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Refugee camp water and sanitation

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INTRODUCTION

History of the Refugee Situation in Thailand

In 1975, political changes in Vietnam, Cambodia and Laos drove about 160,000 people across the border into Thailand. The majority of these people came across the Mekhong river from Laos and were granted asylum by the Thai government.

From 1976 until 1978 the refugee population in Thailand remained more or less stable. There was a continual, relatively small inflow of refugees from Kampuchea, Vietnam and Laos which was offset by a steady, though smaller, number leaving for resettlement.

In 1979, a series of events occurred which greatly increased the flow of refugees into Thailand. In January, the exodus of boat people from Vietnam took a sharp increase to the extent that the monthly rate of arrivals increased by as much as four-fold. Again in June, tens of thousands of Khmer crossed the border into Thailand, followed by another near 200,000 in late 1979 and early 1980.

After 1980, the number of refugee arrivals decreased to pre-1979 levels, as shown in Figure 1.

The approximate present-day camp populations are presented in Table 1.

The Problem

During the initial stage of the 1979-80 refugee crisis, there was an urgent need for food,

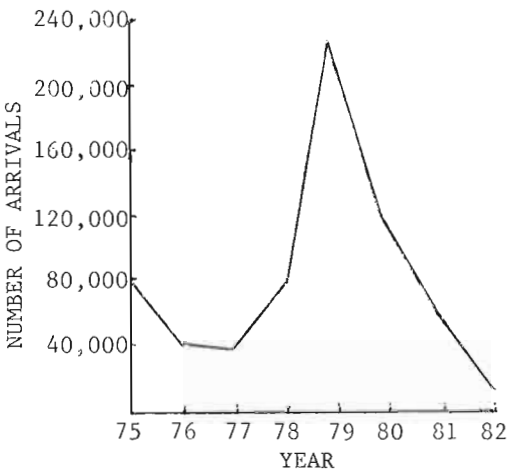

Figure 1. Refugee Arrivals in Thailand (ref. 1)

Table 1. Approximate Refugee Camp Populations 1983

Camp	Country of Origin	Population
Chiang Kham	Laos	3,300
Ban Nam Yao	Laos	7,300
Ban Vinai	Laos	38,000
Ban Na Pho	Laos	17,000
Khao-I-Dang	Khmer	45,000
Sikhiu	Vietnam	5,100
Phanat Nikhom	Laos,Khmer,Vietn.	17,200

housing and medical aid. Sanitation and public health facilities were generally insufficient. Latrines were not properly constructed, systems for the disposal of wastes and refuse were inadequate, and there was poor, if any, drainage in the camps. These problems were compounded by the continual expansion of the population accommodated in hastily-built facilities and the fact that many refugees from rural areas were unused to living in crowded conditions. As the emergency subsided and the health of the population began to stabilise, public health and sanitation problems in the camps persisted. The communities in the camps continued to have high rates of water-related diseases such as typhoid, malaria, gastroenteritis, diarrhoea, cholera, parasites and skin diseases. (ref. 1)

Later in 1980, when the focus began to shift from curative medical care to preventative health programmes in the camps, the problems of water and sanitation became of more concern. Water and sanitation became integral parts of preventative public health care programmes, the objective being to create and maintain conditions that will promote health and prevent disease by maintaining a safe supply of water, providing effective disposal of human and household waste, eliminating stagnant pools and controlling the population of rodents and mosquitoes and other insects which are likely to spread disease.

WATER SUPPLY

As refugees come into Thailand and are organised into refugee camps and holding centers, an urgent need in terms of public health is always the procurement of a potable water supply. Generally, several options for water supply are open to the UNHCR and the implementing volunteer agencies. These include rain water collection, surface water, hand-dug shallow wells, bore-hole deep wells and

trucked-in water supply. A summary of the water sources for the refugee camps is presented in Table 2.

Rain Water

Rain water constitutes a fair percentage of the total consumption in many camps during the rainy season. Rain collectors used include bamboo baskets with plastic sheets placed inside, cement jars, galvanised tanks, stacked concrete rings or discarded 200-L oil drums and are placed to collect rooftop runoff. Although a valuable supplement to the water supply during the rainy season, rain water has not proven to be a viable alternative for year-round supply.

Hand-dug Shallow Wells

Although hand-dug shallow wells can be an appropriate water supply on the village level, the extensive use of shallow wells in the refugee camp has shown that shallow wells are not suitable as a drinking and cooking water source.

A good example of the problem with shallow wells is found in Ban Vinai Camp, where water quality analysis has shown positive foecal coliform concentrations in all shallow well water samples tested. Even the inclusion of design features such as concrete aprons, cement seals, and locking covers, as well as the location of latrines at over 30 metres from the wells, has not solved the problem.

The contamination of the shallow ground water itself (not necessarily the individual well) is the main reason why shallow wells are not acceptable as a potable water source for refugee camps. The dense populations in the camps and such practises as indiscriminate defecation, urination and disposal of washwater invariably pollute the shallow ground water.

Another appropriate village-level technology which has been found inappropriate for the refugee camps has been the hand pump. The problem is that hand pumps are subjected to very heavy use (12 hours per day non-stop pumping) and rapidly break down.

Trucked-in Water Supply

Trucked-in water supply has been used as a temporary supply, as well as a permanent main water source, for several camps. Although the quality of trucked-in water can be controlled and kept at high standards, the transportation costs are usually restrictive. At Khao-I-Dang, where trucked-in water comprises 76% of the total water supply, the 1983 cost per month of the water supply program exceeds ฿512,000. This equals an approximate cost of ฿1.39 per cubic metre.

Another problem with trucked-in water supply is that with this type of source there is no storage capacity, as water is consumed on a day-to-day basis. Any cut in the supply will immediately have a severe impact on the population.

Borehole Deep Wells

The technology which has had the most widespread use and success in providing a reliable, potable water source has been the borehole deep well, equipped with a submersible or direct drive pump. Although expensive to install (at Ban Vinai, a 1983 cost of approximately ฿6,944 was incurred in the drilling of a 35-metre deep well and the installation of a pump and distribution stations), these systems can withstand the heavy demand placed on them by the large refugee populations.

Table 2. Water Sources for Thai Refugee Camps

Camp Name	Source	Quality	Production (L/c/d)	Use
Sakaeo	4 Deep wells	Good	15	D,C
	Rain collection	Good	5	D,C
	Shallow well	CONT	10	B,W,Wa
	Reservoir	CONT	-	B,W
Phanat Nikhom	Trucked	Good	15	D,C,B,W
	2 Deep wells	Good	8	D,C,B,W
Kamput	River	CONT	10	D,C,B,W
	20 Hand pumps	Good	1	D,C,B,W
	4 Deep wells	Good	4	D,C,B,W
Ban Na Pho	6 Deep wells	Good	23	D,C
	Numerous shallow wells	CONT	-	W,Wa
Sikhiu	City system	Good	40	D,C,B,W
Khao-I-Dang	Trucking	Good	10	D,C,B,W
	13 Deep wells (only 4 productional)	Good	5	D,C,B,W
Ban Vinai	15 Deep wells	Good	20	D,C
	+ 150 Shallow wells	CONT	10	W,B,Wa

CONT=Contaminated, D=Drinking, C=Cooking, W=Washing, B=Bathing, Wa=Watering

Deep wells, however, are not a viable solution in all cases, and the hydrogeological conditions of an area should be investigated before wells are drilled. This obvious point is sometimes neglected in the hurried rush to provide a permanent potable water supply, as occurred in Khao-I-Dang, where only 4 of 13 deep wells are productional.

HUMAN WASTE DISPOSAL

One of the more difficult problems in the refugee camp situation is the collection and disposal of human waste. The selection of a suitable waste disposal system design can be influenced by the population, layout, soil conditions and water availability in the individual camps. In addition to the need for appropriate design, education about the use of sanitation facilities should be included, particularly when rural people are obliged to live in overcrowded conditions which they have not previously experienced.

Historically, the waste disposal systems in the Thailand refugee camps have evolved from the initial use of pit latrines, to aquaprivies and finally to water seal latrines and waste stabilisation ponds.

Pit Latrines

The pit latrine has been used in the camps as a quickly constructed response to the sanitation problem. The basic design (ref. 2) used is shown in Figure 2.

As an initial response to indiscriminate defecation, the pit latrine has shown some promise. However, the experience in the camps has been that because of very heavy use, objectionable fly and odour problems soon drive people away from using the latrines. In the Khao-I-Dang refugee camp, long trenches of 3 to 4 metres depth were used under long rows of toilet cubicles, crude timber ventpipes at the back of the cubicles reduced odours, while lime was added into the pit after each use. The capacity of the latrines proved to be great but flooding and collapsing of the pits plagued the system. (ref. 3)

The main cause of the problems associated with the pit latrine design shown in Figure 2 is poor ventilation. The bamboo superstructure lets in a great deal of light, and therefore a hole cover must be used to keep flies from emerging. The hole cover, in turn, blocks off the air flow which should proceed through the hole and out the vent pipe. As a result, objectionable odours accumulate.

Aqua Privies

The problems with pit latrines led to the investigation of other alternatives, one of which is the aqua privy. The application of aqua privies to the refugee holding centers originally appeared very favorable, as reported by Suwarnarat and Nawarat. (ref. 4)

The actual operation of the aqua privy, however, proved difficult. Bielik et al. (ref. 5) reported that the failure of the privies was due to several factors, including improper toilet shed and seepaway design. Seepaway design was especially critical. Due to impervious soils and a high water table during the rainy season, the aqueous effluent from the aqua privies rather than seeping away from the system, filled the seepaway and backed the fluid up into the aqua privy.

Presently, water seals are being used on the aqua privies and the sludge and aqueous portions are pumped out on a regular basis. This has reduced the aqua privies to mere holding tanks where active anaerobic digestion can begin.

Water Seal Latrines

The system which has gained the widest acceptance and success in the refugee camps has been the water seal pit latrine. Essentially its design is the same as that of Figure 2, with the introduction of a water seal (Figure 3). The water seal separates the pit and the latrine compartment, and prevents the smell from getting from one to the other. In addition, the cisterns are sealed to prevent contact with the ground water.

The pit or cistern serves as a holding tank and primary anaerobic digester. Once the cisterns are filled, their contents are removed and transported to a disposal site.

Oxidation Ponds

In many of the refugee camps, the wastewater from the latrines is transported to a stabilisation pond system by pump trucks. The design most widely employed includes an anaerobic pond followed by a facultative pond and two aerobic ponds in series. The design and

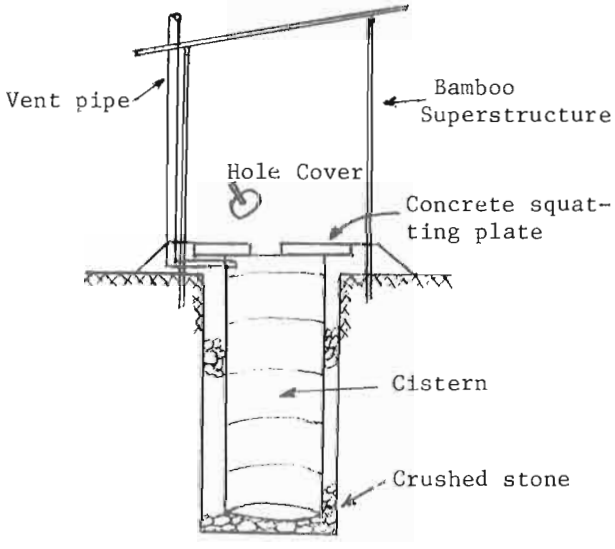

Figure 2. The Basic Features of the Thailand Refugee Camp Pit Latrine

Table 3. Water Quality of Lagoon Effluents

Lagoon	pH	COD (mg/L)	BOD (mg/L)	Ortho Phosphate (mg/L)	Ammonia (mg/L)	Nitrite (mg/L)	Nitrate (mg/L)
Anaerobic	7.6	923	120	7.5	1.8	0.026	44
Facultative	8.5	850	90	7.8	1.9	0.040	40
Aerobic I	8.5	555	80	5.9	1.9	0.023	48
Aerobic II	8.5	397	80	4.5	1.6	0.016	50

operational parameters used are according to Tam. (ref. 6)

Normal BOD removal efficiency is over 80% for the anaerobic and facultative ponds and good pathogen removal occurs in the aerobic ponds. Listed in Table 3 is typical water quality of the effluent from the lagoons. This information is based on data from the Ban Vinai and Na Pho treatment lagoons.

Based on the positive results reported by McGarry (ref. 7) on fish culture in oxidation ponds, an attempt at fish production was carried out in the Ban Vinai lagoons. A polyculture of silver, chinese and common carp was introduced into the facultative and aerobic lagoons, and all the fish died within minutes. The immediate deaths were due to ammonia toxicity which occurs with high ammonia concentration at pH greater than 7. If the ammonia toxicity problem can be overcome, fish culturing in oxidation ponds can improve the functioning of the pond as well as provide an additional food source.

CONCLUSION

Several water supply schemes have been implemented in the various refugee camps. Generally it has been found that water systems employing borehole wells have been the most appropriate to the refugee situation in Thailand. In most instances pit latrines and aqua privies have been unsuccessful in disposing of the large quantities of human wastes in the refugee camps due mostly to inappropriate application of the technology. Water seal latrines have proved more effective when coupled with the use of stabilisation ponds.

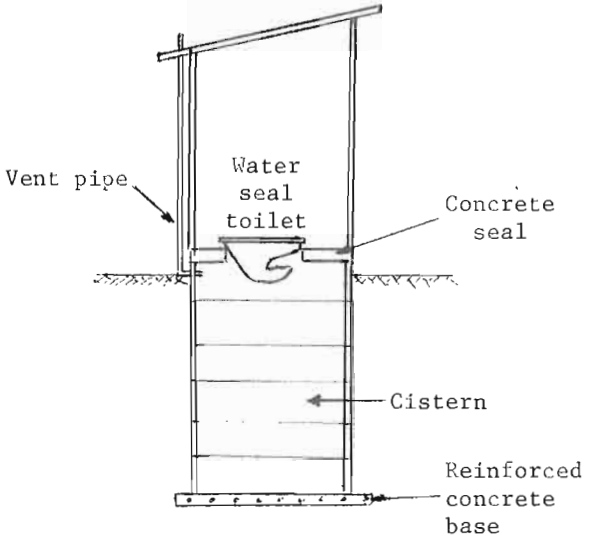

Figure 3. Water Seal Pit Latrine

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