one percent mercury. Mining methods are primitive and operations are not carried on during the farming season. Ore is treated in native retort furnaces and losses are high. The mines are largely controlled by the Chinese National Resources Commission.

When German armies captured the USSR's chief producer of mercury, China, as well as the US was called upon to make up the deficiency in supply. In 1941 China exported about 3,480 flasks to the USSR; in 1942 about 5,800 flasks were shipped.

Although China's deposits are small, they are numerous and of considerable potential importance. No study of reserves is believed to have been made and there is little development ahead of mining. Technical assistance is needed and, should this

be supplied, China will have an important surplus for export over and above domestic requirements.

JAPAN

Stock-piling of mercury for war purposes appears to have been started in Japan as early as 1935 with a sharp increase in purchases from Spain and Italy, Japan's chief sources of supply. Imports reached a peak of 38,051 flasks in 1941. In the succeeding years imports exceeded 600 flasks in one year only, 1943, when Italy and Germany shipped a total of 7,842 flasks. Korea was the main recipient of small exports, with some mercury going to Formosa for amalgamation of gold ores. Mine output was inconsequential before World War II, amounting to only 368 flasks in 1937, and Japan depended on imports for its annual requirements of about 12,000-14,000 flasks. Government assistance in the form of subsidies and the discovery in Hokkaido of the Itomuka mine which accounted for more than three-fourths of Japan's wartime output, increased domestic production to a peak of 7,096 flasks in the year 1944.

Production amounted to 1,421 flasks in 1946 with only Itomuka and Oketo operating at the end of the year. Japan's future requirements have been estimated at 5,800 to 8,700 flasks annually of which domestic production may be able to supply one-half. Japan's known reserves were reported to total 43,964 flasks in 1945, but much of this is low in grade. Practically all the above-marginal reserves are in the Itomuka mine. Several of the mines are equipped with flotation plants but at Itomuka losses were high and flotation did not prove economical. The average grade of ore mined declined from 1.9 percent mercury in 1939 to 0.18 percent in 1945. Future operations will necessitate selective mining to operate economically, together with efficient exploration, mining, milling and distillation methods.

TABLE 6—STATISTICAL SUMMARY OF THE JAPANESE MERCURY INDUSTRY

YEAR	IMPORTS	MINE OUTPUT	EXPORTS	APPARENT CONSUMPTION
1930	7,167	121	348	6,940
1931	7,640	102	406	7,336
1932	9,883	69	696	9,256
1933	10,703	234	812	10,125
1934	14,442	196	754	13,884
1935	23,673	148	899	22,922
1936	14,845	429	957	14,317
1937	16,003	368	783	15,588
1938	11,078	716	377	11,417
1939	14,500	1,429	870	15,059
1940	19,020	3,520	870	21,670
1941	38,120	4,323	1,450	40,993
1942	546	5,197	1,450	4,293
1943	7,842	6,706	1,041	13,507
1944	349	7,096	635	6,810
1945	3	3,139	145	2,997
1946	....	1,361	....	....
1947	....	1,619	....	....

USSR

In prewar years the USSR was self-sufficient and the world's fourth largest producer, with an output of about 8,700 flasks of seventy-six pounds annually, practically all of which was produced at the Nikitovka mines in the Ukraine. The German armies closed in on the mines in 1941, but the Russians removed the equipment to deposits further east before the Germans arrived. However, the USSR had lost its one large producer at a time when consumption was almost immediately increased by war requirements (fulminate primers, pharmaceuticals, etc.) from 8,700 flasks to a rate of more than 15,000 flasks annually. Large-scale production of mercury deposits in Asiatic Russia began in 1939 or 1940 with the building and expansion of Im. Frunze, an antimony-mercury combine. After the loss of Nikitovka, production of Im. Frunze at Khaidarkan, Chauvai, and Turgai in Central Asia was increased and exploitation of other deposits began, such as the Chagan-Uzun in the Altai Mountains and those near Vladivostok in Siberia. Estimated 1943 capacity of the Im. Frunze combine was believed to be about 5,000 flasks; Chagan-Uzun, 2,500; and the Siberian deposits, 800.

By the summer of 1942 domestic production is believed to have reached a production rate of about 6,500 flasks annually. Chinese mercury shipments amounting to 3,480 flasks in 1941 and 5,800 flasks in 1942 were flown to Russia from Kunming to alleviate the shortage but supplies still became drastically short. The USSR requested

7,000 flasks of mercury from the US during 1942 and almost 8,000 flasks were shipped during that year through Lend-Lease.

At the end of 1942 USSR authorities requested that additional supplies from both China and the US be shipped immediately. Preparations were being made for an offensive and requirements increased considerably.

During 1943 about 15,000 flasks were shipped to the USSR, again under Lend-Lease, but Chinese shipments dropped off. No further requests to the US were made and the only imports were in the form of manufactured goods. From 1943 through 1946 the USSR imported 7,366 flasks from China. No mercury was shipped from China to the USSR during 1947.

The present position of the USSR is apparently one of self-sufficiency where civilian requirements are concerned; in fact, productive capacity including the Nikitovka mines, now reported to be back in operation, is believed to equal the wartime demand. Should purchases be made in the near future by the USSR they would be limited to low-priced offerings for stockpile purposes. The Mercurio Europeo, international mercury cartel, has large stocks of mercury on hand and would like to sell substantial quantities without materially affecting the market. This could only be done by selling to the USSR or to other governments for stockpile purposes and may be a possibility.

Although the mercury mines of the USSR and Satellite countries should be able to meet all domestic demands in event of an emergency, a stockpile would be needed to maintain a constant flow to industry. Many deposits have been reported but most of these have yet to be exploited. Lack of equipment is a major limiting factor. With more intensive exploitation, it is probable that the output of mines in the USSR could be increased to 17,000 flasks annually within a few years. This would approximate the World War II rate of consumption. At the same time the Idria mine, now held by the Yugoslavs could supply at least 8,000 flasks annually to the USSR, and Czechoslovak production could be increased.

If the USSR should invade Europe, about 175,000 flasks would fall into the hands of the Soviets. There are at least 75,000 in Spain and 100,000 in Italy as well as small stocks in France, Belgium, Norway, the Netherlands, and Sweden.

TABLE 7—WORLD PRODUCTION OF MERCURY 1938-47, BY COUNTRIES

(In Flasks of 76 Pounds)

COUNTRY	1938	1939	1940	1941	1942	1943	1944	1945	1946	1947
Algeria	191	256	791	147	121	146	165	326	340	348
Australia:										
New South Wales	...	...	[2]	1	[2]	...	...	[3]	[3]	[3]
Queensland	...	3	37	34	15	15	12	3	...	[3]
Austria	[1]	9	[1]	[3]	[3]	[4]	[4]	[3]	[3]	[3]
Bolivia (exports)	...	7	...	...	...	51	2	3	...	[3]
Canada	10	6	2,024	7,057	13,630	22,240	9,682	...	...	...
Chile	44	100 [3]	100 [6]	1,305	2,256	2,563	1,181	862	827	[3]
China	560	4,931	3,403	2,756	4,293	3,133	3,510	1,828	1,189	290
Czechoslovakia	2,900	2,669	2,582	[3]	[3]	[3]	[3]	[3]	[3]	[3]
Germany	1,392	1,218	957	899	493	3,480 [5 6]	3,480 [5 6]	[3]	...	[3]
Italy	66,752	67,154	91,230	94,161	75,885	61,945	22,997	25,527	50,822	53,984
Japan [7]	592	1,358	3,394	4,323	5,197	6,706	7,096	3,139	1,361	1,619
Korea (Chosen)	16	1	2	[1]	[1]	[1]	[1]	[1]	[1]	[1]
Mexico	8,519	7,376	11,653	23,137	32,443	28,321	26,053	16,443	11,661	9,700
New Zealand	10	...	...	73	150	93	90	30	...	[3]
Peru	...	...	...	...	145	326	152	209	5	...
Rumania	...	...	...	...	21	176	[3]	[3]	[3]	[3]
Southern Rhodesia	...	[2]	[1]	2	3	[2]	...	[2]	...	...
Spain	41,409	35,912	52,214	86,473	72,288	47,756	34,349	40,694	41,801	35,420
Sweden	...	...	...	59	11	...	21	1	...	[3]
Tunisia	270	58	125	88	3	[2]	...	...	...	[3]
Turkey	597	359	500	242	176	271	143	158	75	[3]
Union of S. Africa	...	...	42	204	579	1,189	1,192	852	764	...
USSR	8,700 [6]	[1]	[1]	[1]	[1]	[1]	[1]	[1]	[1]	[9]
United States	17,991	18,633	37,777	44,921	50,846	51,929	37,688	30,763	25,348	23,244
Yugoslavia [8]	...	...	...	...	...	...	...	...	[3]	[3]
Total [6]	150,000	145,000	215,000	275,000	265,000	240,000	157,000	131,000	144,000	144,000

[1] Estimates included in the total.
[2] Production less than 1 flask.
[3] Data not yet available; estimate included in the total.
[4] Included under Germany.
[5] Includes Austria.
[6] Estimate.
[7] Preliminary.
[8] Output of Idria Mine included under Italy until ceded to Yugoslavia after World War II.
[9] Present output believed to be at the rate of 10,000 flasks annually. C.I.A. estimate.
SOURCE: Bureau of Mines.

TABLE 8—STATISTICAL SUMMARY OF THE MERCURY INDUSTRY IN THE UNITED STATES, 1938-47

(In Flasks of 76 Pounds)

	1938	1939	1940	1941	1942	1943	1944	1945	1946	1947
Production—Flasks	17,991	18,633	37,777	44,921	50,846	51,929	37,688	30,763	25,348	23,244
Number of producing mines	91	107	159	197	184	146	102	68	61	[1]
Average price per flask:										
New York	$75.47	$103.94	$176.87	$185.02	$196.35	$195.21	$118.36	$134.89	$98.24	$83.74
London	$66.92	$88.26	$201.10	$194.20	$227.87	$281.44	$281.44	$242.45	$120.39	$73.02
Imports for consumption—Flasks	2,362	3,499	171	7,740	38,941 [2]	47,805 [2]	19,553	68,617	13,894	10,228
Exports: Flasks	713	1,208	9,617	2,590	345 [2]	385 [2]	750	1,038	907	884
Consumption—Flasks	19,600 [3]	20,900 [3]	26,800	44,800	49,700	54,500	42,900	62,429	31,200	35,100
World Production (Estimated)	149,900	145,000	215,000	275,000	265,000	240,000	157,000	131,000	144,000	144,000

[1] Six mines accounted for 90 percent of production.
[2] Large quantities were reexported in 1942 and 1943.
[3] Apparent consumption.
SOURCE: Bureau of Mines.

Declassified and Approved For Release 2013/01/29 : CIA-RDP78-01617A001600060001-7

TABLE 9—MERCURY CONSUMED IN THE UNITED STATES, 1937, 1942-47,
(In Flasks of 76 Pounds)

	1937	1942	1943	1944	1945	1946	1947
Pharmaceuticals		8,088	14,563	8,358	11,166	4,093	3,037
Dental preparations		1,198	566	442	537	1,086	598
Fulminate:							
Munitions	}	}	{ 1,931	}	{		
Blasting caps	}	4,146	{ 1,211	} 1,890	{ 1,115	682	538
Agriculture		1,533	1,993	3,930	2,862	3,134	5,622
Antifouling paint		1,220	2,702	2,439	1,661	994	760
Electrolytic preparation							
of—Chlorine Caustic Soda		549	691	657	597	546	665
Catalysts		3,253	4,432	4,764	3,650	3,310	5,079
Electrical apparatus [1]		4,550	3,284	7,092	24,468	3,849	6,720
Industrial and con-							
trol instruments [1]		3,529	3,674	3,249	3,776	3,960	4,686
Amalgamation		180	24	29	205	76	119
General laboratory		294	360	265	337	196	199
Vermilion		215	185	[2]	[2]	[2]	[2]
Redistilled [1]		6,175	5,384	6,613	9,712	5,572	4,653
Other		9,103 [3]	10,880	2,236	2,343	3,167	1,701
	35,000 [4]	49,700 [5]	54,500 [5]	42,900 [5]	62,429	31,200 [5]	35,100 [5]

[1] A partial breakdown of the "redistilled" mercury showed its largest use was for industrial and control instruments and the remainder for dental preparations, electrical apparatus, and laboratory purposes.

[2] Included in "Other."

[3] A large part was used for chemical warfare purposes.

[4] Apparent consumption, breakdown not available before 1942.

[5] The items do not add up to total which has been increased to cover approximate total consumption.

SOURCE: Bureau of Mines.

TABLE 10—ESTIMATED MERCURY RESERVES OF THE UNITED STATES, INCLUDING ALASKA, AS OF JANUARY 1944

(In Flasks of 76 Pounds)

State	Workable at $100 a flask			Workable at $195 a flask [2]			Workable at $300 a flask [2]		
	Measured and indicated [1]	Inferred	Total	Measured and indicated [1]	Inferred	Total	Measured and indicated [1]	Inferred	Total
Alaska	300	300	600	9,500	14,200	23,700	14,500	30,200	44,700
Arizona	...	500	500	3,500	3,500	7,000	3,500	3,500	7,000
Arkansas	...	...	...	200	3,500	3,700	200	3,500	3,700
California	31,000	34,000	65,000	72,400	107,400	179,800	90,300	160,600	250,900
Idaho	...	1,000	1,000	14,300	3,700	18,000	34,000	5,400	39,400
Nevada	5,400	8,000	13,400	25,000	50,000	75,000	29,000	75,000	104,000
Oregon	3,500	1,000	4,500	10,000	6,800	16,800	13,000	7,800	20,800
Texas	500	500	1,000	2,500	3,000	5,500	3,000	6,000	9,000
Washington	...	...	...	...	500	500	...	2,000	2,000
Total	40,700	45,300	86,000	137,400	192,600	330,000	187,500	294,000	481,500

[1] Ore at most mines is indicated and inferred because ore is extracted during development.
[2] Cumulative totals.
SOURCE: Bureau of Mines.

MERCURY MINES OF THE WORLD

CHART NO. I

No. on Map	Name and Location of Mine or Producing Area	Ownership and Nationality of Controlling Capital	Production Year — Flasks of 76 pounds	ORE DEPOSITS AND ORE RESERVES Geological and Mineralogical Notes and Ore Analysis	PRODUCTION METHODS and Plant Capacities	TRANSPORTATION Labor Employed and Other Data
	ALASKA					
1.	Decourcey Mine, Decourcey Mountain Region, 35 miles southwest of Flat on east slope of Iditarod River.	Decourcey Mining Co. United States Control.	Alaska Production 1940 162 1941 Not separated 1942 Not separated	Lenses of cinnabar averaging 1 foot thick occur along 5 zones of enrichment in sandstone and shale beds over 1,800 feet in length and 385 feet in width. Sedimentary beds intruded by dikes and sills of diabase. Ore bodies vary in dip from 50 to 80 degrees. Ore averages 32 lbs. Hg per ton. Reserves: Developed ore, 6,970 tons containing 322 lbs. Hg per ton.	Cinnabar lenses developed by surface trenches and adits. Ore hand sorted to 30 percent Hg. conc. Retort plant constructed at mine. Output 1944, 400 fl. (est.)	Air service from Flat to Decourcey on charter basis at $30 a trip, 300 lbs. of freight. From Fairbanks to Flat, freight by air is 26 cts. a pound
2.	Red Devil Mine, 8 miles west of Sleitmut, which is on the Kuskokwim River about midway between Bethel and McGrath. Georgetown District 61° 46'N 157° 20'W	New Idria - Alaska Co. Headquarters: San Francisco, California. United States Control	1943 786 1944 548 1945 Not separated 1946 699	Cinnabar associated with stibnite in brecciated and altered andesite dikes of Tertiary age intruding Upper Cretaceous sandstone and shales. Ore occurs in form of lenses in both andesite and sediments along the contact. Ore averages 1½% Hg. Reserves: 4 lenses have total indicated reserve 11,000 tons 45.3 lbs. Hg/ton. 7 lenses inferred reserve 15,000 tons 36.7 lbs. Hg/ton.	Mined underground through adits and shafts. Cut and fill method of mining. 40-ton wood-fired Gould Rotary furnace. Development partially financed by Government Funds. Further operations depend on higher prices.	Transported by boat to United States. Owners also operate New Idria mine in California. Mine could yield 300 to 400 flasks a month for a few years at high prices.
	CANADA		Canada Production			
3.(a)	Pinchi Lake Mine 12 miles from Fort St. James, on Manson Creek, British Columbia	Consolidated Mining and Smelting Co. Headquarters Trail, B. C. Canadian Control.	1939 6 1940 2,024 1941 7,057 1942 13,630 1943 22,240 1944 9,682 1945 --- 1946 --- Pinchi Lake 52,600 from 1940-44, value $10,000,000. Bralorne 1,700 in 9 months.	The two mines are 90 miles apart but both occur in the same belt which lies along a major fault zone about 150 miles long and from 200 to 1000 feet wide. The ore bodies at these two mines and elsewhere along the belt are found in sheared and brecciated limestone or in carbonitized serpentine with fault gouge and impervious caprock often controlling deposition of cinnabar. At Pinchi Lake, the larger cinnabar ore bodies are in limestone overlain by schist. The grade varies considerably from 0.25 to 3% Hg.	Mine developed by a 3-compartment shaft, 250 feet deep on 65 degree incline. Six mine levels opened, total of about 5,000 feet of drifts, 6,000 feet of raises and 20,366 feet of diamond drilling. Treatment plant capacity 1200 tons ore per day consists of coarse crushing by gyratory crushers, wedge roasters, rotary kiln furnaces and condensers. Reported mercury recovery 95%, impurities 0.005%.	Pinchi Lake capacity increased 20 times in 3 years. Started producing in 1940 and tried cold pressing but discontinued it because it proved unsuccessful. Mines closed down in 1944 with cancellation of contracts with United States.
3.(b)	Bralorne Takla Mine Takla Lake British Columbia	Bralorne Mines Ltd.				
	CALIFORNIA					
4.	New Idria Mine, 57 miles south of Tres Pinos, 67 miles southeast of Hollister, 55 miles southeast of Mendozo. San Benito County. Altitude 2,500 to 5,200 feet.	New Idria Quicksilver Mining Co. United States Control.	Largest producer in the United States. Accounted for more than 1/3 country's production in 1946. Second largest all time producer.	Ore is cinnabar in silicified shale breccia beneath steep thrust fault that brings Jurassic sandstone and serpentine against overturned Cretaceous shale and sandstone beds. Both ore and silicified zones are controlled by changes in dip and strike of fault and are principally in inverted troughs. Main mineralized zone, which contains several ore shoots is 20-100 feet wide, 1,000 feet long and 1,500 feet deep. Ore averages 0.5 - 1.5% Hg. Reserves: Old dumps and stope fills which contributed much to production in recent years are largely exhausted. Newly discovered ore shoots are large and high grade.	Mine developed by means of adits at levels 200, 300, 400, 500, 700 and 1,000 ft. below outcrop, from 1,000 ft. level a three compartment winze extends to 1,400 ft. level. Total length of underground workings is 20 miles. Ore is processed in 4 Gould rotary furnaces.	Produces more mercury annually than its next three United States competitors. 75-100 workmen.

MERCURY MINES OF THE WORLD — CHART NO. II

No. on Map	Name and Location of Mine or Producing Area	Ownership and Nationality of Controlling Capital	Production Year / Flasks of 76 pounds	ORE DEPOSITS AND ORE RESERVES Geological and Mineralogical Notes and Ore Analysis	PRODUCTION METHODS and Plant Capacities	TRANSPORTATION Labor Employed and Other Data
	CALIFORNIA (Cont'd.)					
5.	Lea Grant Mine, 20 miles north of Idria, 45 miles southeast of Hollister, San Benito.	Ownership not reported. United States Control.		Cinnabar is disseminated in sandstone, and fills fractures therein. There are at least 5 zones of mineralization. Ore averages 0.2% Hg. Mineralized area is about one square mile. Individual ore shoots are pockety and known reserves are small.	Shallow surface and underground workings, widely scattered. 100-ton rotary furnace.	
6.	Sulphur Bank Mine, near the southeast arm of Clear Lake, 10 miles north of the town of Lower Lake, Lake County.	Bradley Mining Co. United States.	Total production to the end of 1944 was 126, 285 flasks.	Cinnabar disseminated within highly kaolinized zones of altered "bouldery" andesite, especially near contacts and in open spaces formed by joint planes or small faults. Cinnabar also forms thin "paint" in the Franciscan fault breccia beneath the andesite, chiefly around sandstone boulders in fault breccia exposed in bottom of Herman pit. Ore averages 0.6 - 0.7% Hg.	Open pit mine. Roughly one square mile in area. Ever-increasing amounts of overburden must be moved in order to maintain a constant amount of ore. In 1938, 144,999 dry tons of waste rock was excavated and 22,186 tons of 0.72% ore mined.	Reserves 1944: Measured none, Indicated and Inferred 34,170 flasks from 165,000 tons of ore. Gould Rotary furnace.
7.	Abbott Mine eastern boundary of Lake County, 24 miles west of the town of Williams, Lake County.	International Metal Development, Inc. United States Control.	Third largest producer in the United States in 1944.	Details on geology not available. Ore averages 0.77% Hg. Reserves are comparatively small with fair chance of discovering new high-grade ore shoots. Mine closed in August 1946.	Extensive underground workings, many are caved. Deepest shaft is 285 feet. 40-ton rotary furnace.	Transport by truck to Williams, 24 miles, then via Southern Pacific.
8.	Great Western Mine at 2,000 ft. altitude on the north slope of Mt. St. Helena, 4 miles by road southwest of Middletown, Lake County.	Bradley Mining Co. United States Control.	California Prod. 1938 12,277 1939 11,127 1940 18,629 1941 25,714 1942 29,906 1943 33,812 1944 28,052 1945 21,199 1946 17,782	Ore bodies occur in beds of silica-carbonate rock, in Franciscan sandstone, and in chert beds. The deposits in silica-carbonate rock are the most important. Cinnabar is the ore mineral. Ore averages 0.6% Hg. Reserves are very small.	Mine developed by 8 miles underground workings mostly inaccessible, and distributed through a vertical distance of over 750 feet. Entry to main workings by adit, winze inclined 25° to 30° connects main level adit with orebody on lower level. Stoping, using square set method of mining. Herreshaft furnace of 20 tons daily capacity.	
9.	Mirabel Mine 4 miles south of Middletown, State highway runs by the property, Lake County.	Mirabel Quicksilver. United States Control.		Cinnabar occurs in a silica-carbonate rock in ore shoots of both tabular and pipe-like forms. The largest ore shoot is a tabular body 240 feet long, 20 feet wide and 200 feet high. The ore minerals are cinnabar, meta-cinnabar and native mercury. Ore averages 0.1 - 0.5% Hg. Reserves are very small.	Exploration carried to 500 feet below the surface. Extensive underground workings.	
10.	Klau Mine 17 miles by road west of Paso Robles in Santa Lucia Range. Mine is just off road leading to Cambria 15 miles over the range. San Luis Obispo County.	Klau Mining Co. lessee. Mrs. Ellard W. Carson, Owner. United States Control.		Cinnabar occurs as vein networks in a brecciated shale, the veins often consisting of greenish clayey material. Pyrite and marcasite are fairly abundant and are commonly associated with the veinlets and irregular masses of dark red crystalline cinnabar. Rocks are of Franciscan, Cretaceous and Tertiary age. Ore averages 0.4% Hg. Very little development ahead of mining - Heavy ground.	A considerable amount of open-pit work has been done, but the mine has been developed chiefly from a 450-foot inclined shaft near the center of the property. Most of the many miles of tunnels, shafts and cross-cuts driven on the property are now caved. Rotary furnace of 50 ton daily capacity.	1938 - 20 men.

MERCURY MINES OF THE WORLD

CHART NO. III

No. on Map	Name and Location of Mine or Producing Area	Ownership and Nationality of Controlling Capital	Production Year / Flasks of 76 pounds	ORE DEPOSITS AND ORE RESERVES Geological and Mineralogical Notes and Ore Analysis	PRODUCTION METHODS and Plant Capacities	TRANSPORTATION Labor Employed and Other Data
	CALIFORNIA (Cont'd.)					
11.	Oceanic Mine 40 miles by road from San Luis Obispo and 5 miles east of Cambria. Altitude 500 ft. San Luis Obispo County.	American Quicksilver Co. United States Control.		Ore is of two types: (1) high-grade type is a medium grained sandstone containing disseminated cinnabar; (2) is a sandy siltstone containing almond shaped "nuggets" of replacements of fossil shells by cinnabar and some native mercury associated with the cinnabar. The ore shoot has a maximum horizontal extent of 500 feet and a thickness of 15-40 feet. The mine workings are in rocks of Miocene age. Reserves total several thousand tons of low-grade ore averaging 0.1 to 0.15% Hg.	Extensive underground workings, shafts, adits, and crosscuts. Shaft to 750 feet depth below outcrop, level interval 70 ft. in upper workings and 50 ft. in lower workings. Mined by top slice method. Ore is crushed in 2 Hercules-Blake jaw crushers at the portal of 400 level, transported by 2,800 ft. aerial tramway to furnace plant. Gould rotary furnace 75 ton per 24 hours, capacity, calcined ore trammed to dump in cars hauled by small gasoline locomotive.	1938 - 40 men
12.	Socrates Mine 6 miles southeast from the Geysers, on the divide between Big Sulphur and Little Sulphur Creeks. Sonoma County.	Contact Quicksilver Co. United States Control.	California Prod. 1938 12,277 1939 11,127 1940 18,629 1941 25,714 1942 29,906 1943 33,812 1944 28,052 1945 21,199 1946 17,782	The mine workings are along the sheared northern contact of a serpentine dike which cuts the Franciscan sandstone. Ore bodies occur along and beneath the contact where native mercury is abundant in cracks and fissures in silica-carbonate rock, or is disseminated in the sandstone, and variable amounts of cinnabar nearly everywhere accompanying the native mercury. Grade of ore varies considerably. The main ore shoot extends from the surface to a depth of at least 400 feet; its average length is about 70 feet. It is rarely over 15 feet wide. The second main shoot fingers out in depth. It was 160 feet long at the surface and extended downward at least 250 feet. Most of the rich ore has been mined.	Mine developed by 6,000 feet of workings on 4 main levels. Rotary furnace of 30 tons daily capacity.	
13.	Mt. Jackson Mine 4 miles northeast of Guerneville in west-central Sonoma County.	Sonoma Quicksilver - Mines, Inc. United States Control.		The ore shoots are steeply dipping pipes and tabular lodes, and are generally greatest in the vertical dimension. They are enclosed in silica-carbonate rock. Cinnabar is the ore mineral. Grade of ore is about 0.2% Hg. Reserves: Fairly large reserves of measurable and indicated low grade ore. In addition unexplored ground below old workings appears promising.	Mine developed by 6,720 feet of workings on five accessible main levels. Rotary furnaces of 100 tons and 40 tons daily capacity.	
14.	Great Eastern Mine 4 miles northeast of Guerneville. Adjoins Mt. Jackson mine. Sonoma County.	Magee Mercury, Inc. United States Control.		The ore shoots are steeply dipping pipes and tabular lodes, and are generally greatest in the vertical dimension. They are enclosed in silica carbonate rock. Cinnabar is the ore mineral. Grade of ore averages 0.1 - 0.2% Hg. Reserves are small and of marginal grade.	Developed by about 5,280 feet of accessible workings on 3 main levels. Rotary furnace of 80 tons daily capacity.	

MERCURY MINES OF THE WORLD

CHART NO. IV

No. on Map	Name and Location of Mine or Producing Area	Ownership and Nationality of Controlling Capital	Production Year / Flasks of 76 pounds	ORE DEPOSITS AND ORE RESERVES Geological and Mineralogical Notes and Ore Analysis	PRODUCTION METHODS and Plant Capacities	TRANSPORTATION Labor Employed and Other Data
	CALIFORNIA (Cont'd.)					
15.	Reed Mine 25 miles west from Monticello, 25 miles east from Lower Lake, Yolo County.	Bradley Mining Co. United States Control.		The mine lies on a northwest trend-fault between serpentine on the southwest and the Knoxville formation on the northeast. The silica-carbonate rock reported to occur along the edge of the serpentine acts as the enclosing rock for the cinnabar deposits and follows a fault zone ranging between 0 and 100 feet wide and extending for a horizontal distance of more than a mile. Ore averages 0.5% - 0.65% Hg.	40 ton rotary furnace. The mine is capable of continuing production for several years.	
16.	Mt. Diablo Mine on the eastern slope of Mt. Diablo about 10 miles southeast of Concord, and 4 miles east of Clayton, Contra Costa County.	Bradley Mining Co. United States Control.	California Prod. 1938 12,277 1939 11,127 1940 18,629 1941 25,714 1942 29,906 1943 33,812 1944 28,052 1945 21,199 1946 17,782	The deposits are in fracture zones near the footwalls of serpentine masses in Franciscan rocks. Ore zone is 4,000 feet long, 5 to 15 feet wide, 60 to 65° dip. Meta-cinnabar is the primary ore mineral. Other constituents of the ore include cinnabar, marcasite, pyrite, quartz and fragments of country rock. Reserves are small.	Mine developed by an adit and a winze sunk to a depth of 165 feet. Two levels below adit, one at 80 feet depth other at 165 feet. Mining is also being carried on by open pit and glory-hole methods, 2 rotary furnaces, a new D retort and condensing unit recently installed	
17.	Knoxville Mine 28 miles east of Lower Lake in the northern end of Wapa County and 21 miles west of Monticello, Wapa County.	George E. Gamble of San Francisco. United States Control.		Ore deposits are roughly pipe-like in form and extend to a depth of more than 500 feet. Ore is cinnabar and meta-cinnabar in black silicified serpentine and Knoxville shale. Ore averages 0.1 - 0.2% Hg. Mine essentially worked out and abandoned except for remnants of near-surface ore. Dumps largely exhausted.	Mine developed by 2 shafts and undergrcund workings. D-retort and rotary furnace of 30 tons daily capacity.	Total production 120,000 flasks, fourth largest mine in California. Opened in 1862.
18.	Oat Hill Mine 9 miles southeast of Middletown, on The Livermore estate, Napa County.	H. W. Gould and R. A. Hanan. United States Control.		Cinnabar occurs in at least 10 separate veins and is also disseminated throughout the adjacent zone of highly altered sandstone, particularly below the footwall of the faults. The country rock is kaolinized Franciscan sandstone. Ore averages 0.1 - 0.15% Hg. The ore in the Osceola-Fanny and Humbolt areas is practically exhausted. The Eureka, Manganita, Mercury and Minnesota vein areas are caved or abandoned but could be reopened.	Mine developed by 21 miles of underground workings with a vertical range of 875 feet. Plant consists of 4' x 64' rotary furnaces.	
19.	Falcon or Santa Ynez Mine 7 miles northeast of Santa Barbara on north slope of Santa Ynez mountains. Santa Barbara County.	Falcon Mercury Mine Corp. United States Control.		The ore deposit is in a sheet-like body of silica-carbonate rock which lies along the northwest-trending fault in one of the lenses of Franciscan rock. The ore shoots are small, irregular and tabular. Cinnabar is the ore mineral. Ore averages 0.1 - 0.25% Hg. Reserves: 500,000 tons ore indicated.	During dry season ore is mined by power shovel from open cuts on hill. Wet season from 2 tunnels in hill. Ore is trammed to jaw crusher at mill, then is fed by Cottrell feeders into 3 rotary furnaces; 30 tons, and 50 tons. Other equipment: compressors; 1 Universal 1/8 yd. power shovel; 2 - 4 ton trucks; 1 - 2 ton truck; 1 P-4 bulldozer; stopers-jack-hammers, etc.	Acute labor shortage in 1943.

MERCURY MINES OF THE WORLD — CHART NO. V

No. on Map	Name and Location of Mine or Producing Area	Ownership and Nationality of Controlling Capital	Production Year / Flasks of 76 pounds	ORE DEPOSITS AND ORE RESERVES Geological and Mineralogical Notes and Ore Analysis	PRODUCTION METHODS and Plant Capacities	TRANSPORTATION Labor Employed and Other Data
	CALIFORNIA (Cont'd.)					
20.	Red Canyon Mine (Red Rock), 16 miles northeast from Santa Ynez and 14.5 miles from the San Marcos Highway. Altitude 2,800 feet, Santa Barbara County.	Cachuma Mining Co. United States Control. Operated in recent years by National Mining and Milling Co.		The country rock is made up of ribboned, interbedded, fine-grained greywacke and a shale of Franciscan age. The ore shoots are tabular bodies, up to 100 feet in pitch length, 50 feet wide, and 5 feet thick which follow the faults, and irregular pipe-like bodies situated at the intersection of the faults. Cinnabar is the most abundant ore mineral with considerable meta-cinnabar reported. Ore averages 0.23% Hg.	Underground workings, mine is very well - equipped. Mine workings extend to a depth of 500 feet. There are 8 levels, first 4 are worked out. Equipment consists of 30 ton Gould rotary furnace, adequate condenser system, diesel-driven generator. 1 - 1½ ton truck; 1 - 5 ton truck.	18 men in 1942 - short of labor during the war.
21.	New Almaden Mine 10 miles southeast from San Jose, Santa Clara County.	New Almaden Corp. United States Control.	Largest all time U.S. producer. Now of minor importance. Began producing about 1820.	This area is underlain by a broad belt of complexly faulted Franciscan sandstone, greenstone and shale. These rocks contain masses of serpentine much of which has been converted to silica-carbonate, the host rock for the cinnabar deposit. The ore averages 0.1% to 0.2% Hg. Reserves: Fairly large tonnage of low grade ore some of which is marginal and some submarginal ore.	The workings, which underlie an area of 1 square mile, total at least 50 miles in length and extend to a depth of 2,450 feet. Only those above the 800 foot level are accessible. The plant consists of a 100 ton rotary furnace.	Total recorded production to end of 1940 - 1,040,952 flasks.
	OREGON					
22.	Horse Heaven Mine at the western edge of the John Day Basin where John Day River turns north, Central Oregon, Jefferson County.	Horse Heaven Mines, Inc. United States Control.		The ore deposits are closely related to volcanic plugs. The oldest rocks in the vicinity of the mines are a series of andesite flows, tuffs, and tuffaceous sedimentary rocks, known as the Clarno formation. Ore bearing zone is a block 1,200 feet long and 400 feet wide. Cinnabar is the most important ore mineral but there is also native mercury and meta-cinnabar. Ore averages 0.15% Hg. Reserves: Fairly large tonnage of low grade ore.	Mine developed by shaft and 9 mine levels. 50 ton Herreshoff furnace.	Short of labor in war years.
23.	Bonanza Mine 8 miles east of Sutherlin, 196 miles south of Portland, Douglas County.	Bonanza Mines, Inc. United States Control.	Oregon Production: 1938 4,610; 1939 4,592; 1940 9,043; 1941 9,032; 1942 6,935; 1943 4,651; 1944 3,159; 1945 2,500; 1946 1,326	The cinnabar is concentrated in a thin tuffaceous sandstone which lies just beneath a shale-siltstone member of the Umpqua formation. Ore averages 0.4 - 0.8% Hg. Reserves moderately small as compared to past production.	Mine developed by 6,250 feet of drifts, cross-cuts and adits in the mine as well as several hundred feet of inclined shafts. Plant consists of one 50 ton Herreshoff and 2 - 50 ton rotary furnaces.	Produced 95% of Oregon total in 1946. 8,034 tons mined, 8,188 tons furnaced and 1,261 flasks recovered.
24.	Bretz Mine In southern Malheur County near the Nevada-State line. 20 miles northeast of town of McDermitt, Nevada, Malheur County.	Bradley Mining Co. United States Control.		The known ore-bodies appear to have been localized by faults in both lake beds and volcanic rocks. Cinnabar is disseminated in minor amounts in both rocks but the ore bodies are in unaltered lake beds or in argillized tuff. Ore averages 0.64% Hg. Large reserves averaging about 0.71% Hg. occur along the sides of the old pits and dumps.	Uses the furnace at the Opalite Mine.	Bretz Mercury trucked to R.R. at McDermitt.

MERCURY MINES OF THE WORLD

CHART NO. VI

No. on Map	Name and Location of Mine or Producing Area	Ownership and Nationality of Controlling Capital	Production Year — Flasks of 76 pounds	ORE DEPOSITS AND ORE RESERVES Geological and Mineralogical Notes and Ore Analysis	PRODUCTION METHODS and Plant Capacities	TRANSPORTATION Labor Employed and Other Data
	IDAHO					
25.	Hermes Mine (Bonanza) at the head of Cinnabar Creek, 7,600 ft. altitude. 18 miles by road from Yellow Pine and 12 miles by road from Stibnite in Valley County.	Bonanza Mines, Inc. United States Control.	Idaho Production 1938 --- 1939 Not separated 1940 Not separated 1941 Not separated 1942 Not separated 1943 4,261	The ore is in faulted, silicified zone of a limestone member of a large roof pendant of the Idaho batholith. The only mercury mineral is cinnabar; Deposits well explored. Ore varies - 0.15 - 0.35% Hg. Reserves: Several years supply of ore averaging 0.34% Hg.	In the main mine area the ore does not extend much over 150 ft. below the surface. Shallow workings. Two - 75 ton rotary furnaces. In 1946 868 flasks of mercury were recovered from 7,219 tons of ore.	By truck to railhead at Cascade, Idaho, 82 miles.
26.	Idaho-Almaden Mine 11 miles east of Weiser which is on the Snake River, 4,000 ft. altitude, Washington County.	Idaho-Almaden Mines Co. United States Control	1944 Not separated 1945 627 1946 868	The cinnabar is associated with an opalite gangue. The deposit is a replacement of the folded Payette sandstone and occurs as a blanket from 20 - 40 feet in thickness beneath a capping of impervious shale. Deposit occurs within an area about a mile long in a northerly direction, and half a mile wide. Grade 0.33% Hg. Reserves are reported to be small.	The mine is worked by open pit and from several shafts, the deepest being 155 feet with levels at depths 30 and 50 feet. Practically exhausted. Closed down several years ago.	By truck to Weiser, on Union Pacific System.
	NEVADA					
27.	Cordero Mine near the Nev-Oregon line, nearest town is McDermitt on highway U. S. 95, northern part of Humbolt County.	Cordero Mining Co. United States Control.	Nevada Production 1938 336 1939 828 1940 5,924 1941 4,238 1942 5,201 1943 4,577 1944 2,460 1945 4,338 1946 4,567	The ore body is in clays and tuffs which overlie rhyolitic lavas. Cinnabar is distributed over a north-east trending area about 300 feet wide and 3,500 feet long. Low grade ore. Reserves small. Churn drilling disclosed a new ore body at 600 feet.	Underground workings are over 1,200 feet in extent. One ore body ranged from 10 to 15 feet in width and extended 80 feet below the surface. 120 ton Herreshoff furnace.	Largest producer in state for many years. Second largest in the U.S. in 1945.
28.	White Peak Mine 67 miles southeast from Winnemucca, Humboldt County.	James O. Greenan. United States Control.		Two types of deposits: 1. Cinnabar-bearing fault zones in rhyolite. 2. Pre-Tertiary rocks and cinnabar bearing diabase dikes. The ore shoots in the diabase dikes are as much as 60 feet long, 40 feet down the dip, and 8 feet wide. Ore averages 1.5% Hg. Small reserves of low grade ore.	Mine developed by a 112 foot shaft and 325 feet of drifts and cross cuts. 10 ton rotary furnace.	
29.	Red Bird Mine 1 mile from Tuscarora, Elko County.	Fred C. Bacon, Twin Falls, Idaho. United States Control.		The workings of the mine are in upper-Triassic limestone conglomerate and shale. Cinnabar occurs as high grade pods and in masses of limestone-conglomerate with many mineralized calcite veins forming low grade deposits. No developed ore reserves, mining keeps pace with exploratory work.	Mine developed by surface cuts and adits. Most of the ore comes from a stope 10 feet wide, 150 feet long and extending 70 feet up the slope from a level 30 feet above the haulage level. 6-tube retort furnace.	Closed in August 1945.

MERCURY MINES OF THE WORLD

CHART NO. VII

No. on Map	Name and Location of Mine or Producing Area	Ownership and Nationality of Controlling Capital	Production Year / Flasks of 76 pounds	ORE DEPOSITS AND ORE RESERVES Geological and Mineralogical Notes and Ore Analysis	PRODUCTION METHODS and Plant Capacities	TRANSPORTATION Labor Employed and Other Data
	NEVADA (Cont'd.)					
30.	Pershing Mine 22 miles from town of Lovelock, Pershing County.	Pershing Quicksilver Co. United States Control.		Upper Triassic sediments cut by a few diabase dikes and sills of Jurassic age. Ore bodies occur where cinnabar is either in closely spaced disseminated crystals or fills numerous fractures. Most of the orebodies lie within the conglomeratic dolomite just above the buff sandstone. The main ore body is about 700 feet long, 15 feet wide, and 40 to 50 feet deep. Grade - 0.13% Hg.	Mine developed by adits and shafts. There are 6,135 feet of main workings. Plant consists of a 60-ton Herreshoff furnace and a 50-ton rotary furnace.	Idle in 1945.
	ARKANSAS					
31.	Humphreys Gold Corp. Mine 16 miles southeast from Amity by road, Clark County.	Humphreys Gold Corp. United States Control.	Arkansas Production 1938 Not separated 1939 364 1940 1,159 1941 2,012 1942 2,392 1943 1,532 1944 191 1945 Not separated 1946 Not separated	Several hundred feet of sedimentary strata which are divisible into two formations (1) the Jackfork sandstone and (2) the Stanley shale, both are of Pennsylvania age. They are highly deformed. The mineralized zone is 5,200 feet long, 150 feet wide and 40 to 250 feet deep. Ore averages 0.25 to 0.5% Hg.	By truck to Amity on Missouri Pacific R.R. 100-ton Rotary furnace.	Largest producer in state during the war.
32.	Parker Hill Mine and Parnell Hill Mine 6 miles northwest of Murfreesboro, 24 miles from Amity, Pike County.	Arkansas Quicksilver Co. United States Control.		The Parnell Hill mine is opened near the top of the Gap Ridge sandstone. The ore is near the upper-sandstone-shale contact. They are of Pennsylvania age. Reserves: None in sight.	15-ton Rotary furnace.	
	ARIZONA		Arizona Production			
33.	Mazatal Mts. deposits 65 miles south of Mesa, 85 miles southwest of Phoenix, Maricopa County.	Pine Mountain Mercury Mines Co, Pine Mountain Mine. United States Control.	1938 Not separated 1939 Not separated 1940 740 1941 873 1942 701 1943 541 1944 548 1945 Not separated 1946 95	Not reported. Ore averages 0.15 to 3.3% Hg. During the last two years the Ord mine in Gila County has been Arizona's only producer.	Mine developed by a 210 foot vertical shaft and several thousand feet of drifts adits and open cuts. 50-ton rotary furnace and a 30-ton Foster paddle-conveyor type furnace.	
	TEXAS					
34.	Fresno Mine 17 miles from Terlinga, 102 miles from Alpine, Presidio County.	Harris Smith, Homer Wilson. United States Control.		Cinnabar is found in marine Cretaceous rocks which are overlain by Tertiary volcanic flows and intercalated continental conglomerates. Most of production has come from the contact of the Devils River limestone and Del Rio clay but some deposits are in or along steeply dipping calcite veins and faults. Ore averages 0.99% Hg. Reserves are small.	Medium size rotary furnace.	Largest producer in Texas in 1944. Inactive in 1945.

MERCURY MINES OF THE WORLD

CHART NO. VIII

No. on Map	Name and Location of Mine or Producing Area	Ownership and Nationality of Controlling Capital	Production Year / Flasks of 76 pounds	ORE DEPOSITS AND ORE RESERVES Geological and Mineralogical Notes and Ore Analysis	PRODUCTION METHODS and Plant Capacities	TRANSPORTATION Labor Employed and Other Data
	TEXAS (Cont'd.)					
35.	Study-Butte Mine at the town of Study-Butte, 90 miles from Alpine, 95 miles from Marathon, Brewster County.	Texas Mercury Co. United States Control.	Texas Production: 1938 Not separated; 1939 Not separated; 1940 Not separated; 1941 Not separated; 1942 Not separated; 1943 1,769; 1944 1,095; 1945 2,099; 1946 ---	Deposit is found along a sharply upturned edge of a sill-like intrusive. The cinnabar occurs in nearly vertical fractures in the intrusive and in irregular bodies along its contacts. Ore averages 0.75% Hg.	Four main levels explore over 3 miles of mineralized area. Most of the stopes are 5 to 10 feet wide. Only a few are longer than 200 feet or higher than 50 feet. The ore is hand sorted. Two-medium size rotary furnaces. 90 miles by truck to Alpine, shipping point.	
36.	Chisos Mine 65 miles by road from Alpine, Brewster County.	United States Control. Operator: The Esperado Mining Co. which also has the Waldron mine in Brewster County.		Several thousand feet of Cretaceous sedimentary rocks which are intruded locally by igeous rocks. The ore deposits consist of cinnabar in calcite veins, in breccia zones, and in blanket bodies along favorable stratigraphic horizons. Ore is low grade. No known reserves.	3 main shafts explore an area of ½ square mile. The vertical extent is 840 feet in the eastern part of the mine and 800 feet in the western part. 100 ton rotary furnace.	Since 1897 produced more than 100,000 flasks.
	MEXICO					
37.	San Isidro Mine Nuevo Mercurio district, 10 miles via dirt road from Opal on Mexican-El Paso Railroad. State: Zacatecas.	Mercurio Mexicano S.A. Mexican Control.	1942 250 per mo.; 1943 3,000	Anticlinal structure in limestone and shale with cinnabar in veins and bunches 3-12 ft. wide following fracture zones. Ore averages 0.5 - 2% Hg. Reserves: 33,000 tons of measured ore.	Developed by 100 foot shaft and 300 feet of drifts along vein. Air drills. Hand methods. 2-40 ton Nichols-Herreschoff furnaces. 10 mile dirt road to Opal. Shipped from Opal, Zacatecas to Laredo, Texas. Sold to Financiera Minera.	100 workmen in mine. 10 workmen in plant.
38.	Buenos Aires Mine also Villa Rica Mine and San Jose Mine at Nuevo Mercurio Dist. State: Zacatecas.	Oro Plata y Mercurio S.A. Mexican Control.	1942 100 per mo.	Irregular veins with cinnabar in stringers and bunches following fracture zones in limestone and shale. Ore averages 0.3% Hg.	Shaft 100 feet deep with 330 feet of levels on vein. Hand methods. 1-40 ton Nichols-Herreschoff furnace. 10 miles by dirt road to Opal, by truck. R. R. to Laredo, Texas. Sold to Financiera Minera.	Production to 1942 was 750 flasks. 50 workmen at mine. 10 workmen in plant.
39.	El Coyote Mine and others. Nuevo Mercurio Dist. State: Zacatecas.	Carlos Sarabia. Owner. Mexican Control.	1942 100 per month	Fracture zones in limestone and shale. Vein of variable width. Cinnabar in stringers and bunches. Ore averages 0.4% Hg.	Shallow workings along vein. Mining by hand methods. One Nichols-Herreschoff 40-ton furnace. Mercury shipped 10 miles by truck to Opal, Zacatecas thence by R. R. to Laredo, Texas.	Total production to 1942 was 1,000 flasks.
40.	La Cruz Mine Sain Alto District. Reached by R.R. via Durango branch to Cantuna. State: Zacatecas.	Cia Minera Sain Alto Owner-Operator. Mexican Control.	1942 200 per month	Folds and fracture zones in sandstone and shale. Cinnabar in veinlets in enriched zone 150-300 feet deep. Grade of ore varies from 0.5 - 2% Hg.	Vein developed to 400 ft. depth and 300 feet in length. Air drills. Diesel hoist. Concentrated to 80% Hg. by Denver Flotation unit. 2-tube retort furnace. Mercury shipped 6 miles by truck to R. R.	Entire production during the war sold to Financiera Minera. Total production to 1942 was 3,000 flasks; 100 workmen in mine. 50 workmen at smelter.

MERCURY MINES OF THE WORLD

CHART NO. IX

No. on Map	Name and Location of Mine or Producing Area	Ownership and Nationality of Controlling Capital	Production Year	Production Flasks of 76 pounds	ORE DEPOSITS AND ORE RESERVES Geological and Mineralogical Notes and Ore Analysis	PRODUCTION METHODS and Plant Capacities	TRANSPORTATION Labor Employed and Other Data
	MEXICO (Cont'd)						
41.	Unidad Benificidora Sain Alto district. Reached by R.R. via Durango branch to Cantuna. Road 10 miles to Sain Alto then 6 miles to mine. State: Zacatecas.	Unidad Benificiadora Sain Alto Mexican Control.	1942	10-12 per month	Fracture zones in sandstone and shale. Cinnabar in veinlets of variable width, mine workings are shallow.	Underground mining, along vein, hand methods. Small retort furnace.	Mercury shipped by truck 16 miles to Cantuna. R.R. to Laredo, Texas. Sold to Financiera Minera.
42.	Carlos Fernandez Property. Sain Alto District. 5 miles by road from Sain Alto mine. State: Zacatecas.	Carlos Fernandez Owner-Operator. Mexican Control.	1942	100 per month	Fracture zones in sandstone and shale; veins of cinnabar in stringers and bunches of variable width. Ore averages 1⅜% Hg.	Deposit developed to depth of 100 feet and 200 feet in length. Hand mining methods. Denver Flotation equipment.	Mercury shipped by truck 15 miles to Cantuna, Zacatecas; R.R. to Laredo, Texas. Sold to Financiera Minera.
43.	Felipe Martinez property. 6 miles by road to mine from Sain Alto. State: Zacatecas.	Felipe Martinez Mexican Control.	1942	30 per month	Fracture zones in sandstone and shale. Cinnabar in stringers and bunches 2 - 6 feet wide.	Deposit developed to depth of 150 feet and length of 150 feet. Hand mining methods. Retort furnace "D" type, 1½ tons capacity.	Mercury shipped 16 miles to Cantuna by truck then R.R. to Laredo. Sold to Financiera Minera. 25 workmen employed.
44.	Canoas Mine Reached via Loreto on Aguascalientes San Luis Potosi R.R. and 12 miles via dirt road. State: Zacatecas.	Thomas B. Miller and Enrique Lopez, owners. Mexican Control.	1942	about 100 per month	Fracture zones in rhyolite. Cinnabar in veinlets, quartz gangue, ground honeycombed by holes. Average grade .3 to 1% Hg.	Mine developed by 2 shafts, 130 feet deep, mined by hand. Gasoline hoists. 1 - 40 ton Nichols-Herreschoff furnace. 5-pipe retort furnaces.	Mercury shipped 12 miles over dirt road to Loreto by truck then to Laredo, Texas by R.R. Sold to Credito Minero. Large past production. 150 men employed. Diesel power.
45.	Santa Brigida Mine 2 miles east of Pozos, R.R. to Pozos, via good dirt road to mine. State: Guanajuato.	Pablo Parkman, Owner. Soc. de Mineros Mexiconos - Operators. Mexican Control.	1943	Est. 100 per month	Two well-defined veins in limestone and shale containing cinnabar, calcite and quartz. Veins are 3 and 10 feet in width. Ore varies from 1 to 5% Hg.	Veins developed 200 feet in depth and 650 feet in length. Mining by hand methods. Flotation plant. 15-ton Scott furnace and 7-ton pipe retort furnace.	To Pozos by truck. R.R. to Laredo, Texas. Sold to Credito Minero and Financiera Minera. Several hundred tons of mercury already produced. Also some copper.

MERCURY MINES OF THE WORLD

CHART NO. X

No. on Map	Name and Location of Mine or Producing Area	Ownership and Nationality of Controlling Capital	Production Year	Production Flasks of 76 pounds	ORE DEPOSITS AND ORE RESERVES Geological and Mineralogical Notes and Ore Analysis	PRODUCTION METHODS and Plant Capacities	TRANSPORTATION Labor Employed and Other Data
	MEXICO (Cont'd.)						
46.	San Antonio Mine Guadalcazar district, 2 miles south by southeast of Trinidad. State: San Luis Potosi.	Tobias E. Guzman and Associates, Owners. Mexican Control.	1943	20-30 per month	Masses and stringers of cinnabar over large area in limestone.	Several stopes open to the surface. Shaft 400 feet deep. Gambusinos style mining over old stopes, pillar robbing.	Mercury shipped 12 miles by truck to Antiquo Morelos then 51 miles to San Luis Potosi. R.R. to Laredo, Texas. Extensive old mine. Past production said to be very large. 50 workmen mine. 50 workmen smelter.
47.	Guadalupana-Dulces Nombres Mine 12 miles southwest of Moctezuma, reached by R.R. to Moctezuma then 12 miles poor road to mine. State: San Luis Potosi.	Information not available.	1942	10 per month	Mineralized fracture zones in limestone and marl. Cinnabar in stringers and pockets of variable width. Known and probable reserves 50,000 tons 0.2% Hg.	"Gambusino" method of mining. 20 ton flotation plant. Several pipe furnaces.	
48.	Linterna Mines Group Cuarenta district, 25 miles south of Rosario. State: Durango.	C.D. Moll and Jesus Paiz, operators. Cia Explot. de Villa Cinabrio. Durango, Sr. Paul Balleros, Owner. Mexican Control.	1942-3	40 per month	Mineralized fractures and bedding planes in conglomerate beds overlying granite. Total reserves all classes, 200,000 tons - 0.3% average grade.	Leased to "Gambusinos" for 50% of production.	Mercury shipped by truck 25 miles to R.R. station at Rosario.
49.	La Cruz Mine Huitzuco group, about 16 miles east of Iguala. State: Guerrero.	Compania Explotadora de Mercurio de Huitzuco, S.A. Owners and Operators	1940 1941 1942 1943	1,287 1,349 821 882	Extensive lenses and fissure fillings in dolomite. The ore mineral is livingstonite, a sulfide of mercury and antimony. Average grade 0.13% Hg., 0.60% Sb. The only deposits of livingstonite exploited commercially, beside those at Huitzuco, are in the USSR.	Mined underground by open-stope method. Flotation plant; distillation plant - 8 units.	Concentrates shipped by truck 16 miles to Iguala thence to Tlalnepantla for refining. Production prior to World War II, 70,000 flasks. Employed about 300 persons in 1941. Grade of ore declining.
50.	Huahuaxtla Mine about 20 miles north of Iguala, 12 miles south of Taxco. Reached via Mex-Acapulco R.R. State: Guerrero.	Dodero Bros. Owners and Operators. Compania Explotadora de Mercurio de Huahuaxtla, S.A. Mexican.	1942	250 per month	Cinnabar in veins from a few inches to 30 feet in width in limestone and shale. Average grade of ore is 0.3% Hg.	Veins developed to 170 feet in depth and 1,600 feet in length. Hand mining methods. 100-ton Nichols-Herreshoff furnaces. C.P. Mercury.	Shipped from Iguala to Laredo by R.R. Past production large.

MERCURY MINES OF THE WORLD

CHART NO. XI

No. on Map	Name and Location of Mine or Producing Area	Ownership and Nationality of Controlling Capital	Production Year — Flasks of 76 pounds	ORE DEPOSITS AND ORE RESERVES Geological and Mineralogical Notes and Ore Analysis	PRODUCTION METHODS and Plant Capacities	TRANSPORTATION Labor Employed and Other Data
	MEXICO (Cont'd.)					
51.	El Moral Mine 15 miles northwest of Mascata, 10 miles by burro to mine. State: Jalisco.	Cia Minerales Mex Leasees and operators. Mexican	1942 30-35 per month	Cinnabar in veins and disseminated in rhyolite. Ore averages 0.25 - 0.33% Hg. Estimated reserves in 1943 16,000 tons 0.3% Hg.	Shallow open cut mining, hand methods.	
	PERU					
52.	Chonta Mine Chonta District 40 miles southwest of Huanuco. Prov. Dos de Mayo. Altitude: 14,600'.	Panaminas, Inc. operators, a subsidiary of Ventures Ltd. of Canada. United States Capital Control.	Peru Production 1941 --- 1942 145 1943 326 1944 152 1945 209	Cinnabar occurs in cavity fillings and a few narrow veins in sedimentary rocks. Grade of ore varies between 0.3 - 0.9% Hg. Reserves are small.	Hand mining, underground workings, ore is hand sorted. 20 ton daily capacity Gould rotary furnace installed in 1942. Furnace is coal fired.	Property is very inaccessible. Grade of ore is lower than expected.
53.	Santa Barbara Mine 2 miles south of the town of Huancavelica. Prov. of Huancavelica. Altitude: 12,250'.	E. E. Fernandini Owner. Peruvian Control.	1946 5	Irregular pockets of cinnabar in nearly vertical sandstone-limestone beds of Cretaceous age. Ore is low grade but the tonnage is large. Reopened in 1943.	Extensive underground workings. Mill planned for 250 tons per day; 2 Gould furnaces and a hydroelectric plant of 750 kw. capacity were started in 1943.	Mercury shipped by truck to Huancavelica, rail to Callao. Discovered in 1570 and worked by Spaniards.
	CHILE					
54.	Punitaqui Mine 22 miles southwest of Ovalle, Prov. of Coquimbo, Central Chile.	Cia. Minera Punitaqui Chilean owned and managed. Headquarters: Calle Agustinas 925. Santiago, Chile.	1938 44 1939 100(Est) 1940 100(Est) 1941 1,305 1942 2,256 1943 2,561 1944 1,181 1945 862 1946 500(Est)	Gold occurs in a mineralized sheer zone, 30 feet wide and 2,500 feet long, in porphyry. The zone has a N - S strike with a 60° dip. Cinnabar occurs in northern part of the mine workings. Ore contains from 6 - 9 gr. Au, 0.01 - 0.07% Hg, 0.6 - 0.8% Cu. Reserves in 1942: Measured ore 300,000 tons, indicated ore 600,000 tons.	Deposit developed by an adit 2,500 feet long, a shaft 500 feet deep, and 4 levels 135 feet apart. Ore mined by cut-and-fill method. Flotation plant of 400 tons daily capacity. Ore containing cinnabar is treated in distillation furnaces.	Gold-copper concentrates transported by railway to Chagres Copper smelter; mercury sold to Metals Reserve Co. during the war.
	GERMANY					
55.	Landsberg Mine At Obermoschel near Bingen. A port on the Rhine, southwest Germany.	German Control.	1938 1,363 1939 1,102 1940 870 1941 522 1942 500 1943 --- 1944 ---	Cinnabar disseminated in a melaphyre lava bed. Country rock is Permian. Ore averages 0.2% Hg. Reserves not reported.	2 revolving tube furnaces 200 tons daily capacity. 80% recovery.	The property closed down at the end of 1942 presumably because sufficient mercury was being received from Italy.

MERCURY MINES OF THE WORLD

CHART NO. XII

No. on Map	Name and Location of Mine or Producing Area	Ownership and Nationality of Controlling Capital	Production Year — Flasks of 76 pounds	ORE DEPOSITS AND ORE RESERVES Geological and Mineralogical Notes and Ore Analysis	PRODUCTION METHODS and Plant Capacities	TRANSPORTATION Labor Employed and Other Data
	CZECHOSLOVAKIA					
56.	Mariabana and Mernik Mines near Vranov and Teplov, in Slovakia.	Before the war- French capital, le Cinabre Quicksilver Co.	1937 2,750 1938 2,900 1939 2,669 1940 2,582 1941 1,500(Est) 1942 1,500(Est)	Accurate information on the deposits is lacking. Average grade of ore is 0.3% Hg.	Accounts for practically all domestic production.	Output largely consumed domestically but small amounts have been exported.
	YUGOSLAVIA					
57.	Idria Mine Province of Gorizia in foothills of Julian Alps, 25 miles northeast of Trieste. Ceded to Yugoslavia after World War II.	Rudnik Zivets Sreba owned by the Yugoslav Government. Formerly operated by R. Miniere di Idria of the Italian Government.	1936 8,928 1937 8,230 From 1938 until the end of World War II annual production about 8,500 flasks.	Veinlets and dissemination of cinnabar in fractured schist and dolomite beds forming a syncline. Mineralization extends over length and width of few thousand feet and minable ore is up to 30 feet in thickness. Average grade 0.6% Hg. from 1938-43. Ore reserves limited to less than 10 years at present production rate. Explorations to northwest and southeast of deposit have not found new areas of minable ore.	4 shafts with 13 connecting levels; depth of about 1,300 feet; cut-and-fill mining method used. Ore hand sorted, coarse goes to vertical furnace and fines to rotary furnace. Distilling temp. 800° F.	Number of workmen in Mine Plants 1936 541 82 1937 520 80 Mercury marketed by Cartel agreement with Spain until taken over by Yugoslavia.
	ITALY					
58.(a)	Abbadia San Salvatore Mine 2 miles north of the town of Abbadia San Salvatore, Province of Siena. Workings 2,400 to 3,400 ft. above sea-level.	S. A. Min. Monte Amiata Italian Government Control. Through Agrarian Bank and the Iri Holding Trust.	1936 33,729 1937 58,666 For the period 1938-43 Monte Amiata mined 46% of Italy's total; Siele 32%; others in Tuscany 7%, Idria 15%.	The mineralized region covers an area of faulting 18 miles long by 6 miles wide. The Mt. Amiata Mine is at the north end and the Siele group in the middle of the zone. Within this region the only igneous rock considered to be of importance is the Tertiary Trachyte lying to the north of the Siele concession. Sedimentaries, consisting of limestone, shale and sandstone underlie the greater part of the district - the most widespread and most important to ore deposition are Eocene. Clays, derived from the limestone, are probably residual in old lake beds and at Siele were important sources of ore. Ore occurs near the fault zone in all Tertiary formations, as veinlets in limestone, and disseminated in sandstone, where it selectively replaces calcareous cement along cracks and fractures. Although relatively small at Siele, the individual ore bodies are numerous and rich. The cinnabar varies from a dark red, crystalline to a light red powdery mineral. Pyrite and marcasite are present with calcite, quartz and gypsum the gangue minerals. The average grade of ore mined at Siele in the last ten years has varied between 1.86% and 4.75%. The average grade of ore mined at Siele in 1945 was 2.25% Hg. compared to 1.52% Hg. at Monte Amiata. Reserves at Monte Amiata are reported to be sufficient for several decades at the normal rate of production. Measured reserves of Siele are 224,650 flasks, all of which is in the Solforate del Siele mine; indicated 120,000 flasks, and inferred 375,000 flasks.	Mine on east slope of Mt. Amiata is developed by adits and shafts, cut-and-fill mining used. Waste is sorted from the ore in the stopes and used for back filling. Compressed-air rock drills and electric locomotives were temporarily replaced at end of war due to power shortage. Tower furnace for lump ore and Cermak - Spirek (similar to Scott) for fines.	Shipped by rail from plants to Port of Livorno for export. Number of workmen in Mine Plants 1936 1,099 284 1937 744 273 Wood fuel used in furnaces with some charcoal and coal.
58.(b)	Siele Mines Carpine Siele, Solforate del Siele, Grande Putizza, Abetoso Nibbio about 100 miles by road northwest of Rome. On the border of Siena and Grosseta Provinces. Altitude: 1,500 - 2,200 feet.	Stabilimento Minerario del Siele Capital: 32,947,200 lire. Control held by Giovanni Armenise Italian Capital.	1937 18,009 1938 17,008 1939 22,011 1940 41,479 1941 39,020 1942 27,013 1943 16,658 1944 [1] 7,775 1945 [2] 5,817 [1] for 5 months Jan.1-May 31. [2] for 7 months June 1-Dec. 31. Operations were suspended from May 31, 1944 to June 1, 1946 because of the war.		The Solforate section is developed by 3 main shafts to a depth of 650 feet, connected by seven major levels over a total length of about 3000 feet and across a width of 175 feet. Mining is confined to the Solforate section with the Grande Putizza being developed. Stoping is principally by the horizontal cut-and-fill method which is adapted to fairly heavy ground such as at Siele. There are 5 Spirek furnaces with a capacity of 16 tons per day and 3 with a capacity of 24 tons. Recovery is 93%. About 260 pounds of wood is consumed per ton of ore.	Haulage is by electric locomotives 1½ miles to the treatment plant at Siele, Labor: 600 men in 1946, 300 underground, 250 on the surface and 24 salary employees. Average wage $1.60 (1946). Power consumption 110,000 to 130,000 kwh per month, purchased at 53¢ U.S. per kwh in 1946.

MERCURY MINES OF THE WORLD

CHART NO. XIII

No. on Map	Name and Location of Mine or Producing Area	Ownership and Nationality of Controlling Capital	Production Year	Production Flasks of 76 pounds	ORE DEPOSITS AND ORE RESERVES Geological and Mineralogical Notes and Ore Analysis	PRODUCTION METHODS and Plant Capacities	TRANSPORTATION Labor Employed and Other Data
	ITALY (Cont'd.)						
59.	Cerreto Piano Mine Near the village of Cerreto Piano, Province of Grosseto.	Soc. It. An. Mercurio. Italian Control.	1936 1937	1,055 974	Cinnabar disseminated in Eocene limestone beds and Pliocene sandstone beds similar to Siele. Ore lower grade, averages 0.5% Hg. Developments limited. Ore reserves unknown.	Mine developed by several adits, and about 10,000 feet of drifts and crosscuts. Considerable mine timber necessary. Cermak-Spirek rotary furnaces.	Number of workmen in Mine Plants 1936 189 21 1937 144 15
	SPAIN						
60.	Minas de Almaden 130 miles southwest of Madrid, 65 miles north of Cordoba, Province of Ciudad Real Mineral rights consists of a circle of about a 15 mile radius from the San Teodoro shaft.	Consejo de Administracion de las Minas de Almaden and Arayanes, a dependency of the Treasury. The council consists of 7 members appointed by the ministry, comprising a president, 2 mining engineers, 1 industrial engineer, 1 lawyer, 1 finance expert and a representative of the miners.	1937 1938 1939 1940 1941 1942 1943 1944 1945 1946 1947 Production from 1500 to 1946 6,622,434 flasks. No accurate record from 375 B.C. to 1499 A.D.	28,357 41,409 35,912 51,803 85,523 70,034 47,016 34,200 40,694 41,000 (Est) 9,229 First 6 months	The ore occurs in 3 definite quartzite beds of Silurian marine origin about 80 feet apart and ranging in width from 20 to 40 feet. The strata dip from 70° to vertical, are fractured, and are interstratified with bituminous slate. Cinnabar and free mercury are disseminated between the grains of sand in the quartzites and also occur in pockets and fissure fillings. There is some pyrite, calcite and sericite. The three mineralized quartzite beds are known as the San Pedro - San Diego, San Francisco, and San Nicolas, and are usually mined from slate wall to slate wall. Grade of ore averaged 6.5% from 1940-45. Measured reserves were reported in 1945 at 250,000 tons, 6 to 8% Hg.; and indicated, 650,000 tons over 2½% Hg. This would total about one million flasks. Large tonnage of inferred ore occurs but estimates are not available.	Mine is served by 3 shafts, two to 14 level (1250 feet), third to 12 level is for ventilation. Levels are 60 to 90 feet apart. All of the ore above the 12th level has been mined. Horizontal extension is limited by faults. Length on upper levels is 600 feet and 300 feet on lowest levels. A modified cut-and-fill method of mining is used. Mine pillars and shafting are of stone masonry. There are 16 coal-fired shaft furnaces, 8-10 tons daily capacity, for coarse ore, and 8 oil-fired furnaces, 8 tons capacity, of the Cermak-Spirek type for fines, with top feed through baffle tiers. Recovery reported to be 92%. Plant capacity is about 10,000 flasks per month.	Mercury is shipped to ports via the Madrid-Alicante R.R. Labor is wasted and labor cost is 80% of the total; 2400 men are employed where 800 would be sufficient. 2 other mines produce less than 2% of the country's total. Workers are paid a continuous monthly wage for working only 8 shifts of less than 6 hours each, because of the local fear of poisoning.
	ALGERIA						
61.	Ras-El-Ma Mines near main road between Constantine and Philippeville. Department of Constantine, Northern Algeria. Lat. 34° 2'N. Long. 2° 5'W.	Soc. Min. Francaise Du Mercure. Headquarters: Par Jammapes. Operator Edmond Wells. Control not known.	1938 1939 1940 1941 1942 1943 1944 1945 1946	191 256 791 147 121 146 165 326 340	Cinnabar with sulphur disseminated in beds of marl and clay. Ore averages less than 0.5% Hg. Reserves estimated in 1940 at 100,000 tons. 0.4% - 0.5% Hg.	Mined by adits and open-stopes. 50-ton flotation plant constructed in 1940. Only used one single retort in recent years.	Mercury transported by rail from mine to Phillipeville. Diesel power plant, 88 workmen in 1943.
	UNION OF SOUTH AFRICA						
62.	Monarch Kop Mine Letaba district, Murchison Range, East of Gravelotte. Eastern Transvaal.	The Monarch Cinnabar (Pty.) Ltd. British Control.	1938 1939 1940 1941 1942 1943 1944 1945	Not producing Not producing 42 204 579 1,189 1,192 852	Cinnabar occurs with quartz and calcite in beds of calcareous chloritic schists 15-20 ft. thick. The beds are exposed for several hundred feet along surface. Mine closed down recently due to drop in mercury price and exhaustion of developed reserves. The company received a loan from the government to develope the property.	A concentrating plant was constructed in 1942. There are 2 small rotary furnaces at the property. The mine was discovered in 1936 and began producing in 1940	Supplied all domestic needs and started to export small amounts in 1943. Mercury shipped via Selati Railway, to port.

MERCURY MINES OF THE WORLD

CHART NO. XIV

No. on Map	Name and Location of Mine or Producing Area	Ownership and Nationality of Controlling Capital	Production Year	Flasks of 76 pounds	ORE DEPOSITS AND ORE RESERVES Geological and Mineralogical Notes and Ore Analysis	PRODUCTION METHODS and Plant Capacities	TRANSPORTATION Labor Employed and Other Data
	TURKEY						
63.	Ahirli and Karareis Mines near Izmur on the Aegean Sea. Prov.of Izmur. Both mines are on the Karaburnu Peninsula which juts into the Aegean sea.	Karareis Civar Isletmesi Limited Birketi Turkish capital. Formerly state participation.	1937 1938 1939 1940 1941 1942 1943 1944 1945 1946	483 597 359 500 242 176 186 97 158 ---	Vein deposits of cinnabar at shallow depths in Cretaceous limestones and in Miocene basalt. Grade of ore averages 0.33% Hg. The Karareis property is said to be richer than Ahirli. These are the only Turkish mines from which mercury is regularly mined although deposits have been reported near Odemis, and in Ushak (Usak) district near Konya at the Baltali Mine.	Worked by underground and open cut methods. Treatment plant 250 to 275 flasks per month capacity. Mines need crushing equipment, new furnace and new haulage system.	Reported capable of producing 6000 flasks of mercury per year. Turkish army principal buyer during the war.
	U. S. S. R.						
64.	Nikitovka Mines at Nikitovka 19 miles south of Artemovsk, 245 miles south of Kharkov. Don Basin, Ukraine 48° 40' N 38° 00' E.	Nikitovka Combine Russian State Control.	1933 1934 1935 1936	6,723 7,743 8,700 (Est.) 8,700 (Est.)	Vein deposits of cinnabar, accompanied by quartz, chalcedony, and kaolin. Average grade of ore is 0.23% Hg. Reports on reserves differ and their accuracy cannot be determined.	Before the war, a flotation plant was used to raise the grade to 15-20% Hg. The reduction plant was removed prior to occupation by the Germans.	Mine was being rehabilitated after recapture by Soviet troops.
65.	Khaidarkan deposit, Osh Oblast, Kirgiz 39° 58' N 71° 20' E. Chauvai Deposits, Osh Oblast, Kirgiz 40° 08' N, 72° 10' E.	Antimony Mercury Combine, Im Frunze. Russian State Control	1943	5,000 (Est.)	At Khaidarkan, cinnabar occurs with quartz, some stibnite, chalcedony and florite in Paleozoic rocks. The ore mineral at Turgai in Kazakh is livingstonite, an antimony-mercury sulfide, while at Chauvai it is metacinnabar. Total mercury reserves of these deposits is reported to be very large.	Potential production of these deposits was estimated at 6000 flasks annually in 1943.	After the loss of Nikitovka in 1941, there was an intensive development of mercury deposits in USSR.
66.	Oirotiya Deposits near Chagan-Uzun Altai Krai, Oyrot Aritovo. 50° 05' N, 88° 25' E.	Russian State Control			Ore is cinnabar disseminated in limestone and accompanied by pyrite, stibnite and calcite.	Potential production estimated at 2500-3000 flasks in 1943.	
	CHINA						
67.	Hunan Prov. Deposits at Feng-huang, Huang, and Ma-yang.	Controlled by National Resources Commission	1938 1939 1940 1941 1942	435 4,664 1,447 803 951	These deposits are part of the Chinese mercury belt 420 miles long by 180 miles wide, extending from Western Hunan, across Kweichou from northeast to southwest through Yunnan Province and extending into Kwangsi and Szechuan Provinces. The mines are small and scattered. Ore averages about 1% Hg.	Ore is mined by hand. Methods are wasteful. After handsorting, ore is treated in native retort furnaces. Technical assistance is badly needed.	During the war mercury was shipped to Kunming by truck then by plane to Russia
68.	Szechuan Prov. Deposits. At Yuyang and Siu-shan.	National Resources Commission	1938 1939 1940 1941 1942	145 174 20 52 52			

MERCURY MINES OF THE WORLD

CHART NO. XV

No. on Map	Name and Location of Mine or Producing Area	Ownership and Nationality of Controlling Capital	Production Year	Flasks of 76 pounds	ORE DEPOSITS AND ORE RESERVES Geological and Mineralogical Notes and Ore Analysis	PRODUCTION METHODS and Plant Capacities	TRANSPORTATION Labor Employed and Other Data
	CHINA (Cont'd.)						
69.	Kweichou Prov. Deposits. At Tungjen, and Sanho, Wangchai-chai Pachai, Tafahtung and Sunchi, where deposits are known as Wang-shan-chang Tatunglah and Yehwuping.	Kweichou Mining Administration for the National Resources Commission.	1938 1939 1940 1941 1942 1943 1944	1,653 2,552 1,244 2,755 3,828 3,422 2,987	The deposits are scattered over an area of about 9 sq. miles. The ore is cinnabar containing small amounts of stibnite and native mercury, occurring as an impregnation of certain beds of magnesium limestone, and along fissures and bedding planes as isolated bunches and irregular disseminations.	Mined by hand, primitive methods, ore is handsorted and treated in native retort furnaces. Losses vary between 30 and 40%.	Mercury statistics reported by the Chinese government vary considerably and are not always accurate.
	JAPAN						
70.	Yamato Mine 2½ miles east of Matsuyama village in Uda-machi, Uda-gun, Nara Prefecture.	Teikoku Suigin Kogyo KK, Imperial Mercury Mining Co. Ltd. Japanese Control.	1938 1939 1940 1941 1942 1943 1944 1945	46 565 1117 548 229 247 128 27	There are 3 veins consisting of cinnabar and gangue minerals along a fault zone in quartz diorite believed to be Tertiary age. The veins average only a few inches in thickness but pinch and swell on both strike and dip. Walls of veins are filled with disseminated cinnabar and are richest where the veins split. Laterally the veins split and fade out. Reserves: Measured 27,257 tons, indicated 72,941 tons averaging 0.03% Hg.	The deposit is worked by an inclined shaft along the principal vein. Nine levels driven from the shaft. Mining by underhand stoping. Exploited to a depth of 150 feet and 700 feet laterally. Concentration is by 50 ton flotation plant, some handpicking. Concentrates shipped to retort plant at Osaka for distillation.	Mining ceased in September 1945 but mine was kept unwatered in 1946. Reserves are submarginal. Grade of ore has dropped considerably in recent years and mine is practically exhausted.
71.	Itomuka Mine 24 miles west of the town of Rubeshibe in Rubeshibe-machi, Tokoro-gun, Abashiri-shicho, Hokkaido.	Nomura Mining Co. Japanese Control.	1938 1939 1940 1941 1942 1943 1944 1945	Not operating 317 2,156 3,523 4,288 4,784 5,309 2,216	Cinnabar and native mercury occur in a group of conjugate shears which split away from a near-vertical fault in andesite. The shears dip 20-60° S and have an average length of 200 to 250 feet. Ore is also found disseminated in the wallrock. The ore minerals are associated with a gangue of marcasite, quartz, chalcendony, calcite and a little pyrite. Reserves: measured ore - 916,730 tons 0.14% Hg. indicated ore - 201,000 0.16% Hg.	Mining is by open cut and underground methods with the latter of secondary importance. The deposit has been exploited to a depth of about 325 feet. There are 2 flotation plants, the Motoyuma, a pilot plant of 50 tons capacity and the Itomuka of 200 tons (planned 600 tons). Furnaces - 1 Herreschoff. Retorts were used for high-grade ore, 12 tubes at mine and 6 tubes at Rubeshibe.	In August 1944 during peak operations 2,833 workers were employed of which 221 were women. 370 men were in underground workings and 606 people worked in the open cut.

SOURCES:

Files of the Foreign Minerals Division, U. S. Bureau of Mines; Mining Division, U. S. Bureau of Mines; U. S. Geological Survey; Reports of Supreme Command Allies in the Pacific; Foreign Economic Administration; Consular reports of Department of State; and Files of the Department of Commerce.

Information was also gathered from Minerals Yearbooks, issues of London Mining Journal, African World, Engineering and Mining Journal, Mining and Metallurgy, South African Mining Journal, the Metal Bulletin, and Mineral Trade Notes from 1940 - 1947. Reports of private mining companies were used for obtaining information on several foreign deposits.

26 January 1948

Document No. 001
NO CHANGE in Class. ☐
[X] DECLASSIFIED
Class. CHANGED TO: TS S C
DDA Memo, 4 Apr 77
Auth: DDA REG. 77/1763
Date: 30 JAN 78 By: 023

CONFIDENTIAL

U. S. GOVERNMENT PRINTING OFFICE
3342—STATE—1949