The Evolution of Non-Ferrous Recovery at The Solid Waste Authority of Palm Beach County’s North County Resource Recovery Facility

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The North County Resource Recovery Facility is a 2,000 tpd refuse derived fuel (RDF) Waste to Energy facility located in West Palm Beach, FL. Palm Beach Resource Recovery Corporation (PBRRC), a wholly owned subsidiary of The Babcock & Wilcox Company (B&W), operates and maintains the facility under a long-term operation and maintenance (O&M) agreement with the Solid Waste Authority of Palm Beach County.

This paper describes how this facility’s non-ferrous recovery has evolved and expanded from its initial operation with manual hand-picking stations strictly for the removal of used beverage containers (UBCs) to its present day configuration collecting multiple non-ferrous streams using five (5) eddy current separators throughout the facility. In addition, the recovery of coins from the waste stream has been tested and is in operation.

Of primary importance to the facility is the reduction in waste to the adjoining landfill. Since commissioning in 1989 the plant has strived to increase annual waste throughput, now averaging 866,000 tons over the past five years. Additionally non-ferrous metal pricing over the years has contributed to make investments justified, in addition to the saving of landfill space.

Pertinent data included within the paper will include but not be limited to the following:

- Facility waste throughput by year
- Total non-ferrous recovered in tons by year
- Total non-ferrous recovered in lbs per ton of waste processed, by year
- Curbside recycling UBC recovery in fiscal year recovery
- Residue test data for project development
- Coin recovery
The North County Resource Recovery Facility in general overview is a 2,000 ton per day RDF type waste to energy facility. It is owned by the Solid Waste Authority of Palm Beach Country and has been in commercial operation since 1989. The fuel processing side of the facility was designed, engineered and initially operated by National Ecology Corporation, who was shortly acquired by The Babcock and Wilcox Company (B&W) and then years later disbanded. B&W has the operation and maintenance contract/responsibility for both the fuel preparation and power generation sides of the facility, under a long term contract with the Solid Waste Authority.

For fuel preparation purposes the facility has three identical lines. Municipal solid waste (MSW) is delivered to the tipping floor, sifted and inspected by a clawed excavator and fed into a flail mill. The loosened material is then presented to an overhead ferrous magnet before entering a trommel for sizing. Here there are 2-5/8” holes and slots for residue, 6-5/8” holes for UBC densification, and an “overs” stream for the large items. Both the densified 6” stream and the overs (after additional shredding) become boiler fuel. The original design concept was to employ up to eight (8) people on each processing line to recover at least 60% of the UBCs in the processed waste stream.

After five months of operation, recovering almost 700,000 lbs of UBCs (3.1 lbs/ton), the decision was made by the owner to cease this portion of the contract.

B&W, with the owner’s consent, elected to absorb the cost associated with the manual recovery of UBCs while investigating, designing, and justifying replacement of the picking stations with ECS (eddy current separator) machines. Recovery dropped to 1.6 lbs/ton and the first fiscal year concluded with a total recovery of 1.1 million pounds. The project was approved and machines selected were of the concentric rotor design, with the first installed in May 1991, and two more shortly thereafter. In order to maintain the plant’s primary purpose of waste shredding, the machines were installed with 100% bypass capability. To maximize recovery, a variable frequency drive was employed to adjust trajectories while a single picker per line was retained to remove debris attached to the UBCs. The new method retained the existing crushing and loading system into closed van trailers.

While UBC recovery increased averaging 3.3 lbs/ton in fiscal year three, the machines were not without challenges. Ferrous metal retained in the rotating field became extremely hot and burned holes in conveyor belts and the fiberglass shell over the rotating magnets. The rotating magnets themselves worked loose and dictated a reduction in RPM of 13%. A conveyor belt thicker than original was used to resist the abuse by the MSW. However, with the increased availability, overall recovery per ton of waste increased and hovered around 5 lbs/ton for several years. To maintain availability, a spare ECS magnetic head assembly was acquired and kept ready for installation. An in-state repair shop was employed to make repairs to the rotating head assemblies, as the OEM repairs required extensive travel.
While tuning the systems it was noted the debris pickers were plagued with sticks, spears and various non-ferrous products (baseball bats, fasteners, matchbox cars, ornamental items, fire extinguishers, hardware, auto AC parts). While the sticks were discarded, the metals were retained, accumulated and sold as loose non-ferrous scrap in a rolloff container. Concluding 2005 these “precious metals” have exceeded 4 million pounds and average 0.5 lbs/ton of waste. Initially viewed as pure junk having to be removed to make the UBC product, this material itself has provided substantial revenue throughout the years.

In 1996 the facility realized there were worthwhile non-ferrous metals contained in the post combustion ash stream going to the landfill. Tests showed non-ferrous metals exceeded 3% by weight of the boiler bottom ash. Projected out this would exceed 2,800 tons annually at nearly 7 lbs/ton of processed waste. It took some time for a conceptual design and to gain agreement between all involved parties. Installation soon followed, and the first shipment was made in September 1997. As the plant ash system has no storage capability this system was designed with 100% bypass capability and to operate inline 24/7. Thusly the eccentric rotor design was selected, due to the combination of our experience with concentric and quick accessibility of a machine. The system was installed in the bottom ash stream (sans flyash) with a vibratory feeder, vibratory screening device and tramp ferrous magnet preceding the actual ECS. The system has been on a long-term average recovery of 5 lbs/ton of waste. Through 2005 the system had recovered over 35 million pounds of material that would have otherwise gone into the landfill. As the system has aged it has also been simplified, without flyash there is no need for prescreening material, and the tramp magnet provided little metal but much ash. It too has since been retired. Occasional testing for non-recovered material has shown the system to be working well. The difference between the tested 7 lbs/ton and the average 5 can be attributed to system availability, lighter cans, changes in the shredding plant or improved curbside recycling.

Entering 1998 the facility was operating four ECS systems (3 prior to and 1 post combustion). The UBC concentric units were suffering poor availability and were becoming expensive to maintain. In addition the large sieving trommels (10’ X 70’) were also a cause of substantial downtime and the design, fabrication and installation of replacements was underway. The first new trommel was operational in 1998, the third one in 2002. However, these new trommels removed more residue (through the 2-5/8” holes) and also substantial UBCs with this residue. This stream is direct loaded into trucks and hauled to the landfill. While the trommels were being replaced we also elected to replace the 48” wide concentric ECS units with 1.5 meter wide eccentric units in hopes of increased recovery due to less burden depth on the belt, or at least the same as we increased the shredding rate. Since the replacements were completed (three each) UBC recovery has averaged just 2.8 lbs/ton.

Summing up the non-ferrous operation at this point: UBCs and precious metals were being recovered from the 6” material at each processing line. Metal that was missed by the ECS, or bypassed it via the secondary shredder, was subject to collection after combustion. In 2001 the facility was recovering a total of 8.7 lbs of non-ferrous from every ton of waste processed. The only stream not being scrutinized at this time was the residue sieved out by the trommels. Annual tonnage here exceeds 200,000 at a rate up to 75 tph depending on the number of lines running and the feed rate at any given moment. It also varies in density,
moisture, stickyness and odor. It was
believed that this stream was unprocessable
in its varying conditions, and material
contained within it was unmarketable due to
odor and contamination.

Beginning in late 1997 and continuing
through 2001, the plant staff conducted tests
to determine what metals were contained in
this residue stream. Seventeen individual
tests were run, using 3 tons of sample each
time. The material was slow fed across an
installed ECS with the diverted material then
hand sorted for desirable versus non-
desirable. Substantial Lysol and Raid were
needed to support the hand sorting. The
average of the tests showed another 2.5
million lbs of material (3.2 lbs/ton of waste)
of marketable mixed non-ferrous metals. It
also showed $175,000 annually in coins.
More importantly it showed an increasing
trend in the metal and value of the coins as
the trommels were replaced. But the
material was still odorous with lots of
insects. This established (with some
confidence) what was contained there – and
an estimated value was calculated – but its
marketability was still questionable.

We felt the material needed to be cleaned in
order to generate revenue. Not wanting to
add equipment, the boiler bottom ash
"submerged scraper chain" conveyor
presented itself as a viable option. The water
would resolve the insects, odor and possibly
some debris as this bath is followed by a
ferrous magnet and the post-combustion
ECS system. This gave us the confidence
that the material would be marketable, and
an agreement was signed in late 2001. The
selected design included a single 1.5 meter
eccentric ECS (a duplicate of the UBC
lines), a screened vibratory conveyor for
cleaning the recovered material and a
medallion separator for coins. First shipment
occurred in March 2002 followed by system
tuning over several years, to where recovery
exceeded 3 lbs/ton of waste. In October
2004 an economic decision was made to
market “residue UBCs” and send the denser
mixed metals to the boiler for recovery from
the ash stream. While developing the project
this was the ideal solution to the odor /
contamination issue – however we did not
want to risk boiler availability by purposely
introducing additional aluminum to the
stoker grates. Today we found the grates can
tolerate this material. Adjustments, tuning,
and marketing continue today as warranted.
The system is running over burdened and is
missing substantial material. Testing has
quantified the loss material but has justified
only small investment at this time. Coin
recovery has never met expectations for two
reasons. The ECS burden depth buries the
majority of coins and the medallion
separator slots plug easily with moist
material, sending the few coins to the dense
small material. Entering 2006 the residue
non-ferrous system is collecting a UBC
product, hand picked “precious metals” and
dense small mixed metal product. The
UBCs are crushed, weighed and sold,
precious metals are added to existing
containers, and the dense mixed metals
(with coins) are sent into the boiler with the
RDF and recovered post-combustion as
mixed non-ferrous metals. While coins were
never the justification for the project they
were the most interesting. Project specifics
had recovery at $0.22/ton, at an average rate
of 56 cents a minute at $175,000 annually,
literally raining coins down a chute.

The North County Resource Recovery
Facility began operation in 1989 recovering
3.1 lbs of picked cans for every ton of waste
processed. In 2005 the facility recovered
nearly 10 lbs from every ton of waste for a
total of 7.7 million pounds. In addition
maintenance costs per ECS unit have
reduced by nearly a third comparing
98/99/00 to 03/04/05. 2006 projected
revenues from the sale of metals will exceed
2.5 million dollars. Mixed silver coins for
years 2003/2004 averaged $38,000 annually,
while pennies were about $5,000 each year. However optimizing for metal recovery and overall economics had reduced the coins by almost 75% for year 2005.

Future potential for the facility would point towards the missed material in the residue stream. Occasional but continued testing shows additional materials/coins/revenues are available here. The challenge is extraction, solvable two ways: installation of additional recovery equipment, or reduction in feed rate. Either one reduces the burden to allow the desired material to be repelled by the magnetic forces. Another area of consideration is the handling and packaging of UBCs. Currently pickers are stationed throughout the facility and all pre-combustion material is shipped loose in van trailers. The facility will modify systems again when the technology is there and the justification warrants changes.

**Biography's**

Jim Riley has been in the power/boiler industry for 29 years, 19 of which have been in the WTE field. Mr. Riley is currently the Maintenance Manager at PBRRC, but has also served as both the facility's plant engineer and operations manager.

**Ray Schauer**

Since receiving his Bachelor of Engineering degree from Stevens Institute of Technology Mr. Schauer has had over 30 years of capital facility design, construction and operations experience. Mr. Schauer is currently the Director of Engineering and Public Works of the Solid Waste Authority of Palm Beach County Florida. In this capacity he is responsible for the planning, design, permitting, construction and maintenance of the agency's solid waste processing facilities and related infrastructure. He is also responsible for the operations of the Authority's 2000TPD Waste to Energy Facility, Residential and Commercial.