

# **INTEGRATED WATER RESOURCES MANAGEMENT: RESTORATION OF WATER QUALITY IN WATER RESOURCES FROM DEVELOPING COUNTRIES**

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Water is most essential but scarce resource in developing countries. Presently the quality & the availability of the fresh water resources is the most pressing of the many environmental challenges on the national horizon. The stress on water resources is from multiple sources and the impacts can take diverse forms. Geometric increase in population coupled with rapid urbanization, industrialization and agricultural development has resulted in high impact on quality and quantity of water in developing countries. The situation warrants immediate redressal through radically improved water resource and water quality management strategies.

## **Reuse/recycling of treated domestic sewage:**

□ Cities/towns discharging wastewater should treat the wastewater suitably for land application and dispose of such water on land to the maximum extent possible. In cases where wastewater is to be discharged into a water body, the degree of treatment will have to be higher, keeping in view the low quantity of available water for dilution and abstraction points downstream, etc.

□ If the city does not have adequate land for irrigation due to increased urbanization, the neighboring states may be approached. The fresh water so saved from irrigation could be utilized for meeting the drinking water requirements or for ensuring minimum flow in river.

□ It is felt that the dilution of effluents is not a practical and economically viable solution to the problem that domestic and industrial effluents be adequately treated for re-use, for irrigation, industries, etc.

□ Where irrigation from treated sewage is not feasible, the possibility of recharging ground water aquifer by sewage, treated to a certain desirable level, may be explored by taking up some experimental studies.

## **Water Conservation**

**Incentives for Water conservation:** If water is available in abundance, there is a usually tendency to use it carelessly. Along with the measures towards pollution abatement it is imperative to further intensify our efforts for conservation of water to prevent water scarcity in surface water sources and ground water depletion. Price of water should reflect its scarcity value and environmental costs. It is very important to reduce water use through pricing. The need is to develop surface irrigation sources and take measures for rainwater harvesting and

preventing water run-offs. There is no doubt that water harvesting is a highly desirable solution but it is an iota solution to a holistic problem of water scarcity.

**Wastewater as a resource:** Since, there is no dilution available in the receiving water bodies, it is important that no wastewater is discharged into them even after treatment. The efforts should be to use entire wastewater after proper treatment. There are many cases where the sewage or industrial wastewater is treated and used for various inferior uses. Many companies are coming in this business. Focus should be to promote such business. This will benefit the water quality in many ways: 1. reduce pollution 2. save water 3. save nutrients 4. reduce over-exploitation of water resources.

**Wastewater Use in Agriculture:** The incorporation of wastewater use planning into national water resource and agricultural planning is important, especially where dilution water in the receiving water bodies shortages exist. This is not only to protect sources of high quality waters but also to minimize wastewater treatment costs, safeguard public health and to obtain the maximum agricultural and aquacultural benefit from the nutrients that wastewater contains. Since in most of the urban centres, treatment plants either do not exist or not adequate. Wastewater use may well help reduce costs, especially if it is envisaged before new treatment works are built, because the standards of effluents required for various types of use may result in costs lower than those for normal environmental protection. The use of wastewater has been practiced in many parts of the country for centuries. Unfortunately, this form of unplanned and, in many instances unconscious, reuse is performed without any consideration of adequate health safeguards, environmentally sound practices or basic agronomic and on-farm principles.

**Prevent pollution rather than control:** Past experience has shown that remedial actions to clean up polluted water bodies are generally much more expensive than applying measures to prevent pollution from occurring. Although wastewater treatment facilities have been installed and improved over the years in many parts of the country, water pollution remains a problem. In some situations, the introduction of improved wastewater treatment has only led to increased pollution from other media, such as wastewater sludge. The most logical approach is to prevent the production of wastes that require treatment. Thus, approaches to water pollution control that focus on wastewater minimization, in-plant refinement of raw materials and production processes, recycling of waste products, etc., should be given priority over traditional end-of pipe treatments. For water pollution originates from diffuse sources, such as agricultural use of fertilizers, which cannot be controlled by the approach mentioned above. Instead, the principle of "best environmental practice" should be applied to minimize non-point source pollution.

**Apply the polluter-pays-principle:** The polluter-pays-principle, where the costs of pollution prevention, control and reduction measures are borne by the polluter, is not a new concept but has not yet been fully implemented, despite the

fact that it is widely recognized that the perception of water as a free commodity can no longer be maintained. The principle is an economic instrument that is aimed at affecting behavior, i.e. by encouraging and inducing behavior that puts less strain on the environment. Examples of attempts to apply this principle include financial charges on sewage generated by urban population, industrial waste-water discharges and special taxes on pesticides. The difficulty or reluctance encountered in implementing the polluter-pays principle is probably due to its social and economic implications. Full application of the principle would upset existing subsidized programmes (implemented for social reasons) for supply of water and removal of wastewater in India. Nevertheless, even if the full implementation of the polluter-pays-principle is not feasible at present, it should be maintained as the ultimate goal.

**Balance economic and regulatory instruments:** Until now, regulatory instruments have been heavily relied upon. Economic instruments, typically in the form of wastewater discharge fees and fines, have been introduced to a lesser extent. Compared with economic instruments, the advantages of the regulatory approach to water pollution control is that it offers a reasonable degree of predictability about the reduction of pollution, i.e. it offers control to authorities over what environmental goals can be achieved and when they can be achieved. A major disadvantage of the regulatory approach is its economic inefficiency. Economic instruments have the advantages of providing incentives to polluters to modify their behaviour in support of pollution control and of providing revenue to finance pollution control activities. In addition, they are much better suited to combating nonpoint sources of pollution. The setting of prices and charges are crucial to the success of economic instruments. If charges are too low, polluters may opt to pollute and to pay, whereas if charges are too high they may inhibit economic development. Against this background it seems appropriate, therefore, to apply a mixture of regulatory and economic instruments for controlling water pollution.

**Establish mechanisms for cross-sectorial integration:** Since water quality management is related to many sectors, their involvement is very crucial in implementing various policies and regulations. In order to ensure the co-ordination of water pollution control efforts within water-related sectors, a formal mechanisms and means of co-operation and information exchange need to be established.

**Encourage participatory approach with involvement of all relevant stakeholders:** The participatory approach involves raising awareness of the importance of water pollution control among policy-makers and the general public. Decisions should be taken with full public consultation and with the involvement of groups affected by the planning and implementation of water pollution control activities. This means, for example, that the public should be kept continuously informed, be given opportunities to express their views, knowledge and priorities,

and it should be apparent that their views have been taken into account. Various methods exist to implement public participation, such as interviews, public information sessions and hearings, expert panel hearings and site visits. The most appropriate method for each situation should take account of local social, political, historical, cultural and other factors. Public participation may take time but it increases public support for the final decision or result and, ideally, contributes to the convergence of the views of the public, governmental authorities and industry on environmental priorities and on water pollution control measures.

**Give open access to information on water pollution:** This principle is directly related to the principle of involvement of the general public in the monitoring, decision-making process, because a precondition for participation is free access to information held by public authorities. Open access to information helps to stimulate understanding, discussions and suggestions for solutions of water quality problems.

**Promote interstate co-operation on water pollution control:** Trans-boundary water pollution, typically encountered in large rivers, requires interstate co-operation and co-ordination of efforts in order to be effective.

Lack of recognition of this fact may lead to wasteful investments in pollution load reductions in one state if, due to lack of cooperation, measures are introduced upstream that have counteractive effects. Permanent interstate bodies with representatives from riparian states can be established, with the objective of strengthening interstate co-operation on the pollution control of the shared water resources.

**Economic Instrument for Pollution Control:** Besides the 'command and control' regulatory mechanism the government should introduced major economic incentives for pollution abatement in developing countries, not as alternative to regulation but only as a supplementary measure. A water law should be introduced, empowering the state pollution control boards to levy a cess on local authorities supplying water to consumers and on consumption of water for certain specified activities. The Law also should provide for a rebate on the cess payable if the person or local authority concerned installs a plant to treat sewage or trade effluent. Besides the Water Law, efforts have to be made to introduce and implement the Zero discharge concepts, which would enhance recycle and reuse of effluent discharge.

**Waste minimization and clean technologies:** It may be noted that by recycling techniques the waste concentrations may increase, however the total load remain the same. The concentration of waste strength would help the economical conversion of spent wash to biofertilizer.

Waste strength reduction can be achieved by adopting in plant control measures such as reduction of spillages of wastes, elimination of process failures, use of proper equipment for handling and dry cleaning techniques etc. This is often termed as clean technologies; it does not add to the cost of production, in fact

industry gains from it. Innovation in pollution prevention/waste minimization efforts on the part of the industries needs to be sternly promoted.

All organic wastes are best source of energy. A number of anaerobic technologies are now available for treatment of organic industrial effluents. Spent wash, black liquor (pulp mill), dairy effluents, sugar factory effluents and press mud etc. are some of the organic wastes tried for energy recovery. The energy recovery will incidentally solve the air pollution problem, as biogas is a cleaner fuel compared to baggasse, rice husk or coal. It is essential to introduce energy audit in all the industries so hat cost-benefit ratio can be established in each case.

Bio-fertilizers are now prepared from organic rich wastes by admixing filler materials. Spent wash is converted to manure by addition of press mud, bagasse cillo, agricultural residues etc. In this technology the entire liquor effluent is converted into solid mass and it can be termed as "Zero-discharge" technology.

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