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# ADDING METALS RECOVERY SYSTEMS (MRS) TO EXISTING WASTE-TO-ENERGY FACILITIES

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## INTRODUCTION

The prices for ferrous (Fe) and non-ferrous metals (NFM) reclaimed from the ash at waste-to-energy (WTE) facilities continue to increase. As a result, existing WTE plants are installing metals recovery systems (MRS) to capture most of these metals. These systems provide increased revenues to the facility, increased facility recycling rates, and a decrease in the quantity of ash disposed of at a sanitary landfill. This paper will review MRS economics and the permitting, design, equipment purchase, construction, and startup (where applicable) of these systems at three WTE facilities.

## EXISTING FACILITIES ADDING METALS RECOVERY SYSTEMS

The three existing WTE facilities reviewed in this paper not only vary in nameplate municipal solid waste (MSW) daily throughput, but, in the ability to process bottom ash (BA) and/or combined ash (CA). The preferred option is to remove fly ash (FA) from the MRS in order to reduce screen plugging and overall maintenance costs associated with the new system. Table 1 lists the three facility sizes, type of ash being processed, and the recovered metals.

Facility A had no metals recovery equipment as part of the original WTE design. CA (including metals) was hauled to an adjacent landfill and some Fe metals were extracted from the ash piles via a crane-operated electromagnet. The solid waste permit for the WTE facility required that, if metals were extracted in the future, only BA would be processed. Thus, the FA bypasses the MRS and is added to the BA on the belt conveyor prior to truck loadout.

| Facility | MSW Throughput (tpd) | Ash Types Processed | Recovered Metals |
|---|---|---|---|
| A | 2250 | BA | Fe, NF |
| B | 1500 | BA or CA | Fe, NF |
| C | 1000 | CA | NF |

**TABLE 1. WTE FACILITIES ADDING MRS**

Facility B was designed with a drum electromagnet for Fe removal. However, this magnet was no longer functional and a complete new system (similar to that used in Facility A) was required including a FA bypass system. Two key differences in Facility B compared to Facility A were: 1) no redundancy in the ash loadout conveyor system, and 2) no limitations on ash to be processed (i.e., BA or CA).

Facility C has a completely intact Fe recovery system. Thus, the only need at this facility was the addition of an eddy current separator (ECS) for NF removal, and ancillary feed and discharge conveyors.

## SAMPLE FINANCIAL ANALYSIS

The recent demand to provide additional metals recycling systems equipment was driven by higher Fe and NFM pricing. However, as shown in Figure 1, NFM pricing has shown a dramatic increase over the past few years and has been the financial motivator for the addition or expansion of MRS. For

Facility A, projected annual tonnage of Fe is 27,000 tons and for NF is 1485 tons.

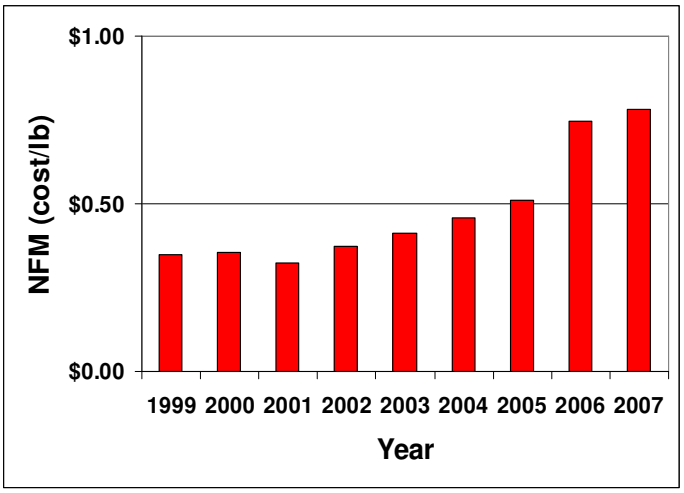


**FIGURE 1. NFM PRICING**

For both Fe and NF metals, the following items contribute to the annual revenue stream received by the facility:

- Percent contamination of the collected stream
- Marketing fees
- Collected product transportation fees
- Process equipment operation and maintenance costs

As a typical example, the estimated annual net revenue from Fe and NF metals in 2008 will result in a simple payback period on the initial capital expenditure of 2 to 4 years.

## PROCESS EQUIPMENT

Figure 2 indicates the process flow at Facility A. As noted previously, some Fe metals recovery has been done at the landfill using a crane-operated electromagnet. However, this operation has resulted in capturing only a small fraction of the Fe metal from the ash stream.

Where economically feasible, it is preferred to process only the BA in the MRS. Keeping the FA separate until final loadout reduces plugging and other additional maintenance of the process equipment. Thus, a complete new system of handling FA has been installed. This system includes a FA drag conveyor, storage hopper, screw conveyor, and conditioner.

Facility A has redundant inclined belt conveyors which, for height and length reasons, were extended 25 feet. The first step in metals recovery is to pass the BA over a finger deck screen. The "overs" (or bulkies) are dropped into the Fe storage bunker. The finger deck screen "unders" are moved by a vibratory conveyor and presented to a drum magnet. The collected Fe is also conveyed into the Fe storage bunker. The next step is to screen the ash stream and present the 3/8-inch "overs" material to an eddy current separator (ECS). The ECS "ejects" NFM over a vertical gate and the NFM is discharged to a small storage bunker. The BA is now combined with the bypassed FA on a belt conveyor and the CA is discharged in trucks for landfill disposal.

## IMPLEMENTATION SCHEDULE

The duration from the commencement date for installation of an MRS to startup is generally about 12 months. However, issues such as the permitting timeframe can vary for each state, county, or city and may impact the overall schedule (either negatively or positively). The components of the implementation schedule are:

- Conceptual and Detailed Design
- Permitting
- Equipment Procurement
- Bidding for/Selection of General Contractor (GC)
- Construction Phase
- Startup/Testing

Figure 3 indicates the estimated duration of the above listed tasks.

### Conceptual and Detailed Design

The initial effort of an MRS is development of conceptual design sketches, review of various options with plant personnel, and selection of the preferred system. This is followed by development of detailed design documents for permitting as well as bidding for the general contractor.

### Permitting

Generally, MRS permits include local Building Permit(s) and a "minor permit modification" of the existing facility Solid Waste Permit. On average, 6 months is a reasonable period to obtain the necessary permits. Obviously, permitting, as well as other tasks, requires the completion of detailed design documents.

### Equipment Procurement

All process equipment (shown in Figure 2) was procured by the facility Purchasing Agent. Equipment pricing included delivery to the site. However, plant staff, along with outside contractors, off-loaded the delivered equipment in the designated "laydown area."

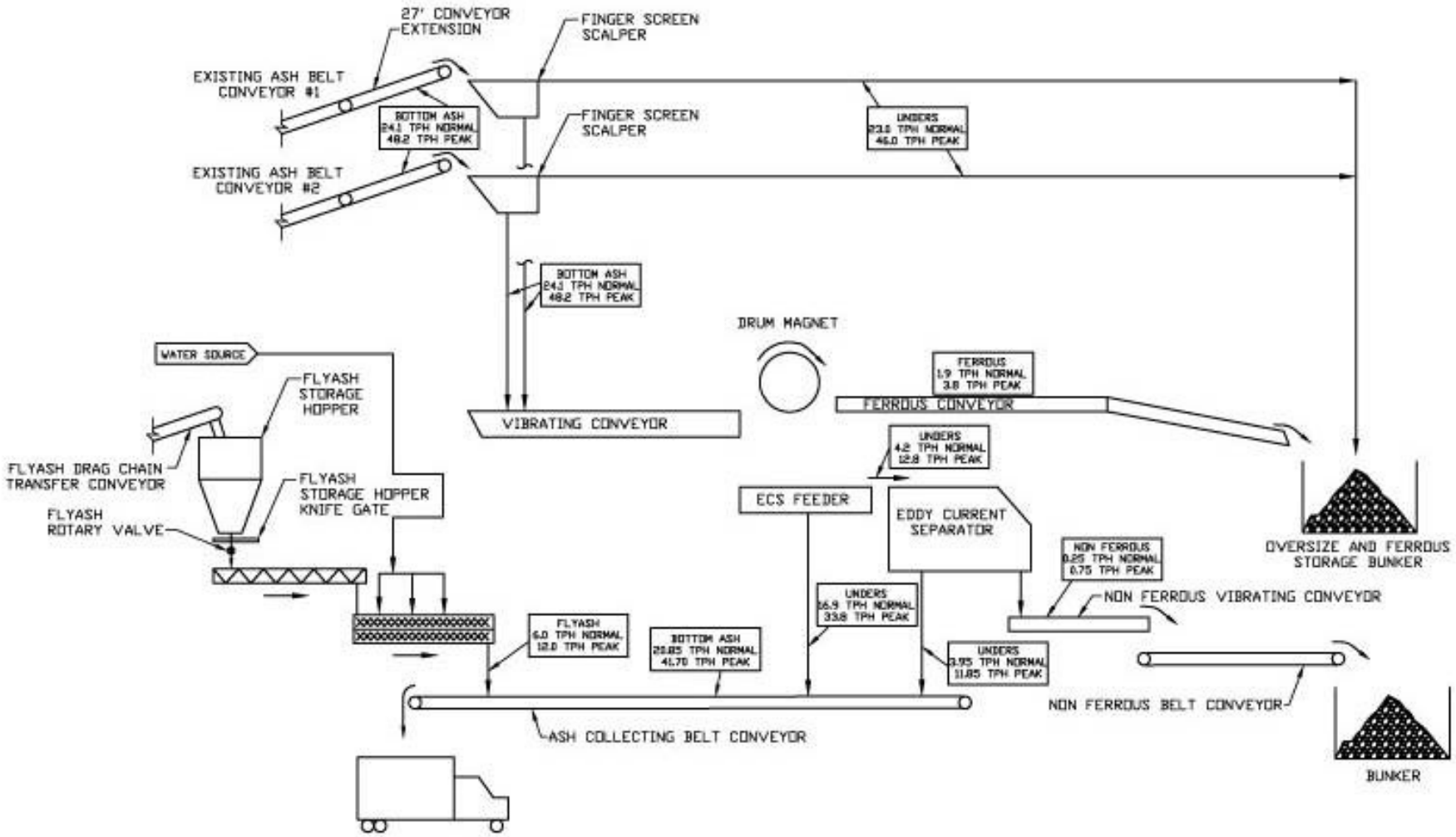


**FIGURE 2. PROCESS FLOW DIAGRAM**

Bidding for/Selection of General Contractor

Bid documents were prepared by the Purchasing Agent and engineering design firm and included a Service Agreement, Technical Scope of Work, and Bid Forms. Typically, three GC bids were received and evaluated and a GC selection was made. The GC was responsible for erection of new buildings, installation of process equipment, electrical wiring and controls, piping, and system startup and testing.

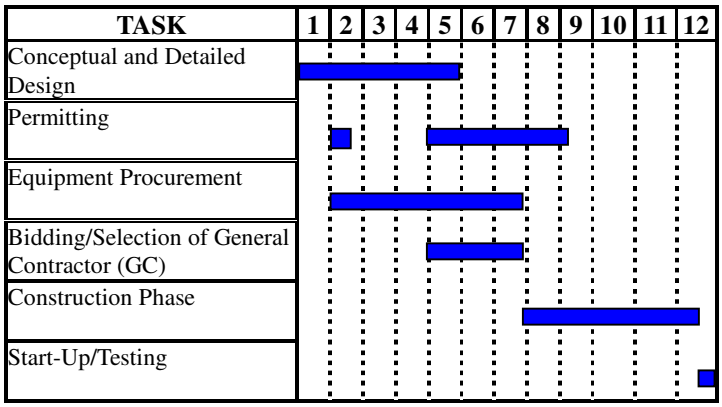


**FIGURE 3. IMPLEMENTATION SCHEDULE**

Construction Phase

Depending on local permit requirements, the construction may be broken down into two phases: foundation and main building(s). If allowed, construction of the foundations (including pushwalls) will speed up the GC construction phase as the main building permit applications are still under review. The construction phase varies in duration based on project size, but typically is 4 to 6 months.

Startup/Testing

This is generally a 2 to 3 week period wherein the GC, plant personnel and equipment vendor representatives all work together to get the system up and operational.

## CAPITAL COST ESTIMATE

Each MRS installation will vary in terms of total capital cost expended at the facility. Not only is it a function of the added process equipment, rather the total cost to permit, design, and construct the MRS. Listed below is a typical cost breakdown of the components by percentage.

| Item | Approximate % of Total Cost |
|---|---|
| Design Engineering | 6 |
| Permitting Fees | 3 |
| Equipment Procurement | 28 |
| General Contractor | 58 |
| Contingency | 5 |

**TABLE 2. BREAKDOWN OF CAPITAL COSTS**

## SUMMARY

The rapid rise in the value of recovered metals (in particular, NFM) recovered from ash at a WTE facility over the past few years, has encouraged owners to invest in new and additional process equipment in order to maximize the metals recovered from the ash stream. With a relatively short payback period, the facility enhances project revenues while increasing the recycling rate and reducing the volume of ash disposed at the landfill.