POLLUTION PREVENTION PAYS

FOR THE FOOD PROCESSING INDUSTRY

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Pollution Prevention is an idea whose time has come. Although the Clean Water Act, Clean Air Act, and even Superfund, pointed us in the right direction by identifying areas of pollution problems, they proved that throwing money at pollution will not make it go away. Treatment is not the answer to the problem of pollution. The answer is Prevention. The simple principle of pollution prevention is that reducing and preventing wastes pays off economically as well as environmentally.[(1)]

o WHAT IS POLLUTION

An understanding of what pollution is, and where and how it originates, is required before a grasp of the pollution prevention pays program can be realized. We have all, on occasion, relaxed in front of the TV for the 6 o'clock news only to find staring back, a glassy-eyed, belly-up fish floating in a stream that looks like a cesspool. And who hasn't been behind a bus that belches thick, black, odiferous exhaust into the atmosphere. These are both easily recognizable as pollution.

Pollution is caused by waste. The news media has made us quite aware of hazardous, toxic, and human waste concerns. There are other wastes, however, that can have just as profound a negative effect on the Publicly Owned Treatment Works (POTW) or sewage treatment facility as those receiving all the media attention. Those wastes can originate in the food processing industry.

As raw materials are stored, transferred and eventually processed, there are resulting wastes both intentional and non-intentional. Intentional wastes would be expected wastes such as peeling and pits from vegetable processing, blood and bones from meat processing, wash-down water from all processors, etc. Unintentional wastes are those resulting from leakages or losses due to such activities as improper storage, handling and transfer; improperly maintained production equipment; improperly supervised wash-down activities; raw material or product spills in the parking lots. These are wastes resulting from the loss of raw material or semi-processed product.

These activities are both wasteful and costly in three areas. First, the loss of raw material or semi-processed product is a loss of a valuable resource, whether it be for use in the product, use as animal feed or as a rendering product. Secondly, if pretreatment is used prior to discharge to POTW or if operating a full treatment facility with a direct discharge to surface waters, the additional waste load will increase the operating cost and the solids (sludge) production and disposal cost. Thirdly, increased loadings can have an adverse effect on the POTW and can result in surcharges and fines being levied against the guilty company.

The adverse effect of the wastes on the POTW is largely due to four factors or waste characteristics. These same factors will increase the operating cost of a pretreatment facility. These waste characteristics are: Biochemical Oxygen Demand (BOD), Suspended Solids (SS), Fats, Oils and Grease (FOG) and Flow.

BOD is the amount of oxygen required to reduce some of the organic matter in the waste under standard conditions and is the most frequently used limiting factor for surcharge. Given the organic nature of food processing waste, the resulting BODs are usually quite high. SS is the measure of solids in solution which can be filtered out using a prescribed methodology. FOG and flow are self explanatory. These four characteristics result in food waste having a high potential for pollution creation if not removed or properly treated.

BOD, TSS, FOG levels can be directly equated to raw material, semi-processed or final product being lost down the drain. A pound of BOD_5 is equivalent to 0.89 pounds fat, 1.03 pounds protein and 0.65 pounds carbohydrate. A quantity of process material that is negligible in terms of production can have a major negative impact when allowed to enter the wastewater stream.

Water usage and resulting discharge is another area of wasteful practice in most food processing plants. Consideration of the quantity and quality of water is of major importance since water of insufficient quality, though drinkable, may result in product defects during processing, i.e. increasing waste.

o <u>WHY DOES POLLUTION PREVENTION PAY</u>

Due to federal mandates from the U.S. Environmental Protection Agency, most cities and towns have or are implementing pretreatment standards. These standards will determine the maximum levels of waste characteristics (BOD, TSS, FOG) that each industrial discharger will be allowed in order for the POTW to meet the limits set forth in their NPDES (National Pollutant Discharge Elimination System) Permit. Failure to comply with these pretreatment levels can result in surcharges, penalties and fines being levied against the industry, or the municipality can also refuse to accept an industrial discharge. Continued non-compliance can also result in "bad press" from the news media and the image of a bad corporate neighbor. A proven, effective method for reducing these costs--both tangible and intangible--is removing/reducing the waste, i.e. Pollution Prevention.

o HOW DOES POLLUTION PREVENTION PAY ?

Inaccurate record keeping may have lulled management into thinking that water and waste loads are within acceptable levels. Food processors discharging to a POTW with adequate capacity to handle high waste loads may also harbor the false belief of efficient, non-wasteful processing operations. Unfortunately, it is usually not until there is a financial incentive, (fines, surcharges, etc.) that most plant managers begin the evaluation of wasteful processing procedures. If, however, management would realize that, in most cases, efficiently-run wet food processing plants only loose 2-5% of input material, they may have some concept of losses they are incurring.

Therefore, the first step toward waste reduction or pollution prevention is the full commitment from management of time, personnel and financing. Lack of this commitment is one of the most formidable obstacles to waste reduction and can result in a loss of thousands of dollars each year in raw material cost and waste disposal.[(2)]

The second step is a facility assessment or waste audit. A waste audit or assessment is a self-help step toward determining the practice, procedures, and operating parameters that have resulted in excess water use, high waste loads, non-compliance, and reduced profitability. An audit provides the basis for the collection and evaluation of technical and economical data necessary to select appropriate waste reduction techniques.[3]

Depending on the size of the facility, an audit can be conducted by a single person or a team. The team approach is suggested in order to obtain a wider range of perception, knowledge and experience. An in-house audit team should be composed of management and plant personnel from: facilities and environmental engineering, product quality, inventory control, purchasing, the process line and the clean-up crew. The team should be selected and led by a technically competent person who has been given sufficient authority to complete the job.[2]

Once a team has been selected the actual waste audit can be conducted. The waste audit is designed to identify sources, quantities, and general types of wastes being generated as well as areas of excess water use. This information is obtained from plant records, a review of plant processing procedures, and actual monitoring that is conducted in conjunction with the audit.

The simplest approach is to collect all available background data; raw materials in, product out, steam generation, water usage, waste water generation, etc. on a process-by-process basis. Table 1 provides some sources of information. This information can then be added to an overall production flow chart of the facility. All forms of reuse, recycle, or recovery should be noted on the flow chart. The flow chart should indicate the source, type, quantity, and concentration of each raw material input, waste stream output, and the water usage for each process. A material balance for each process is now possible--ins vs. outs. This will help determine data gaps and needed sampling points in order to determine waste stream quantity and composition, problem areas and data conflicts.[2]

With background data in hand the actual audit can begin to determine the validity of the data, collect additional information needed, and observe actual process operation and clean-up activities. This will help to identify and locate all waste streams. Sampling of waste streams should be conducted over a period of time in order to insure a representative sample.

All processes, from raw material delivery to final shipping, must be closely examined. Table 2 lists some waste locations and questions that should be asked to help determine waste type. Clean-up operations should be closely monitored for water usage, cleanser or disinfectant-type and drain screening.

Once the major waste streams have been identified, all applicable potential waste reduction techniques should be evaluated from both technical and economical aspects. The most cost-effective solution for each waste stream should be selected. In addition to isolated waste streams, a facility-wide reduction method should also be addressed. Often the implementation of dry clean-up procedures, water management techniques, proper equipment maintenance, and recovery of excess and off-spec product will offer enough of a waste reduction as to decrease the need for more expensive process changes.

After the waste reduction program has been selected, a training program for plant employees must be conducted. Employees want to do a good job and become eager program participants when they realize that they can have a direct, positive effect on their environment and the future of the environment for their children. Some form of incentive program has, in the past, worked toward keeping employees interested and enthusiastic.

Additionally, continued monitoring of waste streams is desirable in order to better document cost savings and prevent future problems.

The U.S. Food and Drug Administration or U.S. Department of Agriculture (FSIS) should be consulted prior to implementing any reuse or recycle program in a food plant.

o POLLUTION PREVENTION PAYS IN THE NORTH CAROLINA FOOD PROCESSING INDUSTRY

Many North Carolina food processing facilities have found a solution to their waste problems in the pollution prevention pays concept. These firms have employed techniques such as volume reduction, production/process modification, recovery and reuse to reduce their overall manufacturing costs. They are saving thousands of dollars each year in waste management, disposal, and raw material cost[1]. Through process modifications resulting from studies funded by the N.C. Pollution Prevention Challenge Grants program the following four food processors are realizing a decrease in treatment cost and an increase in profitability. These examples should provide an idea as to the magnitude of savings that can be expected. A summary of the savings is presented in Table 3.

Dairy and Ice Cream

Maola Milk and Ice Cream Co., located in New Bern, NC, is a multi-product dairy. The plant discharges its waste to the New Bern POTW. Due to potential surcharges, POTW upgrade costs being levied by the city, and management's determination to be an exemplary corporate citizen, Maola undertook a waste reduction program. Through a program of recovery, reuse, and reduction of milk solids lost, Maola realized an annual savings of \$300,000/yr.[4]

This, when broken out, translates into 100,000 lbs. of milk per month or $165,000 saved from fluid milk recovery, and 300,000 lbs. BOD_5/yr saved in the recovery process. The recovery process had an initial investment of $54,000 and an annual cost increase of $35,000.[(4)]

Fluid Milk

Hunter Jersey Farms, a fluid milk dairy located in Charlotte, NC, is a subsidiary of Harris Teeter Supermarkets. The plant discharges its pretreated waste to the city's POTW. This project consisted of methods to reduce/recover/reuse milk solids from receiving, cleaning-in-place (CIP), and high-temperature-short-time (HTST) systems.

The results indicate initial costs for the proposed system modifications are $167,000 and an increase of annual operating cost of $75,000 yr. A BOD_5 reduction of 226,400 lb/year was estimated. The study indicated a net savings of $406,000/yr.[(5)]

Seafood

Beaufort Fisheries, located in Beaufort, NC, is a manufacturer of traditional menhaden fish products. While making the decision to diversify into other areas, it was decided that a study into reduction of waste load and water use in the current and proposed processing operations should be explored.

Through changes in off-loading procedures which allowed reduction and recycle of fish rinsing waters, and by integrating this rinse water and recovered solids with existing operations, (4-5 process changes), 250,000 lb BOD_5/yr could be eliminated along with the need for 15 mg water/yr. Although initial and annual O & M costs were estimated at $300,000 each, an annual savings of $900,000/yr was predicted.[(6)]

Meat Processing

Randolph Packing Co., located in Asheboro, NC, is a beef slaughter house and boning operation that discharges its wastewater to the Asheboro POTW. In an attempt to reduce the waste load to the POTW, process changes and a system to recover solids and blood for rendering was examined.

The estimated initial cost of the proposed modification was $10,000 with an increase of annual operating cost of $10,500. The net annual savings per year were initially estimated at $1,500. Although a $1,500/yr savings does not seem extreme, these modifications were also responsible for a 60,000 lb/yr reduction in BOD_5 loading and the saving of approximately 1,000,000 gallons of potable water.[8]

o SUMMARY

The diversity of the food industry is not only evident in the products it produces, but also by the waste it generates. Fortunately, the waste from most food plants is not a health hazard and is very amenable to biological treatment[9]. However, with the more stringent environmental standards being enforced, the cost of biological treatment and sludge disposal has forced many food processors to re-examine their operations and their views on "waste". They have realized that BOD in their waste water has resulted from losses in production input or finished product. There is the further realization that these physical losses not only translate directly to profit losses, but also to costs associated with wastewater treatment--a double loss situation.

Costs associated with wastewater treatment and sludge (solids) disposal will continue to increase as stricter regulations and standards for phosphorous, nitrogen, and aquatic toxicity are enforced. Food processing plants not previously affected by pretreatment standards may suddenly find themselves in a non-compliance situation.

As was the case in the four previous examples, increasing production cost associated with waste treatment and sludge disposal was the impetus for action. The action was an examination of the waste stream which led to a realization that all "waste" was not created equally. With proper collection and handling, waste that cannot be eliminated can in many instances become a new profit source. An examination of your process line could lead you to the same realization.

Traditional treatment is not the answer to the waste problem facing food processors. The answer is pollution prevention. As can be seen in the studies presented, pollution prevention does pay in the food processing industry if management is committed to working with its employees.

The N. C. Pollution Prevention Program has helped, and continues to help industries throughout the state. The non-regulatory program was designed to provide free technical assistance and financial incentives to entice industry to clean up its waste from within, through source reduction, recycling, recovery and reuse methodologies. This type of program--a proven success--should be considered by other states.

TABLE 1
BACKGROUND INFORMATION

Production Process

- Plant schematic and process flow diagram
- Sewer - process/storm/city - locations
- Purchasing records
- Operating manuals
- Water use records
- Plant operating schedule
- Production records

Waste Stream Information

- Environmental monitoring records
- Environmental permits (pretreatment, NPDES, solid waste, air emissions)
- List of environmental violations
- Location of solid waste containers
- Design details on waste treatment units
- Operating manuals for waste treatment units
- All in-plant monitoring data

Economic Information

- Water and sewer rates
- Solid waste management cost
- On-site treatment facilities operating cost
- Waste management contracts/billings

General Information

- Current recovery/reuse/recycle practices
- Previous environmental audits
- Vendor information

TABLE 2

AREAS TO WATCH FOR WASTE

1. RECEIVING/SHIPPING

- o Is there raw material spoilage before processing?
- o Is there raw material loss during transfer activities?
- o Is there a single supplier that has repeatedly sent off-spec materials?
- o Is there final product spoilage or loss before shipping?

2. PROCESS LINE OPERATING PROCEDURES AND EQUIPMENT MAINTENANCE

- o Is there loss of product due to improper equipment fit, leaking lines, pumps, valves, etc.?
- o Are there spillages resulting from overfilling or mixing activities?
- o Are there collection barrels or tanks for off-spec product? How are bad batches handled?
- o Are there drip pans to catch product, juices, peels, pits, etc., and how are the collected materials disposed of?
- o Are dry ingredients allowed to pile up or blow around the facility?
- o Do all employees know how to correctly operate their equipment?
- o Is product lost to freeze-on or burn-on?
- o Are lines, vats, tanks properly emptied before cleanup begins?

3. CLEAN-UP ACTIVITIES

A. Is all unused or off-spec product collected (kept out of drain)?

B. Are dry clean-up activities employed prior to wash down?

C. Are high pressure hoses with automatic shut off valves used?

D. Do all floor drains have screens?

E. Have all detergents and disinfectants been evaluated for their waste load contribution?

4. MISCELLANEOUS

A. Have all possible recycle/reuse methods for water, liquids and solids been investigated?

B. Has alternate uses for non-reusable/recyclable foodstuffs been examined?

T A B L E 3

SUMMARY - N. C. POLLUTION PREVENTION PROJECTS

PLANT TYPE	PLANT NAME & LOCATION	BOD REDUCTION	WATER REDUCTION	INITIAL COST	INCREASED ANNUAL COST	NET ANNUAL SAVINGS
o Dairy and Ice Cream	Maola Milk New Bern, NC	300,000 lb/yr	-	$54,000	$35,000	$300,000
o Fluid Milk	Hunter Jersey Charlotte, NC	226,400 lb/yr	-	$116,922	$75,390	$406,244
o Seafood	Beaufort Fisheries Beaufort, NC	250,000 lb/yr	15 mg/yr	$300,000	$300,000	$900,000
o Poultry	Breeden Poultry & Egg Morganton, NC			$438,000		$150,000
o Meat Processing	Randolph Packing Co. Asheboro, NC	600,000 lb/yr	1 mg/yr	$10,000	$10,500	$1,500

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