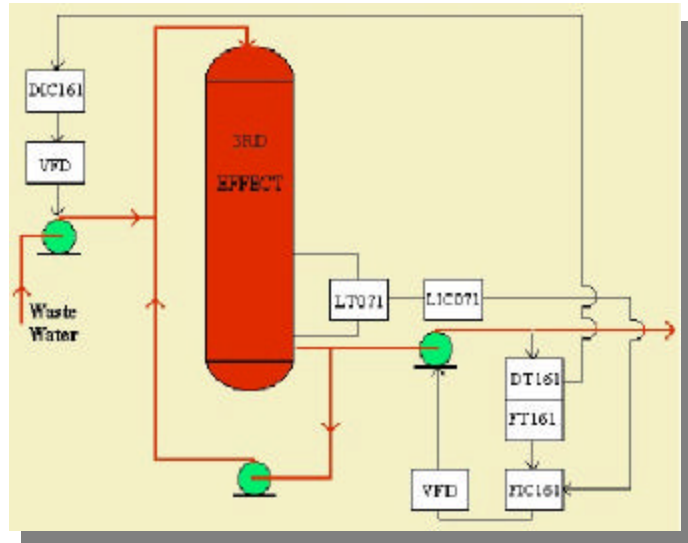


# Model-Free Adaptive Control on Evaporators

<i>Use of MFA Control</i>	<i>Benefits</i>
Manipulates inflow and outflow simultaneously.	Improves density control by at least 50% reduction in variability.
Reduces over-drying the slurry.	Steam consumption is reduced.
Enables evaporator to be started and maintained in automatic control.	Allows flexible production and reduces load disturbances on the steam generation system.
Reduces product density variation.	Product quality and production efficiency is improved.
Improves efficiency & productivity.	Full investment is returned in months if not weeks.



A multivariable MFA controller in CyboCon software quickly and tightly controls density and level by manipulating inflow and outflow simultaneously. An MFA constraint controller protects the evaporator level from running too high or too low.



## Case History: Model-Free Adaptive (MFA) Control Tames Zero-Discharge Wastewater Treatment at Tri-Valley Growers, Madera, CA, reported in Control Magazine

Tri-Valley is a zero discharge plant, and processes its wastewater through a three-effect evaporator to concentrate solids. In the first effect, the water starts to evaporate. The second effect achieves high density. The third effect produces a sludge solid, evaporating water so it can be reused.

The two main variables to be controlled are outlet water density, which controls density of the solid, and the wastewater level in the evaporator. The two manipulated variables are the inlet and discharge water flow rates. Both affect water density and level. The process is, by its nature, a multi-input, multi-output (MIMO) system.

The old system, using three PID controllers, was difficult to start up and

maintain in automatic control, and the density loop frequently oscillated.

"The MFA controller is well-suited to this type of application since it does not require a process model, and can perform both adaptive and multivariable control," says Steve Smialkowski, process control engineer. "It enables complex processes to be controlled without quantitative process knowledge and identification, and eliminates the need for controller design and complicated manual tuning."

Smialkowski reports that a new multivariable control system using MFA improves evaporator control. Unlike traditional self-tuning or model-reference adaptive control systems, MFA is as simple as a basic feedback control system. There is no model or identification mechanism in the MFA system. For con-

figuration, only qualitative information such as the process acting type and process time constant are required. The system allows operators to switch between PID auto, manual, and MFA control modes with bumpless transfer. If a PC goes down, the PLC assumes control.

"By implementing MFA, Tri-Valley Growers has achieved much better evaporator control performance," Smialkowski says. "Commissioning was completed in one eight-hour business day."

The MFA controllers took over the control without any bumps to the system. The evaporator can now be started and maintained in automatic control mode, and the process variables reach their setpoints quickly with little overshoot. Smialkowski says, "The system stability margin has been significantly increased, and variation in product density has decreased more than 50%."