Top Secret

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DIRECTORATE OF
INTELLIGENCE

Industrial Facilities
(Non-Military)

# *Basic Imagery Interpretation Report*

## Mao-ming Shale Oil Refinery

## Mao-ming, China

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CENTRAL INTELLIGENCE AGENCY
Directorate of Intelligence
Imagery Analysis Service

| INSTALLATION OR ACTIVITY NAME | | COUNTRY |
|---|---|---|
| Mao-ming Shale Oil Refinery | | CH |
| UTM COORDINATES | GEOGRAPHIC COORDINATES | 25X1 |
| 49QDP875975 | 21-40-45N 110-52-57E | |
| MAP REFERENCE | | |
| ACIC. USATC, Series 200, Sheet M0615-14HI, 3rd ed. Mar 67. Scale 1:200,000 (SECRET | | 25X1 |
| LATEST IMAGERY USED | NEGATION DATE (If required) | |
| | NA | 25X1 |


ABSTRACT

Mao-ming Shale Oil Refinery extracts oil from shale and refines it into petroleum products. The products of the refinery include straight-run and cracked gasolines, kerosene, diesel and fuel oils, phenol, sulfuric acid, and probably coke. The processing facilities presently completed include two shale oil retorts, a primary distillation unit, a thermal cracking unit, a phenol unit, a blending/treating unit, a probable delayed coking unit, at least one sulfuric acid plant, and several unidentified secondary processing units.

The shale oil retort section has been observed in operation on all photography since it was first seen in September 1963, and the distillation unit since November 1964. Construction has been under way at the refinery on all coverages through November 1971.

This report includes a photograph and line drawing of the refinery, a location map, a detailed listing of equipment and facilities, dimensions of storage tanks, and a discussion of the status of the facilities.



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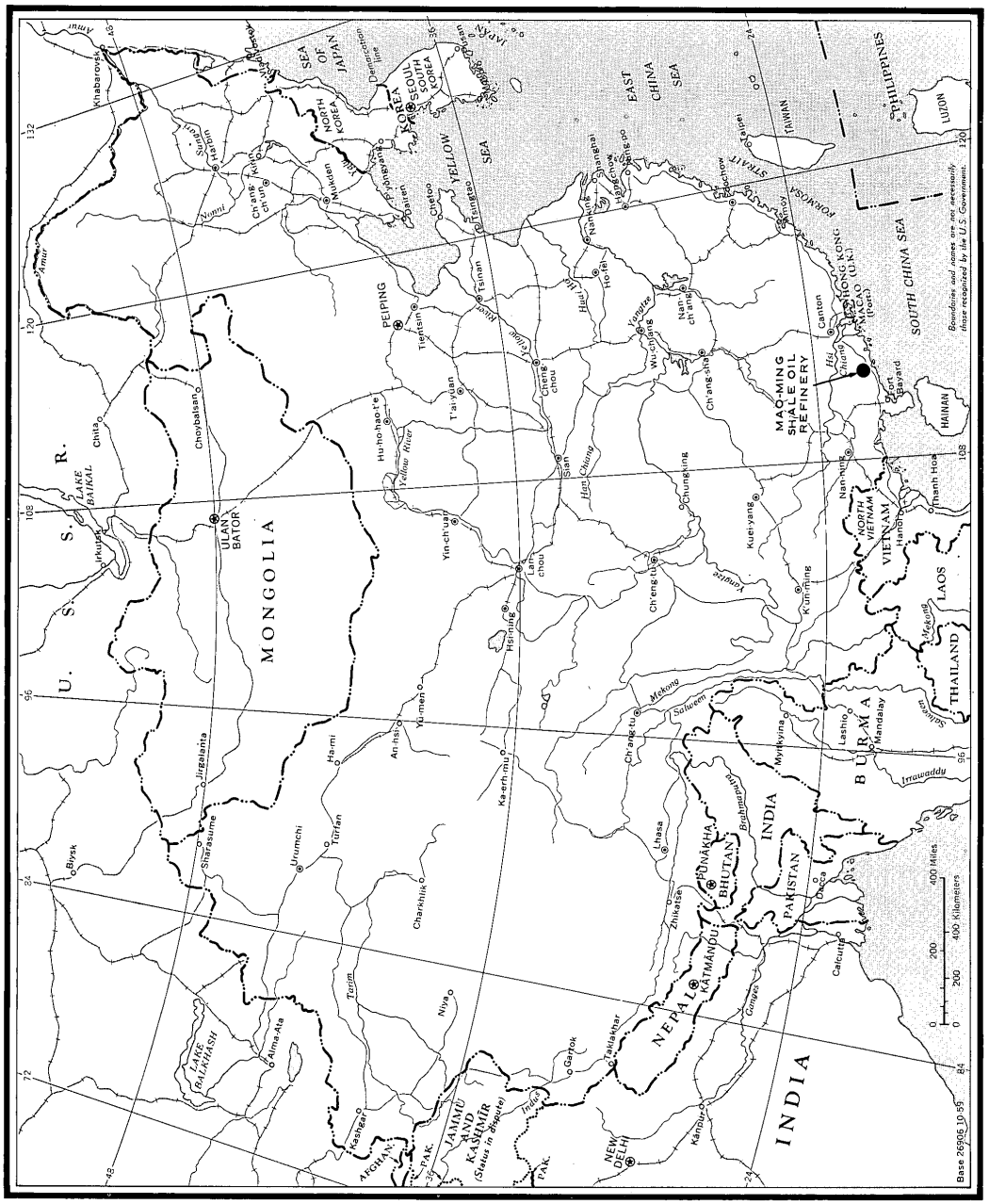


*FIGURE 1. LOCATION MAP.*



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## INTRODUCTION

Mao-ming Shale Oil Refinery is located 15 nautical miles south-southeast of the city of Mao-ming, Kwangtung Province (see Figure 1). Construction of the refinery was reportedly started in 1959. 1/ Experimental production of oil from shale was carried out in January and August 1961. 2/ Continuous production began in March 1962. 1/ Shale to charge the retorts is brought in by rail from a large open-pit mine 1.5 nm north of the refinery.

A large water treatment facility is located just south of the refinery and is connected to it by a canal. Steam and electricity are provided by the collocated Mao-ming Thermal Power Plant Refinery [redacted] 25X1 Rail service to the refinery is provided by a spur from the Li-tang to Chan-chiang rail line.

## BASIC DESCRIPTION

The refinery measures 5,450 by 5,200 feet and occupies 650 acres (see Figures 2 and 3). It is partially secured by a wall.

### Operational Functions

This plant is designed to obtain oil from oil shale by means of heat and pressure generated in retorts. The oil is then refined by the standard techniques utilized for crude oil. The plant has two conveyor-connected retort buildings which contain a series of individual retorts. One primary distillation unit performs the initial fractionation of the oil from both retorts. The secondary processing units presently complete include a thermal cracking and unidentified secondary processing unit, a phenol unit, a blending/treating unit, a probable delayed coking unit, and two unidentified secondary processing units. The refinery also contains one and probably two sulfuric acid plants. A fluid catalytic cracking unit is under construction and one of the unidentified secondary processing units is being expanded.

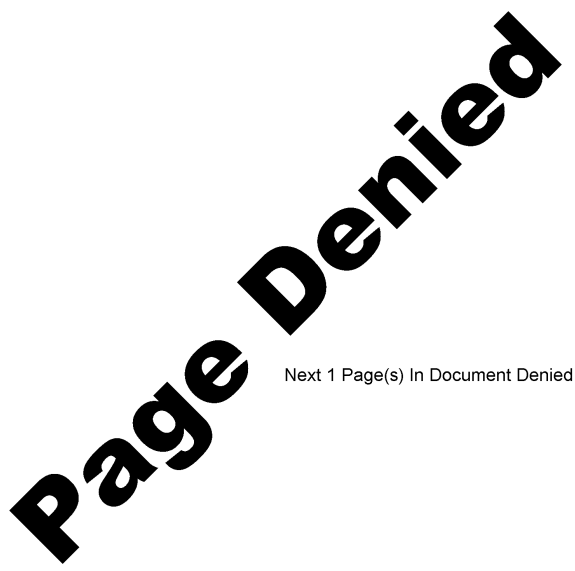
The products of the refinery include straight-run and cracked gasolines, kerosene, diesel and fuel oils, phenol, and probably coke. Sulfuric acid is also produced. When the fluid catalytic cracking unit is complete, the refinery will be capable of producing high octane gasoline.

### Construction and Operational Status

In September 1963, when the refinery was first seen on photography, one shale oil retort was complete and operating, and another was under construction. The primary distillation unit was complete but did not appear to be operating. It is possible that the oil produced at that time was shipped out and refined elsewhere since several tank cars were present in the shipping area. The distillation unit was first seen operating in November 1964. The construction status of the refinery from September 1963 through November 1971 is shown in Figure 4.

The phenol unit in Area M was started in 1966. This unit probably is not associated with storage tanks located in the same area which had been started earlier. Construction of the second shale oil retort progressed slowly until September 1968, when a large amount of construction material and a crane were seen nearby. After that time the rate of construction was more rapid, and by September 1971 the retort was completed.

The refinery was covered on photography only once between December 1968 and September 1971, and on that coverage the area was mostly cloud covered. The fluid catalytic cracking unit (Area D) was first seen in September 1971 when it was in a midstage of construction. Based on the normal construction time for such a unit, it was probably started in late 1970 or early 1971. The probable sulfuric acid plant (Area F) was complete when it was first seen in September 1971. It was probably started in 1969 or 1970. Unidentified construction seen in Area U in September 1971 may be for a chemical plant that will depend at least partially on the refinery for feedstocks.

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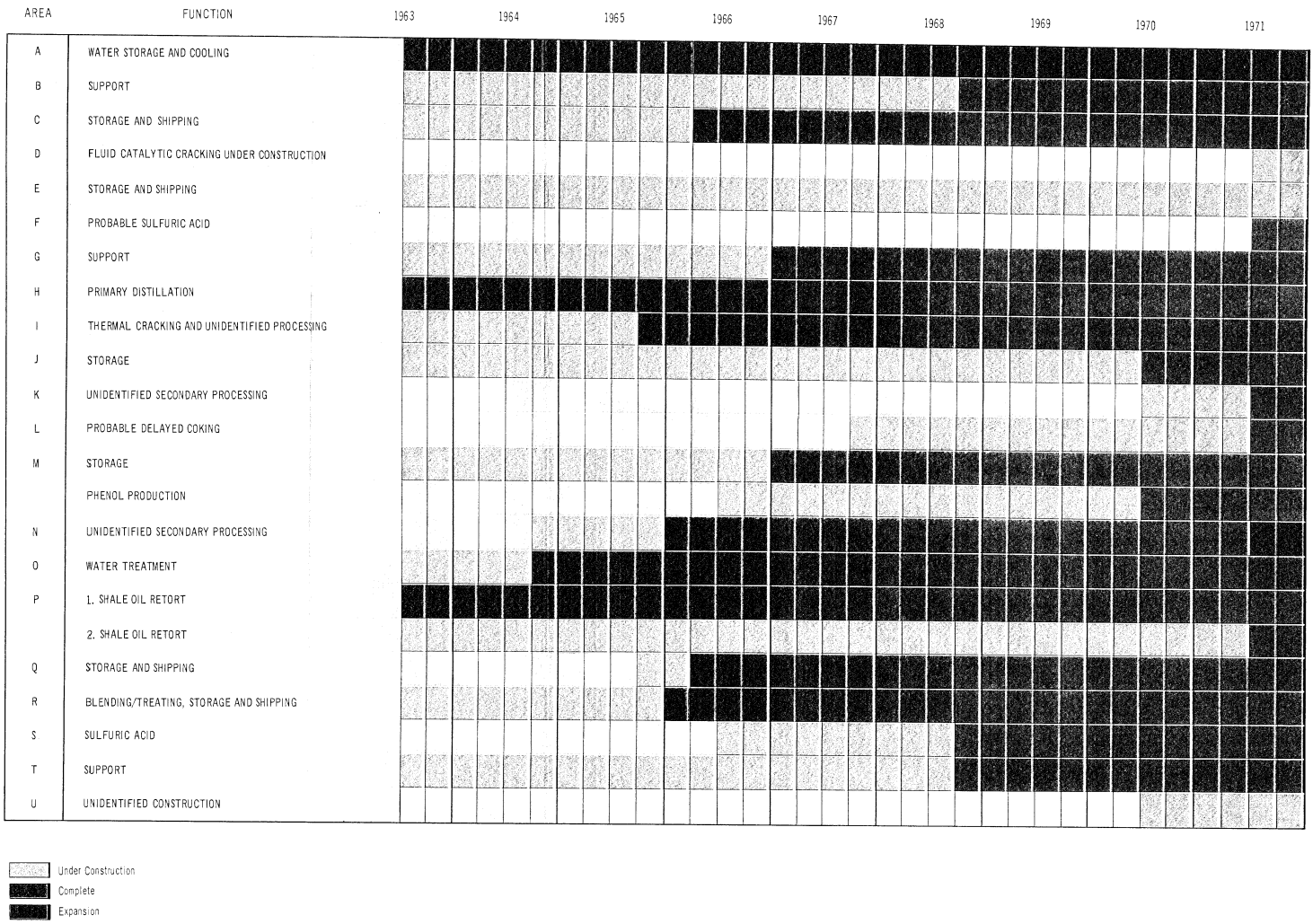


*FIGURE 4. CONSTRUCTION CHRONOLOGY, MAO-MING SHALE OIL REFINERY, CHINA.*

The shale oil retort has been observed in operation on all coverages from September 1963 through November 1971, and the distillation unit on all coverages since November 1964.

Facilities and Equipment

Table 1 lists the functional areas and equipment within the refinery. The buildings and processing equipment in areas which are still under construction are not included in the table or shown in Figure 3. All measurements are rounded to the nearest 5 feet.

Table 1. Equipment and Facilities at Mao-ming Shale Oil Refinery
(Keyed to Figure 3)

| Area | Functional Description | Equipment and Facilities |
|---|---|---|
| A | Water Storage and Cooling | 3 Cooling towers<br>22 Buildings<br>2 Cylindrical storage tanks, 20 feet in diameter<br>4 Semiburied water storage tanks, 115 feet in diameter<br>4 Covered water reservoirs<br>18 Water storage basins |
| B | Support | 123 Buildings (3 under construction)<br>6 Cylindrical storage tanks<br>2 25-foot-diameter<br>4 15-foot-diameter<br>21 Water storage basins |
| C | Storage and Shipping | 2 Loading racks<br>17 Buildings<br>20 Cylindrical storage tanks<br>2 120-foot-diameter<br>3 115-foot-diameter<br>14 75-foot-diameter<br>1 55-foot-diameter<br>6 Tanks under construction<br>1 Semiburied storage tank, 70 feet in diameter |
| D | Fluid Catalytic Cracking Under Construction | Equipment not listed |
| E | Storage and Shipping | 2 Loading racks<br>22 Buildings (one under construction)<br>19 Cylindrical storage tanks<br>1 115-foot-diameter<br>1 80-foot-diameter<br>10 75-foot-diameter<br>3 55-foot-diameter<br>2 50-foot-diameter<br>2 25-foot-diameter<br>6 Tanks under construction<br>2 Water storage basins |
| F | Probable Sulfuric Acid | Equipment not listed |

| Area | Functional Description | Equipment and Facilities |
|---|---|---|
| G | Support | 35 Buildings<br>9 Tanks under construction |
| H | Primary Distillation | 1 Unit with<br>1 atmospheric column<br>1 vacuum column<br>7 other columns<br>2 banks of heat exchangers/ cooling coils/accumulators<br>2 furnaces<br>6 processing buildings<br>1 air cooler<br>1 pump building<br>3 support buildings<br>6 horizontal treating tanks<br>5 cylindrical storage tanks<br>1 20-foot-diameter<br>1 15-foot-diameter<br>3 10-foot-diameter |
| I | Thermal Cracking and Unidentified Processing | 1 Combination unit with<br>8 columns<br>3 clusters of processing equipment<br>1 bank of heat exchangers/ cooling coils/accumulators (on the roof of a building)<br>2 furnaces<br>4 processing buildings<br>2 air coolers<br>1 pump/compressor building<br>1 support building<br>2 cylindrical storage tanks, 15 feet in diameter |
| J | Storage | 16 Buildings<br>22 Cylindrical storage tanks<br>5 55-foot-diameter<br>2 50-foot-diameter<br>4 40-foot-diameter<br>2 35-foot-diameter<br>3 30-foot-diameter<br>1 20-foot-diameter<br>2 15-foot-diameter<br>3 10-foot-diameter<br>1 Tank under construction<br>1 Semiburied storage tank, 25 feet in diameter |
| K | Unidentified Secondary Processing | 1 Unit with<br>7 columns<br>2 clusters of processing equipment<br>4 furnaces<br>4 processing buildings<br>1 air cooler<br>1 pump building<br>1 horizontal storage tank, 55 feet in diameter<br>5 Support buildings |

| Area | Functional Description | Equipment and Facilities |
|---|---|---|
| L | Probable Delayed Coking | 1 Unit with<br>2 probable coking drums<br>3 columns<br>2 processing buildings (one with a bank of heat exchangers/cooling coils/ accumulators on the roof)<br>1 furnace<br>1 overhead crane<br>3 cylindrical processing/ storage tanks<br>1 blowdown stack with associated water storage basin, building, and cylindrical tank<br>5 Support buildings<br>1 Cylindrical storage tank, 15 feet in diameter |
| M | Storage and Phenol Production | 1 Phenol production unit with<br>6 short processing tanks<br>2 clusters of processing equipment<br>6 horizontal processing tanks<br>1 furnace<br>3 processing buildings<br>2 Processing buildings with an associated short column and a horizontal processing tank<br>2 Processing buildings with 4 associated short columns and a horizontal storage tank, 72 feet long<br>7 Buildings<br>30 Cylindrical storage tanks<br>10 35-foot-diameter<br>7 30-foot-diameter<br>2 20-foot-diameter<br>3 15-foot-diameter<br>8 10-foot-diameter<br>6 Horizontal storage tanks<br>1 60-foot-long<br>2 40-foot-long<br>3 35-foot-long |
| N | Unidentified Secondary Processing | 1 Unit with<br>6 columns<br>2 clusters of processing equipment<br>3 banks of heat exchangers/ cooling coils/accumulators<br>1 furnace<br>5 processing buildings<br>28 cylindrical processing/ storage tanks<br>1 horizontal processing tank<br>3 support buildings<br>3 Support buildings<br>6 Cylindrical storage tanks<br>2 35-foot-diameter<br>4 15-foot-diameter<br>(This unit is being expanded) |

| Area | Functional Description | Equipment and Facilities |
|---|---|---|
| O | Water Treatment | 6 Buildings<br>2 Water treatment basins |
| P | Shale Oil Retort | |
| | (1) Shale Oil Retort | 1 Retort building<br>2 Large clusters of processing equipment<br>32 Buildings<br>6 Cylindrical processing/storage tanks |
| | (2) Shale Oil Retort | 1 Retort building<br>8 Processing columns<br>3 Large clusters of processing equipment<br>33 Buildings<br>3 Silos<br>19 Cylindrical processsing/ storage tanks |
| Q | Storage and Shipping | 12 Buildings<br>9 Cylindrical storage tanks<br>3 35-foot-diameter<br>3 30-foot-diameter<br>2 20-foot-diameter<br>1 10-foot-diameter<br>3 Horizontal storage tanks<br>1 50-foot-long<br>2 30-foot-long |
| R | Blending/Treating, Storage, and Shipping | 1 Unit with<br>6 batch agitators<br>1 furnace<br>2 processing buildings<br>11 cylindrical processing/ storage tanks<br>1 loading building<br>2 support buildings<br>6 Support buildings<br>9 Cylindrical storage tanks<br>7 75-foot-diameter<br>1 55-foot-diameter<br>1 15-foot-diameter |
| S | Sulfuric Acid | Equipment not listed |
| T | Support | 71 Buildings (2 under construction)<br>1 Overhead crane<br>2 Cylindrical storage tanks, 15 feet in diameter<br>4 Tanks under construction<br>5 Water storage basins |
| U | Unidentified Construction | Equipment not listed |

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REFERENCES

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ACIC. US Air Target Chart, Series 200, Sheet M0615-14HL, 3rd edition, March 1967, Scale 1:200,000 (SECRET)

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Requirement

COMIREX NO6
Support Number 422821

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