

# IWA Conferences

## Design, construction and monitoring of domestic wastewater treatment systems in rural settlements in Brazil --Manuscript Draft--

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## **Design, construction and monitoring of domestic wastewater treatment systems in rural settlements in Brazil**

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**Abstract:** *Environmental sanitation in rural and also urban settlements is rather difficult due to the lack of access to knowledge and specialized professionals necessary for the implementation of techniques and solutions that guarantee better quality of life to families, decrease environmental impacts and are economically compatible to the families' income. The present study, through a participatory process involving families from a rural settlement in Brazil, implemented sanitation systems in households in a dynamic self-managed collective effort. The study is structured in the action-research methodology, based in social research designed. It was selected and constructed ecological sanitation systems that can treat the "black" and "gray" wastewater treatment in different units. During the operation, the systems present great acceptability and excellent performance in terms of removal of organic matter and solids.*

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### **Introduction**

Investments in sanitation of rural areas are still scarce. Environmental sanitation in rural settlements is rather difficult due to the lack of access to knowledge and specialized professionals necessary for the implementation of techniques and solutions that guarantee better quality of life to families, decrease environmental impacts and are economically compatible to the families' income, and thus contribute to the desired universalization of sanitation.

This study proposed the use of an alternative system for collection and treatment of domestic sewage different from traditional systems mostly because of its easy construction and maintenance. In addition, such systems also reflect our concerns with the environment, quality of life and the rational use of natural resources, based on the multiple dimensions of sustainability.

Currently, discussions on concepts, elements, strategies and experiences on more sustainable sanitation systems emphasize the interaction and inseparability of the

political, environmental, social, economic and cultural dimensions, considering the time and geographical levels.

Given the environmental, technical, economic and social dimensions, and the participation of the different actors involved, this paper aimed at the development and choice of ecological sanitation systems through a participative process with families of a rural settlement.

## **Material and Methods**

The study was carried out at the Olga Benário Rural Settlement located in the municipality of Visconde do Rio Branco, mesoregion of Minas Gerais state, Brazil, with geographical coordinates 21°00'36" South and 42°50'27" West.

The methodological basis of this study is the action research, which is a social research with an empirical basis conceived and performed in close association with an action or the resolution of a collective problem and where researchers and participants (representative of the situation) are involved in a participative or cooperative manner (Thiollent, 1996).

In order to describe the involvement of 29 families from Olga Benário settlement along the process, starting with the conception and construction of the ecological sanitation systems, didactic methods were used to assist the communication between researchers and the community and to help families understand the complexity of the problem.

The study was carried out in 3 stages in order to organize and plan the activities within the community and optimize the space-time of the research.

In the first stage of the research, in order to collect data regarding the current situation of each family, semi-structured interviews were performed based on the questionnaires. It was possible to observe the predominance of rudimentary systems for domestic sewage disposal with any treatment for such effluent, and also that the separation of domestic sewage between black water (from toilets) and grey water (other sources such as sinks and faucets) is already implemented.

Visits to the locals where families are settled in temporary homes enabled the identification of possible sources for contamination of the wells used for water supply. In order to consider this possibility, water samples were collected at strategic points for microbiological analysis. The Colilert<sup>®</sup> Test Kit (APHA, 2005) was used for the analysis of the fecal contamination indicator organism, *Escherichia coli*.

In addition, the considerable distance between the houses, an important variable to be considered, it was decided for "individual on-plot sanitation systems", where excreta and grey water are handled on the household plot.

The second stage of the research consisted of an activity that involved the whole community in order to demonstrate through illustrations and theoretical explanations the overall process of water contamination by excreta and also to present some types of sanitation systems.

With the information collected during the visits and focusing on environmental concerns and on effluent reuse, the ecological sanitation systems were chosen. These systems are covered in a more holistic manner if compared to traditional systems and the effluents are used as resources in a closed water and nutrient cycle (Werner et al., 2004).

The third stage of the research consisted of workshops which had the main objective to present construct process of the sanitation systems. Due to the reality of no investments and the current economic condition of the involved families, the

option was to apply the auto-construction. According to Jacobi (1998), the process of auto-construction basically meets certain social demands which are not satisfactorily supplied by other means. First, after the selection of the type of system, it was construed three experimental units in the settlement served as a way to materialize all the discussion about sanitation.

Settlers and researchers can be authors and constructors, as long as they participate on the dynamics of mutual aid proposed by the self-managed task-force which organize and re-qualify the construction process by adding the knowledge of the future residents and of the technical professionals involved, which sustains and feeds our proposals for action.

## Results and Conclusions

The results of the water quality analysis were able to alert and increase awareness of the families concerning the importance of giving a proper destination and treatment to domestic sewage. This fact was observed by the increased of families interest in discussing the possible sanitation technologies available. After these activities of explanation about the techniques available the community selected by vote the type of sanitation system, 53% decided for the evapotranspiration tank, although 35% do not feel secure to decide. Therefore, after a workshop developed main to explain the proper functioning of the selected system and to show the construction process, the interest and approval of evapotranspiration tank change to 93%. It was selected and constructed ecological sanitation units that treat “black” and “grey” wastewater separately. Evapotranspiration tank was used to treat the cloacal wastewater (black). Constructed wetland was used to treat the grey wastewater. The main reasons for this choice were the fact this system enables the reuse of the liquid effluent and the minimum maintenance requirements.

During the operation, the systems presented excellent performance in terms of removal of organic matter and solids. Removal above 90% of COD (chemical organic demand), BOD (biochemical organic demand) and suspended solids were achieved.

From this study it was possible to observe that the participative action research methodology as well as the access to knowledge and the great involvement of the settlers along the process increased their interest in sanitation systems constructed as a group. Compostable toilets still appeared as a good option due to previous experiences with such systems in a different occasion, and the evapotranspiration tank was chosen as the best option for reasons such as low construction and maintenance costs, more pleasant appearance, minimization of risk of contaminating water, and the fact that it enables effluent reuse e the handled “on plot” of grey water in low volumes through reuse.

It is also intended that for those involved, environmental concerns become more evident, as well as the complexity of this issue. The importance of it is not only immediately finding a solution but also developing a collective consciousness and autonomy in a socio-cultural context of generation and use.

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