

**APPRAISAL OF THE VINSANRES ECO-SAN TOILET DEMONSTRATION**

**PROJECT**

**1997 -2000**

**6 October 2000, Nha Trang**

**Vietnam**

**Dr Pham Si Nghien and Paul Calvert**

## TABLE OF CONTENTS

<b>1. BACKGROUND</b>	<b>5</b>
<b>1.1 Appraisal team</b>	<b>5</b>
<b>1.2 Acknowledgements</b>	<b>6</b>
<b>1.3 Nomenclature</b>	<b>6</b>
<b>1.4 Description of the Toilets</b>	<b>6</b>
1.4.1 Traditional Double Vault	6
1.4.2 Traditional Double Vault, ventilated	7
1.4.3 Single Bucket, ventilated and solar heated	7
1.4.4 Multi-Bucket, ventilated and solar heated	7
1.4.5 Double Vault ventilated, and solar heated	7
1.4.6 Double Vault ventilated, solar heated and with a Moveable Shelter	7
<b>1.5 Note on toilet numbering in this report.</b>	<b>7</b>
<b>2. PURPOSE AND SCOPE OF THE APPRAISAL</b>	<b>8</b>
<b>3. APPROACH</b>	<b>8</b>
<b>3.1 PROJECT LITERATURE</b>	<b>10</b>
3.1.1 Summary and Comment on References 1 & 2	10
<b>3.2 MEETINGS WITH PASTEUR INSTITUTE STAFF</b>	<b>11</b>
<b>3.3 MEETING WITH PEOPLE'S COMMITTEE OF CAM DUC COMMUNE.</b>	<b>14</b>
<b>3.4 FIELD VISITS TO USERS OF VINASANRES AND PRIVATELY CONSTRUCTED TOILETS TO COLLECT DATA USING THE QUESTIONNAIRE AND OBSERVATION SHEETS.</b>	<b>15</b>
3.4.1 Solar Heating	15
3.4.2 Fly Screens and Vent Pipes and Airflow	16
3.4.3 Correct Use of Toilet	17
3.4.4 Closing of the toilet defecating holes	17
3.4.5 Urine Ways	17
3.4.6 Paper Collection	17
3.4.7 Construction	18
3.4.8 High Quality of Vinasanres Phase 3 Toilets	18
3.4.9 Doors	19
3.4.10 Storage of Faeces and closure of vaults	19
3.4.11 Comment on Private Toilets	19
3.4.12 Reuse: Urine	20
3.4.13 Reuse: Treated Faeces	21
3.4.14 Benefits	22
3.4.15 Operating Costs	23
3.4.16 What did the users think of the toilets?	24
3.4.17 Preference for another type of toilet	25
3.4.18 Demand	25
3.4.19 Could people afford it?	26

3.4.20 Cost of toilets	26
3.4.21 Comments of users	28
3.4.22 Note on hygiene and hand washing	29
<b>3.5 SCHOOL VISIT TO LEARN EFFECTIVENESS OF HYGIENE EDUCATION AND KNOWLEDGE OF VINASANRES AMONGST CHILDREN</b>	<b>30</b>
3.5.1 Approach	30
3.5.2 Children: Hygiene Awareness and Causes of Disease	31
3.5.3 Children: Toilets known, used and preferred	31
<b>3.6 MEETING AND DATA COLLECTION WITH WOMEN'S UNION, TO LEARN OF THEIR PERSPECTIVES ON VINASANRES, EFFECTIVENESS OF HYGIENE EDUCATION AND OPINIONS AND PREFERENCES OF TOILET DESIGNS</b>	<b>32</b>
3.6.1 Women: Ranking of Toilet Attributes	32
3.6.2 Women: scoring of toilet types against their ranked toilet attributes	33
<b>4. DISCUSSION OF THE FINDINGS AGAINST THE KEY POINTS IN THE TOR</b>	<b>34</b>
4.1 Develop new and/or improved sanitation systems for Vietnam	34
4.2 Promote South-South cooperation in the field of non-conventional sanitation	34
4.3 Achievements of the Vinasanres project in Khanh Hoa Province.	35
4.4 Acceptability by the local population.	35
4.5 Training, health education and follow-up programme.	36
4.6 Public health aspects.	36
4.7 Agricultural use of the output from the toilets.	37
4.8 Cost effectiveness in relation to alternative sanitation systems.	37
4.9 Multiplier effects of the project.	37
4.10 Actual and potential risks.	38
4.11 Gender perspective	39
<b>5. CONCLUSIONS</b>	<b>40</b>
<b>6. RECOMMENDATIONS</b>	<b>41</b>
6.1 Recommendations regarding new toilet construction :	42
6.2 Specific recommendations on Urine Reuse	43
6.2.1 Composting	43
6.2.2 Direct use	44
6.2.3 Pig and Human Urine as a combined fertiliser	44
<b>7. REFERENCES</b>	<b>45</b>

<b>8. APPENDICES</b>	<b>46</b>
8.1 Appendix 1 List of Vinasanres Toilets	46
8.2 Appendix 2 Terms of Reference for an Appraisal of the SIDA-funded Vinasanres project in Vietnam	48
8.3 Appendix 3 Toilet Observation / Inspection Sheet	50
8.4 Appendix 4 User Visit Questionnaire: Acceptability, Gender and Reuse questions:	52
8.5 Appendix 5 Results of School Questionnaire	54
8.6 Appendix 6 Results of Women's Union Exercise	55
8.7 Appendix 7 Current Estimated Costs of Vinasanres TDVV	56
8.8 Appendix 8 Project proposal "Solar Latrine for Coastal Central Area in Central Vietnam". Ministry of Health, Hanoi, 19 April 1996. Also reply from Winblad Konsult AB, 27 April 1996	57
8.9 Appendix 9 Diagrams of Vinasanres Toilets from ref. 1.	58

**APPRAISAL OF THE VINSANRES ECO-SAN TOILET DEMONSTRATION  
PROJECT  
1997 -2000**

6 October 2000, Nha Trang  
Dr Pham Si Nghien and Paul Calvert

## **1. BACKGROUND**

The purpose of the Vinasanres project was to develop new and/or improved sanitation systems for Vietnam and to promote South-South cooperation in the field of non-conventional sanitation.

SIDA has since October 1996 paid a total of SEK 146,000 (approx. US\$ 18,000) to Vinasanres. SIDA has also paid for a training course in microbiological testing at the Pasteur Institute in Nha Trang. In addition SIDA has paid fees and travel expenses for resource persons from the Sanres Programme to visit Vietnam and for Vinasanres staff to participate in international conferences plus money for translating and printing a Vietnamese edition of the book Ecological Sanitation

The actual field testing of toilets was done in the Cam Duc Commune, Can Ranh District, Khanh Hoa Province, about 30 km south of Nha Trang. In this area neither pit toilets nor pour-flush toilets are suitable due to the risk of groundwater pollution. The commune has 9,440 inhabitants in 1,831 households. Most of the households are engaged in farming. Each household has a house on a 300-600 sq.m plot. About half (52%) of the households have their own well, usually 5-15m deep, or a rainwater collection system. The other half collects water from neighbours. There is no piped water supply in the commune<sup>3,5</sup>. Many households depend on these shallow wells for drinking water supply and most are contaminated by faeces<sup>1</sup>. About one third of households (30%) have a "hygienic" toilet (hygienic = pour-flush, septic tank or double vault in good condition), two thirds (65%) have a simple, shallow pit toilet and the rest (5%) have no toilet.<sup>3,5</sup>

One of the original aims of the project was to increase the status of dry sanitation systems like the traditional double-vault toilet by developing types that could be attached to the house or even placed inside the house.

The project has been carried out by the Pasteur Institute in Nha Trang (Dr Bui Trong Chien, Mr Duong Trong Phi). The first batch of toilets, 30 units of six types, were completed and have been in use since May 1997. Another 20 units were added in September 1997 and 12 units in 1998. A training course on bacteriological and parasitological testing methods was held at the Pasteur Institute in May 1998.

### **1.1 Appraisal team**

This appraisal was undertaken by Dr Pham Si Nghien and Mr Paul Calvert between 20 September and 3 October 2000. It was undertaken at the request of WKAB under the approval of the Ministry of Health, Hanoi.

## **1.2 Acknowledgements**

Grateful thanks are extended to Dr Bui Trong Chien, Director of the Pasteur Institute, Dr Tu The the Deputy Director, Dr Nguyen Viet Dung, the Head of Public Health who ensured our visit was a pleasant and fruitful one. Special thanks are due to Mr Duong Trong Phi, deputy Head of Public Health, Pasteur Institute, who guided us with boundless energy through the project history and around the toilet sites and also to our Cam Duc guide Mr Ha, leader of the Health Station in Cam Duc. Dr Nguyen Huy Nga, Ministry of Health in Hanoi, is also to be specially thanked for arranging a visa permit first in London and then in New Delhi; and Uno Winblad for encouragement and permitting great flexibility in the dates for the appraisal.

## **1.3 Nomenclature**

In the report we have use the following abbreviations for the various types of toilets. This seems easier than using numbers, especially as earlier reports have used different numbering systems. The abbreviations are as follows:

TDV	Traditional Double Vault
TDVV	Traditional Double Vault Ventilated
	All the following are ventilated and solar heated:
SB	Single Bucket
MB	Multi-Bucket
SH	Double Vault Solar Heated
DVMS	Double Vault Moveable Shelter

Other abbreviations in the text:

PI	Pasteur Institute
VND	Vietnamese Dong (US\$1 = 14,000VND)

## **1.4 Description of the Toilets**

The six types of toilets, with numbers built during this project, are:

- Traditional Double Vault (TDV) (2)
- Traditional Double Vault, ventilated (TDVV) (15)
- Single Bucket, ventilated and solar heated (SB) (9)
- Multi-Bucket, ventilated and solar heated (MB) (9)
- Double Vault ventilated, and Solar Heated (DVSH) (12)
- Double Vault ventilated, solar heated and with a Moveable Shelter (DVMS) (15)

All of the toilets are urine diverting types and all of them use ash to cover freshly deposited faecal matter. There are diagrams of the toilets in Appendix 9.

### **1.4.1 Traditional Double Vault**

This comprises two vaults for containment of faecal matter. There are two defecation holes, one into each vault, separated by shallow depression and drain that guides the urine out through the cubicle wall to be collected in a pot, bucket or can outside.

#### **1.4.2 Traditional Double Vault, ventilated**

As above but with ventilation of the vaults to encourage desiccation of the faecal matter.

#### **1.4.3 Single Bucket, ventilated and solar heated**

This design has a single defecation hole and vault. A bucket is placed in the vault under the defecation hole. When it is full it is removed through an access door in the side of the vault and the contents emptied into one of two solar heated storage bins constructed on the back of the toilet. After one storage bin is full the other is used. When both are full the first is emptied.

#### **1.4.4 Multi-Bucket, ventilated and solar heated**

The multi bucket design has a single large vault with a solar heater. A bucket is placed under the single defecation hole. When full the bucket is dragged under the solar collector and an empty bucket placed under the defecation hole. Originally designed for three bucket operation there is space for more. When all the buckets are full the oldest one is emptied.

#### **1.4.5 Double Vault ventilated, and solar heated**

This design has two defecation holes, with the urine depression between, and two vaults. Inside the appearance is the same as the ventilated and unventilated Traditional Double Vault toilets above. However the vaults extend out at the back of the toilet and are solar heated.

#### **1.4.6 Double Vault ventilated, solar heated and with a Moveable Shelter**

This design has two vaults, two defecation holes and two urine channels. There is a light wooden frame structure that can be bolted down over either vault. Solar heating is achieved by the dormant vault having no structure over it and therefore being exposed to the sun.

#### **1.5 Note on toilet numbering in this report.**

The toilet numbers are taken from the register of Vinasanres toilets compiled by Mr Phi at the Pasteur Institute (see Appendix 1). These numbers do not refer to the order in which the toilets were built. They are numbers which were assigned after all the 62 toilets were built. They were assigned geographically across the project area, thus one can say that toilets 16,17,18 probably lie close together as do 53, 54, 55 and so on.

## 2. PURPOSE AND SCOPE OF THE APPRAISAL

Quoting from the TOR (Appendix 2):

“The purpose of the Vinasanres project was **to develop new and/or improved sanitation systems for Vietnam** and to **promote South-South cooperation** in the field of non-conventional sanitation.” and:

“The main objectives of the appraisal are to assess the **progress** and **achievements** of the Vinasanres project in Khanh Hoa Province.

Particular attention shall be given to:

1. - acceptability by the local population,
2. - training, health education and follow-up programme,
3. - public health aspects,
4. - agricultural use of the output from the toilets,
5. - cost effectiveness in relation to alternative sanitation systems,
6. - multiplier effects of the project,
7. - actual and potential risks.

The appraisal shall include a **gender perspective**, i.e. consider impact and consequences for men and women and their respective roles, responsibilities and needs, access and control over the resources.

The appraisal report should **discuss possible improvements** to be made if the project is to be expanded.”

## 3. APPROACH

The appraisal team undertook their task in the following manner:

1. Reading of the available literature on the project
2. Meeting with members of staff of the Pasteur Institute associated with the project for clarifications on project details, to hear their account of the project and to see photographs, drawings and additional reports relating to the project
3. Meeting with the People’s Committee and Health Administration, Cam Duc Commune
4. Field Visits to users of Vinasanres and privately constructed toilets to collect data using the questionnaire and observation sheets (Appendix 3, 4).
5. School visit to learn effectiveness of hygiene education and knowledge of Vinasanres amongst children
6. Meeting and data collection with Women’s Union, to learn of their perspectives on Vinasanres, effectiveness of hygiene education and opinions and preferences of toilet designs
7. Meeting with the Parish Priest
8. Write draft report
9. Present to staff at the Pasteur Institute Nha Trang and Cam Duc commune leaders and receive their feedback



10. Finalise report and send to WKAB

The main findings of each of these activities are given below with additional information recorded in the appendices. The subsequent section discusses the findings in relation to the objectives given in the Terms of Reference.

NB. There is no microbiological/pH/temp component in this appraisal as this would be too time consuming for a short appraisal. However this work has already been done, see refs 1 & 2 which we have summarised and commented on in section 3.1.1.

### **3.1 PROJECT LITERATURE**

The most noteworthy reports are: - Testing Eco San Toilets in Central Vietnam<sup>1</sup>, - together with A Microbiological and Sociological Evaluation of Urine-Diverting Double Vault Latrines in Cam Duc, Vietnam<sup>2</sup>. (See 3.1.1 below). Also useful are the Rapid Assessment report<sup>3</sup> by Winblad and Stenstrom and the Follow-up Visit report<sup>4</sup> (Winblad) which provide benchmarks on progress with toilet design development together with A Report on the Rate of Progress of the Vinasanres Project<sup>5</sup> (Institute Pasteur). What is lacking is a complete project document which states the aims and objectives of the project, but these are agreed upon in correspondence between WKAB and the Ministry of Health (27 April 1996, Appendix 8). The project documentation is also perhaps somewhat lacking with regard to the hygiene education and follow up of toilet users as little is recorded on plan, methodology and scale of these activities. In fact the quality of use of a greater number of toilets may have been better if the project had planned more input here.

#### **3.1.1 Summary and Comment on References 1 & 2**

(Ref 1. Testing Eco San Toilets in Central Vietnam, Presentation in the 9th Stockholm Water Symposium, August 1999 Nguyen Huy Nga, Bui Trong Chien, Duong Trong Phi, Bui Chi Chung, TA Stenstrom, A Carlander, T Westrell and U Winblad.

Ref 2. A Microbiological and Sociological Evaluation of Urine-Diverting Double Vault Latrines in Cam Duc, Vietnam Dec 1999, A Carlander, T Westrell)

The six different models of Vinasanres toilet were tested in order to determine the storage time necessary for a die-off of micro-organisms within the faecal material in order to make the material safe for reuse as fertiliser in agriculture. In these tests two different indicators were used: the bacteriophage *Salmonella typhimurium* type 28B and eggs from the pig's roundworm *Ascaris suum*. The bacteriophage is believed to mimic well the die-off of viruses and the eggs of *Ascaris suum* to function as a model for the die-off of sturdy parasitic eggs. Although very resistant organisms both were reduced faster in these toilets than indicated by former information in literature. The researchers attribute this to the high pH, low moisture content and high surrounding temperatures. The study found that there was no significant difference in the technical performance of the different designs and so could not say that one was better than the other. How the families used the toilets therefore appears to be more significant (i.e. putting enough ash, not allowing the vault contents to become wet and storing them for an adequate length of time).

The researchers conclude that a six month storage time should render the faecal material safe for reuse and handling by humans and that a high pH is the most significant factor (in a desiccating toilet) in destroying the organisms. The Pasteur Institute further concludes that the solar collectors are not worth the additional construction complexity and therefore the Traditional Double Vault Ventilated toilet, well built and well ventilated, is the most appropriate of the designs for Vietnamese families. This design is certainly easier to keep fly-proof and will not require maintenance of the solar collector.

Perhaps one limitation of the study was that it only covered 12 toilets of six designs and their orientation and exposure to solar radiation differed and was not always optimal. Consequently the difference in performance regarding temperature and moisture was not really assessable. Whilst solar-assisted desiccating toilets should naturally be sited for maximum radiation some users complained the correctly sited ones were too hot during the middle of the day. A comparison with composting toilets in the same environment would have been an interesting addition to the project and study. However there is no doubt that this is very significant study and the findings are extremely valuable in indicating the most critical operating parameters of these toilets.

### **3.2 MEETINGS WITH PASTEUR INSTITUTE STAFF**

The Pasteur Institute staff associated closely with the project are Dr Chien the Director, Dr Dung Head of Public Health at the Institute, Mr Phi deputy head of Public Health, and non more so than Mr Phi.

**May 1997:** The project started with a community survey to investigate hygiene behaviour, sanitation and water supply at the Cam Duc Commune<sup>1</sup>.

**Household Selection:** The households were selected by the People's Committee. The selection gave priority to families in which there was a community volunteer, families who had lost kin during the war, particularly poor families and elderly persons living alone without help from children.

**Financial contribution from families:** The owners of the first 50 toilets had to pay 100,000VND each towards the project cost (about 10% of the toilet cost). In phase 3, because of the higher standard of finish, the owners were required to pay 200,000VND each (about 14% of the toilet cost).

**June 1997:** Thirty Vinasanres toilets were built to six designs and the owners trained in their use.

**July 1997:** All the 30 households were revisited and retrained in the use of the toilet and basic hygiene. 20 more families were selected for 20 more toilets of 5 ventilated designs with slight improvements to such things as roof material, urine drainage, hole closures. These were built in **Aug. 97** and training given to the users.

**September 97:** These 20 households were again given training in use and hygiene behaviour.

**October 1997:** a rapid assessment visit was made by Uno Winblad and Thor Axel Stenstrom.

**May 1998:** A workshop, Microbiology Indicators for Sanitary Systems, was held at the Pasteur Institute, Nha Trang. Four people from China participated, 3 from the Institute of Public Health and Engineering in Beijing, one from the Ministry of Health.

**May-Dec. 1998:** Tests on 12 toilets using Salmonella phages and pig Ascaris suum.

**June 1998:** Research on users maintenance of toilets and their acceptance of the toilets (50 households)

**Also in June 98:** A comparative trial of hygiene education was begun. Training was given to 30 families on hygiene practises to prevent parasite infection using UNICEF-sponsored flip charts designed by the Ministry of Health, Hanoi. These families and 30 others as controls were given de-worming treatment. Faecal samples were examined from all members of all families after one week. All the participants gave fresh stool samples for examination for reinfection in **September 98 and Jan 99**. The hygiene practises of the study group were examined again in Jan 99. The study was inconclusive. No statistical difference in parasite re-infection could be shown.

**Aug. 98:** Four types of toilet were redesigned TDVV, DVSH, SB and MB, (the Moveable Shelter design was discontinued).

**Sept. 98:** Twelve toilets to these designs were built (three of each). These toilet designs incorporated the imported Chinese urine diversion pan made of white porcelain. However three Chinese pans had been broken in shipping and Mr Phi designed an improved local squat pan that could be cast (and then polished) in situ. The cost of these 12 toilets was 15,500,000VND excluding the cost of the Chinese squatting pans (The Chinese squat pans cost around US\$10 each).

**Nov. 98:** All households having Vinasanres toilets (62) were surveyed on their use and maintenance behaviour and given advice as required.

This was repeated in **Jan 99 and May 99**. (results reported in ref. 1, which records deficiencies amongst around 25-40% of the households on the first visit but a high standard of use and maintenance at virtually all on the second and third. If the users failed to correct deficiencies in their operation of the toilet, or became worse, they were liable to be summoned to the People's Committee office for additional training and thereby loose at least half a day's work. This deterrent and the re-education given during the visits appears to have worked well. It would have been valuable to continue this process longer.

**Dec. 98:** Workshop on Sanitation in Nha Trang. Attended by health officers of the Preventative Medicine Centre of the Province and all District Health Officers of Khanh Hoa Province (40 participants). Ecological sanitation was given its global context by Uno Winblad and the Vinasanres project in Cam Duc provided a working example.

**Feb.-May 99:** A report was written on the project for the Stockholm Water Symposium in July 99 ("Testing Eco San Toilets in Central Vietnam", Nguyen Huy Nga, Bui Trong Chien, Duong Trong Phi, Bui Chi Chung, TA Stenstrom, A Carlander, T Westrell and U Winblad)<sup>2</sup>. Mr Phi pointed out that the designs of toilets in this paper are refinements of the ones actually operating at Cam Duc.

**Feb. 2000:** Mr Phi translated into Vietnamese and printed the book Ecological Sanitation<sup>3</sup>.

**Sept. 2000:** Appraisal of Vinasanres

### **3.3 MEETING WITH PEOPLE'S COMMITTEE OF CAM DUC COMMUNE.**

The committee gave us an overview of the situation in Cam Duc and their impressions of the project. The most notable points were that they felt the toilets were suitable for the local situation in that they saved water - important because of the annual water shortages. Prevented well water pollution, important in the high water table parts of the commune. They appreciated the fact that the treated faeces was a good source of fertiliser and stated that the urine was too. They felt that the cost of the toilets was about 1/3 of the cost of a septic tank system. However late in the discussion it transpired that they had recently built a septic tank WC at the office at cost of 2 million VND (This comprised a single pour flush squat pan, cubicle and a septic tank with three 2 cubic metre chambers). When we pointed out that a Vinasanres toilet now costs at least 1.1 million VND they said that they felt people could build them cheaper if they did the work themselves. (This is probably not the case if the toilet are to have good vents and hygienic squat pans and closers etc.) When asked why they had not built an eco-san toilet at the office as a demonstration they said that with so many people coming to the office it would be difficult to manage. They also proffered the opinion that they felt the wells in the commune would all be badly polluted in ten years if the trend towards septic tank toilets continued. Also participating in this meeting were the seniors from the commune Health Station.

Two of them have Vinasanres toilets. One of them, belonging to the Chairman, is not using it because it was built on a site where he plans to build a house but has not yet done so. The other belongs to the local Communist Party Secretary and People's Council Chairman. He spoke very positively about it saying that if used correctly there is no smell and that the treated material is good to use. He has used material from his toilet on mango trees. He also said he used the urine on vegetables at a dilution of 6:1. (his was the first toilet to be built and was the Vice Chairman of the Peoples Committee at the time the project started). When asked if other families were using the urine he believed about 30% were. The other members at the meeting quickly responded to that saying to their knowledge more like 70% were using the urine.

Interestingly when we visited this toilet (TDVV) the next week the urine had clearly not been collected for some time and the urine hose pipe connected to the spigot was broken and blocked. The active faecal chamber was infested with maggots and had not had anywhere near adequate ash additions. Immediately adjacent the Vinasanres toilet the owner keeps a rather basic traditional double vault toilet in use but in poor repair. We discussed this with him and suggested that he should be setting a good example as Party Secretary and Council Chair, to which he agreed.

The committee were aware of a number of private copies of the Vinasanres toilets; more than 10 they believed. (This later proved quite correct)

They had not any idea about how to help the community build more toilets, but hoped for some kind of assistance from the government or international agency. It was not possible they said for people to take loans for toilet construction. Loans were only available for productive enterprises. I suggested they should consider ecological toilets as productive enterprises and tie the building of them into agriculture and use of the faeces and urine thereby having them qualify for loans.

We also invited the leader of the Women's Union, Mrs Huan, to participate otherwise it would have been a totally male meeting. She is also the owner of a Vinasanres toilet (Multi-bucket type). She was happy with the toilet and said it was appropriate because they faced water shortages in the commune. She also said the treated material was good for cassava cultivation but that she didn't use the urine and let it go into the ground. She was not sure of the cost of the toilet but when pressed she guessed 900,000 VND. Mrs Huan said that her neighbours wanted a toilet like this but could not afford one.

Later in the appraisal we also met the Parish Priest. He was aware of the project, appreciated it, but was not close enough to it to know the details. In this predominantly Christian community the priest has considerable influence on the people. Whilst he has many other responsibilities the project might benefit from engendering more interest and support here. We discussed the possibility of the Church helping to raise funds to assist poor families install Vinasanres toilets to which he responded positively.

### **3.4 FIELD VISITS TO USERS OF VINASANRES AND PRIVATELY CONSTRUCTED TOILETS TO COLLECT DATA USING THE QUESTIONNAIRE AND OBSERVATION SHEETS.**

We observed the condition, use and maintenance of 40 ecological toilets. Thirty of these were Vinasanres toilets and 10 were private ones. All the private ones were of the Traditional Double Vault Ventilated type. We interviewed 34 toilet owners: 28 Vinasanres users, 5 private copies and one septic tank water closet owner. The observation and question sheets are given in appendices 3, 4.

We had originally intended to visit all the 62 Vinasanres toilets, but when we came across privately built copies of these we considered it most relevant to investigate those as significant indicators of acceptance and uptake. As our study of the Vinasanres toilets progressed we found ourselves uncovering very little we had not already observed or elicited by enquiry from the users. We therefore devoted time to prepare for and conduct the school and Women's Union tests and exercises to observe the Vinasanres project from their perspective.

NOTE It is important to note whilst reading the following that the phase 3 toilets do not suffer from the defects mentioned regarding urine flow, closing of vaults and defecating holes.

#### **3.4.1 Solar Heating**

Sixteen out of the thirty (53%) Vinasanres toilets observed receive at least or more than half a day of full solar radiation. The other 14 are rather shaded, at best receiving only a third of a days solar radiation. Poor solar radiation was due to poor orientation and to tree cover. The 10 private toilets are all TDVVs and are built in generally shaded sites, which, for comfort is a natural selection.

### 3.4.2 Fly Screens and Vent Pipes and Airflow

Twenty-two (76%) fly screens out of 29 (one toilet was a TDV having no vent) were in position and. Seventeen in good condition and five in fair condition showing obvious signs of rusting. Seven fly screens were missing or holed.

All the vent pipes of phase 1&2 had been extended by 50 cm above the roof. (In phase 3 this was standard) One owner gave the unsolicited remark that this had made the toilet better (no odour). Two or three of these extensions were missing. (A recently cut coconut tree accounted for one of these).

Two vent pipes had lost their wire tie support at the roof level.

The phase 1 toilets have bigger, 100 mm, diameter vent pipes than the subsequent toilets which have 90 mm diameter pipes. The larger diameter pipe could no longer be found by the contractors in phase 2 and 3. The larger diameter pipes are black high density polyethylene and the others are PVC. We were not able to see if any of these factors made a difference to the airflow through the toilet chambers.

The following table records the toilets where there was positive draught (i.e. into the faeces hole) however in most cases the draught was very slight indeed (just barely pulling a trace of the incense stick smoke)

Table showing toilets where a draft was observed

Toilet No.	draught	Type of toilet	phase	vault closures	fly screen	wind	solar heater exposure
51	just pos	DVMS	1	good	y	negligible	N shaded
49	a hint	DVMS	2	good	y	“ “	EW shade
31	a hint	DVMS	1	good	y		very shaded
33	pos on one hole neg on other	DVSH	1	fair	y	“ “	S exposed
36	pos	DVSH	1	good	y	“ “	S exposed
41	pos	DVSH	1	good	y	“ “	W shaded
8	pos (wind driven)	DVSH	1	open	y	NE breeze against door	
4	pos (wind driven)	DVSH	1	good	y	wind on door	shaded
60	pos (wind driven)	DVSH	3	good	y	wind on door	SSE exposed
40	pos	MB	3	good	y	negligible	S exposed
47	pos	SB	2	fair	y	“ “	S exposed
27	slight	TDVV	1	good	n	“ “	shaded
19	fair	TDVV	2	partly	y	slight breeze	NS shade
28	v slight	TDVV	3	partly	n		shaded

We observed: 7 DVMS, 8 DVSH, 4 MB, 4 SB, 6 TDVV and 1 TDV



There did not appear to be any logic regarding whether a vent worked or not. Some seemingly good toilets with no apparent undesirable air-in leaks and with solar collectors in the sun did not draw a draught. Some toilets like #28 and #19 in the table above pulled a slight draft in spite of having poorly closed vaults although once there is a breeze one cannot say whether the vent is pulling the draft or the wind pressure differentials around the structure (ventilation above or below the door at the front and partly closed vault doors at the rear) would have a similar effect anyway. However if the vents are going to work at all it is important that all unnecessary air leaks (and fly leaks) are avoided and that users are very aware of this. All but the latest (phase 3) solar collectors invariably suffered from lack of good closure.

### 3.4.3 Correct Use of Toilet

Three toilets had a noticeable faecal odour, they also had wet vault contents (10%). One of these had a lot of fly larvae in it (3%). This can be compared with the Pasteur Institute observations in May 1999 when 3.2% had a faecal odour and 3.2% (presumably the same toilets) had maggots. In another toilet the active vault was being used correctly but the dormant vault had wet contents. Four toilets were non odorous but rather moist, having been under ashed (13%). Thus we can say only three out of the 30 (10%) were currently being poorly used and 13% being less than ideally used but probably safe if the storage time was at least the specified 6 months.

### 3.4.4 Closing of the toilet defecating holes

Defecation Hole Closer Error	Number of toilets with this problem	
Not in place	3	10%
In place but gaps for flies	8	27%
Gap between floor slabs	1	3%

The reason for gaps when the closers are in place is generally caused by slightly poor seating of a cement closer and the hole due to chipping and general wear and tear. This problem is largely overcome with the later versions of the toilet.

### 3.4.5 Urine Ways

In the thirty toilets visited 10 urine ways were not really smooth or sloping enough to channel the urine away easily. Seven of these gave some odour and a few of them were also unsightly because of staining. The newer toilets do not suffer from this problem.

Thirteen or 43% of the toilets visited had water buckets and mugs for rinsing the urine way.

### 3.4.6 Paper Collection

In 33% of the toilets used paper was put into the pit (in two of which mango leaves were used more often than paper) in 67% to a container. The containers varied from metal cans in which burning was done also (not aesthetically pleasing but it does sterilise the can), plastic

waste paper baskets, plastic buckets and in one case a swing top bin. One waste paper basket had a lid (not effective as flies can get through the sides of the basket. Our impression is that only the swing bin approached a more hygienic solution to paper collection. On one occasion we saw some used toilet paper lying unburnt (#11) (This was also where the vent pipe elbow to the vaults had been chiselled out, presumably to access and repair a loose urine pipe. The elbow had not been re-cemented into the wall so there was access for flies, the dormant vault was wet, staining the vault walls. The active vault was dryer. Although a phase 3 toilet this one was sadly not very well used or maintained.)

### **3.4.7 Construction**

The following is a list of problems observed in the design / construction of the toilets. All those in the first group have been solved in the third phase of toilets. The second group of problems could still benefit from some further attention to detail:

1. No footings for the toilet structure (phase 1 only)
  2. Shallow urine pans and poor slope of urine channel
  3. Poor Rainwater run off from gutter between solar collector and toilet wall.
  4. Poor closure of solar collector
  5. Warping of the wooden frame of the solar collector
  6. Damage to cement plastering on vaults on Moveable Shelter design (probably due to leaching of chemicals from the bamboo screen structure which is phenol formaldehyde coated.)
- 
1. Too few steps (which are therefore too high for children and old people)
  2. Imperfect closure of the defecation hole
  3. Cubicle ventilation at roof level
  4. Potential decaying of door material (mostly due to poor protection from the sun and rain)
  5. Short roof eaves (overhang)

However it is important to note the following:

### **3.4.8 High Quality of Vinasanres Phase 3 Toilets**

The best toilets in Phase 3 were excellent. White-washed inside and out, tiled floors and porcelain Chinese squatting pans or Mr Phi's terrazzo pans. Much better fitting solar collectors on angle iron frames. It was also clear what a big difference the individual family attitude to cleanliness makes (c.f. #11 in the note on paper collection 3.4.6 above). The best toilets, besides being spotlessly clean, had small details that personalised them, e.g. swing bin for paper collection: a tidily fitted electric light; an air-freshener; a nail with the water mug hanging neatly on it; clean matching buckets for ash and water; modesty curtains over the lower ventilation grilles; a neatly folded cloth to clean your feet before entering; a very neatly hand-written sign advising users of the important things to do when using the toilet. These toilets, and their owners, demonstrate what eco-san can and should look like. They also indicate how important the user is to their success. Any technology badly used and maintained will be unattractive and uninspiring. This shows how important it is to invest in high quality and sustained hygiene education and awareness work to achieve lasting behaviour change.

### **3.4.9 Doors**

The woven bamboo screen doors have stood up well over the three years of use in the cases where they have been protected from sun and rain. However quite a few have been exposed by very short eaves on the roof and have decayed at the bottom (Nine out of 27 similar doors). Two families had made themselves rather attractive doors from the outset with more durable materials (One from un-painted seasoned wooden planks with similar strapping the other a wooden frame with hardboard facing painted well to weatherproof it).

### **3.4.10 Storage of Faeces and closure of vaults**

On 50% of the toilets there was imperfect closure of the vaults or solar collectors. Some people do not appear to realise that it is important to properly close an emptied vault. The reason it is important is because the two vaults are connected (so that the vent pipe will work for both). The best closures were on the latest types of solar collector which have a metal frame that locates into a cement mortar rebate on the vaults. The TDVV also had sound closure of the vaults in that they were cemented in place with a weak cement mix. Unfortunately there is no guarantee that the owner will cement them back in place after removal of the treated matter (but neither is there any surety that owners of solar heated varieties will repair solar collectors or the cement mortar rebates if they become damaged).

The Multi bucket design can fill up rather quickly especially where there are more users. Moving the buckets and lifting out the oldest one for emptying can be difficult especially for older people (one old man mentioned this). Older people may also find this a problem with the single bucket design.

### **3.4.11 Comment on Private Toilets**

The presence of over 10 private toilets, and there may be almost twice this number, is a very encouraging sign. It is the most positive signal that the local community accept it as a step forward from the unventilated traditional double vault and from the very basic dug pit latrine. Of the ten we saw, 2 were being used well and had been well built. One can be described as badly built and used. The others were generally quite well built but had small defects such as vent pipes only half the height of the walls or of too little diameter either of which could easily be rectified. Interestingly the latest ones seemed to have the largest diameter vent pipes, some had two, one on each vault. It was clear that some of the users did not understand the correct usage of the toilet and would benefit from training. One was removing the ash and faecal matter early and keeping it in a lightly covered clamp. Another was keeping the vaults open and using buckets which he emptied regularly into a similar clamp. Too little use of ash was also a problem in some. One of the best was almost as good as any of the best Vinasanres toilets. The owner said it had cost 2.5m VND 2 years ago (which seems high). It had good steps, tiled interior, matching buckets for ash and water. It had two vent pipes, properly closed vaults and the urine was piped to a healthy banana plant now higher than the toilet. The only point that let down this toilet was that the last user had left the cover off the defecating hole and had not put ash; otherwise the pile was dry, conical and well ashed, so this observation was rather out of keeping with everything else about the toilet. It also pulled a slight draft in spite of being a TDVV and well shaded. It was very clean. The squat pan was a good copy of Mr Phi's phase 3 cast and polished in-situ pan.

### 3.4.12 Reuse: Urine

There is evidence of both reuse and non use.

Some families are actively collecting, diluting and using the urine on plants each day. At a good many other households the urine simply spills onto the ground and soaks away. It generally appears to follow that organised, tidy and enterprising households have taken to using the urine productively or have at least piped it sub-soil. In the cases where the urine is not being used there has obviously been the intention to collect and reuse earlier but the containers (in particular plastic ones of a variety of types - buckets, cut down plastic cans etc.) have been badly UV-degraded and broken and appear neglected. One family (Toilet number 33) reports having had to buy three plastic urine buckets in two years (at a unit cost of 18,000 Vietnamese Dong; equivalent to US\$1.30 each). Other families have used earthenware or cement-based pots (although these are of course heavier).

Where do they use it?

Where Urine Used	No. of users doing this
Mango trees	5
Mix with manure / compost	4
Vegetables	2
Flowers	2
Flowers and Mango trees	1
Coconut Flowers and Vegetables	1
Cashew	1
Coconut	1

In some cases the urine spigot (a short projecting PVC pipe) has had a flexible hose connected to it to guide the urine safely into the collecting vessel. In others a longer spigot is directed much closer to the ground to overcome the problem of missing the collecting vessel and or splashing.

On one of the best privately constructed double vault ventilated toilets the owners had piped the urine into the soil (sand) to directly feed a banana plant.

Two families of labourers share a Multi-bucket toilet (toilet number 34) which is also used by some of their neighbours. The homestead, although simple and of mostly traditional construction (wood, mud, thatch, tiles and galvanised iron sheets) presented an air of industry and organisation: Drying of firewood, composting of animal manure and stall sweepings, old thatch, kitchen waste, leaves, and so on, and tidy stacking of coconut leaves, their stems, firewood, etc. This family had made a clamp beside their Vinasanres multi-bucket toilet. This was filled with leaf stems, coconut tree trimmings and other woody and leafy matter (biomass). The urine outflow directly emptied into this clamp. They appear to understand well the principles of composting, this clamp has all the right ingredients, air spaces, carbon and nitrogen, moisture. Mr Phi reports that in earlier years they used to collect the urine in a pot and empty it onto their other compost pile. As they have no agricultural land or garden one presumes they sell this as they do the treated faecal matter. (see below)

### 3.4.13 Reuse: Treated Faeces

The Multi-bucket toilet (#34) mentioned above and used by 14 people reaps a small benefit. The family exchanges the treated faeces for 70kg (two bags) of dried cassava each year. The value of this is 70,000 Vietnamese Dong (US\$5). Another user reported an annual value of 50,000 VND for the treated material

The number of Vinasanres users who reported using the treated faeces for gardening / fields was 19 (of which 2 gave it away and 1 swapped it for dried cassava). However 9 had so far never had to remove any material from the vaults. One can say that there is little doubt that they will use it or sell it when it is ready for removal.

#### REUSE OF ASH AND FAECES

	Number of owners Interviewed	Used the Treated Faeces	Have not yet emptied
Vinasanres	28	19	9
Private	5	3	2
Total	33	22	11

#### URINE REUSE

	Number of owners Interviewed	Use Urine	Do not use Urine
Vinasanres	28	17	11
Private	5	1	4
Total	33	18	15

The number of respondents stating that they reuse the urine tallies fairly well with the observation of the toilets which showed 15 of the toilets having some kind of pot or bucket for collection although some did not appear to be in active use. At least two toilet owners had piped their urine sub-soil to dispose of it. One, the contractor who built the phase 3 toilets (which included one for himself) had an evaporative plant bed similar to the Kerala ones except that this one was not sealed at the bottom. It was being used successfully to grow a sturdy medicinal plant. Most of those who did not use urine allow it to infiltrate the soil where it falls.

### 3.4.14 Benefits

Thirteen (46.5%) respondents reported financial savings or benefits from use the treated faecal matter. This is a very encouraging sign. Their information is given in the table below:

Financial Benefits from Using Vinasanres Toilets

Toilet Number	Better Crop	More Crop	More income (annual)	Annual saving on commercial fertiliser
24			100kVND/yr. from cassava, mango and sugarcane	
60			50kVND from sale of faecal material	
19	y			
62				50kVND
54	y			
55				saving (no value given)
50		y		
41				15kVND
34			exchanged for 70kVND worth of cassava	
51				6-70kVND
private				50kVND
private	y			
private		y		

(Note: for the most part the treated faces has been used for growing cassava)

Interestingly whilst urine reuse was practised by 17 out of 28 respondents (61%) not one of the respondents commented on any financial benefits from this. This is in spite of many favourable responses to questions about the value of urine as a fertiliser:

There are three points here

1. Some are adding the urine to biomass or manure that will go to the fields, they do not appear to be considering the added benefit of this although clearly it is one.
2. Some are using the urine around the homestead where they probably would not use any fertiliser so they do not ready equate this with a saving.
3. People are perhaps not accustomed to liquid fertiliser. Manure and treated faeces “look” like fertiliser whilst urine is “just a liquid”.

Other comments on urine:

Some think that that it will not penetrate to the roots of big trees and therefor is of little value on their mango trees.

Some think it will kill (burn) plants

Others mention it smells (which is obviously the case if left too long in the container)

### 3.4.15 Operating Costs

Only seven (25%) respondents out of 28 reported any specific costs associated with the Vinasanres toilets. However they all (except one who said the costs were “small”) said that the costs were acceptable. Unless otherwise stated the reported costs in the following table are over two years.

Costs Associated with Vinasanres Toilets Reported by Users (7 respondents out of 28)

Interview number	1	3	4	6	13	19	26	10
Toilet Number	7	48	52	33	40	53	24	36
Type	MB	DVSH	MB	DVSH	MB	TDVV	DVMS	DVSH
Phase	3	3	1	1	3	2	1	1
Any costs associated with this toilet	y	y	y	y	y	small	y	said no, but apparently paid someone to help empty and remove first vault contents
plastic urine bucket cost 20,000	1in 2yr	1in 2yr		3 in 3 yr	1 in 2yr		1 in 3 yr	
repaint solar collector with tar	y							
additive sawdust=sd			sd 30k/yr	20k/yr			ash, 30k/yr	
Faeces bucket (60,000)			two					
Burdens financial	acceptable	acc	acc	acc	acc	no data	acc	acc
Cost per year	10,000	10,000	90,000	40,000	10,000	?	37,000	?

Comments on table of costs:

Most of these costs are unusual in that most people say they have enough ash. The decay of plastic buckets can be avoided by using earthenware pots as many families have done, or by piping the urine to where it is required.

Buying Ash (or sawdust):

Only three families of 34 (includes the private users) interviewed are buying additional ash or sawdust, all others have sufficient.

Buying Faeces Buckets

This was the only report of buying such buckets (50l size). None of the other 3 users of the Multi Bucket type interviewed report having bought faeces buckets. Note that this one is from the first batch of toilets.

### 3.4.16 What did the users think of the toilets?

Respondents were asked to score their toilet against the categories in the table below. A score of 1 = very unsatisfactory and a score of 6 = fully satisfactory. (only sixteen responded to the question on cost but otherwise everyone gave scores to the other categories)

Appearance	5.0
Comfort	5.1
Cost	5.2
Safety	5.2
Privacy	5.4

The users did not find the additional work required by the Vinasanres toilets burdensome. 50% said it was no problem and 50% said it was worthwhile.

Asked what additional jobs there were with this type of toilet the answers included cleaning the toilet room, refilling the water bucket, providing clean paper, burning dirty paper, refilling the ash container, emptying the treated faeces, diluting and using the urine, moving the faeces to the solar collector (by rake or bucket depending on the type). (Generally the men were responsible for moving buckets of treated material. The other jobs were shared or the responsibility of the woman) The respondents were asked "Do you find these extra jobs unacceptable / just OK / no problem / worthwhile?" No one found the extra jobs either unacceptable or just OK. Fourteen found them worthwhile (8 women, 6 men) and fourteen no problem (10 women, 4 men). This can also be stated as 44% of women and 60% of men found the extra work worthwhile.



### 3.4.17 Preference for another type of toilet

Ten Vinasanres owners would prefer a different type of toilet. Six of them would prefer a septic tank water flush toilet. Four Moveable Shelter owners would prefer another toilet, three of them would opt for a Ventilated Double Vault and one for a water flush toilet (septic tank). All the other 18 Vinasanres owners interviewed would stay with the type they have. These results indicate that 22 out of 28 would stay with desiccating toilets (79%).

User's preferences for another type of toilet

No.	Currently Own	Would prefer	Probable reason
49	DVMS	TDVV	Doesn't like the shelter, decays, nuisance to move
54	DVMS	TDVV	Doesn't like the shelter, decays, nuisance to move. Not very well kept.
24	DVMS	TDVV	“
51	DVMS	Septic Tank	Not so well kept or cleaned
36	DVSH	Septic Tank	V.busy woman, paid neighbour to help empty and remove full vault
8	DVSH	Septic Tank	Built 110 paces from home, not often used
4	DVSH	Septic Tank	Elderly woman, toilet hardly used, finds steps difficult
19	TDVV	MB	Not so well kept or cleaned, possibly thinks MB easier to manage treated matter.
27	TDVV	Septic Tank	At a clinic, little used
52	MB	Septic Tank	Broke a bucket because too heavy for him

Comment: The desire for a septic tank, for some people, perhaps equates with wanting a toilet inside the house. Several of the owners wanting to change to septic tanks would probably actually be happy with an eco-san toilet if they understood it could be easier for them to use; closer to home, attached to home (they simply were not ready for that three years ago). Exposure to the best toilets in Phase 3 might interest them in toilets attached to the home. The above table shows that 6 owners would move away from eco-san given a choice (21%). However the authors believe that with further education and exposure to the best examples this would reduce significantly.

### 3.4.18 Demand

A lot of the respondents reported that many people, some people or neighbours wanted a Vinasanres toilet (4,15 and 4 in each category). The owner of #62 (one of only two control TDV toilets built) was more specific, she said she knew 7 people who wanted one. We understand that she meant the TDVV, four of which have been privately built with varying degrees of competence very close by. If we take “many” to mean 6 and “some” to mean 3 and neighbours to mean 2, and include the 7 that owner #62 mentioned then the demand currently stands at 84 just from the knowledge of 28 out of 64 users. The demand could thus be projected as 192.

### 3.4.19 Could people afford it?

When asked if people could afford a Vinasanres toilet:

19 said	no	68%
4 said	some can	14%
3 said	didn't know	11%
2 said	20% of people can	7%

Asked for their suggestions on how people might afford one six suggested the project could help, three said the project could subsidise by 50% and another said by 66%. Two people said if people had the money they would put septic tanks and a third person said that if Chinese pans were given then people would build the toilets themselves.

### 3.4.20 Cost of toilets

The current cost of the Vinasanres toilet is approximately 1.3 to 1.4 million VND (US\$93-100) There are a number of sources of information:

Table showing costs of Vinasanres toilets and copies

Information source	million VND	US\$
The contract cost of the 12 Vinasanres toilets built in 1998 with tiles and Chinese and cast squat pans	1.44*	103
The detailed recall of an owner of a private TDVV without tiles (Built in mid 1998)	1.1 see below	79
The recall of an owner of a private TDVV with tiles and cement cast polished squat pan (Built mid 1998, seems high)	2.5	178

\* This includes the cost of a Chinese squat pans at 140,000 VND (US\$10). The contract for building the 12 toilets was 15.5mVND.

Cost Recall by Owner of a Private TDVV

item	quantity	unit	rate	total	currency
granite blocks	130	pieces	3,000	390,000	Vietnamese Dong
bricks	750	pieces	200	150,000	"
cement	3	bags	45,000	135,000	"
steel				100,000	"
iron sheet	2	sheet	25,000	50,000	"
sand				50,000	"
vent pipe				30,000	"
door				150,000	"
other items				45,000	"

TOTAL				1,100,000	Viet. Dong
TOTAL	US\$ exchange rate of		14,000	79	US\$

The estimates for the Vinasanres toilets in 1997 were as follows:

Traditional Double Vault	970,000VND	69US\$
Traditional Double Vault Ventilated	1,000,000VND	71
Double Vault Solar Heated, Ventilated	1,063,000VND	76
Double Vault Moveable Shelter, Solar H., Ventilated	940,000VND	74
Single Bucket Solar Heated Ventilated	868,000VND	62
Multi Bucket Solar Heated Ventilated	1,038,000VND	67

Based on the experience of building and testing in the three phases Mr Phi has redesigned the toilet so that the lower structure is slightly lower and smaller. He calculates the current cost (Oct. 2000) at around 1.2 - 1.32m VND (US\$86 - \$94) for a well finished and tiled toilet with terrazzo pan and 1.03 - 1.12m VND (US\$73 - \$80) for an un-tiled version. (See Appendix 7).

For comparison the current prices of various commodities and wage rates are given below:

Description	VND	US\$
Rice/kg	3000	0.21
Petrol/litre	4,500	0.32
mason's helper/day	18,000	1.29
Harvest labour/day	20,000	1.43
Mason/day	30,000	2.14
Teacher/month	500,000	35.71
Vietnamese Bicycle	500,000	35.71
Chinese Bicycle	600,000	42.86
Japanese Bicycle	2,500,000	178.57
Colour TV (minimum)	4,500,000	321.43
Refrigerator	4,500,000	321.43
Motorcycle (Chinese)	10,000,000	714.29

### 3.4.21 Comments of users

1. Roof overhangs too small to protect door from rain and sun
2. Multi-bucket fills up too fast under heavy use. (This just applies to toilet #34 with 17 users who need to empty a bucket every 30 days into a composting clamp). However it should be noted that the toilets were designed for regular use by about six persons.
3. Treated faeces good for cassava (and some also said sugarcane)
4. Urine good for vegetables
5. (#41 DVSH) reported getting double the yield, 600kg vs. 300kg per 1000m<sup>2</sup> and buy 15,000VD less fertiliser. He has a DVSH phase 1 and has emptied it three times at 6 month intervals. He believes in using the urine for vegetables and treated faeces from cassava. but was able to state that there is more fertiliser value in urine than faeces per day.

6. SB Phase 2 (i.e. without a Chinese pan,) 38yr old man, reported that some people like the Chinese squatting pan and would build the toilet themselves if they got a pan.
7. DVMS, Phase 1, 49yr old woman reported that she did not like the moveable shelter. It was easily damaged by the rain (by which we understand she means it decays over a few years), though she did say it is not as hot inside as the other toilets. However, she would prefer a TDVV.
8. The 42 yr old female respondent owning a privately built TDVV reported an annual saving of 50,000VND on commercial fertiliser. Most interestingly she could give us a detailed breakdown of the costs of building her TDVV (see table) , such recall lending additional creditability to her account of savings on fertiliser expenditure. All six members in her family used the new toilet and she said they didn't want any other type although she knew of the DVSH. Previously the family had a wooden bucket toilet. The toilet was being used reasonably well; the faecal pile was conical, ash addition was good, however the defecation hole closers were not well fitting neither was there a suitable fly screen on the vent pipe (they has used the top of a tilly-lantern). The adequate use of ash was obviously preventing a fly nuisance. Incidentally they had built the vaults from granite blocks. This seems to be the preferred material for vaults of the privately built units, there is a feeling that bricks and cement plaster will not last longer than ten years (this may be due to them having seen some toilets where there has been too little ash addition and the contents have remained wet and odorous and seepage and staining are evident.) They reported using the treated matter after more than eight months storage. The observations showed one vault empty and one about 2/3 full after a use of about 2 years and one suspects the storage time might have been less than eight months unless it had just been taken which did not appear to be the case.
9. A male farmer, (#19 TDVV Ph2) volunteered the unsolicited information that the extra vent pipe height (extended 50cm above roof height) had made a positive difference. He said people liked the TDVV toilet and wanted one and estimated 20% could afford one and 80% could not. He diluted the collected urine about 6:1 and used it once a week on coconut trees, flowering shrubs and vegetables.

#### **3.4.22 Note on hygiene and hand washing**

At many households, in order to see what reaction and result I would get, I asked to wash my hands after inspecting the toilet. Interestingly I was never given a bar of soap and do not recall ever seeing one. Most often commonly powerful laundry and dish washing detergents were brought from another part of the house. Occasionally they were available by the water source. One gained the impression that hand washing with soap after defecation was not very common practise. The use of these strong detergents for hand washing does not seem to be a very desirable trend. It is strange that the women interviewed at the women's union later all said they used lifebouy soap for handwashing - it did not appear to be the case on observation.

### **3.5 SCHOOL VISIT TO LEARN EFFECTIVENESS OF HYGIENE EDUCATION AND KNOWLEDGE OF VINASANRES AMONGST CHILDREN**

In order to supplement the user questionnaires and to specifically learn from children the following questionnaire was administered to 48 children at the local secondary school. We were told that only classes 6 and 9 were present on Thursday mornings so the 48 were equally split between girls and boys of these classes (age groups 12 and 15).

#### **3.5.1 Approach**

The question sheet was given in two separate parts, the second only administered after the first had been completed and collected.

Questions

First part:

1. How do we get diarrhoea?
2. How do we get cholera?
3. How do we get worms (give two ways if you can)?
4. Tell three simple things you can do yourself to prevent these diseases

Second part:

1. Where do you defecate?
2. Name all the types of toilet that you know, both wet and dry types.
3. Which type do you like best?
4. Why do you like it?

After the question papers had been collected all the children's hands were inspected for cleanliness. Those with short clean nails were rewarded with three sweets and those with dirty nails with only one. The reason for doing so was made clear. The intention of this was to create a talking point amongst the children and one that would clearly spread through the school. ( The number of children in the school is 843 of which 395 are girls ( 46.73% girls). No one was able to give a clear reason for it.)

In fact we were favourably impressed with the children's cleanliness and felt no one deserved only one sweet. A few received just two for having one or two slightly dirty nails but all the rest had clean short nails.

The results were difficult to assess, all being in Vietnamese. However a multiple choice type questionnaire was not favoured as on this subject it was felt it would provide too many leading answers.

### 3.5.2 Children: Hygiene Awareness and Causes of Disease

The answers to how we get diarrhoea, cholera and worms although containing some truths almost universally excluded any reference to faecal contamination of water, food or hands. The answers to question 4, "Tell three simple things you can do yourself to prevent these diseases" yielded only *three* responses that mentioned hand washing with soap. 25 out of the total of 62 respondents mentioned hand washing at all. (Women 7 out of 13, one with soap). This appears to indicate that the commune hygiene education activities concentrate on the preventative measures, addressing such things as personal hygiene and boiling of drinking water. It does not appear to emphasise the faecal oral route of disease transmission.

With regard to their hygiene awareness and the causes of diseases their knowledge was generally quite fair. However only 8 out of 49 (16.3%) mentioned faeces in answer to "How do you get Diarrhoea?", and only 2 in answers to "How do you get cholera?" "How do you get worms?" In asking "Tell three simple things you can do yourself to prevent these diseases" we expected more answers to include hand washing with soap. In fact 19 (38.8%) mentioned it. However they almost all mentioned boiling of water, eating freshly cooked food, avoiding raw and unwashed fruit and vegetables. One feels that the hygiene education might emphasise the faecal - oral route more in future. There were some thoughts that we could have presented the questions differently, however a multiple choice type of questionnaire was felt to be too leading.

### 3.5.3 Children: Toilets known, used and preferred

Amongst the 49 children 12 (24.5%) had heard of the Vinasanres types. (Women 9 out of 13 or 69.2%). Regarding toilets at home 27 (55%) of the children had WC's, four (8.2%) had traditional vaults, 13 had pit toilets (26.5%) and 3 had Vinasanres toilets (6.1%) and one did not answer.

Regarding their preferences 5 (10.2%) children said they preferred Vinasanres, 31 (63.3%) septic tanks, 5 Sulab-type (10.2%) and 8 (16.3%) biogas. (There had been a programme on the TV about biogas the previous evening)

(Note in the excellent report (ref.2.) by Anneli Carlander and Therese Westrell , page 40, they mention a study by Dr Bui Chi Chung Head of Public Health at Institute Pasteur recording that 30-40% of children's hands at the two schools were contaminated with *Ascaris* when randomly sampled. There appears to have been a misunderstanding of information here - faecal samples of the children were tested before and after administration of de-worming drugs but apparently hand contamination was not investigated).

The full results of the school questionnaire are given in the Appendix 5.

### **3.6 MEETING AND DATA COLLECTION WITH WOMEN'S UNION, TO LEARN OF THEIR PERSPECTIVES ON VINASANRES, EFFECTIVENESS OF HYGIENE EDUCATION AND OPINIONS AND PREFERENCES OF TOILET DESIGNS**

To gain more of a gender perspective on health education uptake and toilet design preferences we spent morning with 13 women from the Women's Union. Three of the women had Vinasanres toilets. We administered the same questionnaire as we had at the school and in the same way.

However the additional questions below were also asked:

1. Do you think the Vinasanres toilets are easier for men to use than for women?  
(a) Easier for men. (b) Easier for women. (c) No difference

If answer (a) or (b) give the reason why.

Their answers were, universally, (c) "no difference".

2. In your opinion is there more work in managing and maintaining a Vinasanres toilet for women than for men ?  
(These jobs would include: cleaning the toilet room, refilling water bucket, providing clean paper, burning dirty paper, refilling the ash container, emptying the treated faeces, diluting and using the urine, moving the faeces to the solar collector)

- (a) More work for men. (b) More work for women.  
(c) Different jobs but similar amount of work. (d) The same, all jobs are equally shared.

The women's response to this question was shared between (c) and (d).

3. What type of soap do you use at home for:  
(i) washing your hands? (ii) washing clothes? (iii) taking a bath?

The women responded with:

- (i) Handwashing: bar of soap, lifebouy soap.
- (ii) Clothes washing: OMO powder
- (iii) Bathing: lifebouy and shampoo.

No. 3 may seem an odd question but was prompted by the fact that, during the survey, the appraisers were never offered a bar of soap when they asked to wash their hands at any of the households.

#### **3.6.1 Women: Ranking of Toilet Attributes**

Following this we asked the women to rank in order of their perceived importance the list of attributes below. To rank them the women worked in three groups (less daunting for them than working alone and provokes more discussion and a jollier atmosphere. It also gives fewer results to sort). The results of the groups were compared and after further discussion (it transpired that two of the groups had not clearly registered the meaning of the Low Cost attribute) whole groups ended up with the same top four attributes although in different orders



of importance. A table of common toilet types were then scored by each group against the top four attributes. Detailed results in Appendix 6

This is the final ranking of the attributes by the women:

rank	Attribute
1	Keeps family healthy
2	No smell
2	Does not pollute well water
4	Low cost of construction
5	Easy for children to use
6	Easy for old people to use
7	Uses less water
8	Collects urine for gardening or farming
9	Treats faeces for gardening or farming
10	Should have a place to wash hands
11	Should have an electric light
12	Less work to maintain
13	Should be far from house
13	Should be inside house

### 3.6.2 Women: scoring of toilet types against their ranked toilet attributes

Women's Scoring of Toilet Types against their selected top four attributes:

Ranked position of attribute:	1	2	=2	4	Total Score
Attribute:	Keeps Family Healthy	No Smell	Does not pollute well water	Low Cost of Construction	Lowest score is best
Traditional Double Vault	7	10	6	5	28
Septic Tank-type	6	3	11	13	33
Traditional Single Vault	10	10	10	3	33
Vinasanres Ventilated Double Vault with Solar Heat	5	5	5	9	24
Vinasanres Ventilated Double Vault (no solar heat)	5	7	5	9	26
Sulab-type pour flush <i>This type was not known by the women and so not scored</i>					

Compare this with the women's response to the preceding questionnaire about toilet preference when 5 out of 13 women said they preferred Vinasanres types and 8 preferred a septic tank WC. The difference between their spontaneous answer and the one worked out by considering all the factors such as cost, protection of wells etc. is interesting.

Unfortunately their duties at home for lunch-time prevented us discussing this further.

However we offer the suggestion that septic tank equates with a clean toilet in the home and that they have not yet quite realised that the eco-san toilet can offer this. Certainly when one looks at what they expect of a toilet then eco-san is the logical choice.

## **4. DISCUSSION OF THE FINDINGS AGAINST THE KEY POINTS IN THE TOR**

### ***4.1 Develop new and/or improved sanitation systems for Vietnam***

The project has certainly achieved its aim in this regard. Five new designs have been developed, tested and improved during the course of the project. They have been proven to produce safely sanitised faecal matter which can be used on the fields. The safe storage time has been declared as six months based on a detailed study of virus and helminth survival in the toilets (refs 1,2). The latest toilets, built in the third phase are attractive, clean and odour free and generally appear to be very well managed and maintained.

The TOR also mentioned the objective of increasing the status of dry sanitation in Vietnam by developing types that could be attached to a house or even placed inside the house. No toilets have yet been built like this. Are any of these toilets of a standard that one would want them inside the home? The answer is certainly yes to three of the thirty Vinasanres toilets visited and one of the private toilets. What makes the difference? The owners are very good housekeepers and the toilets are impeccably used, well kept, clean, bright and attractive.

What makes the others unattractive to have in the house? They are not all carefully used, the floor finishing makes them difficult to keep spotless and in many the urine channels are too shallow in form and slope. This results, inevitably, in some splashing, occasional stagnation and, which is unattractive, varying degrees of staining. However many of them are used adequately and provide a valuable service to the families that own them. To them they are clearly an improvement on the traditional vault, pit toilets and “cat holes” they used before.

It is clear that the Vinasanres team has learnt a great deal in the course of this project and that the standard of the toilets has increased dramatically from the earliest ones with long shallow urine channels to the latest ones with Chinese and cast squat pans and tiled floors.

### ***4.2 Promote South-South cooperation in the field of non-conventional sanitation***

Pasteur Institute staff on the Vinasanres project have participated in workshops in El Salvador in 1996. They also shared their experience and learning with other southern practitioners and students of ecological sanitation in the 1999 six week Ecological Sanitation Training Course in Sweden and at the Stockholm Water Symposium 1999. In 1998 a workshop, Microbiology Indicators for Sanitary Systems, was held at the Pasteur Institute, Nha Trang, in which four people from China participated. In September 1998 nine of the phase 3 toilets were built using porcelain squatting pans imported from China and developed under the SANRES programme there. All these are examples of South - South cooperation. In addition to this the SANRES co-ordinator, Uno Winblad has shared his experience and knowledge from the other SANRES research projects in China, Mexico and El Salvador and from other ecological sanitation projects too such as one of the author's work in Kerala.

### **4.3 Achievements of the Vinasanres project in Khanh Hoa Province.**

1. It has undertaken a community hygiene behaviour, sanitation and water supply survey in Cam Duc Commune.
2. It has built 62 ecological toilets of five new designs almost all of which are in regular daily use today and have been since construction. (i.e. In use for two to 3 years)
3. It has trained the owners in use of the toilets and given them hygiene education
4. It has spawned the building of more than 10, possibly 20, private copies of one of its designs. This is a clear indication of the success of the project and the acceptance of the technology by the local population.
5. It has held workshop on Microbiology Indicators for Sanitary Systems
6. It has tested the effectiveness of the toilets in pathogen destruction and found them all effective though with no specific type emerging as better than the others.
7. It has raised awareness of ecological sanitation in Vietnam through participation in workshops in Sweden and El Salvador and organised a Government sponsored Ministry of Health(?) workshop on Sanitation for Health Officers of the Provincial Medical Centres and District Health Officers of Khanh Hoa Province.
8. It has produced a Vietnamese edition of the book Ecological Sanitation (SIDA). 800 copies have been printed and distributed to public health officials around the country. A workshop based on the book is scheduled for 4-5 January 2001.

### **4.4 Acceptability by the local population.**

This proven by the private building of 10-20 copies of the TDVV Vinasanres design. It is also demonstrated by the fact that almost 80% of users would stay with eco-san given the choice. The authors believe if one takes into account the quality of the phase 3 toilets the figure would be higher. A group of 13 women of the Cam Duc Commune Women's Union worked through an exercise that prioritised toilet attributes and then scored different toilet types against these attributes. Their results placed ecological toilets above twin pit pour flush latrines, septic tank WC's and the traditional double vault (unventilated) types. The indications from the users is that almost 200 other households would like a Vinasanres toilet.

#### **4.5 Training, health education and follow-up programme.**

Whilst this component of the project has clearly made progress it is felt that a higher frequency and number of visits to the users could have resulted in a higher standard of use being attained and sustained earlier. The standard of use of many toilets is adequate, but when one sees the standard of the best one would wish to see more families attain the same. It is hard to change habits, so fairly intensive regular follow-up from the beginning is best to inculcate good habits.

It is worth noting here that of US\$ 10,950 spent on the first stage of the project only \$550 (5%) were spent on promoting community participation<sup>6</sup> (education) and that the Health Station at the commune, like everywhere else in Vietnam, have severely limited budgets and staffing. The health budget per person in Vietnam is only \$4 compared with \$6 in Laos, \$12 in Bangladesh and \$1200 in USA<sup>7</sup>. This points to the need to consider more funding for hygiene education for behaviour change in subsequent sanitation initiatives.

#### **4.6 Public health aspects.**

The microbiological evaluation established that all the toilet designs were capable of producing safe material for use in the fields with a six month storage time. Generally people are observing this standard.

There are no complaints of any sickness or disease from owners, on the contrary they all give positive responses to how they feel about their own health and that of their children since having these toilets.

It is important to continue to emphasise that the time to empty a vault is when the active vault is full and there is no place left to defecate unless the previously used vault is emptied. In this way there is no doubt about adequate storage time. If the vaults are designed slightly smaller (lower) as is the intention of the Pasteur Institute, to improve ease of entry, reduce cost and still provide adequate storage time, this will help to bring more regular supply of the treated matter (which the farmers want for their fields) but based on filling vaults and not on measuring time which can be eroded for convenience. It is also an easy indicator for health workers to check: If they find a vault empty without the active vault being full they know the users are taking material early.

With a high water table in many parts of Cam Duc the Vinasanres toilets, although too few in number to yet make any significant difference, must surely contribute to improved public health by keeping faecal matter out of the ground water and off the ground.

Toilet paper could be better managed to improve public health safety. Only once we saw an example of used paper not being burnt but its containment inside the toilet is usually in a basket with access for flies.

#### **4.7 Agricultural use of the output from the toilets.**

There is no doubt that the treated faecal matter is useful to and wanted by the farmers. They have developed their own awareness of its value and some pay for it in cash or kind. Most of the treated faeces has been used on cassava fields, the principal crop of the commune.

The use of urine is also quite widespread, though an awareness of its economic value appears not to have been attained. Some people add it to their manure or composting heaps, others dilute it and use it on mango trees, mix it with animal manure or urine or use it on flowers, vegetables, coconut and cashew or a mix of these. They generally say they are happy with the results (but do not monetorise them).

#### **4.8 Cost effectiveness in relation to alternative sanitation systems.**

The Vinasanres toilets appear to be competitive with the alternatives available in Cam Duc. The current cost of a basic Vinasanres toilet is around 1.03 million VND and a tiled one with Chinese squat pan, or similar, around 1.32 million VND (see Appendix 7). A septic tank WC would cost around 2 million VND and a Twin Pit Pour Flush toilet around the same as a Vinasanres toilet of similar quality. Obviously the simple pit toilets and very basic vault toilets are cheaper than this but they are not hygienic and increasingly the people of Cam Duc aspire to something better.

#### **4.9 Multiplier effects of the project.**

project has clearly triggered a demand in the Cam Duc community. 10-20 private toilets have already been built and are operating. There is probably demand for 200 more simply based on the knowledge of the respondents to our investigations.

There do not appear to be any toilets established elsewhere inside or outside Vietnam based on this work as yet.

Two 10-15 min videos shown on local TV in 1998 and 1999, and on National TV in March 2000. These included details of the Vinasanres project, interviews with local government officials, toilet users and with Mr Phi. They introduced the concept of ecosan and explained how the toilets work and are used. Although the videos reportedly made clear this work was being done at Institute Pasteur Nha Trang there have, disappointingly, been no enquiries arising from these broadcasts. Posters and leaflets about eco-san have been distributed across the province

#### **4.10 Actual and potential risks.**

The actual risk and potential risks all surround the possibility of:

1. reuse of the faecal matter too early (risk of contamination of fields, workers, crop)
2. inadequate use (principally, not putting enough ash and not closing either the vaults or the defecation holes properly, not emptying urine regularly) (risk of access / breeding of vectors)
3. incorrect construction (i.e. if toilets are copied badly so that defecation holes and vaults cannot be closed properly; vent pipes do not operate; urine pans do not drain adequately.)
4. Used toilet paper not being properly managed (access for flies, not being fully burnt)

However if adequate training and follow-up are given and the correct building and operation methods are established these risks should be small. They should become no greater than the propagation of water flush toilets with the fear that people will invariably install them wrong, forget to flush them or not close the lids of septic tanks or soak pits after emptying.

These basic rules must be followed:

- Keep used toilet paper in a closed container, burn regularly
- Plenty of ash to cover the faeces
- Close the hole
- Rinse the urine pan with a mug of water
- Wash your hands with soap
- Keep the vaults closed
- Check the vent fly screen is intact
- Only empty when both the vaults are full
- If you are not going to use the urine: pipe it into the ground near a fruit tree to avoid odour and mosquito breeding.

#### **4.11 Gender perspective**

The men and women are clearly happy with the toilet and with the fertiliser, the treated faecal matter, for the (mostly) cassava fields.

Thirteen women at the Cam Duc Commune Women's Union prioritised 14 toilet attributes and scored several toilet types against them. They gave the ecological toilets better scores than water flush toilets. They did not believe the Vinasanres toilets favoured men in any way and felt that the tasks in maintaining them were shared and the amount of work the same.

The user survey found that no one, men or women, found the extra jobs (compared to their earlier dug pits or simple vaults) associated with the Vinasanres toilets (e.g. putting ash, cleaning, emptying vaults etc.) either just OK or unacceptable. On the contrary they found them either worthwhile or no problem. There is a difference between the men and women on this score. 44% of women said they found the jobs worthwhile whilst 60% of men said they found them worthwhile. This difference may be accounted for in that the women usually take care of the cleaning and ensuring there is enough ash whilst the men do the vault emptying. The latter is far less frequent but has the rewarding feeling that it is a free fertiliser.

The question in the user survey, particularly aimed at women; "Is there any of the garden produce for your own personal use or income? Do you get to use the faeces/urine there? Was not really understood, people said that everything was shared. (In fact Mr Phi and Dr Nghien were opposed to the question feeling that it was not relevant since all family income was considered shared.)

## 5. CONCLUSIONS

The standard of the latest toilets built by the Pasteur Institute is very good. The project can be justifiably proud of the progress made from the first toilets to these fine examples. The project has learnt its lessons well and improved the toilets at each stage. The best of these toilets is certainly of a standard that could be attached to or built into a house. There is no smell, no flies and the toilets are clean and attractive. The microbiological research undertaken by the Pasteur Institute together with the Swedish Institute of Infectious Disease Control and the Swedish University of Agricultural Sciences has shown that the faecal matter is sanitised within six months. The reason that no toilets have been built in or attached to houses appears to be that the community is psychologically not yet ready to consider it. However, wider exposure of the latest toilets should begin to change this attitude.

The ventilated version of the traditional double vault (TDVV) appears to emerge as the favourite on a number of counts. The study of virus and helminth destruction does not indicate any design to be better than the others in this regard. If this is so then the TDVV, being easier to construct, easier to keep the vaults closed and having no solar collector to corrode and requiring least manipulation of the contents has many benefits. It appears to work well in the shade (which is where people naturally prefer to build a toilet if possible as it is more comfortable). For solar heated toilets to benefit from their solar collectors they must be built in the sun. It seems likely that if built in larger numbers there would often be neglect of this point (wrong orientation, allowing vegetation or buildings to shade it) negating the cost and effort of making and maintaining the solar collector. Most of the moisture reduction is achieved by the addition of adequate quantities of dry ash. Adding more or less ash probably has greater influence on the moisture of the vault contents than indifferent solar heating. It may be that thorough education on adequate ash addition and ensuring natural ventilation might be more effective than trying to achieve reliable solar heaters that do not decay and which remain fly and airtight over the life of the toilet. The addition of a bed of ash or other dry material prior to use (in Kerala we put straw) would help ensuring low moisture contents.

The potential of ecological sanitation protect public health and to save water by not flushing; to protect the environment and ground water by not contaminating them with pathogens; to improve soils and save on costs of commercial fertiliser is significant. The Government and people of Vietnam could reap widespread benefits to public health and agriculture through adopting an ecological approach to sanitation. An ecological approach to sanitation can also provide considerable savings in water supply and waste water treatment in urban and peri-urban areas. The Cam Duc demonstration should therefore be seen not simply as a small demonstration of rural sanitation appropriate for an agricultural commune but rather as the first step in a sanitation revolution which is already beginning in other countries around the world.

There is still some valid research and extension work that can be done in Cam Duc. Pilot demonstrations in other parts of Vietnam will be an important subsequent phase followed by wider dissemination and larger numbers. Policy makers, academic institutions, practitioners and the public must be made aware of the Cam Duc project and its results.



## 6. RECOMMENDATIONS

Since this is the pilot demonstration /research programme in ecological sanitation in Vietnam it is appropriate to provide for a further stage:

1. Hygiene education and regular user training to bring all users up to the standard of the best. (Cleanliness of the toilet, hygiene behaviour, closing of defecating holes and vaults and plentiful use of ash, reuse of urine, etc.) It would be useful to include the 10-20 private TDVV households in this education programme.
2. The earlier toilets should be improved to a better standard. (Particularly urine ways - it would be possible to do this by building in better urine ways and raising the foot pads slightly). These improvements should be offered as an incentive to the users of the earlier toilets to improve use and management of their toilets and undertaken only when such improved behaviour is demonstrated. It would be beneficial to rectify the defects on the 10-20 private toilets also based on the same criteria.
3. Establish a practical demonstration of the value of human urine as a fertiliser. There should be participation from the scientific community but above all the demonstration should be most convincing to the community.
4. Hold a community workshop in Cam Duc to expose the best toilets to the commune and nearby communities. Use the workshop to give hygiene education, raise awareness about the important principles of construction and operation of the eco-san toilets and of the fertiliser value and volume of urine compared with faeces. The workshop should highlight the savings and income that are a valuable feature of ecological sanitation whilst also providing comfort, hygiene and cleanliness. It may be possible before this to identify two or three families who, having seen the best phase 3 toilets are keen to have an ecological toilet attached to or inside their home. This workshop would also be a good time to start the comparative growing trials with urine (Recommendation 3) so that many people know about them and can observe them over the subsequent months.
5. Train masons in the community how to build the most preferred toilets ensuring they are thorough on all the important details. (They should participate in 1, 2 and 4 above).
6. Produce a simple construction and operation manual in Vietnamese for the TDVV.
7. Hold a national workshop in early 2001 to raise awareness of, endorsement of and participation in eco-san amongst policy and decision makers in Vietnam, including senior agronomists, economists and planners in addition to public health. It is important to invite key members of the Ministry of Agriculture and Rural Development as wider dissemination will come under their purview. Agriculture, nutrition and national policy research institutions should also be invited to participate both in the workshop and in demonstrations and dissemination.

The Ministry of Health and Ministry of Agriculture and Rural Development should, in addition, pursue the following:

8. Seek both Government and International support and assistance for early expansion of the demonstration project in and around Cam Duc. Ensure any funding also provides for good hygiene education and regular user training and follow up. Seek approval and endorsement of the Vinasanres toilets from the District Authorities.
9. Seek both Government and International support and assistance for wider dissemination starting with pilot demonstrations in new locations. Ensure any funding also provides for good hygiene education, regular user training and follow up and demonstration of reuse, especially of urine.

SIDA / SANRES might be approached for funding of recommendations 1 - 7 as these are a logical extension and conclusion of the research programme.

### **6.1 Recommendations regarding new toilet construction :**

1. Always use smooth fast draining urine pans (they could be improved by being deeper)
2. Ensure the hole closers are a good fit and durable (Some closers are plastic bowls with cement mortar cast inside. Care must be taken to see that the bowls are not distorted by the weight of the mortar when casting and that the defecation holes in the squatting pan are perfectly round otherwise there is a mismatch and gaps will remain for flies. If these pans are mass produced in porcelain with matched closures this occasional problem can be avoided.)
3. Ensure adequate roof overhang to protect the door material from weathering
4. Provide additional ventilation under roof eaves to allow heat to escape (this could be achieved by simply omitting the lintel over the door).
5. Reduce the height of the vault or increase the number of steps to ease access (and provide a handrail where users are elderly or handicapped). Try to ensure the steps are all equal in height.
6. Ensure vault access openings are fly (and draft) proof and durable. Ideally they need to be designed so that they cannot be left open although good training should also ensure this.
7. Use 100 mm diameter vent pipes or larger, (continue to use the same material for fly screens which appears durable)
8. Ensure good follow up so that good habits are instilled from the beginning.
9. Actively encourage hand washing with soap after defecation and get the owners to consider where this will be done right from deciding where to site the toilet.
10. Encourage urine reuse and try piping the urine closer to where it will be used. (Where there is no interest it should be piped into the ground to feed a banana plant or other useful plant, or in very high water table areas into an evaporative plant bed as in Kerala)

11. Encourage more hygienic containment of used toilet paper (see diagram of perforated paint tin and covered bucket)
12. Demonstrate the effectiveness of urine as a fertiliser
13. Try to build toilets attached to or inside houses, it will make access easier for the young and elderly and encourage fastidious cleaning.
14. Moveable Shelter Design. If more of this type are built increase roof eaves and put 20 mm spacers under the bottom of the wooden cubicle frame so that air can circulate. This will allow the wood to dry after rain or floor washing and prevent premature decay. This would also apply to any low-cost structures with wooden frames, moveable or fixed that might be considered in future.
15. Involve the community more both in hygiene education and user training introduce more participatory methods of planning, implementation. Involve the community in participatory monitoring and evaluation aiming to achieve high standards of use and maintenance through peer assistance and pressure.
16. In new locations select the more dynamic, tidy and organised families to demonstrate the first toilets to ensure a high standard of use and maintenance is set from the beginning. They are your teachers of the next generation of users.
17. The inside of the vaults of the Multi- and Single Bucket types do not require cement plastering.

## **6.2 Specific recommendations on Urine Reuse**

Five out of 12 respondents 41% in the Nga, Chien, Phi, Carlander Westrell Stenstrom Winblad Dec. 99 study stated they did not use urine on plants and in our study 11 out of 28 do not.(39%). We can say there is little significant appreciation of the value of urine.

It seems urine reuse and the understanding that it is by far the most valuable part of the excreta for fertilising the soil has not been internalised. It would be instructive to organise some four demonstration plots - identical in all respects of area, sun, shade, soil, plants etc. other than plot 1 is fed water only, plot 2 with water and 6 month stored desiccated human faecal matter from the toilets, plot 3 with water and urine, and plot 4 with water, urine and 6 month stored desiccated human faecal matter from the toilets. Liquid volume to be the same on all plots. Urine with the water in diluted form, preferable at least 1 part urine to 4 parts water.

### **6.2.1 Composting**

One alternative use of urine in this agricultural community could be to run it into an aerobic pile of biomass for aerobic composting and subsequent use as a fertiliser. One family (toilet #34) is doing this.

### **6.2.2 Direct use**

Some families could relatively easily pipe the urine directly from the toilet to their vegetable, flower or mango gardens. The addition of extra water down the urine channel would have the combined benefit of keeping the urine pan odour-free and diluting the urine application to the plants.

Both the above (6.2.1 and 6.2.2) ensure there are no mosquito breeding sites and remove the task of frequently emptying the urine pot.

### **6.2.3 Pig and Human Urine as a combined fertiliser**

Many families keep pigs and collect the pig urine and faeces. Some families divert the toilet urine to be collected with the pigs urine and this is transported to the fields as required. (We are not sure if mosquitoes breed in these collection tanks but they generally have a floating layer or crust of organic matter from the pig pen which prevents it.) There is obviously nitrogen loss from these tanks due to the storage time of probably several weeks or more. However, improved practises of using pig's urine and human urine could be investigated together as the increased volumes and enhanced benefits might make any improvements economically more attractive to the farmer. This is worth further research.

## 7. References

1. Testing Eco San Toilets in Central Vietnam, Presentation in the 9th Stockholm Water Symposium, August 1999 Nguyen Huy Nga, Bui Trong Chien, Duong Trong Phi, Bui Chi Chung, TA Stenstrom, A Carlander, T Westrell and U Winblad.
2. A Microbiological and Sociological Evaluation of Urine-Diverting Double Vault Latrines in Cam Duc, Vietnam Dec 1999, Anneli Carlander & Therese Westrell, Swedish University of Agricultural Sciences, International Office, Uppsala, Sweden, ISSN 1402-3237.
3. Rapid Assessment 23,24 October 1997, Uno Winblad, Thor Axel Stenstrom.
4. Follow-up visit 11-14 July 1998, Uno Winblad.
5. Report on the Rate of Progress of Vinasanres Project; Ministry of Health, Nhatrang Pasteur Institute, Department of Environmental Sanitation and Nutrition, 1997.
6. Statement of Expenditure in connection with Sanres Funded Costs 1996-1997, Ministry of Health, Department of Preventative Health, Dec. 1997.
7. Personal discussion with Dr Pham Si Nghien, Sept. 2000
8. Personal discussion with Mr Duong Trong Phi, Sept. 2000

## 8. Appendices

### 8.1 Appendix 1 List of Vinasanres Toilets

(A number after the X indicates the phase of construction and also indicates that we inspected that toilet)

Toilet No.	Village	TDV	TDVV	SB	MB	DVMS	DVSH	
1.	BGN					X		
2.	BGN						X	
3.	BGN						X	
4.	BGN						X1	
5.	BGN					X		
6.	BGN						X2	
7.	BGN				X3			
8.	BGN						X1	
9.	Yen Hoa				X			
10.	Yen Hoa			X				
11.	Yen Hoa		X3					
12.	Yen Hoa					X		
13.	Yen Hoa				X			
14.	Yen Hoa						X	
15.	Yen Hoa						X	
16.	Yen Hoa			X				
17.	Yen Hoa				X			
18.	Yen Hoa				X			
19.	Tan Hoa		X2					
20.	Tan Hoa		X					
21.	Tan Hoa					X		
22.	Tan Hoa		X					
23.	Tan Hoa		X					
24.	Tan Hoa					X1		
25.	Tan Hoa		X1					
26.	Tan Hoa			X				
27.	Tan Hoa		X1					
28.	Tan Hoa		X3					
29.	Tan Hoa		X					
30.	Tan Hoa		X					
31.	Nghia Dong					X1		
32.	Nghia Dong				X			
33.	Nghia Dong						X1	
34.	Nghia Dong				X2			
35.	Nghia Dong						X	
36.	Nghia Dong						X1	
37.	Nghia Nam						X	
38.	Nghia Nam	X						
39.	Nghia Nam			X3				
40.	Nghia Nam				X3			
41.	Nghia Nam						X1	
42.	Nghia Nam			X				
43.	Nghia Nam					X2		
44.	Nghia Nam					X		
45.	Nghia Nam		X					

46.	Nghia Nam		X					
47.	Nghia Bac			X2				
48.	Nghia Bac						X3	
49.	Nghia Bac					X2		
50.	Nghia Bac					X1		
51.	Nghia Bac					X1		
52.	Nghia Bac				X2			
53.	Nghia Trung		X1					
54.	Nghia Trung					X1		
55.	Nghia Trung			X1				
56.	Nghia Trung			X2				
57.	Nghia Trung			X				
58.	Nghia Trung		X					
59.	Nghia Trung						X	
60.	Nghia Trung						X3	
61.	Nghia Trung		X					
62.	Nghia Trung	X						
<b>Toilet No.</b>	<b>Village</b>	<b>TDV</b>	<b>TDVV</b>	<b>SB</b>	<b>MB</b>	<b>DVMS</b>	<b>DVSH</b>	
	TOTAL BUILT	2	15	9	9	12	15	
Observed:	Phase 1	1	3	1	0	5	5	=15
	Phase 2	n/b	1	2	2	2	1	=8
	Phase 3	n/b	2	1	2	n/b	2	=7
Total Observed		1	6	4	4	7	8	=30
In addition 10 Private TDVV were observed:								10 Private

## **8.2 Appendix 2 Terms of Reference for an Appraisal of the SIDA-funded Vinasanres project in Vietnam**

### **1. BACKGROUND**

SIDA has since October 1996 paid a total of SEK 146,000 (approx. USD18,000) to Vinasanres. SIDA has also paid for a training course in microbiological testing at the Pasteur Institute in Nha Trang. In addition SIDA has paid fees and travel expenses for resource persons from the Sanres Programme to visit Vietnam and for Vinasanres staff to participate in international conferences plus money for translating and printing a Vietnamese edition of the book Ecological Sanitation

The purpose of the Vinasanres project was to develop new and/or improved sanitation systems for Vietnam and to promote South-South cooperation in the field of non-conventional sanitation.

The actual field testing of toilets was done in the Cam Duc Commune, Can Ranh District, Khanh Hoa Province, about 30 km south of Nha Trang. In this area neither pit toilets or pour-flush toilets are suitable due to the risk of groundwater pollution (many households depend on shallow wells for drinking water supply). One of the original aims of the project was to increase the status of dry sanitation systems like the traditional double-vault toilet by developing types that could be attached to the house or even placed inside the house.

The project has been carried out by the Pasteur Institute in Nha Trang (Dr Bui Trong Chien, Mr Duong Trong Phi). The first batch of toilets, 30 units of six types, were completed and have been in use since May 1997. Another 20 units were added in September 1997 and 12 units in 1998. A training course on bacteriological and parasitological testing methods was held at the Pasteur Institute in May 1998.

### **2 PURPOSE AND SCOPE OF THE APPRAISAL**

The main objectives of the appraisal is to assess the **progress** and **achievements** of the Vinasanres project in Khanh Hoa Province.

Particular attention shall be given to:

1. - acceptability by the local population,
2. - training, health education and follow-up programme,
3. - public health aspects,
4. - agricultural use of the output from the toilets,
5. - cost effectiveness in relation to alternative sanitation systems,
6. - multiplier effects of the project,
7. - actual and potential risks.

The appraisal shall include a **gender perspective**, i.e. consider impact and consequences for men and women and their respective roles, responsibilities and needs, access and control over the resources.

The appraisal report should **discuss possible improvements** to be made if the project is to be expanded.

### **3. APPRAISAL TEAM AND TIME SCHEDULE**

The appraisal team will consist of:

- Mr Paul Calvert
- Dr Pham Si Nghien

The appraisal team will be based in Nha Trang. The total time required is 2 weeks during the month of September 2000.



#### 4. REPORTING

A debriefing session, presenting a first draft (written) appraisal report should be held at the Pasteur Institute in Nha Trang before departure from Vietnam.

The appraisal report shall be written in such a form that it can be presented as a paper at the First International Conference on Ecological Sanitation to be held next year.

A draft report shall be e-mailed to Sanres office:

<mom.winblad@comtech-data.se> with a copy to <uno.win@wkab.se> within two weeks of the completion of the work in Vietnam. Within three weeks of receiving comments on the draft from Mr Uno Winblad, a final version shall be e-mailed to the same addresses.

26 January 2000

Uno Winblad

### 8.3 Appendix 3 Toilet Observation / Inspection Sheet

OUTSIDE:

date:

time:

1.	Toilet No. & Type		Phase 1 2 3 Private
2.	Orientation	Access door/ solar collector NSEW?	
3.	Shaded	surrounding buildings and trees	
4.	Door	Open or closed? Condition of door and hinges and catch	
5.	Fly Screen	In place and in good condition?	
6.	Fly Trap	Any flies?	Vent Dia:                      Extra Height:
7.	Roof	What condition? Any cracks leaks or serious dampness? Eave Overhang	F                      R                      S
8.	Toilet walls	What condition? Any cracks leaks or serious dampness?	
9.	Vault Walls	What condition? Any cracks leaks or serious dampness?	
10.	Foundation	What condition? Any cracks leaks or serious dampness?	
11.	Vault Doors	Properly closed? Leaks for flies?	
12.	Urine observed to?	To ground? saturation / smell? Container? smell? mosquito larvae? plants?	
13.	Evidence of use		
14.	Steps	Number	Height to floor
15.	General	Surroundings	

INSIDE:

1.	Toilet No.		
2.	Faeces hole Cover	In Position, Handle, Access for flies?	
3.	Check airflow	Incense sticks and matches	Door Open Door Closed
4.	Faeces Hole	Clean? Dirty? Taper?	
5.	Pit	Smell? Conical dry pile? Wet and flat? Fly Larvae?	
6.	Urine way	Clean and clear smooth and slope enough splashing / smell	
7.	Paper collection	How? Clean and tidy? Covered? What done with it?	
8.	Floor	Clean and dry?	
9.	Water bucket and soap	Water Bucket? Mug? Soap?	
10.	Ash pot and scoop	Ashpot Scoop Ashes	
11.	Ventilation	Windows Eaves Door Min height of ceiling	
12.	Observe vent inside vault	Connects btwn vaults Conn <sup>n</sup> size OK?	
13.	Vault contents	Quantity  Appearance	
14.	Finger nails?	Length, colour	
15.	Show me :	where you wash your hands	

Additional comments:

**8.4 Appendix 4 User Visit Questionnaire: Acceptability, Gender and Reuse questions:**

1.	Respondent: M/ F/ C and age	
2.	Toilet Number :	Phase: 1 2 3 Private
3.	Toilet Type TDV TDVV SB MB	DVMS DVSH
4.	Why did you build this type of toilet	
5.	No. of family members? Do all use? Who doesn't use it?	
6.	Score 1-6 where 1=very unsatisfactory, 6=fully satisfactory Appearance Comfort Cost Safety of sanitation Privacy any other likes or dislikes?	1 2 3 4 5 6 1 2 3 4 5 6 1 2 3 4 5 6 1 2 3 4 5 6 1 2 3 4 5 6
7.	What toilet (if any) did you have before? What jobs do you have to do with this toilet that you didnt have to do before?	
8.	Do you find these jobs (in Q7):	unacceptable, just ok, no problem, worthwhile
9.	What jobs does your husband/wife do related to this toilet, and other family members?	H / W
10.	Do you feel any difference in your own health after having this toilet: what?	yes no what:
11.	Do you feel any difference in your children's health after having this toilet	yes no what:
12.	Do you know the cost of this toilet? What?	yes no cost:
13.	Do you know there are different types of this toilet? Name some differences	
14.	Do you prefer any of these other types or any other type of toilet?	
15.	How many people do you know who wants a dry toilet? Which one? Do you think they can afford it? If not how do you think they might get one?	Number: Type: Afford it? Y N Suggestions:
16.	What do you do with infant's faeces?	
17.	Do you ever face any water shortage for any purpose?	
18.	Do you think people have any reason to feel uncomfortable to use urine for gardening? (what makes them feel uncomfortable?)	

19.	What type of ash do you use? Do you have enough ash? Where and how often do you get other ash if reqd? What other uses does ash have?	
20.	How many times have you emptied the treated faeces? Where used?	
21.	Value of treated faeces for garden/ag Value of urine for garden/ag	1 2 3 4 5 6 1=poor 6=excellent 1 2 3 4 5 6
22.	What gives more fertiliser <u>value</u> per day: one person's daily urine or one person's daily faeces?	Faeces Urine
23.	Are you using urine on your plants? Undiluted or how? Which plants: How long have you done this: Do the results make you:  Is it because of the urine or some other factor? Did you use any other fertiliser on them? What will you do with the plants	Y N undil 1 urine to ___ water Plant type(s) _____ months disappointed / indifferent happy / very happy
24.	Are there any costs associated with running or maintaining this toilet (What? What about before?)	
25.	Is any of the garden produce for your own personal use and income? Do you get to use the faeces /urine there?	
26.	What benefits - financial or otherwise do you get from this toilet? (less work, less walking, better plants for use/sale, easier for children, etc.?)	
27.	What burdens - financial or otherwise- do you get from this toilet? (e.g. have to buy extra ash at VD? per month, more work than before as have to carry buckets and empty them, have to carry urine,	
28.	Observe length and cleanliness of finger nails	

## 8.5 Appendix 5 Results of School Questionnaire

Questions	Respondents:	Class 6	Class 6	Class 9	Class 9	Class 6&9	Class 6&9	Wom - en	Wom - en
	No. of Respondents:	25	%	24	%	49	%	13	%
Q1 How do you get Diarrhoea	correct	0	0	8	33	8	16	2	15
	partly correct	13	52	13	54	78	159	6	46
	incorrect	12	48	3	13	63	129	5	38
Q2 How do you get Cholera	correct	0	0	2	8	2	4	0	0
	partly correct	4	16	16	67	36	73	4	31
	incorrect	20	80	6	25	106	216	9	69
Q3 How do you get worms	correct	0	0	2	8	2	4	6	46
	partly correct	4	16	19	79	39	80	7	54
	incorrect	17	68	3	13	88	180	7	54
	no answer	4	16		0	20	41		0
Q4 Tell three simple things you can do to prevent these diseases	correct	23	92	24	100	139	284	13	100
	incorrect	2	8	0	0	10	20	0	0
	mentioned handwashing with soap?	0	0	11	46	11	22	7	54
mentioned handwashing?	8	32	2	8	42	86	1	8	
Q5 Where do you defecate Type of toilet at home?	In the latrine	25	100	24	100	149	304	13	100
	W.C.	10	40	17	71	67	137	7	54
	Trad Vault	4	16		0	20	41	2	15
	Pit	9	36	4	17	49	100	1	8
	Vinasanres	1	4	2	8	7	14	3	23
	no answer	0	0	1	4	1	2	0	0
Q6 Types of toilet you know	Did know Vinasanres	7	28	5	21	40	82	9	69
	Didn't know V'sanres	18	72	19	79	109	222	4	31
Q7 Type of toilet you like best	Vinasanres	2	8	3	13	13	27	5	38
	Septic Tank	16	64	15	63	95	194	8	62
	Sulab/ twin pit	5	20	0	0	25	51	0	0
	Biogas	2	8	6	25	16	33	0	0
Q8 Why do you like it	Vinasanres	hygienic, clean, reuse faeces							
	Septic Tank	clean, more comfort, no flies, more civilised							
	Sulab/ twin pit	no comments							
	Biogas	hygienic, can use gas							

## 8.6 Appendix 6 Results of Women's Union Exercise

Women's perceptions of the importance of a range of toilet attributes and their ranking of several toilet types against those attributes. Cam Duc Commune .

This table shows the scores the three women's groups chose to give to the toilet attributes. After they had assigned scores in groups they discussed the results and then were allowed to modify the results if they felt it appropriate. The scores were aggregated ("ag" column) . The "rank" column shows the order of preference: 1 = most important, 14 least important.

	First round.						After group discussion					
	Group	1	2	3	ag	rank		1	2	3	ag	rank
Less work to maintain		4	11	9	24	8		<b>12</b>	11	9	32	12
Uses less water		2	6	<b>12</b>	20	4		5	6	12	23	7
Collects urine for gardening or farming		9	8	7	24	8		9	8	7	24	8
Should be inside house		11	13	<b>12</b>	36	13		<b>12</b>	13	14	39	13
No smell		3	4	1	8	2		3	4	1	8	2
Easy for children to use		6	9	6	21	5		6	9	6	21	5
Treats faeces for gardening or farming		10	7	8	25	10		10	7	8	25	9
Keeps family healthy		1	1	2	4	1		1	1	2	4	1
Should have an electric light		8	12	<b>12</b>	32	12		8	12	11	31	11
Should have a place to wash hands		12	5	4	21	5		<b>12</b>	5	10	27	10
Does not pollute well water		5	3	3	11	3		2	3	3	8	2
Low cost of construction		13	2	<b>12</b>	27	11		4	2	4	10	4
Should be far from house		14	14	<b>12</b>	40	14		<b>12</b>	14	13	39	13
Easy for old people to use		7	10	5	22	7		7	10	5	22	6
nb the numbers in bold have been inserted where no score had been given and is the average value of the remaining unassigned scores.												

## 8.7 Appendix 7 Current Estimated Costs of Vinasanres TDVV

Costing of Vinasanres TDVV toilet (Mr Phi, Institute Pasteur, Oct.2000)					
LOWER STRUCTURE	Quantity	measure	rate	Total VND	
Bricks	350	piece	180	63000	
Cement	134	kg	840	112560	
sand	0.46	cu.m	40,000	18400	
Gravel	0.079	cu.m	130000	10270	
Squatting Pan				60000	
Iron	8	kg	4800	38400	
Labour	3.94	mandays	35000	137900	
PVC pipework				8750	
<b>Sub Total</b>				<b>449280</b>	
UPPER STRUCTURE					
Bricks	400	piece	180	72000	
Cement	70	kg	840	58800	
Sand	0.445	kg	40000	17800	
GI Sheet	2	piece	45000	90000	
Wood	0.0247	cu.m	1500000	37050	
Bamboo Sheet	0.667	sheet	9000	6003	
wood	4	piece	500	2000	
nails	0.5	kg	10000	5000	
hinge	1	set	5000	5000	
Vent Pipe(PE) 100dia	2.5	metre	8000	20000	
Elbow	1	piece	3000	3000	
Labour	3.966	manday	35000	138810	
carpenter	0.5	manday	40000	20000	
flyscreen				10000	
<b>SubTotal</b>				<b>485463</b>	
Tiled Floor Basic Quality					
Tiles	2.22	sq.m	38000	84360	
White Cement	1	kg	2000	2000	
Labour	0.5	manday	35000	17500	
Labour	0.5	manday	35000	17500	
<b>Sub Total</b>				<b>121360</b>	
Tiled Floor Better Quality					
Tiles	2.22	sq.m	56000	124320	
White Cement	1	kg	2000	2000	
Labour	0.5	manday	35000	17500	
Labour	0.5	manday	35000	17500	
<b>Sub Total</b>				<b>161320</b>	
<b>Basic Cost:</b>				VND	US\$
Total Cost of toilet no tiles				934743	66.8
Total Cost of toilet basic tiles				1056103	75.4
Total Cost of toilet better tiles				1096063	78.3
<b>Cost with transport component:</b>					
Total Cost of toilet no tiles			10%	1028217	73.4
Total Cost of toilet basic tiles				1161713	83.0
Total Cost of toilet better tiles				1205669	86.1
<b>Cost with transport and contractor component</b>					
Total Cost of toilet no tiles			20%	1121692	80.1
Total Cost of toilet basic tiles				1267324	90.5
Total Cost of toilet better tiles				1315276	93.9



**8.8 Appendix 8 Project proposal “Solar Latrine for Coastal Central Area in Central Vietnam”. Ministry of Health, Hanoi, 19 April 1996. Also reply from Winblad Konsult AB, 27 April 1996**

**8.9 Appendix 9 *Diagrams of Vinasanres Toilets from ref. 1.***