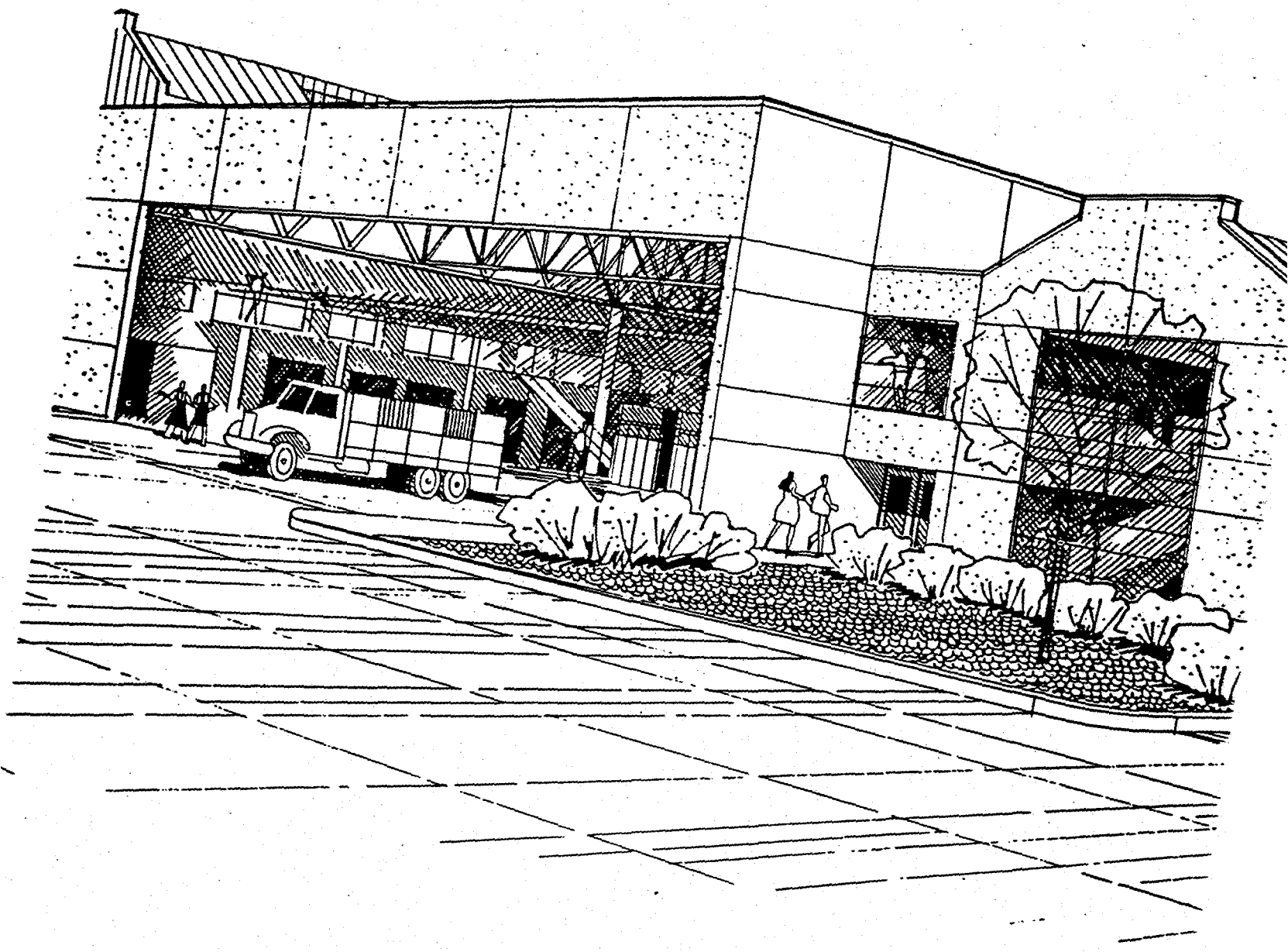
WHAT'S A MRF?

AN INTRODUCTION TO MATERIALS RECOVERY FACILITIES



WHY THIS PUBLICATION WAS CREATED

This publication describes what MRFs are and how they work. The goal is to increase public understanding and acceptance of these facilities as they are developed throughout the United States.

The function of a MRF is often misunderstood. MRFs are perceived as a new building type despite the fact that many have operated in parts of the country for years. MRFs complement recycling programs. Their mission is to extract and sort recyclable materials which were previously sent to landfills and burners. MRFs come in all types, sizes and designs. For simplicity, only the most basic terms and operations are described in this publication.

A FEW WORDS & PHRASES YOU'LL NEED TO KNOW

Garbage is the familiar term describing unsorted wet and dry waste, or everything that is discarded, and is more currently called **solid waste**.

Municipal solid waste (MSW): Unsorted, wet and dry solid waste not including industrial process wastes, agricultural wastes, mining wastes and sewage sludge. MSW is typically divided into residential and commercial categories.

Mixed waste: Unsorted, dry municipal solid waste.

Recyclables: Reclaimed materials which can be used as raw materials in the manufacture of new products. Typical recyclables are newspapers, magazines, corrugated cardboard, computer paper, mixed paper, glass jars and bottles, varieties of plastic containers, aluminum cans, tin cans, designated scrap metals, motor oil, wood and yard trimmings.

Source separated recyclables: Dry recyclables separated by type at the point of discard in the home or business.

Commingled recyclables: Recyclables which have been separated from solid waste but not from each other. Starting from unseparated, the levels of separation are commingled, partially commingled and fully separated.

C&D waste: Wastes from construction and demolition activities.

Compostables: Organic materials which can be reclaimed through biological decomposition.

Processing: Handling, separating, sorting and upgrading recyclables in a MRF.

Recovery rate: The percentage of recyclables reclaimed from a defined waste stream.

Residue: Waste material left over or rejected after extracting or processing recyclables.

Throughput: The quantity of waste received at a facility to be processed, typically measured in tons per day.

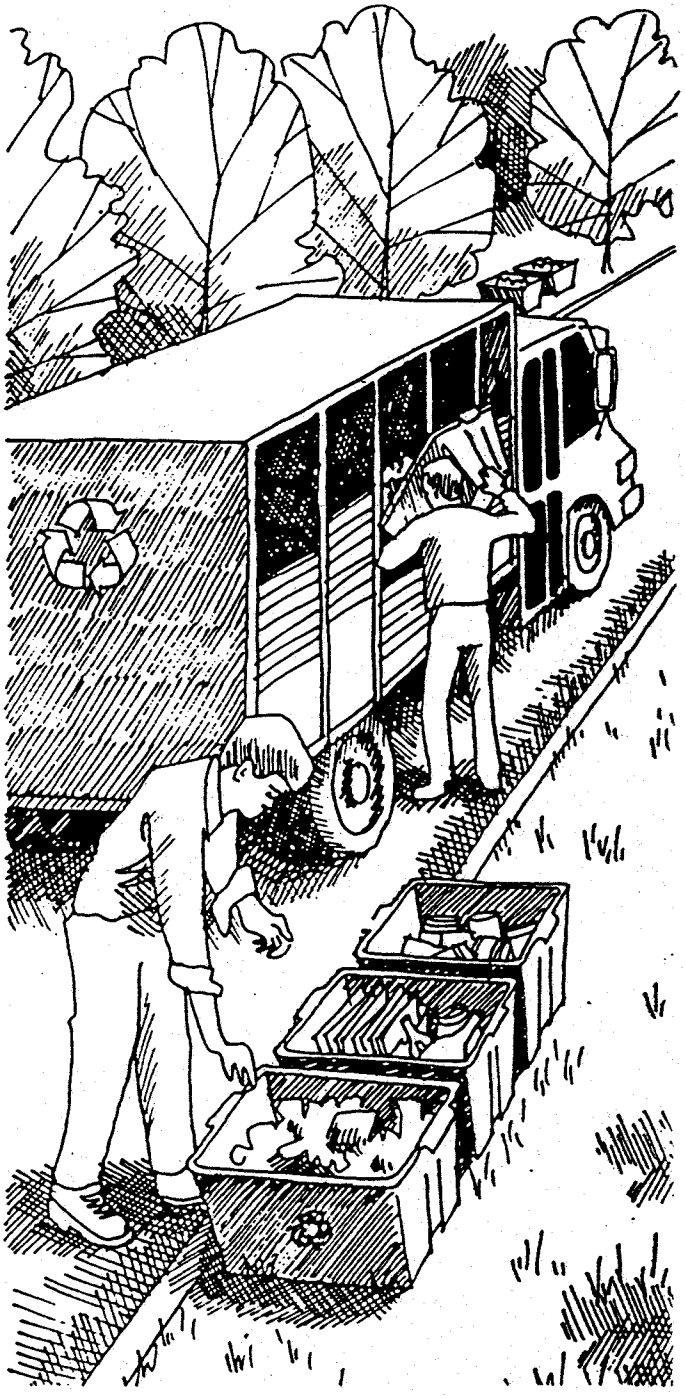
White goods: Discarded appliances such as refrigerators and ranges.

WHAT'S A MRF?

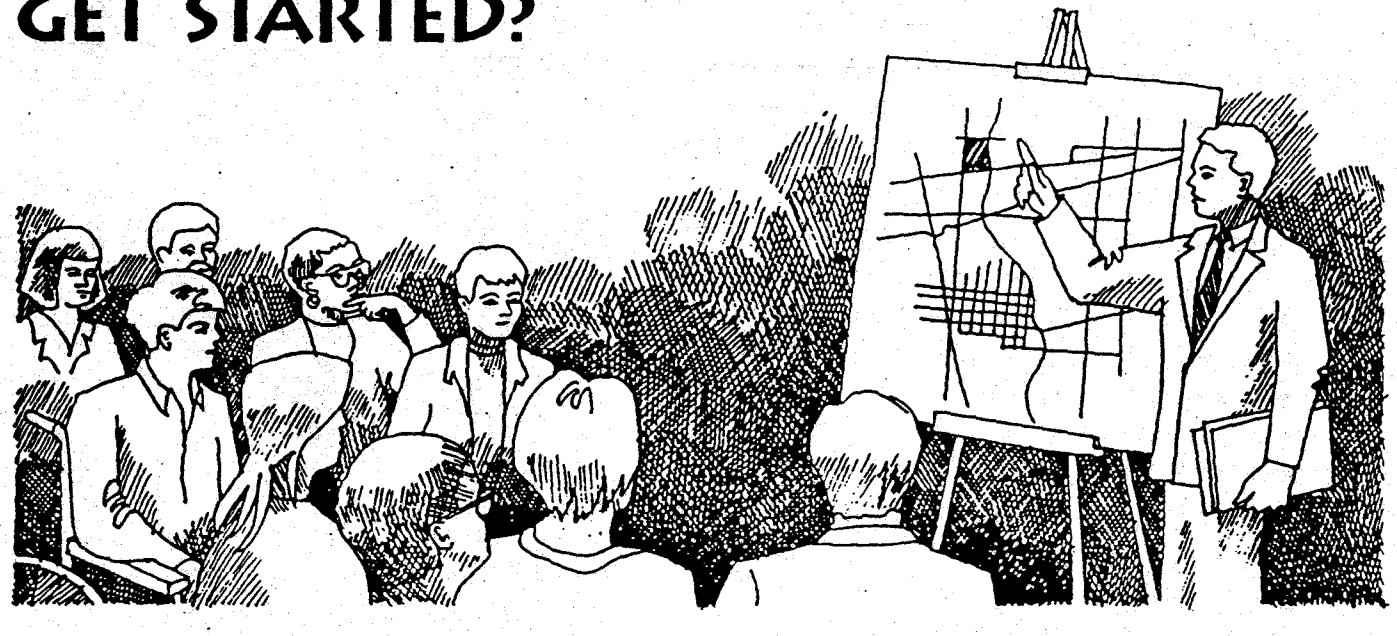
Meet "MRF." It rhymes with "surf" and it's recycling's companion, the materials recovery facility. MRFs are a link in the chain of managing wastes — from garbage to reusable material. MRFs complete the process started when people separate their garbage.

A MRF is a facility where recyclable materials are processed and sorted for re-use. Sometimes called an intermediate processing facility (IPF), or an intermediate processing center (IPC), they do the same thing. They upgrade recyclables into marketable commodities. Typically the recyclable materials have been fully separated at their source or are commingled when delivered to the MRF.

Waste collection/disposal systems vary regionally and by community. MRFs also differ depending on their location and the type of recycling program they support. The amount and complexity of processing at MRFs vary considerably. Some accept a small range of source separated materials and use simple processing techniques. Other larger facilities are designed to process a wide range of commingled recyclables with more varied and complex equipment. Almost all use some amount of hand sorting. Recyclables can arrive at a MRF from various sources: commercial, residential, curbside collection, public or self-hauling and from public drop-off or collection centers. A few MRFs use sophisticated equipment to extract recyclables from mixed waste.



HOW DO MRF PROJECTS GET STARTED?



Most communities adopt solid waste management plans, typically mandated by state or local governments. MRFs are integral to these waste management plans because they increase recovery of recyclables and reduce the amount of waste sent to landfills.

MRFs are developed in several ways. They can be sponsored by the public or private sector, or by joint arrangement. Public sponsors are cities, counties, districts and special waste agencies. Private developers include national waste companies, scrap processors, local collection companies and equipment vendors. A common joint arrangement is for a public agency to design and construct the facility and then contract with a private company for operation and maintenance. Or a community provides the site and a private company finances and constructs the facility. In a fully private development, sometimes called a Merchant MRF, a company purchases a site and develops the facility. Less common is private development with sale or lease back to a public agency.

Every project starts with an operating program. The program establishes the throughput based on the collection system; sources, quantities and composition of the wastes; and the markets for recyclables. Next, goals are set for recovery rate of recyclables and, when included, compostables. Also important is the disposal of residue from the MRF: where it is going, how far it is to be shipped and by what method.

Rarely are any of these program elements static, so planners and designers of the MRF establish assumptions based on the best information available at the time of development. It's not unusual for a program to expand or change after construction has begun.

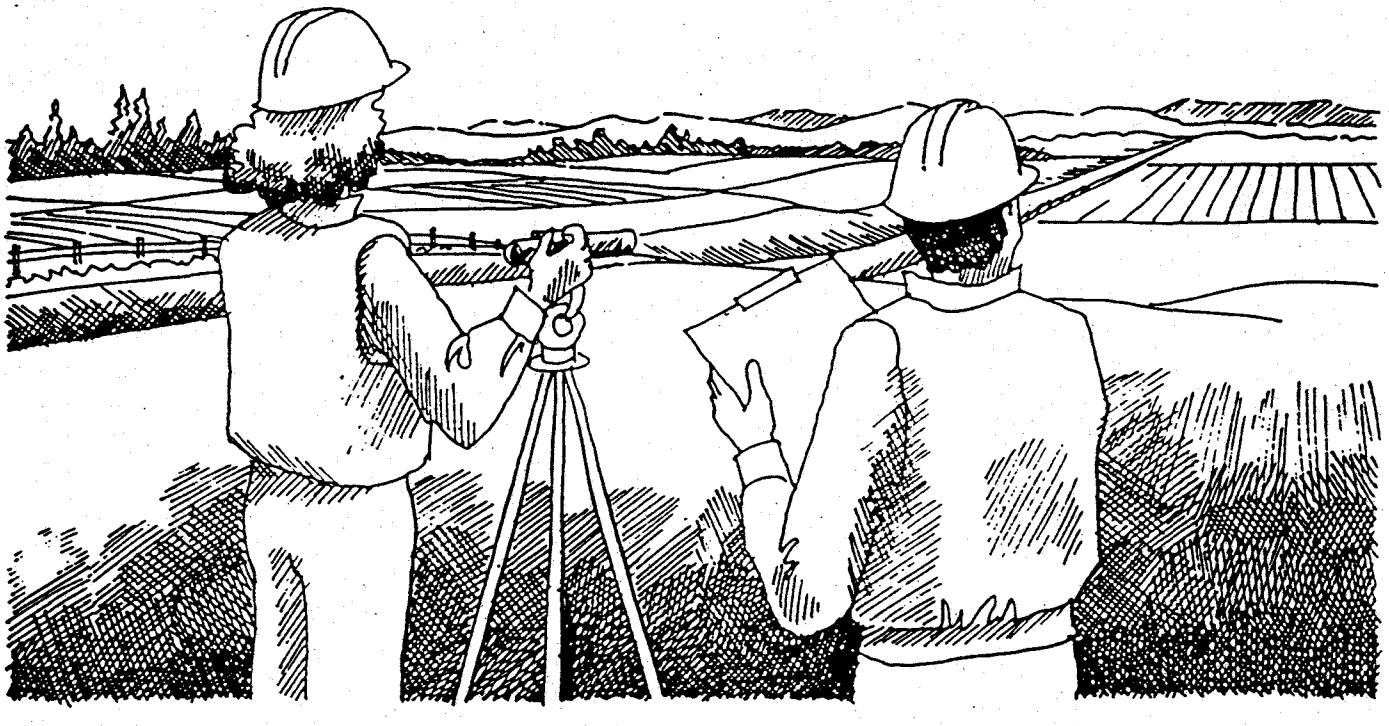
HOW ARE MRFS SITED?

Obtaining site approval is often the most challenging part of the project development process. A proposal to build a MRF, whether building new or using an existing structure, often attracts controversy.

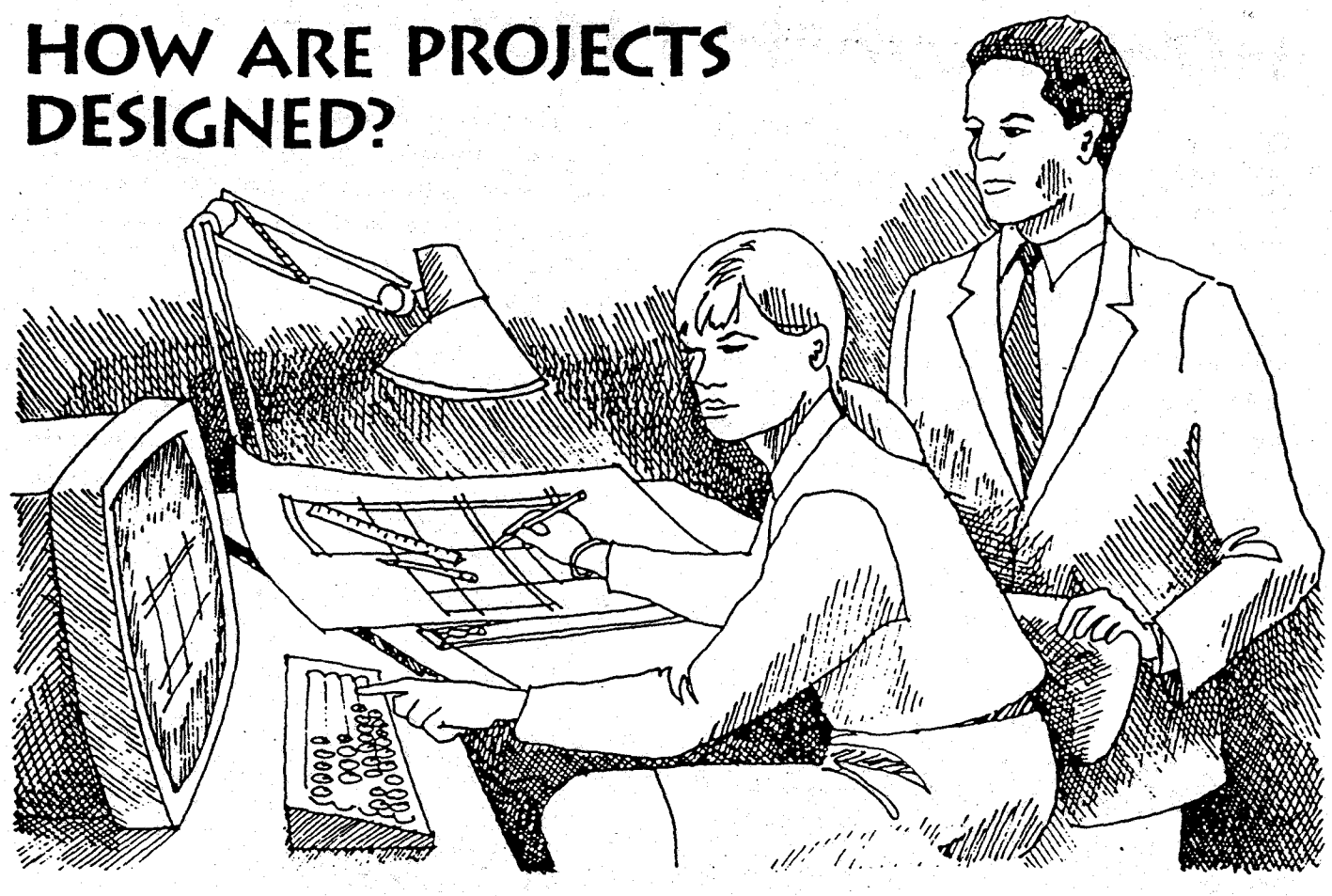
Site selection criteria include technical and political considerations. Technical considerations are location near the center of waste generation, accessibility for receiving and shipping, compatibility with adjacent land uses, topography, subsurface conditions, and the route and distance to the residue disposal destination.

Political considerations involve public perception of the same issues. Residential and business neighbors worry about compatibility. Acceptance hinges on belief in the mitigation of the perceived negative impacts. The credibility of a sponsor's solution usually sets the tone for the approval process.

Gaining approval for a site balances optimum location against political reality. MRFs are cleaner and quieter, with less negative environmental impact, than most users of land zoned for industrial use. MRFs are equivalent to light manufacturing buildings. MRFs do not accept hazardous wastes. MRFs do sort recyclables. The most sensitive impacts, traffic and litter, are managed with good design, mitigation plans and follow through.



HOW ARE PROJECTS DESIGNED?



Many professional and technical people work on the design of MRF projects. These consultants or project teams are led by engineers or architects and may include civil engineers, geotechnical (soils) engineers; structural, electrical and mechanical engineers; landscape architects and traffic engineers. Some projects include political consultants, community involvement specialists and environmental consultants. Many large waste companies have in-house engineering staffs providing technical services. Project designers pay close attention to operating efficiency, technical details and concerns for facility appearance.

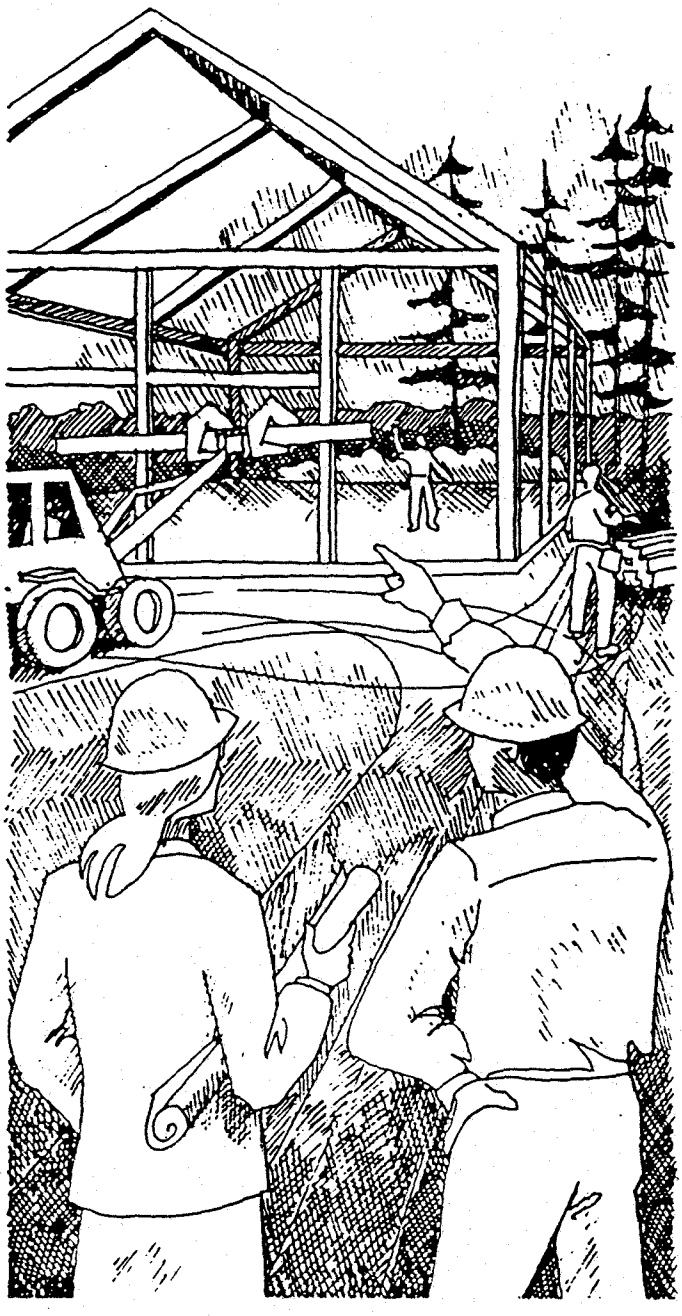
In the most familiar arrangement, the sponsor/developer, public or private, engages an engineer or architect, who plans the site, designs the facility and selects the processing equipment. The consultants assist in securing permits. They prepare construction documents including drawings and specifications. Then they solicit bids from contractors. During construction the consultants monitor the progress on behalf of the sponsor. Sometimes, tasks such as equipment design and procurement are done as a separate process.

HOW ARE PROJECTS BUILT?

Projects are built or developed differently depending on how they originate. Public works projects typically follow a traditional model: engage consultants, prepare construction documents, take bids, award contracts, monitor the construction process and take occupancy of the facility. A variation is the design/build contract. In this method the public agency solicits a complete facility package from a developer or contractor. The design/build developer or contractor includes the design and engineering services with the cost of the building in a single package. This nontraditional method can save time and money but leaves less direct control in the hands of the public agency.

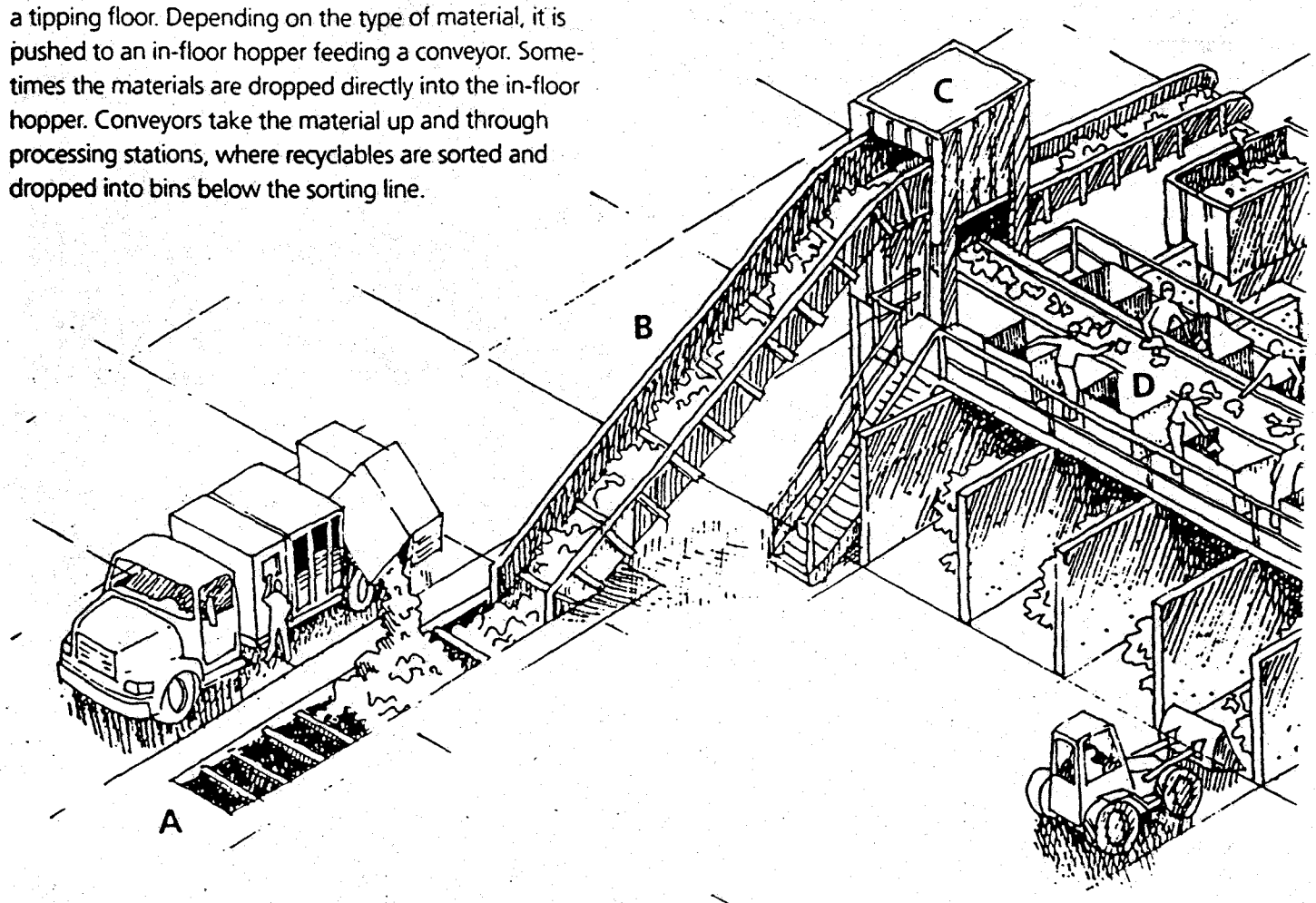
When time is critical, a "fast track" technique can be used. In this practice, design, bidding and construction proceed at the same time. For example, site improvements, building foundations and equipment ordering can be done while drawings for the building are being worked on.

With more latitude than a public agency, private developers can use combinations of these methods. Because they do not have to bid all work, they are free to negotiate contracts with selected suppliers and contractors. Each project development method has its own pros and cons. There is no one best method.



WHAT HAPPENS INSIDE A MRF?

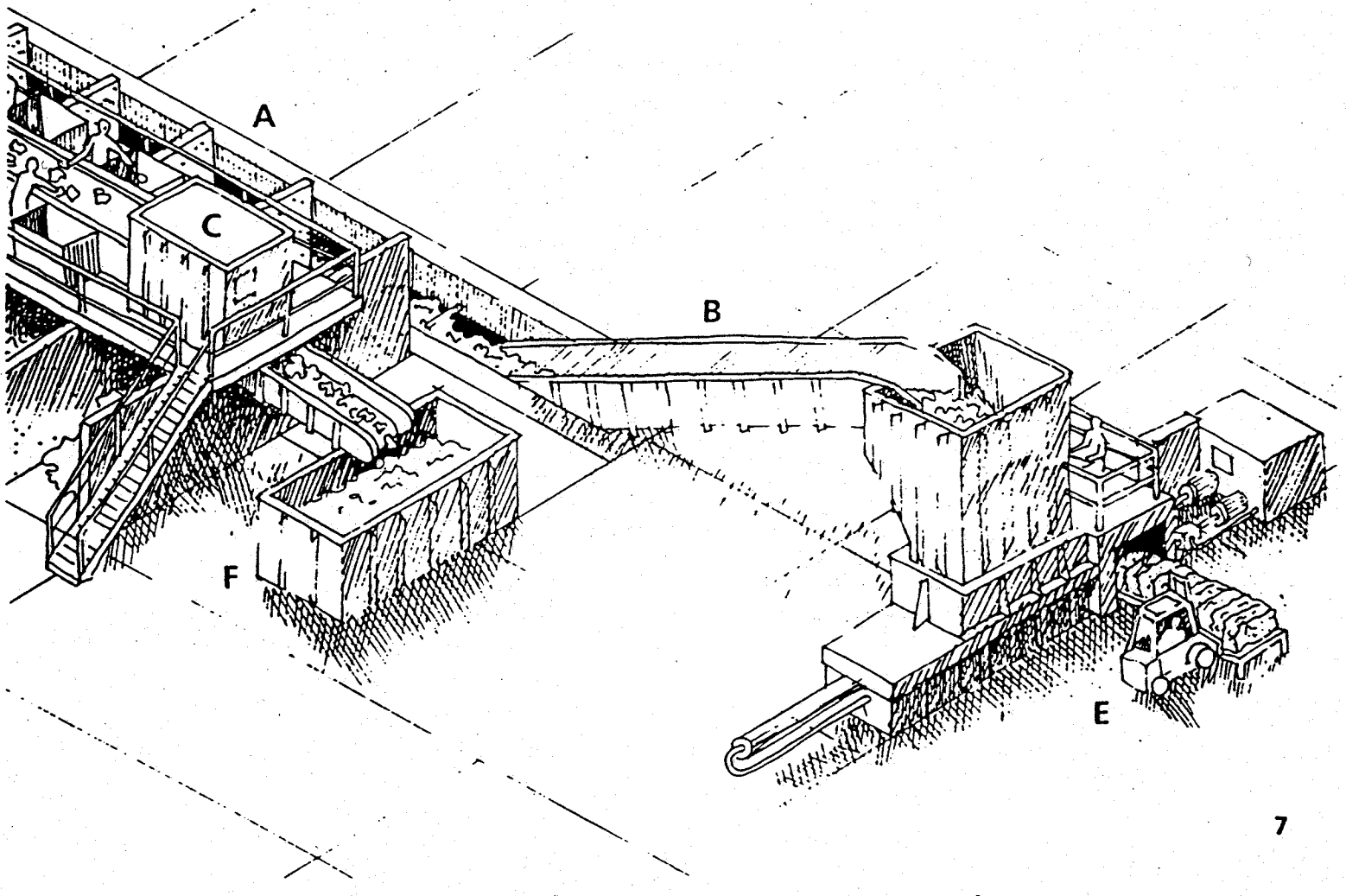
Incoming recyclables are dropped on a large floor called a tipping floor. Depending on the type of material, it is pushed to an in-floor hopper feeding a conveyor. Sometimes the materials are dropped directly into the in-floor hopper. Conveyors take the material up and through processing stations, where recyclables are sorted and dropped into bins below the sorting line.



Each facility is custom designed. Elements in this illustration:

A *In-floor hopper*
B *Conveyor*
C *Mechanical separator*
D *Sorting line*
E *Baling*
F *Residue*

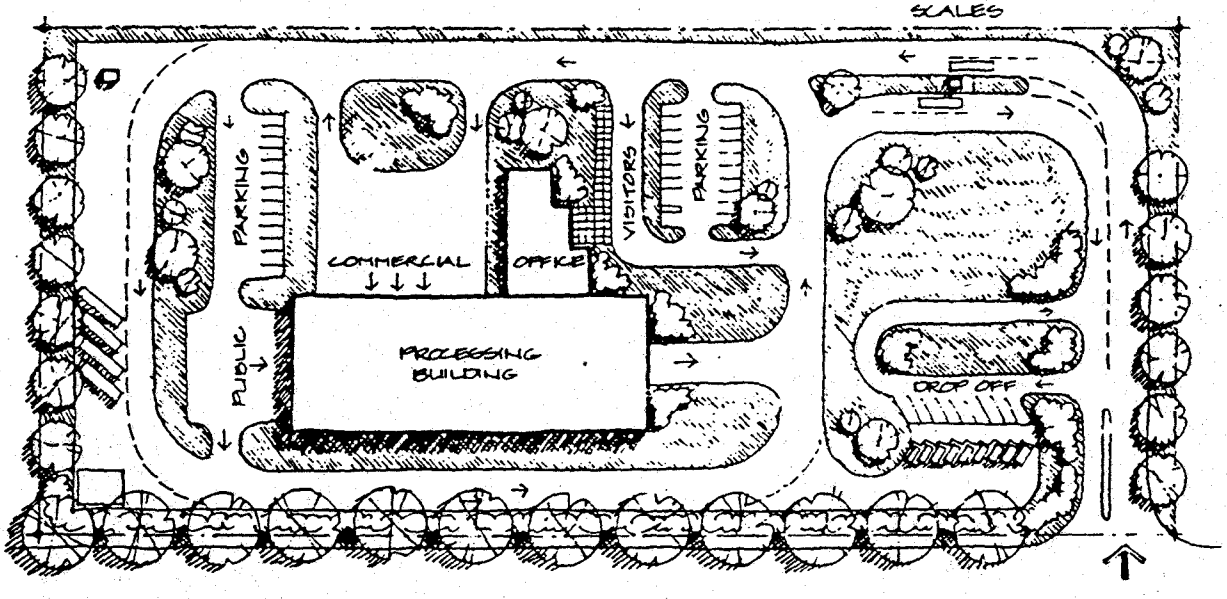
In addition to hand sorting stations and conveyors, processing equipment includes a variety of separation devices from simple magnets and screens to complex mechanical and air driven separators. Mechanical separation can occur before or after hand sorting. The arrangement and types of sorting systems designs vary considerably. Preparing recyclables for efficient shipment involves densifying, crushing, shredding and baling the product. Temporary storage allows transportation economy and market timing. Residue is loaded or compacted into trailers or containers for disposal.



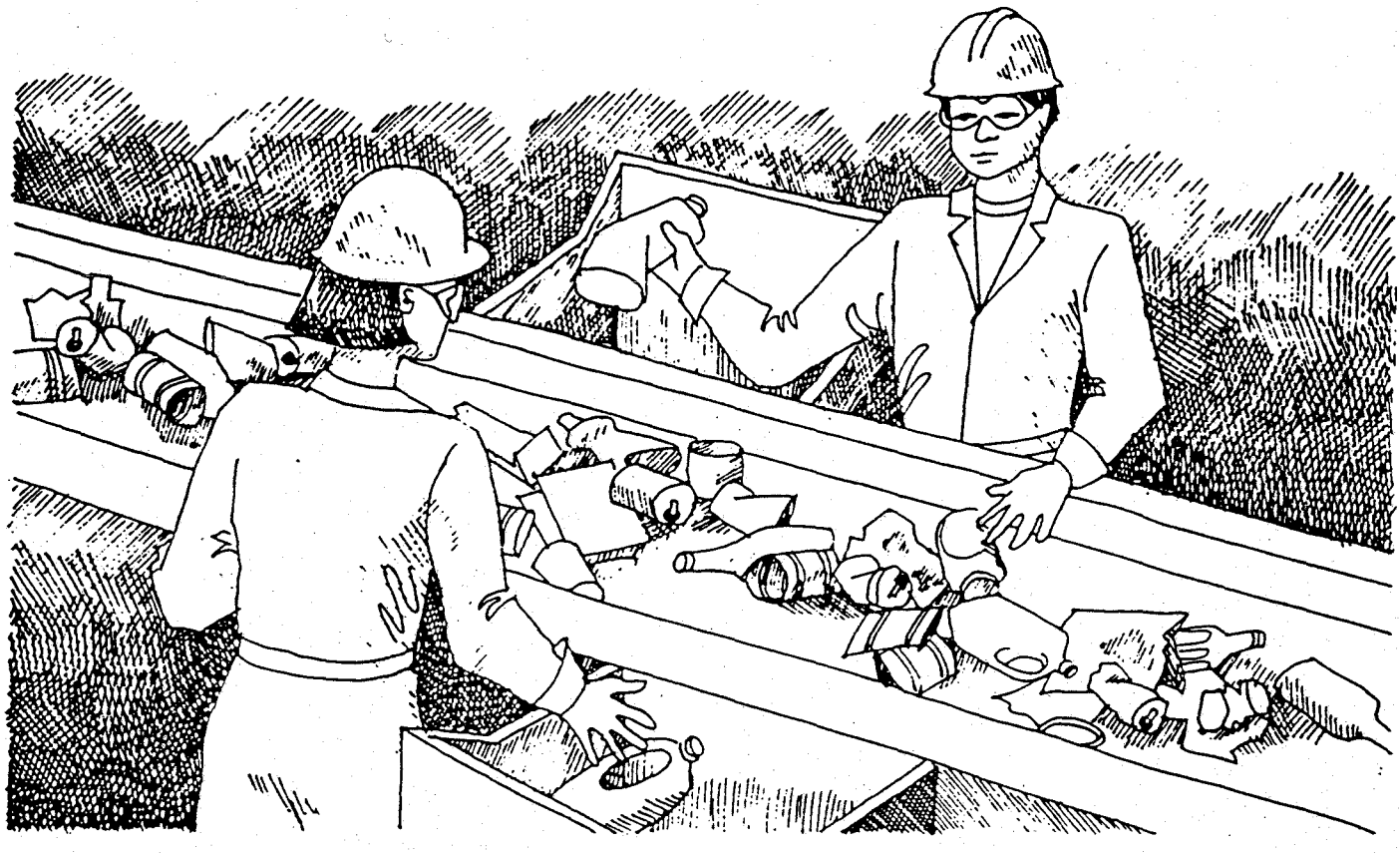
WHAT ELSE IS ON A MRF SITE?

A large processing space is the core of the facility. Office and staff support spaces are incorporated within the shell or located in a separate building. At the entrance, scalehouse personnel manage weighing and payment while monitoring access to the site, which is usually fenced. As the facility grows in size and complexity other related activities may be included: visitor facilities, maintenance space and sometimes a recyclables drop-off center for the public. Some facilities accept yard debris, white goods, C & D waste and other specialized wastes. MRFs are popular attractions for tours and field trips, so many installations include educational display spaces.

The area of the site varies according to the size of the facility, the complexity of the program and its setting in an urban or less developed location. Site areas range from under an acre to several acres where the MRF is sometimes located with other waste-related operations.



HEALTH AND SAFETY ISSUES AT A MRF

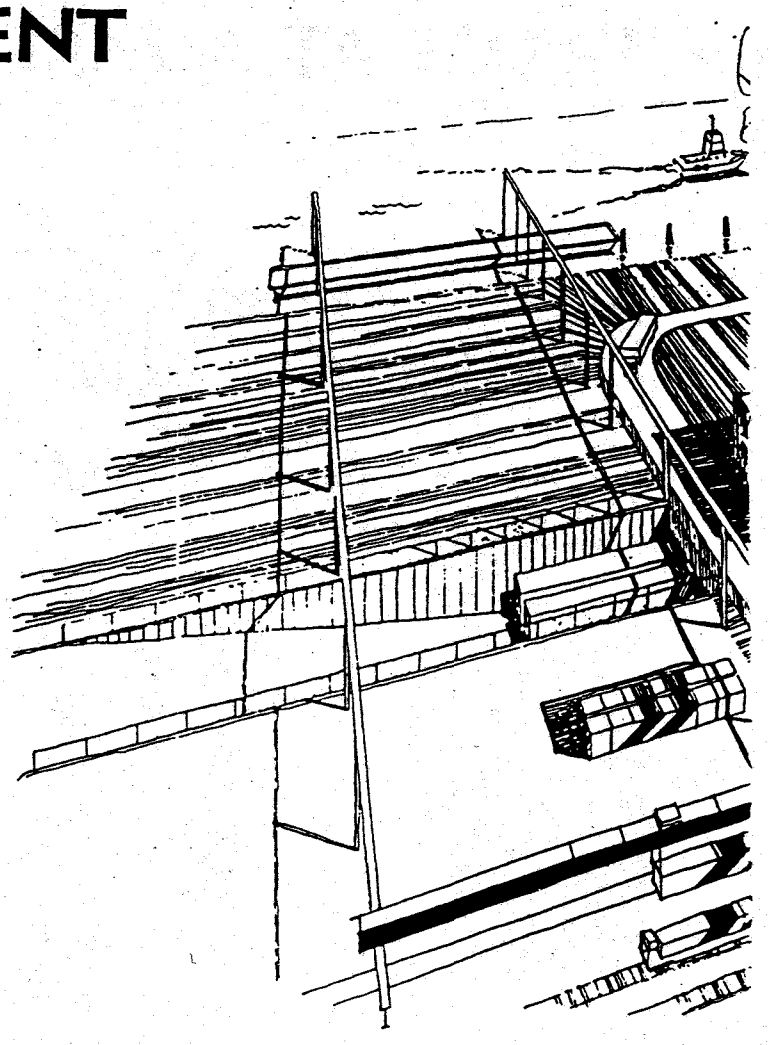


MRFs are a highly regulated building type. Their planning and implementation is governed or reviewed by federal, state and local jurisdictions. They are subject to local planning, building and fire codes. Additional site specific operating conditions and design criteria are often negotiated at the local level.

Like any manufacturing operation, there are concerns for occupational safety and health. OSHA compliance requirements are reviewed. Operators examine each proposed facility plan with a careful eye toward facility design, equipment selection, layout, visibility, ventilation and lighting. Their goal is to design for safety from the beginning.

Workers are provided with appropriate personal protective gear and receive safety training. Most operators rotate workers on a regular basis and pay close attention to the ergonomics of each task.

WHAT'S A TRANSFER STATION & HOW IS IT DIFFERENT FROM A MRF?

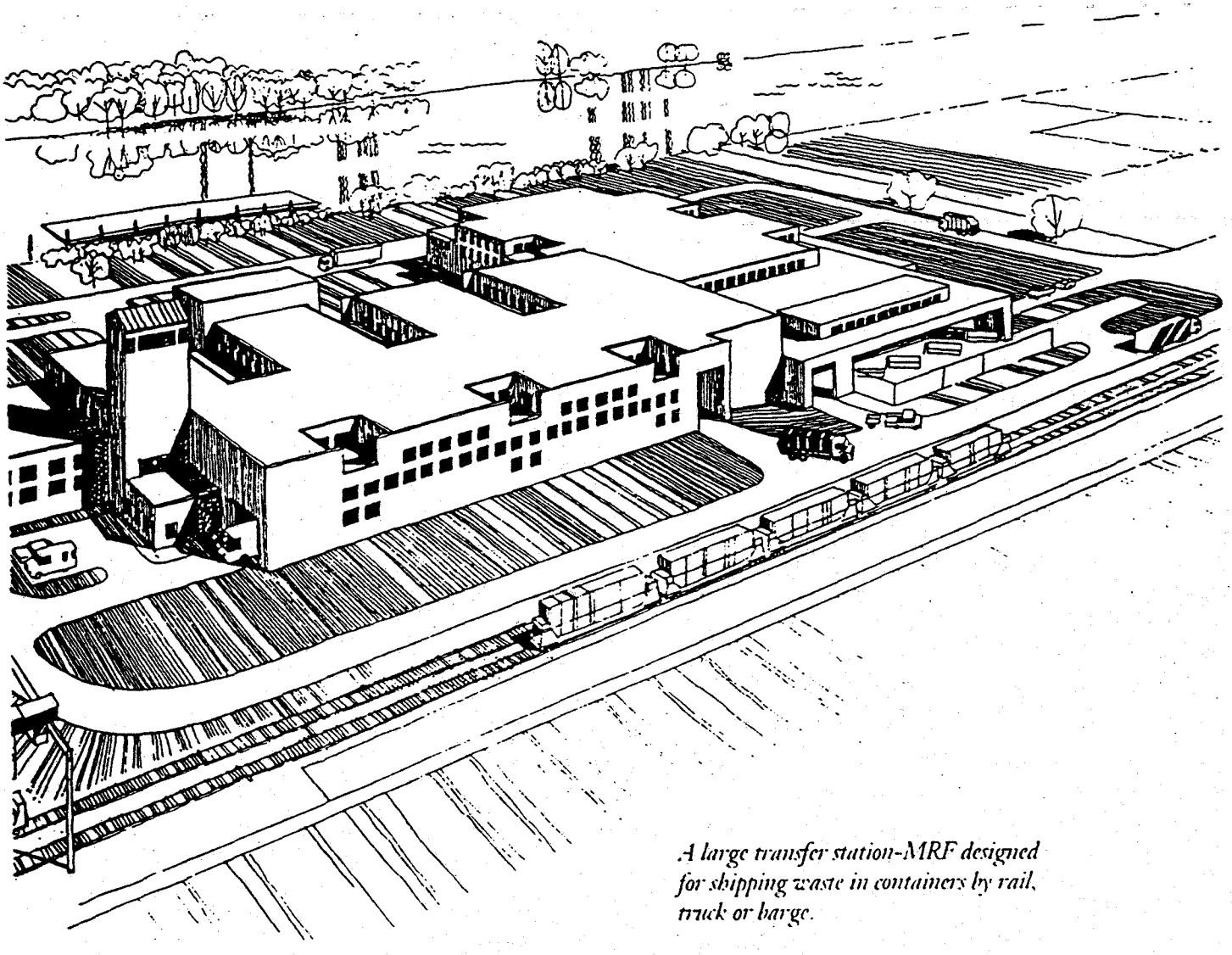


A transfer station is a facility where municipal solid waste is transfered from route collection vehicles to large trailers or containers for shipment. The mission of a transfer station is to economize shipment of waste to a disposal location. Transfer stations are popular because they save money in transporting quantities of waste over a distance. It's less expensive to ship one large load than send several small trucks to a distant landfill. A typical transfer tractor-trailer carries the equivalent of three to five route collection trucks.

The operation is simple. Municipal solid waste is received at the station from residential and commercial collection trucks and individuals. This waste is reloaded into transfer trailers or containers and then shipped for disposal by truck, rail or, in some cases, by barge. There is a wide range in facility sizes.

The most common direct loading arrangement is to drop waste from above. Collection trucks back in and dump waste directly into an open top trailer or container below. When it's not feasible to have a lower level for the transfer truck, the waste is dropped on a flat floor called a tipping floor. Then it is pushed against a wall, called a push wall, lifted and dumped into the top of the trailer or container.

At large stations garbage is dropped into a depressed floor area. The "pit" allows several activities. Waste can be accumulated for a short period of time, balancing the surge of material received during peak hours with the constant, slower loading process. A bulldozer pushes the waste toward a chute at the end of the pit where it drops into the trailer. The treads of the dozer also break up the

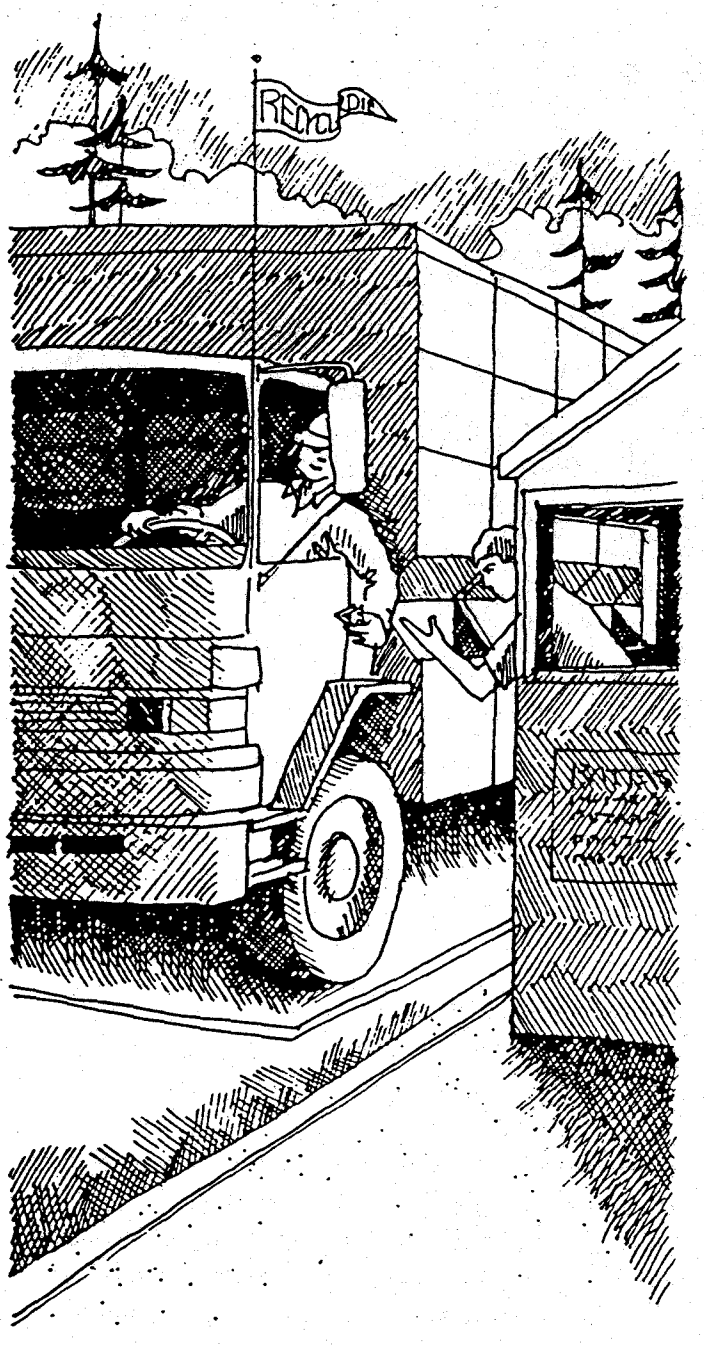


A large transfer station-MRF designed for shipping waste in containers by rail, truck or barge.

waste, increasing the density of the shipped material.

Sometimes the waste is compacted to optimize the amount in each load. The loading process is similar when compactors are used. Large compactors are top loaded. Smaller compactors are loaded using a push wall.

At some transfer stations operators sort their waste stream to remove high quality recyclables or accept recyclables for transfer to a processing facility. While not as efficient as a MRF, the process provides recovery of some recyclables. Increasingly, transfer stations are being built or modified to sort or process waste, creating a type of transfer station-MRF.



WHAT DOES A MRF COST?

Development costs for a MRF include "hard" and "soft" costs. Hard or capital costs include land, building and furnishings, processing equipment and vehicles. Soft costs include site evaluations, surveying, soils investigation, permitting, and design and engineering for site work and buildings. Operating costs consist of staff wages, building operation, debt service and maintenance expenses. Environmental monitoring, safety reviews and mitigation costs are continuing expenses once the facility is running.

WHERE DOES THE MONEY COME FROM?

Like most construction projects, the initial cost of the development is borrowed and then repaid during the life of the operation. Public projects are typically funded through tax-exempt general obligation or revenue bonds. The bonds are paid off with revenue from taxes, disposal fees called "tipping fees" and from the sale of recyclables extracted at the MRF. Private projects built for public agencies are financed by banks or mortgage companies. Part of the security of the loan is the long term value of the contract which guarantees that a specified waste stream will come to the MRF. Merchant MRFs derive all their income from fees and the sale of recyclables.

Customizing this publication

A separate information sheet may be inserted into this booklet. A template for the insert is available for those who wish to provide information about a specific project or proposal. An identity, return address and bulk mail permit number may be applied to the back cover of the booklet.

Availability and distribution

This publication is designed to be printed as needed. Plate-ready film is available from various sources. Individuals, groups, private companies, agencies or government units may print the quantity they want. Pooling orders is encouraged to increase savings. For a sample booklet or information on copy sources contact:

Office of Solid Waste
U.S. Environmental Protection Agency
401 M St. SW, Mail Code OS 301, Washington, DC 20460
202/260-4745

Metro
Solid Waste Department
600 NE Grand Ave., Portland, OR 97232
503/797-1650

Sax Associates Architects
320 SW Stark St., Portland, OR 97204
503/248-1995

Credits
Text: Charles Sax, AIA
Metro project coordinator: Kathleen Dowdall
Graphic design: Sue Gemmell, Metro
Illustrations: Jan Moore, AIA, David Evans
Technical review: Robert Carn, P.E.; Steve Dunn; Nathiel Egosi, P.E.; Russell Filtz; Kevin Murray; Wayne Pherdehirt, P.E.; Jerry Powell

ABOUT THIS PUBLICATION

Funding for creation of this publication has been been provided by a grant from the United States Environmental Protection Agency to Metro, Portland, Ore. This publication does not necessarily reflect the views of the Agency and no official endorsement should be inferred. Additional in-kind services have been provided by Metro. Metro does not own or operate a MRF, however, Metro does own a transfer station which operates as a combination transfer station-MRF.

Metro supports public awareness of all waste facilities with the goal of increasing recycling.

Printed on recycled paper