

WATER REDUCTION PERFORMANCE SUPPORT SYSTEM FOR THE POULTRY INDUSTRY

John A. Pierson

AUTHOR: Research Engineer, Georgia Tech Research Institute, 151 6th Street, Okeefe 039, Atlanta, Georgia, 30332

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Abstract. Numerous water reduction studies have been completed for poultry processing facilities. Methodologies for conducting in-house water usage audits and developing subsequent reduction strategies are not readily available to processors, however, without technical assistance visits.

A software consultation program has been developed to guide the poultry processing plant engineer, facility manager or designated individual with developing a water reduction strategy. This paper discusses a software program blueprint designed to assist with diagnosing possible sources of excessive water consumption while also providing assistance on how to identify, measure and correct losses.

INTRODUCTION

Georgia's growing economy has fueled a rapid population increase along with industrial growth. The resulting consumer and industrial demands upon Georgia's water resources have thus greatly increased water usage and wastewater discharge volumes. Of the approximately 2,300 million gallons of water per day used in Georgia during 1990 for non-power generation activities, industrial facilities accounted for only 31% of the total, with usage roughly split between ground water and surface water withdrawals. Public supply and agricultural activities accounted for the remaining 42% and 21%, respectively, with domestic and commercial well water accounting for the final 6% (State Geological Survey, 1992).

Although industrial users account for only one-third of the state's water use, regulatory requirements to date have focused on industrial versus domestic users. Federal regulations have required state agencies to tighten wastewater discharge levels to maintain, and in many instances, regain higher water quality for continued support of the state's growth and for preservation of the natural environment. Industrial facilities are heavily impacted by these actions because their operations are generally focused upon production versus water usage or wastewater treatment. Regulatory actions, coupled with the increasing urbanization of the state, make it paramount that future industrial water resource management strategies or activities include solutions that address water usage along with the traditional focus upon wastewater pretreatment.

Water Conservation Research

Research related to food processing facility water conservation has been derived primarily from numerous in-plant studies.

Available information consists of case studies detailing general approaches for assessing water usage and/or methods for managing water reduction efforts. Shober (1990) outlined procedures implemented at a variety of food processing facilities that resulted in increased water conservation, reduced wastewater strength and substantial returns on investment. One poultry processing plant obtained a 50% reduction in water use, improved wastewater treatment efficiency and derived annual savings of approximately \$35,000.

The overall impact of closely monitoring water usage and employing reduction strategies is even more pronounced for large facilities. Merka (1990) reported a poultry processor reduced water use by 1.75 gallons per bird and realized an annual water savings of \$360,000.

Because of wastewater pretreatment requirements, however, the majority of water conservation investigations have occurred indirectly as a result of significant efforts to quantify waste characteristics and sources before attempting to manage final plant effluent controls. Carawan (1989) highlighted the tremendous cost savings possible throughout various types of food processors from pollution reduction. Richardson (1990) further stressed the need to effectively inform and manage people with regard to waste reduction to improve effluent quality. Merka (1990) noted that by analyzing the sources of waste loadings with regard to permitted contaminants, processors could greatly improve effluent quality.

In addition, water reduction studies have been completed at poultry processing facilities by technical assistance sources. These studies have highlighted water reduction techniques specific to the processors. Carawan *et al.* (1994) conducted a workshop highlighting a summary of water conservation practices, water volume measurement techniques and waste minimization findings for the poultry processing industry.

The Need for Enhanced Water Conservation

Technical assistance personnel from both the University of Georgia and the Georgia Tech Research Institute (GTRI) have historically assisted various processors with conducting water use audits. With over thirty primary processing facilities located throughout the state of Georgia, however, on-site visits can be time consuming and laborious. Additionally, personnel transfers and turnover have required frequent visits to each facility.

The work to date has demonstrated that approaches for conducting in-house water use audits and developing subsequent reduction strategies were not readily available to processors

without technical assistance visits. The poultry processing industry required an in-house capability for ensuring water reduction plans remained viable long-term.

PROGRAM INITIATIVE

To address these deficiencies, a self-audit software consultation program for water reduction strategies was developed. This program was designed to guide the operator, plant engineer or facility manager in diagnosing possible sources of excessive water consumption while providing assistance on how to identify, measure and correct losses. The software program:

- assists the user with quantifying the water balance in/out of the facility;
- helps the user to identify opportunities to reduce water usage;
- provides recommendations on how to implement changes.

Applications Approach

The water reduction performance support system (WaRP) software package allows a plant engineer or other facility personnel to perform the water audit without on-site assistance. In a common scenario, when a processor requests assistance with a facility water usage problem, WaRP is forwarded to the facility engineer. The system guides the plant engineer through the common steps and decisions needed to evaluate water usage.

Once the water audit is conducted, the facility's results are compared against the current industry standard, normalized per bird processed. Additionally, based upon applicable water and sewage rates, an estimate is provided of savings that could be achieved if the industry standard were met. This allows the user to determine capital available to reduce water usage levels.

Common best management practices (BMPs) are also provided to assist the user in implementing techniques for reducing water usage. Because a common frame of reference is being used, if questions arise at any time throughout the process, the plant engineer can contact a GTRI environmental engineer and quickly address issues. The GTRI engineer can also visit the facility as requested.

WaRP Software Program

WaRP can be applied to IBM-compatible PC or MAC computer environments. The program generally requires 8 MB of RAM and approximately 5 MB of hard drive space. Future versions will require a CD-ROM because of graphics and video capabilities.

Several pieces of information are needed to accurately complete the water audit. This information is divided into Necessary Information and Optional Information. The Necessary Information tailors the water audit to the facility. The Optional Information increases the accuracy of the results. While the Necessary Information must be provided, default values based upon the industry averages are already included in the Optional Information. All information provided must correspond to the same time period. Table 1 details the Necessary and Optional information.

Table 1. WaRP Input Information

Necessary Information	Optional Information
Recent Water Bill	Offal % of wastewater total
Sewage Bill	Yield in pounds per process bird
Number of birds per day	% Bird Uptake of processed Water
Cost per CCF of water	% Fresh Product
Cost per CCF of	Pounds of ice per 70 lbs sewage of fresh product
Processing Days	Total tons of cooling per month tower capacity
Well water usage	Total boiler horsepower
CCF is 100 cubic feet, or 748 gallons	

The program provides summary details which include:

- unaccounted gallons of water per day;
- percentage losses of incoming flow;
- gallons used per bird processed;
- dollar savings if water usage were reduced to 4 gallons per bird processed.

Also, WaRP includes *Quick Tips for Water Reduction*. This section summarizes information gathered from both published work and technical assistance visits. An important feature includes a general format for developing an in-house *Water Team* so that facilities can enhance institutionalizing water reduction strategies.

RESULTS TO DATE

An essential short-term portion of this effort has been the conduct of in-plant visits and consultations to validate the general water reduction strategies. Additionally, on-site process and unit operation observations have identified potential additional water reduction techniques or areas for research. Finally, on-site visits have helped tailor the WaRP system to the appropriate level detail needed to assist all processors, provided flexibility to address individual, process specific issues, and also served as a tool for bench marking facility water usage against the poultry processing industry.

Future Efforts

Near term efforts are concentrated on continuing to (1) catalogue general, established water reduction strategies currently

used in the poultry industry; (2) build the database of default values for water usage in current poultry processing operations; (3) assist poultry processing facilities with incorporating water reduction strategies into daily operations. To accomplish these tasks, WaRP is being fielded and demonstrated throughout the state of Georgia.

Longer term efforts will include (1) developing a Windows®- based program which allows the user to easily model their process, enter measurements and other information into the system, and analyze information entered into the system; (2) integrating the WaRP software with Factory Automation Support Technology (FAST) wearable computer; (3) expanding WaRP's capabilities to include broader environmental management system data collection and audit capabilities.

CONCLUSIONS

The poultry processing industry will continue to be impacted by increased urbanization of the state, changing regulatory requirements and competitive pressures of the global marketplace. It is important that future industrial water resource management strategies or activities include solutions that address water usage along with the traditional focus upon wastewater pretreatment.

The Water Reduction Performance Software System (WaRP) provides the poultry processing industry a tool for conducting in-house water use audits and developing subsequent reduction strategies previously unavailable to processors without technical assistance visits. Additionally, WaRP assists poultry processing facilities with incorporating water reduction strategies into daily operations. And in the future, WaRP will provide the industry expanded capabilities to include broader environmental management system data collection and audit capabilities.

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Project Team

The field work for this project will involve visiting numerous facilities throughout the state. The project team has worked with Matt Brass, facility engineer, and Ken Long, Complex Manager, for Seaboard Farms, Canton, Georgia. Additionally, Georgia Tech personnel included Chris Treanor, Jim Walsh, and Chris Thompson. Students involved included Jennifer Ockman, Joselyn Hoffman, Nelse Hansen, Jonathan Strickland and Caroline Fitzpatrick.

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