HOW POLLUTION PREVENTION PAYS FOR FOOD PROCESSORS

Roy E. Carawan
North Carolina State University
Raleigh, NC 27695-7624

Eight processors have received Challenge Grants

A unique program of pollution prevention has benefited at least eight food processors in North Carolina. Two dairy plants, two poultry processors, a beef slaughtering facility, a breaded foods plant, a snack foods plant and a seafood processing plant have received Challenge Grants from the NC Pollution prevention Pays Program administered by the NC Department of Natural Resources and Community Developent. The Department of Food Science Extension faculty at NC State University helped implement each study to assess pollution prevention in these food processing plants.

Four food processors have completed their studies and demonstrated the potential for savings from pollution prevention activities. These processors include the two dairy plants, beef slaughtering facility and seafood processing plant. The processors are Maola Milk and Ice Cream Company (MAOLA) in New Bern, NC; Hunter Jersey Farms (HUNTER) in Charlotte, NC; Randolph Packing Co. (RANDOLPH) in Asheboro, NC and Beaufort Fisheries (BEAUFORT) in Beaufort, NC as listed in Table 1. MAOLA received two Challenge Grants with one study completed in 1986 and the other in 1987.

Each Grant was used to fund a study to assess management and process changes to prevent pollution. The studies were each implemented with the assistance of the NC Agricultural Extension Service faculty in the Department of Food Science at NC State University. he studies were for the demonstration of the savings possible by reducing disposal/discharge and production costs while increasing plant efficiency and income from sale or use of recovered food products or by-products.

NC Program utilizes pollution prevention pays concept

The Governor has charged the NC Department of Natural Resources and Community Development with creating and implementing the Pollution Prevention Pays (PPP) Program. The Department is convinced that pollution prevention provides technological, economic and environmental advantages over traditional methods. The "end-of-the-pipe" and landfill approaches are expensive to industry and create regulatory costs and problems for government. They

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[1]Roy E. Carawan, Extension Specialist, Department of Food Science, North Carolina State University, Box 762-, Raleigh, NC 27695-7624

Table 1. Food Processing Plants, Production, Location and Study

NC Plant	Foods Processed	Completion	Designation	City
Maola Milk and Ice Cream Co.	Milk/Ice Cream/Drinks	1986	MAOLA	New Bern
Maola Milk and Ice Cream co.	Milk/Ice Cream/ Drinks	1987	MAOLA II	New Bern
Hunter Jersey Farms	Fluid Milk/ Drinks	1986	HUNTER	Charlotte
Randolph Packing Co.	Beef Slaughtering Co.	1986	RANDOLPH	Asheboro
Beaufort Fisheries Co.	Menhaden	1986	BEAUFORT	Beaufort

discourage creativity and innovation. The Challenge Grant program provides cost sharing grants to industry to encourage new methods for reducing pollution.

Although many scientists and technical people have practiced pollution prevention pays, Dr. Joseph T. Ling of the 3M company can be credited with first using the 3M Pollution Prevention Pays (3P) Program. Dr. Ling concluded that government, industry and the public are beginning to be aware of the shortcomings of conventional pollution controls, not to mention their cost. pollution mention Pays utilizes the concept that the conservation approach should be used to eliminate the causes of pollution before spending money and resources to clean up afterward. Dr. Ling defines the conservation approach as the practical application of knowledge, methods, and means to provide the most rational use of resources to improve the environment. Dr. Ling believes that the pollution prevention approach has been hindered or precluded by many rigid environmental laws and regulations. They specify no deviation from the conventional technology nor do they allow alternative abatement approaches.

One example is municipal pretreatment ordinances with specific limits on the concentration of pollutants in wastewater discharge. For food processirg plants, maximum concentration limits on compatible pollutants such as BOD5 often preclude water reuse and recycling. studies indicate that plants with

the least amount of water use per unit of product processed have the least amount of pollutants per unit of product processed. Thus, such ordinances my discourage water conservation and waste reduction practices.

Dr. Ling notes that pollution controls solve no problem; they only alter the problem. He says there is significant opportunity if realistic and effective solutions are sought for pollution problems.

Pretreatment of food plant wastewater does not really solve a pollution problem. It only generates sludge which must be disposed of properly to prevent moving the pollution to another location. As pretreatment or treatment requirements increase, the resources consumed, the residues produced and the costs incurred rise exponentially. Dr. Ling defines this environmental paradox as follows: "It takes resources to remove pollution; pollution removal generates residue; it takes more resources to dispose of this residue and disposal of this residue also produces pollution."

Michael G. Royston recognizes pollutants as material residues from industrial, domestic or agricultural processes which are discharged into the environment. He believes that such materials could either be reused or they should not have been produced in the first place. Royston notes that pollution acts as an indication of inefficient processes. He concludes that as inefficiencies are reduced, so is pollution reduced.

The studies reported in this paper were performed to help food processors apply their ingenuity to develop cost effective resource conservation practices and technology and to increase plant efficiency. Much of what is reported was known to the general industry but not practiced by the plants studied. The help, resources and encouragement of the Pollution Prevention Pays Program and the NC Agricultural Extension Service were the components necessary to make such activities happen.

Each study has a similar format

The four food plants were each reviewed by a study team for management practice and process changes to prevent pollution. changes were selected for evaluation and economic analysis. Changes were selected from those opportunities shown in Table 2. A conceptual scheme was developed for each study based on reduction of compatible pollutants such as BOD5 and cost effectiveness.

Evaluation was done by a team comprised of two or more extension specialists from NCSU and a project leader at each plant. Each evaluation was planned for a six month period but the studies required 9 to 12 months to complete. Evaluations focused on the following:

Table 2. Measures to Control Water Use, Product Loss and Waste Load

Number	Measure
1.	Management understanding, interest and support
2.	Installation of modern processes, equipment and piping to reduce loss of product to sewers and to minimize water use
3.	Appointment of water use waste control supervisor
4.	Employee training
5.	Accurate records of water use and waste
6.	Scheduling to reduce water use and waste
7.	Proper and efficient cleaning procedures
8.	Wastewater monitoring
9.	Planned maintenance program to reduce water use, losses and waste
10.	Planned quality control program to reduce losses and waste
11.	Systems to recover wasted or undesired parts of product
12.	Developing of alternative uses for wasted or undesired product recovery
13.	Installation of processes that can recover lost product from the wastewater stream

1. Technological feasibility
2. Applicable regulations
3. Safety and sanitation requirements
4. Management acceptance
5. Impact on waste loads
6. Impact of water use
7. Cost as could be estimated without a detailed study
8. Impact on plant efficiency
9. Employee training requirements

The sequence of the studies was as follows:

1. Literature search for known practices to reduce pollution for the food industry studied.
2. Plant visits with the team to review current water use, waste load and operational factors.
3. Review of observed inefficient practices to seek alternatives.

Employees were asked for solutions to known problems.

4. A Benchmark water use and pollutional load was established.
5. Changes were selected for evaluation.
6. After the changes were individually evaluated, a report combining changes was prepared.
7. The report was discussed with management and possible plans for

3. Cost reduction
4. Regulatory requirements

Benchmark. A beginning water use and waste load was established for each plant studied. Water use coefficients ranged from 200 ga1/1,000 lb of raw milk received (RM) for HUNTER to 6,000 gal/l,000 lb fish received (FR) for surimi processing at BEAUFORT. Waste load coefficients were from 3.0 lb/1,000 lb RM for HUNTER to 125 lb/l,000 lb FR for BEAUFORT.

Pollution Prevention Potential. For each study, the pollution reduction potential was totaled for the incorporation of all the changes. The pollution prevented was summarized for biochemical oxygen demand (BOD5) load reduction and is presented in Table 3. The prevention ranged from 320,000 lbs BOD5 per year for BEAUFORT to 60,000 lbs BOD5 per year for RANDOLPH.

Costs and Savings. The costs and savings for the recommended changes for each study were totaled and are presented in Table 3. Initial costs ranged from $8,000 for RANDOLPH to $312,500 for BEAUFORT. Annual costs ranged from $10,555 for RANDOLPH to $308,377 for BEAUFORT. Net Savings were predicted from BEAUFORT at $900,000 to RANDOLPH at $1,425 annually.

Table 3. Pollution Prevention Potential (BOD5), Initial cost, Annual Cost and Net Savings (Loss)

Study	Pollution Prevention Potential	Initial Cost	Increased Cost	Net Savings
	(lbs/yr)	($)	($)	($)
HUNTER	226,400	166,962	75,390	62,894
MAOLA	320,000	206,342	111,179	339,699
MAOLA-II	320,000	53,530	35,006	302,050
BEAUFORT	250,000	312,500	308,377	900,000
RANDOLPH	60,000	8,000	10,555	1,425

Wastewater Characteristics. Many food plants discharging to municipalities are finding their wastewater discharge regulated by limits on the concentrations of selected wastewater parameters such as BOD5, chemical oxygen demand, (COD); total suspended solids, (TSS); and fats, oils and greases, (FOG). The benchmark wastewater BOD5 concentration for the plants studied was 1,800 mg/l for HUNTER, 2,900 mg/l for MAOLA, 2,400 mg/1 for MAOLA-II, 2,500

mg/l for BEAUFORT and 2,543 mg/l for RANDOLPH (Table 4). Wastewater parameters predicted after recommended charges are estimated to be from 4,496 mg/l for BEAUFORT to 610 mg/l for RANDOLPH.

Table 4. Estimated or Measured BOD5 for Food Plants Studied

Study	Products Processed	BOD_5 Before Changes	BOD_5 After Changes
		----(mg/l)----	
HUNTER	Milk/Drinks	1,800	1,200
MAOLA	Multiproduct	2,900	1,900
MAOLA-II	Multiproduct	2,400	1,900
BEAUFORT	Menhanden-Surimi	2,500	4,500
RANDOLPH	Beef	2,543	610

The increase in BOD5 concentration predicted for BEAUFORT from 2,500 to almost 4,500 mg/l helps to demonstrate the need for mass limits if society wants to eliminate pollution. Food plants with lower water use coefficients almost always have lower waste load coefficients. If water use reduction is a worthy environmental goal, then water reuse and recycling needs to be encouraged. The incorporation of such changes frequently, as observed for BEAUFORT, leads to reductions in water use and waste load but the concentration of wastewater parameters often increases.

Top management is responsible for a firm's accomplishments in the environmental field. Their attitude is responsible for water use reductions and waste elimination. Each of the companies studied could only achieve success because someone at the top thought this activity was important. They quickly realized that the lowest cost control measures usually are those that attack the problem at its source. None of the changes reviewed for the food plants studied can be implemented successfully without continuing interest by management.

Each of the studies has demonstrated the savings possible through avoidance of disposal/discharge costs, reduced production cost, increased plant efficiencies and income from sale or reuse of recovered materials. Other changes may be feasible for these plants and recommended changes may need modification before installation. However, all food plants can benefit from similar studies of their operations to select cost beneficial changes for preventing pollution.

The following conclusions and recommendations are offered

Conclusions

1. Food processors can reduce pollution. In many cases this activity can pay with savings greater than the costs to implement necessary changes.

2. The management of food processing plants similar to these studied can often reduce water use and pollutants without expending capital. Capital expenditures can further decrease water use and pollutants.

Recommendations

1. sewer use and pretreatment ordinances should contain mass limits and not concentration limits.

2. sewer use and pretreatment ordinances should recognize process and management changes as effective pretreatment procedures.

3. The disposal of residues, by-prducts and sludges from food processing plants needs more efficient and effective methodologies.

4. Food plant employees should be trained to minimize water use and wastes.

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Study	Industry Representative	Department of Food Science Faculty (Extension)
MAOLA I	R.A. Bullard	John E. Rushing
MAOLA II	R.A. Bullard	Roy E. Carawan
HUNTER	J.M. Hunter	John E. Rushing Roy E. Carawan
RANDOLPH	Craig Hamlet	Dwain H. Pilkington Roy E. Carawan
BEAUFORT	Sam D. Thomas	Frank B. Thomas David P. Green Roy E. Carawan