

# Water and Sanitation in post-tsunami reconstruction

*Understanding plans and identifying solutions*

*Organized by*

**TRINet**

*in collaboration with*

**Project Management Unit (ETRP & TEAP), GoTN**

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Training Hall, 4<sup>th</sup> Floor, TWAD Board, Chepauk, Chennai, 600 005

## **WORKSHOP REPORT**

### **Inaugural Session:**



**Thiru C.V. Sankar**, IAS, OSD (R&R) and Project Director (ETRP & TEAP) began by saying that sanitation is one of the key areas with over 64% of houses having no toilets. The percentage was higher in coastal areas and this was a clear case of neglect on the part of everyone concerned – the government, the community and the people themselves. Sanitation was of crucial importance in the tsunami rehab sites and the situation was compounded with the low lying nature of the land, high groundwater table, soil permeability issues etc. The sanitation programme was the most critical component of the rehab programme when compared with the putting up of shelters or constructing roads or other infrastructure. There was a need to put up systems that were simple and easy to maintain. He had been under the impression that knowledge levels were high within the government departments to address the sanitation issues but apparently it was not so and a small consultation group had been set up for this. The idea was to work on a batch of solutions of systems that work, and set up maintenance mechanisms to ensure they are sustainable. TWAD board was eminently suitable for all this. There was a need to have systems in place before implementation is done and there was a need to look at the various options such as ecosan, dewats etc. These ventures needed encouragement and people need to see how the toilets work and then come to accept them. Provision of toilets for women was very important. He was surprised at some of the senior officials of the government saying that in coastal areas they have not been used to toilets and the same could be maintained. Finance was not really that big a problem, it was envisaged that financial support would be initially given to a centralized body like TWAD board before training and empowering the local bodies could be done. He ended his speech by hoping that the day's discussions would lead to clear cut plans of action.



**Mr Sankaran** of the TWAD Board spoke on behalf of the Managing Director, TWAD Board. He gave a summary of the activities of the TWAD Board with respect to the relief activities in the aftermath of the tsunami disaster which included immediate provision of drinking water to the affected communities by means of tankers and also went ahead with the repair of the various water supply schemes that had been damaged by repairing pumps and pipelines.

Adequate labour to carry out the works was difficult to find and had to be brought in from outside. The timely action of the TWAD board helped in preventing outbreaks of water borne diseases. The ADB had sanctioned Rs 82.18 crores for 36 water supply schemes and 5 recharge centres. Work was under progress and all the schemes were due for completion by March 2008. Sanitation for the permanent shelter settlements was being done with World Bank assistance. Various technical options were being considered with various constraints including availability of suitable land and an algorithm was being utilized to help in this. He concluded by saying that a

separate tsunami cell had been formed within the TWAD board for the implementation of the projects in the tsunami affected sites.



**Mr Prashant Hedao**, Steering Committee member of TRINet outlined the objectives of the workshop. He said that three components could be visualized: technical solutions, implementation and social component. A good technical solution that was badly implemented would be useless. Again, one could not assume that just because a toilet was built, it would be used by the people. Today's workshop would focus mainly on the technical aspects. The objective was to understand the government's existing strategies and proposed plans with regard to water and sanitation, understand the proposed sanitation guidelines and learn from the experiences of the people who have worked in these areas. He concluded by saying that while our country had a number of commissions such as the space commission and the atomic energy commission, it was perhaps time to have a sanitation commission to create awareness about the importance of sanitation.

### Session 1:



This session focused on the plans of the implementing agency, namely TWAD Board, for the proposed sanitation facilities in the permanent shelters reconstructed in the aftermath of the tsunami followed by the guidelines for sanitation developed on behalf of the World Bank and the Project Management Unit (ETRP & TEAP). The **Chairperson** for the session was **Dr K. Thanasekharan**, Director and Professor, Centre for Environmental Studies, Anna University, Chennai. He began by saying that the Anna University was directly involved in the rehabilitation process and was doing the EIA for 11 sites and hence was keen to know the options with respect to water and sanitation as there was a need to evaluate the environmental and social aspects based on the choices. Water and Sanitation are two important components and there is a need to plan what is suitable for the community. It had to be technically feasible, environmentally compatible and socially acceptable having to fit into the regular habits of the community.



**Mr Rajkumar of the TWAD board** gave an outline of the work carried out by the TWAD board in the immediate relief phase. Using photographs, he described the impact of the tsunami on water supply structures such as OHT connections, pumping mains, pump rooms and wells. Immediately after the tsunami, the TWAD board had taken the initiative to supply water to the affected areas using lorries and tankers and also worked to make the damaged water supply systems functional. This timely intervention by the TWAD board helped in preventing outbreak of diseases. It was a difficult task considering the shortage of labour and the difficulties in monitoring labour etc. Some lessons learnt included the following: source should be located away from the coast, periodic water quality monitoring was required and awareness on water borne diseases as well as environmental quality had to be created. Under the TEAP (ADB assistance), 36 water supply schemes and 5 recharge structures were proposed to be built.

The second part of his presentation dealt with sanitation for the permanent shelters in 200 sites using World Bank assistance under the ETRP. Since the shelters are located in coastal areas with sandy subsoil and shallow groundwater, disposal of sewage was a problem and normal soak pits would not work properly. A number of alternatives had been proposed depending on the size of the settlement and other considerations based on the guidelines developed by the consultants. Four major classes were made based on the number of houses as well as water and land availability. The system proposed by NEERI would be executed in 52 places, Dewats in 40, mounds in 28, SPISF in 69 and Septic tanks in 11. An outlay of Rs 69.97 crores was proposed. The O&M would be handed over to a local contractor for a year on completion of the scheme; the contractor had to train the local body to operate and maintain the system.

Mr Rajkumar's presentation is available on the TRINet website at <http://www.trinet.in/modules/mydownloads/visit.php?cid=53&lid=279>. To reduce the file size, photos have been removed from the presentation.

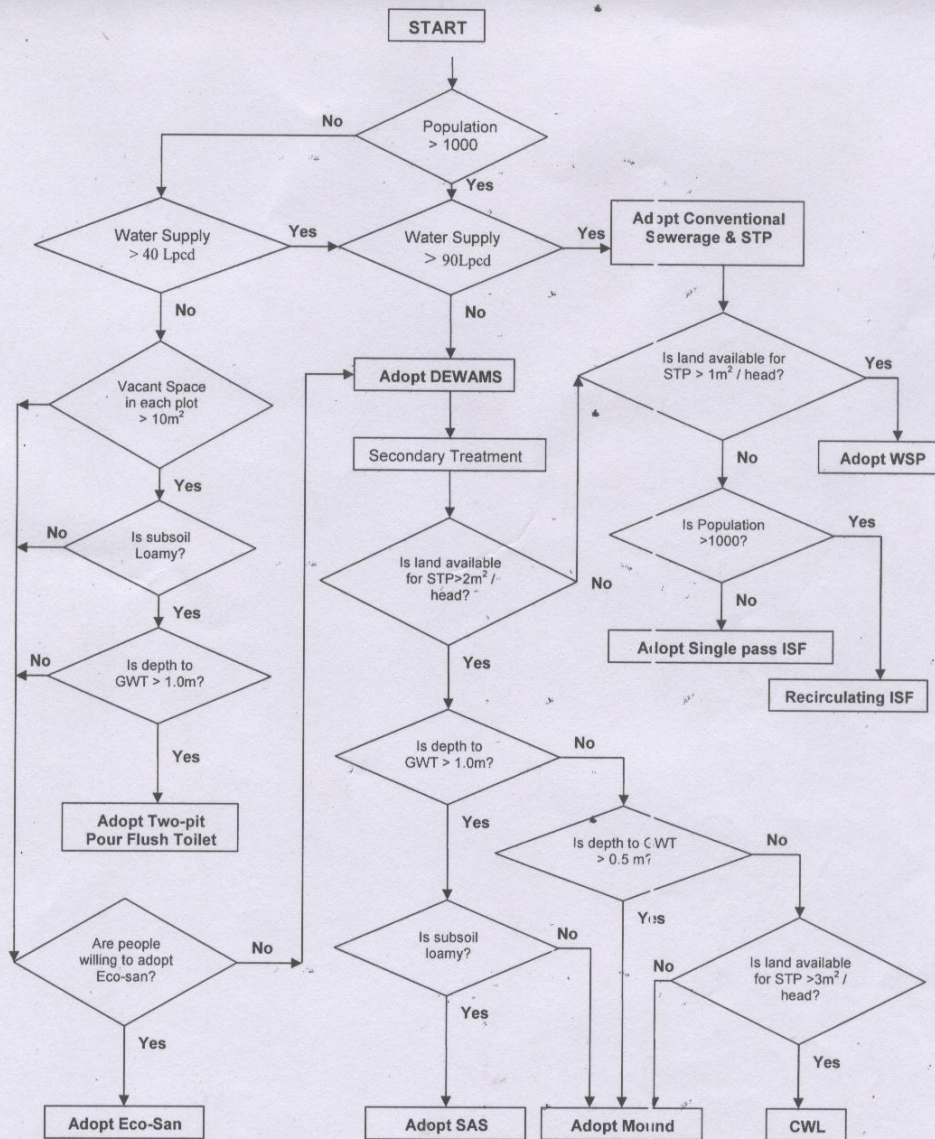


**Mr R. Pannirselvam**, a well known consultant and author of books on environmental engineering who has prepared the sanitation guidelines on behalf of the PMU for the ETRP divided his presentation into six parts. In the first part, he explained what is sanitation and its need to protect public health. Sanitation methods could be divided into two classes. Onsite sanitation referred to disposal of wastewater within the plot whereas offsite sanitation referred to the centralized collection of wastewater and conveying it to a Sewage Treatment Plant (STP) to remove pollutants before disposal on land or water. For onsite sanitation, optimum water supply should be less than 50lpcd because otherwise it becomes difficult to dispose. For offsite sanitation, a minimum 90lpcd per capita supply of water was needed to allow collection using sewerage system with proper gradient to ensure self cleansing velocity. The offsite system required land for pumping stations as well as for the STP and depending on the choice of the STP, skilled manpower could be needed for operation and maintenance (O&M).

A number of factors needed to be considered before the right sanitation system was selected and these factors ranged from the total population of the area, space availability, depth of the groundwater table and skills available for O&M. In areas where the number of houses is less than 200, and the available water supply is less, offsite sanitation with conventional sewerage and STP is not suitable because not only the human wastes but also the sullage has to be disposed properly. In some cases, onsite sanitation may also not be feasible. Hence a via media between the two, namely Decentralized Wastewater Management System (DEWAMS) could be preferred. The guidelines include discussion about a number of methods for onsite sanitation. In off site sanitation, there is no pre-treatment. In DEWAMS, pre-treatment is done to eliminate solids by putting in an interceptor tank like a septic tank where all settleable solids settle, and solids free effluent is let into the collection system. Since there are no solids to settle, the collection system can be laid over a flat terrain. Since it is for a small volume of flow, the wastewater could be reused especially for landscape gardening. The interceptor tank can be provided for every house or for a cluster depending on space availability. The sewers are laid at shallow depth as there is no solid component in the effluent, and no regular manholes required but a clean-out can be provided which can be used to push water to clean up in case of any clogging. Treatment consists of various options, the most common could be soak pit though it is not suitable in the area under consideration because of the shallow ground water. As an alternate, the low pressure subsurface dispersion system could be used with the effluent pumped up to around 0.5 m, or even above ground into an artificially created 'mound'. Depending on land availability, options such as intermittent sand filters, reed beds and waste stabilisation ponds could be used. This system had as advantage the low maintenance of the small bore system and of the treatment and disposal system.

A field data collection sheet was developed incorporating a number of items including population, number of houses and projected increase in population, land availability and the preference of people in choice of toilets, environmental factors such as distance from the sea and backwaters, potential for wastewater reuse etc and an algorithm was created so that using this data, the most suitable sanitation system for the area could be chosen.

Mr Pannirselvam's presentation is available on the TRINet website at <http://www.trinet.in/modules/mydownloads/visit.php?cid=53&lid=280> . The next page gives the algorithm that he has developed to choose the right sanitation system for an area.



**LEGEND**

SAS – Soil Absorption System

ISF – Intermittent Sand Filters

DEWAMS – Decentralized Wastewater management

WSP – Waste Stabilization Ponds

CWL – Constructed Wetlands

**ALGORITHM FOR SELECTION OF SANITATION TECHNOLOGY FOR THE PERMANENT SETTLEMENT FOR TSUNAMI AFFECTED PEOPLE**



**Dr R. Sivacoumar**, Scientist from NEERI's Chennai Zonal Laboratory made a presentation on the sanitation guidelines for settlements with more than 200 houses. This number was because of the EIA guidelines which required that residential complexes of more than 200 units required a scientifically designed sewage treatment plant, which means that it has to adhere to standards set by MoEF or any appropriate authority. Recent EIA guidelines issued in September 2006 however talk of areas greater than 20,000 sq m of built up space (approximately equal to 800-1000 houses) requiring an STP, but since the programme was started when the earlier EIA guidelines were in force, the earlier set was being followed. Guidelines based on EIA studies are required to be done at the planning stage itself where the technology to be used is decided. Standards give end-of-pipe solutions suggesting the treatment type if the water is to be discharged into a nearby water course, for example. Design considerations try to fulfil the above two. The main objective is to ensure that there should be no contamination of groundwater or surface water or surface soil; and the system should be easy to maintain. The guidelines could be broadly classified into engineering, environment, process and cost considerations.

Under engineering – the design is usually for a period of 30 years, it often happens that there is under-utilization for a considerable period and hence, the recent approach is to build in modular fashion, adding units according to need. The design also is controlled by the population, sewage flow and fluctuations; the topography (area, slope, terrain); land availability (becoming a problem even in rural areas, hence the preference for compact systems), groundwater depth, soil conditions, reuse or recycle plans, the degree of treatment that is required which then decides the cost, the available hydraulic load etc. Environmental considerations such as odour and mosquito nuisance are also to be kept in mind while designing such facilities, which should be kept as simple as possible to construct and maintain. It is also better to go in for systems that are manufactured indigenously, does not require too many skilled staff and that merge with the landscape.

The current EIA guidelines issued on Sep 14 2006, say that building and construction projects greater than or equal to 20,000 m<sup>2</sup> and less than or equal to 1,50,000 m<sup>2</sup> of built-up area need scientifically designed STP. This works out to the equivalent to 800-1000 houses compared to the earlier requirement of STP for the equivalent of 200 houses. However, since the project was formulated before September 2006, it was decided to follow the earlier guidelines.

Dr Sivacoumar then explained the characteristics of sewage and recent approaches to treatment of wastewater and its disposal. Decentralization is preferred especially in the context of residential complexes since the collection and conveyance costs are close to 80% of the total costs. It is hence preferable to treat wastewater as close to the source as possible and also promote reuse and recycling of treated water, especially for agriculture, after ensuring that certain minimum standards are adhered to based on the type of crop. He discussed the various standards for various components of wastewater for different kinds of reuse or disposal and also the various disposal options. The various treatment technologies used in Tamil Nadu include Waste Stabilization Ponds (WSP), Activated Sludge Process (ASP), Upflow Anaerobic Sludge Blanket (UASB), Fluidized anaerobic Bio Reactor (FABR) etc. FABR is the system suggested for the tsunami affected areas.

Dr Sivacoumar's presentation is available on the TRINet website at <http://www.trinet.in/modules/mydownloads/visit.php?cid=53&lid=281>

#### **Discussion:**

Mr V.Vivekanandan said that water supply appeared to be the key element in finalizing sanitation facilities. He wanted to know if it were possible to obtain detailed information, scheme wise, on the assured water supply per capita for the areas where permanent shelters were being constructed as this would be helpful to NGOs working in those areas. Was this information available in the public domain?

Mr Rajkumar replied that the information was available and could be made available. It was right now under preparation having been proposed and sent to the PMU and sent to ADB who had to approve it. For settlements with less than 200 houses, the water supply was to be 40lpcd and for more than 200 houses, it would be 75lpcd.

Ms Annie George wanted to know if the water supply had to be a limiting water. The 40lpcd etc referred to the potable water supply and so could other alternate supplies for sanitation, even if slightly saline be used, when availability of regular water supply is difficult; and if water supply could be delinked from sanitation.

Mr Pannirselvam said that this was an important question as for settlements greater than 200 houses, the FABR system was to be used along with conventional sewerage and the 40lpcd water supply would need to be augmented as otherwise the system would not function properly... Dr Sivacoumar said that the system was designed on the wastewater generated and not on the water supply. To this Mr Pannirselvam said that it was not a question of whether FABR would work, but whether sufficient sewage would be generated if only 40lpcd was to be supplied as without sufficient volume of wastewater, the self cleansing velocity would not be generated. Dr Thanasekharan said that it was as Mr Pannirselvam had pointed out – it was not the water supply of the population that was of concern but the amount of wastewater generated that decided the system. The questions were whether wastewater could flow through the pipeline and how much minimum flow was required if a pipeline was to be used.

Mr Ganapathi wanted to know if the treatment system could function if saline water is used as a supplement to what is provided. He felt that people should not be deprived of a system just because non-saline water was not available.

Dr Thanasekharan said that it was perhaps alright to augment if sufficient water was not available but it appeared from Mr Rajkumar's presentation that that the TWAD board is taking care even of this requirement with no problem. Even if there is a problem, water supply can be augmented as it was provided based on per capita requirement and it is not wise to think of providing water supply to suit a technology. It had to be ascertained if 40lpcd was sufficient for a community, and if so, what was the volume of wastewater generated, and go by that for designing treatment systems.

Mr Paul Calvert wanted to know if only 40lpcd is available, and if people start flushing their toilets with salty water, could the treatment plant cope with such effluents? Would that damage the STP's capacity to operate? The answer was that as far as the FABR system was concerned, it would definitely affect the performance of the system because a major component is aeration – which would be affected by the salinity. Mr Calvert then commented that there appeared to be a very high that very salty sewage was going to be generated and that it was prudent to think about it now and not two years down the line when the plants are not able to cope and don't function.

Dr Navaneetha Gopalakrishnan said that the plants should work even at high salinity levels (even >1500mg/l but <3000mg/l) considering that there are ASP plants that treat salty wastes from tanneries.



Mr Venkateswaran wanted to know if 40lpcd was sufficient for a person considering the international standards suggest 135lpcd. Mr Rajkumar responded that according to TWAD board norms, the quantities are 40lpcd in the case of rural water supply, 75 lpcd for town panchayats and 90lpcd in the case of municipalities and these quantities have been approved by the GOI as well. The water supplied is only for drinking and cooking. It is assumed that for other purposes, local resources are available in rural areas whereas in urbanized areas, this non-potable water source may not be available and hence the higher quantum of water supplied.

Mr Venkateswaran then pointed out that the discussion was about sanitation and not water supply. The question was how the disposal of 40 lpcd supplied by the from TWAD board as well as other supplemental water used was going to be effected.

Mr Pannirselvam responded that the 135 lpcd was broken as follows: 5 l for drinking, 5 l for cooking, 55 l for bathing, 40 l for washing etc. Cooking, drinking and bathing were the important items requiring potable water and for other purposes, local water could be used. The FABR technique was well proven and would work at smaller flows; but the question was about the collection system. It was only when 90lpcd wastewater was generated the self cleansing velocity of 0.6m/s would be generated. Even if 40lpcd is provided, the question is whether the collection system is to be designed for 40lpcd or 90 lpcd. If additional water is supplied by local sources upto 50lpcd, then the sewerage and treatment systems have to be designed for 90lpcd.

A question was asked about reuse of wastewater as mentioned in the guidelines for greater than 200 houses. The questioner wanted to know in which of the tsunami affected settlements, had recycle and reuse been given a consideration, and what was going to be the end use of that particular water.

The response was that the reuse of wastewater was optional and that the process chosen had to fulfil the EIA standards. If at all the wastewater was to be reused, the appropriate standards had to be made and this was based on the reuse requirements.

Mr George Heston wanted to know where to get information on the water supply in different areas and also wanted to know what the programme plans were for the second and third line affected areas. The response was that the district collector was the nodal officer and information could be collected from his office or from the TWAD board office.

With regard to his other question of 1.5m clearance requirement, Mr Pannirselvam said that when effluent flows through substrata, there is removal of organic matter before dispersal. A minimum clearance of 1 m was always necessary between that level and the groundwater level. They preferred 1.5m for reasons of safety as it enables further purification before it joins the aquifer. Hence 1.5 m was the distance between bottom of trench or dispersion point and highest groundwater level which could be in the rainy season.

The area required for the disposal was important because of land availability. If there was no possibility for taking the treated effluent to the nearest watercourse, then the disposal was to be done on land.

Mr Prashant Hedao wanted to know if the FABR technology had been used in a rural setting since the only example that was given was of the Apollo hospital in the city. Dr Sivacoumar said that he would provide examples of locations where this technology has been used in a housing settlement.

A question was asked if when the dispersion was done through a mound through a slotted pvc pipe, overflow in the event of surcharge could affect the local area and promote the breeding of a tiny insect. Was there any chemical or other preventive to control this insect. The response from Mr Pannirselvam was that the mound system was designed to ensure 1m level difference between the bottom of the dispersion point and the ground water table. Any seepage would be absorbed by the vegetation around or lost by evapotranspiration. Water was not fed continuously on the mound and no ponding was expected. He was not aware of the insect problem.

A question was asked regarding the capacity of local bodies for operation and maintenance of water supplies. The earlier systems of ponds had now gone into disuse and was there any pain of reviving them to use in periods of low water supply.

Mr Rajkumar said that for O&M, the local people were to be organized and awareness and training programmes were to be conducted. TWAD Board was already giving such training and some women SHGs had taken to maintaining schemes so effectively that power consumption had been reduced. He said that when people are given ownership of an asset, they learn to maintain and hence they wanted to emphasize ownership. Locally available sources had to be used for purposes other than for drinking water supply.

Mr Pannirselvam was asked about the interceptor tank size and also when the sanitation guidelines would be made available. He responded that the size was rectangular for a group of houses and the details were given in the guidelines. The PMU was responsible for the guidelines – Mr Balamurugan said that they should be available in a week or ten days.

The ownership issue was a big question – and one participant wanted to know if there were any stakeholder meetings, local committee etc and how was the implementation and planning done by the TWAD board?

Mr Rajkumar said that a TN rural water supply and sanitation programme had been created and had held many training programmes linking with local groups. TWAD Board engineers had interacted with locals regarding maintenance of schemes as well as to generate funds at the village level by creating street groups to collect charges according to the Government Order. He said that the village panchayat president was also head of this group and listed the other members of the group.

Mr Prashant Hedao said that the NCRC-UNDP survey had found 96% of the affected tsunami community were used to open defecation, and hence where are these committees functioning? To this Mr Rajkumar pointed out that this committee was only for water supply. A system was yet to be evolved for the tsunami affected areas.

Mr Pannirselvam was asked about the appropriate technology for collection of wastewater in areas where the old houses and new constructions were mixed – where the water supply was less than 40lpcd and the number of houses was more than 200. The response was that the lpcd supplied and the number of people in the area had to be taken into account.

Members from the Aga Khan development network described their experience with water and sanitation in two districts of Gujarat and said that community mobilization and participation was very important in the success of sanitation programmes. They were asked to share this information and Mr Balamurugan of the PMU said that he would coordinate to get the information.

Mr Biju pointed out that based on the Nagapattinam experience, it appeared that close to the 2<sup>nd</sup> anniversary of the disaster, NGOs were going to complete construction of 50% of the houses and hand them over. He wanted to know from Mr Rajkumar when the construction of sanitation facilities was going to start and when would it be completed. He said that without sanitation facilities people were relocating to new sites and soon this would be a man-made disaster. Mr Rajkumar said that as far as sanitation was concerned, a procurement plan had been prepared and submitted to the PMU who had to send it to the World Bank to get clearance. The sanitation programme would be launched as soon as clearance was made available.

Mr Balamurugan added that the documents had been sent to the World Bank and approval was expected soon. First priority for sanitation was in areas where housing was completed and the sanitation facilities would be completed in 4 months.

Dr Thanasekharan summed up the discussions and said that contact had been established between beneficiaries and the experts and this had to be continued. Technically too a lot had been learnt from the presentations and this learning should also be continued.

## Session II:



The afternoon session focused on waste treatment systems. **Prof A.R. Santha Kumar**, Professor Emeritus, IIT-Madras and Consultant, UNDP, was Chairperson. He initiated the session by outlining some good practices in coastal areas for construction of sanitation facilities. He said that the previous discussion had indicated that there were to be two categories of sanitation facilities – one set for less than 200 houses where DEWAMS was to be used and the other set of more than 200 houses where a STP would be used. In both systems, the most important thing was that solids should not settle from place of transport to place of treatment as there would be risk of clogging. The risk was lower in DEWAMS but it was high in the areas where STP was to be used. Experience from Chennai city showed that bleeding from manholes was an everyday problem and this was because self cleansing velocity was not being generated in the transportation lines resulting in the sewage getting clogged. Manholes at regular intervals would need to be provided to allow clearing of blocks. This issue has not been sufficiently discussed in the greater than 200 houses category – the slope for the sewer lines, the self cleansing velocity to be maintained and for this, the wastewater that has to be generated. Construction that involves concrete and reinforcement is susceptible to breakdown when acidity or salinity is present in the water and hence adequate precaution has to be taken while doing underground construction. This is an important issue as DEWAMS is being proposed in areas where water table is high, and twin chamber units are being proposed at regular intervals below ground level. Invariably half of it will go below the ground water table. If so, how is the construction going to be managed as if the construction is going to leaky, there is no use of such a unit as before the bacteria reach the treatment plant, they will contaminate the ground water. Hence there was need for adequate safety measures for good construction, if necessary by lowering water table temporarily by using pumps. The material that is being talked about is very corrosive – if steel is to be used for reinforcement for the slabs, it will get corroded. Cover recommended for above ground structures would not be sufficient for below ground structures. Hence the steel would have to be treated and conventional 40mm cover used or a larger cover below ground will have to be used. Otherwise in 5-6 years there will be cracking. Since these structures are to be made in coastal areas, the entire design should be made as an uncracked design. There was no point in using corrosion resistant steel as there is no guarantee that it would not corrode. It was better to go for good quality concrete rather than treatment of steel or other options to ensure that there is no leakage.



**Mr Paul Calvert** from EcoSolutions spoke about Ecosan. The challenge being faced in the tsunami affected areas is because of high water table and shortage of water supply. If only 40 lpcd is to be supplied and flush toilets are used, then there will not be water for any other purpose such as drinking or cooking as flush toilets are very water intensive. And yet the wastes have to go somewhere. They believe that there is a very valuable alternative in the urine diverting dry compost toilets. It is not connected to any sewer or any sewage treatment system. This was first used extensively in the areas with high water table in Kerala where septic tanks and pit latrines are quite out of the question. The sewer system would be possible but would have to be high tech system and out of the price range of anyone. This toilet is composed of two chambers, the first is used only for the fecal matter on top of which ash or soil is added and lasts for about a year. The other side then is used. By the second year, the first pit is ready for use as it can be emptied. The urine and wash water is diverted. In this system the fecal matter is contained till the pathogens are destroyed; a sewage treatment plant does the same but at a much greater cost. A septic tank cannot do this – the effluent from a septic tank though it looks like a clear liquid has considerable percentage of pathogens. Ecosan is appropriate not only for fishing communities but for all of us, in fact it can be considered to be the most advanced sanitation system considering the growing scarcity of water.

The location of coastal communities makes it difficult not only for creating infrastructure but for O&M as well. It is better to create systems that can be locally managed and experience has

shown that this is possible. The volume of water required is very low – and whatever wastewater comes out is relatively benign and can be disposed off. Fecal matter and urine have great value as fertilizer. Since the fecal matter is high in water, dehydrated it is very low in quantity. Urine is high in nitrogen and phosphorus whereas fecal matter is mostly fibre and water. Composting toilets can pay for themselves unlike other systems. It is only that people's fears and inhibitions have to be overcome. Rather than spending a lot of money in manufacture of fertilizer, that money could be used to set up ecosan toilets which could be used to generate manure and hence, revenue. Mr Calvert gave examples of the use of urine specially collected for soaking tweed in Scotland and by farmers in China indicating how others see the value in what appear to be wastes. The water saved would then be available for other uses. The grey water (from baths, washing) becomes more valuable as it is not contaminated with black water and could be used for other purposes such as gardening or landscaping.

Good awareness campaigns are necessary and it works as they learnt from experience in Kerala. The fear of the unknown has to be overcome but once it is done, the method becomes popular. The compost that comes out is in small quantities. The urine on the other hand can be used as a wonderful fertilizer to grow vegetables. He ended his presentation raising questions about what the plans were for disposal of sludge from the DEWAMS and the STP systems – it had been indicated that the sludge would be collected and dried on sludge drying beds. He pointed out that this sludge would have higher concentrations of heavy metals after processing millions of litres of water and concentrating and hence could not be used as fertilizer unlike that obtained from ecosan toilets.



**Mr Subburaman** of SCOPE, Trichy, began by showing pictures of the bad state of toilets in the temporary shelters in Akkarapettai in Nagapattinam and said that fisherfolk who were used to open defecation were not given proper and continuous training in usage of toilets. Water was not used for flushing and the supply of water was inadequate. Women used the toilets as they had not other choice whereas men preferred open defecation. Many users threw

plastic bottles and other waste inside the toilet basin. Pit latrines that were constructed as an emergency measure for crisis management had many problems. Despite the problems, toilets played an important role in improving awareness of advantages of local sanitary facilities, and this was appreciated especially by women. He showed pictures showing the problems created by pit latrines and septic tanks because of the high water table in the region. The solution was obviously the three in one toilet model of ecosan. He said that these toilets had been constructed in Kameshwaram village in Nagapattinam district and explained in detail about the usage of the toilets and also showed an animated sequence about its usage. He concluded by saying that awareness creation was a very important component for its success.



**Dr Lucas** of Auroville made a presentation of the Dewats or decentralized wastewater treatment systems and began by saying that ecosan was the best sanitation system and dewats was actually one step back. As a medical doctor, he decided that there was no point in handing out anti-diarrhoeals and other medicines for that only benefited the pharma industry and not the people. His

presentation on dewats was based on the work of the CSR, Auroville. Dewats does not compromise with standards. What is aimed from this system is less power supply needs to maintain the system. Systems fail because of requirement of highly skilled operators, chemical inputs etc. Requirements in O&m should be as low as possible and there should be reuse of water as close as possible. Dewats is not defined by any particular elements. Thus a biogas digester becomes part of a dewats systems.

The first part of the system is the settlement tank. For 200-250g of wastes, we use 20-30 l of water which is now dirty and has to be cleaned again. He showed a set of tanks in series (baffled tank reactor) which could be used. Alternatively an anaerobic filter could be used as a module of dewats. This could be followed by a constructed wetland with subsurface flow. The plants are those that grow in natural wetlands. This could be followed by a polishing pond which could be

stocked with fish which controls mosquito breeding. In Auroville, a mobile desludging unit has been purchased and is used regularly. The sludge is disposed in trenches where groundwater levels are very low after treatment with EM technology and co-composted with other material to produce compost that is used in forestry. The desludging has to be done on a regular basis and the sludge has to be disposed carefully. He also showed photos of larger dewats systems in Gujarat. With this background that CSR took up the challenge of dewats in the tsunami hit areas to design a mobile reusable system that could be used in the temporary shelters and later could be reinstalled in the permanent sites. Pictures of the construction (using ferrocement in one case and FRP in another case) of these units explained how the process was achieved. The units were constructed in Auroville, loaded on lorries and taken to the sites. He also gave a break up of the costs and showed how the per capita cost was about Rs1,500 per capita – which was a small amount compared to the money that is being spent on a house. To date 10 dewats have been completed for upto 600 users and many are to be built.



**Mr Ganapathi** of Exnora international said that one Dewats unit had been constructed in Trichy and had been under use for over a year. The O&M is by the local women's self help group. The biogas generated is being used to heat water to boil milk to be sold to local tea shops. Last year during the floods when no other fuel was available, the biogas was used to prepare food for the local people. The district corporation in Trichy plans to put up more toilets like this and the public toilets look more like gardens than toilets. The most important thing was to mobilize people to ensure that the system is properly maintained – both the dewats system and the community toilets. The treated water is used for raising coconut and banana plants. Awareness creation on the importance of sanitation has to be done for this to be successful.

**Dr Sivacoumar** of NEERI spoke on fluidised aerobic biological reactor (FAB reactor), a modular design suggested for 49 sites in 13 districts of TN. The choice is based on space constraint. It is maintenance free, works with less manpower and sludge generated is low. It also will meet the stringent standards of the TNPCB in terms of BOD and suspended solids. It is also a well proven technology. There are more than 400 plants all over India and can work with any flow systems.

The system works on the principle of attached growth with media supporting the biomass, fluidization of media increases the surface area. Microbes grow luxuriantly in this system and hence high loading rate is possible. Research is going on to develop special media to reduce the tank size. Diffused aeration is from the bottom of the tank. There is better control over effluent quality. The tube settler component also helps in reducing tank size. They collected sewage characteristics from the various sites but did not find much fluctuation in the characteristics. This information was used for design purposes. The effluent characteristics expected were also described. Options to further improve effluent characteristics are also available but would increase the cost. The design criteria were described. The sludge removal can be done once in two years as the quantities generated are low. The sizes that have been worked out for 400kld tanks were worked out and presented followed by the information on costing of the civil works and electro-mechanical equipment. Modular costs beginning at 55kld upto 450 kld including operating costs were also given.

The presentation made by Dr Sivacoumar is available from the TRINet website at <http://www.trinet.in/modules/mydownloads/visit.php?cid=53&lid=286>

#### Discussion:



**Dr Navaneetha Gopalakrishnan** started by saying that while Ecosan was simplest of all, it was not clear if it would meet the standards set by the regulatory authorities. It was also not clear how many people would prefer to use such a system and it would be good to know the feedback from the community. It was a different thing for individuals or a small group of say, ten

houses, to go for this. But when settlement size was closer to two hundred, it was not clear whether this option was viable. In the case of dewats, going in for ferrocement, it could be expensive. It was also not a complete solution as it required further treatment such as a wetland and the problem was the non-availability of land or space to dispose the effluent. Again from the regulatory viewpoint, it is not clear if the effluents would meet the regularoty standards. The generation of biogas was a positive point in this system. Public acceptance may be there but disposal of treated effluent may still pose a problem. The FABR was a power intensive system. When normal regular power was not available, it was difficult to visualize how such a power intensive system was to be maintained. Mr Pannirselvam had suggested an interceptor tank – the widely used septic tank’s tank could be used as an interceptor tank to collect the liquid wastes to be further treated at a centralized treatment system. This appeared to be most suited for both types of settlements.



**Mr V. Vivekanandan** said that it had been a good learning experience for many non technical people like him. Many of them are in the difficult position of implementing large housing programmes and breaking their heads over sanitation given the fact that many of the community have not been used to toilets at all. At one level there was a need for the community to be sensitized

and get to using toilets properly and at the second level there were technical issues such as the high water table and distance from the coast and the third level was that these systems should be used sustainably in the long run. The discussions have highlighted many issues and he is fully convinced about the many issues about each of these things. The most important issues include – the issues about water supply and the assumptions about water. He said that the new settlements that are coming up along the coast are more like mini urban settlements – an urban mileu in a rural setting. It is not clear how the government has the capacity to take on this kind of challenge. Largely, in rural areas, many of such issues are left to their own devices. But for the first time, we are expecting the state machinery to take over considerable responsibilities and run it, even if it is through the panchayats. So local bodies are now expected to manage centralized systems which involves a major governance problem. The kind of limitations in cities are known. And now for the first time we are saying that these panchayats, which are very weak in some respects, are going to take over functions. A problem is very obvious in the case of the fishing community which are known for their independence and minimal interaction with others. Now they will overnight be required to become dependent on the governance system of the state machinery systems. The technology choice appears to be inherently biased towards centralization and state run systems even if this is in the form of decentralized panchayati raj institutions. This is a fundamental question that has to be raised. In this light, the STP idea looks a question mark if done across the board, across the state. Consdiering other technologists, there appears to be a lot of scope. Ecosan requires a huge amount of awareness building and community mobilization. TWAD Board and NGOs must come together for this, and it is clear that extensive planning and coordination have to be done for this whole idea of sanitation. It is not clear if this component is there in the budgets at the moment. He also pointed out to the standard replies of ‘under preparation’ or ‘gone for approval’ when information was sought and said that it would be good if the information was shared in the draft form when comments and suggestions could be made or appropriate preparations could be effected to ensure that the project was successful. The government system which has been very transparent in the tsunami context, which is now shifting towards the implementing agencies, could also share the information, even as they are being prepared. This would help the NGOs in preparing the community, an important feature as emphasized by the Gujarat experience. The ownership issue will work only if the information is shared with them and also if choices are given to them. The community needs to be prepared and so also the individual families.

Mr Venkateswaran said that one subject that has not been discussed in detail was the construction of toilets. While Ecosan can be of interest to an individual, the community toilet is not so acceptable. The toilet must be part of the main dwelling. Constant interaction with the people is necessary for ownership feelings to develop. TWAD board must conduct training programmes where NGOs are also involved, the community will surely participate.

Ms Annie George wanted to know if the interim tanks that are being constructed by the NGOs could be used as interceptor tanks; and also there was a need to know the government's plans for an area because the design of the tanks, the slope etc would change with landfilling, road laying and other activities.

Mr Navaneetha Gopalakrishnan, answering on behalf of Mr Pannireselvam said that the interceptor tank was nothing but a small septic tank and the top liquid layer could be collected and treated. A leach pit could not be used for this, but could be rectified for use as an interceptor tank, said Dr Santha Kumar. However, some level of planning and design would have to go into this.

A question was asked about the quality of construction: what will be the minimum cover required and the quality of cement. Dr Santha Kumar replied that minimum cover required for ordinary construction is 40mm but since we are dealing with sewage and saline environment, 50mm cover would be better for below ground level. The quality of concrete below ground should be better than that above ground. The water-cement ratio below ground can be controlled better, also the major chemical ingredient that we are fighting against needs to be identified and accordingly the solution would have to be done.

Dr Lucas said that the common experience showed that it is much easier for people to change from zero sanitation to ecosan than for people used to flush toilets. We who are used to flush toilets do not want to be weaned away from them. Even if flush toilets are to be used, people have to be taught accordingly to ensure that the toilets are used and not misused or kept unused. One reason why decentralized systems are being promoted is because they are decentralizing logistics and technology but also governance and responsibility.

A participant commented that his experience was that in many houses attached toilets ended up being used as puja rooms – but this depended on the mindset of the people.

A question was asked about the fate of E.coli in dewats. Dr Lucas said that tests have been done in Auroville as well as other places and they found that the numbers go down continuously till the water can be used for agriculture. It depends on what the end use of this water is – for drinking or for toilet flushing or gardening.

Mr Karunakaran, an advisor for two NGOs felt that though the issues are being taken up very late, it is better late than never. Rather than looking at the system in compartments – the carriageway, the type of treatment and so on, it was time to view the system in a holistic manner that made it acceptable to the agency, to the community, to the manager, to everybody. A decision has to be made at the administrative level, whether district or state, that this is the integrated system that is to be adopted in this area and then work has to be done accordingly. Coming to the various types of systems, every system is good for the appropriate area. What is appropriate with limitations at the ground level has to be decided upon. For example, the system proposed by NEERI is fine, but decisions have to be taken about who is going to take care of it on a sustained basis and who is going to bear that cost. There the administration has to take a decision and act. Out of the cost projections made, 60% goes to electro mechanical component, which is a large chunk of the O&M costs. Who then is going to monitor the levels – the parameters for which the system is designed, for a period of 8-10 years. The total lifespan of such as system is only 8-10 years for the electro-mechanical component. This means that the local body has to be ready to replace all these components in 8-10 years. They do not have the capacity or technological expertise. And only if they are provided the budgetary support will they be able to accomplish this. Hence the whole thing has to be viewed from an integrated system approach.

Mr Paul Calvert pointed out that except the ecosan, all the systems will benefit if the fecal matter does not reach them. He said he was not able to understand the logic of flushing down fecal

matter and then trying to treat the water to remove it. Was it not better to avoid mixing the two in the first place?

Mr Subburaman agreed that awareness building was very important – despite building toilets many remained unused. For this, they had a film – ‘mudal idam’ or ‘first place’ which was shown, followed by exposure visits to communities which were already using ecosan toilets. They had also come up with the concept of ‘use and get paid’ toilets rather than pay and use toilets. They had also found that it is more difficult to manage men compared to women in the proper usage of toilets.

**Dr Santha Kumar** summed up saying that there had been a good discussion on various issues and the various treatment systems. Decisions would have to be taken based on ground realities and the process taken forward.

**Mr C.V. Sankar**, in his concluding remarks said that the deliberations had brought forth the various technologies and various issues had been raised during the discussions. There was no universal solution. He said that the TWAD board and other agencies executing the projects could provide information on why a particular decision was taken to the NGOs. If there were any changes to be made at the local level, these could be communicated and changes could be made accordingly. He said that he would send an official request to the TWAD board regarding this and requested the officials from the board present there to make a note of this and act accordingly. It was not absolutely necessary to follow exactly what the World Bank finalized as though the bank would give the money, the State government would ultimately repay it. However, it was not advisable to keep changing the decision matrix at this point because a final decision would never materialize. He had believed right from beginning that sanitation was the most difficult part of the reconstruction programme. The idea was to have a system that local bodies could take care of eventually. Initial work would have to be done by the state government and the implementing agencies. The governance issue was a very important one, and fisher panchayats being totally different from village panchayats added complexities to the issues. He had no issues against Ecosan and said that probably Mahatma Gandhi had the same ideas. However the population then and now were quite different and wondered if we had the luxury to experiment with this type of approach. If the method did not work, people would turn around and ask why this experimentation was tried with this type in this project. This was an area where NGOs needed to put in a lot of effort, he also called on donor agencies to set aside a portion of their funds for these activities and said that there were funds available from the government also to make the facilities widely available to people. It was not right to thrust some solutions on some people. He said that some experiments were also ongoing regarding the decentralized systems. The basic idea was to ensure that people have access to sanitation and there could be no compromising on standards. He personally felt that very good habitations have been created and there was need to involve the community more, as some organizations like SIFFS had done. Responsibilities have to be built into the system. He suggested that such meetings like today's be organized by NGOs at the district levels where the collector could chair the meeting and adequate participation from the communities ensured to share their views and get feedback.