Pinellas County Resource Recovery Facility  
Capital Replacement Project

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ABSTRACT
Pinellas County has completed the first two phases of a four-phase project intended to preserve the life of the Pinellas County Resource Recovery Facility (PCRRF) for years to come. This project, called the Capital Replacement Project (CRP), is designed to restore key portions of the County’s investment, and prepare the facility for a smooth transition to a new operating contract when the current term expires in 2007. By the end of 2004, with the scheduled completion of the CRP project, key plant systems and components are expected to be in robust condition and capable of many years of additional service.

INTRODUCTION
The key elements of the CRP were outlined in a paper presented at the 9th Annual North American Waste-to-Energy Conference in 2001, and published in the proceedings thereof. The PCRRF is owned by Pinellas County, and operated by Wheelabrator Pinellas Inc. (WPI) under a management agreement originally scheduled to expire in 2003. With the negotiation of mutually beneficial terms in the Agreement between Pinellas County and WPI for performing the CRP project, the operating contract has been extended to 2007. The key elements of the CRP project are:

- Boiler Refurbishment
- Refuse Crane Rebuilds
- Cooling Tower Refurbishment
- Tipping Floor Expansion
- Instrumentation and Controls Upgrades

This paper will describe each of these projects and work completed to date (February 2002).

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Each of the three boilers at the PCRRF consists of a Martin grate system and furnace/boiler design by D.B. Riley. Each boiler has a maximum continuous rating of 244,000 lbs/hr of steam at 615 psia, 750°F. Boiler Units 1 and 2 were completed in 1983, while Unit 3 was added in 1986. MSW rated capacity is approximately 1,050 TPD, based upon 4,800 Btu/lb higher heating value.

The original boiler/furnace configuration had been modified slightly over the years, to incorporate over fire air system modifications for improved combustion, and to add a selective non-catalytic reaction (SNCR), urea-based system for NOx reduction. In addition, boiler tube cleaning equipment had been removed or modified. Although the units have operated fairly reliably over the years, the boilers required frequent cleaning due to gas side fouling, and exhibited higher than optimal economizer gas exit temperatures and off-design superheater outlet temperatures, resulting in loss of turbine-generator capacity.

Condition assessments were performed on all three boilers, and it was determined that the steam drums were in excellent condition, and furnace water walls were in generally serviceable condition, although some warping was apparent. To focus on performance enhancement, it was decided to redesign the convection passes with several key objectives:

1. Optimize final steam temperatures.
2. Achieve uniform gas velocities and good ash dropout.
3. Reapply cleaning systems to maintain boiler heat transfer.

Boiler design and fabrication was awarded to Babcock, Borsig Power (BBP and formerly D.B. Riley) of Worcester, MA. Part of the design configuration included a "cold flow" model to confirm velocity profiles throughout the unit. The model testing, performed by NELS Consulting of Niagara Falls, Ontario was an iterative process. A one-sixth scale plastic model was used, and multiple runs were conducted to optimize an arrangement of baffles to achieve uniform velocity distributions and maximum ash dropout.
BOILER ERECTION

Each boiler was scheduled to be taken out of service, and refitted with all new convection passes, from furnace outlet to economizer outlet, over a 14-week shutdown period. In order to preserve existing electrical capacity contract provisions, the 14 week period was prearranged with the electric utility to coincide with periods of relatively low load demand, starting in late fall, through the end of the year. Accordingly, one unit is scheduled to be taken out of service for refurbishment each year in 2001, 2002 and 2003.

Unit 2, the middle unit, was completed in late 2001. It was taken off line on September 13, 2001, and returned to service on December 28, 2001. Following its return to service, performance testing confirmed its ability to perform at design levels. Superheater outlet temperature has returned to design level of 750°F, with a small amount of desuperheating, and economizer gas outlet temperatures have decreased approximately 100°F. The new boiler cleaning systems, a combination of rappers and steam soot blowers, are performing as intended.
Photo 8 - Demolition of Economizer Section

Photo 9 - Old superheater Headers and Support Structure

Photo 10 - New Superheater Headers and Support Structure Photo

11 - Flying Water Wall Panels

Photo 12 - Installation of New Releaser Tubes

Photo 13 - Hanging New Water Wall Panels
REFUSE CRANE REBUILDS

The original refuse cranes had reached the point where more frequent maintenance was required and some of the electrical parts were becoming obsolete. In addition, motor failures were becoming more frequent, as a result of very high ambient temperature levels at the trolley elevation, during the summer months. Each of the three cranes is equipped with orange peel grapples, originally rated at 11 tons capacity. In order to increase design margins and have a more robust design, replacement trolleys were specified with a 15-ton capacity rating, while retaining the original 11-ton grapples.

Crane trolley replacements were scheduled coincident with the first (Unit 2) boiler outage. Complete trolley assemblies were hoisted through roof hatches, one at a time, while the remaining two cranes kept the operating units running. In addition to new trolleys, the refurbishment included replacement trolley and bridge cable festoons, operator chairs/controls, and motor controls.

The crane rebuilds were completed on schedule, and are functioning reliably. Crane operators are pleased with the new controls, and they report smoother and more responsive operation, particularly with wet fuel.
**Cooling Tower Rebuilds**

The PCRRF has a five cell wet cooling tower, with three cells built in 1983 to serve turbine-generator No. 1 and Boilers 1 and 2, while cells four and five were added in 1986, along with Boiler No. 3 and turbine-generator No. 2. The cooling tower basin is concrete, with wood cells, single speed fan drives and conventional plastic fill. Each cell is capable of being isolated from the others on the water and air sides, making reconstruction of one cell at a time possible.

Detailed internal inspection revealed that approximately 20% of the wooden structural members had experienced degradation, most often at bolted joints and attachment points. Members are pressure treated lumber, primarily 4"x4", and 2"x6" size. During the inspections, a detailed map was created, showing each damaged member, which was scheduled for replacement. In addition, the entire upper deck, of plywood construction, was badly deteriorated, and it was decided that tongue and groove construction, 2”x 6” redwood boards, would provide better long-term service in this application. In addition, internal cell baffles, hot water distribution decks, and hot water risers were replaced in kind. The initial plastic fill was found to be in good condition, requiring only localized replacement to repair damaged areas. Motors were reconditioned, and new gearboxes, drive shafts, and fan blades were installed.

The original schedule was for each cell’s refurbishment to take approximately 30 days, with at least three cells always operational. Actual replacement averaged approximately three weeks per cell, and this portion of the project was completed well ahead of schedule.

**Photo 17 - Interior of Cell 1**

**Photo 18 - Damaged Member Flagged for Replacement**

**Photo 19 - Fan Deck With Shroud Removed. Ready for Demolition**

**Photo 20 - New deck Framing and Gear Box**
**Tipping Floor Modification**

The tipping floor modification project was not based upon replacement of deteriorated or worn out equipment, as were the other project elements. Rather, this project was initiated in order to improve customer service by reducing queuing times during heavy waste delivery periods. At the PCRRF, the original traffic pattern had vehicles entering into the South end of the building, backing into one of eight tipping bays, and exiting the floor through the door on the North end.

![Figure 1 - Existing Tipping Floor Traffic Pattern](image)

Given the relatively long and narrow layout of the tipping hall, traffic congestion on the floor sometimes occurred, especially when a vehicle had difficulty unloading, or experienced a breakdown. This would tend to inhibit other vehicles from traveling the length of the building to unload and drive out. As a way to alleviate this periodic congestion, a new design and traffic pattern was devised to allow trucks to approach and line up to an open tipping bay from outside the tipping hall, and back into one of seven new rollup doors on the Westside of the tipping hall.

![Figure 2 - Revised Tipping Floor Traffic Pattern](image)
In order to make this change, approximately 70,000 cubic yards of fill was brought in, and a new apron was created. The width of the new apron is 120 ft., of which 60 feet is concrete, and 60 ft. is asphalt construction.

Photo 21 - Existing Tipping Floor and Ramps

Photo 22 - Placing New Fill

Photo 23 - New Concrete Slab Against Existing Building

Photo 24 - New Entrance Doors on West Side

Photo 25 - Push Wall on North End of Tipping Floor
In terms of construction sequencing, the tipping floor modification was scheduled to be completed prior to the crane replacement project, in order to minimize any potential issues leading to safety concerns on the floor, or to waste diversion or excessive traffic congestion. To date, the new traffic pattern has proven beneficial in minimizing unloading time, and improving on safety concerns. A side benefit was the construction of push walls on the North and South ends of the tipping building to allow more flexibility in storage and staging of MSW on the floor.

**Instrumentation and Control Upgrades**

Like many early generation waste-to-energy facilities, the PCRRF's instrumentation and control technologies reflected common design practice in the late 1970's and early 1980's. It has a conventional vertical control panel, containing individual control switches, indicating lamps, single loop analog controllers, including some pneumatic devices, window type annunciators, and paper chart recorders.

![Photo 26 - Existing Boiler Control Panels](image)

![Photo 27 - New Martin Controller With Steam Flow Chart](image)

In the late 1990's, in order to comply with the Clean Air Act Amendments, spray dryers, fabric filters, lime slurry systems, carbon injection and SNCR systems were added. These were controlled and monitored by a new, cathode ray tube (CRT) based Distributed Control System (DCS), leaving a hybrid of original and new control and monitoring systems. The CRP represented an opportunity to modernize boiler and balance of plant controls, thus achieving consistency of platforms for the operators, and a reduction in the variety and vintage of control technologies to be maintained by the technicians.

![Photo 28 - New Operator Control Stations](image)

The instrument and controls retrofit project will unify and expand the DCS systems in place, and will monitor and control the boilers and balance of plant controls. This will be accomplished in phases, as each boiler is retrofitted over a period of three years. As each boiler comes off line in sequence for retrofit, its associated controls and monitoring systems are changed out, using modern "smart transmitters" to replace the older pneumatic and electronic systems. With the completion of each boiler, the associated vertical control panel is effectively abandoned in place. As the project progresses, the various "balance of plant" systems, such
as deaerators, feed pumps, cooling tower, and condensate systems are converted over to DCS monitoring and control. Upon completion of the last boiler, scheduled for late 2003, the vertical control panels will be demolished. At that time, the turbine controls will be relocated to a new bench board panel, and the auxiliary electrical and switchyard controls will remain on conventional control panels.

**Martin Control Upgrades**

Along with the upgraded boiler and balance of plant controls and monitors, the grate systems and their associated controls have evolved over the years. Martin GMBH, of Munich, GDR, who provided the original grates and controls, were contracted to provide upgraded controls coincident with the boiler work. These controls manipulate grate movement, ram feeder sequencing and feed rate in response to steam flow demand, O2 levels, furnace temperatures, etc. Part of this scope entails the addition of new proportioning controls to some of the grate hydraulic systems that were previously “on-off” or stepwise controlled. Another portion was the use of new sensor technologies, in particular, a sophisticated and accurate furnace temperature pyrometer. Finally, new programmable logic controllers (PLC’s) were supplied, with new software and operator interface functions, which was connected into the DCS.

The new grate control system has exhibited superior control characteristics compared to the original system. Specifically, steam flow control is very smooth and responsive.

**Project to Date Summary**

The County and WPI have completed the first two phases of detailed engineering and planning, and completion of the first boiler train, and most of the balance of plant functions for the CRP. The boiler outages were completed within a 106-day period, from shutdown to return to service, and within the allocated schedule. The retrofit unit has easily passed its acceptance tests, and is routinely “cruising” at 90% of Maximum Continuous Rating, and at design steam conditions. Instantaneous power generation has increased by about 10%. Early indications are that the project, when complete, will enable the PCRRF to enjoy many years of future service, with lower maintenance costs, improved availability, and modernized equipment.

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**Acronyms**

BBP Babcock, Borsig Power
CRP Capital Replacement Project
CRT Cathode Ray Tube
DCS Distributed Control System
PCRRF Pinellas County Resource Recovery Facility
PLC’s Programmable Logic Controllers
SNCR Selective Non-Catalytic Reaction
WPI Wheelabrator Pinellas Inc.