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EFFECT OF DESTRUCTION OF NORTH VIETNAMESE PETROLEUM STORAGE FACILITIES ON THE WAR IN SOUTH VIETNAM

The Central Intelligence Agency

The Defense Intelligence Agency

NSA, DIA reviews completed

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Summary

It is estimated that the neutralization of the bulk petroleum storage facilities in North Vietnam will not in itself preclude Hanoi's continued support of essential war activities. The immediate impact in North Vietnam will be felt in the need to convert to an alternative system of supply and distribution. The conversion program will be costly and create additional burdens for the regime. It is estimated, however, that the infiltration of men and supplies into South Vietnam can be sustained. The impact on normal economic activity, however, would be more severe. New strains on an already burdened economic control structure and managerial talent would cause further reductions in economic activity, compound existing distribution problems, and further strain manpower resources. The attacks on petroleum storage facilities in conjunction with continuing attacks on transportation targets and armed reconnaissance against lines of communication will increase the burden and costs of supporting the war.

Although previous airstrikes have destroyed about 18 percent of North Vietnam's bulk petroleum storage capacity, the country still has a capacity to store 190,000 tons* of petroleum in eleven targeted facilities and in at least 31 untargeted facilities. The two most important facilities are located at Haiphong and Hanoi. They account for 116,000 tons, or 60 percent of total bulk storage capacity. There are in addition nine facilities on the JCS target list, two of which have been previously attacked. These eleven facilities, which are all vulnerable to air attack, account for 95 percent of total bulk storage capacity. The remaining 5 percent is accounted for by the small, dispersed, and untargeted facilities with a capacity of about 8,000 tons.

The import and consumption of petroleum has increased significantly in recent months. Monthly imports in the first five months were at a level equivalent to an annual import of 300,000 tons, an increase of 58 percent above 1965 levels.

Data on actual consumption of petroleum are less precise. It is estimated that military and military support activities account for 55 percent of total consumption. As of 1 April 1966 the consumption of

* All tonnages are given in short tons.

petroleum had increased by more than 20 percent above 1965 levels -- to a total of 206,000 tons. The higher level of imports, if continued for the rest of 1966, will be used to satisfy increasing petroleum requirements, both military and civilian, and to implement plans for dispersed storage of petroleum stocks.

Neutralization of North Vietnam's eleven targeted petroleum storage sites, according to calculations of the Department of Defense, would require initially an estimated 540 sorties and the expenditure of 737 tons of ordnance. Estimated civilian casualties could range from 200 to 300 persons because the facilities in urban areas are in lightly populated zones. With provisions to minimize casualties, the number could be considerably lower.

It is estimated that the successful execution of the planned attack would leave North Vietnam with enough petroleum stocks to satisfy normal requirements for a period of 60 days. It is believed that within that time, with Soviet and Chinese cooperation, North Vietnam could restore the flow of petroleum supplies. If restoration of the flow, probably by rail from China, took longer than this, North Vietnam could extend these supplies to meet essential requirements for a period of 90 days by eliminating non-essential petroleum requirements.

Note

In a memorandum accompanying copies of this report that were sent to the Department of State and the Defense Intelligence Agency on 8 June, the following sentence was added to the summary:

> A strong and successful interdiction campaign against these stocks would modify our estimates of these times.

I. Availability of Petroleum Storage Capacity in North Vietnam

Airstrikes in 1965-66 have destroyed or rendered useless more than 41,000 tons of bulk storage capacity in North Vietnam. The country still has bulk storage capacity for about 190,000 tons of petroleum products. The storage facility at Haiphong with a capacity of 79,000 tons and that at Hanoi with a capacity of 37,000 tons, represents nearly 60 percent of total current bulk capacity. An additional nine targeted installations account for 64,000 tons, or about 35 percent of capacity. (The names and locations of these facilities are shown on Table 1 and the map.) Small dispersed and untargeted storage facilities account for about 8,000 tons, or about 5 percent of the total tonnage.* Approximately 31 such sites in

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	Number	Capacity		
		Thousand Gallons	Short Tons	Percent
South of 20°N	13	515	2,100	26
Between 20° and 21°N	6	364	1,500	18
North of 21°N	12	1,105	4,600	56
Total	31	1,984	8,000	100

* An additional 7,000 tons of capacity are available at airbases in North Vietnam.

Table 1

North Vietnam: Principal Petroleum Storage Targets and Initial Attack Requirements

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Name	Capacity (Short Tons)	Estimated Sorties			Ordnance Requirement (Short Tons)	Population Situation in the Immediate Target Area
		Strike	Support	Total		
Haiphong	79,000	58	24	82	131	Urban; relatively light population
Hanoi (Thanh Am)	37,000	36	24	60	54	Urban; relatively light population
Vinh	2,000 a/	2	2	4	5	Rural; small villages
Nguyen Khe	14,000	40	20	60	90	Rural; small villages
Phuc Yen	15,000	50	24	74	113	Rural; many small villages
Bac Giang	7,000	20	16	36	45	Urban; relatively light population
Do Son	4,000	22	12	34	51	Urban; relatively light population
Viet Tri	4,000	20	20	40	45	Rural; many small villages
Phu Qui	2,000 a/	4	2	6	9	Rural
Duong Nham	15,000	38	20	58	86	Rural; one village in area
Kep	b/	54	32	86	108	Rural; no villages in area
Total	180,000 c/	344	196	540	737	

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a. Both the Vinh and Phu Qui facilities have been bombed a number of times. The capacity of these facilities is that portion of the initial capacity not destroyed.
b. The capacity at Kep (about 1,000 tons) is included with small dispersed sites.
c. All tonnages have been rounded to the nearest thousand tons and do not add to the totals shown.

The land mass north of 20° includes Haiphong and Hanoi and the heavy concentration of the rail net, including the Dong Dang - Hanoi - Lao Cai system. Of the 18 dispersed sites north of 20°N, only one (Son La) is not located on or near a rail line. Even the 13 widely scattered small capacity sites south of 20°N are located at or near the north-south railroad right-of-way (whatever the condition of the railroad itself).

Eleven sites representing about 46 percent of the total dispersed storage are located on or near the Dong Dang - Hanoi - Lao Cai rail system; two sites representing about 7 percent are on or near the Thai Nguyen - Hanoi rail line.

In addition to the dispersed tank storage facilities, the North Vietnamese store a considerable quantity of petroleum in drums. Drummed storage has been identified at numerous locations. Two large sites have been located -- one with about 2,000 drums in the vicinity of Hanoi and another with 4,000 drums near Thai Nguyen. It is not known with certainty how many drums North Vietnam has. 25X1 25X1 about 70,000 drums entered supply channels in North Vietnam in 1965 and possibly 60,000 more have entered thus far in 1966. Thus perhaps 130,000 new drums have been added to the indeterminate number of drums available in North Vietnam at the end of 1964. These new drums represent potential storage for at least 29,000 tons of petroleum, although an unknown number of them have undoubtedly been lost through attrition or have been put to other uses.

II. Use of Storage Capacity and Methods of Distribution

1. Haiphong Bulk Storage

North Vietnam's largest bulk petroleum storage center, located at Haiphong, accounts for over 40 percent of total storage capacity. Haiphong is the only bulk ocean import terminal; its capacity was designed to accommodate incoming tankers and provide an interim storage pending movement of petroleum to other consumption areas outside of Haiphong.

2. Hanoi Bulk Storage

North Vietnam's second largest bulk petroleum storage center is located at Hanoi. This storage site is largely rail served and, like that at Haiphong, was built by oil companies with commercial interests and distribution practices in mind. It is situated so that it can serve as a major distribution hub through the use of available rail and road transport routes for movement of oil to storage and distribution points elsewhere in the country. It is believed that North Vietnam has continued to use this storage in the same way as did the oil companies.

3. Other Bulk Storage Facilities

It is estimated that North Vietnam makes maximum possible use of the nine other targeted storage facilities in order to minimize the vulnerability inherent in concentrations of inventories in Haiphong and Hanoi.

4. Distribution from Haiphong

In the absence of firm evidence, a hypothetical pattern of movement of petroleum from Haiphong to other storage sites has been constructed* on the basis of the percentage which each site represents of the

* No attempt has been made to devise a flow pattern for petroleum moved from the up-country bulk facilities to ultimate consumers, but it is expected that after local consumers are supplied, bulk carriers -- tank trucks, sampans, and junks mounted with small tanks (perhaps 2,200-gallon capacity) -- and cargo trucks carrying packaged petroleum are used to serve nonlocal consumers.

total storage capacity outside of Haiphong. About 130,000 tons of petroleum were imported into North Vietnam by tanker through the port of Haiphong during the first five months of 1966. This quantity corresponds to an average daily rate of about 860 tons. About 60 tons of petroleum are consumed daily by marine activities, which are considered to be supplied from Haiphong. After other local consumers in the Haiphong area are supplied it is probable that not more than about 800 tons of petroleum per day are shipped from Haiphong to other storage sites. Prorating the movement of this quantity (800 tons) to other bulk storage sites on the basis of the storage capacity at the sites, the following quantities would be shipped:

Site Number	Name	Quantity (Tons)
1	Hanoi	290
2	Phuc Yen	120
3	Nguyen Khe	110
4	Viet Tri	35
5	Bac Giang	50
6	Vinh	20
7	Do Son	35
8	Duong Nham	120
9	Phu Qui	20
	Total	800

Sites 1 through 6, representing 80 percent of the total bulk oil storage outside Haiphong, are served primarily by rail or rail shuttle. Of these, sites 4, 5, and 6 can be, and probably are, served also by water. Sites 7 and 8 can be served only by water and to a limited extent by road. Site 9 is served only by road. The quantities of petroleum to be shipped to these sites by the transport routes indicated represent only a nominal part of the estimated total capacity of such routes.

III. Consumption of Petroleum Available in North Vietnam

1. Total Availability

North Vietnam is entirely dependent on imports for the supply of petroleum products. During 1965 the country imported about 190,000 tons of products. Ocean tankers delivered more than 165,000 tons of the total and dry cargo ships delivered about 12,000 tons. The remainder was delivered overland by railroad through Communist China.

Imports of petroleum, almost entirely by tanker, during the first five months of 1966 amounted to about 130,000 tons, at least 50 percent more than was imported during the same time period in 1965. If this higher level of imports is maintained, North Vietnam will receive about 300,000 tons of petroleum during 1966.

2. Consumption

It is not possible to predict with certainty the consumption rates for 1966. Vehicle imports, which increased the inventory by 20 percent in 1965, are continuing at a high rate. Deliveries to date plus those known to be on order represents an increase of 25 percent to the gross inventory as it stood at the end of 1965.* There is, moreover, evidence [redacted] that transport by motor vehicles has increased in intensity over that of 1965 -- to compensate at least partly for the interdiction of the railroads and to circumvent bomb-damaged sections of normal highway routes. Greater reliance is also being placed on water transport, a significant portion of which is motor-powered long-haul traffic. In addition, increased activity in the military establishment and in the economy, particularly the construction sector, confirms the probability that the consumption of petroleum will be considerably greater in 1966 than in 1965.

On the basis of an estimated inventory of petroleum-using facilities and equipment as of April 1, 1966, a petroleum consumption rate of 206,000 tons has been estimated for 1966. This amount represents an increase of almost 20 percent over 1965 but is still about 30 percent less than the annual rate at which petroleum products (300,000 tons) are expected to be received this year. Some of the difference undoubtedly will

* This calculation does not take into account losses resulting from air attacks in North Vietnam and Laos during 1966.

be accounted for by the assignment of petroleum to the dispersed tank and drummed storage sites being created to reduce the vulnerability of the normal storage facilities to aerial attacks. The Communists may anticipate a further increase in requirements for 1966, or they may be attempting to import as much as possible during the early months of the year in anticipation of bombing attacks on major storage facilities.

The use pattern associated with the consumption rate estimated, as of 1 April 1966, is regarded as reasonably representative of the full year 1966 in the absence of effective bombing of major storage facilities. The tabulation, below, prepared by DIA and based largely on inventory data, identifies the principal users of petroleum and provides quantities at the annual consumption rate of 206,000 tons:

	Short Tons	
	Tons	Percent
Military	68,000	33
Aircraft	10,200	
Naval ships	3,500	
Personnel, cargo carriers, and transport	33,700	
Armored vehicles	900	
Generators	19,800	
Civilian Transport	111,000	54 a/
Highway	47,300	
Inland waterway	39,600	
Coastal waterway	23,600	
Coastal waterway	11,000	
Merchant marine	3,850	
Haiphong dredge	4,400	
Harbor craft	2,200	
Fishing fleet	2,200	
Industry and Commerce	12,000	6
Agriculture	4,800	2
Household Use	11,000	5
Total	206,000	100

a. It is estimated that 42 percent of the civilian transport consumption is used in support of military operations either directly or indirectly.

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3. Requirements for Support of the War in South Vietnam

[redacted] at the end of 1965 the North Vietnamese forces and civilian activities in Military Region IV, which includes the four southern provinces of North Vietnam, were consuming petroleum at the rate of 1,500 tons per month. With the high level of transport activity observed during the latest dry season, it is estimated that the average level of consumption by Military Region IV during 1966 will amount to about 2,000 tons per month, or 70 tons per day. The delivery to Military Region IV of this 2,000 tons of petroleum, as well as other supplies (including food), probably requires an additional 500 tons of fuel per month. The 2,000 tons of fuel being delivered to Military Region IV supports the following major activities: (a) the small civilian economy, (b) the maintenance and construction of lines of communication and transport facilities within the region, (c) the military establishment in the region, and (d) the construction and maintenance of roads in Laos and the actual movement of men and supplies to Laos and through Laos to South Vietnam.

The share of the 2,000 tons consumed monthly by Military Region IV for the actual movement of supplies to and through Laos is estimated to be small. At the end of 1965, it appeared that only about 400 tons of the 1,500 tons shipped to Military Region IV was being used in the Laotian Panhandle. At present, this amount has probably increased to between 500 and 600 tons. This amount would support the estimated 400 to 500 trucks that are being used in the Panhandle of Laos to construct and repair roads, support the Communist forces in Laos, and move supplies to the South Vietnamese border area. This estimate also allows for the loss of some petroleum by aerial attacks on the truck and fuel dumps in Laos. Petroleum is moved into the Laotian Panhandle by truck, mostly in drums, although a few tank trucks have been observed on the roads in the northern part of the supply route. The trucks that carry supplies destined for South Vietnam are estimated to consume about one fourth of the 500 to 600 tons of fuel moving into the Panhandle.

IV. Physical Vulnerability of Petroleum Storage in North Vietnam

1. Target Environment

a. Location

Sites for the bulk storage of petroleum -- commercial or military -- normally are chosen at transshipment points (such as ports) or adjacent to major consumption areas. In their local environment, the tank farms are usually on the fringes of urban areas or in lightly populated districts, to minimize fire hazards, so that accidental damage to surrounding properties and casualties to personnel from such causes will be at a minimum. For defense security, to reduce vulnerability to possible enemy action, a number of small, dispersed storage areas are created during military buildup periods. In general, the target environments for the petroleum storage facilities in North Vietnam correspond with these traditional considerations. The sites fall into three broad categories: (1) those in urban areas with relatively light population density in the immediate target area, (2) facilities in rural area surrounded by small villages, and (3) tanks in rural areas with sparse population in the immediate target area.

The Haiphong, Hanoi, Bac Giang, and Do Son petroleum facilities fall into the first category. They are located on the outskirts of urban centers within the Hanoi-Haiphong complex. Within the immediate target area the petroleum facilities are surrounded by extensive ricefields and small villages.

The Nguyen Khe, Phuc Yen, and Viet Tri tanks are located within the delta region of North Vietnam. They are situation in rural areas and generally surrounded by ricefields and many small villages.

The Duong Nham and Kep petroleum facilities are situated to the northeast of Hanoi in a rural, sparsely populated region. The Phu Qui facility is northwest of Vinh, and is surrounded by rough uninhabited terrain.

b. Probability of Civilian Casualties

It is estimated on the basis of currently accepted methodologies for estimating casualties that the initial strikes against the

11 targeted installations could inflict as many as 200 to 300 civilian casualties. Most of these casualties will be caused by raids directed against the large storage tanks located in the urban areas of North Vietnam. However, the airstrikes would be planned to minimize civilian casualties; thus if the civilian population received effective early warning, the numbers could be considerably lower. An estimate of the initial casualties for each facility is shown in Table 2.

2. Force Requirements

On the basis of Department of Defense calculations, about 540 aircraft and 737 tons of ordnance would be expended, on the average, to achieve a 70 percent destruction during the initial strikes. Therefore, some reattacks would probably be necessary to neutralize the major facilities. (The details are shown in Table 1.)

Table 2

Estimate of Civilian Casualties
from Initial Attacks
on North Vietnam Bulk Petroleum Storage Sites

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	Name	Number of Casualties Low	High
	Haiphong	116	174
	Hanoi	15	25
	Vinh a/	4	6
	Nguyen Khe	4	6
	Phuc Yen	24	36
	Bac Giang	11	17
	Do Son	12	17
	Viet Tri	13	18
	Phu Qui a/	1	1
	Duong Nham	0	0
	Kep	0	0
Total		200	300

a. Previously struck facilities.

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V. Estimated Effects of Airstrikes

There are a number of gaps in the intelligence base on which estimates of petroleum consumption and reserve stocks have been made. As a result, estimates of the effects of the airstrikes must be presented as a range, rather than as a single value.

To make this range meaningful, the question of the degree of success that the airstrikes achieve -- that is, the level of damage inflicted -- has not been considered. This means that the analysis is based on the assumption that the 11 targeted storage facilities are neutralized quickly through initial and follow-up strikes and that restrikes are laid on as necessary to keep these facilities from being reactivated.

This assumption is particularly critical in the case of Haiphong, whose pumping and distribution facilities could be used in a variety of conceivable partial damage situations. As always, effects are directly related to the speed and decisiveness with which the entire target system is taken under attack. At the extreme, an attack program carried out over a period of months which left key facilities partially operational need have little effect on either essential military or civilian activities.

1. Post-Attack Petroleum Stocks

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Dispersed storage facilities -- tanks and drums -- hold a minimum of at least 12,000 tons if not more; there could be 14,000 tons in the storage system and additional amounts in the distribution system for a total of over 30,000 tons in the immediate post-attack period. This volume represents about 60 days' supply at the normal daily consumption rate. The existence of an estimated 60-day stockpile may be illusory. Surplus quantities of one product may remain while other essential products are non-existent. Time would be required to inventory the remaining products, and petroleum would have to be expended in moving petroleum products to the locations where they are needed. The effective stocks remaining, therefore, would then be less than that indicated above.

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2. Post-Attack Alternatives

Following the airstrikes, it can be anticipated that the North Vietnamese regime would make a major effort to repair the Haiphong facilities to the point where this vital port could be used to restore the flow of supplies.

If repeated airstrikes virtually eliminate the Haiphong facility, it would be necessary to unload directly from tankers into lighters, barges, and coasters or into railroad tank cars. Tankers would then be required to remain on station for several weeks, and the flow of petroleum would be sharply reduced as a consequence of a shortage of equipment and facilities for handling bulk cargoes. Coasters or oceangoing junks could supply some petroleum to Haiphong and to other key coastal cities. As an alternative or supplement, tankers could unload at the Chinese Communist port of Fort Bayard, and subsequent movement to North Vietnam could be made by rail and by water.

3. Use of Chinese Ports and Transportation Routes

Fort Bayard is the Chinese ocean port most readily accessible to North Vietnam. Fort Bayard has storage capacity for about 72,000 tons of petroleum. A standard-gauge railroad line runs from the port via Li-tang to P'ing-hsiang on the North Vietnamese border, a distance of 407 miles. The estimated capacity of the railroad for military supplies is about 5,600 tons per day; it is considerably higher for civilian goods, including POL. The estimated military capacity of the railroad is about seven times the capacity required to transport the current level of petroleum imports into North Vietnam.* The number of tank cars required in continuous use to move the tonnage would be about 170, or 1 percent of the current inventory of tank cars in China.** At P'ing-hsiang on the North Vietnamese border, all tonnage must be transloaded from the Chinese standard-gauge to the North Vietnamese meter-gauge railroad. The meter-gauge railroad from the border to Hanoi has a daily capacity of at least 3,000 tons, or more than three times the daily required capacity for POL. The capacity of this rail line is not being fully utilized at present. There is a POL storage facility at P'ing-hsiang with a capacity of about 2,000 tons, and that installation could be used to even out the flow of POL traffic on the railroad. North Vietnam has about 200 tank cars and might have access to at least 150 of the narrow-gauge Chinese tank cars formerly used in the transit trade through

* At an estimated annual rate of 300,000 tons in 1966.

** Twenty-one 40-ton cars arriving daily would equal the current import level.

North Vietnam. POL destined to consumers not conveniently served by the direct railroad route would move in tank trucks or in drums.

In addition to the railroad route from Fort Bayard to P'ing-hsiang, there is an all-weather road leading from Fort Bayard to the North Vietnamese border at Mong Cai, a distance of 235 miles. This route has a minimum capacity of 1,475 tons per day. Coastal water craft, which are in ample supply in China, could also be employed to carry petroleum from Fort Bayard to various small ports and consumers in North Vietnam as far south as the Demilitarized Zone. Assuming that this rail/road system remains uninterdicted or that its capacity remains high under sporadic attacks, it is believed an effective alternative to the present system based on Haiphong could be established within 30 days.

4. Use of Other Inland Transportation Routes

An alternative to the use of Fort Bayard by tankers would be to import petroleum by the overland rail route from the USSR (perhaps from the Irkutsk refinery), via Mongolia and China, to North Vietnam. The railroad distance from Irkutsk via Naushki on the Soviet/Mongolian border to Erhlien on the Chinese/Mongolian border and thence to P'ing-hsiang on the Chinese/North Vietnamese border is about 3,400 miles. About 132 40-ton tank cars in continuous use would be required for each 100,000 tons carried in the USSR and Mongolia, and about 280 40-ton tank cars would be required for each 100,000 tons carried in China. Chinese cooperation with the USSR would be necessary to establish this alternative route. There could be delays for negotiations and for marshaling equipment and facilities which would require more than 30 days before this alternative route could be delivering at the required rate. However, the tanker route to Fort Bayard and the short rail haul from there to North Vietnam is regarded as the more likely alternative.

5. Elimination of Non-Essential Requirements

The petroleum stocks estimated as the likely supply remaining after the initial airstrikes would enable North Vietnam to continue most transport activities for 60 days assuming that the stocks are properly distributed. It is estimated that an alternative means of resupply would have been effected within that time. If post-attack emergency arrangements took longer than 60 days, North Vietnam could eliminate or reduce

certain less essential petroleum uses and sustain essential operations for a period of 90 days.

a. Military Establishment

Operating reserves of fuel allocated to ground force units and installations would allow continuation of activities at the present level for an estimated period of 30 days. Limited naval operations could be continued for two to three months from stocks on hand and, if needed, additional refueling could be effected from craft engaged in coastal trade with Communist China. In the absence of US attacks, the North Vietnamese Air Force jets could be supported from airfield stocks for a period of 120 to 150 days, and transport operations could be supported for 90 days.

The motorized cargo and personnel carriers assigned to the military establishment are believed to be consuming petroleum at a rate of 60 tons per day. Not all of this is essential: some of it could be dispensed with by greater reliance on primitive transport means and troop movement on foot. While some loss in mobility would result, essential military activities could proceed on schedule. A cut of 30 tons a day in vehicle activity (50 percent) would reduce over-all military consumption by 16 percent.

b. The Economy

The North Vietnamese economy accounts for an estimated 67 percent of total petroleum consumption. The components are: civilian transport, 54 percent; industry and commerce, 5.7 percent; agriculture, 2.1 percent; and household use, 5.2 percent. It is estimated that 42 percent of civilian transport is used directly or indirectly in support of the military establishment. Therefore, in terms of total consumption, 55 percent is allocated to military uses and 45 percent for the economy. In the event of a petroleum shortage, there are certain nonmilitary functions, such as the distribution of food, that the North Vietnamese would seek to maintain unimpaired. Other distribution activities now dependent on petroleum would be shifted to other transport media or dispensed with.

For example, export industries, such as coal mining could be drastically curtailed in a period of petroleum shortage. Pig iron

production at the Thai Nguyen iron and steel plant, most of which is for export, is not essential for continuing the war effort. The dispersal activity itself and the stockpiling of construction and repair materials along principal rail and road routes probably does not require continuous expansion although it would have to be maintained. Materials to expand industrial facilities, which now come into North Vietnam through Haiphong or by rail from China and ultimately result in truck traffic for local hauls, are not essential to continuing the military effort or to the minimum functioning of the economy. This conclusion assumes that the USSR and Communist China would be willing to continue to supply essential civilian goods and military supplies without repayment -- a judgment that is supported by past practices by both countries.

c. Overall Estimate

In estimating the ability of North Vietnam to curtail the use of motor transport, it is important to remember that the railroads provide long-haul transportation for both military and economic support. Similarly, primitive transport means always play an important role in subsistence agricultural economies. The major use of petroleum is in short-haul motor transport.

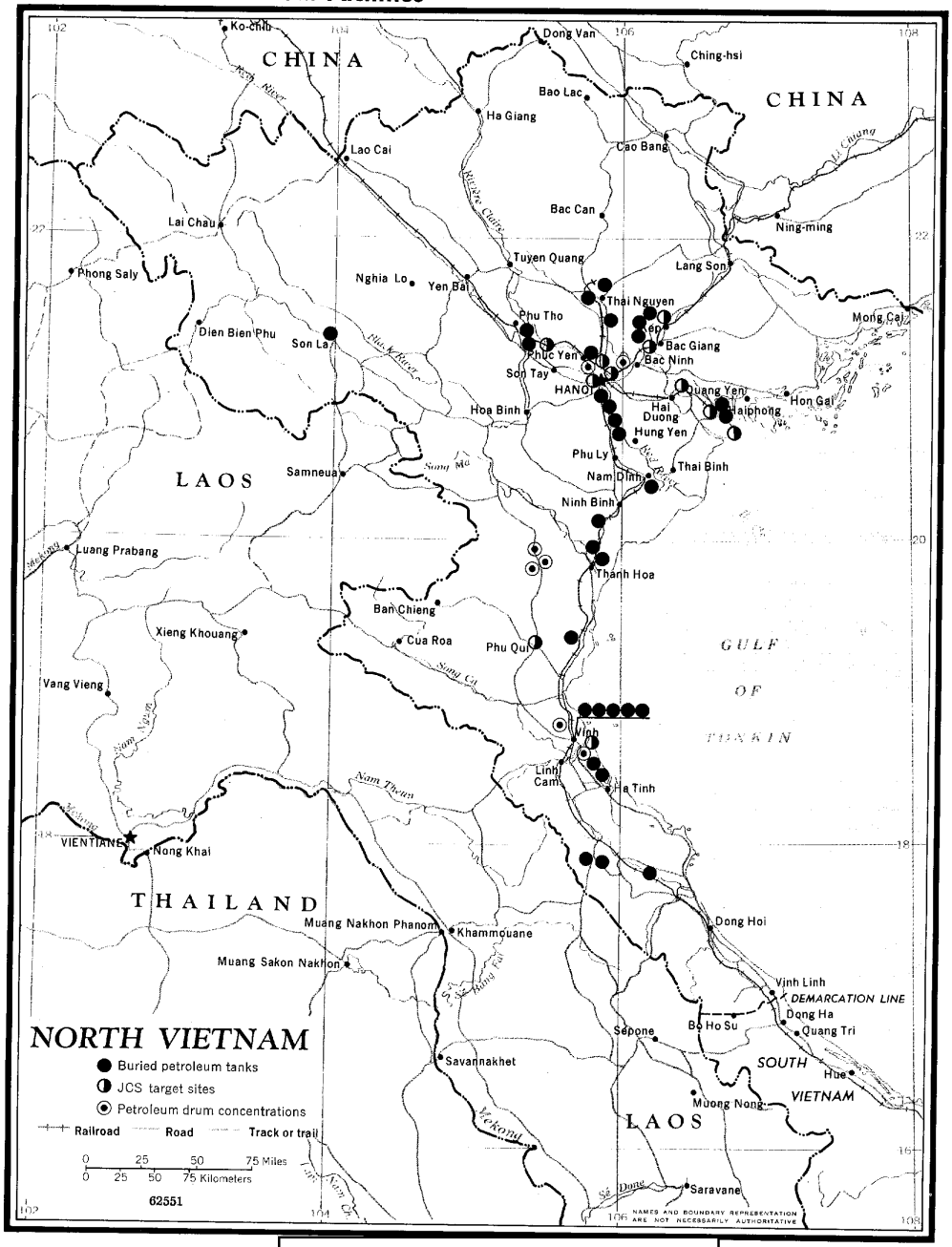
A precise quantification of present POL uses that would be regarded as non-essential in time of serious supply stringency was not possible in the time period available to us. Past experience in other war situations and an analysis of North Vietnam's current petroleum uses serve to permit a rough estimate of order of magnitude. It is believed that, with a reasonable priority control program, the petroleum stocks considered as being available after attack could be stretched to 90 days (instead of 60 days at normal consumption rates) without interfering with essential military and economic activities.

VI. General Estimate of Effects

There is little doubt that neutralization of the bulk POL storage facilities in North Vietnam would present the Hanoi regime and its allies with an immediate problem in improvising an adequate flow of petroleum products. This problem would be made more difficult if the auxiliary pumping, piping, and primary distribution facilities were to be kept inoperable. Because Hanoi has already gone to considerable lengths to reduce the vulnerability of its bulk petroleum storage centers by dispersal and other passive defense measures, including burying tanks, there probably exists an emergency plan for an alternative system of supply. Logically, the alternative system would be based on China's Fort Bayard and port facilities and connecting rail links. It is concluded that this alternate system could be put into operation prior to the exhaustion of stocks in North Vietnam. Following neutralization of targeted storage, it should be possible to restrict the flow of essential military supplies if dispersed storage, in tanks and drums, were subject to attack by armed reconnaissance missions. The increased activity associated with these sites following attacks on bulk storage sites should facilitate identification of such sites and may make it possible to eliminate some of the small depots.

The burden of a petroleum shortage would fall on less essential or non-essential military and civilian uses. The immediate impact in North Vietnam will be felt in the need to convert to a new system of supply and distribution. This conversion will necessitate costly measures and create significant problems in adapting to a new situation. It is estimated, however, that the maintenance (or indeed some increase) of the flow of supplies to the insurgent forces in South Vietnam could be sustained. The cost to Hanoi, through the destruction of facilities and the need to divert additional manpower to emergency logistic activities, would not be insignificant, but the ability to continue the war would remain.

North Vietnam: Petroleum Facilities



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