

Montenay Recyclable Trash Improvements (RTI) Project

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Municipal trash is converted to a solid fuel for an off-site boiler installation. Existing Miami-Dade Resources Recovery Facilities were modified and new processing facilities were added at a cost of \$26 million dollars. This major recycling project was developed over three years, was built in 1996 and was successfully commissioned in 1997. Process machinery includes three modified shredders with a final throughput capacity of 110 tons per hour, conveyors, trommels, and raw product separation equipment. The RTI process makes commercial grade biomass fuel and two soil products. A discussion of process design and testing is presented. Other bulk material handling issues such as delivery contracts for raw trash and remote site fuel delivery is included. Elements of the plant designs for truck tipping, rejects separation, process and storage buildings are also discussed.

Introduction

The RTI project is unique as it successfully converts municipal trash into useful fuel and soil products. The following benefits are realized.

1. The cost of adding site boiler capacity to the Miami-Dade County Resources Recovery Facilities was avoided as received volume of garbage and trash deliveries had been growing beyond the current capacity of the plant. Also, solid waste disposal of municipal trash in the limited existing landfill was deemed undesirable. By converting Municipal Trash to off-site fuel and soil, the need for added boiler capacity and excessive landfill use were eliminated.
2. A local Independent Power Producer (IPP) receives a clean, low cost alternate fuel source for their boilers. The IPP has its own seasonal source of bagasse, but needs other sources of fuel during the sugar cane growing season. The IPP boilers are designed for coal and bagasse, and the RTI fuel product.
3. A very clean primary soil product with a high organic content is produced, and has had a ready market for sod farms and other agricultural uses.
4. A gravelly secondary soil is useful as daily landfill cover to abate windborne dust.

This paper discusses design, construction, testing and operation of the RTI process which provides these products.

Project Objective

Establishing a suitable level of production for the RTI process required careful planning with The Miami-Dade County Department of Solid Waste Management. At the completion of discussions, Montenay and the County contractually agreed the project should be capable of processing 270,000 tons per year of municipal trash. The contract made the distinction that the trash received for processing have a average minimum biomass content of 45 %. Further, the IPP had agreed to accept the RTI Fuel and a large portion of the soil, provided the specified product size and quality requirements is met. All project objectives were met with a trash throughput capacity of 110 tons per hour. The final fuel product is required to meet the following sample sizing and quality requirements:

Size:

13% maximum by weight passing a 1/4" Gilson test screen.

95% minimum by weight passing a 4" Gilson test screen.

Quality:

3% maximum by weight plastic and rubber content

2% maximum by weight painted and treated wood

5% maximum by weight non-combustible (inert) material

Primary soil has similar sizing and quality requirements.

Project Development

Biomass content of the incoming municipal trash stream was established by sampling typical incoming waste composition. Particular note was made of materials which should not be included for processing. For Miami-Dade, approximately 65% of the incoming municipal trash is biomass such as brush, grass clippings, palm fronds, paper, stumps, and the like. Given the average incoming composition, a test was conducted to simulate separation of typical shredded trash. It was determined that the soil and rock could be separated from the usable fuel by the use of trommels and destoners. Destoners are fluid bed vibratory type separators. A trommel screen size around 1/4" was found to be optimal for separation of soil and fuel.

To maintain high utilization of the process, the County required a yield factor of 70%. This assured that at least 70% of the available biomass can be recycling as fuel.

IPP's solid fuel boilers are capable of burning a wide variety of solid fuels including bagasse, coal, and wood fuels. However, the proper boiler operation requires the fuel to meet certain limits of size and composition. Minimizing the amount of plastic and rubber avoids formation of chlorine compounds in the flue gasses. Inert materials such as rock, sand, and dirt are minimized to avoid handling excessive ash. Treated wood containing arsenic, copper and chromate compounds and lead base paint coated wood need to be minimized to avoid presence of trace metals in the flue gas. And finally, the fraction of fuel which is under 1/4" needs to be minimized to avoid excessive burning of fuel in suspension.

The RTI project was formulated by Montenay International Corp. and subsequently, contracts were developed with Miami-Dade County and IPP which met the environmental, technical and commercial objectives.

The project was developed in two phases. The first phase required modification of the trash receiving system from the receiving pit to the shredders. Prior to modification, the rated capacity of the three existing infeed lines was 80 tons per hour. The objective of the first phase was to raise the capacity to 110 tons per hour with a reliability of 85%. The second phase required construction of an entirely new processing plant for full scale separation of the soil and fuel separation streams, complete with fuel storage, additional tipping and separating capacity, and product weighing facilities.

After process development, and competitive bidding Contractors were selected to design and furnish the process equipment and buildings for the project.

RTI Design and Construction

The first task is to properly receive and unload the trash trucks to a storage pit. The storage pit

and tipping hall were already in existence, but needed to be modified for increased trash deliveries and separation of rejects. Unlike putrescible garbage, municipal trash is predominantly biomass, and does not produce odor during storage and processing. For this reason, standard open side vents and forced draft roof fans were used throughout the project. To date no fugitive dust emissions have been identified for the buildings and processing equipment. Typical daily cleanup combined with a process dust removal system is sufficient to maintain adequate levels of cleanliness.

An entirely new truck tipping hall was built on the east side of the existing tipping hall. The existing truck tipping was converted to floor sorting space to remove rejects from the incoming trash stream. Piles of tipped trash are brought around from the new tipping building to the separating floor by use of a large front end loader. The large loader separates the material, and places rejected material in a pile in another part of the separating floor. Rejected material may be as much as 17.6 % of the incoming stream. The process may also use small skid/steer loaders to assist in separation of the material. After floor sorting and removal of the rejected material, recyclable trash is moved into the pit for further processing.

Recyclable trash is mixed and stacked by trash pit cranes during non-operating hours by two large bridge cranes. During operating hours, trash pit cranes feed three infeed lines.

During the first phase of construction, three infeed lines were modified from pan conveyors to a combination of walking floor, pan and variable speed belt conveyors. The walking floor was selected for its impact resistance as it receives trash directly from the pit crane. The walking floor conveyor feeds a pan conveyor which is also impact resistant. The impact resistance is required because the existing cherry picking cranes are used to remove reject material from the line, and the cranes may impact the conveyor during separation. From the pan conveyor, the trash material is transferred to the picking belt conveyor. An enclosure is built for each infeed line for picking personnel to remove smaller reject materials from the belt prior to shredding. For design throughput of 110 tons per hour, the infeed flow rates of 30, 30, and 50 tons per hour total were respectively selected for lines 1, 2, and 3. A total of 14 manual sorting personnel (pickers) were assigned to three picking stations. The pickers were assigned 4, 4, and 6 each respectively to picking enclosures 1, 2, and 3. To protect the shredder and assure the quality of the end product, the pickers manually removing rejects such as oversize materials, mattresses, cable and rope, chunks of concrete, gas containers from the infeed lines. The picking enclosures and conveyor side shields are ergonomically designed for picking material from the belt. Rejected materials are dropped to the rejects conveyor through chutes positioned adjacent to the worker and the belt. The enclosures are provided with air conditioning. Local speed control of the belt is available if material conditions require more or less picking. An emergency stop for each line is also provided.

The shredders were also modified. The old low capacity compression feeder system was removed, and replaced by a gravity feed system. A gravity feed system feeds material directly off the belt into the shredder. A new explosion vent to the roof above the shredder and a Fenwal explosion suppression system were added to minimize damage in the unlikely event that explosive materials should enter the shredder. The vent roof is composed of two large sloped

rubber flaps which can open during an explosion. In their normal position, the flaps cause rain to drain away from the vent onto the surrounding roof.

To avoid disruption of the ongoing trash processing operation, infeed line 3, the line with the largest capacity was modified first, and tested. As the line flow capacity tested in excess of 50 tons per hour, the modified line was placed in production. Modification of lines 1 and 2 followed in a similar fashion.

To handle the rejects from the grapple crane and the picking station, a walking floor rejects conveyor was provided below all three picking stations. The rejects walking floor conveyor transfers material to an inclined pan conveyor which loads out to a bunker. Rejected material is removed from the bunker daily, and loaded onto trucks bound for landfill.

Phase 2 of the project began with construction of the Biomass and Trommel buildings. The Biomass building is used to store the biomass fuel and soil products, and is configured for about 1.5 days storage at 110 tons/hr throughput capacity. The maximum production scenario is for a 6 day per week operation. The storage is intended to receive products of operations. After the production run, the fuel and soil products are moved by a large loader into trucks bound for the IPP.

The Trommel building adjacent to the biomass building contains three trommels for separation of the products, and two destoners which separate the light fuel fraction from stones. Stones and other heavy objects separated at the destoners are sent to the secondary soil bunker. Dual destoners were dictated by the expected capacity of the stream which is greater than 1/4 but less than an inch in size.

Shredded trash is combined into one stream after each of the three lines is processed for ferrous removal. With the exception of the #3 outfeed conveyor, all conveying equipment downstream including ferrous magnets and conveying was in operation before the RTI project. All of the features of the trash shredder discharge system were retained except the final collection belt conveyor. The direction of the belt was reversed to so that the material would cascade to the new RTI conveying system instead of being directed to the garbage system. Two belt conveyor move the shredded and magnetically separated trash to Trommel 1. The size of the Trommel 1 screen opening was set at about 1 inch to separate the larger fraction of biomass for fuel. Material larger than 1 inch passed to the third trommel which is used to remove oversized material. Material larger than 5 inches in diameter is rejected from the fuel stream. All material passing the 5 inch opening is sent to the fuel bunker. Material which passed through the 1 inch opening in Trommel 1, falls on a conveyor which conveys material to Trommel 2. Trommel 2 has a 1/4 inch screen which separates soil (less than 1/4 inch) from a stream which contains mostly fuel, but some rock, sand, and other inert material. This stream is directed to the destoners, where the stones and similar dense materials are removed. The light material is a fuel component and is conveyed to the fuel bunker.

In order to achieve separation, the destoners require a fan to fluidize the air and a cyclone to retrieve the material blown out of the destoner with the air from the fluid bed. An air

lock/rotary valve is used to discharge the collected material from the cyclone to the conveyor carrying the fuel from the destoners.

Fuel and soil conveyors slope toward the top of the Biomass building and discharge into their respective bunkers. Primary and secondary soil normally discharge into their respective bunkers through chutes placed at the end of these conveyors. However, the fuel bunker is much larger (1.5 days storage), and requires a shuttle conveyor to distribute the fuel product along the bunker. A shuttle conveyor is a reversible belt conveyor set on trolley tracks so that the discharge and storage pile can be moved as needed over the 80 foot length of the bunker. In addition, the shuttle conveyor receives and combines both the large and small fuel fractions to create an homogenous product.

The conveying system includes bypass systems which allow for operational flexibility. By reversing the conveyor which would feed the destoners, the material can be sent to the secondary soil bunker, thus allowing the destoners to be serviced while fuel production is limited to the large fraction only. The destoners may be operated together or separately through the use of diverters. Fuel may be diverted by use of flop gates to on-site fuel storage. Also, the fuel shuttle conveyor may be positioned to a truck loading chute. And finally, the primary and secondary soil can be directly loaded via truck chute, or by conveyor to another building.

Additional space was required for front end separation of rejects and non-processibles. The old trash receiving building was converted to this purpose and modified to connect to the new tipping building. A new tipping building was constructed at the same floor elevation as the old tipping building including roadway modifications for trash delivery truck traffic.

A new pitless scale was constructed for weighing the biomass fuel and soil as it leaves the Resources Recovery Facility. The scale goes through an automated sequence which proofs the position of the truck, validates the tare weigh, and prints net weight duplicate tickets for the driver. The site inventory control of the scale is linked to the County Solid Waste Management system, and also to local operator control. The link to local operator control is made by use of a wireless data transmission system. The link to the County is by dedicated modem phone line.

Upon completion of RTI process and balance of plant construction and checkout, six days of commercial testing were performed to demonstrate Fuel and soil product quality and recyclable trash throughput.

Process Testing

In order to test throughput capacity of the system, a daily mass balance was prepared for each test run. About 1500 tons were received and processed each day. County weigh scales were used to tally the weight of incoming trash deliveries and outgoing fuel and soil products. In addition, the floor and infeed line rejects and ferrous materials were weighed out to determine the split of materials processed on a daily basis. Over 6 days, the average tonnage processed by the shredders was 116 tons per hour. Summary test results are provided in Appendix 1.

Reliability testing required recording each minute of process equipment downtime and its related cause. The stoppages were observed and recorded for each day of the test. Availability of the new process equipment passed at 90%. A minimum of 85% was required.

Product quality testing required that samples of fuel and soil be taken about every 4 hours. The samples were combined, quartered, and tested using 6 to 8 pounds of sample product. Each aspect of product quality was measured and, with the exception of inert content in the fuel, passed the test criteria. Later adjustment of the destoners brought the inert content aspect of biomass fuel quality within contract limits. Summary test results are provided in Appendix 2.

Spillage of material outside the seals of the conveyors and trommels was required to be less than .05% of the throughput measured in a new and clean condition. As the infeed system modification was constructed well ahead of the final separation process, each was measured separately to meet the criteria. The method of estimating spillage was to estimate the volume of spilled material, and multiply times the average density of the spillage. After a trial test and modification of the seals, the spillage test criterial was met.

The project was placed into commercial operation immediately following the six day test on April 12, 1997.

Operation and Maintenance

Since placing in service, a complete operation and maintenance plan has been formulated. The equipment is scheduled to run for 16 hours a day, 6 days a week. Maintenance is performed daily during the 8 hours of down time.

Appendix 1

Results of Mass Balance

	Percent
Trash Received	100
Rejected from Separation Floor	12.6
Rejected from Picking Station	7.2
Ferrous Removed	1.7
Primary Soil	15.4
Secondary Soil	6.5
Biomass Fuel	48.1
Oversize Material	1.1
Shredder Moisture Loss (est)	2.0

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Appendix 2

Fuel Properties	Required	Test Results	Disposition
Greater than 4" in size	5% Max	1.7%	Pass
Less than 1/4" in size	13% Max	11.1%	Pass
Plastic and Rubber	3% Max	2.8%	Pass
Treated Wood	2% Max	-	Pass
Inert Material	5% Max	5%	Pass

Soil Properties

Less than 1/4" in size	97% Max	98%	Pass
Soil, Sand, Grit, Biomass	95% Min	100%	Pass
Ferrous Content	1%	0%	Pass