MnTAP Intern Project Report

Tiro Industries, LLC

Waste Water Reduction Project

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Abstract

Mr. Kevin Grigg, a student engineer at the University of Minnesota, was selected by the Minnesota Technical Assistance Program (MnTAP) to participate in a water conservation technical internship at Tiro Industries, LLC.

The Fridley Minnesota company was earlier notified by the Metropolitan Council Environmental Services (MCES) that the company may be subject to a Service Availability Charge (SAC), if Tiro Industries does not reduce its average daily water usage to 84,940 gallons by April 2004. Without reductions in water use, the Metropolitan Council may access a one-time maximum SAC charge of up to $250,000 as part of the company's upcoming industrial discharge permit renewal in 2005.

A water audit of the facility accounted for an estimated 85% of daily water use. Primary water use includes water used in product (15%) and water used for cleaning purposes (43%). Because cleaning processes consume the largest overall proportion of water at the facility, cleaning processes were therefore identified as the primary source for water reduction. Targeted cleaning processes include the drum and pail rinsing area, tote-washing area, mixing tank cleaning and the product fill lines.

Summary recommendations are as follows.

Waste Reduction Option	**Waste Reduced**	**Raw Material Saved**	**Cost Savings**	**Payback Period**	**Status**
Replace worn out pit cleaning nozzles	7,100 gpd	7,100 gpd	$33,000/SAC ~~$34,400/annually~~ 6200	Immediate	Implemented
Timer reduction in pit cleaning	3,900 gpd	3,900 gpd	$18,100/SAC $18,300/annually 3400	Immediate	Implemented
Eliminate Metal Drum Label Removal Step	-	-	$16,600/annually	Immediate	Implemented
Replacement of Spray Balls with D26948 Nozzle	3,300 gpd	3,300 gpd	$15,400/SAC $7,500/annually	Immediate	Recommended
Update Tank SOPs/CIP Timers	2,700 gpd	2,700 gpd	$12,500/SAC	Immediate	Recommended
Utilization of Tank Cooling Jackets	1,700 gpd	1,700 gpd	$7,900/SAC $1,600/annually	Immediate	Recommended
Fix Leaking Tank Jackets	180 gal/hr	180 gal/hr	-	-	Recommended
Vacuum Pump Partial Recycle	38 gal/hr	38 gal/hr	-	1327 hrs	Recommended
Continue Awareness Program	-	-	-	-	Recommended
Total Savings	18,700+ gpd	18,700+ gpd	$86,900+/SAC $78,400+/annually		

Through implementing the above action items and through improved water conservation awareness, Tiro Industries may avoid future costly SAC charges while improving upon its overall efficiency.

Section 1 - Background

Tiro Industries, LLC
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Fridley, MN 55432-6198
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SIC: 2844 – Perfumes, Cosmetics, and Other Toilet Preparations

Tiro Industries, LLC is a contract manufacturer of hair and personal care products with a technical service group whom develops a large percentage of its clients' products. Located in Fridley, Minnesota, Tiro Industries' 450,000 square foot facility produces hundreds of types of shampoos, conditioners, hairsprays, lotions, hair pomades, hair gels, hair waxes and cleaning products with distribution throughout the world. By manufacturing an extensive range of products and by utilizing its extensive manufacturing capabilities, the company demonstrates exceptional flexibility in product development and in its production and filling operations.

Tiro has approximately 400 employees of which 341 are currently full-time employees. They utilize over 100 different mixing tanks ranging in size from 5 gallons to 9,800 gallons in size. Normal operations include compounding, filling, packaging and shipment of manufactured products. Tiro has capacity for liquid fill operations for manufacturing shampoos and conditioners, hot fills operations for manufacturing waxes and pomades, and aerosol operations for manufacturing pressurized products such as hair sprays, as well as non-aerosol hair sprays and lotions.

Tiro has several client service options. Clients may request that Tiro fully develop new products for sale through Tiro's product development and product safety programs all the way through product shipment. Alternatively, Tiro using client provided formula specifications is able to fully manufacture client-owned products. In all, Tiro is fully capable of meeting nearly all client requests through its staff expertise and inventory of thousands of raw materials chemicals that are maintained on-site.

Tiro Industries also operates a pilot lab that few industry competitors possess. This laboratory utilizes small exact replicas of the larger tanks that the company uses to simulate large production runs allowing scale-down testing prior to large-scale production.

The Metropolitan Council of Environmental Services (MCES) has recently notified Tiro and has suggested that the company reduce its water consumption in order that a MCES Service Availability Charges (SAC) is not imposed when Tiro Industries' industrial wastewater discharge permit is renewed in 2005.

The Metropolitan Council is responsible for nine Twin Cities area waste treatment facilities. SAC is assessed to companies who discharge wastewater at levels greater than levels that were established at the time of a facility's initial building construction. SAC revenues are uses by the MCES for capital projects such as building new wastewater treatment facilities.

SAC fees are based upon the quantity of wastewater discharged from the facility, and are calculated upon the average daily wastewater effluent. MCES evaluation of Tiro's potential SAC fees will be completed during the first quarter of 2004, by comparing the number of working days to the quantity of wastewater effluent discharged per operating day.

The Metropolitan Council only assesses charges based on the amount of wastewater entering the sanitary sewer. Non-sewered water uses such as lawn sprinklers, water-used-in-product, and cooling water lost to evaporation may be calculated as non-sewerable water and therefore are not subject to SAC. Tiro's most recent wastewater report to the MCES in January 2003 indicated that on average 111,000 gallons of wastewater was released to the sanitary sewer per day during the third and fourth quarters of 2002. This is above the facility's current allowable SAC value of 84,940 gallons allowed sewered per operating day. The company has set their goal to be below their current allowable value. If the company can demonstrate that their effluent may consistently remain below 84,940 gallons per day, additional SAC fees will not be assessed.

Initial Efforts

Tiro Industries began a water awareness program after being notified by the MCES of the SAC fee. Directed by Mr. Scotty Andrews, this program has reduced Tiro Industries' average sewer effluent volume from 112,000 gpd in February to an August usage level of 91,000 gpd [A4].

The aforementioned reduction of 21,000 gpd is a direct result of the efforts by Mr. Andrews. A water task force was organized consisting of employees from different areas of the plant as well as from different shifts. This group would meet periodically to get updates on efforts to conserve water and discuss different ideas for water conservation. The shift leaders would also monitor their departments water use, looking for wasted water. They made their staff aware of the problem and made it a personal issue for their department employees.

In addition, Mr. Andrews explained the water issue at two of Tiro Industries' monthly company meetings. This discussion emphasized that everybody needs to cut down their water use in order to reduce water consumption and eliminate potential SAC fees.

Additionally, maintenance of the pipes and fixing of leaks was increased. The maintenance department has always kept up with leaks around the facility. Increased awareness led to more being identified for repair.

Water Audit

A water audit was done on the facility to confirm the previous water use assumptions, including that the cleaning processes used a large proportion of overall daily water use. The audit confirmed this assumption and verified quantify of water used among production and non-production functions. With a quantification of water use completed, it was discovered that cleaning processes were identified as the source of highest use and therefore became the focus point for this project.

As part of the awareness program, Scotty Andrews identified various water meters that would prove useful to better monitor water use. There are fourteen water meters located throughout the facility, along with a meter attached to a water softener near the DBC area.

Not all the meters were used in the water audit. This is because some metered readings had been accounted through other meter readings. For example, the de-ionized water systems had meters that were being monitored. These metered quantities were already included within the audit though water-used-in-product calculations, and therefore care was needed not to duplicate these metered values.

There were 9 of the 15 meters that were found to have known uses and were not already accounted for elsewhere. The remaining six meters (two of which are main meters reading overall incoming water) were monitored daily to track any abnormal water uses. This helped identify leaks and running faucets to a areas within the facility. The location and a description of the nine traceable meters is given below:

- Mezzanine – this meter, located in the mezzanine across from the pilot lab, monitors the amount of hot city water provided to the facility
- East Soft – this meter, located in the DBC area, monitors the amount of cold soft water produced by the water softener found here
- Comfort 1 & 2 – these two meters, located in the boiler room, monitor the amount of cooling water evaporated by two of Tiro's cooling towers
- Process 1 & 2 – these two meters, located in the chiller room, monitor the amount of cooling water evaporated by the other two cooling towers
- North Sprinkler – this meter, located near the boiler in the boiler room, monitors the amount of sprinkler use on the north side of the building
- South Sprinkler – this meter, located just outside the south entrance, monitors the amount of sprinkler use on the south side of the building
- Boiler – this meter, located on the boiler in the boiler room, monitors the amount of make-up water added to the boiler

The other five meters not included in the water balance are described below:

- West Main – this meter, located behind the company store, in combination with the East Main monitors the amount of incoming city water
- East Main – this meter, located near parcel post, in combination with the West Main monitors the amount of incoming city water
- Shipping & Receiving – this meter, located against the wall in pre-weigh, monitors the amount of domestic water used by the shipping and receiving departments
- System A DI – this meter, located on the ozonated de-ionized water system in compounding, monitors the amount of DI water produced by this system
- System B DI – this meter, located on the de-ionized water system in compounding, monitors the amount of DI water produced by this system
- System A DI – the meter, located behind the DBC area, monitors the amount of DI water produced by this system

Besides the nine-metered sources included in the water audit, there are three other known areas of water use. The first is the amount of water that is used within product. The company can track this usage daily through a program run by Steve Johnson.

The second is the domestic use. This is calculated by using an MCES formula that estimates each full-time employee routinely uses on average 20 gallons of water per day. The last non-metered use is from the East Soft water meter. Just before the softener, the East Main line splits into two streams. One stream goes through the softener and the other into the System C DI water unit. The combination of the DI water used and the amount of soft water produced should total the amount fed by the East Main. This was not found to be true because every time the softener regenerates, which occurs every 30,000 gallons or almost daily, water is lost to the drain.

The combination of the nine-metered sources and the three non-metered sources combines to give the total amount of water that can be tracked without installing additional metering. Some of the unidentified water use is from a smaller softener's regeneration cycle and some non-metered cleaning water. The results of the water audit are displayed in Table 1 below:

Table 1 – Water Audit on Tiro Industries

Source [metered]	Average Amount Used [gal/day]	Percent
East Soft (Cleaning)	24,600	27%
Mezzanine (Cleaning)	15,000	16%
Comfort Cooling Tower 1	2,600	3%
Comfort Cooling Tower 2	2,400	3%
Process Cooling Tower 1	240	0%
Process Cooling Tower 2	1,000	1%
North Sprinkler	4,500	5%
South Sprinkler	700	1%
Boiler Make-up	780	1%

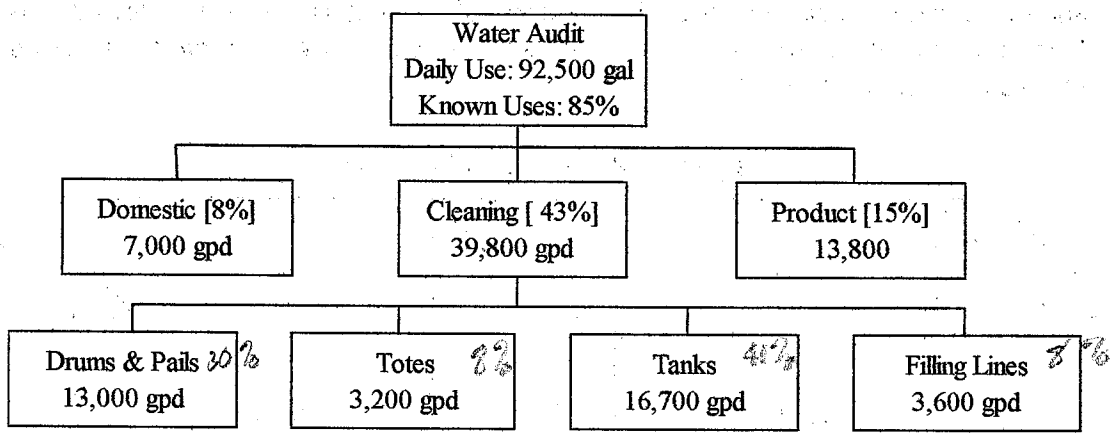
Source [non-metered]	Average Amount Used [gal/day]	Percent
Product	14,200	15%
Domestic	7,000	8%
Softener Regeneration	4,000	4%

May-July Daily Avg.	92,500
Percent Acctounted For	84%

It is easily seen that the combination of the East Soft and Mezzanine meters add up to 43% of the company's daily use. This confirms that the largest amount of water use is cleaning. The East Soft meter measures the amount of cold soft water produced for the facility, while the Mezzanine's hot water heater produces the hot non-softened water for the facility. The cold soft water is heated as it is used in heat exchangers as cooling water before eventually being used in cleaning.

After discovering that cleaning is the principal project focus, the total amount of water used for cleaning was further identified. Tiro Industries utilizes four primary areas of cleaning-- pails and drums, totes, mixing and holding tanks and filling lines. This is displayed in Figure 1 below:

Figure 1 – Tiro's Water Use



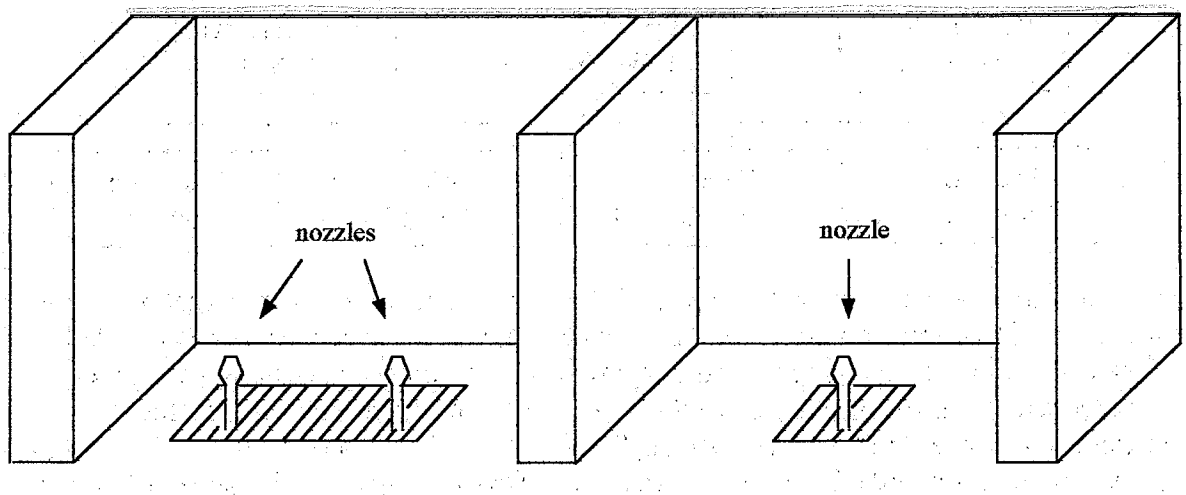
Each of the four cleaning areas was evaluated following identification. After targeting an area, it was investigated to discover how the process operated and why. Data was gathered including any device flow rates, currently practiced cleaning times, equipment models, and any other information that may prove useful. Once this was completed, these areas were further researched. As another MnTAP intern stated, "make yourself an expert". Information on how other companies accomplished the same tasks or how Tiro accomplished the same task in the past was therefore examined. The information found was discussed with people who are involved and/or knowledgeable about the process. If a change was found to be both feasible and cost effective, a proposal for implementation was written and submitted.

Section 2 - Drum & Pail Cleaning

Drum and pail cleaning area were identified to use 12,000 gallons per day. This accounts for 13% of Tiro's daily water use and 30% of the cleaning water.

The drum and pail cleaning area, commonly referred to as "the pit", was the first area to be evaluated. This area consists of two bays containing three nozzles. The devices stick out of the floor, and the container is placed upside down on top of the sprayer. An adjustable timer is started, and the container is sprayed out with the water washing down out into the grated drain. This area is shown in Figure 2 below:

Figure 2 - Pail & Drum Washing Area



Cleaning performed within this area was then studied. The flow rates of the nozzles were first determined [A5]. These nozzle's flow rates depend on the delivered water pressure. A higher pressure produces more flow in combination with more impact. The line pressure at Tiro is that of the incoming city water at 60 psi. This pressure drops as it is delivered throughout the plant and typically falls to 40 psi when it reaches the floor. At this pressure, this style of drum washing nozzle should deliver 13.5 gallons per minute (gpm).

The stations are also fitted with adjustable timers. These are turned on by pushing a button and can be stopped at anytime. The timers are adjustable to 1, 2, 3, or 5 minutes. There is nothing in place to limit changing the time. They are sometimes run to the full timer setting but are usually stopped before the cycle finishes.

Nozzles

The flow rates of the three nozzles were taken. It was expected that they would be flowing at flow rates near 13.5 gpm if operating correctly. This was referenced from the manuals for this model of nozzle. The flow rates depend on the model, and the pressure they operate at. Because the pressure on the floor of the plant in typically 40 psi, this was the pressure used to reference the manuals for flows.

The flow rates found for the three nozzles are given below. Only one of the nozzles was operating as expected. After a closer examination, it could be seen that the two devices operating at a higher flow rate were worn and missing parts. This led to the recommendation to replace the two worn nozzles.

Table 2 – Pail & Drum Washing Nozzle Flow Rates [A5]

Nozzle	Flow Rate [gpm]
Left	13.52
Center	21.27
Right	21.8

There were two options for replacement. The first was to replace the two worn nozzles with the same models-- just newer. These would have the same flow rate as the left pit nozzle. The second was to replace them with 15498 Keg Washing Nozzles. These devices, supplied by Spraying Systems, Company, operate in the same manner as the old nozzles. The only differences are that their spray is effective for only 2 feet instead of 3 feet and they operate at a lower flow rate. This option was discussed with Izya Krampf, the supervisor of the compounding cleaning crew, and a new setup was designed.

The left station would contain two of the 15498 Keg Washing Nozzles. This side would be used strictly for pail cleaning. The lower flow rate of five gpm, these keg-washing nozzles have to offer would reduce the water use without changing the cleaning procedures. The right station (see Figure 2), would contain the old "left" nozzle operating at 13.52 gpm. This would be used strictly for drum rinsing.

The estimated savings from using the new setup was calculated to be 4,500 gpd [A5]. If implemented, this change would reduce the company's SAC fees, while saving additional costs from purchasing and heating unnecessary water. The devices were bought and installed on August 12, 2003. The results have shown that the reduction amounts to an estimated 7,100 gpd. The nozzles have proven effective in cleaning and required only 45 minutes to install.

The cost to implement this option was minimal. It took about 45 minutes to setup the new keg washing nozzles with the necessary piping. Each of the nozzles was purchased for $583.03 per item for a total cost of $1166.06 [A4]. The nozzles were purchased in stainless steel models. This will keep them from corroding quickly. The simple construction and being built in stainless steel will keep them from being replaced frequently. The previous models were installed before Tiro moved into the facility two years ago.

The area uses hot water to clean their pails and drums. Any of the water saved will reduce the impending SAC charge and will help save in water heating costs. Because the SAC fees are substantial, the payback for this option is immediate. The summary of the savings from installing these new nozzles is shown below:

Table 3 – Cost Analysis of Pit Nozzle Replacement [A5]

Waste Reduction Option	Waste Reduced [gpd]	SAC Savings	Water Savings [annually]	Water Heating Savings [annually]	Status
Installation of two 15498 Keg Washing Nozzles	7,100	$33,000	$6,800	$26,600	Implemented

As demonstrated in Table 3, the new setup produced a significant decrease in water use. The results of any implementations to the pit area can be monitored through the Mezzanine meter, because it measures hot city water use. Although this has only been monitored for eleven days, the water coming from the Mezzanine area has not been this low since before March. By referring to the appendix, it can also be seen that the amount of drums and pails cleaned on a daily basis has not been reduced. This indicates that the reduction is from the new setup and not from a decrease in cleaning volume.

Timers

The cleaners were observed to determine how long it was taking them to clean a pail or drum. With this information, the process could be evaluated to discover if the cleaners were using the best possible times to clean the containers. If the time could be reduced, making the process more efficient, the water use would also be reduced.

The timers can be set to limit the amount of time spent per container, but can also easily be adjusted. The timers allow for the water to be started and stopped anytime. The cleaners can start the timer, and if the drum or pail is easily cleaned they can stop the water before the timer expires. Although some operators do this, most let the timer run its full cycle. If upper limits for these timers were set they would limit the amount of water used in each container.

By observing the cleaners during their regular routine and recording the cleaning times per container, the current typical time to clean a drum and pail was determined. The smaller containers were being washed on the nozzles for 2.13 minutes [A3]. Even with the new nozzles installed, this was 10.5 gallons to clean a 5-gallon pail! The drums were taking 3.06 minutes and using 41.6 gallons for each container.

A test [A3] was setup through Izya Krampf, to evaluate the most efficient times for cleaning a drum or pail. The containers were cleaned as usual, but were removed periodically to check if they were clean. When they were clean, the time was recorded. It was found that the larger containers such as drums should take no more than two minutes while the smaller containers such as pails should have an upper limit of 1 minute. The results of the test are given below:

Table 4 – Drum & Pail Efficiency Test Results [A3]

	Previous Method [s]	Test Average [s]	Test Range [s]
Pails	128	21.5	7.6 - 87
Drums	188	20.3	11.4 - 41.5

As can be seen in Table 4, the previously used procedure used a lot more water than necessary. The reduction in the amount of time allowed by these timers would reduce the water use due to a more efficient cleaning procedure.

The estimated savings by limiting these timers to two minutes for the right station and one minute for the left station are 2,100 gpd [A5]. By monitoring the Mezzanine meter, the actual results show a 3,900 gpd drop since the new timer program was loaded on August 22nd.

More information on efficient cleaning times was gathered for the pails than the drums. As Table 4 shows, the optimum time found to clean a drum was found to be similar to that of a pail. This is reasonable considering the drum cleaning station is designed for a higher flow rate to increase the effectiveness of the cycle. Therefore, the cycle should not take much longer than it does for a pail. Preliminarily, the suggestion was to limit the drums to 2 minutes, but after further investigation it may be found that further time reductions can be made.

The savings from implementing the timer limits are shown below in Table 5. The timers required no rewiring because they are adjusted through the PLC. This required Darrell Hartung to upload a program into the PLC system. The timers will still have the switches on them, but they can no longer be manually changed. If a container needs additional cleaning than the limited amount, the timer can be reactivated for an additional cycle.

Table 5 – Cost Analysis for Limiting Drum & Pail Cleaning Times [A3, A5]

Waste Reduction Option	Waste Reduced [gpd]	SAC Savings	Water Savings [annually]	Water Heating Savings [annually]	Status
Timer Limits	3,900	$18,100	$3,700	$14,600	Implemented

The time to change the timers is negligible and had no cost. The payback for this option is immediate. As Table 5 shows, there are both the SAC savings and the hot water savings. The SAC fees are a one-time charge while the hot water savings will continue annually.

The change has not caused any problems in the cleaning cycle. As mentioned before, the limit for the drum cleaning could probably be lowered. The ease of controlling these limits by adjusting the PLC program allows for the time limits to be easily lowered.

Drum Labels

Tiro Industries currently requires the removal of all drum labels from their drums before they are rinsed. There are three ways that labels are currently removed. The first is by hand with a scraper. The second is by using excessive amounts of hot water during rinsing to heat the drum allowing for easier label removal. The third means is to remove the labels by blasting them using a water jet from a spray nozzle.

After being washed and crushed, the metal drums are picked-up by American Iron Company. This company then compresses and packages them. The scrap metal bales are then sent to another company that melts and recycles the drums. After talking with a representative of American Iron, it was found that the removal of the labels is an unnecessary step.

The labels do not need to be removed. American Iron assures the drums are destroyed. They can even provide Tiro with a certificate of destruction for each drum. This certificate guarantees the metal drums are being melted. Because label removal is an unofficial Tiro policy to reduce liability and not a requirement of American Iron, label removal may be eliminated.

Being the generator of the waste, Tiro is concerned with the liability surrounding industrial waste. Although this is a valid concern, consider a comment the Minnesota Pollution Control Agency (MPCA) concerning the scenario of a mishandled or lost drum:

> "The MPCA would look to the recycler to take care of the situation. They were in control of the waste and they would be considered the generator if the waste was mismanaged under their control. In a slightly different scenario if the recycler collected the drums and went bankrupt before they could recycle them the MPCA look to the original drum users if needed. It may be difficult to find out who is the generator of the waste."

The costs associated with removing these labels are seen below:

Table 6 – Costs of Label Removal on 55 Gallon Metal Drums [A5]

Label Removal [min/drum]	Drums Cleaned [avg./day]	Cleaner's Wage [$/hr]	Labor Per Day	Labor Per Year
5 min 33 s	50	13.11	$60.55	$16,500

This practice can be eliminated at no cost and without increasing liability. Tiro can extend this to their plastic barrels and fiber drums if they feel the receivers of them are established enough to handle any problems they generate themselves. It will decrease labor costs and help to save water. The drums will still be triple rinsed as required by American Iron and is good practice.

By eliminating the label removal step, the drums are still cleaned, crushed, and ready to be recycled, but all the while saving Tiro $16,500 annually with an immediate payback.

Liners

The possibility of using liners for all the drums and pails to further reduce the water use in the pit area was investigated. These liners would be plastic bags that the pre-weigh department would insert into the container. The chemicals would then be put into the lined container and transported to its respective batch. After the chemicals have been used, the liner would be removed and discarded as solid waste leaving a dry, clean drum or pail left to be reused or recycled.

This would reduce the water amount used by the pit area to almost nothing. The liners would only contain residual chemicals and are suitable to discard without rinsing. The idea was discussed with the employees in the pre-weigh department and compounders. The problem pre-weigh had with the idea was the size. They said the drums would be too large to use a liner. The compounders would not be able to tip the drums while keeping the liner from falling into the batches. They were open to the possibility of using them in the pails.

The pros and cons of using pail liners are given below:

Pros:

- Liners would reduce rinse water used to almost nothing
- Pails would have a longer lifecycle
- Decrease in labor used to clean the pails
- Reduction in the costs to buy the water
- Reduction in the costs to heat the water

Cons:

- Pre-weigh and compounding agree the liners would be a hassle
- They have been tried before and were not found useful (too many fell in batches delaying production while the plastic was filtered)
- Increase in solid waste
- Possibility of rupturing requiring pails to be rinsed anyway
- With the previously discussed options implemented, the area is already reduced to 600 gpd so additional reductions would be small
- Although small, increased costs to purchase the liners

Because the water use has already been reduced to a low amount, the use of pail liners will not have a large effect on the water use at Tiro. The increased cleanliness of the pails and increased lifetime would be advantageous considering Tiro occasionally purchases pails. The increase in hassle, small effects, and replacement of water waste with solid waste leads to a recommendation that this avenue not be pursued as a feasible water reduction option.

Summary

The pit washing area was consuming much more water than was needed. The amount of water used to clean a relatively small container ranged from one to nine times the quantity of the container. To remove residual chemicals this was unnecessary.

Four different ideas were investigated for this area. The first three were all found to be feasible and have been implemented. These include the replacement of 2 worn nozzles along with a different setup, introduction of lower timer limits, and elimination of the metal 55-gallon drum label removal. The idea investigated that is not recommended is the use of pail liners. Basically, these were found unfeasible considering the effect the nozzles and timers had. Table 7 summarizes the savings resulting from the changes recommended in the drum and pail cleaning.

Table 7 – Cost Analysis Summary for Drum & Pail Rinsing [A3, A5]

Waste Reduction Option	Waste Reduced [gpd]	SAC Savings	Water Savings [annually]	Water Heating Savings [annually]	Wage Savings [annually]
Nozzle Replacement	7,100	$33,000	$7,800	$26,600	-
Timer Limits	3,900	$18,100	$3,700	$14,600	-
Label Removal	-	-	-	-	$16,600
Net Savings	11,000	$51,100	$11,500	$41,200	$16,600

The total SAC savings are considerable and are one-time savings. The annual costs from the water, the heating costs, and labor costs will continue annually saving Tiro costs well into the future. The cost to implement these ideas was $1166.06 for two nozzles with a minimal amount of labor to install them and a brief amount of time writing and loading a new timing program.

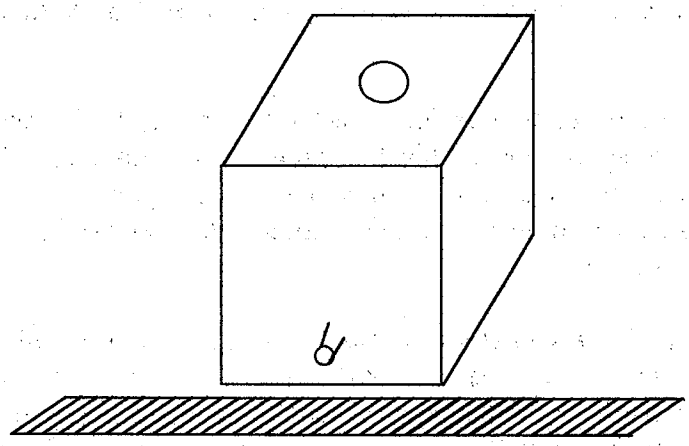
Section 3 - Tote Cleaning

The tote cleaning areas use a combined total of 3,200 gal/day. This accounts for 4% of Tiro's daily water use and 8% of the cleaning water.

There are several tote washing areas located throughout the compounding area. There is one located between the large mixing tanks 5 and 604. This area is not commonly used because it only has hot water available. The main tote cleaning area is located near the stairs leading to the mezzanine for the 300 series tanks.

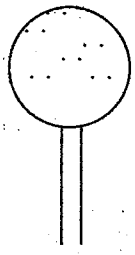
The main tote cleaning area has outlets with hot and cold water and a sanitizing line available. The totes are wheeled to the area and placed so the outlet on the tote is near the floor drain. They are then propped up on one side to assist with drainage. This can be seen in Figure 3 below:

Figure 3 – Tote Diagram



After the tote is in place, the insides of the container are sprayed with a Strahmann hand nozzle. This removes any solid materials from the walls of the tote. The cleaner will then insert a drilled-hole spray ball into the top of the tote. This device delivers a 360° spray to the inside of the tote. The materials are washed out the bottom outlet. Once the cycle is finished, the tote is checked for cleanliness by running a finger along the walls. When found to be clean, sanitizing solution is then run through the spray ball to sanitize the tote. The spray ball is shown below in Figure 4:

Figure 4 – Drilled-Hole Spray Ball



The flow rates of these drilled-hole spray balls were found to be 21 gpm [A5]. As with the floor nozzles in the pit area, the flows depend on the pressure of the water. These spray balls deliver a solid stream of water out of the drilled holes that impact a small specific area. The wash down water created after impact helps to remove more of the material.

Rotating Spray Device

The flow rates of 21 gpm through the spray balls seemed excessive. For the amount of water used, the totes should have been cleaned much quicker than they were. Most of the products being cleaned out at Tiro only need rinsing to remove them, with the exception of products such as gels. With rinsing as opposed to washing, the issue is getting water on the soil rather than giving it more pressure. The options to replace the inefficient spray balls were examined.

The same company that provided the 15498 Keg Washing Nozzles for the pit area helped evaluate the tote cleaning process. Doug Snyder, a representative from Spraying Systems Co., made a site visit to Tiro. After evaluating the tote cleaning area, he left Tiro with a rotating spraying device to sample.

Tiro had experimented with another rotating device. The 21400A model tank washing nozzle is fluidly driven rotating model that spins rapidly while throwing water against the sides of the container. Talking with users of the device, it worked well for cleaning totes. The problem was that it broke down within its first year of use. The ball bearings inside wore a line into the device, and it would no longer rotate.

The device left with Tiro operates in a similar way to the 21400A model. It is fluidly driven while providing a fan of spray that impacts the sides of the tank. This model, the D26984, is a constant speed nozzle. Unlike the 21400A model, its speed is controlled by a gear system within the device. This slows the nozzle down so the spray is delivered in a constant fan throughout the inside of the tote.

The rotating nozzles are inserted into the top of the tote as were the spray balls. After running for a period, the totes are checked and if clean are sanitized. The D26984 model is advantageous because it offers a lower flow rate of 14 gpm in contrast to the 21 gpm delivered by the spray balls. It also provides the fan of spray instead of the small direct impact delivered by the drilled-hole spray balls.

The sample device was tested on several totes. In a test with two totes containing the same conditioners, the sample device outperformed the spray ball. Both totes were cleaned using the same procedure just exchanging the nozzles. Not only was the time of cleaning less using the D26984 model, it operates at a lower flow rate. The results of the test are shown below:

Table 7 – Tote Cleaning Test [A3]

	Time
Drilled-Hole Spray Ball	3 min 39 s
Rotating D26984 Device	2 min 20 s

As observed in Table 7, the rotating device proved more effective. It reduced the cleaning time by over a minute. This is a 31% reduction in the time used cleaning a tote. Further data was gathered by substituting the rotating nozzle for the spray ball and evaluating the time it took to clean the tote. From observations during the cleaning of totes, Tiro employees use on average 4 minutes 29 seconds to clean a tote with a spray ball. In contrast, tests show that it takes the D26984 2 minutes 32 seconds to clean a tote.

On average, the new device out performed the spray balls by reducing the average tote cleaning time by 1 minute 57 seconds. As mentioned earlier, it operates at 7 gpm less than the spray balls giving additional water reduction. The totes tested were cleaned to the same level as done with the spray balls so cleanliness of the container was not compromised while testing.

The reduction in water by using this nozzle would be twofold. The first would be the increased effectiveness leading to a lowered cleaning time, and the second from the reduction in flow rate. In addition to using the new nozzle, a timer should be placed on the main tote washing area. This would limit the amount of time allowed for each tote. Initial suggestions would be to set the timer cycles for 3 minutes on the hot water and 1 minute on the cold. Additional cleaning, if needed can, be done by starting and stopping the timer. After operating for a period of time, the timers could be easily adjusted based on cleaner's feedback.

The cost analysis for installing a timer and replacing the spray balls is given below. If the nozzles prove effective, they should replace all the spray balls. This would eliminate the option of using the inefficient spray balls. The savings is based on reducing the time from the current practice of rinsing for 4 minutes 29 seconds to 3 minutes and using the new nozzle.

Table 8 – Cost Analysis on the Tote Washing Station [A3, A5]

Waste Reduction Option	Waste Reduced [gpd]	SAC Savings	Water Savings [annually]	Water Heating Savings [annually]	Status
Use of a D26984 Rotating Nozzle	900	$4,200	$850	$3,300	Recommended
Timer Limits	600	$2,800	$575	$2,200	Recommended

The nozzles would be ordered from Spray Systems, Co. at a cost of $556.91 [A4] per nozzle. It is seen that in Table 8 the SAC fees saved can justify purchasing these nozzles. Additional costs from adding a timer further justify the cost of purchasing one of these nozzles to try.

Although eventual replacement of all the spray balls is suggested, one of the D26984 nozzles should be bought on a trial basis to find out if it will hold up. Spraying Systems has said that customers have been operating this type of nozzle in their facilities for up to two years now without replacement. An additional line strainer might be needed if problems with wear arise. No costs for a timer were found, but the electrical department could probably make one a simple one at low cost.

Section 4 – Tank Cleaning

The tanks at Tiro include the smaller portable tanks to the large 9,800-gallon mixing tank. They also can be either mixing tanks containing baffles and blades or holding tanks without any mixing equipment contained. The estimated water use to clean these tanks is 16,600 gpd. This accounts for 18% of Tiro's daily water use and 41% of the cleaning water.

The tanks, although varied in size, are cleaned using a standard procedure regardless of this difference. If the steps layed out in the standard operating procedures (SOPs) do not get the tank clean, additional steps are required. Tank cleaning is similar to that method to clean totes.

While cleaning tanks, two different types of equipment are available depending on the size of the tank. Most of the larger ones contain clean in place systems (CIP). These systems are simply spray balls that are installed within the tank. The attached water source is turned on providing a 360° spray to the inside of the tank. Because these are installed in the top of the tanks, the underside of the baffles and mixing blades are shadowed and not directly cleaned. This requires that parts of the tanks be hand cleaned. The alternative to the CIP is to insert a spray ball just as was done with the totes.

The first step is to spray the tanks out with a Strahmann handgun to remove or loosen the product. Whichever device is used, they typically run for 15 – 25 minutes depending on the tank size and product being removed. The water is usually pumped out as it is added to the tank. This cleans the pump used during batching so additional fresh water is not used. The tanks are then sprayed with cold water using the Strahmann gun, spray balls, or CIP to cool them for inspection. If found to still be dirty, additional cleaning steps are done. The final step is to run sanitizing solution throughout the tank for sterilization.

Procedures

It was found that, while following the standard operating procedures, variability existed between cleaners with the amount of time spent on each of the steps. The cleaners could clean the same tank with the same product while one runs the water for twice as long as the other.

The elimination of this variability is difficult. The problem is the variety in the process. Each tank can be used to produce any of the many products they make. So standardization of the procedure for particular tank is impossible. To try to write up a procedure for a certain type of product is also difficult because each type has diverse properties. For example, a conditioner can be sticky, water-based, non-water based, thick, or contain glitters. To classify all these would be impossible.

What can be done is a vague classification. Tiro produces large quantities of shampoos and conditioners. Although these are diverse, the cleaning is usually similar from one to another of these products. Typical times to clean these products can be discovered by having a tank cleaner maintain a journal recording the minimum time it takes to clean a shampoo for example. Although it will vary somewhat, a typical time will become apparent. To further break this down, the tanks can be categorized as small, medium, or large.

By associating times with each step during cleaning, the variability in cleaning will be reduced. This will provide more effective cleaning and reduce some of the excessive cleaning. Most cleaners currently run a spray ball or CIP for 20 – 25 minutes regardless of the soil inside or the tank size because this will clean most everything. A small tank containing a water-based shampoo does not take this long.

This information could be compiled into a chart. This chart would categorize the tanks by size. After finding the size, the cleaner would simply go down to the type of product being cleaned to discover the time needed to effectively clean the tank. The charts could be posted throughout the compounding area for easy reference and the many clocks located here can be used to monitor the time.

Timer Limits

The times found for tank cleaning can be used to timer the system. Any of the tanks containing the CIP systems could have a timer easily installed. This timer would have the options to press for the typical soil. After the cycle is initiated, it will automatically shutdown when completed and the tank should be clean. Additional cleaning, if needed, could be done by simply starting and stopping the timer manually.

The use of a timer system further helps to limit cleaner variability. The process would be more optimized saving volumes of water. In a typical day, almost 25 tanks are cleaned. Based upon this and an average reduction of five minutes per tank, a cost analysis is given below in Table 10:

Table 10 – Cost Analysis on Tank Washing [A5]

Waste Reduction Option	Waste Reduced [gpd]	SAC Savings	Water Savings [annually]	Water Heating Savings [annually]	Status
Reduction of Cleaning Time	2,600	$12,100	$2,500	$9,700	Recommended

Nozzle

In addition to using the D26984 spray nozzle for totes, it can replace the spray balls used in the smaller to medium tanks. The nozzle produces enough spray to effectively clean to a 13 feet radius and therefore is able to be used in small to medium tanks.

Two tests were done on a hairspray and shampoo substituting this nozzle for the spray ball. It was inserted the same as the spray ball was through the top of the tank. The D26984 nozzle did not reduce the cleaning time as hoped. The device took the same time it takes using the spray ball to clean the tanks. Despite this, the device did reduce the water use because it operates at a lower flow rate of 14 gpm in contrast to the 21 gpm the spray balls use. Although the device did not reduce the cleaning time, it would reduce the amount of water used.

If one of these nozzles is purchased on a trial basis for totes, it should be experimented in the tanks. If the rotating nozzle proves effective, it is recommended that this device replace all the spray balls used at Tiro.

In addition to using the D26984 rotating nozzle, the spray balls used in the CIPs should be phased out as they wear down. The 27500 Teflon Rotary Tank Washing Nozzle offered by Spraying Systems, Co. and already installed in six of Tiro's tanks, does not have a lower flow rate than the systems already installed. It does offer is a better spraying pattern that should lead to more effective cleaning. The spray balls in the CIPs produce a small stream that directly impacts a small area in the tank while a 27500 rotating nozzle will impact more areas of the tanks. This will reduce the time spent each cleaning cycle and lead to a reduction in water use.

Cooling Procedure

The current practice of cooling the tanks for inspection and additional manual cleaning is to spray them with cold water. This is either done by spraying them with a Strahmann sprayer or by running cold water into the tank through a spray ball or CIP system. This water is not used to clean the tank and is going straight to the drain.

The alternative would be to train the cleaners to utilize the cooling jackets on the tanks. These jackets fully recycle the water used. The water enters the jacket and cools the tank through conduction. Although the chillers would take on additional cooling load, it should not be a significant increase.

The cleaners typically have to spray the tanks for 10 minutes with cold water to be able to enter them. Estimations on costs saved by using the cooling jackets are based upon using a Strahmann gun, operating at 7 gpm to cool the tank. The water lost is probably much higher because the cleaners often use the spray balls/CIPs for running the cold water. These operate at 21 – 25 gpm [A3].

Table 11 – Cost Analysis on the Tank Cooling [A5]

Waste Reduction Option	Waste Reduced [gpd]	SAC Savings	Water Savings [annually]	Water Heating Savings [annually]	Status
Utilize the Cooling Jackets	1,700	$7,900	$1,600	$6,400	Recommended

Leaking Jackets

The cooling/heating jackets on two of the large 6,000 gallon tanks are leaking. Tanks 602 and 603 leak considerable amounts of water when being used. Tiro has identified this problem and repairs have not yet been scheduled. The data gathered for the amount of leaking water was done by collecting the amount of water dripping off the tank during a cycle and timing it.

Table 12 – Leaking Cooling/Heating Jackets [A3]

Tank	Estimated Flow Rate	
	gal/min	gal/hr
602	2.75	165
603	0.25	15

Increased Line Pressure

Tiro Industries as mentioned previously has a line pressure of about 40-psi by the time it has reached its application area. There are options available to increase the line pressure by using portable pumps or installing booster pumps to increase the overall pressure. This option was investigated to examine whether it would improve Tiro's cleaning efficiency.

Increasing the pressure for cleaning is not recommended at Tiro. Research found that most of the products being cleaned are removed easily once hit with water. A pressure increase would lead to increased flow rates. Because the issue is getting the water to the soil and not a difficulty of removing it in most cases, an increase in pressure would not help alleviate this problem. This is why it is recommended that all the spray balls at Tiro be replaced. They produce effective impact at 40 psi but only a small area receives the direct stream their drilled holes shoot.

Summary

Considerable water savings exist within this area. The difficulty arises with the variety of tanks and products handled in compounding. Several changes in the cleaning of Tiro's mixing tanks will help reduce the volume of water being used here. The following is a list of the recommendations for this area.

Table 13 – Summary of Tank Recommendations

Area of Concern	Description of Recommendation
Procedures	The standard operating procedures could be further detailed to include times for each step.
Timer Limits	Timers should be installed on the larger tanks using CIP systems.
Nozzles	The D26984 Rotating Nozzle can replace the spray balls to clean smaller tanks.
	The spray balls used in the CIPs should be phased out over time.
Cooling Procedure	The cooling jackets should be utilized in cooling the tanks after cleaning.
Tank Jackets	The leaking tank jackets should be fixed before the MCES evaluation period in 2004.
Increased Pressure	The line pressure is sufficient so a pressure increase is not recommended.

Because of the product diversity, the water savings in this area can only be estimated. The largest impact will come from effectively controlling the time spent during tank cleaning. The reduction in water can easily reach 6,500 gallons or more reducing the use from 16,700 gpd to below 10,200 gpd.

Section 5 - Awareness

When Tiro Industries became aware of the MCES's estimate that they could face a $250,000 SAC charge, they began working on the problem. Through continued monitoring of the water levels and increasing awareness, Tiro has been able to reduce their water use by an estimated 21,000 gpd. This equates to a $98,000 reduction in SAC fees.

The details and results of the increased awareness Scotty Andrews brought about were discussed in the introduction. Because of the significant impact this has had on Tiro's water use, it is recommended that they continue the program.

The first recommendation would to continue the postings throughout the plant. This keeps the employees updated on the water use. Although the water use does fluctuate depending on production, postings keep employees aware that water use is an issue. Even if this is not continued on a daily basis, it should be done on a regular basis.

The second recommendation is to continue with an active water use committee. This committee would consist of lead managers from different shifts. Ideas about water conservation could be discussed at regular meetings. Even if nobody has anything to bring to the table to for improvement, updates and explanations on Tiro's water use could be given. This will ensure that every shift is informed and conscientious about their divisions water use.

The third recommendation is to assign a team or individual to "leak patrol". The maintenance department does an excellent job at fixing the leaks around the facility, but they need to be informed of the leaks first. If a group or person could be in charge of making regular inspections throughout the plant to identify any substantial leaks, the problem will be kept in check. To get the leak fixed quickly, if substantial, it is helpful to quantify it. Place a bucket underneath the leak and measure the time it takes to fill, and then weigh the bucket to get a flow rate. This will allow the daily amount of water lost from the leak to be quantified. In doing so, this provides incentive to fix it quickly if the leak is losing a lot of water.

The last recommendation is to include a water discussion in their training. When a new employee is hired, they should be made aware that Tiro feels water conservation is an issue. They should be informed of the impact this can have on the company so they have the motivation to personally watch their water use.

When an effective awareness program is in place and maintained, it will work like safety program. Personnel will make responsible water use part of their work habits and continue the reduction efforts already started. In the appendices, a description of UniLever's [A4] water program can be found. This large company has a division that contract manufactures personal care products just like Tiro. They have dedicated their mission to responsible water use, and their program is impressive.

Section 6 - Vacuum Pumps

There are two vacuum pumps that Tiro operates on their filling lines. The pumps are located on filling lines 511 and 513. They use water for cooling the pump as well as creating a seal for the vacuum. The current setup is directing the water directly to drain as a result of reservoir overflow.

Edelmann & Associates, Inc. is the local Nash Engineering dealer who would supply the parts for the recycle streams. They have informed me that the AHC-25 pump is obsolete and cannot be fitted with a recycle stream. Fortunately, this pump uses much less water than the other model, the EC-150-L which is on the 511 line.

The following table shows the costs of the parts to fit the EC-150-L pump with a recycle stream.

Table 12 – Parts Costs for an EC-150-L Overflow Recycle [A4]

Partial Recycle	Cost
Union Orifice	$85.99
Check Valve	$49.90
Flow Control Valve	$41.00
Total	$176.89

Full Recycle	Cost
Separator	$876.75
Heat Exchanger	$549.00
Make-up Float Valve	$516.60
Gage Glass	$197.81
Union Orifice	$85.99
Strainer	$83.79
Total	$2,309.94

The following provides the estimated hourly water this pump would save if fitted with a recycle stream. It also includes the amount of time that this pump would have to run to makeup the cost of the parts needed.

Table 13 – Vacuum Pump Cost Analysis [A3]

	Water Saved [gal/hr]	Amount Saved [$/hr]	Payback Period [hrs]	Payback Period [shifts]
Partial Recycle	38.1	$0.13	1327	166
Full Recycle	76.2	$0.27	8662	1083

The line does not run consistently, and exact payback periods are hard to estimate. An analysis on the SAC fees saved cannot be made either. The calculation is based on average number of gallons used in a day. Despite this, an estimation of the SAC savings would be $280 for a partial recycle and $565 for a full recycle. These savings would help alleviate the cost of the system and should be considered as they reduce the payback period. The SAC savings would make payback for the partial recycle almost immediate.

Section 7 – Conclusion

Tiro Industries has begun to address their water use issue. The estimated $250,000 SAC charge can be eliminated through employee awareness and additional MnTAP help. Many of the ideas recommended were already discussed at Tiro, but the investigation and research proved which ideas would effectively reduce water use.

Three of the four major areas identified for investigation have recommended changes. The fourth is the filling lines. Although this is a major water user, it is more efficient than many of the other areas at Tiro. The water used during cleaning is usually water needed to get the cleaning done. The lines are already reusing cleaning water. The procedure calls for filling a large bin below the filling nozzles and cycling this water through the nozzles. This water is collected in the bin and recycled back. This continues until the water is really dirty. The bin is refilled with clean water, and the process in done again. This continues until the system is clean.

The following is a summary of the areas investigated and the recommendations within each:

Option	Recommendation Status	Status
Drum & Pail Nozzles	Recommended	Implemented (August 12)
Drum & Pail Timer Limits	Recommended	Implemented (August 22)
Non-removal of Drum Labels	Recommended	Implemented
Pail Liners	Not Recommended	Not Feasible
New Tote Cleaning Device	Recommended	Not Yet Implemented
Updating Tank Cleaning SOPs	Recommended	Not Yet Implemented
Timers on Tank CIPs	Recommended	Not Yet Implemented
New Tank Cleaning Device	Recommended	Not Yet Implemented
Use of Cooling Jackets	Recommended	Not Yet Implemented
Fix Leaking Tank Jackets	Recommended	Not Yet Implemented
Increased Line Pressure	Not Recommended	Not Needed
Continued Awareness Program	Recommended	Continuing
Vacuum Pump Recycle	Recommended	Not Yet Implemented

The cost savings from the above recommendations are considerable. It is estimated that Tiro will be able to save at least 19,000 gpd. This is equivalent to $88,300 in one-time SAC fees. The total annual savings Tiro will be able to receive are $81,300 through labor, water bills, and heating bills.

Tiro has begun forming an effective water management program. This program can become as extensive as the company wants it to be. If a water conservation program is effectively managed and maintained, Tiro will avoid their SAC charge and in doing so become a much more cost-effective company.

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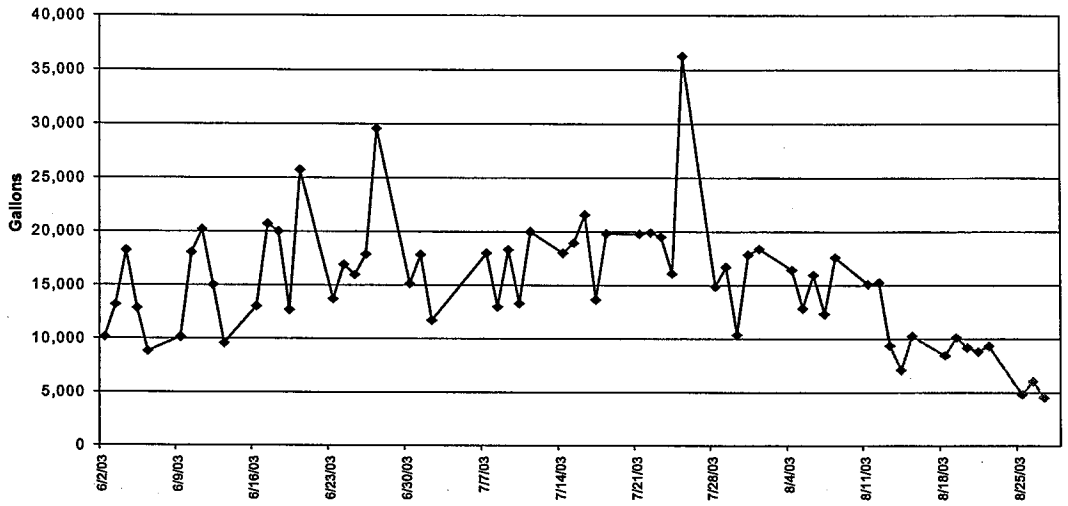
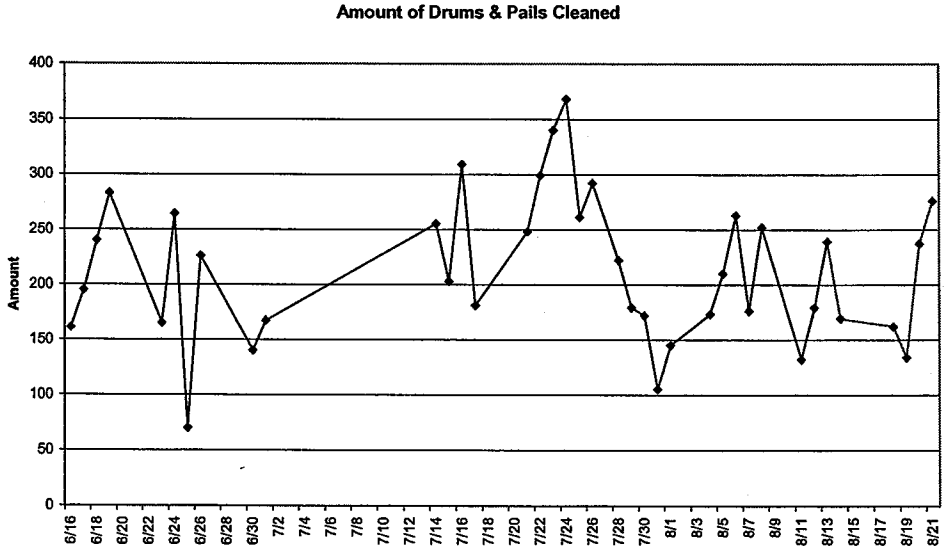
Appendix 3: Test Results

Drum & Pail Cleaning: Nozzle Replacement Aug. 12 and Timer Reduction Aug. 22



Avg. Before Installation: 16,724 gpd
Avg. After Installation: 9,068 gpd
Avg. After Timer Adjustment: 5,104 gpd

Drum & Pail Cleaning: Emphasizes the water drop is not from decrease in volume



Avg. Before Installation: 214
Avg. After Installation: 202

Pail Cleaning: Current Times and Test to Find Optimal Times

Current	Time [s]
1	25.1
2	66.6
3	90.0
4	117.6
5	37.0
6	82.5
7	36.0
8	44.6
9	55.5
10	124.0
11	196.0
12	191.1
13	177.6
14	180.0
15	180.0
16	260.0
17	131.0
18	120.0
19	155.0
20	180.0
21	53.0
22	120.0
23	180.0
24	121.0
25	107.0
26	188.0
27	44.0
28	180.0
29	180.0
30	180.0
31	180.0
32	129.0
33	61.0
34	182.0
Average	128

Test	Time [s]
1	9.7
2	53.5
3	13.7
4	23.9
5	11.5
6	16.4
7	55.4
8	23.0
9	16.7
10	13.0
11	27.5
12	24.2
13	14.4
14	11.1
15	12.0
16	7.6
17	17.7
18	87.0
19	11.9
20	46.5
21	9.9
22	10.6
23	28.2
24	18.4
25	12.1
26	10.6
27	22.1
28	14.2
29	13.9
30	10.9
31	19.8
Average	21.5

Drum Cleaning: Current Times and Test to Find Optimal Times

Current	Time [s]
1	278
2	161
3	177
4	186
5	180
6	151
7	86
8	133
9	133
10	110
11	65
12	68
13	180
14	180
15	180
16	300
17	605
18	182
19	180
20	180
21	179
Average	185

Test	Time [s]
1	24
2	21
3	11
4	11
5	15
6	41
7	41
8	20
Average	23

Tote Cleaning: Current Times and D26498 Rotating Nozzle Test Times

Tote	Spray Ball - Time [s]
1	184
2	222
3	156
4	183
5	203
6	188
7	371
8	193
9	304
10	283
11	600
12	280
13	293
14	360
15	296
16	182
Average	269

Tote	Rotating Nozzle - Time [s]
1	168
2	180
3	207
4	138
5	140
6	143
7	105
8	132
Average	152

55 Gallon Metal Drum Label Removal Test

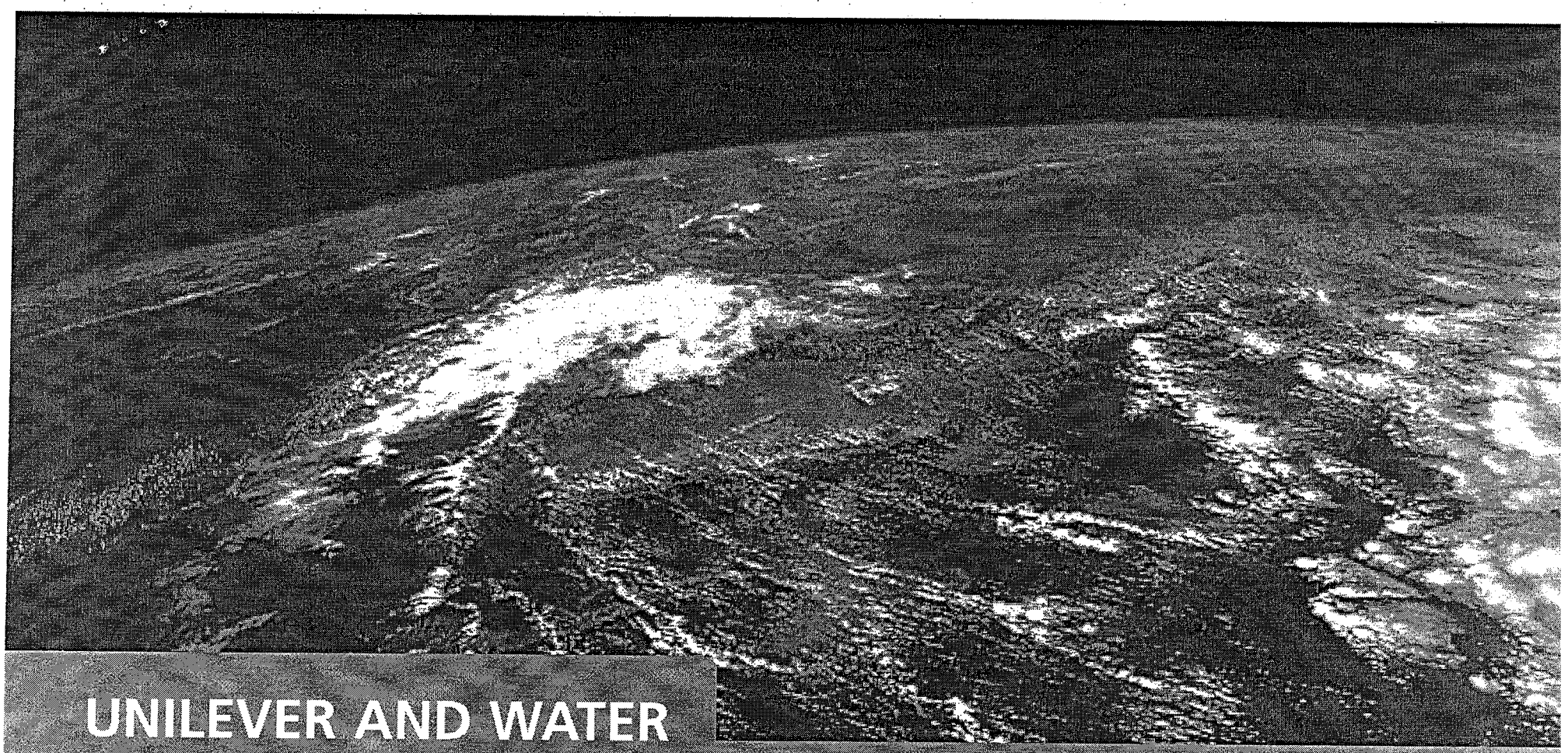
Wage =	$13.11
Average # of Drums per Day	50

Vessel	Time to Remove Labels	Cumulative	Average	Labor Per Drum	Labor Per Day	Labor Per Year
1	265	265	265	$0.96	$48.24	$13,265.95
2	27	292	146	$0.53	$26.58	$7,308.79
3	316	608	203	$0.74	$36.89	$10,145.53
4	147	755	189	$0.69	$34.36	$9,448.86
5	313	1068	214	$0.78	$38.88	$10,692.86
6	313	1381	230	$0.84	$41.90	$11,522.19
7	795	2176	311	$1.13	$56.59	$15,561.57
8	485	2661	333	$1.21	$60.55	**$16,651.27**

Flow Rates for Various Equipment at Tiro

Place	Date Measured	Weight [kg]	Time [s]	Flow [kg/s]	[gal/min]	Flow [gal/hr]
511 Vacuum Pump (Operating)	6/4/03	0.90	24.8	0.036	0.58	34.57
511 Vacuum Pump (Operating)	6/4/03	1.10	32.2	0.034	0.54	32.53
511 Vacuum Pump (Operating)	6/4/03	1.35	45.1	0.030	0.47	28.46
513 Vacuum Pump (Operating)	6/3/03	1.05	13.6	0.077	1.22	73.42
513 Vacuum Pump (Operating)	6/3/03	1.80	22.0	0.082	1.30	77.81
513 Vacuum Pump (Operating)	6/3/03	2.25	27.7	0.081	1.29	77.25
Floor Nozzle - center - in the pit	6/26/03	9.15	7.1	1.289	20.43	1225.61
Floor Nozzle - center - in the pit	6/26/03	6.20	3.7	1.676	26.56	1593.60
Floor Nozzle - center - in the pit	6/26/03	4.75	3.7	1.294	20.51	1230.88
Floor Nozzle - center - in the pit	6/26/03	5.70	4.2	1.367	21.67	1299.95
Floor Nozzle - center - in the pit	6/26/03	7.40	5.1	1.442	22.86	1371.84
Floor Nozzle - center - in the pit	6/26/03	6.95	5.3	1.319	20.90	1254.19
Floor Nozzle - left - in the pit	6/24/03	15.35	18.0	0.853	13.52	811.46
Floor Nozzle - right - in the pit	6/24/03	8.60	6.4	1.342	21.27	1275.94
Floor Nozzle - right - in the pit	6/26/03	11.95	8.5	1.414	22.42	1344.93
Floor Nozzle - right - in the pit	6/26/03	11.25	8.0	1.399	22.18	1330.72
Floor Nozzle - right - in the pit	6/26/03	8.50	6.3	1.347	21.35	1281.09
Pit Strahman 1	6/3/03	6.10	13.4	0.456	7.23	433.57
Pit Strahman 1	6/15/03	5.60	13.4	0.418	6.62	397.44
Tote Spray Ball	6/26/03	9.65	7.3	1.331	21.10	1265.84
Tote Spray Ball	6/26/03	13.55	9.9	1.367	21.67	1300.33
Tote Spray Ball	6/26/03	11.70	9.0	1.301	20.63	1237.70
602 CIP (2 x 2" spray balls)	7/2/03	285.00	178.5	1.597	25.31	1518.86
603 CIP (2 x 2" spray balls)	7/2/03	250.00	164.9	1.516	24.03	1441.81
312 CIP (1 x 4" spray ball)	7/2/03	546.00	730.3	0.748	11.85	711.02
602 Jacket Leak (Cooling)	6/3/03	4.75	30	0.158	2.51	150.58
602 Jacket Leak (Cooling)	6/3/03	4.44	30	0.148	2.35	140.71
602 Jacket Leak (Cooling)	6/4/03	4.82	30	0.161	2.55	152.75
602 Jacket Leak (Cooling)	6/4/03	8.56	45	0.190	3.01	180.82
603 Jacket Leak (Cooling)	6/6/03	0.55	34	0.016	0.25	15.26
603 Jacket Leak (Cooling)	6/6/03	0.70	48	0.015	0.23	13.83

Appendix 4: Technical Sheets

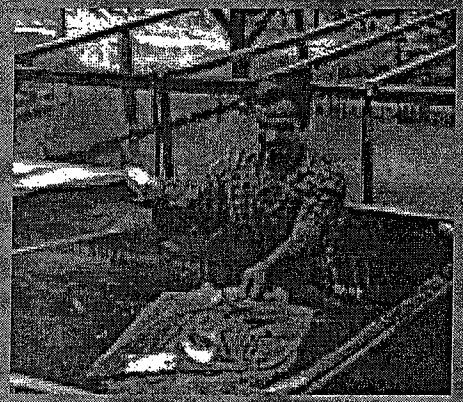


UNILEVER AND WATER

TOWARDS SUSTAINABILITY

Water is a precious and limited resource. To meet today's needs and ensure that future generations enjoy access to clean, safe water, we must all learn to use it in more sustainable ways. Unilever is working hard to integrate this principle into its own water management and to encourage its suppliers, customers and local communities to do so too.

Unilever



Local fish farmer on the Brantas River.

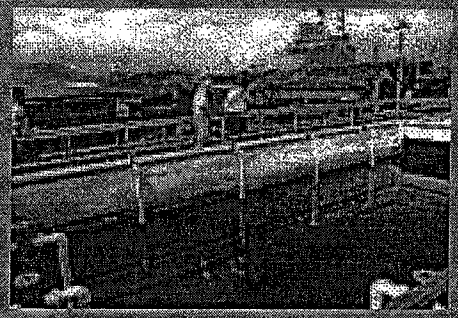
CLEAN BRANTAS PROJECT

An initiative led by Unilever Indonesia has resulted in more than just cleaner water for the communities situated along the polluted Brantas River. It has provided them with a source of social and economic development and healthier lifestyles.

As part of the Clean Brantas Project launched in July 2001, Unilever Indonesia has adopted four villages along the Brantas River. The company works in partnership with these communities, a local university, NGOs and government agencies to improve environmental awareness, sanitation systems, waste management and recycling, tree planting and housing development along the riverbank. As a result of these initiatives, the river now generates income for the villages through small-scale fish farming and cultivation of Java Noni fruit crops for export. It is hoped that the Village Adoption Programme will be expanded by other local companies to include more villages along the river.

PASIG RIVER REHABILITATION PROJECT

The Pasig River is a critical lifeline between Manila Bay and Laguna de Bay, one of the world's largest freshwater inland lakes. Since 1993, Unilever Philippines has been a key partner in the US$ 1 billion 15-year international multi-sector Pasig River



Domestic waste water treatment plant at Unilever Philippines' Manila factory. Treated water from the plant flows through a fish pond before entering a tributary of the Pasig River.

Development Plan to clean up the severely polluted river. We have opened our own on-site domestic water treatment plant, a first in the industry and for metropolitan Manila, to ensure that our operations do not pollute the river. We have also set up partnership programmes to help neighbours not to pollute the Pasig, for example by organising solid waste management workshops for the local traders. In addition, working with the NGOs and civic associations, we have run public awareness campaigns in schools and the community to encourage the establishment of Clean River Zones.

LIVING LAKES

Lakes worldwide are showing signs of strain caused primarily by human activities. As enclosed bodies of water, they are easily damaged by the unsustainable use of their resources. In many regions the supply of drinking water depends on healthy lakes. Since 1998, Unilever has been the Global Partner of the Global Nature Fund's 'Living Lakes' network, a major programme to benefit lakes, their wildlife and the communities that live around them. Local Unilever companies are actively involved in looking after eleven lakes around the world. We have also developed a toolkit to provide guidance and case studies for potential partners in the Living Lakes programme.

For more information about these and other Unilever water sustainability initiatives visit the Environment and Society section of www.unilever.com

Columbia River Wetlands Canada - a Living Lake in a wilderness area supported by Unilever Canada.

UNILEVER AND WATER

Unilever is one of the world's leading consumer goods companies. Our food, home and personal care products are chosen by 150 million consumers around the world every day.

The availability of clean water is essential for our business. Water is used directly in our operations, by our suppliers, by consumers who need water to use our products, and by the communities in which we operate.

Water is a shared resource. Without action by all users, demand for water will continue to outstrip potential supply, particularly in areas of water stress. That is why we are promoting sustainable water management as one of our three sustainability initiatives, alongside agriculture and fish.

OUR WATER VISION

We are committed to ensuring that our activities and those of our suppliers, customers and consumers achieve a sustainable balance between protecting ecosystems and meeting human needs, so assuring the ability of future generations to access sufficient quantities of clean water.

UNILEVER'S WATER IMPRINT

Our first step has been to analyse our own Water Imprint – the total volume of water used in the life cycle of our products, from raw materials to consumer use. The results of this Water Imprint help us make sure our imprint is sustainable and prioritize those areas where we can make a real difference.

GOOD HOUSEKEEPING

Our factories around the world are working hard to reduce their water consumption – already down 7.2% in 2001 compared to 2000. We will increasingly be working with our suppliers, especially within the agricultural sector, to reduce the total supply chain impact on water.

PRODUCT DESIGN AND CONSUMER BEHAVIOUR

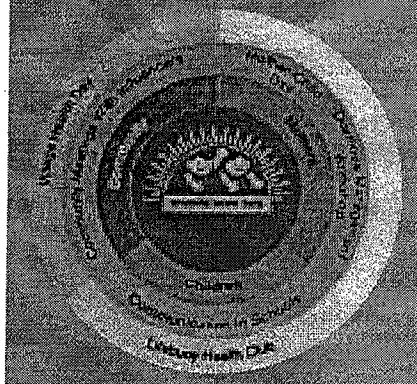
We are paying more attention to the design of our products so that they need less water and have a lower impact on water quality, as well as applying existing strict environmental and human safety criteria to products before they are launched. We are also working with consumers to change product use patterns and foster the responsible use of water.

GUIDING PRINCIPLES

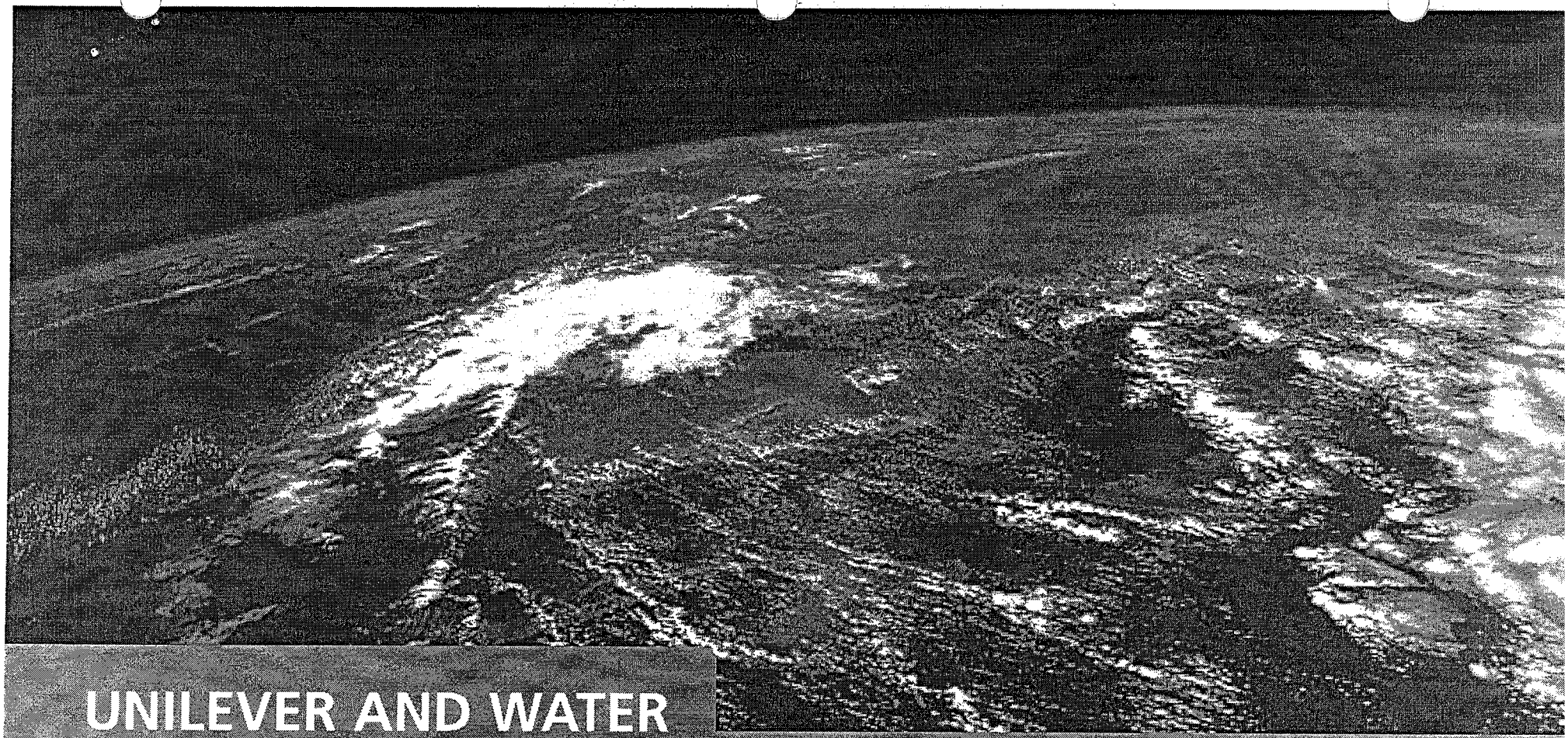
An important part of Unilever's approach to water is our Sustainable Water Integrated Catchment Management (SWIM) principles, which were developed with the assistance of the UK sustainability organisation Forum for the Future. These recognise that competing demands for water – for agriculture, manufacturing and human consumption – and the need to sustain a healthy environment mean that society needs to adopt a more integrated approach to water management. The SWIM principles incorporate a practical approach to helping Unilever and our partners ensure that the community water partnerships we engage in are effective and successful.

LIFEBUOY HANDWASH CAMPAIGN

In India every 30 seconds a child dies from a diarrhoea-related illness. Yet according to a World Bank study done in 1998 in Guatemala, Bangladesh and USA, diarrhoea cases can be reduced by up to 48% just by using soap to improve hygiene. The problem lies in deep-seated traditions and lack of knowledge about simple personal hygiene practices. A campaign by Hindustan Lever is changing the way consumers in India use water and our soap products to promote disease prevention. The Lifebuoy Handwash Campaign aims to educate people about invisible germs and their consequences on health, using a variety of community-based activities for mothers, children and elderly people.



Lifebuoy Swasthya Chetna, the diagram illustrates the interactive nature of the Lifebuoy campaign



UNILEVER AND WATER

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Unilever

Grigg, Kevin

From: TJ TYRRELL [tjtyrrell@thecarycompany.com]
Sent: Wednesday, June 25, 2003 2:35 PM
To: 'Grigg, Kevin'
Subject: RE: Pail Liner Quotes

Kevin,
Thanks for the inquiry.
We offer a few different styles and sizes. We have three different 5 gallon pail liners:
Plastic Pail Liner
Steel Pail Liner
Anti-Static Pail Liner

77WPPL - 5 gallon plastic Pail Liners *100/box - **100/$1.45 each 500/$1.12 each 1000/$1.08 each 3000/$1.06 each**
77WMAL - 5 gallon Antistatic Pail Liner *100/box - **100/$1.50 500/$1.20 each 1000/$1.13 each 3000/$1.08 each**
77WMPL - 5 gallon metal Pail Liner *100/box - **100/$1.25 each 500/$1.05 each 1000/$1.02 each 3000/$1.01 each**

Let me know if you would like prices on other sizes.
Thanks!
TJ Tyrrell
The Cary Company

-----Original Message-----
From: Grigg, Kevin [mailto:kgrigg@Tirollc.com]
Sent: Wednesday, June 25, 2003 1:37 PM
To: 'tjtyrrell@thecarycompany.com'
Subject: Pail Liner Quotes

I was looking for further information on the costs of your various pail liners (specifically 5 gallon). We would be using around 100 liners a day so the orders would be fairly large. If you could get back to me, my email address is kgrigg@tirollc.com. Thank you.

Kevin Grigg
Minnesota Technical Assistance Program
University of Minnesota

Tiro Industries Industrial Wastewater Trend Analysis
(Metropolitan Council Charge Rates Analysis)
2000-2002

(All Volumes Are In Gallons)

The following analysis illustrates how Tiro's Water Use, Industrial Waste Production, and Wastewater Quality have changed during the past three years.

Conclusion: As Met Council strength fees are proportionate to 1) Volume, 2) Solids, 3) Chemical Oxygen Demand and 4) perhaps Surfactants Load Surcharges, Tiro can expect an appreciable increase in effluent strength fees for 5601 as indicated for the monitored period July - December, 2001.

RED = Significant Increases **Purple = Significant Decreases**

5601 Historical Charge Rates

Year:	**2Q2000**	**4Q2000**	**2Q2001**	**4Q2001**	**2Q2002**	**4Q2002**
Rate Per 100,000 Gallons Wastewater	$120	$120	$118	$118	$123	$123
Wastewater Volume Charged (Gals):	4,625,000	8,154,000	6,523,000	10,555,000	15,226,000	16,609,000
TSS Charged Value (Allowed 250 mg/l)	496 mg/l	117 mg/l	138 mg/l	388 mg/l	181 mg/l	201
COD Charged Value (Allowed 500 mg/l)	7,220 mg/l	6,173 mg/l	2,125 mg/l	6,256 mg/l	2,871 mg/l	3,747
Excess Pounds of TSS	9,143 lbs	0 lbs	0 lbs	12,147 lbs	0 lbs	0 lbs
Excess Pounds of COD	249,309 lbs	385,788 lbs	88,402 lbs	506,693 lbs	301,081 lbs	449,771 lbs
Strength Charges per Excess Lb						
Total Suspended Solids	10.2 cts/excess lb	10.2 cts/excess lb	10.4 cts/excess lb	10.4 cts/excess lb	11.4 cts/excess lb	11.4 cts/excess lb
Chemical Oxygen Demand	5.1 cts/excess lb	5.1 cts/excess lb	5.2 cts/excess lb	5.2 cts/excess lb	5.4 cts/excess lb	5.7 cts/excess lb
TSS Charges/Declared Wastewater Volume	$932.59	$0	$0	$1,263.29	$0	$0
COD Charges/Declared Wastewater Volume	$12,714.76	$19,675.19	$4,596.90	$26,348.07	$17,161.62	$25,636.95
TOTAL SEMI-ANNUAL CHARGE	**$13,647.35**	**$19,675.19**	**$4,596.90**	**$27,611.32**	**$17,161.62**	**$25,636.95**

5601 Calculations	Jan-Jun 2000	Jul-Dec 2000	Jan-Jun 2001	Jul-Dec 2001	Jan-Jun 2002	Jul-Dec 2002
Met Council Strength Charge	**$13,647.35**	**$19,675.19**	**$4,596.90**	**$27,611.32**	**$17,161.62**	NA
Incoming Water (Gallons):						
Total City Water Used:	9,361,000	11,512,000	8,135,000	13,948,000	17,827,000	19,966,000
Containment Dike Collection:	74,400	128,400	145,200	108,000	135,600	117,000
Total Incoming Water:	9,435,400	11,640,400	8,280,200	14,056,000	17,962,600	20,083,000
Water Not Discharged to Sanitary Sewer:						
To Storm Sewer:	2,830,400	514,540	0 (Air Cooled)	0	0	0
Lawn Sprinklers:	432,200	981,000	0	1,145,500	60,000	431,200
Used in Product:	1,150,222	1,377,015	1,456,820	1,758,742	2,247,856	2,426,212
Lost to Evaporation:	396,765	614,325	300,517	596,752	428,310	616,290
Total Not Discharged to Sewer:	4,809,587	3,486,840	1,757,337	3,500,994	2,736,166	3,473,702
Wastewater to Sanitary Sewer:						
Cooling Water:	132,255	204,775	100,172	198,917	142,770	205,431
Domestic Waste:	628,320	1,144,520	992,640	1,029,600	1,206,120	1,570,460
Industrial Waste:	3,865,238	6,804,265	5,430,051	9,326,489	13,877,544	14,833,407
Total Discharged to Sewer:	4,625,813	8,153,560	6,522,863	10,555,006	15,226,434	16,609,298
Water Quality:						
pH:	7.43	6.9	7.03	6.6	8.7	7.0
Total Suspended Solids:	496 mg/l	112 mg/l	116mg/l	391mg/l	180mg/l	200mg/l
Chemical Oxygen Demand:	7,220 mg/l	6,400 mg/l	2,450mg/l	6,400mg/l	2,900mg/l	3,800mg/l
Phenols:	Not Detected	0.304 mg/l	Not Detected	Not Detected	0.14mg/l	NA
Surfactants (MBA):	**290**	**650**	**640**	**841**	370	NA

Edelmann & Associates, Inc.

1900 Annapolis Ln.
P.O. Box 41729
Minneapolis, Mn 55447-0129
Tel: (763) 559-7867
Fax: (763) 559-9403
Jayanthi@edelmann.com

TO:	**Kevin Grigg**
FAX:	**763-572-2940**
COMPANY:	**Tiro Industries**
FROM:	**Jayanthi "Jane-tee" Grebin**
DATE:	**07/31/03**
PROPOSAL:	**073103GLD**
PAGES:	**1 of 2**

REFERENCE: Partial or Fully recirculated System for the pumps below

The AHC-25 is an obsolete pump There are no parts available to refit this pump from a once-thru to partial or recirculate pump.

The EC-150-L
Parts needed to convert once thru package to partial recirc. Package.

Flow Control Valve	PF-3654	$41 00
Check Valve	PF-0241	$49 90
Union Orifice	PF-0976-12	$85.99

Parts needed to convert once-thru package to full recirc. package.

Separator	PU-19573	$876 75
Gage Glass GL-0058 (2),	GL-0385, GL-1009	$197.81
Heat Exchanger	PU-19615	$549.00
Union Orifice	PF-0976-16	$85.99
Strainer	PF-0377-A	$83.79
Optional:		
Make-up Float Valve	PF-7370	$516 60

Note: **All items above are for standard packages not SS packages**

Lead time. 4-6 weeks (verified at time of order)
FOB. Factory
Freight: Collect or PPD & Add

Terms: Net 30 days

Please send all orders through Edelmann & Associates as follows:
TO:NASH-ELMO INDUSTRIES
C/O EDELMANN & ASSOCIATES

Account Responsibility. Gary Davidson
Prepared by: Jayanthi Grebin

Spraying Systems Co.®

July 17, 2003

Kevin Grigg
Tiro Industries
5601 East River Road
Fridley, MN 55432
Fax 763-572-2940

The following quote is in response to your request:

Qty	Part #	Description	Price/Ea	Delivery
1	D26984-1/2-SS9.9	Constant Speed Rotating Nozzle. Stainless Steel Material	$525.09	Approx. 2 Wks
1	D26984-1/2-SS4.5		$486.12	
1	D26984-1/2-SS13.6		$556.91	
1-5	3150-21	Drum Washing Nozzle-Brass Material 21 Orifices	$194.12	1-2 Weeks
1-5	3150-SS21	Drum Washing Nozzle. Stainless Steel Material. 21 Orifices	$697.10	1-2 Weeks
1-5	15498-15-SS	Keg Wash Nozzle for Pail Cleaning. Stainless Steel Material. 15 Orifices	$583.03	Approx. 2 Wks
1-5	CU150-AL10	Adjustable Pattern Spray Gun Aluminum Body	$89.00	1-2 Weeks
6-11			$84.67	
12-35			$70.14	
1-5	21400A-316SS10-316SS	Rotating Nozzle-Stainless Steel Material	$258.20	Approx. 2 Wks

All pricing is FOB factory and valid for 60 days. Pricing is for single shipment to single location. Quantity pricing applies to each line item individually. ***Spraying Systems Co.*** terms are Net 30 days with an Open Account. Thank you for your interest in our full product line of spray nozzles and accessories.

Sincerely,
R.J. Martin & Associates

Doug Snyder (TH)

Doug Snyder
Application Specialist

Spraying Systems Co.®

Represented by
R.J. Martin & Associates, Inc.
10125 Crosstown Circle, Suite 200, Eden Prairie, MN 55344-3317
Tel: 952-944-7202 • FAX: 952-944-8292
E-mail: doug.snyder@spray.com

FAX FROM DOUG SNYDER

To:	Kevin Grigg/ Scotty Andrews	**Re:**	Spray guns/ tank wash
Company:	Tiro Industries	**City/ST:**	Fridley, MN
FAX:	763/ 572-2940	**Date:**	7/16/2003
Phone:	763/ 572-2861	**Pages:**	

Kevin & Scotty

Thank you again for your time on Tuesday during our meeting. It was a pleasure to meet you both and have the opportunity to discuss the tank, tote, and drum cleaning applications and water usage issues at your plant. We appreciate the fact that you are studying the use of our Spraying Systems Co. spray nozzles, guns, and accessories in order to satisfy your spray application requirements.

I wanted to review some of the main points that came from our meeting:

I. Drum wash nozzles: 40 psi operating pressure. 170 degree F water Temp.
   A. 2 of the nozzles have been stripped of the orifices.
   B. This lowers the effectiveness of the spray pattern and uses much more water. Kevin indicated that the two nozzle assemblies are spraying at 21 gpm. The undamaged nozzle is spraying at 13. 5 gpm. Replacing these two 3150-21 nozzles will help decrease water usage immediately.
   C. Another option that Kevin mentioned would be to use the 3rd bay as a pail or small drum-washing bay. By using the 15498-15 Keg washing nozzle in this bay – water usage could be further reduced.
   D. I mentioned that raising the drum wash nozzles up a little bit with an extension, might improve the cleaning action of the nozzles towards the "bottom" of the drum. It might help if you had a rack to invert the drum onto.

II. Totes: 40 psi operating pressure. 170 degree F water temp.

   A. You were using our 21400 rotating tank wash nozzle – purchased in May 2002. Tom indicated that parts were wearing due to the friction of the ball bearings. This was evident in the parts we looked at. However, I believe the nozzle may have been taken apart at some point and re-assembled incorrectly. Looking at the parts list, wear should only show up on part #5. Other surfaces of the nozzle should be protected by the race.

July 16, 2003

B. Currently you are using a spray gun to rinse the tote and then a drilled hole spray ball to clean totes. Spray gun is a Strahman style gun with flow rate of 7 gpm. The spray ball is also used to clean some small tanks up to 2500 gallon capacity. Flow rate is approximately 20 gpm and is run for 6-7 minutes in the totes. (120-140 gallons per tote x 25 totes per day = 3000 – 3500 gallons per day.)
C. Left a D26894-1/2-SS13.6 Constant rotating nozzle for testing. Try to cut cleaning down to 3 minutes per tote or less. Flow rate is 14 gpm on this nozzle. Cuts flow rate down to 1300 gallons per day for 25 totes.
D. Goal is increase effective impact on all areas of the tank interior to insure a cleaner surface.

III. Tanks: Mix and holding tanks # 79, # 47, #98, and #68

A. These tanks use the Spraying Systems Co. 27500C-1-50-TEF or the 27500C-¾-18-TEF rotating tank wash nozzles. Kevin indicates that these have worked well though we did not discuss operating times. Operator error can be traced to nozzle being left on too long in some cases.

III. Larger tanks – 6000 gallons

A. These tanks have different spray ball arrangements. Their seems to be either 2 drilled hole balls (#313 & #314) or 4 drilled hole spray balls per tank. (#600)

B. Two tanks have rotational spray assemblies in them – 2 per tank (#602 & 603).
C. Four tanks have one central spray ball unit (#309, #310, #311 & #312)
D. Most of these units operate in the 12 –12.5 gpm flow range. Run times can vary between the tanks – but usually 20 – 25 minutes per tank.
1 spray unit per tank = 240 – 300 gallons used per tank
2 spray units per tank = 480 – 600 gallons used per tank
4 spray units per tank = 960 – 1200 gallons used per tank

Finish work for cleaning is also done on all tanks with spray guns. Adds more water to the equation.

We can study the cleaning of these larger tanks at more length, but the main goal would be to cut cleaning time in half if possible.

We did discuss the options of generating more pressure with a pump system, utilizing a different type of spray assembly to increase cleaning impact on tank surfaces. Would attempt to use approximately a 14 gpm to 16.5 gpm flow rate for one nozzle assembly.

July 16, 2003

Possible use of a demo AA190E tank wash unit at existing 40 psi pressure or to use in conjunction with a rented pump unit.

I hope this helps summarize our main points. I will follow-up with you to see how the sample nozzle worked, and to further explore the option of complete skid mounted tank wash systems. I also have ordered one of our CU150-AL10 spray guns to be sent to your attention. The flow rate on that gun is also about 6.5 -7 gpm. But your workers should find it much more comfortable and easy to use.

Please feel free to contact me with further questions or clarifications. Thank you again for your time and have great day!

Fridley Residents:

In order to ensure that tap water is safe to drink, the Environmental Protection Agency (EPA) prescribes regulations that limit the amount of certain contaminants in water provided by public water systems. This annual report is your guide to see how water provided by the City of Fridley compares to the drinking water standards set by the Safe Drinking Water Act. It fulfills an obligation the City has to provide accurate and timely information about your drinking water and Fridley's water system. This year's report again delivers good news: ***no contaminants have been found that exceed levels set by EPA for safe drinking water.***

If you have questions about Fridley's drinking water, or if you would like information on opportunities to participate in public meetings where decisions regarding water quality are made, please contact Jim Saefke at 763-572-3561.

Jon H. Haukaas,
Director of Public Works

Summary of Laboratory Results

Before the City of Fridley can deliver water to your home, it must first be analyzed in certified laboratories that can detect trace amounts of contaminants. The Fridley test results for 2002 are shown in the table below. **No contaminants were detected that exceeded EPA limits in drinking water.** Because the City of Fridley supplements its own supply with water from the City of New Brighton, New Brighton results are also listed in the table.

How to Interpret the Lab Data

Regulated substances have Maximum Contaminant Levels (MCLs) set by the EPA. This is the highest level of the substance allowed in drinking water. Some contaminants also have MCL goals (MCLGs). This is the level of a substance where there is no known or expected health risk. MCLGs allow for a margin of safety. MCLs are set as close to MCLGs as feasible using the best available water treatment processes.

Unregulated substances do not have MCLs. They are assessed by comparing the detected amount to state standards known as health risk limits. If an unacceptable amount of any substance is ever found in the water, the City of Fridley will notify residents immediately of the problem.

The MCL for lead and copper is known as the **Action Level (AL)**. This is the concentration of a contaminant which, when exceeded, triggers treatment or other requirements which a water system must follow. Ninety percent of all samples tested must be below the action level. City of Fridley water has been found to be in compliance for both lead and copper.

Units of Measurement
pCi/L: pico curies per liter, a measure of radioactivity
ppm: parts per million (milligrams per liter)
ppb: parts per billion (micrograms per liter)

Detected Substance (units) *MCL (highest level allowed in water by EPA)* *MCLG (level where there is no known health risk)*	Results for Fridley Tap Water Level Found	 Range of Detections	Results for New Brighton Tap Water Level Found	 Range of Detections	Meets Federal and State Regulations	Typical Source of Substance in Drinking Water
Disinfection Byproducts: Formed during chlorination						
Total Trihalomethanes (ppb) *MCL: 100 MCLG: No limit set*	2.6	0	2.6	0	Yes	By-product of drinking water chlorination.
Inorganic Substances: Salts and metals of natural or man-made origin						
Barium (ppm) *MCL: 2.0 MCLG: 2.0*	0.14	0.07-0.14	0.07	0	Yes	Discharge of drilling wastes; discharge from metal refineries; erosion of natural deposits
Nitrate as Nitrogen (ppm) *MCL: 10 MCLG: 10*	0.51	ND-0.51	0.51	ND-0.51	Yes	Runoff from fertilizer use; leaching from septic tanks, sewage; erosion of natural deposits
Nitrite as Nitrogen (ppm) 2/11/00 *MCL: 1.0 MCLG: 1.0*	0.03	0	not detected		Yes	Runoff from fertilizer use; leaching from septic tanks, sewage; erosion of natural deposits
Fluoride (ppm) *MCL: 4.0 MCLG: 4.0*	1.3	0.93-1.4	1.3	1.1-1.4	Yes	State-required additive; erosion of natural deposits; fertilizer and aluminum factory discharge
Mercury (inorganic) (ppb) *MCL: 2.0 MCLG: 2.0*	0.02	ND-0.02	not detected		Yes	Erosion of natural deposits; discharge from refineries and factories; runoff from landfills and cropland
Lead (ppb) 6/25/01 *AL: 15 (90% of samples tested must be <15 ppb)*	90% of samples were <3.0	0 out of 30 homes tested >15 ppb	not applicable		Yes	Corrosion of household plumbing systems; erosion of natural deposits
Copper (ppm) 6/25/01 *AL: 1.3 (90% of samples tested must be <1.3 ppm)*	90% of samples were <1.05	1 out of 30 homes tested >1.3 ppm	not applicable		Yes	Corrosion of household plumbing systems; erosion of natural deposits
Sulfate (ppm) *No established MCL or MCLG*	45	14-45	24	0	Yes	Erosion of natural deposits
Sodium (ppm) *No established MCL or MCLG*	14	8.5-14	6.5	0	Yes	Erosion of natural deposits
Radiologicals: Naturally-occurring minerals that emit radiation						
Alpha Emitters (pCi/L) *MCL: 15.0 MCLG: 0*	2.3	0	not detected		Yes	Erosion of natural deposits.
Microorganisms						
Total Coliform Bacteria (samples) *MCL: found in 1 monthly sample* *MCLG: found in no samples*	Found in 1 monthly sample*	0	not applicable		Yes	Naturally present in the environment.

*Follow-up sampling showed no contamination present.

ND: Not Detected

EPA Drinking Water Regulations

Drinking water, including bottled water, may reasonably be expected to contain at least small amounts of some contaminants. The presence of contaminants does not necessarily indicate that water poses a health risk. More information about contaminants and potential health effects can be obtained by calling the EPA's Safe Drinking Water Hotline (800-426-4791).

EPA regulates about 90 substances that are potentially harmful to human health and have at least a reasonable possibility of being found in either water sources or finished drinking water. Our water is monitored for these regulated contaminants at one time or another. Tested substances fall into one of five different categories.

Microbial Contaminants, such as viruses and bacteria, which may come from sewage treatment plants, septic systems, agricultural livestock operations, and wildlife.

Inorganic contaminants, such as salts and metals, which can occur naturally or result from urban stormwater runoff, industrial or domestic wastewater discharges, oil and gas production, mining, or farming.

Pesticides and herbicides, which may come from a variety of sources such as agriculture, urban stormwater runoff, and residential uses.

Organic chemicals, including synthetic and volatile organic chemicals, which are byproducts of industrial processes and petroleum production, and can also come from gas stations, urban stormwater runoff, and septic systems.

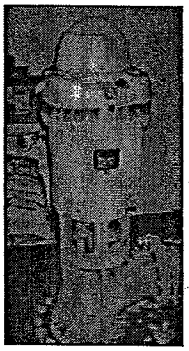
Radioactive contaminants, which can occur naturally or be the result of oil and gas production and mining activities.

Are Contaminants in Drinking Water a Concern for Me?

Some people may be more vulnerable to contaminants found in drinking water than the general population. Immuno-compromised persons, such as persons with cancer undergoing chemotherapy, persons who have undergone organ transplants, people with HIV/AIDS or other immune system disorders, some elderly, and infants, can be particularly at risk from infections. These people should seek advice about drinking water from their health care providers. EPA/Centers for Disease Control guidelines on appropriate means to lessen the risk of infection by Cryptosporidium and other microbial contaminants can be obtained by calling the EPA's Safe Drinking Water Hotline (800-426-4791).

Fridley Water Supply Sources

All water supplied by the City of Fridley is groundwater. The City operates 10 wells, ranging in depth from 199 to 850 feet, that draw water from the Quaternary Buried Artesian aquifer, the Jordan-Galesville aquifer, the Jordan aquifer, the Mt. Simon aquifer, and the Prairie Du Chien-Jordan aquifer. The Jordan and Mt. Simon formations are deep, bedrock aquifers. Water in these units is located in the spaces between the rock grains (such as sand grains) or in the fractures within the more solid rock. Buried artesian aquifers are shallower aquifers composed of glacial sand and gravel, over which a confining layer of clay or clay till was deposited.



High service pump for one of Fridleyís wells.

Some of Fridley's water is supplied to the system through an interconnection with the City of New Brighton. This water is also groundwater from the Mt. Simon, Jordan, and Prairie Du Chien formations. The interconnection between the two cities provides a back-up supply in case of a natural disaster that interrupts water service in one of the two communities.

The sources of drinking water (both tap water and bottled water) include rivers, lakes, streams, ponds, reservoirs, springs, and wells. As water travels over the surface of the land or through the ground, it dissolves naturally-occurring minerals and, in some cases, radioactive material, and can pick up substances resulting from the presence of animals or humans. Before a water source is used for a drinking water supply, it is tested for contaminants that may possibly be present. These test results for Fridley water are in the Laboratory Results table in this report.

Bottled Water

Food and Drug Administraion regulations establish limits for bottled water that must provide the same protection for public health. Studies repeatedly show that bottled water is no safer than conventional tap water.

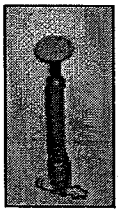
Water Treatment

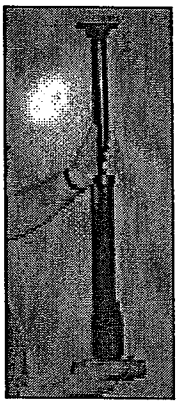
Fridley water undergoes a number of treatment processes before distribution. The water is filtered to remove iron and manganese, disinfected to keep the pipes free of harmful bacteria, and fluoridated for strong teeth according to State of Minnesota regulations. All chemical additions are precisely controlled by closely-monitored electronic pumps so that safe dosages are always used. The focus of the water treatment process is filtration. The city operates several filters at the three treatment plants. Specially-formulated sand and gravel remove iron and manganese as the water passes through the filter. This reduces the possibility that water will cause staining, and it helps improve the taste of the water.

Information for Homeowners

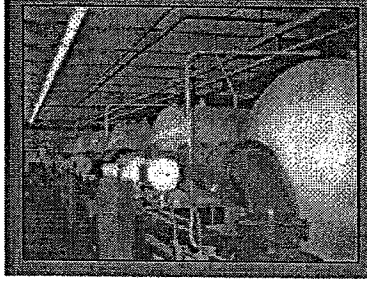
The City of Fridley owns and maintains all water mains and pipes up to the stand pipe (otherwise known as the curb stop). The customer owns and is responsible for the standpipe, the service line into the home, and the water meter. The standpipe is the apparatus that contains the outside shutoff valve. The City owns the shutoff valve contained within the standpipe; however, it is the homeownerís responsibility to keep the top of the standpipe accessible, undamaged, and at grade level. Homeowners need to make sure that the top of the standpipe does not get covered with pavement or buried under soil. Take care not to damage or bend the standpipe while mowing or digging on the property.

Property owners have a standpipe like this one buried on their property. The pipe contains the water shutoff valve for the home. Take care to keep the top of the standpipe accessible and at grade.





The white cylinders in the photo are filters in one of Fridley's water treatment plants. As water is forced through the filter, iron and manganese from the well water are left behind.



The Filtration Process

Container Options: Reduce, Recondition and Recycle

Minnesota Technical Assistance Program ■ FACT SHEET

Disposing of empty containers may be difficult because landfill operators have become concerned about groundwater contamination from hazardous residues left in empty containers. Operators are also concerned about using landfill space for large quantities of empty containers.

This fact sheet outlines strategies for reducing, reconditioning and recycling empty containers. It also provides a reference list of outlets that recondition or recycle empty containers.

Good Housekeeping

Empty the containers. Remove all valuable raw material from containers. One inch of paint left in 10 55-gallon drums equals a loss of 20 gallons of new paint, valued at $500. Use a pump to completely empty drums or tip containers to drain and use the remaining material.

Outside storage. When storing empty containers outside keep them closed to prevent rainwater from entering them. Keep empty drums on their sides. Rainwater can collect on their tops and seep inside, even when bungs are closed.

Monitor inventory. Store empty containers in a controlled-access area. This allows you to monitor container inventory and prevent unauthorized materials—hazardous and nonhazardous—from being added to containers.

If containers with hazardous residues are removed from company property, your company may still be liable for them.

Reduce Waste Containers

Returnable containers. Ask your supplier to use returnable containers. A deposit is usually required. Keep the returnable containers in good condition to receive the deposit refund.

Reuse containers. When possible, purchase materials in containers that can be reused. Containers may be reused to hold new material and, in some cases, hazardous waste. Make certain all containers meet U.S. Department of Transportation (DOT) requirements for their new uses.

Recondition containers. Reconditioners strip, paint and resell good-quality, heavy-gauge empty containers. But, most chemicals are shipped in less-expensive, lightweight containers—which cannot be reconditioned. The purchase price for heavy-gauge containers may be more, but you will save money by avoiding disposal costs associated with the lightweight containers. Ask your supplier to ship your materials in drums that can be reconditioned and meet U.S. DOT requirements for their new uses.

Reconditioners want containers completely empty and in good condition with all bungs, rings and closures in place.

Recycle Containers

Scrap metal and plastic recyclers may accept empty containers for recycling. Check with recyclers to learn what they accept. Here are a few questions to ask.

- What type of empty containers do you accept for recycling?
- Do I need to certify the container is empty?
- Do the ends need to be removed or do the containers need to be crushed?
- Do you accept residues in the bottom of containers? If so, how are they handled?

Hazardous Waste Residue Caution

If your drums contain hazardous residues, verify they are properly handled by the reconditioner or recycler. Under the Superfund Amendments of 1986, your company may be liable for clean up of hazardous residues left in empty containers. Containers reused for hazardous materials or wastes must meet U.S. DOT requirements.

(continued)

MnTAP is funded by a grant from the Minnesota Office of Environmental Assistance to the University of Minnesota, School of Public Health.

MnTAP • University of Minnesota • 200 Oak Street SE, Suite 350 • Minneapolis • Minnesota 55455-2008
612/624-1300 • 800/247-0015 (Minnesota only) • FAX 612/624-3370 • www.mntap.umn.edu

Empty Container Outlets

The outlets listed below recondition or recycle empty containers. Call first to verify the type and size of containers accepted and the type and amount of residue allowed.

For additional collectors and processors in your area, contact your local county solid waste officer or the Minnesota Materials Exchange. The Materials Exchange is a free service that links organizations with usable goods they no longer need to those who can use them. The Materials Exchange can help you identify reuse opportunities. For more information call 612/624-1300 or 800/247-0015. Or, visit <www.mnexchange.org>.

MnTAP maintains the following list of empty container outlets solely as a service to Minnesota companies. This is not a complete list of available outlets and does not represent an endorsement by MnTAP. MnTAP, by providing the list, does not guarantee that the services do or do not ensure compliance with environmental and safety laws in any specific application.

	Company	Containers Accepted	Notes
Drum Reconditioners	Bargain Container Co. A division of Western Container Minneapolis, MN 612/338-2413 bargaincontainer.com	Fiber or steel drums; 35-gallon and up	Nonhazardous residues only; charge for steel drums; resellable drums only
	Donna's Scrap Hauling and Barrel Service Minneapolis, MN 612/789-0950	Fiber drums; any size	Nonhazardous residues only; must be clean; must be open top with lids and rings
	Industrial Container Services Minneapolis, MN 612/781-0923 www.iconserv.com	Plastic or steel drums; 30- and 55-gallon	No residues
	Lushanko Container West St. Paul, MN 651/428-7420 651/457-7420	Fiber, plastic or steel drums; 15-gallon and up	Nonhazardous residues only; triple rinsed
Metal Container Recyclers	Becker Iron and Metal, Inc. Marshall, MN 507/537-0571	Any size	No residues; must be clean, empty and dry
	Chuck's Auto Salvage Grand Rapids, MN 218/328-6281 800/300-6281 chucksautosalvageinc.com	Any size; underground storage tanks	Nonhazardous residues only; must be clean and empty
	Goose Lake Auto Parts Waconia, MN 952/657-2221 888/657-6262 www.gooselakeauto.com	One to 55-gallon	Nonhazardous residues only
	Great Western Recycling Industries St. Paul, MN 651/224-4877	Any size; one end cut off	Nonhazardous residues only; must be clean; no lids
	Harley's Auto Salvage Faribault, MN 507/334-8290 harleysautosalvage.com	One to 55-gallon	No residues; must be clean, empty and dry; call first
	KBI Twin Valley, MN 218/584-8567	One to 55-gallon; underground storage tanks	No residues; triple rinsed; call about underground storage tanks

(continued)

	Company	Containers Accepted	Notes
Metal Container Recyclers	Leder Brothers Company Minneapolis, MN 612/721-6244	One to 55-gallon; underground storage tanks	No residues; must be open at one end; 300 pound minimum; acceptance based on what containers held; call first
	LeRoy Iron and Metal LeRoy, IA 641/329-5356	Any size; underground storage tanks	No residues; triple rinsed; call first
	The Schwartzmann Company, Inc. Anoka, MN 763/421-1187	55-gallon; one end cut off; underground storage tanks cut in half	No residues; must be clean and dry; 1/2 cubic yard to 40 cubic yard quantities
	Scrap Metal Processors Minneapolis, MN 612/377-6663 usascrap.com	Underground storage tanks cut in pieces	No residues; must be clean
	Wadena Hide and Fur Company Wadena, MN 218/631-2617	One to 55-gallon	No residues; triple rinsed; call first
Plastic Container Recyclers	Master Mark Plastics Albany, MN 320/845-2111 Paynesville, MN 320/243-7318 800/535-4838 mastermark.com	High-density polyethylene (HDPE), low-density polyethylene (LDPE)	Minimum quantity requirements; call first
	National Polymers, Inc. Lakeville, MN 952/469-4977	Rigid HDPE, LDPE and polypropylene (PP)	No residues; appointment only; fee charged; businesses only

For More Information

MnTAP has a variety of technical assistance services available to help Minnesota businesses implement industry-tailored solutions that maximize resource efficiency, prevent pollution and reduce costs. Our information resources are available online at <mntap.umn.edu>. Or, call MnTAP at 612/624-1300 or 800/247-0015 from greater Minnesota for personal assistance.

Minnesota Pollution Control Agency

Managing Empty Containers

Hazardous Waste #4.16, May 2000

This fact sheet is intended for generators of hazardous waste that need to safely dispose of empty containers.

Inside

Environmental Concerns

Just because a container is empty does not mean that it can always be thrown in the trash. Some containers may have more health and safety concerns because of the kinds of material they held. This fact sheet will help you determine the correct way to manage your empty containers.

Waste Prevention

Before you buy new products, think about how you'll have to manage the empty containers. Can you purchase the material in containers that can be returned and refilled? Can the empty containers be reconditioned and reused? Can they be recycled? Without purchasing more than you need, can you buy the product in one large container rather than several small ones? Making wise purchasing choices up front can reduce the amount of waste you must manage. Recycle empty containers whenever possible.

Containers that held Nonhazardous Waste

These containers are exempt from the hazardous waste rules. Reuse and/or recycle, when possible, or manage them as an industrial solid waste. Note: Not all nonhazardous waste is acceptable for disposal as an industrial solid waste. Check with your solid waste hauler/recycler to determine whether your waste is acceptable and whether there are other conditions you must meet.

Containers that held Acute Hazardous Waste

Acute hazardous waste is waste that is:

- one of the following F-listed wastes: F020, F021, F022, F023, F026 or F027; or
- a P-listed waste such as cyanide compounds or nitroglycerin.

Empty containers that once held acute hazardous waste are exempt from the hazardous waste rules if one of these three conditions has been met:

1. the container or inner liner has been triple-rinsed* using a solvent that is able to remove remaining residue; OR
2. the container or inner liner has been cleaned by another equally effective and approved method; OR
3. the inner liner that was in contact with the acute hazardous material has been removed from the container.**

**Triple-rinse* means to flush the container three times, each time using a volume of solvent equal to approximately ten percent of the container's capacity. Collect the rinse material and use as product, or manage it as a hazardous waste.

**Manage these inner liners as hazardous waste.

Containers that held Pesticides

Empty pesticide containers are subject to Minnesota Department of Agriculture regulations. These containers must be tripled-rinsed* (see above) prior to disposal or

Minnesota Pollution Control Agency, 520 Lafayette Road North, St. Paul, Minnesota 55155-4194
(651) 296-6300. toll-free (800) 657-3864, TDD (651) 282-5332 or (800) 657-3864

Metropolitan Council Environmental Services
Industrial Waste Section
230 East Fifth Street
St. Paul, Minnesota 55101-1633

For MCES Use Only	
Permit No:	
Staff:	
Received:	OT 1 2 3 4

Industrial Waste Discharge Report

Report due at the MCES office by the 30th of the month following the end of the reporting period.

1. Company Name: Tiro Industries, LLC
2. Location Address: 5601 East River Road, Fridley, MN 55432
   Mailing Address: 5601 East River Road, Fridley, MN 55432
3. Reporting Period covered by this report:
   A. ☐ Jan-Mar, 20 ___ ☐ Apr-Jun, 20 ___ ☐ Jul-Sep, 20 ___ ☐ Oct-Dec, 20 ___
   B. ☒ Jan-Jun, 20 03 ☐ Jul-Dec, 20 ___
   C. ☐ Jan-Dec, 20 ___
4. Total days of operation during this reporting period: 128
5. Average number of employees during this reporting period: 366
6. Number of working hours during a normal operating day: 24
7. Volume determinations for this reporting period:

A. Incoming water supply:

	Volume in gallons	Determination method
City water supply	14,299,000	Meter Readings
Private well(s)	0	NA
Other	111,600	Containment Dike
Total	14,410,600	Meter Readings and Measurements

B. Water not discharged to sanitary sewer:

	Volume in gallons	Determination method
To storm sewer	0	NA
To receiving water	0	NA
Lawn sprinkling	292,100	Meter Readings
Used in product	1,973,388	Batch Records
Lost to evaporation	227,100	Meter Readings @ 0.75
Other	0	NA
Total	2,492,588	Meter Readings

C. Wastewater discharged to sanitary sewer:

	Volume in gallons	Determination method
Cooling water	75,700	Meter Readings @ 0.25
Domestic waste	936,960	366 Employees X 128 Days X 20 Gallons
Industrial waste	10,905,352	Industrial Waste Equation
Other	0	NA
Total	11,918,012	Total A-- Total B

8. Date(s)/time frame of representative sample collections: May 1-2, 2003

9. Describe type and location of each monitoring point: Manhold in South Parking Lot

10. Monitoring point(s) represent: ☐ total facility ☒ other Main Sewer Line for Industrial and Domestic Waste

11. Volume (in gallons) discharged to the sanitary sewer during sampling time frame:

At monitoring point(s) 54,195 + 1,000 (N. Meter) total facility 55,195

12. Volumes in question 11 determined by: Flow Sampler Meter Readings

13. Method of sample collection: ☐ manually ☒ automatically

Describe 15 Minute Intervals for 24-Hours

14. Method of sample compositing: ☒ manually ☐ automatically

Describe Flow Proportional Based Upon Hourly Flows

15. Sample collected by: ☐ permittee ☒ other, name SampleTech Environmental

16. Sample composited by: ☐ permittee ☒ other, name Braun Intertec

17. Sample analyzed by: ☐ permittee ☒ other, name Braun Intertec

18. Analytical results: Report wastewater parameter concentrations determined at the monitoring point(s). A total facility value shall also be shown for each required parameter. Submit all laboratory data sheets and calculations. Permittees subject to EPA Categorical Pretreatment Standards shall also complete and attach an EPA Categorical Compliance Report.

Parameter	Monitoring Point(s)		Total Facility		For MCES Use Only
pH	8.0	units		units	
Total Suspended Solids	240.0	mg/L		mg/L	
Chemical Oxygen Demand	3,900.0	mg/L		mg/L	
Grease & Oil		mg/L		mg/L	
Cadmium		mg/L		mg/L	
Chromium		mg/L		mg/L	
Copper		mg/L		mg/L	
Lead		mg/L		mg/L	
Mercury		mg/L		mg/L	
Nickel		mg/L		mg/L	
Zinc		mg/L		mg/L	
Cyanide, Total		mg/L		mg/L	
Other		mg/L		mg/L	

19. Is the information contained in this report representative of the wastewater normally discharged from this facility during this reporting period? ☒ Yes ☐ No If No, attach an explanation.

20. Were these results obtained using EPA approved methods for sample collection, preservation, and analysis? ☒ Yes ☐ No If No, attach an explanation.

21. Are the laboratory data sheets from all sampling events submitted with this report? ☒ Yes ☐ No If No, attach an explanation.

Report submitted by: (*Note: Incomplete reports will not be accepted*)

Name (print) Brian L. Haugstad Date 07-11-03

Title Regulatory Affairs Manager Phone 763-572-2818

Signature Brian J. Haugstad Fax 763-572-2950

E-mail Address bhaugstad@tirollc.com

Appendix 5: Calculations

S.A.C. Fees

Avg. Number Gal/Day * 1 S.A.C. Unit*Day/274 Gal * $1275/S.A.C. Unit = Amount Charged

Example: Amount saved for a 4000 gal/day reduction

4000 gal/day * 1 SAC unit/274 gal/day * $1275/SAC unit =$18,613.14 in savings

Water Costs

Cost/gal * gallons used = Cost of the water

Example: 100 gallons of water used in a day

100 gal/day * $0.0035/gal = $0.35/day

Cost of Fuel to Produce Hot Water

Amount * ΔT * 1Btu/(^{o}F*lb) * 1/Efficiency *10^5 Btu/Therm * Cost/Therm = Hot Water Cost

Example: 100 gallons of water heated in a day

100 gal * (160-55)^{o}F * 1Btu/(^{o}F*lb) * 1/0.45 * 10^5 Btu/Therm * $0.7/Therm = $1.36/day

Total Hot Water Costs

Water Cost + Cost to Heat the Water = Total Costs

Example: 100 gallons of hot water used in a day

$0.35/day + $1.36/day = $1.71/day

*assuming 275 work days:

$1.71/day * 275 days/yr = $470.25 annually

Label Removal

Avg. Drums/Day * Working Days/Year * Time/Drum * Wages/Hour = Wages Lost Annually

Example: The removal of labels from drums

50 drums/day * 275 day/yr * 5.54 min/drum * $13.11/hr * 1 hr/60 min = $16,649.24 annually

Flow Rates

Weight Collected/Time it Took * Density = Flow Rate

Example: Pail Cleaning Nozzle

5.7 kg * 1/4.2 s * 0.2642 gal/1 kg * 60 s/1 min = 21.67 gal/min

Drum & Pail Cleaning Time Reduction

Containers Cleaned/Day * Flow Rate * (Difference in Times) = Water Saved

Example: Limit Pail Cleaning to 1 minute

118 pails/day * 5 gal/min * (2.13 – 1) min/pail = 667 gal/day

Drum & Pail Cleaning Nozzle Savings

Containers Cleaned/Day * Time/Container * (Difference in Flow Rates) = Water Saved

Example: Change to the Keg Washing Nozzle

118 pails/day * 2.13 min/pail * (13.5 – 5) gal/min = 2136 gal/day

Tank Washing Calculations

Number of Tanks Cleaned * Flow Rate * Reduction in Time Spent Per Tank = Water Saved

Example: Reduction for a typical day at Tiro

25 tanks/day * 7 gal/min * 5 min/tank = 875 gal/day

Tank Cooling Calculations

Number of Tanks Cooled * Flow Rate * Time Spent Per Tank = Water Saved

Example: Cooling Estimated in a day at Tiro Industries

25 tanks/day * 7 gal/min * 10 min/tank = 1750 gal/day