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PROGRESS REPORT OF THE LATIN AMERICAN WORKING GROUP

" STRATEGIES FOR MANAGEMENT AND TREATMENT OF WASTEWATER "

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1. BACKKGROUND

Upon the conclusion of the Regional Meeting for Latin America of the Water Supply and Sanitation Collaborative Council, held in Quito, Ecuador, from october 16 to 18, 1996, it was decided to conform four Latin American working groups. One of them to deal with the " Strategies for the management and treatment of Wastewater".

Dr. Vicente Jonguitud, Vice-president of AIDIS of Mexico, offered himself voluntarily as coordinator of this group. Afterwards, that coordination was taken by the National Commission of Water (CNA) of Mexico.

The representation of ANDESAPA in this group was given to ACODAL of Colombia, and of CAPRE, to the Ministry of Health of Costa Rica.

2. BRIEF SUMMARY OF THE EXISTING SITUATION IN LATIN AMERICA IN RELATION TO COLLECTION AND TREATMENT OF WASTE WATER

Latin America comprises 19 countries occupying a surface area of 19'942.000 square kilometers wherein live 460'924.000 people.

It is estimated that the rural/urban migration that is so prevalent in Latin America has given rise to a proportional reduction in the rural population with respect to the urban population anticipated by the year 2000. A consequence of the rapid urbanization of the population has been the establishment of urban fringe areas on the periphery of existing cities without any planning of infrastructure and services. These marginal urban areas already harbor 40% of the urban population and are expected to absorb 80% of the population growth anticipated during the 1990s. As a result, their population will increase from 130 to 200 million inhabitants.

During the water supply and sanitation decade, new services of wastewater and excreta disposal were provided to 74 million people in the Region, increasing coverage by 7 points and bringing it to 66%. The extension of urban services barely kept up with the rate of population growth, with coverage increasing from 78% to 80%. The estimated coverage in 1995 is 85%.

The greatest headway, in relative terms, was made in the area of rural coverage, although it remains low. It rose from 22% in 1980 to 39% in1995. The goal for the decade was 37%. It may be necessary to revise these figures and take into account the disposal installations that are not operating or that have unutilized capacity. In comparison, the coverage of water supply services in 1995 reached 81, 89 and 56% respectively.

The unmet needs of wastewater and excreta disposal in 1995 in Latin Americ can be estimated on the basis of previous coverage figures, which indicate that a total of 128 million people lack adequate means of disposal, 58 million in the urban areas and 70 million in the rural areas.

Existing information on wastewater treatment installations in Latin America is limited. In 1962, it was estimated that in the served countries with the most coverage, less than 10% of the sewerage systems had treatment installations. Currently it is estimated that the situation has not changed significantly in regional terms, although several countries have made noteworthy efforts in this respect.

On the basis of the coverage data (1995) and assuming an average of 200 l/p/h of wastewater for the population that has sewerage and water connections, it can be estimated that 173 million inhabitants produce 405.5 m3/second, of which only between 20 and 40 m3/second receive some treatment. The urban population that has residential water without sewerage connections at a rate of 50 l/h/d would produce some 66.7 m3/second more wastewater. The total urban populations, estimated are 346 million, would produce 467.2 m3/second of wastewater. It is important to note that these figures should be considered only as indicators of the order of magnitude of the current and projected demand for wastewater treatment, since other factors also need to be considered such as the possible increase in the population which already has sewerage services, industrial use, and other sources of major discharges.

The treatment of urban wastewater poses an important challenge for the decision-making agencies as well as for the administrators and technical personnel in the countries, due to the problems related to natural resources, water supply, and other uses, the high cost of the treatment installations, and the lack appropriate policies and technologies that are adapted to the characteristics and particular situation of the countries of the region.

In brief, the foregoing provides a clear idea of the magnitude of the problems and the principal issues relating to water supply and sanitation in the Region. Despite the efforts exerted by the countries and the international support received, the problem has still not been fully dealt with so that in a relatively short period the existing deficit in coverage, in the quality and quantity of water supply, and the services of sanitary excreta disposal can be eliminated and the services extended to those who most need them. In addition, the data indicate that the situation in urban fringe areas is

very serious and should be given priority in the coming years. It is necessary for both the authorities and the community to participate in this effort.

3. ACTIVITIES CARRIED OUT BY THE MEMBERS OF THE WORKING GROUP

3.1 ACODAL carried out an International Forum in Cali, Colombia, from july 9 to 11, 1997, whose central theme was "THE COMPARISON AND THE COMPLEMENTING OF TECHNOLOGIES IN DOMESTIC WASTEWATER FOR MUNICIPALITIES "

In this forum were dealt topics such as : i) the state of the art and tendencies in Latin America; (ii) Behavior and efficiency of the biological treatment systems; (iii) Application of biological treatment systems; (iv) Management of sludge and odors control; (v) low-cost innovative systems-experiences; (vi) Long-term cost and sustainability; (vii) Anaerobic systems; (viii) UASB Reactors; (ix) Investment cost estimate for UASB reactors; (x) Analysis of investment and operation cost of wastewater treatment systems for small towns.

The general conclusions of this forum are presented as Annex 1 of this report.

3.2 Organized by CAPRE, ACODAL and the Costa Rica Institute of Aqueducts and Sewer Systems (AyA), the FIRST MEETING FOR CENTRAL AMERICAN, THE CARIBBEAN AND THE ANDEAN REGION ON TECHNOLOGIES FOR TREATMENT AND CONTROL OF EFFLUENTS, was held in San Jose, Costa Rica from August 6 to 8, 1997.

The principal objetives of this meeting were:

- *To know different technologies commercially available for the treatment of liquids effluents of any origin.*
- *To present several measuring equipments for adequate control of parameters in liquids effluent.*
- *To interchange experiences of different countries in the field of the legislation on liquids effluent.*
- *To know various investigations about the theme being carried out in different countries of America.*
- *To provide an environment of integration and support between professionals of the sector in Latin America.*

ANNEX 1

International Forum

THE COMPARISON AND THE COMPLEMENTING OF TECHNOLOGIES IN DOMESTIC WASTEWATER FOR MUNICIPALITIES

Cali, July 9 to 11, 1997

GENERAL CONCLUSIONS

This documents is a transcription of the reports that were presented to the organizers of the event on behalf of the selected moderators for each different topic of the program.

THE STATE OF THE ART AND THE TREND IN LATIN AMERICA

1. *A great interest was observed in solving doubts about primary advanced sedimentation, utilizing chemical DAF products and its variants. It was concluded that these were not utilized very much for wastewater and that each case in particular had to be studied, although is has been demonstrated in many cases that their present problems with sludge and that bacteria is not affected because the doses are not large and they favor coprecipitation.*

2. *For the implementation of any technological process of wastewater treatment, it is necessary to have clear policies of training in operation and maintenance of the systems that are constructed.*

3. *There arose the need to include in the debate of technologies the physical-clemical treatment, although, with what was discussed in the session, it was concluded that the application of flotation by dissolved air is not the most adequate solution for the treatment of domestic wastewater.*

4. *It is recommended to consider the consumption of water for domestic wastewater in a range between 200 to 250 l/h/d, aiming to give finacial viability to projects, as well as implementing policies for the reduction of water that obliges to lessen the actual consumption levels.*

5. *Although the automatization of plants is possible in small municipalities according to the avaible resources, it is indispensable to count on staff training first.*

AEROBIC PROCESS

6. *Aerobic treatment has had an ample development, plants have existed since 1912. This fact allows for the present technological development to present a large range of variables in conventional processes.*

7. *There exists a large number of variants in aerobic processes. Among the many variants, the process of activated sludge and percolator filters are the most utilized processes in Europe and the United States.*

8. *The number of variants is a direct result of having a high level of understanding of the fundamental principles that govern the process of stabilizing the organic matter by aerobic mechanisms.*

9. *This high level of understanding has allowed an improvement in joining the numerous variants of aerobic processes to specific requirements typical of the different applications for the treatment of domestic wastewater.*

10. *Aerobic processes provide a high level of reliability in the predictions of resultant output levels.*

ANAEROBIC PROCESSES

11. *The anaerobic treatment has had a trajectory of many years, specially applied in industrial and agricultural wastes. In the first case, the aerobic treatmemt implies the handling of sludge, which is carried out by aerobic and anaerobic methods. The wastewater that comes from the cleaning of stables in farms, has been traditionally handled by anaerobic digestors systems of high retention time level (30 or more days depending on the temperature).*

12. *What is interesting in the present anaerobic development is the application of this technology in the control of domestic wastewater with a low concentration level of organic waste through structures of low retention time (average of 6 hours).*

13. *The anaerobic processes comparatively need less external aids (for example: energy, chemical additives) and produce a lower quantity of residual sludge that requires an adequate disposal.*

14. *Although there exist a few variants in anaerobic processes, not many alternatives are considered at the present or are being adequatelly developed for the treatment of domestic wastewater*

15. *The recent arrival of anaerobic technologies is due in most of its part to the ability to separate the retention time of solids from the hydraulic retention time. This has enabled a considerable reduction in the volumes of reactors, and consequently, in the cost of their construction.*

16. *The UASB reactors have been successfully used in the anaerobic treatment of wastewater of domestic origin.*

17. *The bacterial quality of the effluent from the anaerobic systems is moderate because of the 6 hours hydraulic retention time, therefore, the need for a final desinfection was mentioned.*

18. *There exists the need to develop a greater understanding of the fundamental processes that govern the anaerobic systems in order to be able, in a more reliable way, to adopt the technology for medium to large scale applications (plants greater than 1m3/second)*

BOTH PROCESSES

19. *Both technologies aerobic and anaerobic, take in concern the control of other compounds apart from BOD and SS, this is why the presence and reduction of nitrogen and phosphorous is analyzed, the firts element being important in the quality of the receiving flow because of the additional demand of oxigen, and the second one because it helps in the eutrofication of lakes and ponds with the consequent deterioration in the quality of water and the accelerated aging of the resource.*

20. *The importance in presenting one or the other technology is based on the feasibility of complementing both systems for the treatmernt of domestic wastewater.*

21. *There exist disadvantages in both systems, these are being considered by investigators in each trend so as to mimimize their effect and to transform these limitations in opportunities. In the case of high operating costs and the maintenance of aerobic systems, this is compensated with high efficiencies in the quality of treated water. In the same way, the anaerobic system presents lower costs in construction as well as in operation, but gives place to lower efficiencies, therefore needing the implementation of a post-treatment .*

APPLICABILITY OF BIOLOGICAL TREATMENT SYSTEMS

22. *Although there exists a much greater experience in aerobic treatment than in anaerobic treatment, it can be concluded that the state of the art of both technologies permits their usage in projects of domestic wastewater treatment.*

23. *While the aerobic treatment projects can be designed and carried out for any volume of water, the anaerobic treatment is considered for medium scale projects with a modular handling, providing that this is a competitive alternative in comparison to the aerobic treatment in terms of cost benefit and the capacity of fare payments. In the same way, an adequate handling of odors has to be made since there exists at the present time suitable technology for this.*

24. *In the process of aerobic treatment, the technology of activated sludge is the most widely used, specially with its high rate variants, conventional and of extended aeration.*

25. *The aerobic and anaerobic technologies cannot be compared since they handle different results in the efficiency of removal; while in an aerobic treatment the efficiency in terms of BOD can reach 95 to 96%, for the anaerobic process the values vary between 60 to 80% for the same parameter.*

26. *As a result of the above statement, the anaerobic treatment is an intermediate technology in terms of efficiency and the removal of organic matter, but with very low operation and maintenance costs.*

27. *Any type of biological treatment does not significantly remove pathogenic microorganisms, except for pools used for stabilization that specifically include this handling in their design.*

HANDLING OF SLUDGE AND ODOR CONTROL

28. *Anaerobic plants generate 3 to 5 times less sludge than aerobic plants, and have the characteristic of being more dense (2 to 8% of TS) and stabilized. This permits, in comparison with aerobic systems, to save in the first two links of the traditional chain in the treatment of sludge: denseness and biological stabilization.*

29. *In aerobic plants, the handling of sludge represents approximately 10% of the flow, 50% of the cost of the treatment of wastewater, and 90% of headaches. Sludge from primary sedimentation (very diluted 0,5%) and activated sludge (less diluted, 3%) are usually treated as a whole, but the optimum technical solution would be to digest the first one in anaerobic digestors and the second one in aerobic digestors. The biological digestion of sludge permits a 40 to 50% reduction of its volatile solids.*

ODORS

30. *Odor is a common factor in both types of plants, but of greater intensity in anaerobic plants (as a result of the reduction of sulfates to sulfides).*

31. *Initially, when new tecnologies emerge, not much attention is given to the topic of odors, trying to limit costs to a minimun. Although the measuring of odors can become somewhat subjective, its effect is determinant in the acceptance of the plant by the community. Besides this, there exists the risk of corrosion of materials caused by H2S and the value loss of adjacent lands.*

32. *The methodology to solve the problem of odors is:*
    a) Control at the source.
    b) Control in the liquid phase.
    c) Control in the gaseous phase.

33. *From the UASB plant in Bucaramanga (240.000 inhabitans) a study was presented on the mitigation of odors consisting in the application of iron salt in the reactors in order to precipitate sulfides, as well as implementing a potent system for the extraction of odors in sedimentation zones and chemically treating them with hypochlorite and soda. To diminish these odors, it is necessary to carry out a high initial investment, as well as in the permanent operation of the plant.*

34. *From the UASB plant from the VIVERO in Cali, a successful experience was presented in the control of odors, avoiding turbulence, covering the structures and burning odors in a biogas torch, as well as additional investigations in progress, dealing with the use of filters in the gaseous flow as an emergency system in the case the torch extinguishes for any reason.*

LOW COST SYSTEMS-EXPERIENCES

35. *Successful experiences exist around the world dealing with the reutilization of municipal wastewater, specially in agriculture. Israel and Mexico are among some of these experiences.*

36. *In Colombia, reutilization is not applied very much, but there exists a great potential for this, for example the Cauca Valley which holds extensive zones dedicated to agriculture.*

37. *An agreement has not been reached over the maximum size in UASB.*

38. *The anaerobic technology has to be considered as part of the global treatment in the process of domestic wastewater. It has very important advantages, as is the savings in the processing of sludge.*

39. *In any project that deals with descontamination of water, the type of technology should never be defined a priori ; an analysis of alternatives should be carried out first, one which considers technogical, financial and cultural aspects.*

40. *The aerobic and anaerobic treatments, more than competitive alternatives, they are complementary technologies.*