



The C&D facility design took advantage of the terrain — tip floor and processing on the upper level, with outfeed line dropping into transfer trucks on the lower level.

Due to operational and permit conditions, the C&D facility was constructed adjacent to Norcal's existing transfer station within the City and County of San Francisco. Because the facility is fully enclosed, it is permitted to operate 24 hours a day. To date, SF Recycling has operated the system eight hours a day on a five-day-a-week schedule.

The expansion and upgrade project provided a set of challenging obstacles as the site earmarked for the facility included a severe slope. To overcome this issue, over 16,000 square feet of floor space needed to be engineered and constructed over the hillside adjacent to the transfer station. The design of the building and operation

CAPTURING CLEAN WOOD

MIXED C&D RECYCLING ON-LINE IN SAN FRANCISCO

Integrated materials recovery facility opened last July with capacity to process 400 tons/day of construction and demolition debris.

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PROCESSING some of the heaviest materials in the waste stream, a recycling line used to sort construction and demolition (C&D) debris was completed as part of an expansion and upgrade at a waste transfer station site in San Francisco last July. The new facility is playing a key role in San Francisco's march toward 75 percent recycling citywide by 2010.

SF Recycling & Disposal, Inc., a subsidiary of Norcal Waste Systems, Inc., has operated a C&D recycling line serving the city and county of San Francisco since the early 1990s. The line began as an outdoor operation; a metal canopy was added to protect recycling workers from the weather. When the city of San Francisco set its sights on reaching 75 percent recycling and the city's Board of Supervisors adopted the goal, the need was created to improve existing recycling facilities and build new ones.

SF Recycling's C&D facility is housed in a new 46,000-square-foot building and permitted to process 400 tons/day of mixed C&D debris. The facility's design capacity is rated at approximately 75 tons/hour, with a theoretical maximum throughput of 1,200 tons/day based upon a 16 hour/day operation. Currently the staff numbers 13 employees, including a supervisor, two equipment operators and ten material sorters. Capital costs for the integrated Material Recovery Facility (iMRF) totaled \$14.4 million.



Loads are emptied on the tip floor and inspected for hazardous materials and items that pose a danger to workers and equipment. Mist, misting, sprinkling and direct applications of water are used throughout the building to minimize airborne particulate matter.

took advantage of the terrain — the tip floor and processing line are on the upper level and the outfeed line drops into transfer trucks on the lower level (see opening photo). SF Recycling wanted to build a facility large enough to process all C&D waste in San Francisco. It also wanted the structure to be visually appealing and

blend well into the surroundings. So SF Recycling had the face of the retaining wall textured with a hand-sculptured, stained concrete veneer so that the exposed foundation blends in with the exposed bedrock.

With the exception of the wood load-out hopper, the operation is completely enclosed. A balanced air system controls the air quality within the building. Outside air is introduced in the sorting area above the sorting platforms and air from within the building is evacuated in the tipping area. To deal with airborne particulate matter, a combination of misting, sprinkling and direct applications of water are all employed throughout the day to improve air quality.

The iMRF mainly receives material from residential remodeling and new construction. In some cases, C&D loads from construction sites that have actively sorted materials into separate containers are brought in. But given parking and space constraints typically associated with construction in San Francisco, this is the exception rather than the norm. In addition to the residential and commercial construction debris, the facility also receives material from manufacturing and industrial businesses that have significant amounts of wood and/or metal in their waste stream. Currently, the facility serves only the city of San Francisco. While additional throughput capacity is available, SF Recycling is not soliciting material from other jurisdictions at this time. SF Recycling does not differentiate between the refuse tipping fee and the C&D tipping fee. The current disposal charge for all refuse delivered to the transfer station totals \$85.14/ton.



FACILITY LAYOUT AND PROCESSING

The original C&D recycling equipment included a Mayfram sorting system to process limited quantities of C&D material in an open-air environment. Satisfied with the performance of that equipment, SF Recycling hired Enterprise to refurbish the existing sorting line — extending it to provide increased sorting capacity — and to construct a parallel line to the existing one, using Mayfram equipment. Processing enhancements also included two General Kinematics finger screens, a Dings magnet to remove metal from the fines product, a North Shore Manufacturing hydraulic grapple and an American Pulverizer low speed high torque wood grinder.

Incoming material is tipped on the north end of the build-

ing. Prior to this point, load checkers at the entrance to the transfer station have done a preliminary inspection of the load to prequalify the container for the C&D operation. Once tipped, another load checker does a cursory inspection for prohibited materials such as hazardous waste and also verifies that nothing in the load will harm the workers or the equipment. The material is then either lifted onto the incline conveyors by a Caterpillar loader or added to existing unprocessed inventory on the tipping floor. All unprocessed material is initially screened to remove fines, which are sent to a landfill and used as alternative daily cover. A magnet extracts the metal from the fines prior to placing them in a storage bunker.

Once screened, the unprocessed material proceeds down the sorting table and the material handlers manually re-



1) All unprocessed material is initially screened to remove fines. 2) Sorters pull out paper, unpainted wood, ferrous and nonferrous metal, unpainted sheetrock, cement, brick, green waste, cans and bottles. 3) Recovered materials (e.g. wood) are dropped into bunkers under the sorting line.

move all of the paper, unpainted wood, ferrous and nonferrous metal, unpainted sheetrock, cement, brick, green waste, cans and bottles. In designing the system, SF Recycling opted to have sorters pull off metal instead of installing a magnet system. Most of the metal that comes through is medium to large-size pieces that workers can grab and drop down a metal chute. Magnets can also be problematic as they pull off incidentals and prohibited materials.

Major components of total incoming loads are as follows: Fines, 21.5 percent; Wood, 20.6 percent; Metal, 15.5 percent; and Inerts, 11.9 percent. As materials are sorted, the commodities are dropped into bunkers under the sorting belt and either top loaded into trucks for transportation to end markets or, in the case of the wood, ground on site prior to transportation. The hydraulic grapple is primarily used to load the wood grinder and on occasion loads the in-feed conveyors and moves large bulky products on the tipping floor.

TOTAL DIVERSION

In its first month of operation (July 2003), the facility had a throughput of 6,436 tons with a recovery rate of 63 percent. Currently, the facility averages 4,380 tons/month of throughput with a recovery rate in excess of 85 percent. Projections indicate that SF Recycling will maintain an average monthly throughput of approximately 4,300 tons/month and all indications are that its recovery rate will yield diversion percent-

ages in the range of 86 percent. The current average recovery rate is 73.5 percent.

Materials recovered using this C&D sorting system are as follows: Fines, 29.4 percent; Wood, 29.1 percent; Metal, 20.4 percent; and Inerts, 15.7 percent. SF Recycling runs the materials processed in this plant across the sorting lines once. Managers have found that the most effective way to sort the materials is to do a good job on the initial pass by combining the automated separation systems with hand sorting done by recycling workers.

With the exception of metal and incidental amounts of paper and beverage containers, all materials removed during the sorting process require payment of tipping fees at secondary recycling or processing facilities. These fees help pay operational costs for facilities that receive wood, fines, inerts, concrete and tires. Transportation costs are an associated expense. Concrete is sent to a crushing operation where it is made into recycled aggregate and used in road base applications and new construction. Metal markets are typically very consistent in the Bay area due to its close proximity to maritime transportation opportunities and metal processing operations located in the ports of Oakland and Redwood City. Paper products are limited to mixed wastepaper that is comprised primarily of brown grade paper such as cardboard and newsprint.

WOOD PROCESSING

All wood is sorted by hand. Currently, only unpainted wood is being sorted. Painted wood, once subjected to the pulverization process and ultimately off-site grinding, can

create significant issues for C&D operators due to the fact that the paint may become dislodged from the wood and create potentially hazardous fines that prevent the wood from being recycled. The wood is size-reduced into a 12-inch minus product in the high torque low speed grinder. The ground wood is then conveyed into a storage hopper.

About 80 percent is sent to a second party wood processor for sale into the biomass market. The wood grinder takes the 12-inch minus material and generates a 2-inch minus bone-dry ton product that meets the cogeneration plants' specifications. About 20 percent goes to Norcal's Jepson Prairie Organics composting operation north of San Francisco, where it is blended in with other compost feed stocks. Jepson Prairie processes source-separated compostables, including food residuals, soiled paper and corrugated from San Francisco's residential and commercial programs and from other jurisdictions in the Bay Area.

LONG-TERM SOLID WASTE INFRASTRUCTURE

South of San Francisco, the city of San Jose created a C&D diversion deposit program to encourage recycling of construction and demolition debris (see "Giving A Boost To C&D Diversion," March 2002). Neighboring Alameda County also has an incentive program for C&D diversion (see "Materials Recovery Facility Taps Recyclable-Rich Loads," February 2003). Norcal Waste Systems did not consider the deposit process that has been implemented in other jurisdictions because the deposit system makes the C&D processor responsible for policing a city-specific program. The C&D facility was included in part in the city's last rate process and approved with other significant recycling programs and facilities, such as the city-wide implementation of a single-stream residential recycling program and Recycle Central @ Pier 96, the single-stream and mixed commercial materials recovery facility.

The city of San Francisco is evaluating a certified facility-based ordinance that will place the burden of proof on the individual who generated the material. For example, if contractors want to pursue a serious deconstruction project and recycle all of the material generated, then they would have the option to do so. In the event that the contractor is not willing to undertake a deconstruction and recycling project, compliance could be achieved by taking the material to a certified facility like the iMRF. The city would then enforce diversion rates and processing quantity calculations at the facility level. Periodic audits of the certified facilities would be done and enforcement of the regulations could then occur at local transfer stations and landfills for contractors who were taking their C&D to a noncertified site in an attempt to circumvent the city's ordinance. ■

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Reprinted From:
February, 2004

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JOURNAL OF COMPOSTING & ORGANICS RECYCLING

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