September 17, 2003

Mr. Dan Foster

Eden, NC 27882

Dear Mr. Foster:

Thank you for allowing the N.C. Division of Pollution Prevention and Environmental Assistance to assist your efforts to use less water and reduce waste in the brewing operations and associated activities at your facility. Attached is a summary of the water (2/5/03) and clean-up (3/20/03) assessments. This report is considered in DRAFT form until October 12, 2003. Feel free to make any changes to the text including deletions. Please contact me with any questions or concerns you may have at this time.

Sincerely,

Norma Murphy (919) 715-6513 **Division of Pollution Prevention and Environmental Assistance**

North Carolina Department of Environment and Natural Resources

Site Visit Summary

Miller Brewing Company Eden, North Carolina

Industrial Assistance Section

Norma Murphy Tom Rhodes Brian Rosa John Seymour

September 17, 2003

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Disclaimer

This report is intended to offer information and guidance for identifying opportunities and options for waste reduction. Compliance with environmental and occupational safety and health laws is the sole responsibility of each business. All legal and regulatory references within this document are intended only for informational purposes and are not to be taken as reliable sources of legal reference. Businesses should contact the appropriate legal and regulatory authorities for current regulatory requirements as well as for interpretation and implementation. All references and vendor materials (when available) mentioned in the report are included. Mention of a vendor or manufacturer does not represent an endorsement by the State of North Carolina. Neither the State of North Carolina nor the authors of this report are responsible for practices or procedures implemented by individual firms.

Miller Brewing Company: Water Conservation and Waste Reduction Assessment

1.0 Introduction

Miller Brewing Company requested the N.C. Division of Pollution Prevention and Environmental Assistance (DPPEA) assess the company's current water use activities and solid waste generation in various areas of the brewing facility. On Feb. 25, May 2, and June 2, 2003, Norma Murphy, John Seymour, Tom Rhodes and Brian Rosa visited the facility to identify economically and scientifically-sound water conservation and waste reduction opportunities. Dan Foster and the Miller Brewing staff provided facility information including water flow and usage, process descriptions, employee work habits, and waste generation, treatment and disposal practices.

The following report briefly summarizes suggestions leading to more efficient water use at Miller Brewing and reduction in waste generation. The comments are in response to information gathered from observations of beverage processing and clean-up and conversations with facility personnel. Significant reductions in pollutant generation can typically be realized through simple modifications to operations or improvement in management practices. However, to ensure the effectiveness and efficiency of the changes, action in one area needs to be coordinated with actions in other areas. If Miller Brewing seeks to pursue any of these options, DPPEA will provide guidance to assist with implementation.

2.0 Plant Description

Miller Brewing, located in Eden, N.C., employs approximately 743 people and operates a fermented beverage production and packaging operation for three shifts per day, five days per week. The following production areas work together to make Miller and its various contract brand-name beverages:

- Product Fermentation
- Bottle/Can Filling
- Pasteurization
- Packaging
- Raw Material Receiving and Handling
- Final Product Storage
- Process Area and Equipment Clean-up
- Building Maintenance

3.0 Wastewater Treatment

Incoming water is treated with carbon filtration, post chlorination and settling prior to use in beverage production. Miller owns and operates an on-site wastewater treatment plant that treats the industrial process wastewater (mainly brewery and lubricant waste). During the week, two million gallons per day (MGD) are treated while on the weekends .5 MGD are treated. The sanitary discharges are sent to the city of Eden's sewer system. Miller's industrial wastewater treatment includes activated sludge operations, biological treatment and land application of the biosolids that are then reused in landscaping and agricultural operations. Miller Brewing has water quality permits that include Industrial Process & Commercial Operations (NC0029980), Authorization to Construct (NPDES, 002980AC), Food/Tobacco/Soaps/Cosmetics (NCG060112), and Distribution of Residual Solids (WQ0001347).

3.1 Water Usage and Costs

During peak water usage, consumption can reach up to 100 million gallons per month; normal operating conditions use approximately 35 million gallons per month. Typically, the treatment plant receives two millions gallons of process wastewater daily and .5 million gallons on weekend days. For the 12 month period 7/02 to 6/03, Miller Brewing spent approximately \$865,000 for water and sewer services provided by the town of Eden.

4.0 Water Conservation

Water is a raw material that is a limited resource and is expensive to properly treat and manage. Using less water in the facility's operations can significantly reduce water consumption and associated treatment costs and resources. Reduced water use can equate to prolonging the life of the existing pretreatment system and potentially eliminating the need for future expansion and equipment purchases. However, water conservation should not compromise plant sanitation or safety considerations.

Before the facility is shut down for weekends/ holidays, all toilets, showers, sinks and faucets are checked for leaks and are repaired as necessary. If practical, additional areas should be surveyed by management to determine if undiscovered areas of running water are present. Since unused running water is a waste and contributes to the environmental and economic demands of the plant, every point of water use should be evaluated.

An additional area of water conservation is equipment monitoring and preventive maintenance. As shown in these photos, equipment leaks can contribute significantly to





water usage and product loss. Daily checks of pumps, valves piping and tanks should be completed and necessary repairs made to conserve water.

4.1 Facility-Wide Water Conservation Considerations Water Tracking and Efficiency:

To accurately identify areas to target for conservation and to adequately assess success of these efforts, water use in predetermined areas should be quantified. Metering is one measure to reduce water consumption. However, it may be more costly to implement than other conservation measures (such as installing low-flush toilets) and it does not guarantee water savings.

Investment in metering must be accompanied by investment in other water conservation measures such as dry clean-up and employee involvement and training. Specifically, targeted areas such as bottling/filling, conveyance systems, pasteurization and clean-up should have defined use and trend data to help target and prioritize areas for further evaluation and improvement.

Sub-metering water use in these facility operations will define actual water consumption by process, including operators over specific time periods. Weekend usage should also be tracked to identify leaks and areas of running water. Monitoring and sub-metering allows excessive water consumption and leaks to be quickly detected and corrected.

Ensure water flow has been calibrated to current production levels to avoid using excess amounts of water and associated chemicals. Feed pumps should also be synchronized with operations to avoid discharge of excess chemicals/water. Chemical suppliers will volunteer their assistance to adjust the chemical/water feed mechanisms to match the current flows and to shut off when not needed for production. Reduced chemical/water costs could be significant over a year's time.

Employees should be made aware of water use in their areas, how over-usage affects their job and the company's profits/bottom line, and should be involved in finding ways to use less water. Involving employees in water conservation efforts and other facility improvement efforts can lead to many benefits, including:

- Reduced maintenance costs.
- Better customer/supplier relationships.
- Higher morale within the workplace.
- A greater ownership of processes by staff.
- A greater awareness by staff of their own contribution to quality and productivity.
- Improved skills and greater job satisfaction.
- Improved performance for internal and external customers.
- Continuous improvements becoming part of everyone's normal work habits.

4.2 Specific Water Conservation Considerations by Facility Operation

4.2.1 Dry Clean-up

Dry cleanup means using brooms, brushes, vacuums, squeegees, scrapers, and other utensils to clean material before water is used. By collecting the majority of wastes, residues, or contaminants in a dry form, large volumes of water and wastewater can be eliminated. The bulk of solid materials can be more efficiently removed in dry form before water is introduced for secondary washing.

Benefits of Dry Clean-up

- Saves water and reduces wastewater.
- Reduces water, wastewater and surcharge costs.
- Reduces pollutant loading entering wastewater system.
- Saves energy for processes that use hot water.
- Reduces hydraulic capacity demands on any wastewater treatment systems.



• Better enables the reuse, recycling or composting of dry collected materials.

As shown by the above picture Miller Brewing is practicing dry clean-up in some areas of operation. However, the Eden facility may want to consider additional opportunities for dry clean-up such as:

- Sweeping floors instead of hosing with water.
- Vacuuming or sweeping dry material spills instead of using water.
- Use squeegees and scrapers first to remove residual from machines.
- Vacuuming or sweeping particulate emissions (dust) instead of hosing with water.
- Do not use a hose as a broom. This practice is a waste of valuable labor, water and energy.
- Use push brooms and squeegees to sweep and collect solids from the plant floor before it is washed with water.

Eliminate/Reduce Floor Washing Where Feasible

Many floor surfaces (i.e. warehouses, offices, automotive garages, non-critical processing areas/lines) may require a reduced cleaning frequency and still meet sanitation standards.

- If necessary, use dry absorbents and sweep or vacuum these areas.
- Find and eliminate the source of spills and leaks that may be the sole reason why water washdowns are needed.
- Spot mop if necessary.
- Use floor mats, and other means to reduce the tracking of waste and dirt residual throughout a facility.

4.2.2 Conveyance System

The conveyor belt system uses a mixture of water and lubricant to assist in the transport of bottles between processing areas. The lubricant and water are mixed by an automated system located in the recycling area. This system controls the mixing ratio and distribution of the lubricant to the spray nozzles and onto the conveying surfaces.

The belt lubricating system consists of a pressurized delivery system and spray nozzles. A variety of nozzle configurations act to lubricate the belt surfaces. Belt/ motion sensors activate the nozzles in the presence of containers.

This area could result in major savings in reduced



chemical and water usage and decreased discharges to the pretreatment system. To thoroughly assess the conveyance system, Miller Brewing should consider the following options:

- Install sub-meters on the separate lines to determine individual water/lubricant use including information on operator(s) and time periods (regular shift, shutdown, clean-up, etc.). Collect and chart data to determine use trends and identify areas of excess consumption.
- 2. Ensure the lubricant/water mixing system is properly calibrated and that employees are trained on its use and misuse.
- 3. Conduct a facility-wide nozzle audit to identify those nozzles that are not working and need replacing.
- 4. Ensure the manufacturer considers that the nozzles are water-efficient and that the pressure settings are in accordance with the manufacturer's specifications. Review spray patterns for optimum application.
- 5. Evaluate the need for two nozzles when perhaps one will provide the necessary lubrication. Nozzles on the B4 line were observed for this opportunity.
- 6. Check the flow to the nozzles to ensure the minimum amount of lubricant is provided while ensuring the needed lubrication of the lines.
- 7. Follow manufacturer's guides for routine and periodic maintenance of the nozzles and the spraying system to reduce the potential for down-time and lost product.

The following summarizes nozzle operation observations made during the site visit:

- Nozzles were observed to be turned on and flowing when no container/product was present. Specifically, C5 was in operation without a product flow. This practice will eventually waste a considerable amount of water/lubricant and create unnecessary discharges to pretreatment.
- Some nozzles were noticed to be broken/misdirected and were not lubricating the intended surfaces.
- Many seemed to have too much lubricant applied which created many areas of excess foam. This liquid waste will be directed to treatment for management.

4.3 Water (Cleaning and Rinsing) Reuse Considerations

Tremendous opportunity exists to reuse cleaning and rinsing water in-process. Instead of using water only once, water can be pumped or drained into a recirculation tank for reuse. In-process water reuse can allow the user to salvage a valuable product that presently is being discharged as wastewater, such as cleaning chemicals in washing. Depending on water quality requirements for the particular stage of reuse, water simply may be recirculated or require basic treatment such as solid settling and/or filtration. Water quality control standards need to be carefully established for each point of reuse. For high water quality demands, more advanced water reclamation techniques exists, such as ultrafiltration, nanofiltration (or reverse osmosis), carbon filtration and ion exchange. Specifically, the B8, B10 and B11 rinse water was stated to be once-through, where after the bottle rinse it is discharged to wastewater treatment. This area could be considered for water collection and reuse in pasteurization. With several areas in North Carolina approaching limits on the reasonable availability of high-quality fresh water, as well as limits on the capacity of streams to assimilate the water they receive, wastewater reuse rules have been revised to encourage the reuse of industrial, domestic and municipal wastewater. Industrial effluents can be directly reused without a non-discharge permit in these specific reuse situations:

- Industrial process water within the facility that originated the effluent.
- Cooling tower make-up water.
- Fire fighting or extinguishing water.

Other uses of reclaimed industrial effluents are allowed but are contingent upon a demonstration by the facility that the quality of the water is such that employee health is not affected and that employees are notified that non-potable reclaimed water is being used. Examples include:

- Irrigation of property;
- Vehicle washing;
- Decorative ponds;
- Dust control; and
- Street cleaning.

revised the water flow control and metering

systems were not configured for the lower volumes. This brewer made the following changes that significantly reduced water consumption and associated costs:

Water Tracking and Use Case Study

A midwestern brewing facility operated a

three-shift continuous production schedule.

Initial production volumes were lower, but

- Adjusting production steam and water flow to match current production needs saved \$200,000 a year in water, sewer and energy costs.
- Numerous leaking valves and open pipe discharges of noncontact cooling water were identified. Low cost repairs saved 158 gallons per minute with annual savings of \$82,000.
- A meter that was out of calibration over-recorded water use. Replacing the meter saved \$50,000 a year in excess sewer charges.

5.0 Solid Waste Recycling and Generation

Miller Brewing currently recycles plastics, aluminum cans, cardboard, shrink-wrap, wooden pallets and glass. Spent grains are sent to a cattle farmer for animal feed. Biosolids generated from the liquid brewery waste treatment operations are used for land application purposes. To reduce waste going to the sewer, Miller Brewing may want to evaluate the potential for recycling wasted product into ethanol. This effort could be conducted on a smaller-scale, dedicated line and would require a new system to collect and concentrate the waste beer and fermentable materials which would then go through a treatment process.

Miller may consider further evaluation of faulty materials entering the plant and being used. Damaged materials can be passed down the line into the plant operations. Any problems with incoming materials should be noted and discussed with suppliers, leading to better relationships and less damaged material. Lines should be shut down immediately to fix a problem rather than allowing faulty production to continue. Information about damage should also be passed back to the previous step in the operation so that the problem can be avoided in the future. Progress on reduced rejects could be graphed and displayed on notice boards around the plant. This gives the staff an incentive to maintain improvements and gives them "ownership" of the achievements.

5.1 Crushing/baling operation for expired product in cans and bottles:

Improperly filled/off-spec cans and bottles are managed by crushing and discharging the liquid waste to the on-site treatment plant; cans/bottle glass (including caps) are sent to recycling. Miller Brewing pays approximately \$80,000 annually for management of this waste stream.

The company can save a significant amount of money by utilizing a labor force comprised of developmentally challenged individuals from the Rockingham County Adult Vocational Program. The returned product should be separated either on-site or at a remote location (on-site would be preferable if the union issue could be resolved). The corrugated should be separated from the bottles and the crowns removed on the decrowning line (or with bottle openers if the resources are available).



Waste Management is taking advantage of the multi-item collection program. It is separating and marketing the OCC, steel and aluminum bottle crowns and the glass through its CRA Raleigh facility. Waste Management charges Miller Brewing approximately \$80,000 annually for the facility's hauling and handling costs. Additionally, Waste Management is being paid for the commodities (OCC and aluminum) that Miller could be direct marketing. The only way to quantify Miller's potential savings is to model costs based on anticipated use of the vocational crew. A time/cost study over a one to two month period would evaluate the effectiveness of a sorting crew.

Special tax incentives exist for recycling equipment/space to which Miller is entitled. With the facility's large size, this could save the company a significant amount of money. DENR's Tax Certification Program is described at http://www.p2pays.org/ref/26/25939.htm.

To locate local service providers for these and other solid wastes, check the Recycling Markets Directory Web site at <u>http://www.p2pays.org/DMRM/start.aspx</u>.

5.2 Organic Recycling Alternatives

Currently spent grain (116,200 tons annually) is being shipped and sold to farmers for livestock feed. The price paid to Miller Brewing for spent grain is \$ 6.50 - \$ 7.00/ton. The Farm O.N. (12,540.84 tons annually) is registered with N.C. Dept of Agriculture as a liming material and used by farmers. The Farm O.N. disposal cost to Miller Brewing is \$11.13/ton.

Additionally, Miller Brewing has on-site several thousand outdated wood pallets. These pallets are being stored on the west side of the facility waiting to be sold, recycled or landfilled.

Recommendations:

• Contract with a grinding company to grind all pallets and any other scrap wood to be ground on-site. The ground pallets are now a valued-added product with

markets available. Markets include: boiler fuel, mulch and a carbon source for a composting operation.

• Spent grain and wood chips would make an excellent carbon-nitrogen mix to be composted on-site. Miller Brewing could compost all the spent grain and produce a valued-added product. A good grade of compost would be sold at \$20 - \$30/ton. The Farm O.N. blended into the compost would create a more beneficial and marketable material.

• Basic equipment needed would be a front-end loader. Miller Brewing could screen out the wood chips, which could be reused several times. Eventually, Miller

Brewing would have to import more wood chips. Wood chips are usually available through community DPW, power companies and tree trimmers.

 All wet pack cardboard, cardboard, wood chips from pallet chipping, spent grain, paper from offices, food scraps from employee cafeteria, yard waste and brush from the facility (any organic material) could be collected and utilized as feedstock for a composting and/or ethanol producing operation.



- Product spillage, production mishaps and other collectable product could be utilized in the composting/ethanol production. Composting requires that the moisture content be 60 percent at all times throughout the process. This could also be utilized in ethanol production. Ethanol could be sold as a fuel additive or other marketable product. The following link is an article describing the efforts of midwestern brewing facilities considering ethanol production: <u>http://www.bizjournals.com/milwaukee/stories/2000/04/03/story1.html</u>
- The following link is an abstract of an article where a brewing company collected waste beer and other fermentable material and converted into ethanol using a series of treatment steps: <u>http://www.mbaa.com/TechQuarterly/Abstracts/1986/tq86ab28.htm</u>

By Oct. 1, 2003, DPPEA will release an RFP for grant money through its 2004 Recycling Business Development Grant Cycle. This grant money is available to industry and manufacturers like Miller Brewing Company. The grant money could potentially be used to purchase composting equipment. For further information on the grant opportunities, contact Brian Rosa, DPPEA's organic recycling specialist, at (919) 715-6524 or e-mail: brian.rosa@ncmail.net.

6.0 Enclosures

- Brewing Industry Looks to Ethanol for New Markets
- Converting Brewery Waste to Ethanol