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Design for Waste-Management System

The design of effective water-recovery and solid-waste processing systems is an ever-present challenge in today's technology. Much of their development has been in heavy industry, the major consumer of natural resources and, consequently, the major producer of waste. With so much attention focused on industry, however, there is a tendency to overlook residential communities, also coping with their water and waste-disposal problems. On a smaller scale are apartment houses, which must deal with their water and waste as an integral part of the community effort.

In this context, a study was made, and a system defined, for water-recovery and solid-waste processing for a low-rise apartment complex, consisting of 500 units or 2000 occupants. This system can be modified to conform with the unique requirements of a community, including hydrology, geology, and climate.

The proposed design incorporates the following:

1. Water conservation: Vacuum lavatories, flow limiting devices, and front-loading clothes-washing machines.
2. Direct reuse: Dish and clothes rinse water reused for subsequent wash cycles.
3. Water-waste collection and transport: Separate vacuum collection and transport of gray and black water using a common vacuum source.
4. Waste-water processing:
   a. Separate incineration of concentrated black water and refuse, with heat recovery for power generation.
   b. Subsurface gray-water irrigation in growing seasons – treatment to potable quality for limited household reuse during the remainder of the year.

Water-recovery requirements are minimized by reducing household use, and by recycling only when there is no need for water of less-than-potable quality.

According to the system design, black water is concentrated in vacuum lavatories, transported directly to vacuum receivers located in the center of the community, and incinerated on a more or less continuous basis. Gray water is accumulated in each apartment building and transported periodically to separate central vacuum receivers. Each apartment is also equipped with a tube settler, designed to separate solids and grease and discharge them periodically to black-water vacuum lines. Gray water then is pumped to a small storage pond or tank. A spreading basin is provided also, to accommodate periods when the gray-water supply exceeds the demand.

During growing seasons, landscape irrigation requires a greater quantity of water than the community consumes. As a result, gray water is directed during these periods to a subsurface irrigation network. During periods when irrigation is not required, gray water is directed to reclamation equipment where it is treated to potable quality and reused for clothes washing and bathing. Reclamation is accomplished by a treatment process that features reverse-osmosis membranes.

(continued overleaf)

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Note:

The following documentation may be obtained from:

National Technical Information Service
Springfield, Virginia 22151
Single document price $3.75
(or microfiche $1.45)

Reference: NASA CR-128857 (N73-19158), Volume I, Study of Water Recovery and Solid Waste Processing for Aerospace and Domestic Applications.

Single document price $12.75
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Reference: NASA CR-128858 (N73-19159), Volume II, Study of Water Recovery and Solid Waste Processing for Aerospace and Domestic Applications.

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NASA has decided not to apply for a patent.

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R. Renman of
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