Water Conservation in Poultry Processing

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Water has been used in poultry processing as a medium of great convenience for transport, heat transfer and sanitation. However over the past 25 years, the cost of this convenient medium has increased more rapidly than any other cost in poultry processing. In the past twenty-five years labor rates have increased by three to four times, fuel costs by four to five times and water and sewage treatment costs by five to ten times. Broiler prices have about doubled during this same period. There is little a processor can do to prevent these increases, however, costs can be reduced by using less water.

To conduct a successful water conservation program there should be:

1. Commitment by management
2. Knowledge of water use by the plant
3. Continued management emphasis

COMMITMENT BY MANAGEMENT

The key to reduction in water use is commitment by management. Unless there is this commitment, little will be done to reduce water use. Does a commitment to water conservation make economic sense for your plant? In
some cases, additional water conservation efforts may produce little return but in others water conservation may reduce costs more than any other single item.

Table 1. Comparison of Water and Sewage Costs

<table>
<thead>
<tr>
<th>Cost of Water and Sewage (1000 gals.)</th>
<th>Gallons Per Bird</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>3.5</td>
</tr>
<tr>
<td>$1.00</td>
<td>0.35¢/bird</td>
</tr>
<tr>
<td>$2.00</td>
<td>0.70</td>
</tr>
<tr>
<td>$4.00</td>
<td>1.40</td>
</tr>
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</table>

Table 1 shows the water and sewage cost per bird at various water and sewage rates and water uses. If a processor is using 9.5 gallons per bird in a high water and sewage rate area, water conservation can probably reduce costs more than any other cost-cutting activity. A plant using 3.5 gallons per bird has already committed the effort and resources to water conservation and needs only to monitor and fine tune the system.

There is always concern that reduction in water use will increase waste strength and that increased waste treatment cost will offset savings from water conservation. Literature reports and field observations indicate that the opposite seems to be true. When attention is given to water conservation, attention will also be given to waste loading. Carawan et al. (1974) studied the water use and waste loading patterns of a broiler processing plant. Their initial study showed a water use of 12.9 gallons per bird and 0.06 pound of Biochemical Oxygen Demand (BOD₅) per bird. After conservation measures were instituted, water use was reduced
to 8.7 gallons per bird and BOD₅ was reduced to 0.02 pound per bird. Field observations have shown processors using 7 gallons per bird discharging waste loads of 0.07 pound of BOD₅ per bird whereas those using 3.5 gallons per bird load their wastestream with 0.03 pound of BOD₅ per bird.

If management commits itself to water conservation it must be a long term and continuous commitment. Water use must be given high priority in processing efficiency evaluation. Management must be willing to commit resources, both time and capital, to water conservation.

IS IT WORTH IT?

A large broiler processing plant that processes 250,000 birds per day and pays $2.50 per 1000 gallons has the opportunity to reduce water cost by $160,000 annually for each gallon per bird reduction in water use. Some processors report water use of less than 3.5 gallons per bird.

If your water use is more than 5 gallons per bird you may want to hire a person to do water conservation work in your plant or plants. It can be the most efficient use of additional salary that you can make. Consider:

. . . An integrated broiler company has three plants each processing 1,000,000 birds per week with 6.0 gallons per bird. It pays $2.50 per 1000 gallons for water and wastewater treatment. A person is hired at $25,000 per year to assist plant managers in water conservation. Through conservation activities, water use is reduced to 3.5 gallons per bird.

-- Annual cost saving $975,000.
-- Salary to cost saving ratio - 39 to 1.

Where else in your company can an additional person reduce operating costs by $39 for each dollar spent on salary?? As water costs escalate these benefits will become ever more significant.
KNOW YOUR PLANT

Although poultry processing is generally the same, wide differences occur in plant-to-plant operations. To be effective in water conservation it is necessary to know your plant. Know where you water is being used and why.

Conduct a Twenty-Four Hour Water Use Study

A starting point in water conservation is to read water meters at the end of each shift to determine the water use during processing, cleanup, and downtime. Most processors do this. To gain more information on water use, read the water meters hourly on one day per month to determine water use patterns. Additional sophistication can be added by continually measuring the volumes discharged by the plant. Here are many types of devices from simple flow height recorders to sophisticated flow recording devices that are tied to computers.

Figure 1 illustrates the variation in water flow from a processing plant during one shift. Some of the events that were identified as causing the changes in the graph are:

1. Shift change (8:30 am)
2. Sump clogged with feathers and pumped out (9:50 am-10:30 am)
3. Break (11:50 am - 12:00 noon)
4. 1-1/2 inch water line left on (12:00 noon - 12:25 pm)
5. Lunch break (1:30 pm - 2:00 pm)
6. End of processing (5:30 pm)
As these data are collected average water use and normal variations in water use can be calculated. Reduction in water use can be determined and variations in normal water use patterns can be explored and corrected.

Can you afford it? These are management decisions based on the situation of your plant. The 1-1/2 inch pipe left on from 12:00 – 12:25 pm cost the company $6.25 or $15 per hour, the wages of two workers. Using a continuous monitoring, system operational errors in water use can be determined and corrected.
Determine water use in the plant by various processes within the plant. Concentrate on:

1. Goosenecks
2. Bird Washers
3. Giblet Harvesting
4. Wasted Water

Goosenecks:

Carawan et al. (1974) reported that hands could be properly washed at goosenecks using a nozzle that delivered 0.6 gallons per minute (gpm) at 8 psi. It is not uncommon to see unrestricted 1/2 inch goosenecks flowing at 3-4 gpm. Table 2 shows the annual cost of goosenecks at various flow rates and water costs.

<table>
<thead>
<tr>
<th>Gallons/minute</th>
<th>Cost per 1,000 gallons</th>
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<tbody>
<tr>
<td></td>
<td>$1.00</td>
</tr>
<tr>
<td>0.5</td>
<td>$62*</td>
</tr>
<tr>
<td>1.0</td>
<td>125</td>
</tr>
<tr>
<td>2.0</td>
<td>250</td>
</tr>
<tr>
<td>3.0</td>
<td>375</td>
</tr>
</tbody>
</table>

*8 hrs./day 260 days/yr.
A study of gooseneck water use showed that gooseneck water flow along the evisceration line varied from 0.8 to 3.6 gallons per minute. Figure 2 is a schematic of the gooseneck flow and annual cost of that gooseneck flow. Notice the bottom middle goosenecks (0.9 and 3.7 gpm). There are two people standing side by side doing similar jobs yet the 3.6 gallon gooseneck is wasting water equivalent to a month's salary every year.

**Figure 2. Dollars Per Year For Goosenecks**

<table>
<thead>
<tr>
<th>GPM</th>
<th>Dollars Per Year</th>
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<tbody>
<tr>
<td>1.6gpm</td>
<td>$673</td>
</tr>
<tr>
<td>1.6gpm</td>
<td>$673</td>
</tr>
<tr>
<td>3.5gpm</td>
<td>$1472</td>
</tr>
<tr>
<td>2.4gpm</td>
<td>$1009</td>
</tr>
<tr>
<td>2.4 gmp</td>
<td>$1009</td>
</tr>
<tr>
<td>1.6gpm</td>
<td>$573</td>
</tr>
</tbody>
</table>

**Evisceration Trough**

<table>
<thead>
<tr>
<th>GPM</th>
<th>Dollars Per Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.7gpm</td>
<td>$1385</td>
</tr>
<tr>
<td>0.8gpm</td>
<td>$336</td>
</tr>
<tr>
<td>0.9gpm</td>
<td>$378</td>
</tr>
<tr>
<td>3.7gpm</td>
<td>$1556</td>
</tr>
<tr>
<td>2.4gpm</td>
<td>$378</td>
</tr>
<tr>
<td>1.6gpm</td>
<td>$462</td>
</tr>
</tbody>
</table>

GPM - gallons per minute

In this same study, a gooseneck at the transfer belt was flowing at 6.5 gallons per minute. It was not being used to wash hands. The only function it had was to wash the bottom of a clean stainless steel pan. At the cost of $2900 per year!! Sanitation is primary, water use to produce a sanitary product is key, however too much water is used in situations that have nothing to do with sanitation.

**FILL A BUCKET**

A simple way is a bucket marked in 1 quart increments, a stop watch and about 6 feet of 1 inch plastic hose.

Use the bucket and watch to measure the flow from goosenecks, hoses,
nozzles, leaks, etc. The plastic hose is useful in places difficult to place the bucket. Place the hose on the nozzle, pipe or gooseneck and catch the water in the bucket. Using this method, one plant studied found that 25 gallons per minute (about 5% of the processing flow) were-used to move the feet from the hock cutter down an 8 foot trough into the floor drain. The feet would have moved down the trough with only 2-3 gallons per minute. The annual cost savings by reducing water at this point would equal one salary.

**INSTALL AND READ WATER METERS**

In locations such as bird washers it may be difficult to accurately measure the water volume discharged. Install water meters to measure flow volumes so that water use efficiency can be studied.

The payback can be rapid. A water meter study that reduces water use by 5 gallons per minute to a process has a 25 day payback.

- **Bird washers**
  What configuration of nozzles will produce a sanitary product yet reduce water use. Flattened pipes, shower heads, holes drilled in pipes, etc. waste water.

- **Pickers**
  How much water is going to pickers? Is that much required to give a good pick?

- **Stunners**
  How much water is used in my stunners? Can I use less?

- **Reprocessing**
  Many times the bird washers are allowed to run even though there are no birds being reprocessed. How much water is being used by reprocessing. Can this amount be reduced?
- Giblet Harvesting

Giblet harvest consumes significant amounts of processing water. Carawan (1974) found that giblet harvesting used 360 gallons per minute. In a recent in-plant study, giblet harvesting was found to use about 200 gallons per minute. At this rate, a double shifted plant will spend $400-500 per day for water used in giblet harvesting. Many times few giblets are being harvested, yet giblet pumps continue to run. In these instances, the water may cost more than the value of the giblets being harvested. Water meters placed in the giblet harvest supply lines can result in significant cost savings through more efficient giblet harvesting.

READ YOUR FLUMES OR WEIRS

Most poultry processing plants have either weirs or flumes installed at the outfall of the plant, however few if any processors utilize this device to determine the water flow patterns discharged by the plant. Figure 1 showed the flow patterns from a processing plant during one shift. Several significant events were identified. As processors become more efficient in water use, constant monitoring of the wastewater discharge volumes can give valuable information.

HOW LEAKY IS MY PLANT?

The weekend wastewater discharge was studied at two similar plants. One plant discharged 100 gallons per minute whereas the other discharged 25 gallons per minute. The difference of 75 gallons per minute cost the first plant $84,000 more than the second each year. Was it due to leaks, mechanical equipment, or water left on? By studying these weekend flow discharge patterns the causes can be determined and corrected.
Is the water being cut off during breaks, meal breaks, shift change, etc. Figure 1 shows that the plant studied cut off the water during down periods. Does your plant do as well?

DRIP, DRIP, DRIPPING AWAY

Small leaks are constant and the costs mount up over a year. One quart per minute, a stream of about 1/2 the diameter of a pencil, with cost about $250 per year, roughly a week’s wages. Table 3 may give an idea of the number of mini vacations your are giving away each year.

Table 3. Cost of Processing Plant Leaks in Man Year Equivalents

<table>
<thead>
<tr>
<th>Water &amp; Sewage</th>
<th>Man Years at</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>10 gpm</td>
</tr>
<tr>
<td>Per 1,000 gallons</td>
<td></td>
</tr>
<tr>
<td>$2.00</td>
<td>0.78</td>
</tr>
<tr>
<td>$2.50</td>
<td>0.97</td>
</tr>
<tr>
<td>$3.00</td>
<td>1.16</td>
</tr>
</tbody>
</table>

*2.080 hrs. at $6.50/hr.

MAKE IT EASY TO SAVE WATER

Evisceration line workers at one processing plant could not turn off the water easily during breaks, lunch and shift breaks so it was allowed to run during these periods. The loss of 35,000 gallons per shift cost this processing plant $32,000 per year.

. Install quick cut-off valves so workers can easily shut off water when not needed or during break periods.

. Have supervisors make sure they do.

. Make it a maintenance priority to keep the valves in good repair.
CONSTANT MANAGEMENT ATTENTION

Water conservation must be taken on as a long term management commitment. Studies have shown reduction in water use when emphasis was placed on conservation however use returned to original levels within 2 months after conservation emphasis ceased. Supervisors and workers must realize that wasted water affects the profitability just like yield, condemnation and downgrades.

Every year US broiler processors are overspending for water equal to a stack of dollar bills a mile and a half high. As water costs escalate the stack will grow.