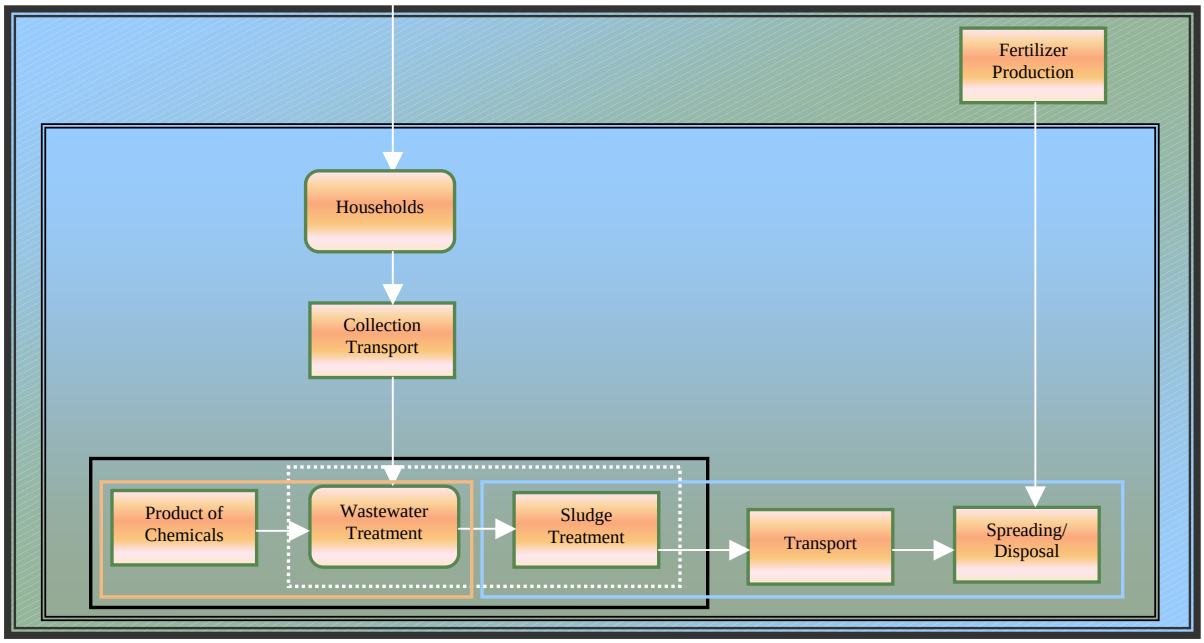
National Decentralized Water Resources Capacity Development Project

Executive Summary



Methods for Comparing Wastewater Treatment Options

Oceans Arks International
Burlington, Vermont

April 2005

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Submitted by
Ocean Arks International
Burlington, Vermont

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National Decentralized Water Resources Capacity Development Project (NDWRCDP) Research Project

Final Report, April 2005

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DISCLAIMER

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ABSTRACT

Present methods used in the US for evaluating the consequences of wastewater treatment systems typically use economic criteria and environmental criteria which only take into account the direct effect of effluent on receiving waters, disregarding indirect and cumulative economic and environmental effects. As a result, the true environmental and social costs of wastewater treatment are often not included in decision making.

Many communities face decisions regarding centralized versus decentralized wastewater treatment as well as numerous strategies and technologies available within the centralized and decentralized sectors. In this report, analytical tools and methods are evaluated that have the potential to capture the environmental consequences of such wastewater alternatives in non-monetary units for US communities. Methods are classified into the broad methodologies of environmental impact assessment (EIA), open wastewater planning (OWP), and life-cycle assessment (LCA).

- EIA is a framework for identifying, predicting, evaluating, and mitigating the biophysical, social, and other effects of proposed projects or plans and physical activities
- OWP is an approach to wastewater decision making that broadens the boundaries of options considered and expands typical evaluation criteria to include indirect environment impacts
- LCA is a method of accounting the environmental impacts of a product, service, or process over the course of its life cycle from extraction of materials to disposal or reuse of the final product

EIA, OWP, and the following LCA methods are examined in detail:

- Eco-indicator 99 (EI 99), an LCA method with a high level of aggregation based on the International Standard Organization (ISO) 14000 guidelines
- The Sustainable Process Index (SPI), an ecological evaluation system that characterizes mass flows by their use of solar energy
- TRACI, an ISO-based method created by the United States Environmental Protection Agency (US EPA) for evaluating the potential environmental and human health impacts of processes under US conditions
- URWARE, a material and energy flow analysis and assessment method used by wastewater researchers in Sweden

The strengths and weaknesses of each method are described. One of the greatest barriers to using each method is the amount of data required. Ways to streamline data needs while still reliably answering central questions about wastewater treatment alternatives are described.

Potential users of the methods examined include state, local, or city policymakers, non-profits concerned with environmental protection, and ”green building” certifiers. Some methods would be of interest in regions of the US where land-use and economic development planning are becoming more important, where recharging groundwater is a priority, or where sustainability is a broad goal.

The following were determined from the evaluation of methods:

- Of the methodologies, EIA and OWP are broader frameworks for assessment and planning, within which LCA methods may be used to more completely account impacts,
  - OWP was developed specifically for wastewater decision making and offers more flexibility in the breadth and depth of analysis and formality.
  - EIA is already in use in the US for wastewater treatment, but it is not clear how much it affects choice of treatment alternatives.
  - LCA is currently most suitable for policy-level studies, and requires a significant investment in data development to be useable in the US.
- URWARE is an advanced material and energy flow analysis tool developed for modeling complex waste and water treatment scenarios but characterizes impacts for European conditions
- Combining the inventory of life-cycle data generated within URWARE with the US-specific impact characterization of TRACI would provide for in-depth analysis and assessment of the environmental and social impacts of US wastewater treatment options
- EI 99 could be used in place of TRACI if aggregation of impacts into a single ecological indicator were desired; however, like URWARE, the impact characterization is modeled on European conditions
- SPI also provides aggregation into a single indicator of sustainability. It does not provide as detailed of an analysis of impacts as do EI 99 and TRACI, which permits less investment in data gathering

The following next steps are among those recommended:

- Imitate national demonstration projects that apply LCA to local decisions, followed by an evaluation of how the data generated could be used in future decisions and how future LCAs could be simplified
- Investigate whether and how EIA information generated under NEPA or the corresponding state laws affects choice of wastewater treatment alternatives

- Use OWP also as the subject of demonstration projects in communities
- Communities espousing sustainability should immediately adopt a process similar to OWP for their wastewater planning
- Generate a longer list of potential parameters to use in evaluating wastewater treatment options and use it to direct the use of the more open-ended, less formal OWP approach

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