Drinking Water Production System for Arsenic Removal: Case Study in Moo 2, Ronpiboon Sub-district, Ronpiboon District, Nakhon Sri Thamarat

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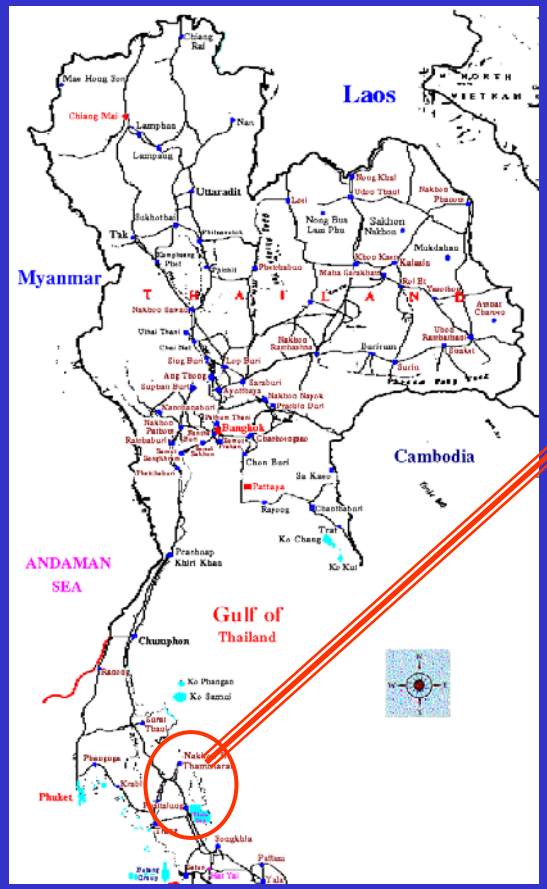
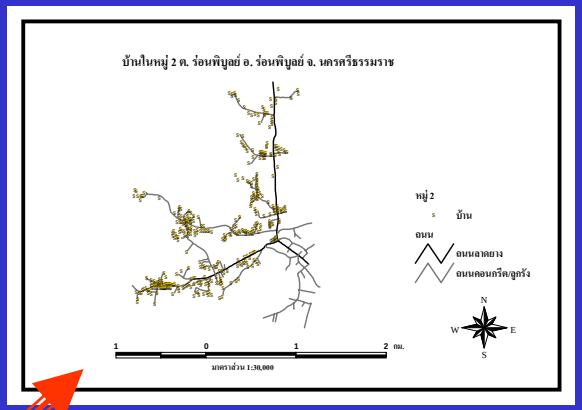
Presentation outline

- **Introduction and Study area**
- **Methodology and Pilot system**
- **Results**
- **Conclusion**

1-Introduction and Study area



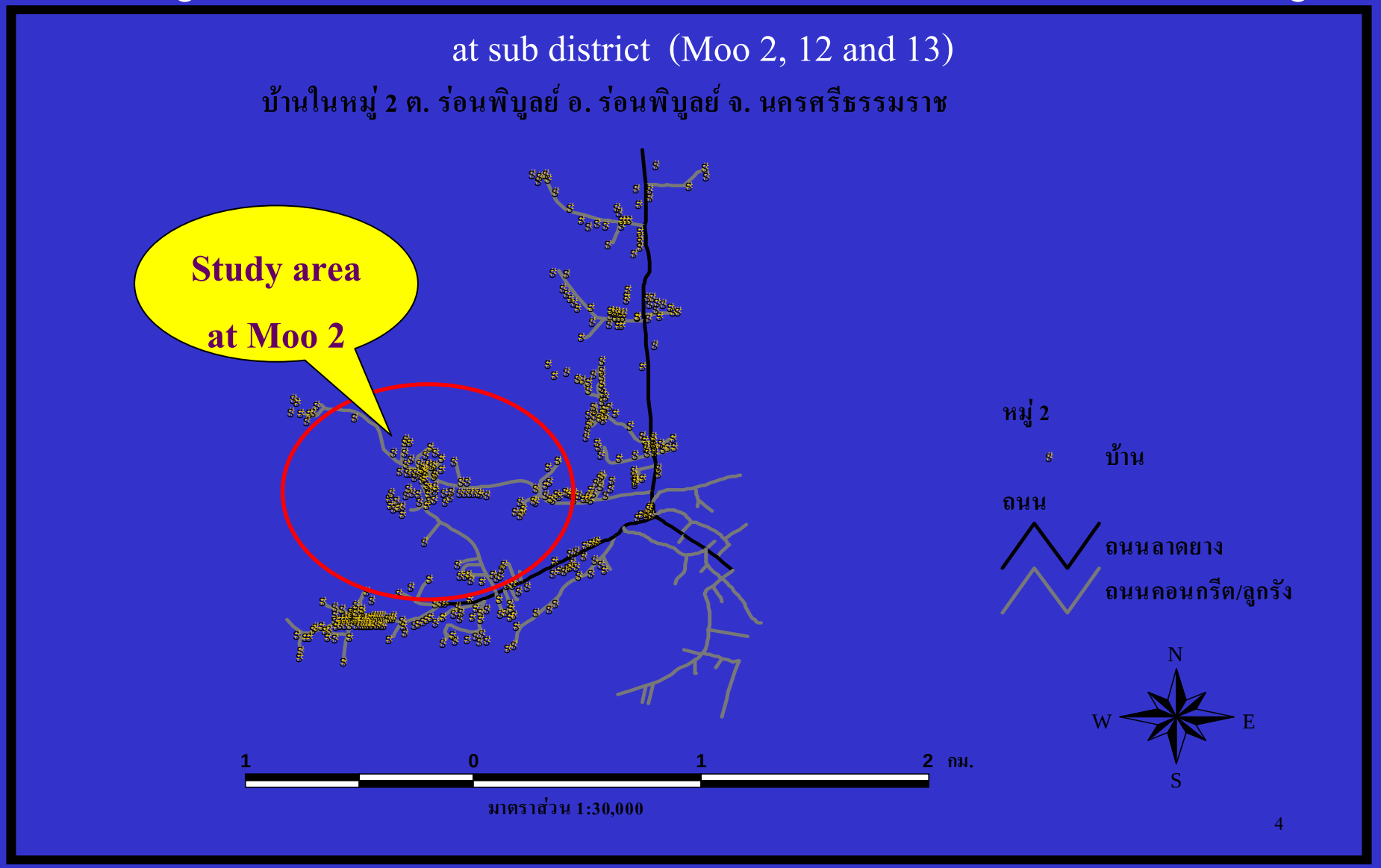


- First Arsenicosis (black foot disease) patient was found in 1987 at Ronpiboon Sub-district, Ronpiboon District, Nakhon Sri Thamarat

- Several reports conclude that the people took the drinking arsenic-rich water over a long period more than 50 years resulting in various health effects including skin problems

Arsenic contamination in surface water, ground water and soil at Ronpiboon was due mining processes of Tin (Stannum) such as refining and metal treating in the last 50 yr

The high concentration level of arsenic in water was found in 3 sites from 16 village at sub district (Moo 2, 12 and 13)



Government agencies such as: Department of Mineral Resources, Dep of Public Works and Town&Country Planning and Royal Irrigation Dept

Providing clean and safe water for peoples in contamination area

Moo 2

Ministry of Public Health produced tap water from groundwater resource for 50 houses but it was the problem of high hardness concentration in produced water

The expansion of people and village, the water supply plant was not enough and then it closed

In year 1998—Co Funding from Ministry of Public Health and Miyasava project from Japan provided the distribution and water supply system, mountain water, for 550 household in Moo2,where far from the central water supply system

In year 2003, the mobile filtration system was constructed by MSTRC-PSU. Composit membrane- Polyamide type, 4 x 40 inc- 1 roll was selected to install in filtration system

The objective of this study was to demonstrate and transfer know how of membrane technology operation for drinking water production in Moo2-sub district Ronpiboon. The investigation of people attitude on drinking water produced by mobile filtration system was reported. The overall data were analyzed to indicate the chance and possibility of membrane system will be use as an alternative arsenic removal system in Moo2. This research focused with public participation

Researcher from community

2- Methodology and Pilot system

Public Participation Concept

6 Dec. 04

2- Pilot system and Location

Modified Mobile Filtration Unit- PSU

Water Quality Analysis

- Local tap water

-Modified pressure system-

Adjusted electric phase and line

(1 Phase + Safe T cut)

*** To ensure that raw water quality is ready before filtration**

Work loads and Data collection

☺ Community research team work are stake holders in Moo 2 and PSU researchers. They started to have a meeting and discussion on the scope and objective in this work

☺ Research project study was official and approved CEO of district of Roonpiboon. The meeting between people and stakeholders were organized and kicked off. The project's objective was reported and public participation also initiated among them.

☺ Questionnaires and Interview methods were used to collect the relevance data from 283 from 550 houses who took drinking water from filtration system

☺ Report to head of Moo2 and Representative people in Moo2 several time until the project finished

Set up the filtration unit

18 Jan. 05

Meeting with Moo 2 committees at Ronna Temple

6 Feb. 05

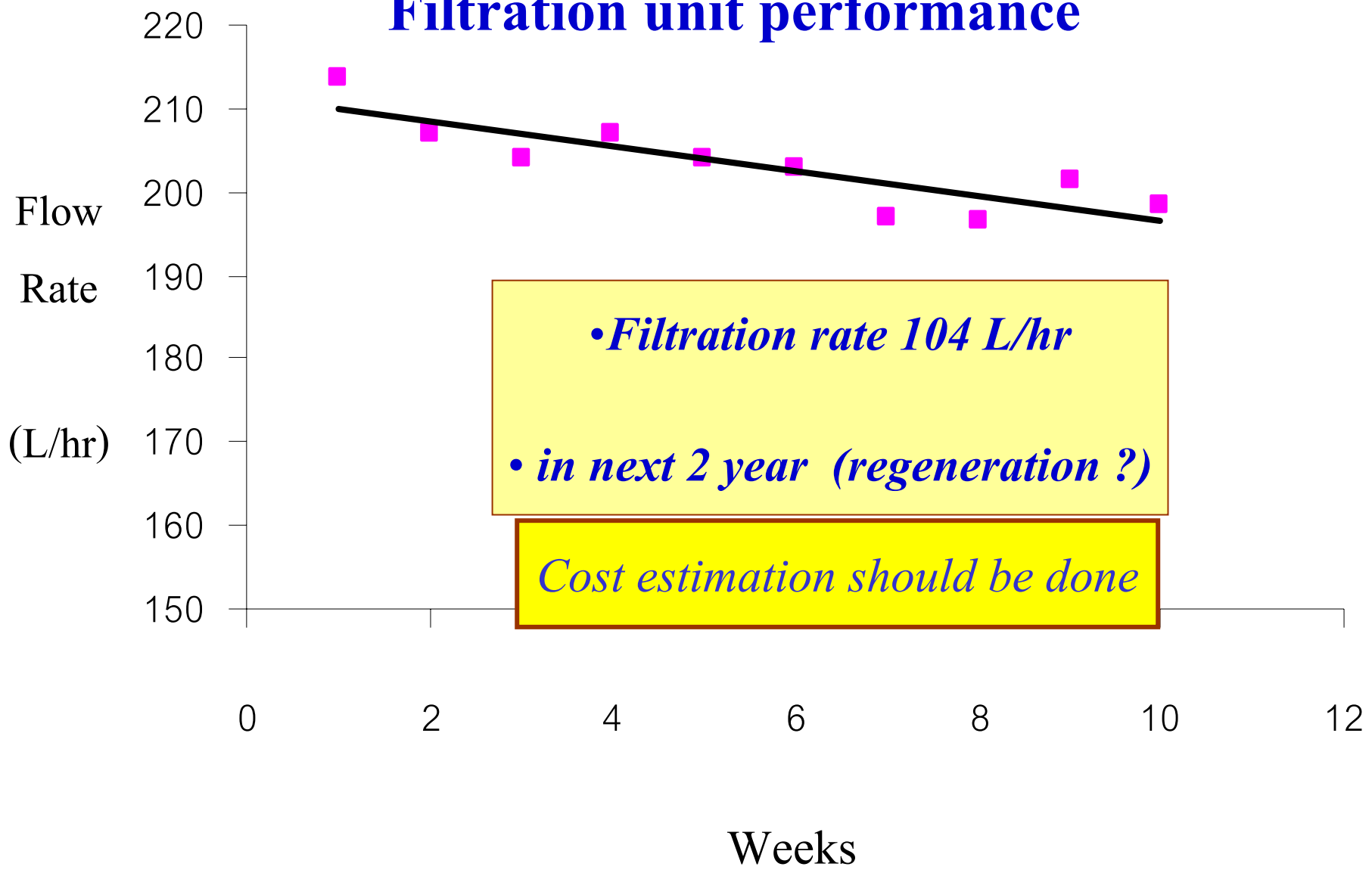
Water quality of Permeate Analysis

- ✓ Feed and Permeate samples were collected every week by community researchers

- ✓ Arsenic content in samples was analysed at Central laboratory, Fac of Science, PSU. The providing method is HG-ICP-OES (Hybrid Generation combined with Inductively Coupled Plasma Optical Emission Spectrometry) that LOQ (Limit of Quantity) is 0.010 mg/L (ppm)

- ✓ pH Turbiduty Color Fe and Hardness were analysed at chemical laboratory, Dept of Civil Eng, PSU. The Standard Methods for the Examination of Water and Wastewater, APHA, AWWA and WEF, 20th Edition, Washington D.C., USA, 1998 used as reference method

Filtration unit performance



- ***Filtration rate 104 L/hr***
- ***in next 2 year (regeneration ?)***

Cost estimation should be done

Filtered water quality from Mountain water supply plant at Moo2, Roonpiboon

#1

	M-W	F-W	T-W*	D-W*	Results
•Hardness	5.34	0.01	500	100	Pass
• Fe*	0.1	0.01	0.5	0.3	Pass
• Chloride*	5.0	5.0	250	250	Pass
• Sulfate*	25	25	250	250	Pass
•*Arsenic*	*0.15*	*<0.01*	*0.05*	*0.01*	*Pass*
•Nitrate*	1.0	0.1	50	10	Pass

Aug. 04

* Commercial shop

Filtered water quality from Mountain water supply plant at Moo2, Roonpiboon

#2

	M-W	F-W	T-W*	D-W*	Results
•Hardness	5.34	0.87	500	100	Pass
•Fe	0.15	0.19	0.5	0.3	Pass
•Chloride	15	<10	250	250	Pass
•Sulfate	<25	<25	250	250	Pass
•*Arsenic*	*<0.01*	*<0.01*	*0.05*	*0.01*	*Pass*
•Nitrate	<0.01	0.2	50	10	Pass

* Commercial shop

28 Dec. 04

Filtered water quality from Mountain water supply plant at Moo2, Roonpiboon

#3-4

	M-W	F-W	T-W*	D-W*	Results
•Hardness	5.34	<0.01	500	100	Pass
•Fe	0.1	<0.01	0.5	0.3	Pass
•Chloride	<5.0	<5.0	250	250	Pass
•Sulfate	<25	<25	250	250	Pass
•*Arsenic*	*ND*	*ND*	*0.05*	*0.01*	*Pass*
•Nitrate	1.0	0.1	50	10	Pass

* Commercial shop

30 Jan. 05

Filtered water quality from Mountain water supply plant at Moo2, Roonpiboon

#5-6

	M-W	F-W	T-W	F-W	W-W*
•Color	2.47	ND	4.12	1.65	5.77
•Hardness	11	ND	11	ND	193
• pH	6.05	5.97	5.16	6.68	6.38
•Turbidity	1.75	0.55	1.65	1.21	1.28
• Fe	0.4	ND	0.2	ND	0.2
•*Arsenic*	*0.10*	*ND*	*0.11*	*ND*	*0.08*

* Commercial shop

14, 17 Feb. 05

Filtered water quality from Mountain water supply plant at Moo2, Roonpiboon

#7-8

	T-W	F-W	T-W	F-W	Standard
•Color	ND	ND	ND	ND	<20
•Hardness	3.56	ND	3.06	ND	<100
•pH	4.52	4.48	4.75	5.08	6.5-8.5
•Turbidity	1	ND	1	ND	<20
•Fe	-	-	-	-	<0.3
•*Arsenic*	*0.12*	*ND*	*0.12*	*ND*	*<0.01*

25 Feb., 4 Mar. 05

Filtered water quality from Mountain water supply plant at Moo2, Roonpiboon

#9-10

	T-W	F-W	T-W	F-W	Standard
•*Arsenic*	*0.16*	*ND*	*0.15*	*ND*	*<0.01*

The arsenic concentration showed high content in feed sample during summer season but it was mostly low content in rain season

24, 31 Mar. 05

Water production and consumption in Moo2

During 18 Jan – 31March 2005

6 Feb 2005 Meeting with community at Ronna Temple

Ronpiboon hospital 1,070 L

18 Jan – 16 Feb 2005

(water consumption 29 days) = 2,925 L

average 101 L /day

Production rate 208.5 L/hr

17 Feb – 4 March 2005

(16 day) ใช้น้ำ 910 L

average 56.9 L/day

Production rate 206.3 L/hr

Drinking water

General purpose

Consumption rate

4 - 29 March 2005

(water consumption 26 day) = 4,729 L

average 181.9 L/day

Production rate 198.5 L/hr

Drinking water

Max vol 1,300 L และ 1,500 L

General purpose

30-31 March 2005

(water consumption 2 day) ~ 1,000 L

average 500 L/day

Total 73 day

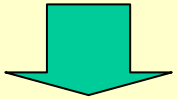
(water consumption) = 9,564 L

average 131 L/day

Capacity of filtration system

- 73 day--9,564 L+ 750 L = 10,314 L

- Initial production rate 208 L/hr and it decreased at 198 L/hr (average 203 L/hr)



- Fouling in membrane

- Estimation of production rate in 2 year will be about 104 L/hr. (Membrane regeneration are recommended!!!)

Attitude investigation on drinking water problem in Moo 2 sub-district Roonpiboon

Data

283 questionnaires from household

a) 51% have the problem in drinking water shortage but….

b) 42% spent money to buy drinking water in average 0.1 – 4 gallon (most of them used water supply from mountain, well water and water resource from neighborhood) (see next figure)

c) 22.6% spent money to buy drinking water in average 0.5 - 17 bath/day (see next figure)

d) 34.6% took drinking water from this project at site

e) 97.5% need drinking water production system in their village

Conclusion

Evaluation and Estimation cost of potable water and drinking water in Moo2

- **Actual price of drinking water**
- **Possible payment price of drinking water**

25 - 1,200 Bht/mth

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Attitude investigation on drinking water problem

283 households- for drink and making food = 7,448 gal/month

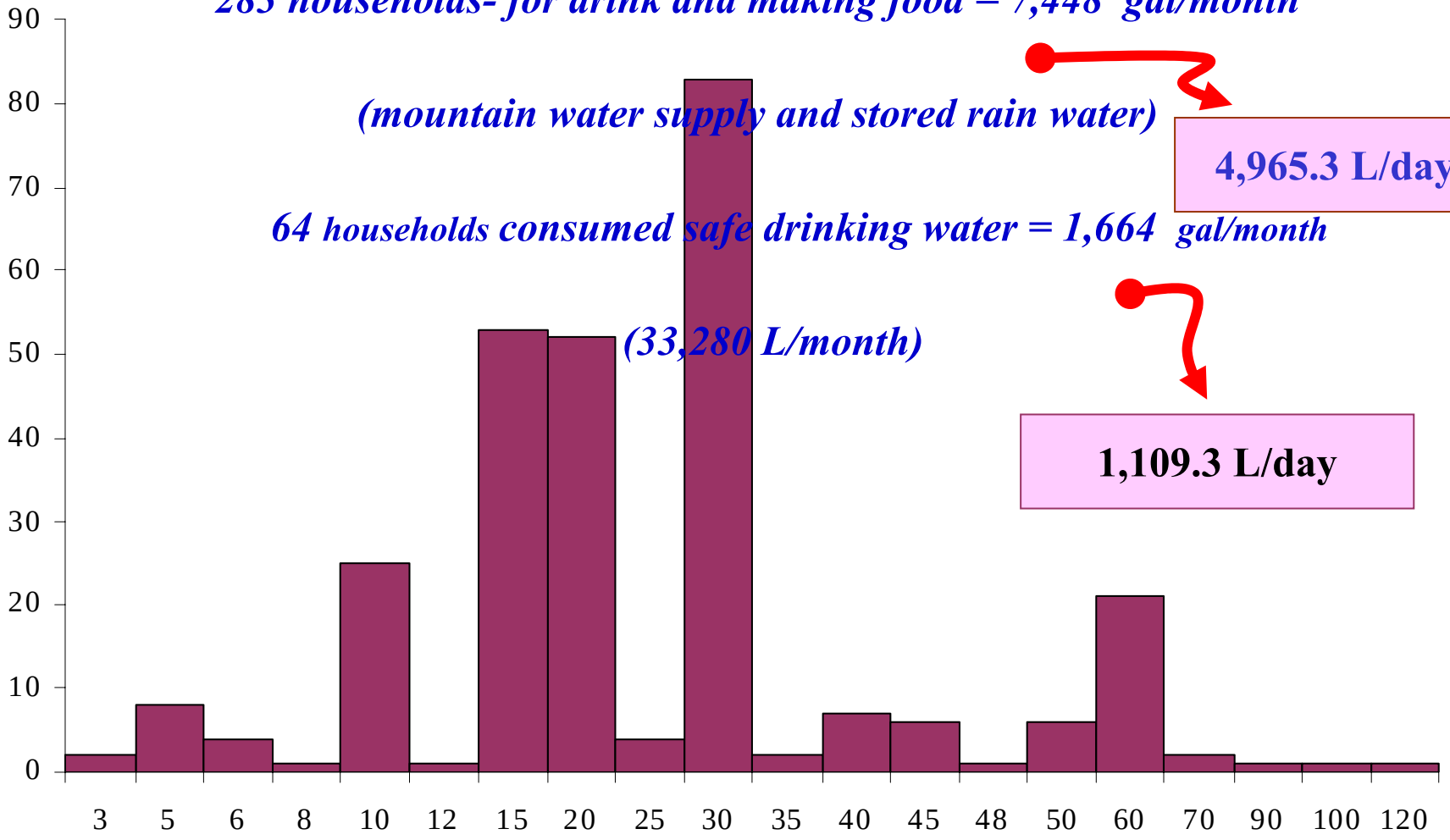
(mountain water supply and stored rain water)

4,965.3 L/day

64 households consumed safe drinking water = 1,664 gal/month

(33,280 L/month)

1,109.3 L/day



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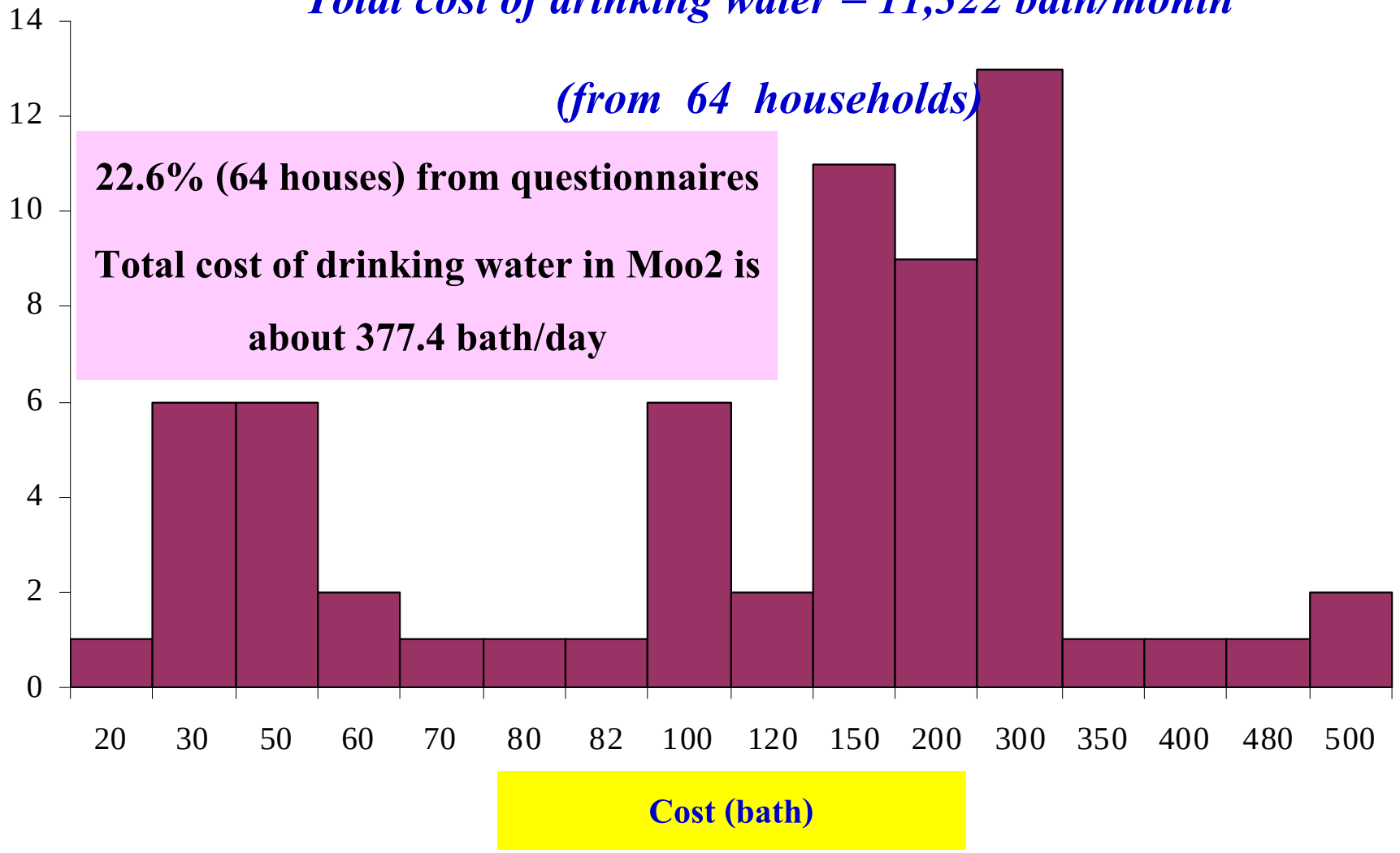
Attitude investigation on drinking water problem

Total cost of drinking water = 11,322 bath/month

(from 64 households)

22.6% (64 houses) from questionnaires

Total cost of drinking water in Moo2 is about 377.4 bath/day



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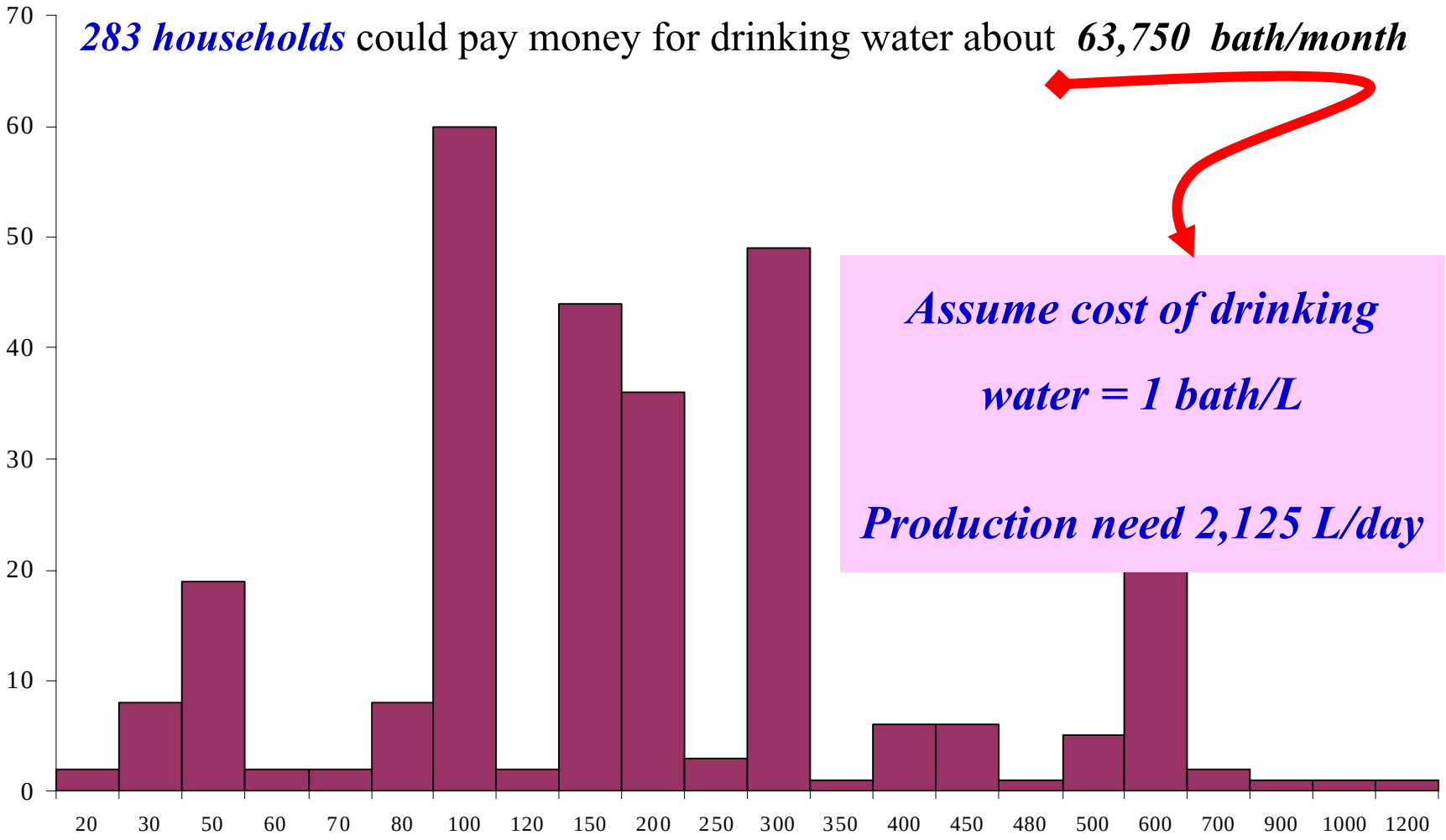
Attitude investigation on drinking water problem



Invitation…

Drinking water quality assurance for better quality life

and for community health

By…Health System Research Institute-Southern,

MSTRC-PSU & Community

☞Many thanks…….

HSRI-Southern for funding support

Assistance researchers and Ronpiboon hospital

Head of Moo2 (Mr Clad Janevanich)

Mr Suttichai Manajit (Tom)

and all peoples in Moo2