REPORT ON PROGRESS OF CAPITAL IMPROVEMENT PLAN AT THE MID-CONNECTICUT WASTE PROCESSING FACILITY

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January 24, 2008

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1 Introduction

In 2006, Grillo Engineering Co. (Grillo) was retained by CRRA to conduct an inspection of the Mid-Connecticut Project Waste Processing Facility (WPF). The inspection focused on the condition of the process mechanical equipment and the ongoing maintenance practices and procedures performed by the operator, the Metropolitan District Commission (MDC). The 2006 report gave a description of the condition of the equipment, the reason for the condition (i.e., maintenance or operating practices), and recommendations for restoration efforts (capital improvements), including approximate repair cost and time.

The purpose of this report is the following:

- Review the capital improvement projects that have been undertaken thus far and their impact on the operation of the facility.
- Review the capital improvement plan through 2012 and determine whether it is consistent with the recommendations in the 2006 report and its potential impact on future operations.
- Review present maintenance practices (scheduling, planning, etc.) and how it relates to future capital projects.
- Based on the present and projected future capital improvements, estimate the life of the WPF beyond 2012 and how future operations may compare with past operations.

In addition to preparing the 2006 Report, Grillo has been retained by CRRA to perform similar evaluations of operating and maintenance practices at the WPF periodically since 1993. That historical perspective is used in assessing the current operating conditions and potential future life of the WPF.

2 Description of the Facility

The Facility was designed in 1984 and began operations in 1988. It has two components: the WPF and the Power Block Facility (PBF). Municipal solid waste (MSW) is received at the WPF and processed into refuse-derived fuel (RDF). The RDF is then transported by conveyor to the PBF where it is combusted. Heat in the form of steam is recovered from the combustion and is used to generate electricity. The WPF is operated by the MDC under contract with CRRA.

The purpose of the WPF is to accept MSW, process it into RDF, and store the RDF until it can be fed to the boilers at the PBF for combustion to produce steam and electricity. The WPF consists of a tipping floor and two complete processing lines consisting of shredders, conveyors, and screening equipment which convert the MSW into RDF. An RDF storage building then holds the material until it is metered to the PBF as needed on a 24-hour per day, seven-day per week basis.

Figure 1 shows a schematic of the WPF. MSW is dumped on the tipping floor and pushed onto the feed conveyor by a front-end loader. A picking station with a grapple allows the operator to pick up oversized non-processible items and remove them from the waste stream. The non-processible materials, consisting mostly of large metal articles, carpets, and other unshreddable items, are loaded into a truck and taken to the landfill.

The processible MSW enters the primary shredder, which opens bags and reduces the particle size to under 12 inches (“minus 12-inches”). The shredded material passes under a primary rotating drum magnet and over a secondary rotating drum magnet to remove ferrous material. The recovered ferrous material is then loaded into trucks and hauled to a recycling market.

The ferrous-free, minus 12-inch material stream then splits into two streams and enters two primary trommel screens. The trommels are rotating cylinders with two hole sizes for screening. The first set of holes is approximately one inch in diameter and removes grit, dirt, broken glass, and other small, generally non-processible ("minus one-inch") materials. That minus one-inch process residue is loaded onto trucks and hauled to the landfill. The second set of holes is about five inches in diameter and removes the material which is properly sized for RDF without further size reduction ("minus five-inch"). The remaining material in the trommel, which is over five inches in size ("plus five-inch"), exits the trommel ("overs").

The minus five-inch material from the primary trommels enters a secondary trommel, which has a short section of one-inch holes to remove additional process residue for disposal. The remaining material is conveyed to a stationary packer which discharges into the RDF storage building.

The primary trommel overs, or plus five-inch material, is conveyed to a secondary shredder which reduces the particle size to under five inches. That material is conveyed to the stationary packer and goes directly to the RDF storage building. RDF remains in the RDF storage building until it is fed by front-end loader onto conveyors which lead to the boilers in the PBF. RDF is stored for times when MSW is not being processed.

The Facility processes waste from 7:30 a.m. until 11:30 p.m., Monday through Saturday. Operators work 10-hour shifts, four days a week. The first operating shift arrives at 6 a.m. and assists with cleaning until about 7 a.m., when they begin to start the equipment. MSW is fed starting at 7:30 a.m. That shift continues until 4:30 p.m. Sundays are available for either operations if there is excess MSW to be processed or maintenance if major maintenance is needed. The second operating shift arrives at 4 p.m. and operates the Facility until 11:30 p.m. At that time, the operations cease and operators assist with cleaning the equipment until 2:30 a.m.

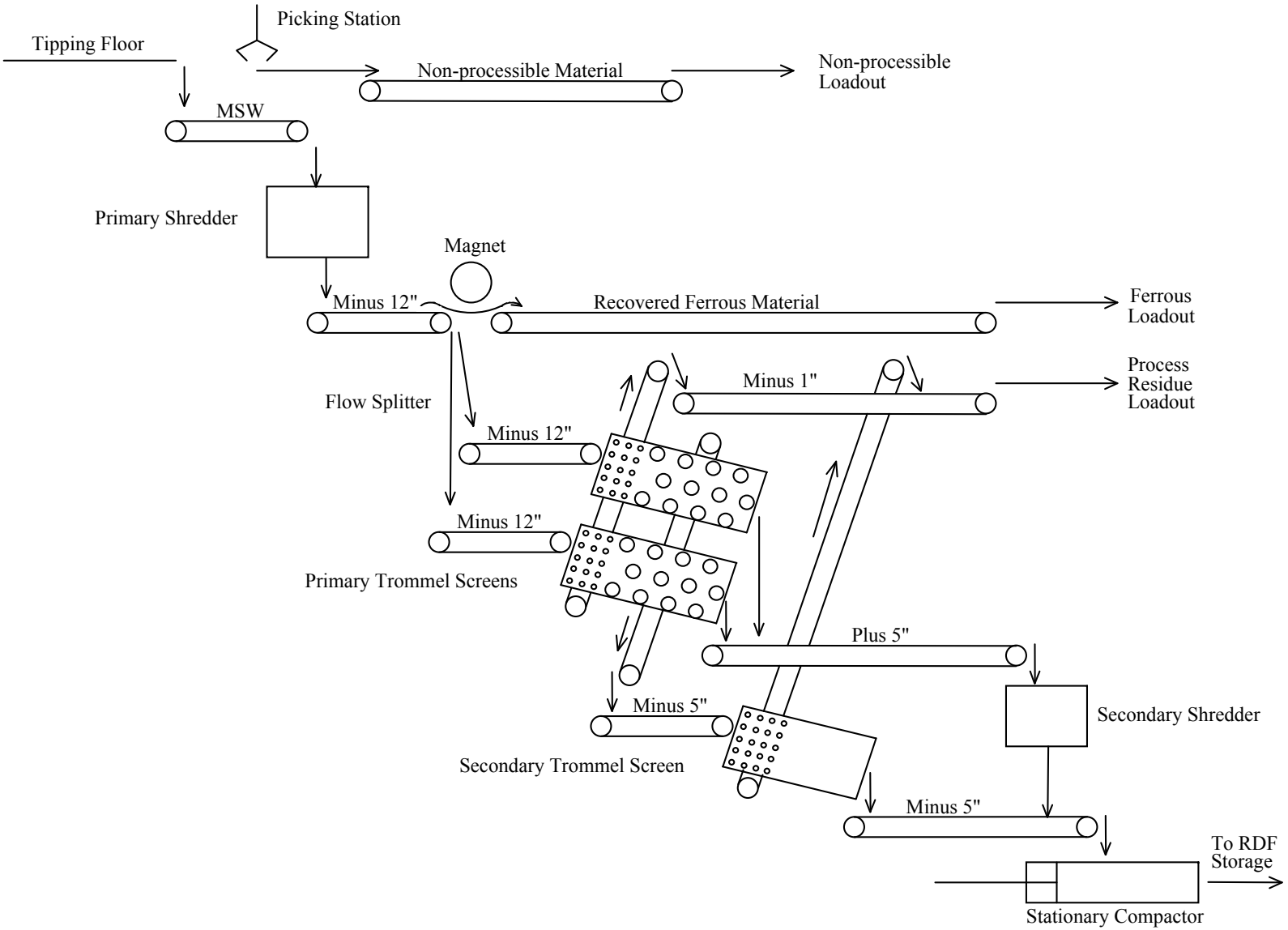
3 Description of WPF Equipment and Operating and Maintenance Practices

Most of the mechanical equipment at the WPF consists of replaceable components. As these components wear out or break, they are replaced by new components and the equipment continues to operate. The rate at which the equipment components wear out or break is primarily influenced by the way it is operated and maintained. MSW and RDF are extremely abrasive materials and can cause premature failure of components. As with any mechanical equipment, if it is cleaned daily, lubricated properly, and maintained in accordance with the manufacturer's recommendations, it will last substantially longer than equipment that has been neglected.

An example of the type of equipment that is common at the WPF is a belt conveyor. It consists of a structural frame to which all of the components are attached. The basic components are the belt, idlers to support the belt, a motor, drive shaft and sprocket at the head end to drive the conveyor, a tail shaft, walls to contain the material, and skirts attached to the walls to prevent spillage.

As an example of a typical problem, material will tend to get caught between the belt and the skirt during normal operation. If this material is not removed at the end of the day, it will cause abrasion on the belt, reducing its life. It will also cause the skirt to move out of position or break, allowing more material to spill off the conveyor. This will allow MSW or RDF to get into other components, causing premature wear and failure. Spillage is expected at any RDF facility, but steps should be taken to minimize it.

Figure 1
Waste Processing Facility Schematic



In addition to operating the equipment during processing hours, the operating staff is responsible for cleaning the equipment after processing has ended. If the spillage is cleaned each day, it will not cause undue harm to the equipment. The maintenance staff is responsible for fixing the cause of the problem. In this example case, it would involve replacing or readjusting the skirting. This type of problem is easily controllable if good operating and maintenance practices are followed.

Once "things get out of hand" and too many pieces of equipment have problems that have not been fixed, the problems escalate. Jams become frequent during operations, causing excessive downtime. Excessive downtime leads to an inability to process all of the material in the allotted time. Operating shifts are extended, which reduces the time that the maintenance shift has to fix problems. If this is allowed to occur, the staff is always in a reactive mode trying to fix problems, rather than in a proactive mode, where problems are avoided by maintaining the equipment before it fails.

At the behest of CRRA last year, the capital improvement plan was implemented and a new management philosophy for maintaining the facility was adopted. The new management philosophy has been to fix the problem areas and keep up with maintenance. This combination [has] made remarkable improvements in the ability of the facility to operate as intended.

The facility ran in a reactive mode for many years. In recent years, CRRA has taken more of a leadership role in managing the facility. That included having a full time person at the facility to monitor operations and direct management to change its operating and maintenance philosophy. At the behest of CRRA last year, the capital improvement plan was implemented and a new management philosophy for maintaining the facility was adopted. The new management philosophy has been to fix the problem areas and keep up with maintenance. By reducing spillage, less time is needed at night for cleaning, which allows more time for maintenance. This has allowed the facility to catch up with needed maintenance and become proactive in avoiding problems caused by a lack of maintenance. This better maintenance results in fewer processing line shutdowns due to jams and more processing time during operations.

After many years of operating, some equipment will need a complete overhaul, regardless of the maintenance performed on it. This is done when it is more prudent to tear out the equipment and replace it with a new one of similar or improved design. These are considered capital projects and are generally budgeted separately from typical operations and maintenance. Capital projects may also arise when a problem area is identified and it is determined that a redesigned piece of equipment could eliminate a problem.

This combination of a new management philosophy and a capital improvement plan have made remarkable improvements in the ability of the facility to operate as intended.

4 Summary of 2006 Report

The 2006 report evaluated all of the mechanical equipment at the WPF and identified areas impacted by operations and maintenance practices. It made recommendations for improvements to operating and maintenance practices and identified those equipment items which needed a complete overhaul. Many of the recommended operating and maintenance improvements have been implemented. Most of those pertained to better cleaning of the equipment and addressing areas that cause spillage, such as conveyor skirting.

Twenty-one capital items were recommended in Table 5 of that report. A summary of those items and their current status are shown in Table 1. CRRA and MDC have developed a capital improvement plan to complete the remaining items and other items over the ensuing years. The capital improvement plan is discussed in the next section.

Table 1
Recommended Capital Improvements

Equipment	Repair	Status
100B Conveyor	Completely refurbish	Complete
103 Shredder feed conveyor	Completely refurbish	Design
119 Trommel	Doors and frames	Out to Bid
120 Trommel	Doors and frames	Out to Bid
123 Belt conveyor	Trough, rebuild hoppers	Out to Bid
124 Belt conveyor	Completely refurbish	Complete
125 Belt conveyor	Completely refurbish	Complete
126 Belt conveyor	Trough	Preparing Bid
130 Belt conveyor	Retrough, impact beds	Complete
136 Air sweep baghouse	Platforms and doors	Design
138/238 Belt conveyors	Platform	Design
200B Conveyor	Completely refurbish	Complete
117 Belt conveyor	Completely refurbish	Complete
219 Trommel	Doors and frames	Out to Bid
220 Trommel	Doors and frames	Out to Bid
223 Belt conveyor	Trough, rebuild hoppers	Out to Bid
224 Belt conveyor	Completely refurbish	Complete
225 Belt conveyor	Completely refurbish	Complete
226 Belt conveyor	Trough	Preparing Bid
230 Belt conveyor	Completely refurbish	Complete
236 Air sweep baghouse	Platforms and doors	Design

5 Capital Improvement Plan

CRRA and MDC developed a capital improvement plan for major overhauls that are anticipated through the year 2012. These overhauls will allow the improvements to be made proactively to minimize downtime from equipment failures. Table 2 shows the capital improvement plan schedule and estimated costs for these future overhauls.

Much of the work pertains to replacement of apron conveyors. Apron conveyors have steel pans that are attached to a chain, instead of rubber belts. The chain has gliders that slide along a guide rail. The components of apron conveyors can be replaced as needed. However, about every five to seven years the conveyors need a complete overhaul.

Some of the items listed in the capital improvement plan were undertaken are in addition to those recommended in the 2006 report. The most significant of those was increasing the size of the secondary shredder motors from 1000 HP to 1250 HP and modifying the rotor design. This has contributed significantly to increasing the throughput of the lines.

Table 2 Capital Improvement Plan						
	Fiscal Year and Estimated Cost					
Description	**2007/08**	**2008/09**	**2009/10**	**2010/11**	**2011/12**	**2012/13**
11G/21G - Overhaul Picking Stations				160,000		
11G/21G/145G - Redesigned a/c system		85,000				
Replace VSD drives on conveyors		85,000				
100A - Overhaul conveyor			350,000			
200A - Overhaul conveyor		300,000				
100B - Overhaul conveyor					300,000	
200B - Overhaul conveyor						300,000
101 - Overhaul conveyor	360,000					
201 - Overhaul conveyor						300,000
102 - Overhaul conveyor				300,000		
202 - Overhaul conveyor					300,000	
104/204 - Overhaul shredder shells	140,000					
104/204 - Shredder bearing cooling system		79,000				
119/219 - Replace trommel thrust rings	40,000					
Replace 1" screens in 6 trommels			185,000			
Replace 5" screens in 4 trommels					200,000	
126/226 - Modify to troughing conveyors	50,000					
127/227 - Replace trommel thrust rings					360,000	
131/231 - Purchase 1250 HP shredder motor	150,000					
131/231 - Purchase 2 spare 1250 HP motors		200,000				
131/231 - Replace shredder crane assemblies			80,000			
131/231 - Purchase 2 spare shredder rotors			100,000			
134/234 - Upgrade motors to 250 HP		110,000				
135/235 - Replace cyclones			180,000			
140/240 - Overhaul packers				200,000	200,000	
500A/500B - Overhaul conveyors				300,000	300,000	
501/502 - Overhaul conveyors			300,000	300,000		
504 - Overhaul conveyor	180,000					
503/504 - Convert to belt conveyors				300,000	300,000	
Total	**920,000**	**859,000**	**1,195,000**	**1,560,000**	**1,960,000**	**600,000**

The capital improvement plan prepared by CRRA and MDC is conservative in that it anticipates overhauling equipment before the end of its useful life. This will ensure that the facility can operate without excessive downtime due to failing equipment. The capital improvements made within the last year have made a remarkable impact on the operation of the facility in terms of the amount of waste it is capable of processing and the cleanliness of the equipment. These areas are discussed below.

6 Capacity and Availability

The capacity of the WPF is a measure of its ability to process waste while the processing lines are running. It is compared with the nominal design capacity of 100 tons per hour per line, and does not consider down time. Availability is a measure of the amount of time that the processing lines are able to operate, regardless of the amount MSW they process when they operate.

Two reporting methods are used when presenting the processing rate of the Facility. In both cases, the numerator is the total number of tons processed during the day. The first method is a measurement of the capacity and is reported as "tons per run hour". This uses as the denominator only the hours during the day that equipment operates. This does not include time that a line is shut down for repairs or maintenance during a run.

The second method is a form of measurement of the availability and is reported as "tons per available hour". In this method, the processing start time and end time for the day are used to determine the denominator. Line downtime is not subtracted out of the total hours. Each day's run is considered to be 16 hours, unless additional processing time is used to reduce MSW inventories. This is also referred to as "tons per clock hour". The original facility design criteria anticipated an average of 85 tons per available hour.

Figure 2 shows a monthly graph of tons processed per run hour versus time, from July 1999 through December 2007. The straight lines through the data are linear regressions from July 1999 through February 2007 and March 2007 through December 2007. A linear regression is a mathematical calculation which results in a straight line representing the "best fit" of the data. The slope of the line indicates whether the parameter has trended upward or downward over the time period evaluated. The first line that ends in February 2007 represents the operation of the facility before the recent plant improvements were made. Improvements were made from February until the present, and work on the facility is ongoing.

Figures 2 and 3 demonstrate the vast improvement in operations since the capital improvement plan has begun. As more projects are completed, the is expected to be capable of operating at about 90 tons per available hour, which is in excess of the original design expectation when the facility was first constructed.

Figure 3 shows a monthly graph of tons processed per available hour versus time, from July 1999 through December 2007. The straight lines through the data are linear regressions from July 1999 through February 2007 and March 2007 through December 2007.

Figures 2 and 3 demonstrate the vast improvement in operations since the capital improvement plan has begun. As more projects are completed, the facility is expected to operate in excess of the levels that are now being achieved. The facility is expected to be capable of operating at about 90 tons per available hour, which is in excess of the original design expectation when the facility was first constructed.

7 Condition of the Facility

The implementation of the capital improvement plan and the new management philosophy pertaining to maintenance has resulted in a dramatic impact on the appearance and operation of the facility. It is in better condition today than it has been since at least 1993.

Figure 2
Tons Processed per Run Hour vs. Time

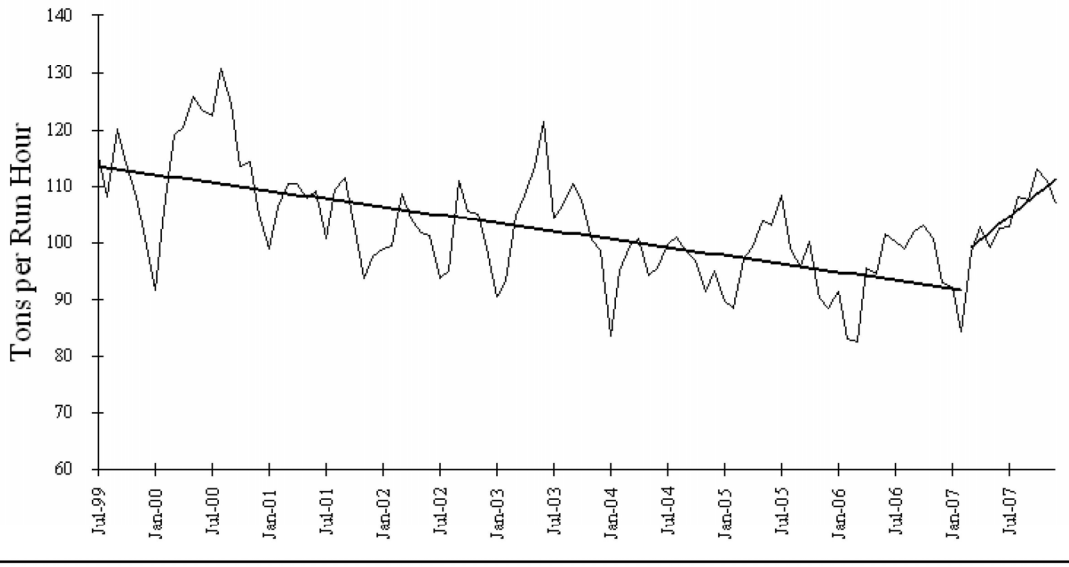
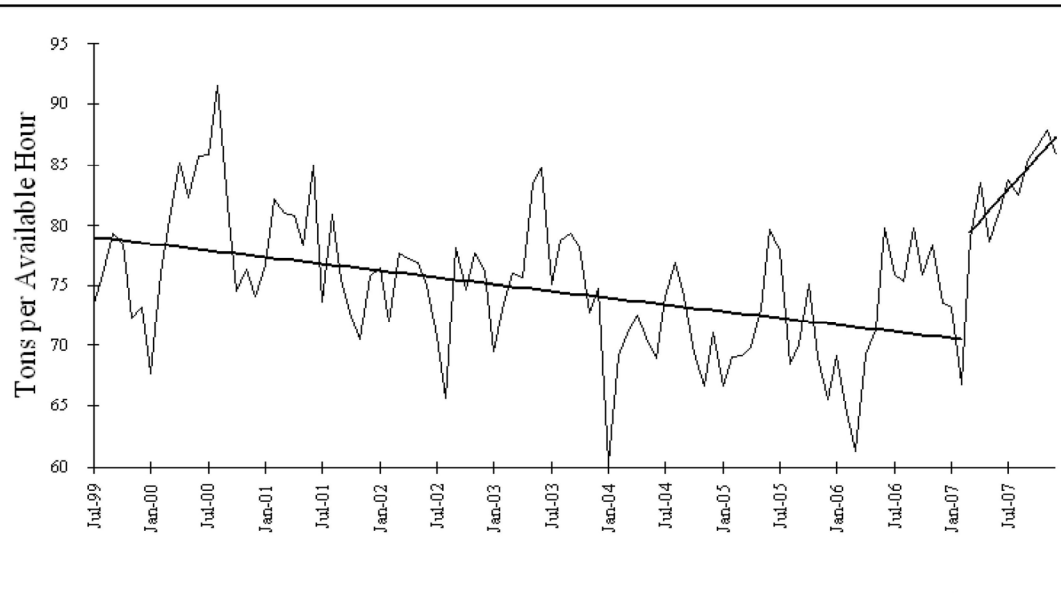


Figure 3
Tons Processed per Available Hour vs. Time



Photos were taken during site visits in 2004 and in preparation of the 2006 report. Photos of the same areas were taken as part of the preparation of this report. Both sets of photos, showing "before" and "after" conditions for comparison are at the end of this report. In each case, the "before" photo is on the left. Every attempt was made to duplicate the position of the earlier photo so a direct comparison can be made.

In some cases, the "before" photos are labeled "after cleaning". These were taken immediately before startup on one day in 2004. The equipment had been cleaned after operations concluded on the prior night. Some of the "after" photos are labeled "while operating". These were taken after approximately seven hours of operation while the equipment was running. The 130 and 230 conveyors had to be shut down for safety reasons to obtain the photos taken from the area near the secondary shredder.

So long as the capital improvement plan and new maintenance policy are followed, the facility should be capable of continuing to process about 90 tons per available hour, which is in excess of the original design capability of the plant, until at least the year 2028.

The photos of Conveyor 100B contain notation "original wheels" and "rebuilt blocks". The conveyor originally had steel wheels to carry the conveyor pans. The conveyor was rebuilt with urethane blocks that wear better and are substantially less expensive to purchase and maintain.

The photos of Conveyor 124 contains the notation "original" and "rebuilt". Conveyors 124, 224, 125, and 225 are under the primary trommels and perform the same functions. All four were similar in appearance to the "original" photo of 124. All have been rebuilt and are now similar in appearance to the "rebuilt" photo.

The photos show the significant improvement in overall cleanliness of the facility, which impacts operations and maintenance directly. The improvement is attributable to the implementation of the capital improvement plan and the new maintenance policy.

8 Future of the WPF

With continued proper maintenance and repair, the facility will be capable of operating for at least another 20 years. The capital improvement plan extends to the year 2012. Periodic overhauls of major steel apron conveyors and other processing equipment are included in that plan. Rubber belt conveyors will continue to need replacement of components as they wear out. This is normal and expected maintenance and is not included in a capital improvement plan. The plan does call for continued upgrading of the rubber belt conveyors from flat belts to troughing belts for those that have not been done yet. Once completed, these will not require complete overhauls in the future.

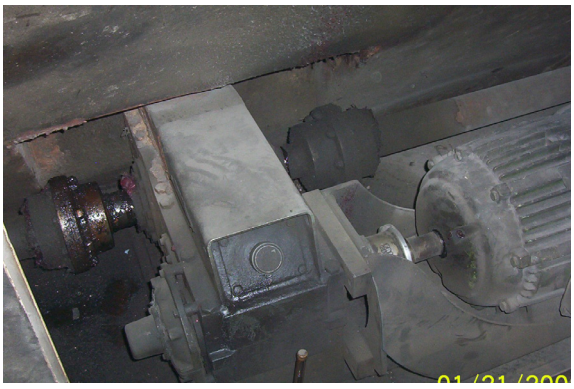
The capital improvement plan also includes non-processing equipment related items, such as floor repairs, building painting, roof repairs, safety upgrades, and mobile equipment replacement, that are not addressed in this report. Overall, the plan is comprehensive, including all future major capital projects.

So long as the capital improvement plan and new maintenance policy are followed, the facility should be capable of continuing to process about 90 tons per available hour, which is in excess of the original design capability of the plant, until at least the year 2028.

2006	2008
	
After Cleaning	Conveyor 115 Tail Shaft While Operating

2004	2008
	
After Cleaning	Conveyor 115 While Operating

2004	2008
	
Spillage Below Conveyors 117/217 and 118/218	

2006	2008
	

After Cleaning **Trommel 119 Spillage at Drive** **While Operating**

2006	2008
	

After Cleaning **Trommel 219 Spillage at Rear Wheel** **While Operating**

2004	2008
	

Spillage Under Trommels 219/220

2004	2008
	

Spillage Under Conveyor 123

2004	2008
	

Conveyor 223

2006	2008
	

Original **Conveyor 124** **Rebuilt**

2006	2008
	
After Cleaning	Conveyor 126 Spillage in Idlers While Operating

2004	2008
	
After Cleaning	Conveyor 226 While Operating

2004	2008
	
Conveyor 226 Spillage	

2004	2008
	

Conveyor 130 Spillage

2006	2008
	

After Cleaning **Conveyor 130** **While Operating**

2006	2008
	

After Cleaning **Conveyor 130 Head Shaft** **While Operating**

2004	2008
	

Conveyor 230 Spillage

2004		2008
		
After Cleaning	**Conveyor 230**	**While Operating**

2006	2008
	

Conveyor 230 Spillage in Idlers

2006	2008
	

Conveyor 239 Spillage at Tail End