CHAPTER 4

ASSESSMENT OF SOLID WASTE MANAGEMENT ALTERNATIVES

4.1 CHAPTER SUMMARY

Chapter 4 evaluates the ability of the existing solid waste management system to meet the stated goals and objectives in the Charles County Comprehensive Solid Waste Management Plan. Feasible alternative technologies, management techniques, and regulatory modifications that could be used to meet identified deficiencies are discussed. In addition, siting constraints for potential new management facilities are reviewed.

A summary of the alternatives is presented in a series of tables at the end of this chapter. This information will also be assessed in the Action Plan.

4.2 COLLECTION SYSTEM (MUNICIPAL WASTE AND RECYCLABLES)

Alternatives for the collection of residential and other non-rubble waste and recyclables include the free enterprise system, licensing, franchising, and public operation. Each of these collection alternatives is described below to provide a basis for evaluating the County's existing collection system.

4.2.1 Assessment of Collection System Alternatives

4.2.1.1 Free Enterprise System

The free enterprise system operates by private subscription for waste collection services. Individual homeowners, apartment complexes, commercial establishments, industries, or institutions contract directly with a private hauler to collect their solid wastes and recyclables. Individual clients are billed for services by the private hauler. The remaining residents who do not contract with a private company haul their own solid waste directly to the landfill and take their recyclables to drop-off centers. The advantages and disadvantages of the free enterprise system are described below.

A. Advantages:

The free enterprise system requires minimal involvement and financing by the local government (i.e., Charles County, Town of Indian Head, Town of La Plata). The individuals or commercial establishments are free to deal with the hauler of their choice. If service is unsatisfactory, there are no barriers to choosing another hauler. The cost for hauling and disposal of the waste is billed directly to the customer. Private enterprise is encouraged with the free enterprise system. Opportunities exist for any small entrepreneur who desires to go into business. Residential customers in the Town of La Plata and Indian Head must have their trash collected by the Town.

B. Disadvantages:

In a free enterprise system, overlapping routes are prevalent. Often, a neighborhood or block will be serviced by several private haulers. In terms of labor, equipment, operation, and maintenance, this system is potentially less cost effective than a system with assigned routes that do not overlap. However, it is difficult to determine the potential cost savings, or if current charges are excessive.

Due to the lack of public involvement with the free enterprise system, it is often difficult to implement modifications to collection practices that may be desirable to meet the goals and objectives of a local government's solid waste management plan, such as volume-based billing for collection services and mandatory collection of recyclables by solid waste haulers. Waste flow control is more difficult to attain under the free enterprise system. When collection is voluntary, vagrant dumping to avoid collection fees or trips to the landfill could also pose a problem.

4.2.1.2 Franchising

Under a franchise system, a local government contracts with one or more private waste haulers to provide collection services. For large jurisdictions, such as a county government, the local government's jurisdiction can be divided into collection districts with approximately equal residential population. Municipalities could comprise a separate collection district, or could form a district with adjacent unincorporated areas, at the discretion of elected municipal officials. One private hauler is awarded the collection contract for each district based on competitive bidding. Collection and disposal services would occur according to the rate established in the competitive bidding process.

The local government would be responsible for determining the number and geographic location of collection districts, and establishing uniform performance requirements and standards for the franchisee. Local government staff members would be required to conduct the franchise award process and administer the contracts. The following considerations must be addressed by the local government in order to implement a franchise system:

- Contract Duration
- Mandatory or Voluntary Collection

- Collection of Recyclables
- Provision of Containers for Refuse and Recyclables
- Frequency of Collection (refuse, recyclables, yard waste, white goods, and bulky items)
- Servicing of Multi-family Housing, Commercial, Institutional, and Industrial Establishments
- Collection Hours and Days
- Performance Standards (e.g., spillage, litter, noise, equipment)
- Personnel Training
- Designated Disposal or Processing Facility
- Annual Adjustments to Service Rates Based on a Certified Operating Cost Statement
- Billing and Bill Collection Procedures
- Performance Bond
- Insurance, Indemnification, and Record-keeping

A. Advantages:

The elimination of overlapping collection routes and the competitive bidding for those routes should result in the reduction of collection costs for homeowners and businesses. More efficient routing for collection vehicles results in less fuel consumption, traffic, and exhaust emissions. The franchise system gives a local government the opportunity for flow control, and facilitates the implementation of new management policies through incorporation of requirements in franchise contracts.

Although recyclable collection and volume-based billing can be implemented in the free enterprise system, the increased control afforded to a local government in a franchise system would facilitate implementation and monitoring of these measures.

Mandatory collection can significantly reduce the occurrence of vagrant dumping, roadside litter, and the introduction of waste generated outside the local jurisdiction into the local solid waste management system.

B. Disadvantages:

Franchising results in increased bureaucracy at the expense of the free market. Establishment of a franchise system would probably result in the elimination of several private haulers from collection activities within the local jurisdiction. The severity of this impact can be mitigated through the number of collection districts established, and by limiting the number of franchises that can be awarded to a single private hauler.

4.2.1.3 Licensing

A licensing system allows existing private haulers to continue to operate within a free enterprise system; however, haulers are required to meet standards imposed by the local government. The haulers would still be responsible for billing customers for collection and disposal services.

The local government would be responsible for establishing uniform performance standards for the haulers. Additionally, the local government would also establish procedures and policies for licensing haulers. The following considerations must be addressed by the local government in order to implement a licensing system:

- Length of License
- Mandatory or Voluntary Collection
- Collection of Recyclables
- Provision of Containers for Refuse and Recyclables
- Collection Frequency (refuse, recyclables, yard waste, white goods, and bulky items)
- Performance Standards (e.g., spillage, litter, noise, equipment)

A. Advantages:

This system allows individuals and commercial establishments to deal with the hauler of their choice. Therefore, small private haulers would be given an equal opportunity to compete with large haulers. In addition to customer choice, the licensing system gives the local government the opportunity for flow control, and facilitates the implementation of new management policies through the requirements of the license.

B. Disadvantages:

Overlapping routes would remain. The private haulers may oppose a licensing system that regulates collection and disposal practices. The local government would be required to establish and enforce standards and licensing procedures and policies.

4.2.1.4 Public Operation

Under this option, collection and hauling services would be provided by local government employees, using equipment owned or leased by the local government. Collection could be made either voluntary or mandatory throughout the local government's jurisdiction. Financing of the system could either be through the tax system, or by direct billing based on the actual cost of providing collection services.

A. Advantages:

This alternative provides the most control for the local government. This can be important for implementation of source reduction and recycling programs, as well as providing uniform quality of service. Theoretically, economies of scale in the procurement of equipment and supplies could be realized by such a large operation. In addition, the public operation does not have to earn a profit or pay taxes, so such costs are not passed on to the consumer.

B. Disadvantages:

In spite of the potential advantages discussed above, studies by Columbia University have found that private collection typically costs 28 to 40 percent less than a comparable public operation. This is attributed to more efficient management and operation characteristic of private industry. A very large capital expenditure would be required by the County to procure the necessary equipment to take over all collection and hauling. A complicated fee structure would be required to reflect the actual costs of collecting and hauling refuse to solid waste disposal facilities. A uniform county-wide fee structure would not be equitable. This option increases government control to the detriment of private enterprise by forcing many local private haulers out of business.

4.2.2 Evaluation of the Existing Collection System

Three of the four collection systems described above are currently employed within Charles County. In the unincorporated areas of Charles County, most municipal waste is collected by private haulers through a free enterprise system. The remaining residents who do not contract with a private company haul their own waste directly to the landfill. Curbside collection of residential recyclables is accomplished by a franchising system to the more densely populated areas of the County. The incorporated Towns of Indian Head and La Plata operate their own collection systems (public operation). These two municipalities use their own employees and equipment to provide curbside collection of municipal waste for their residents. The Towns of La Plata and Indian Head uses a private company to do their residential curbside collection for recyclables.

The existing free enterprise waste collection system requires minimal involvement and financing by the County. However, due to the unregulated nature of the system and the number of haulers, it will be more difficult to implement modifications to the collection practices that are necessary to meet the goals and objectives of the Charles County Comprehensive Solid Waste Management Plan. Volume-based billing for collection services or waste flow control measures is an example. A competitive environment fostered by the free enterprise system should produce the lowest cost for consumers. However, the inefficiencies of overlapping routes may raise operating costs incurred by the haulers which are likely to be passed on to the consumers. Additionally, the use of two separate systems for the collection of municipal waste and recyclables produces extra paper work and confusion for consumers as well as county staff. Based on available information, it appears that the waste collection system in the unincorporated areas could be improved to meet the following objectives:

- Ensure that the County has sufficient control of the collection system so that provisions of the *Charles County Comprehensive Solid Waste Management Plan* can be implemented.

- Ensure that modifications to collection practices will be made in a timely and efficient manner.

- Provide a cost-effective and efficient collection system for the residents of Charles County.
- Reduce the redundancy in the municipal waste and recyclables collection systems.

The franchising system for recyclables collection enables the County to ensure the quality of service by establishing performance standards, and to maintain control over the types and quantities of recyclables collected. Although residents of Charles County have expressed concern for expanding curbside recyclable collection countywide, it does not seem feasible at this time to offer collection to the more rural areas of the County.. Besides expanding curbside collection services, the County should continuously monitor and evaluate the effectiveness and efficiency of the franchising system compared with licensing, free enterprise, or public operation.

Large commercial, industrial, and institutional establishments currently contract directly with private haulers for collection. These establishments often have unique requirements related to collection frequency, containers, and collection hours, which are best addressed by individual contracts; therefore, the existing arrangements for these facilities should be maintained. Alternatively, commercial establishments should have the option of being included in the residential waste or recyclable collection system, if satisfactory service can be provided.

4.3 RECYCLING

Although recycling is not new to the management of solid waste, it is gaining wider acceptance as a viable approach to the solid waste management and disposal problems. State mandated recycling goals and increased public awareness is resulting in an increased amount of material being recovered for recycling. Along with this increase, problems associated with expanding the recycling programs and increased recycling costs are emerging. Although costs associated with recycling are increasing, recycling is considered to be a worthwhile solid waste management tool even at a net loss in order to conserve landfill space.

Recycling issues facing communities today include mandatory versus voluntary programs, flow control, accounting and reporting procedures, compatibility of recycling with other waste management practices and market development. Possible components of a municipal recycling program include curbside collection, drop-off centers, buy-back centers, and processing facilities to recover recyclables from the municipal or rubble waste streams. Each of these components are described in the following sections to provide a basis for evaluating the existing recycling program.

4.3.1 Technology Assessment

4.3.1.1 Curbside Collection

In curbside programs, residents place their recyclables at the curb for collection and subsequent delivery to processing facilities.

A. Operations:

There are several variations of curbside recycling, the three major systems are described below.

1. Resident Sort - Residents segregate target materials by type into separate containers. Typically, three containers are provided to each resident for collection of newspaper, metal cans, glass and plastic.

2. Curbside Sort - In these programs, target materials are placed into a single container, separate from other residential wastes. Collection crews sort the materials at curbside as they place recyclables in the collection vehicle.

3. Single Stream - Target materials are placed in a single container, separate from the other residential wastes. The materials are not sorted by collection crews, but placed into the collection vehicle in a mixed state.

When evaluating curbside collection program variations, it should be recognized that differing approaches may affect the level of participation achieved, material processing requirements, the investment required to fund the program, and operational costs. Some programs are structured to pick up refuse and recyclables at the same time; others collect recyclables separately from refuse. Curbside programs typically target newspaper, glass, plastics, and aluminum, but other materials may be included.

Material processing requirements for the curbside programs are dependent upon the collection option selected, and the specific market requirements. Typically, an intermediate processing facility is used to prepare each material for market specifications and to package the material for shipment to the markets. These services may be contracted to private industry or the facility may be operated by the local government.

B. Equipment:

Municipal refuse collection crews and private haulers both have been used to service curbside routes. As a result of single stream recycling haulers can utilize traditional solid waste collection vehicles to collect recyclables. Some programs require dual stream collection, which would require compartmentalized collection vehicles. The type of vehicle is dependent on availability, the collection route, and the method of collection.

Containers are typically provided to each household for curbside programs. The number and size of container depends on the collection system selected. The containers are typically imprinted with a county, municipal, or recycling logo. Container selection should consider convenience and ease of use from the perspective of the residents and haulers.

C. Costs:

Curbside collection of recyclables could be accomplished by franchising, licensing, or public operation (Section 4.2.1). In general, the public operation of a curbside collection program would be a greater cost to the local government than a franchised program or licensing.

Equipment associated with curbside collection programs include collection vehicles, collection containers, and processing equipment. Operating costs are highly variable and include labor, fuel, supplies, and maintenance. Collection equipment costs can range from $30,000 for a flatbed trailer to $240,000 for a self-loading truck. Labor costs can range from $20 to $135 per ton of material collected.

D. Advantages:

Most curbside programs are now collecting materials through single stream collection. This is the result of new technologies at the Material Recovery Facilities. The greatest advantage is increased productivity during collection and the least burden to residents. Curbside programs provide a convenient way for homeowners to recycle and single stream increases this convenience.

E. Disadvantages:

Curbside collection programs experience high start-up and operating costs. The success of the curbside collection program is dependent on an ongoing public education program. Curbside collection would not be a cost-effective or efficient method for collecting recyclables in remote, rural areas.

4.3.1.2 Drop-Off Centers

Drop-off center recycling is accomplished through the establishment of stations where recyclable materials can be brought by the public. These centers are generally publicly owned and operated. As with curbside programs, no payment is made for the recyclable materials. Drop-off centers can range from small, mobile operations to permanent processing facilities which accept, process, and store recyclables until they are shipped to market.

A. Operations:

Small drop-off centers can use a number of containers for collection of recyclables. Containers successfully used for drop offs include roll-off drums, 55-gallon drums, and igloo bins which are bell-shaped containers. Material processing requirements are dependent upon the type of drop-off center operation, and are similar to the requirements of the curbside programs. Materials from unmanned centers would typically require a higher level of intermediate processing.

B. Equipment:

Drop-off centers require containers for depositing the recyclables. Collection vehicle requirements are dependent on the type of container. Staffed drop-off centers require office or warehouse facilities and storage containers.

C. Costs:

Costs associated with drop-off centers include the collection containers, transportation of the materials to a central facility, site maintenance, administrative costs of record-keeping, and labor for stations which are staffed. These costs are highly variable depending on the level of sophistication. The estimated cost for the Charles County drop-off centers is in the range of $10-$75 per ton of material processed. To determine the true cost of recycling operations, a comprehensive analysis would be required, especially when the drop off centers are funded by two enterprise funds.

D. Advantages:

Capital and operating costs are lower for drop-off center recycling than curbside programs. Unmanned locations can be located close to population centers and can operate 24 hours per day.

E. Disadvantages:

Drop-off centers are less convenient than curbside collection programs. Vandalism and theft may present problems at unmanned drop-off centers. Often, drop-off centers can become unkempt and littered with trash; community or municipal workers must be committed to keep the site clean. Material recovery levels are typically lower than curbside programs. Contamination of recyclable materials is higher than for curbside collection programs.

4.3.1.3 Buy-Back Center

Private buy-back centers operate similarly to drop-off centers; however, individuals are paid for their materials based on current market prices.

A. Operations:

Buy-back centers can be permanent or mobile facilities. Permanent buy-back centers function as an intermediate collection point/processing center taking materials in and distributing them directly to the end processors.

B. Equipment:

At a minimum, a buy-back center requires scales and containers for weighing and storing the recyclables. Other equipment requirements are dependent on the approach or the combination of approaches used.

C. Costs:

Local governments incur no costs associated with the use of buy-back centers since they are privately owned.

D. Advantages:

Paying the public for recyclables provides an incentive to some who would otherwise not recycle.

E. Disadvantages:

Low material recovery rates are typical of these facilities. Market prices may significantly affect participation.

4.3.1.4 Mixed Waste Processing Facility (MWPF)

A mixed waste processing facility or "dirty MRF" recovers recyclables from the mixed municipal waste stream.

A. Operations and Equipment:

For a typical MWPF, mixed municipal solid waste is dumped onto the tipping floor and pushed onto a below-ground conveyor by a front-end loader. Usually, this waste must go through a bag-breaking operation, especially if the MWPF is receiving large quantities of residential waste. Bag-breaking is most often performed manually, although some specialized bag-breaking devices are now available.

Screening drums or other special equipment such as air classification units are used to separate the mixed waste stream, generally into two components:

1. An "undersize" stream, which consists mostly of fine particles fewer than one or two inches in length. This stream contains fine aggregate materials (e.g., glass, stones, etc.) and compostables, such as soil and food particles.

2. An "oversize" stream, which contains recyclable food and beverage containers, paper, film, plastic, and other large objects.

One of the primary objectives of this process is to separate the compostable components of the waste stream from the larger particles of paper and plastic that are more useful as fuel. Size classification can also help improve hand-sorting efficiency. Since the finer material has already been removed, sorters picking materials from the oversize fraction do not have to dig through as much material to reach and pick out the recyclables.

The first recyclable item that is typically removed is ferrous metal. The overhead electromagnetic separator is the device used almost universally in the industry. These separators,

which are manufactured by a number of companies, consist of an electromagnet surrounded by a moving conveyor belt. The electromagnet attracts ferrous metals which "adhere" to the magnetic separator belt. The separator belt then dumps the metal onto another conveyor which transports it to crushing equipment or directly loads it into trucks for shipment to market.
Since magnetic separators are not 100 percent efficient, some facilities station hand-sorters before or after the magnet to increase the amount of ferrous captured.

After the magnetic separation process, the remaining waste often proceeds onto hand-sorting conveyors. These are slow-moving conveyors, located 10 to 15 feet above floor level. The sorters stand on elevated platforms that are adjacent to the conveyors and pick recyclable materials, which they then drop into chutes. The chutes convey the material to one of the following:

- Concrete storage bunkers, located underneath the sorting conveyors.

- Processing equipment (e.g., glass crushers, aluminum can flatteners, or plastics granulators).

- Other conveyors, which transport the recyclables to processing equipment or storage areas.

Very often, MWPFs will receive loads of waste that are dry and contain primarily paper materials from commercial generators. The number of loads containing primarily dry material would be affected by the existence of programs that source-separate cardboard and paper. These dry paper loads can be baled and shipped to market after a minimal amount of sorting to remove contaminants. Such sorting can be done on the tipping floor (in the manner of the "dump and pick" MWPF). In other words, these loads do not have to be processed through the entire sorting system.

Once they are baled, crushed, or otherwise processed, recyclables are either stored within the building or loaded directly into waiting trucks for shipment to markets.

The MWPF may further process non-recovered waste. Non-recovered waste which comes off the sorting conveyor may be shredded to make it easier to burn or compost. The loose, fluff-like material that emerges from the shredder is directed to an on-site fuel pelletization or composting process or loaded into transfer trailers for shipment to off-site fuel production or composting facilities.

B. Costs:

Capital costs for a MWPF are highly variable dependent on the level of mechanization and sophistication of the facility, as well as land acquisition and site development. A typical capital cost range is $20,000 to $30,000 per ton of daily capacity, exclusive of land acquisition. For Charles County, capital cost for a 300 ton per day MWPF are estimated to range from $6 million to $9 million. Operation and maintenance costs are estimated to range from $40 to $60 per ton of municipal waste processed, exclusive of revenues gained from marketing recycled materials.

C. Advantages:

The primary advantage of a MWPF is the convenience to residents and business; therefore, there is no need to segregate wastes at the source. This typically results in higher recovery rates for recyclables.

D. Disadvantages:

Capital and operations costs are significantly higher than for a Material Recovery Facility (MRF) (Section 4.3.1.5). Contamination of materials is a problem, resulting in lower quality recyclables that are more difficult to market. The potential exists for environmental impacts from odors, aesthetics, and contaminated runoff from the facility.

4.3.1.5 Material Recovery Facility (MRF)

A material recovery facility or "clean MRF" processes recyclables that have been source-separated from the waste stream.

A. Operations and Equipment:

Material recovery facilities receive and process recyclables that have been source-separated from the waste stream. They vary in level of sophistication from "recyclable transfer stations" to highly mechanized processing plants for commingled recyclables. Equipment requirements are based upon the level of separation of the incoming recyclables and the type and quality of recycled materials required. Most MRFs will include concrete storage bunkers, compaction and baling equipment. Sophisticated MRFs can include conveyer lines, screening and picking stations, electromagnetic separators, and air classifiers as previously described for the MWPF.

B. Costs:

As with the MWPF, capital and operations costs vary over a wide range, dependent on the level of technology employed by the facility. A typical capital cost range is $40,000 to $70,000 per ton of daily capacity. For Charles County, capital costs for a 20-ton-per-day MRF are estimated to range from $1.6 million to $2.8 million, exclusive of land acquisition. Operations and maintenance costs can range from $20 to $60 per ton, exclusive of revenues gained from marketing recycled materials.

C. Advantages:

MRF's generally produce a higher quality of recyclable materials than a MWPF; therefore, capital and operations costs are significantly lower. There is better control over the types and sources of waste that is accepted. In addition, environmental impacts, including odors, are less of a concern than with a MWPF.

D. Disadvantages:

In order to utilize the MRF concept, residents and businesses must separate recyclables from their waste stream prior to collection. This typically results in a lower participation and recovery rate than for the MWPF.

4.3.1.6 Rubble Material Recovery Facility (MRF)

A large portion of land-clearing, construction, and demolition debris is recyclable. A few examples of recyclable rubble materials include wood, paper, concrete, asphalt, gypsum wallboard, and glass. These wastes are most often mixed when received from project sites, creating an obstacle for recycling. Some separation of wastes can be accomplished at the job site by encouraging contractors to segregate major recyclable components in separate disposal containers. However, segregation of wastes at demolition sites is an expensive, labor-intensive process. Alternatively, a central rubble MRF can be established to separate and process the recyclable components of the rubble waste stream.

A. Operations and Equipment:

Rubble is not as amenable to the highly mechanized separation technology used in some municipal waste MRFs. Since rubble waste is generally large, bulky, and heavy, sorting equipment is limited to front-end loaders, dozers, and human labor. Processing equipment can include grinders, balers, crushers, shredders, and chippers depending on the level of processing at the facility.

Wood waste makes up a significant portion of the rubble, including pallets, stumps, and brush from land-clearing operations. Large tub grinders and wood chippers are often used to reduce these wastes to wood chips for marketing. Chips can be marketed as fuel, mulch, and animal bedding. Depending on the market, painted or treated wood products may be excluded from the chipping operation. In addition, magnetic separation of metal wastes (e.g., nails from pallets) is often used.

Paper waste is primarily corrugated materials which can be easily baled and readily marketed after separation from the rubble waste stream. Contaminated and plastic coated cardboard must be excluded. Recycled paper products are made with the recovered paper waste.

Asphalt roofing waste has a high resale value due to the high percentage of petroleum; however, recycling has not been widespread due to problems associated with the removal of contaminants (e.g., paper backing, stone, gutter scraps, and nails). Sorted shingles and aggregate are mixed, reduced in volume, and passed over magnets to remove metals. The recovered asphalt can be used to manufacture paving products.

Metal waste is separated into the various types (e.g., ferrous, aluminum, copper) and marketed to scrap metal dealers. The scrap metal is used to manufacture new metal products.

The volume of concrete in rubble is highly variable. Waste concrete can be crushed and then passed over magnets to remove rebar and wire which is marketed to scrap metal dealers.

Crushed concrete can be used as aggregate for septic fields, driveways, pipe bedding material, and landfill cover.

Plastic materials are shredded or crushed, depending on the market, and used to manufacture new plastic products.

Earth materials such as soil and yard waste can be used as landfill cover or sent to a yard waste composting facility.

Other products recovered from the rubble waste include the following:

- Bricks - Crushed and used as aggregate or ornamental stone.
- Carpet - Landfill cover.
- Glass - Ground and used to manufacture fiberglass insulation, for sand blasting, or asphalt aggregate.
- Gypsum Wallboard - Crushed and used as agricultural gypsum, wallboard, or cat litter.
- Porcelain - Crushed and used as concrete aggregate.
- Tires - Shredded and used in roadways, to manufacture rubber products (e.g., bumpers, mudflaps, car mats, shoes, gloves).

B. Costs:

Typical capital costs for a rubble MRF ranges from $5,000 to $30,000 per ton of daily capacity, exclusive of land acquisition. For Charles County, the capital cost for a 250 ton per day rubble MRF is estimated to range from $1.2 to $7.5 million. Operation and maintenance costs are estimated to range from $20 to $60 per ton of rubble processed, exclusive of revenues gained from marketing processed materials.

C. Advantages:

Rubble recycling reduces the amount of land required for landfills, and extends the life of existing facilities. Rubble recycling provides a beneficial use for materials which would otherwise be considered waste.

D. Disadvantages:

Depending on available markets, costs for this technology will typically exceed costs for land filling. Depending upon location and adjacent land use there may be adverse impacts from truck traffic and noise.

4.3.1.7 Commercial Recycling

Recycling is provided in the commercial sector primarily through private industry contractors who collect and market recyclables for large- and small-scale businesses. Many smaller businesses collect material and take it to publicly operated recycling centers to minimize costs. Larger businesses and shopping centers often ship recyclables directly to markets.

4.3.2 Evaluation of the Existing Recycling Program

Since 2004, Charles County achieved a waste diversion rate of 35 percent or higher (including yard waste - Section 4.4). Reports show that the recycling program has emerged from one that was primarily dependent on the commercial sector of the community to one which has increased recycling opportunities for the residential sector. The Charles County recycling program consists of five areas:

1. Collection - A combination of curbside collection and citizen drop-off locations collect newspaper, telephone books, office paper, cardboard, textiles, glass, metals, plastics, electronics, batteries, white goods, used oil and antifreeze, yard waste, and tires. The implementation of “single stream” recycling at the curb and centers increased convenience by eliminating the need to presort, making it easier for residents to recycle. There is one buy-back center located in Charles County (Waldorf Metals). Recent favorable metal prices have resulted in more residents opting for buy-back programs opposed to the County’s collection centers. Expansion of the recycling program continues with over 38,370 households receiving service.

2. Processing - The County operates a yard waste composting facility at the Charles County Landfill. The County uses the composted material on the public grounds and athletic fields and offers free mulch, made from recycled yard waste collected within the County, to the public.

3. Public Education - Charles County conducts extensive public education program aimed at community leaders, business organizations, tourist promotion groups, large commercial generators, schools, residents, to promote participation in the recycling effort.

4. Administrative - Administrative programs have been expanded to include a recycling superintendent. Training programs for landfill and drop-off center staff as well as administrative and supervisory personnel are regularly conducted. Training programs focus on general education about recycling and the County's recycling program.

5. Market - The County continues to monitor the market for recyclables to ensure the best price. Factors including transportation, traffic, processors acceptance standards, and the amount of material available are all evaluated in deciding the best possible market.

The existing recycling program has shown significant results, increasing the percentage of the waste stream recycled from 15 percent in 1992, 29 percent in 1999, and 50 percent in 2009. In 1999, approximately 36,266 tons of recyclables were recovered in Charles County and approximately 44 percent of this total was obtained from the residential sector (recyclables and yard waste) and 56 percent from the commercial sector. In 2009, 51,537 tons was recycled in Charles County, with 35 percent from the residential sector and 65 percent from the commercial sector.

Rubble waste is not considered an "eligible waste" under the Maryland Recycling Act, and as such, recycling rubble would not count toward the County's recycling rate. However, Charles County will evaluate the options for a rubble processing facility to process the rubble and reduce the amount and/or volume of rubble landfilled.

The Tri-County Council for Southern Maryland Regional Task Force prepared a Report and Recommendations in October 1993. This report discusses regional solid waste management solutions for Calvert, Charles, and St. Mary's Counties. The following regional opportunities were recommended as long-term solutions:

- Cooperative Marketing of Recyclables
- Regional MRF
- Cooperative Public Education Programs
- Cooperative Procurement Policies

Charles County will continue with an aggressive recycling program to recycle as much of the eligible waste generated in the County as possible.

4.4 YARD WASTE COMPOSTING

Yard waste composting is becoming an increasingly popular waste management option as communities look for ways to divert this portion of the waste stream from landfills. Composting is a simple, low-cost operation which can handle large portions of the waste stream and significantly benefit other waste management operations environmentally and economically.

The availability of and access to outlets which will use or purchase compost is fundamental in determining composting program success. Typically markets include farms, nurseries, municipal operations (parks and landfills). Although compost can generate revenue, the revenue is not likely to exceed the cost of collecting, processing, and distributing the compost. However, reduced disposal costs and environmental benefits of are attractive features of yard waste composting.

4.4.1 Technology Assessment

Yard waste compost is a material which has undergone a biological decomposition of organic matter and is stabilized to the stage of being beneficial to plant growth. Composted yard waste products can be generated for use as a mulch, soil amendment, topsoil, or potting soil. A proper balance of environmental conditions is required to ensure successful composting. The following four factors are critical to the composting process:

- Moisture - Too much or too little may slow down the composting process.
- Oxygen - Required for the bacteria to decompose the organic material.
- Nutrients (nitrogen-to-carbon ratio) - A balance of thirty parts carbon to one part nitrogen promotes efficient composting (e.g., grass clippings have a higher nitrogen-to-carbon ratio than do leaves).
- Temperature - Self generated heat from the bio-decomposition of the waste material naturally rises as the action of the microorganisms increase. This increase has the positive effect of enhancing decomposition and destroying weed seeds that may be present in the material being composted.

Types of yard waste includes leaves, wood, and green waste such as grass clippings, sod, hay, straw, weeds, brush, and hedge clippings. Leaves and wood generally decompose slower than green waste. Wood waste is the slowest to compost because of its density and its high carbon content and low nitrogen content. Green waste is an excellent source of nitrogen and moisture for the composting process. When mixed with leaves and woody material which lack these ingredients, the overall process is enhanced.

The types of compost from yard waste includes mulch, soil amendments, and soil mediums. Mulch is partially decomposed wood waste which can be used as a barrier to retain moisture and insulation to protect plants. Types of mulch includes bark, wood chips and shredded wood. Bark is generally ground or broken up into small pieces rather than chunks; wood chips are generally derived from wood/brush chipping equipment; shredded mulch is produced by running woody material through a tub grinder and is then composted to stabilize the material.

Soil amendments consist of compost that is mixed with soil to improve the physical and nutrient characteristics of the soil. Examples of soil amendments include humus and screened compost. Humus is a dark, rich, well-decomposed organic material; screened compost is the peat-like, fine portion of composting material that has been screened from large, woody particles.

Soil mediums are typically a mixture of soil amendments such as compost, sand, and vermiculite to produce planting mixtures and potting soils.

4.4.1.1 Operations and Equipment

Yard waste composting technologies range from small scale backyard systems to larger scale systems for processing waste within a regional area.

A. Backyard Composting

The type of backyard system is only limited by the imagination of the homeowner. Systems include the following:

- Backyard windrows - elongated piles constructed by layering.
- Cylindrical pens - using woven wire to form a cylindrical pen and layering materials within the pen.
- Perforated steel drums partially filled with compostable material. The drum is rolled to provide for aeration of the compost.

The Charles County Department of Public Works holds subsidized compost bin sales every year and encourages residents to grasscycle lawn clippings.

B. Low-Level Technology for Large Scale Operations

Process involves forming large windrows (12 feet high by 24 feet wide) that are turned once a year with front-end loaders. Compost is ready for use in approximately 1 to 2 years. This technology requires little attention and is relatively inexpensive. The space required for this technology is also minimal in comparison to the other technologies. However, odor is a common characteristic due to the infrequent turning.

C. Mid-level Technology for Large Scale Operations

Process involves medium size piles (6 to 7 feet high by 15 to 18 feet wide). The composting process is completed in approximately 16 to 18 months. Piles are turned more frequently, hence the odor problem occurs less frequently.

D. High-Level Technology for Large Scale Operations

A multi-step control approach involving grinding, shredding, and frequent windrow-turning. Additional process control is provided through moisture addition and temperature monitoring. Compost is ready for use in 3 to 6 months. Capital and initial operating costs are higher due to the additional shredding, grinding, mixing, and screening equipment.

4.4.1.2 Costs

The planning of yard waste composting programs must take into consideration four cost components:

- Capital cost of processing facilities and possibly transfer stations.
- Annual site operation and maintenance costs.

- Annual yard waste collection costs.
- Annual product marketing costs.

The capital cost of the compost processing facilities will vary widely depending on the sophistication of the process used, the amount of waste received, and the type of waste received. A careful evaluation of options versus cost implications is required when planning and financing such facilities.

Site operational costs are more predictable and these typically range from $2 to $5 per cubic yard of material produced, exclusive of collection and marketing costs. Generally, the greatest cost associated with yard waste management arises from waste collection. Curbside pick-up can represent as much as 75 to 80 percent of total project costs. Typical collection costs can range from $8 to $20 per cubic yard of waste.

Marketing costs will vary and will be a function of the demand for the material, influence of competing products, quality of the material produced, and the desired revenue. Marketing costs are minimal when compost products are used by government agencies or when "giveaway" programs with citizens consume all of the product. If revenue is derived from product sales, increasing levels of marketing are required. A good rule of thumb is that wholesale "bulk" marketing results in the high-volume sales and low revenue; whereas, wholesale "bagged" marketing results in low volume but high revenue.

4.4.1.3 Advantages

Composting is a low-cost operation and saves valuable landfill space. Composting has minimal operation and maintenance requirements. The final product is useable and is potentially marketable.

4.4.1.4 Disadvantages

Composting has the potential for odor problems. Markets for compost may vary and excess compost may require a separate storage area.

4.4.2 Evaluation of Existing Yard Waste Composting Program

Charles County has composted yard waste since April 1992. In 1999, 8,145 tons of yard and wood waste was processed (679 tons per month). In 2009, 11,874 tons of yard waste and wood waste was processed (989 tons per month).

The composting site, formerly located off Radio Station Road in La Plata, is now located at the Charles County Sanitary Landfill. The composting area occupies a portion of what is destined to be Cell number 3 of the landfill. The yard waste delivered to the site is de-bagged and composted in “windrows” on the paved pad. The County uses a composting process which is completed in approximately 150 days. The compost is used on County owned athletic fields and public areas.

The County uses a windrow turner and screen to maintain the compost windrows and a tub grinder is used to convert brush and wood waste into mulch.

Yard waste is estimated to comprise approximately 14 percent of the residential waste steam and 5 percent of the eligible commercial/industrial and institutional waste steam. In total, yard waste represents approximately 9 percent of the municipal waste stream in Charles County. At current composting rates for 2007, the 12,641 tons of composted material represents approximately 8.6 percent of the estimated residential yard waste generated. It should be noted that the yard waste composting percentages are based on estimated waste composition. A waste composition study will be recommended (Chapter 5) to provide information for assessing the validity of these percentages and for detailed planning of collection and processing systems that will be necessary. When the characterization is complete, a more definite assessment of the efficiency of the existing system can be made.

Alternatives available to further increase the yard waste composting rate include increasing the participation from the commercial sector and expanding the collection system to the unincorporated areas of the County. Additionally, the composting site has been located on a site which easily affords expansion to accommodate the increased throughput.

4.5 SOLID WASTE COMPOSTING

Municipal Solid Waste (MSW) composting has been practiced for many decades around the world. In the United States, it has met with limited success because of high cost, production odors, faulty technology, and poor product quality. In the past decade, however, interest in solid waste composting has increased in the United States, and more facilities are being built. Typically, the economics of solid waste composting require high landfill tipping fees to justify the high cost of capital, operation, maintenance, and product marketing. Solid waste composting is often used to further process residual wastes generated by a Municipal Waste Processing Facility.

About 70 to 75 percent of a typical solid waste stream consists of newspaper, corrugated, mixed paper, food and yard wastes which can be composted. The remaining 25 to 30 percent must be landfilled, recycled, or processed by some other method. The composted material may be used as landfill cover material, for agricultural purposes, or for landscaping. The market for composted municipal solid waste within Charles County has not been investigated. In the event that a MSW composting facility is considered for Charles County, the determination of markets for the composted material should be a priority.

4.5.1 Technology Assessment

There are several composting technologies available today; however, the general process involves mechanical preparation of the incoming waste, materials recovery (in some cases), active composting, curing, and product screening.

4.5.1.1 Operations and Equipment

The composting processes considered potentially applicable for Charles County are the windrow-with-forced air aeration (WWFA), aerated static pile (ASP), horizontal silo, and in-vessel. When used for MSW, all of these processes normally include pre-processing, post processing, and curing stages. Despite having different digestion processes, all systems have three distinct phases; namely, pre-processing, composting or digestion, and post-processing. The specific design of the composting facility and equipment used depends on the following:

- The quantity and composition of the waste stream being processed.
- The desired quality of the end-product.
- The desired recovery levels of auxiliary products such as recyclables and fuel products.
- The site conditions and proximity of the plant to its neighbors.

In particular, the degree of pre- and post-processing depends on the market for the final compost product. If it will be used as landfill cover, non-compostable materials may be allowed to remain in the compost. If it will be used as a soil conditioner for landscaping, most or all inorganic material will need to be removed. The pre-processing, digestion and post-processing systems are described below.

A. Pre-Processing:

Purely organic waste streams, such as yard wastes, food waste or agricultural wastes require little or no pre-processing. However, MSW is normally more heterogenous in composition and will contain a large percentage of inorganic material. The objective of pre-processing is to remove inorganic materials and recyclables from the waste stream and isolate the organic fraction for composting.

Pre-processing at MSW composting facilities include the following processes:

- Removal of bulky, non-processible wastes.
- Size reduction (shredding and bag-breaking).

- Size classification (screening, air separation, density separation).

- Magnetic separation and recovery of ferrous metals.

Often water and/or sewage sludge is added to the organic fraction of the waste stream to promote decomposition of the material into compost. Water must be added since MSW does not contain a sufficient water content for rapid and efficient composting to occur. Sludge is an optional ingredient that can increase the nitrogen content of the MSW, thus maintaining a suitable carbon/nitrogen ratio for composting. Forced air is required for the completion of the composting process. Often a biofilter consisting of a bed of mature compost or bark chips, 3 to 6 feet thick, is used to filter the exhaust air.

Shredding is a key element of the pre-processing procedure. Shredded waste generally composts more quickly than non-shredded waste and tends to form a more uniform end-product.

B. Digestion:

Several methods are commonly used to digest or compost MSW, including the following:

1. The WWFA process is performed in a large, enclosed hanger with concrete floors. The incoming waste stream is deposited into windrows (long, piled rows) which are then routinely and strategically moved by windrow turners so that the completed compost is located at an outermost windrow by the end of the process. The windrow turners turn and rebuild the windrows by picking up the material with a screw like conveyor and transferring it to an adjacent windrow. Water is added to the material as it is being turned to maintain the materials optimum moisture content for effective composting. The WWFA process uses negative forced aeration to activate the biological digestion process. This process takes approximately 60 days.

2. The ASP process is similar to the WWFA process, except that the piles are not turned for approximately 2 weeks. During this time, anaerobic decomposition of the material occurs and negative forced aeration occurs. The exhaust air is processed through a biofilter prior to release into the ambient atmosphere. The measurement and monitoring of oxygen and carbon dioxide concentrations within the piles alerts the operators when the majority of the material has begun to decompose aerobically. At this occurrence, the forced air is reversed (air is blown into the process). The material is then sent through a trommel where oversized elements are removed. The pile is then processed again using the ASP method for approximately 4 weeks. After the second processing, the material is placed outdoors into a static pile for stabilizing the material.

3. In the horizontal silo system, shredded waste from the pre-processing area is placed into the concrete silos by conveyor belts. The silos are usually between 5 and 15 feet wide, 4 and 8 feet high, and may be over 200 feet in length. The entire composting area is covered by a roof to prevent rain water from entering the piles and subsequently leaching out. Agitation is provided by a turning machine which is

mounted on the silo walls. Forced aeration which may be activated by temperature is supplied to the silos. Often the exhaust air from the silos is conveyed through a biofilter to reduce odors.

4. In-vessel systems have a unique vessel design, consisting of rotating drums and stationary domes. The rotating drums introduce waste into the digester after the pre-processing procedure. In some cases, the drums are equipped with metal spikes or bars to assist in the breaking of garbage bags and in agitating the waste to quicken the degradation process.

   The drums are usually between 10 and 15 feet in diameter and range from 80 to 150 feet in length. The drums may contain a single chamber or be divided into multiple chambers, with the waste being transferred from one chamber by screw conveyors. The MSW water, and a nitrogen source are added to the drum which is rotated for anywhere between 12 hours to 3 days. Forced aeration is also provided to the drums.

   Dome reactors are usually constructed of concrete/steel and range from 20 to 150 feet in diameter. MSW is piled to a depth of 6 to 10 feet in the dome, and is placed and removed from the dome with a screw conveyor. Aeration is activated by temperature sensors located in the waste. The material remains inside the dome for a period ranging from 3 days to 2 weeks.

   In-vessel systems generally utilize a secondary digestion process to promote further decomposition and stabilization of the raw compost. This process will consist of an aerated static pile, windrows, horizontal silos, or even a second vessel. In most systems, the material will remain in the secondary digestion system for a period of 3 weeks.

C. Curing and Post-Processing:

In many systems, compost emerging from the horizontal silos or digester vessels must be further stabilized or cured. This is necessary because when compost is applied to the land before the compost process has completely ceased, it may chemically remove essential nutrients, such as nitrogen, from the soil.

Like pre-processing, post-processing operations concentrate on removing inorganic material from the compost. These contaminants include glass, grit, paper, plastic, and textiles. The methods for extracting these materials include:

- Screening
- Magnetic Separation
- Fluidized-Bed "Destoners" (removes paper, plastics, glass, grit, and rocks)

The residuals generated from this process may be further processed and either landfilled or recovered for fuel.

4.5.1.2 Costs

Typical costs associated with MSW composting include capital costs and operation and maintenance costs. Depending on the process selected and the quality of the end product, these costs can vary greatly. Costs for a municipal solid waste composting facility, excluding land, range from $55,000 to $75,000 per design ton per day.

4.5.1.3 Advantages

Composting has the potential to result in large-scale weight and volume reduction of the MSW stream. Depending on the composition of the input waste stream and the process used, a volume reduction of between 55 and 70 percent could be achieved, thus extending the life of the existing landfill significantly.

MSW composting systems are able to accept yard waste directly into the waste process. In fact, the addition of the yard waste may improve the efficiency of the process because of its high nitrogen and moisture content.

4.5.1.4 Disadvantages

Charles County's municipal waste stream is projected to produce approximately 404 tons per day in 2009 and 529 tons per day in 2020. Substantial operating costs are attributed to MSW composting facility with a capacity this large.

For compost used in agricultural or landscaping applications, the risks posted by heavy metals are not well understood. This has prompted several states, including Maryland, to investigate stringent standards regarding heavy metals content of the compost and permissible rates of application to the land.

A number of operating facilities have had serious problems controlling odor, arousing complaints from neighbors and sometimes compelling the facilities to shut down or install expensive odor control systems. The facility must utilize effective odor control equipment and techniques, such as aeration systems, exhaust air treatment (biofilters and/or scrubbers), enclosed digestion buildings, and frequent turning/agitation of the decomposing material.

The financial community is aware of the problems composting facilities are having securing necessary state approvals for marketing their end-product and in obtaining reliable customer outlets. Any MSW composting project that wishes to be financed will have to demonstrate a sound outlet for the compost or a well-conceived marketing plan with realistic, achievable goals.

4.5.2 Feasibility Evaluation

Because of the uncertainties and problems currently associated with MSW composting, it is not recommended as a suitable solid waste management technique for Charles County during the 10-year planning period for this Plan.

4.6 MUNICIPAL WASTE COMBUSTION AND WASTE TO ENERGY

Before 1970, municipal waste incinerators in the United States were refractory-lined units that functioned solely to reduce the volume of waste destined for disposal. Over the past several decades, the vast majority of incinerators or "waste-to-energy" facilities also produced steam and/or electricity through the combustion process. Waterwall combustion chambers are used to generate steam that is either sold directly, or is used to drive turbines to generate electricity.

4.6.1 Technology Assessment

There are two types of facilities used for the incineration of municipal solid waste; a mass-burn facility and a refuse derived fuel facility. Both types of facilities are described in the following sections.

4.6.1.1 Mass-Burn Facility Operations and Equipment

Mass-burn facilities can be constructed and operated with or without energy recovery. The singular identifying feature of mass-burn facilities is they do not process incoming waste prior to combustion. Incoming waste is dumped into a tipping pit and fed into a charging hopper using a crane or conveyor. The crane removes bulky and non-processible objects (white goods, sofas, tires, etc.) and sets them aside for recycling or landfill disposal. The remaining waste is transferred from the pit into the furnace by a horizontal moving ram.

The furnace is designed to continually agitate the waste as it burns. Waste particles are very heterogenous in size and agitation is required so that complete or near-complete combustion is achieved. Within the furnace, the waste tumbles down a series of stepped grates, and is shoved along by horizontal rams to maximize the rolling action. Controlled quantities of air must also be supplied to the furnace to support combustion.

In a waste-to-energy mass-burn facility, the hot flue gases created by the combustion process rise upward through the furnace into the boiler, where they transfer heat to water-filled tubes. In many facilities, the tubes are located in the boiler walls, a configuration aptly known as a waterwall boiler. Both stationary and rotating waterwall units are commercially available, though stationary units are much more common. One key advantage of the waterwall design is that by absorbing the heat created, the tubes help protect the boiler walls from thermal destructive effects such as slagging. As a result, less excess air is needed for cooling the furnace (too much excess air generally will lower a boiler's energy production efficiency).

After passing through the boiler, the flue gases travel through a superheater, where they increase the energy content of a portion of the steam previously manufactured by the boiler. They are then directed through air pollution control equipment, such as scrubbers and fabric filter baghouses, and discharged to the atmosphere via a stack.

The steam produced in the boiler and superheater can be used for industrial process purposes, central steam heating, or to generate electricity by channeling it through a turbine. The turbine-generator and steam circulation systems employed at mass-burn facilities are identical to those used at fossil fuel power plants. The quantities of steam and/or electricity produced largely depend on the waste capacity of the facility.

As in any combustion process, a solid ash residue is produced. Bottom ash is formed by combusted material that exists at the bottom of the furnace chamber, while fly ash consists of ash and other solids captured from the boiler and air pollution control equipment. Fly ash often is treated by processing it through a pug mill, where it is wetted and reduced in size. Bottom ash may be passed under a magnetic separator and through a trommel screen to recover ferrous and non-ferrous metals for recycling. The ash streams may either be combined prior to shipping them to a landfill or shipped and disposed independent of each other.

4.6.1.2 Refuse Derived Fuel Facility Operations and Equipment

The fuel properties of mixed municipal solid waste can be improved by reducing it to particles less than six inches in length and removing the materials that have little or no heat value. This is precisely what refuse derived fuel (RDF) processing facilities are designed to accomplish. An auxiliary function is the recovery of recyclables, although modern RDF facilities do not sort out nearly as much recyclable material as mixed waste processing or even municipal solid waste composting facilities.

Municipal solid waste is dumped onto a tipping floor where front-end loaders and dozers compact the waste and push it onto in-feed conveyors. Bulky and non-processible items are segregated either on the tipping floor or are lifted off the in-feed conveyor by cranes at designated picking stations. The bulk of the waste enters a series of shredding and screening machines, which convert between 60 and 80 percent of it to loose RDF. Equipment utilized in the processing lines often consists of the following:

- Low-speed shredders of flail mills for breaking open bags of waste.
- High-speed hammermill shredders which use rotating hammers to drive waste through fixed grates, thus pulverizing it to the size of the grate openings.
- Overhead magnetic separators, which recover ferrous metals. They either may be of the belt variety (like those at MRFs), or they may be rotating beltless drums which function in essentially the same manner as the belt separators.
- Trommel screens, similar to those used in the pre-processing areas of municipal solid waste composting facilities.
- Steel-belt and rubber-belt conveyors, which transfer the waste between the different pieces of processing equipment.

The processed RDF consists of paper, plastic, and other particles one to six inches in length. Fine particles (those under one inch) typically consist of non-combustibles such as dirt, food waste, and broken glass. This material is screened out by the trommels and deposited on conveyors, which load it into trailers for shipment to landfills. Ferrous metal is also collected on separate conveyors and transferred into waiting trailers for shipment to scrap markets.

After processing, the RDF normally is stored on a second enclosed tipping floor. This is an obvious difference from mass-burn systems, where the fuel product (raw waste) is stored in a pit. The RDF is pushed onto in-feed conveyors by front-end loaders and enters a feeding system, which may be a complicated series of vibrating screens, auger conveyors, and pneumatic feeders. The purpose of this system is to carefully regulate the flow of RDF into the combustion chamber, thus maximizing combustion efficiency.

The furnaces and waterwall boilers utilized at RDF combustion facilities are similar to those at mass-burn plants. However, in RDF combustion systems, much more of the fuel burns in suspension (combusts while airborne in the furnace), as opposed to on the grates. In addition, RDF boilers do not need to accommodate the larger, heavier objects from the waste stream since

- RDF boilers are generally smaller than those at mass-burn facilities.
- Only one set of moving grates is typically employed (i.e., there is no stepped series of grates).
- The grates themselves are of less-rugged construction than those used in mass-burn systems.

Steam generation, air pollution control, and ash handling systems are similar in design to those used at mass-burn facilities.

There are a number of other general differences between RDF and mass-burn facilities:

- Because some components of the waste stream with poorer heat value and combustion properties are removed during pre-processing, RDF facility will produce approximately 5 percent more energy than an equivalently-sized mass-burn facility.
- Because RDF processing is a more mechanically complex process, RDF systems often exhibit lower availability than mass-burn systems. As with mixed waste processing, very complex processing lines tend to have more mechanical shutdowns and lower overall availability.
- Due to the relative complexity of the pre-processing systems, RDF systems require operators with greater skill and experience.
- Because processed RDF is stored on a separate tipping floor, a larger site is required than for a mass-burn facility.

- RDF facilities may send a greater percentage of their incoming waste stream to landfills, since they screen out the finer materials with poor combustion properties. In a mass-burn system, much of this material will come out in the ash, but some of it may burn and not have to be landfilled.

4.6.1.3 Costs

Capital costs for a waste-to-energy plant, as well as operation and maintenance costs, are generally high and vary greatly depending on the type of facility. Construction costs alone may range from $50,000,000 to $100,000,000 per 500 tons of rated daily capacity.

4.6.1.4 Advantages

The primary environmental benefit of waste-to-energy facilities is the conservation of natural resources. Solid waste that would otherwise end up in a landfill is used to generate energy, thus conserving fossil fuels.

After combustion, the volume of material requiring land disposal is reduced by 85 to 90 percent.

Both mass-burn and RDF systems are commercially proven, as evidenced by the number of commercial-scale facilities in operation and their cumulative years of operating experience. Particularly for mass-burn systems, there are multiple vendors with strong business positions and significant amounts of construction and operational experience.

Waste-to-energy facilities are net energy producers, although they cannot produce electricity on the scale of a normal-sized fossil-fired power plant. Revenues from energy sales usually cover a portion of the plant's operating expenses and debt service.

Improvements in air pollution control technology have resulted in significant reductions in the quantities of major air pollutants emitted from waste-to-energy facilities.

4.6.1.5 Disadvantages

The primary environmental issues associated with municipal waste combustion are air pollution and ash disposal. Because of these issues, there is often significant public opposition to the operation of municipal waste combustion facilities.

Waste-to-energy facilities are difficult to site and permit; the amount of time required for siting, permitting, and construction is considerably greater than for other waste processing and disposal technologies.

The capital cost of a waste-to-energy facility is substantially greater than for any other waste disposal alternative considered in this Plan.
The Clean Air Act, Title 5, holds strict parameters for any facility that discharges emissions into the air. In addition, the U.S. Environmental Protection Agency requires that the ash material from an incinerator facility must pass a TLCP test to characterize the ash prior to disposal in a landfill facility. If more stringent air emissions standards are promulgated, and ash is classified as hazardous waste under Resource Conservation and Recovery Act reauthorization, capital and operating costs for a typical plant could increase appreciably.

4.6.2 Feasibility Evaluation

Because there is no energy recovery or other beneficial by-product, municipal waste combustion is not recommended as a suitable technology for Charles County. A combustion process which produces energy is not recommended as a short-term objective for Charles County. However, as identified in the January 1994 report from the Regional Solid Waste Management Task Force, a regional waste-to-energy facility is recommended as a regional long-term waste management technology.

4.7 LAND DISPOSAL - MUNICIPAL WASTE

Landfilling will remain an important component of every integrated solid waste management program. Source reduction, recycling, and resource recovery can significantly reduce, but not eliminate, the need for landfills.

4.7.1 Technology Assessment

A municipal waste landfill contains compacted solid waste within an enclosed lined area to minimize potential adverse environmental impacts. All landfills within Maryland must satisfy requirements established for construction, operation, maintenance, expansion, modification, and closure as stipulated by MDE.

Despite environmental and public concerns associated with landfills, every integrated waste management system must have access to a landfill. Recycling, composting, and material separation and removal can divert significant portions of the waste stream from final disposal, but not all materials are recyclable. Combustion of solid waste significantly reduces waste volumes, but even the most advanced facilities must dispose of ash residues. Also, waste may need to be disposed of during plant shutdowns.

Today, municipal waste landfills are significantly more sophisticated than the open dumps of the past. "State-of-the-art" landfills use a variety of specific technologies and practices including:

- Liner Systems
- Leachate Collection and Removal Systems

- Leachate Treatment and Disposal Systems
- Leachate Recirculation
- Closure Techniques (i.e., reducing the amount of leachate generation)
- Gas Collection, Venting/Reuse, and Monitoring Systems
- Provisions for Closure and Post-Closure Care and Maintenance
- Ground and Surface Water Monitoring Systems
- Monitoring and Control of Materials Entering the Site

4.7.1.1 Costs

Municipal sanitary landfill construction and operations costs have increased dramatically over the past decade. Factors contributing to the rising landfill costs include:

- Stricter, more comprehensive environmental regulations.
- Increased public awareness and demand for environmental protection.
- Time delays, engineering and legal costs in obtaining permits.
- Design of remediation measures at the existing landfill.
- Property costs for new landfill sites.

Typical costs for landfills include predevelopment, land acquisition, landfill development, construction, operating, and closure and post-closure costs. These costs vary over a wide range.
Pre-development costs are associated with site selection, investigation, and permitting costs. Land costs vary widely in Charles County. Remote, rural areas of Charles County generally have lower land costs, but will have higher transportation costs. As environmental and legal requirements become more complex, the costs associated with obtaining a permit rise. The cost of obtaining a permit depends on the changing requirements of the federal and state regulations and the complexity of the site. The costs for developing a landfill can include roadways, fencing, monitoring wells, and on-site facilities.

Costs for construction of a municipal waste landfill are dependant on the following major activities including:

- Excavation
- Liner Construction
- Leachate Collection and Treatment/Disposal Systems
- Ground and Surface Water Monitoring Systems
- Stormwater and Sediment and Erosion Controls
- Ancillary Facilities and Equipment

The liner and leachate collection/removal system are generally the most expensive components of a landfill. Construction costs for a double-lined landfill are estimated to be in the range of $400,000 to $500,000 per acre.

4.7.1.2 Advantages

Municipal waste landfills are a necessary element of solid waste management for Charles County. State-of-the-art landfills are more sophisticated and environmentally protective than the unlined landfills of the past. Cost on a per-ton-basis for municipal waste landfills are often substantially lower than other management options (e.g., incineration, composting). Other management options are generally more labor intensive, have more extensive maintenance requirements, and are more reliant on high-technology machinery.

4.7.1.3 Disadvantages

Landfilling represents a long-term potential liability, with the post-closure period extending for many years after the cessation of operation. Post-closure costs will be incurred annually during the time that the County owns the property. Post-closure requirements include leachate collection and treatment, gas management, and groundwater monitoring. In addition, costs of construction are increasing, and the potential for adverse environmental impacts is present. Because of this potential, there is significant public opposition to siting new municipal waste landfills. A municipal waste landfill requires a substantial amount of land which is diverted from other beneficial uses.

4.7.2 Evaluation of the County's Existing Sanitary Landfill

The Charles County Sanitary Landfill (also referred to as Charles County Landfill #2) opened on July 1, 1994 in Waldorf, Maryland. The Pisgah landfill closed as a result of a Consent Order issued by the Maryland Department of the Environment on July 31, 1994.

The new landfill has several features which provide several environmental safeguards as well as serving the citizens more efficiently and effectively. The environmental safeguards include a composite liner of clay and a 60 mil HDPE membrane, a leachate collection system, two stormwater management ponds for the entire site, and a passive methane collection system. To better serve the citizens of Charles County, the landfill was built with a citizen disposal area on asphalt with a volume based payment system named “Tag-A-Bag”. A staffed recycling center that accepts a wide variety of materials, and a small drop off area on concrete for bulk loads of waste from pick-ups, van, and trailers. Dual scales expedite truck traffic with a fully computerized scale house.

The landfill was designed with a life expectancy of 12 years and 8 months based on historical volumes and compaction rates. Since opening, the volume of refuse entering the landfill is approximately half of the previous rates and a more aggressive compaction rate was adopted resulting in a landfill life expectancy of over 30 years.

Since constructing the landfill in July 1994, the County has meticulous records regarding the amount of waste accepted and volume of fill material used to cover the refuse. This information combined with aerial surveys using the latest technology have resulted in a series of reports.

4.8 LAND DISPOSAL - RUBBLE WASTE

4.8.1 Technology Assessment

As specified in COMAR 26.04.07, rubble landfills may accept the following:

- Land-Clearing Debris
- Demolition Debris
- Construction Debris
- Asbestos Waste
- Household Appliances and White Goods

As with a municipal waste landfill, rubble landfill technology involves compacting and covering solid waste within a confined area. All new rubble landfills are required to have liners and leachate collection systems and existing rubble landfills must meet these requirements by July 1, 2001 or cease accepting waste.

Rubble landfills have requirements similar to those described for municipal solid waste landfills for separation to groundwater, stormwater management, and water quality monitoring systems. Waste is placed and compacted in lifts of up to 8 foot thickness; 6 inches of soil cover must be applied at least every 3 days and 12 inches of intermediate cover must be placed within one month of completing a lift. Final cover consists of a two layer of vegetated soil.

Volume requirements for rubble landfills may be minimized through removal and recycling of certain components of the waste stream (Section 4.3.1.6). Grinding and chipping wood waste and shredding tires prior to disposal can also be employed to increase the density of the waste, thus conserving landfill space.

4.8.1.1 Costs

Depending on whether the landfill is a lined or unlined facility, costs for a rubble landfill may be similar to a municipal waste landfill. Costs for pre-development, development, construction, operation and maintenance, and closure and post-closure for a unlined and lined rubble landfill are summarized below.

Lined Rubble Landfill costs include:

- Predevelopment costs are similar to the municipal waste landfill.

- Development costs are similar to the municipal waste landfill.

- Construction is similar to the municipal waste landfill.

- Annual operation and maintenance costs are similar to the municipal waste landfill.

- Closure and post-closure are similar to the municipal waste landfill, except landfill gas venting is usually not required. Closure costs are estimated to range from $90,000 to $140,000 per acre. Annual post-closure costs are estimated to range from $40,000 to $180,000.

4.8.1.2 Advantages

Rubble landfills or a joint municipal waste/rubble landfill is a necessary element of solid waste management in Charles County. This is for the simple reason that there are no other economically feasible solutions for a portion of the rubble waste stream.

4.8.1.3 Disadvantages

Landfilling represents a long-term potential liability, with the post-closure period extending for many years after the cessation of operation. Post-closure costs will be incurred annually during the time that the County owns the property. Post-closure requirements may include leachate collection and treatment, and groundwater monitoring. In addition, costs of construction are increasing, and the potential for adverse environmental impacts remain present. Because of this potential, there is significant public opposition to siting new rubble landfills. A rubble landfill requires a substantial amount of land which is diverted from other beneficial uses.

4.8.2 Evaluation of Existing Rubble Disposal

Only a fraction of the rubble generated in Charles County is disposed at the County's Sanitary Landfill. This due to two reasons: (1) there is no economic incentive; and (2) the County Commissioners have adopted a policy banning disposal of rubble from large commercial haulers in an effort to increase landfill life. Small contractors and homeowners who have building construction debris utilize the landfill due to its convenience. An additional factor is that most often the loads brought to the Charles County Landfill are charged up to $70 per ton.

There appears to be adequate capacity for locally-generated rubble at the Prince George's County landfill facilities during the ten-year scope of this plan. There are also a rubble fills in Anne Arundel County, King George County, VA and Lorton, VA.

Due to the fact that these rubble fills are not required to document the place of origin of the inbound waste, there is no mechanism available to verify the estimates of rubble generated in Charles County

The estimates generated for Frederick County would be very similar adjusted for population. Although the Regional Solid Waste Task Force that was in existence in 1994 recommended a regional rubble fill, there has been no action or further discussion of the matter.

4.9 SLUDGE MANAGEMENT

The Clean Water Act requires municipalities to cleanse wastewater prior to discharging it into the environment. This cleansing process generates sludge which in turn must be disposed or reused. Sludge management begins with sludge generation, and continues through treatment and ends with reuse and/or disposal. When properly reused, sludge can be a valuable resource as a soil conditioner and partial fertilizer. The EPA and the MDE encourage the beneficial reuse of sludge wherever environmentally feasible. As previously discussed in Section 3.6.9, wastewater treatment plant sludge from the Mattawoman WWTP and the Blue Plains WWTP is land disposed in Charles County.

4.9.1 Technology Assessment

The characteristics of sludge depend on both the initial wastewater composition and subsequent wastewater and sludge treatment processes utilized. The characteristics affect the various reuse/disposal options available to a municipality. The constituents that are usually the most important in the decision-making process for sludge management practices are:

- Organic Content
- Metals
- Pathogens
- Nutrients
- Toxic Organic Chemicals

For a treatment facility that receives primarily municipal wastewater, such as Charles County's Mattawoman WWTP, the quality of sludge does not limit the types of reuse/disposal options available. When treatment facilities receive large volumes of industrial waste, the facility does not generate a "clean sludge" (i.e., low concentration of metals in the sludge), thereby limiting the options available for sludge disposal.

The most common and accepted practices for the reuse or disposal of wastewater sludge include the following:

- Lime Stabilization/Land Application
- Heat Drying/Pelletization
- Composting
- Landfilling
- Incineration

4.9.1.1 Lime Stabilization/Land Application

Lime stabilization is a process where lime is added to sludge to increase the pH to a level which is destructive to pathogens and odor-producing organisms. The effectiveness of the lime stabilization process is directly related to the pH level achieved in the sludge and the contact time. Numerous studies performed have indicated that a significant reduction in pathogens and odors occurs when the pH is increased to 12 or more and maintained for 2 hours. Design criteria commonly recommend increasing the pH of the sludge to 12.5 by lime addition and maintain above 12.5 for 30 minutes. This method should keep the sludge pH above 12 for a period of 2 hours.

Lime stabilization does not result in the reduction of organic matter as do some biological stabilization methods such as digestion, but, rather the inactivation of biological activity. If the pH is allowed to decrease significantly, biological activity will resume and the production of odors will result. Lime addition should be sufficient to ensure that the pH of sludge does not drop to low levels after prolonged storage. When the lime dosage is too low, the stabilized sludge may attain the pH of 12 initially, but a rapid pH decay may occur. However, if the pH is raised above 12.5 and maintained for 30 minutes, the pH can remain above 11 for up to 22 hours.

Lime dosage depends on a number of factors which include the following:

- Type of Sludge (e.g., primary, waste activated, etc.)
- Chemical Composition (including organic content)
- Sludge Alkalinity
- Solids Concentration

The actual lime dosage should, therefore, be determined on a case-by-case basis. Studies have shown that primary sludges typically require the lowest dosages, whereas waste activated sludges usually require the highest dosages. In addition, the studies have shown that chemical sludges, such as iron and alum, require high lime dosages.

The location of the lime stabilization process within the sludge processing treatment train can also impact the required lime dosage. Pre-lime stabilization consists of a lime slurry added and mixed into a liquid sludge prior to dewatering. Post-lime stabilization involves adding lime in a powdered form to dewatered sludge cake and blending the two together. The mixing is typically accomplished using a pug mill, or paddle mill mixer.

Odors are substantially reduced because the high pH level eliminates or suppresses the growth of microorganisms producing malodorous gases. Hydrogen sulfide, one of the major odors in a sludge processing operation is converted to the nonvolatile forms of hydrogen sulfide and sulfur compounds as the pH is increased to 9 and above.

Pathogens can be reduced 99 percent or more in sludges that have been lime treated to a pH of 12 or greater. The pathogen concentration in lime stabilized sludges can be 10 to 1000 times less than concentrations in anaerobically digested sludges. Studies have shown that lime dosages are typically lower in post-lime stabilization than in pre-lime stabilization operations to achieve the same degree of pathogen destruction. It is suggested that the destruction of pathogens may be enhanced in post-lime stabilization due to the heat generated during hydration of dry quicklime in the sludge.

Land application, defined as the spreading of stabilized sludge on or just below the surface of the land, is a sludge utilization technique utilized by many wastewater treatment facilities in the nation. The land application process incorporates wastewater sludges into soils, thereby providing a valuable resource to improve the characteristics of the land. The sludge can serve both as a soil conditioner and as a partial replacement for commercial fertilizers. Agricultural use of sludge is the most widely used land application method and is often the most economical of sludge disposal methods.

Municipal wastewater sludge is also recognized to have valuable soil nutrients and can serve as a partial replacement for expensive chemical fertilizers; nitrogen, phosphorus, and small amounts of potassium, are found in wastewater sludge. For beneficial reuse, the sludge is typically applied at agronomic rates to agricultural land. An agronomic rate is the rate at which nitrogen and/or other nutrients supplied by the sludge meet the nutrient requirements of the crops being grown. Nitrogen is usually the limiting parameter.
The purpose of applying sludge at these rates is to minimize the leaching of sludge nutrients into the groundwater. Controlled application rates also limit the buildup of heavy metals and other contaminants in the soil.

Site characteristics greatly affect the potential environmental impacts of sludge application. Factors of concern include depth to groundwater, distance to surface waters, slope of the site, soil permeability, and soil pH. Other site characteristics of importance are the proximity of the site to social and cultural activities such as homes and public buildings.

As with commercial fertilizers, the primary means of managing land application of municipal wastewater sludge is by controlling the application rate to optimally disperse sludge constituents. The application rate is the principle factor to be considered in determining the amount of land required. The greater the application rate, the less land needed to handle the sludge produced. Rates of application are calculated based on permissible sludge constituent concentrations and soil characteristics.

Land application is a suitable disposal technology for either liquid or dewatered sludge. Liquid sludge is commonly applied by surface or subsurface injection techniques. If applied on the surface, the sludge can be incorporated into the upper layer of soil by plowing or discing. This is accomplished after application by a tractor pulling a plow-like applicator.

The other method of liquid sludge application is subsurface injection, which is a commonly used method of application in Prince George's County, Maryland. This method requires specially designed sludge application vehicles, which allows the sludge to be injected beneath the surface without turning the soil. Sludge injection essentially eliminates odors associated with land application of municipal domestic sludges.

Dewatered sludge can be surface applied or injected. In surface application, the sludge is first spread on the soil surface and subsequently incorporated into the upper layer of soil by plowing and discing. The operation is similar to an application of animal manure and requires a spreader, followed by a tractor to plow or disc the material into the soil. For subsurface injection, the hauler typically adds water to the sludge at the site to facilitate injection.

All land application programs require storage facilities for periods of inclement weather, and in the event of equipment failures and other service disruptions. Sludge disposal trucks are not able to enter disposal sites when the ground is soft. Storage is also required because MDE does not permit land application during periods in which the surface soils of the sludge land application area are water saturated or frozen.

A. Advantages:

Municipalities in every part of the country are successfully using land application programs and have been doing so for many decades. Land application has been used successfully by both small towns and large cities. Currently, about 25 percent of the nation's sludge is land applied. This breadth of experience has shown land application to be a safe and effective wastewater sludge use option.

Lime stabilization of the sludge is not sensitive to toxic substances in the sludge and pathogens can be reduced 99 percent or more. The land application of sludge is a relatively easy technology to use which can be operated on an intermittent basis. By maintaining pH levels, odors are eliminated. The land application of sludge provides a beneficial use and is the most cost-effective sludge management option.

B. Disadvantages:

The lime stabilization process increases the volume of sludge to be disposed when compared to biologically stabilized sludges. This is an important consideration since the volume of sludge increases annually, while the land available for land application decreases. The stabilization processes produces a drier sludge cake which makes subsurface injection more difficult.

The stabilization process requires the handling of dry lime throughout the process. Additionally the process is mechanically dependent; and scaling of the equipment must be maintained at appropriate levels.

Odor is a potential problem if the process is not managed properly. In addition, storage facilities may impact the environment if not managed properly.

4.9.1.2 Sludge Composting

Sludge composting is the controlled, aerobic, thermophilic decomposition of organic matter to a relatively stable humus-like material. Bacteria, fungi, and actinomycetes are primarily responsible for the decomposition process. Environmental factors which control the rate and course of the reaction are the volatile solids and moisture content, oxygen concentration, temperature and nutrient concentration of the compost. The composting process generates heat, raising the temperature of the material in the range of 55 to 80°C (130 to 175°F). The heat increases the rate of decomposition, evaporates moisture, and effectively destroys or inactivates pathogenic microorganisms and parasites. The end-product of the process, compost, is an organic material which can be easily stored, handled and applied to land as a soil conditioner and lowgrade fertilizer. The finished compost is relatively odorless with a slight ammonia or "wet earth" odor.

Composting is classified by the EPA as a Process to Further Reduce Pathogens (PFRP), which allows unrestricted use of compost. Although composting is not a true sludge disposal process, the finished product is valuable enough to warrant removal and reuse by an outside source.

Initially in composting systems, dewatered sludge and bulking material are mixed together. The bulking material usually consists of sawdust, wood chips, or other carbonaceous material. In addition to serving as a carbon source, the bulking material will increase the porosity and decrease the moisture content of the mixture, so that aerobic conditions can be maintained. Shredded tires and other non-carbonaceous material may also be used to provide porosity; however, an additional carbon source as amendment may then be required.

The three basic compost processes utilized in the United States includes the windrow, aerated static piles, and in-vessel methods. Each method of composting may vary in the time required for stabilization, the degree and quality of process control, and the complexity of the system. However, the finished product from each method is essentially the same.

The active composting process occurs for 2 to 6 weeks depending on the composting method employed and other environmental factors. During that time, the mixture is either mechanically or force aerated and the process generates temperatures in excess of 50° to 60°C (122° to 140°F), resulting in pathogen destruction, moisture removal, volume reduction and solids stabilization. After the active composting period, the material is generally cured for an additional 2 to 6 weeks. Further stabilization and drying takes place during this period. The oxygen requirements during the curing are significantly less than during the composting step. The cured compost may be screened, if required, to remove bulking material for distribution as finished product.

Finished compost is a stable humus-like substance with valuable properties as a soil conditioner. Although compost is not high enough in nitrogen to be considered a fertilizer, it contains several macro- and micronutrients that are favorable to plant growth. As a soil conditioner, compost will improve a soil's physical properties. The addition of compost to sandy soils will increase the soil's ability to retain water. In heavy-textured clay soils, the added organic matter will increase permeability to water and air, and minimize runoff by increasing the water infiltration into the soil.

A. Systems:

1. Windrow Composting - Windrow composting involves mixing dewatered sludge (digested or stabilized to minimize odor generation) with a bulking material and forming long triangular windrows. The windrows are generally 10 to 16 feet wide and 4 to 6 feet high. The operation is typically conducted on a paved, uncovered area. Aeration of the compost is achieved by mechanically mixing or turning the windrows using specialized equipment. The frequency of turning varies from three to five times per week depending on the actual composting process. Windrow turning is the only means of effecting process control such as temperature and oxygen concentration in a conventional windrow.

A conventional windrow may be modified by providing a single aeration channel under the entire length of the windrow. This is called an aerated windrow and provides a more positive means of odor, temperature and process control than a conventional windrow. Any bulking material may be used. The quantity of the bulking material is adjusted to obtain a solids content of approximately 35 to 40 percent. If wood chips or other large bulking material are used, a final screening operation is required to produce a marketable product. After the composting period, the mixture must be cured for an additional 20 to 30 days to provide a dry, stable finished product.

2. Aerated Static Piles - Aerated pile composting consists of mixing the dewatered sludge with wood chips or other large bulking material, forced aeration during the composting process, and screening. Aerated pile composting systems have utilized primary or unstablized sludge; however, odor generation has been a problem. In aerated composting, the mixture is formed into extended piles approximately 8 feet high. These piles rest on top of perforated aeration piping, which is embedded and covered with bulking agent to promote even air distribution within the pile. The entire compost pile is then covered with finish compost to provide insulation and minimize odor generation. Aerobic conditions are maintained during the typical 20 to 30 day active composting period. Aeration can be either positive, blowing air up through the piles, or negative, drawing air down through the piles. With negative aeration, odor can be minimized by exhausting the off-gases through odor control devices. Following the composting period, the compost must be cured for 20 to 30 days to completely stabilize and ensure dryness. The finished compost is then generally screened to remove bulking material.

3. In-Vessel - An in-vessel composting system generally consists of two enclosed mechanical reactor vessels, a bioreactor, and a cure reactor. Some systems, however, use a single vessel for both steps or replace the enclosed cure reactor with an open concrete cure pad.

Initially a feed mixture of dewatered sludge, bulking agent, and recycled compost is introduced into the first-stage reactor. Digested and undigested, primary and secondary sludges are suitable for in-vessel composting. Due to operation and economic considerations, it is desirable to have a high solids concentration in the feed sludge. The feed mixture (sludge, new bulking agent, and recycled compost) flows through the reactor as composting occurs within the vessel. The hydraulic residence time (HRT) in the bio-reactor is approximately 14 days. Each manufacturer's composting system employs various methods of air feed to provide uniform aerobic conditions and to control the composting process. Temperatures developed in the bioreactor result in moisture removal, volume reduction, pathogen kill and solids stabilization. Compost from the bioreactor is transferred to the cure reactor for additional organic conversion and stabilization. Aerobic conditions are maintained to promote additional drying and stabilization during a typical 14-day residence time. Finished compost is discharged from the cure reactor for distribution or recycle. Recycling of finished compost will reduce the amount of bulking material required in the feed mixture, and decrease the moisture content of the mixture.

In-vessel systems can be configured in many ways. Typical configurations currently being marketing in the United States include:

- Vertical, Plug-Flow Cylindrical Silos
- Vertical, Plug-Flow Rectangular Silos
- Circular, Agitated-Bed Reactors
- Rectangular, Agitated-Bed Bin Reactors
- Rectangular, Plug-Flow Tunnel Reactors

B. Advantages:

Leachate and condensate produced during composting are minimal and easily treated by standard wastewater treatment plants. Sludge composting is a viable stabilization process which further reduces pathogens. The process produces a good soil amendment and nutrient source which may be used for landscaping, potting soil, or agricultural purposes. The sludge is reused as a resource.

C. Disadvantages:

Sludge composting provides the potential for odor generation. Large amounts of carbonaceous bulking material is required for the process. Compost must be screened prior to marketing to separate bulking material from the finished product. High capital costs, especially for the mechanical systems. Not an ultimate disposal method — requires distribution and marketing.

4.9.1.3 Heat Drying/Pelletization

Heat drying is a unit operation process that involves evaporating water from sludge by thermal means. This process raises the temperature of the incoming sludge to remove moisture which reduces total volume. The temperature to which the sludge is raised is too low to destroy organic matter, therefore, the nutrient properties of the sludge are retained. The end product contains soil nutrients and is free of pathogenic organisms.

Heat drying is classified by the EPA as a Process to Further Reduce Pathogens (PFRP). Although heat drying/pelletization is not a true sludge disposal process, the finished product is valuable enough to warrant removal and reuse by an outside source.

Sludge moisture content is normally expressed in percent moisture, percent solids, or pounds water per pound dry sludge. The minimum sludge moisture content, practically attainable with heat drying, depends upon the design and operation of the dryer, moisture content of the sludge feed, and the chemical composition of the sludge. For ordinary domestic wastewater sludges, sludge moisture contents as low as 5 percent may be achieved. Chemical bonding of water within the sludge, which can occur through chemical addition for sludge conditioning, can increase the amount of water retained in the dried sludge product beyond the 5 percent moisture level. Heat-dried sludge typically has a moisture content of 10 percent or less.

In heat drying of sludge, water is transferred to the gas phase. The driving force for transfer is the difference between absolute humidity (pounds water per pounds dry gas) at the wetted solid/gas interface and the absolute humidity in the gas phase. The difference in temperature between the heating medium and the sludge/gas interface provides the driving force for heat transfer in a sludge heat-drying process. Dryers are commonly classified on the basis of the predominant method of transferring heat to the wet solids being dried. The most common methods include convection (direct drying) and conduction (indirect drying).

Heat transfer by convection (direct drying) is accomplished by direct contact between the wet sludge and hot gases. The sensible heat of the inlet gas provides the latent heat required for evaporating the water. The vaporized liquid is carried off by the hot gases. Direct dryers are the most common type used in heat drying of municipal sludge and consist primarily of rotary dryers.

Heat transfer by conduction (indirect drying) is accomplished by contact of the wet solids with hot surfaces, such as a retaining wall separating wet sludge and the heating medium. The type of indirect dryers used with municipal sludges include dryers with large rotors and a vertical multiple stage dryer.

Thermal evaporation of water from sludge requires considerable energy. The amount of fuel required to dry sludge depends upon the amount of water evaporated. It is imperative that a dewatering step precede heat-drying so that overall energy requirements can be minimized. The heat required to evaporate water from wet sludge is comprised of the following:

- Heat to raise the sludge solids and associated residual water to the temperature of the sludge produce as it leaves the dryer.
- Heat to raise the water temperature to the point where it can evaporate and then to vaporize the water (latent heat).
- Heat to raise the temperature of the exhaust gas, including water vapor, to the exhaust temperature.
- Heat to offset heat losses.

Since the energy required to operate a sludge heat dryer is directly related to the volume of moisture required to be removed, most drying systems recycle dried sludge back to the feed end of the dryer. The dried sludge is blended with the incoming dewatered sludge (typically at 15 to 20 percent solids) to reduce the overall moisture content of the sludge. The desired sludge feed is typically around 55 to 60 percent solids. Below this solids concentration, the feed sludge is in a "glue-like" phase and does not move through the dryer easily. The drier feed solids reduce agglomeration (large balls) of sludge, thus exposing a greater solids surface area to the drying medium. Regardless of the type of drying system, the process should be preceded by mechanical dewatering and followed by air pollution control systems.

A. Dryers:

1. Direct Rotary Dryers - This type of dryer is the most commonly used in the United States for drying municipal wastewater sludges. Hot drying gases at temperatures of 1200°F (650°C) are added to the dryer, usually in a concurrent flow pattern. Gas velocities must be limited to 4 to 12 feet per second to prevent dust from being entrained with the exhaust gases. The dryers are typically built as either a single pass or triple pass dryer. The triple pass dryers are more advantageous than single pass

dryers in that better control and contact time between the sludge and drying gases are provided, as well as the length of the dryer can be reduced.

The rotary drum usually consists of a cylindrical steel shell that revolves at 5 to 8 revolutions per minute. One end of the dryer is slightly higher than the other, and the wet sludge which has been blended with dried sludge product, is fed into the high end. Flights projecting from the inside of the shell continually raise the material and shower it through the drying gases, moving the material toward the outlet. After the sludge has been held in the dryer for 20 to 60 minutes, the dried sludge is discharged at a temperature of 180° to 200°F (82° to 93°C). Exhaust gases are conveyed to a cyclone where entrained solids are separated from the gases. The spent gases exist at about 300°F (149°C). A portion of the dried product is recycled (blended with wet sludge feed), and the balance goes to storage. The sludge product from this type of drying system is shaped into little round balls due to the rotating action of the dryer. Therefore, a separate pelletization step is not required to produce a marketable product. Gaseous discharge from the cyclone is exhausted to an air pollution control system for deodorization and particulate removal as necessary.

2. Indirect Rotary Disc Dryers - The dryer consists of a rotor mounted in a stator formed as a horizontal shell. This rotor is built up by a tabular shaft carrying a number of hollow disc filled with steam or a thermal oil and provided with agitator blades to ensure transport of the material. The rotor (discs and shaft) is completely submerged in the sludge. The sludge is transported through the dryer in a plug-flow fashion, passing through the annulus between the discs and the drum.

   Scraper bars project into the space between the discs to prevent coating of the heating surfaces and stop the material from following the rotation of the rotor. The scraper also produces a vigorous turbulent action within the dryer that improves heat transfer by inducing maximum particle contact with the heating surfaces and releases the vapor from the bulk mass of the sludge into the vapor dome. The stator can also be supplied, if necessary, with a steam or oil jacket for additional heat transfer.

   The dryer is operated as a closed system; therefore, it does not require sweep air or drying gases. With a closed dryer system, particulates and odors are a minor problem. The heating medium enters the dryer through the central shaft and is distributed inside the rotor by a vacuum created through condensation. Each individual disc is accordingly filled with steam or thermal oil to ensure that the entire heating surface achieves the maximum temperature. Although some air will enter with the sludge, the exhaust vapor is, for all practical purposes, considered low pressure steam. The waste heat contained in the exhaust vapor can be easily and efficiently recovered for thermal conditioning of the sludge feed, which will increase the overall efficiency of the drying system.

   The dried sludge leaving the dryer is in a powder form. A portion of the sludge is returned to the front of the dryer and blended with the dewatered (wet) feed sludge.

The remainder of the sludge is sent to a pelletizing operation so that a marketable product can be produced.

3. Indirect Vertical Multistage Dryer - This type of dryer resembles a multiple hearth furnace. Incoming sludge is fed into the top inlet and moved by rotating arms from one heated tray (level) to another in a zig-zag motion until the sludge exits at the bottom as a dried, granular (pelletized) product. The dryer trays are hollow and are heated by steam or recirculating thermal oil.

   The rotating arms are equipped with adjustable scrapers, which move and tumble the sludge in thin layers and small windrows over the heated trays enhancing heat and mass transfer. The drying and pelletizing process starts with fine particles which gradually, layer by layer, grow larger, drying from the center to the outside. Formation of dust and oversized chunks is minimized. By recycling the dried sludge, the dryer feed is kept at a moisture content between 60 and 70 percent total solids avoiding the glue-like phase inside the dryer and facilitating granulation.

B. Advantages:

Sludge pelletization is considered a process to further reduce pathogens. The process is compatible with various disposal options (e.g., landfilling, incineration, land application). Sludge pelletization produces a marketable product and allows sludge to be reused as a resource (e.g., fuel or soil amendment). Pelletization provides large volume reduction.

C. Disadvantages:

Sludge pellitization requires high operational costs, primarily due to fuel requirements. The process is highly mechanical and requires highly trained operators. There is a high potential for odor production unless control devises are utilized. The process is not an ultimate disposal method; therefore, the product requires distribution and marketing, unless coupled with an incineration process.

4.9.1.4 Incineration

Incineration is a high temperature, two-step oxidation process in which wastewater sludge and a fuel source (if needed) are combusted in an enclosed reactor. The combustion reaction may be divided into two process steps. The first step raises the temperature of the feed sludge to 212°F (100°C) which evaporates water from the sludge and increases the temperature of the mixture. Combustion actually occurs in the second step which increases the temperature of the mixture until the combustible elements in the sludge and fuel ignite. The heat produced by the combustion reaction induces organic and microbial destruction and additional moisture evaporation. The by-products of the reaction are suspended particulates, off-gases, and an inert ash residue. The suspended particulates are contained in the off-gases and are removed by air pollution control devices, such as a wet scrubber, venturi, or electrostatic precipitator. The off-gases are a mixture of nitrogen oxides, sulfur oxides, carbon dioxide, and hydrocarbons and are released to the atmosphere after particulate removal. The inert ash is typically disposed in a sanitary landfill.

The amount of oxygen supplied and the heating value and moisture content of the feed sludge affect the efficiency of the combustion process. Incineration is complete combustion and occurs when air (oxygen source) is supplied 50 to 150 percent in excess of the stoichiometric or theoretical requirement. When the amount of air is inadequate for complete combustion, soot, carbon monoxide and odorous hydrocarbons are produced. Since the excess air exerts a heat demand, it should be held to the minimum amount required for complete combustion. The amount of heat released from a given sludge is dependent upon the amount of combustible elements present which is quantified as the heating value of a sludge. Sludge stabilization prior to incineration is undesirable.

Chemical stabilization will produce chemical sludges which have low heating values, therefore requiring excess fuel to incinerate. Biological stabilization (digestion) reduces the volatile concentration and consequently the heating value of a sludge, which increases the amount of supplemental fuel required for the process.

A combustion process is termed autogenous when the heating value of the sludge is sufficient to raise the temperature of all incoming substances to combustion levels. If the heating value of the sludge is not sufficient, supplemental fuel must be burned to make up the heat deficit. Moisture in the sludge exerts a significant energy demand to vaporize the water. After considering radiation losses, and for heating of gas streams and sludge feed solids, approximately 3,500 BTU are required for every pound of water evaporated in an incineration process. Therefore, sludges containing a low solids content will require supplemental fuel for moisture reduction. Typically, wastewater sludge must be dewatered to about 30 to 35 percent solids to enable autogenous combustion to occur. Sludge incineration systems burning autogenously have nominal fuel requirements and require auxiliary fuel only during start-up. In addition, a smaller capacity incineration system is needed with a drier sludge.

A. Systems:

Two types of systems commonly used in the United States for sludge incineration are the multiple hearth incinerator and the fluidized bed incinerator.

1. Multiple Hearth Furnace - The multiple hearth furnace (MHF) has been the most widely used type of sludge incinerator. It is designed for continuous operation and is relatively simple to operate, durable and capable of handling varying feed patterns. A MHF is cylindrically shaped, containing a series of horizontally mounted hearths. MHFs are available with diameters ranging from 4 to 29 feet and can have from 4 to 14 hearths. However, for wastewater sludge incineration, a maximum of 8 hearths is usually recommended. Feed sludge is introduced into the uppermost hearth and is radially transported by either two or four rabble arms sweeping across the top of the hearth. The central shaft and rabble arms are air-cooled. The rabble arms are designed to move the sludge either inward, away from the hearth periphery, or outward, toward the hearth periphery. As the transported sludge reaches the inside or periphery of the

hearth, it cascades downward onto the next lower hearth where a rabble arm transports the sludge radially as in the hearth above. The sludge moves inward and outward across the hearths, while traveling downward through the incinerator.

An MHF can be divided into four process zones. The first zone, which consists of the upper hearths, is the drying zone where most of the water is evaporated. Since this zone operates at 600 to 900°F, uncombusted volatiles and hydrocarbons can be released in the exhaust gas causing odor and air pollution problems. In many instances, an afterburner must be installed to heat the exhaust gases to combustion temperatures (1400°F) oxidizing the odorous pollutants. The operation of an afterburner results in added fuel consumption. The second zone, consisting of the central hearths, is the combustion zone. In this zone, the majority of combustibles are burned in temperatures ranging from 1400° to 1700°F. The third zone is the fixed carbon burning zone, where the remaining carbon is oxidized to carbon dioxide in temperatures reaching 1800°F. The fourth and last zone consists of the lowest hearths and is the cooling zone (temperatures of approximately 300°F). In this zone, ash is cooled by the incoming combustion air. The sequence of these zones is always the same; however, the number of hearths in each zone is dependent on the quality of the feed, the design of the furnace, and the operational conditions. An MHF can be provided with heat recovery equipment such as air to air heat exchangers and heat recovery boilers.

2. Fluidized Bed Furnaces - These type of incinerators have also been widely used for sludge incineration. Combustion in a fluidized bed furnace (FBF) occurs within an expanded sand bed inside a cylindrical incineration chamber. An FBF is normally available in sizes ranging from 9 to 25 feet in diameter. Sludge, auxiliary fuel (if required) and combustion air are introduced into a sand bed located in the lower portion of the incinerator. Combustion air is injected into the bottom of the incinerator at a pressure of 3 to 5 pounds per square inch (gauge). This causes the sand bed to expand to approximately twice its original volume. The turbulent mixing within the expanded bed induces complete combustion of the sludge particles by allowing the sludge in the reactor to move throughout each section of the reactor during the combustion process. The bed temperature is controlled between 1400° and 1500°F by auxiliary burners located either above or below the sand bed. The air requirement of an FBF is determined by several factors including bed expansion, sand loss in the exhaust gas, and complete combustion. The quantity of excess air for complete combustion ranges from 25 to 45 percent which is less than the requirements for an MHF. As the sludge combusts, the moisture and combustible organics are eliminated, leaving a low density ash residue which is then carried by the gas stream out of the reactor vessel. Sand is also carried out with the ash and must be replaced. Sand losses are approximately 5 percent of the bed volume for every 300 hours of operation. The sand in the fluidized bed furnace also retains combustion heat when the system is not operating; thereby enabling a fluidized bed incinerator to economically endure periods of downtime lasting 18 to 20 hours without using substantial quantities of fuel upon start-up.

A venturi scrubber air pollution control system removes ash from the incinerator off-gas. The ash is then thickened and/or dewatered for disposal. Energy recovery through the use of a hot windbox can reduce fuel costs. A hot windbox uses recoverable heat from the exhaust gases to preheat the fluidizing air prior to injection into the combustion chamber.

B. Advantages:

Incineration requires no prior sludge stabilization and affords the maximum volume reduction of sludge (approximately 95%). Minimal land requirements and labor requirements. Energy recovery can be incorporated into the system to lower operating costs.

C. Disadvantages:

The primary environmental issues for sludge incineration are air pollution and ash disposal. Incineration is an energy intensive process. The process has high capital operation costs. Sludge incineration is mechanically complex requiring highly skilled operators.

4.9.1.5 Landfilling

Co-disposal of sludge with refuse in municipal solid waste landfills has a long and well-established history. It continues today as an acceptable method of sludge management and is allowed under Maryland solid waste and sludge management regulations. However, the Charles County Commissioners have banned the disposal of sludge within the County's Sanitary Landfill.

The basic criteria and requirements for determining the acceptability of landfilling sludge in Maryland include the following:

- A separate permit is required for sludge disposal at any landfill.
- All sludge disposed in a sanitary landfill must be stabilized.
- The landfill must have adequate on-site equipment capable of handling the incoming sewage sludge.
- The owner/operator of the landfill must approve the project.

The following is a list of methods used to dispose of sludge in municipal solid waste landfills:

- Mix sludge with refuse and apply it to the working face.
- Blend sludge with soil and apply it as daily cover material.
- Apply sludge to finished cover to promote vegetation growth and enhance erosion control.

Blending sludge with daily or final cover involves essentially the same practices as land application. As such, these methods are subject to the same climatological problems as land application and are not considered a good emergency back-up system. Co-disposal with municipal solid waste is much better suited for emergency disposal operations.

When mixing sludge and refuse in a municipal solid waste landfill, sludge and solid waste are blended with dozers in the working face and compacted. Usually, landfill operators attempt to keep the ratio of solid waste to sludge very high in order to minimize problems associated with sludge sticking to the undercarriages and frames of dozers and compactors. Timing of sludge deliveries is also an important factor since there must be sufficient refuse available to blend with the sludge.

A. Advantages:

The landfilling of sludge is a good all-weather emergency disposal method; can increase gas production in municipal waste landfills, thus, increasing energy recovery. Land filling is a simple, reliable management approach.

B. Disadvantages:

Landfilling affords no beneficial reuse of the sludge and takes up valuable space in the municipal waste landfill. Operational problems with blending of municipal solid waste and the potential for affecting municipal solid waste leachate quality have negative effects on the environment. Landfilling sludge may be costly, depending upon municipal solid waste tipping fees.

4.9.2 Evaluation of Existing Sludge Management

The most cost-effective and environmentally acceptable sludge management disposal alternative is lime stabilization/land application. Capital expenditures and potential impacts associated with sewage sludge composting, incineration, and pellitization make these alternatives less feasible at this time. Additionally, Charles County has a policy that does not allow for the disposal of sewage sludge in the municipal waste landfill. For these reasons, the existing sludge management method of land application is, at this time, the most feasible option.

The MDE is responsible for reviewing and issuing permits for the land application of sludge in Maryland. Charles County residents have expressed a great deal of concern regarding the land application of sewage sludge in Charles County. As a result, the County initiated an inspection process to investigate and respond to concerns regarding land application practices in Charles County.

In addition, the County requires a separate transportation permit to haul sludge to land application sites within the County. Permit applications for the transportation of sludge into the County are reviewed by the County Commissioners for compliance with Charles County policies, as well as other rules and regulations. Applications are approved, conditionally approved, or denied by the Charles County Commissioners.

4.10 SPECIAL WASTE MANAGEMENT

Special waste management requirements for asbestos, special medical waste, hazardous waste, household hazardous waste, emergency response for hazardous waste spillage or leakage, and procedures for handling non-hazardous contaminated soils will be discussed in this section.

4.10.1 Asbestos

The Charles County Landfill is permitted to receive asbestos, however, currently only accepts asbestos materials from government institutions (schools, government buildings, etc.).

Asbestos disposed at the site must be packaged and labeled in accordance with *COMAR* 26.11.15.04. Procedures for disposal are as specified in *COMAR* 02.04.07.13.

- A minimum 24 hour notice to the landfill supervisor to provide information regarding delivery time, source, and quantity.

- Personnel handling the asbestos wear disposal protective clothing and respirators.

- The asbestos is handled with care to reduce the emission of fibers into the air. Asbestos is delivered to a separate area of the landfill for disposal.

- The asbestos is placed in a trench and completely covered with soil.

The above procedure recognizes that the health threat posed by asbestos is the release of asbestos fibers to the atmosphere and inhalation by humans. Once properly buried within a landfill and isolated from the atmosphere, asbestos poses no known health risks.

4.10.2 Special Medical Waste

The County landfill will not accept special medical wastes, including infectious and/or bio-hazardous medical waste. Currently, special medical waste generated at the hospital is incinerated on-site.

The management of special medical waste is strictly regulated by the MDE under specific medical waste regulations. However, the County reserves the right to address the management of special medical waste under a separate plan.

4.10.3 Hazardous Waste

The County landfill does not accept hazardous substances for disposal other than small quantities of household hazardous wastes. Currently, hazardous waste generators within the County contract with a licensed hauler of hazardous waste for collection and disposal.

Hazardous waste storage, transport and disposal is strictly regulated by the MDE. However, the County reserves the right to address the management of hazardous waste under a separate plan.

4.10.4 Household Hazardous Waste

Several options are available to local governments for reducing the quantity of household hazardous waste disposed in landfills. These options include the following:

- Promoting source reduction through public information programs that emphasize the use of alternative non-hazardous products and the proper handling and disposal of hazardous household materials.

- Holding periodic hazardous waste collection days for residents.

- Establishing a permanent residential hazardous waste collection center where such waste can be collected on a continuous basis.

One drawback with the second option is that citizens must store quantities of hazardous materials in their homes between collection days, sometimes for extended periods of time. And while both the second and third options are costly, the third option requires substantially greater staffing, facilities, and disposal costs.

Charles County holds a household hazardous waste collection day the first Saturday of every month at the Landfill, from April through December. Waste quantities continue to rise as citizen participation continues to increase.

Collection programs can be costly; however, it is a good idea to prevent household hazardous waste from entering the landfill. Expanding the County’s public education program in conjunction with a collection program continues to contribute to the environmental quality of the landfill, as well as sensitizing the public to their role in responsibly managing their waste.

4.10.5 Emergency Response for Hazardous Waste Spillage or Leakage

Charles County's adopted *Hazardous Materials Response Plan* prescribes, to the extent possible, actions to be taken in the event of an emergency or unplanned spillage of hazardous materials within the county. U.S. Route 301, a major north-south truck route along the Eastern Seaboard, traverses the county. Hazardous materials spillage events occur there several times per year. The *Hazardous Material Response Plan* assigns responsibilities for notifications and responses to various agencies within the County. In addition, the Charles County Government administers an emergency preparedness and risk management program, and in conjunction with the Sheriff's Department, provides lead staff in the event of such incidents.

The *Hazardous Material Response Plan* is based on the concept that emergency functions for the various groups responsible for responding to hazardous materials accidents will generally parallel their normal day-to-day functions. All emergency vehicles carry a U.S. Department of Transportation "Emergency Response Guidebook", which contains federal and industry approved protective measures. The *Hazardous Material Response Plan* is consistent with the emergency plans of other agencies/organizations, including the Charles County Sheriff's Department and the Maryland State Police. When implemented, this Plan will abate the hazard and restore conditions to normal.

4.10.6 Non-hazardous Contaminated Soils

The disposal method for soil contaminated with petroleum or petroleum products which are generated within Charles County is dependant on test results indicating the level of toxicity and contamination. The following information is required before the contaminated soil may be disposed in the County landfill.

- A statement from the generator certifying that the soil is non-hazardous waste as defined by federal regulations under Subtitle C, Resource Conservation and Recovery Act.
- The amount of petroleum contaminated soil to be disposed.
- A description of the sampling protocol and a copy of all laboratory analyses.

A minimum of one composite sample shall be analyzed for each required test for every 100 cubic yards of soil to be disposed. In the case of soil reclaimed by thermal treatment, a minimum of one sample shall be analyzed for every production day composited hourly.

4.11 LANDFILL MINING

A county owned landfill that is excavated to recover valuable waste materials. In the case of a sanitary landfill, areas that were filled prior to the implementation of waste-to-energy, materials separation, and recycling programs may contain combustible materials (for waste-to-energy); metals and other recyclable materials. In addition to recovering materials, landfill space and cover material (i.e., soil) can be reclaimed. In addition to excavation and hauling equipment, material separation equipment such as that magnetic separators, optical separation systems (glass), balers, and crushers would also be used.

4.12 MUNICIPAL SOLID WASTE (MSW) COMPOSTING FACILITY

A centralized facility that accepts and processes the biodegradable portion of pre-separated municipal solid waste. In addition to yard waste, a MSW compost facility would process food waste, paper products and other clean wood wastes. MSW is usually composted within an enclosed reactor or building to optimize waste decomposition and to control odors. Several acres of land will be required to process and store the final composted product. Chippers and grinders are required to process wood waste. Front-end loaders and windrow turners may be required to move and turn the piles depending on the type of composting process. Trommels and screening equipment will be required to sort and remove large materials from the final product.

4.13 PUBLIC EDUCATION PROGRAM

Public awareness of, and concern for solid waste management issues has heightened considerably over the past 20 years. As a result, public opinion has played an important role in shaping public policy over such issues as the siting of solid waste management facilities, concerns over the increased cost of waste disposal, and widespread support for recycling. Informed and participating citizens is a key to a successful solid waste management program. In its publication entitled, *Decision Makers Guide to Solid Waste Management*, the EPA makes the following recommendations regarding public information and involvement

- Decision makers should involve the public early in the waste management planning process.
- Promotion and education programs should be tailored to the needs of each community and maintained throughout the year.
- Planning for public education and involvement requires that decision makers understand their audience, prepare a formal plan, and establish a method for evaluating the success of the programs.
- The public has a right and a responsibility to understand the full costs and liabilities of managing the wastes they produce.

Thus, the public should be involved in decision making with respect to solid waste management planning, and public education is critical to enable the public to make sound decisions.

In order to promote sound solid waste management practices, and encourage waste reduction and recycling and other appropriate waste disposal behaviors, Charles County's public education program informs county residents, businesses, and institutions about related county policies and programs. The County's education program consists of press releases, television commercials, the County webpage, online banner ads, fliers, tax bill insert, mailings, public workshops, school visits, and seminars.

4.14 SUMMARY OF SOLID WASTE MANAGEMENT ALTERNATIVES

Table 4-1 presents a summary of the alternatives discussed above and their ability to meet the goals and objectives of this Plan. In addition, the summary indicates whether or not each alternative will be considered in the Action Plan presented in Chapter 5.

4.15 SITING NEW ACCEPTANCE FACILITIES

The decision making process for selecting a solid waste management facility site involves the interaction of several factors. These factors include environmental, technical, economic and socio-economic, and socio-political considerations. Site selection develops a hierarchy of factors influencing the decision, and incorporates objective (quantitative) and subjective (value judgments) considerations into the evaluation of sites through a multi-level screening process.

- Environmental concerns deal with the effects that the facility will have on the ecosystem of the site and surrounding area, and permitting requirements. It includes impacts on wetlands, groundwater, surface water, endangered species, archaeological sites, historical sites, and environmentally-sensitive areas.

- Technical concerns involve the physical location and daily operational requirements such as access to roads, buffers, size and type of facility, soils, easements, sediment and erosion controls, stormwater management, and site utilization.

- Economic and Socio-economic concerns involve costs incurred to establish the site and the financial impact on near-by neighbors of the facility, particularly in comparison to any site being considered.

- Socio-political concerns deals with the reaction of local citizens, industry, and others to the siting process and final decision.

In order for the siting process to be effective, the methodology must consider the future impacts of the decision, involve the public, take conflicting views into consideration, and provide a usable tool with which county decision makers may make the final decision.

TABLE 4-1
SUMMARY OF SOLID WASTE MANAGEMENT ALTERNATIVES

Alternative	Rec*	Potential for Meeting Goals and Objectives of the *Charles County Comprehensive Solid Waste Management Plan.*
		Collection:
Free Enterprise	N	Existing system of collection (municipal waste). Allows competitive pricing for services based off of competition for business. Promotes private business and the freedom for consumers to choose their service provider.
Franchising	R	Provides opportunities for flow control and waste reduction incentives. However, private haulers could be negatively impacted and bureaucracy is increased. Best alternative for flow control.
Licensing	R	Allows for customer selection of haulers and a means for the county to implement policies for flow control and waste management practices.
Public Operation	N	Provides highest level of flow control. This alternative is not judged to be as cost-effective or efficient. Does not provide a mechanism for efficient integration of county and municipal efforts.
		Recycling:
Curbside Collection	R	Curbside collection is an important program for meeting the county's recycling goals. Necessary to achieve the required recycling rate.
Drop-Off Centers	R	Drop-off centers will continue to partially meet the objective for increased recycling. Provides more cost-effective and efficient means of recycling within the remote, rural areas of the county.
Buy-Back Centers	R	Buy-back centers provide an incentive to some who would otherwise not recycle. Existing centers are privately owned and operated and no cost is incurred by the county. Can help achieve the objective of maximizing recycling
Mixed Waste Processing Facility (MWPF)	N	This system ("dirty MRF") does not meet the *Charles County Comprehensive Solid Waste Management Plan* objectives of cost-effectiveness, environmental protection, and increased recycling. Does not provide for a high quality of recyclables
Material Recovery Facility (MRF)	N	Recommended for inclusion within the county program to provide a readily accessible outlet for recyclables. More information will be required from pilot recycling programs to evaluate options concerning regional and private material recovery facilities.
Rubble Material Recovery Facility (MRF)	R	Would complement the county's efforts at waste reduction and recycling, and would increase the longevity of the county landfill where the rubble is disposed.
Commercial Recycling	R	Commercial waste comprises about 56 percent of the waste stream; commercial recycling provides an excellent opportunity for Charles County to reduce the amount of solid waste requiring final disposal. Costs to the county for this program are minimal.

* Recommendation:
R: Recommended for further consideration.
N: Not recommended; eliminated from further consideration.

TABLE 4-1
SUMMARY OF SOLID WASTE MANAGEMENT ALTERNATIVES
(continued)

Alternative	Rec*	Potential for Meeting Goals and Objectives of the *Charles County Comprehensive Solid Waste Management Plan.*
Recycling (continued):		
Yard Waste Composting	R	A critical component of the County's recycling program. Cost-effective and efficient method in which to reduce the amount of waste requiring final disposal, conserving landfill space.
Solid Waste Composting	N	At the present time, the relatively high cost for solid waste composting eliminates this alternative from further consideration. Technology is not proven in the long run.
Municipal Waste Combustion and Waste-To-Energy:		
Municipal Waste Combustion	N	This alternative would be very costly for Charles County. Potential environmental impacts do not meet the goals and objectives of the *Charles County Comprehensive Solid Waste Management Plan.*
Waste-to-Energy	NC	This alternative would be very costly for Charles County. The Tri-County Regional Task Force has identified this as a long-term solid waste management option for the tri-county region.
Land Disposal:		
Landfills (Municipal Waste and Rubble)	R	Necessary, most cost-effective alternative for the management of wastes that cannot be recycled or reused. State-of-the-art facilities are necessary to protect public health and the environment.
Sludge Management:		
Lime Stabilization/Land Application	R	Cost-effective and environmentally acceptable sludge management methodology; beneficial use of resource. Existing program permitted by MDE.
Heat Drying/Pelletization	NC	At this time, capital expenditures to implement this system are not warranted.
Composting	NC	At this time, capital expenditures to implement this system are not warranted.
Incineration	N	Highest capital and operations cost; potential environmental impacts; does not reuse resource.

TABLE 4-1
SUMMARY OF SOLID WASTE MANAGEMENT ALTERNATIVES
(continued)

Alternative	Rec*	Potential for Meeting Goals and Objectives of the *Charles County Comprehensive Solid Waste Management Plan.*
		Special Waste Management:
Asbestos	R	County should reevaluate the current prohibition against asbestos waste in order to provide its citizens with a safe area to dispose of asbestos waste.
Household Hazardous Waste	R	County should expand public education program to include proper management, disposal, and alternatives for household hazardous waste. Periodic collection days should continue.
Special Medical Waste, Hazardous Waste, Emergency Response for Hazardous Waste Spillage or Leakage, Non-hazardous Contaminated Soils	R	The County's current management of these special wastes should continue.
Public Education	R	Critical component of the recycling and overall solid waste management program. Expansion is recommended to cover other aspects of solid waste management such as household hazardous wastes and source reduction.

* Rec = Recommendation:

- R: Recommended for further consideration.
- N: Not recommended; eliminated from further consideration.
- NC: Not currently recommended; may be reconsidered in the future after further study and evaluation

Site selection for a solid waste management facility is one of the most politically volatile issues that local governments face. Public attitudes and concerns are an integral part of the process of siting a new waste management facility. The public and political acceptability of the facility rests on the shoulders of the Charles County Commissioners and the local officials.

A sound framework for establishing a site is essential to providing the County and local officials with a solid foundation from which to arrive at a decision. Once the site decision is made, the County may continue forward to provide the community with an integrated solid waste management system.

The siting process for disposal and processing facilities involves a multi-level screening process, as described in Table 4-2. The first level screening process identifies areas in the County that are unsuitable for siting of land disposal and processing facilities based upon broad technical, environmental and land use criteria.

If a site passes first level screening, it is subjected to more stringent site-specific screening criteria as described in Table 4-2. The suitability of the site will also be evaluated through the requirements of the MDE permitting process, Charles County Department of Public Facilities, Charles County Planning and Growth Management Department, Charles County Commissioners, and through extensive public review through the Charles County citizen groups.

4.16 CONSTRAINTS ON THE SITING OF SOLID WASTE MANAGEMENT FACILITIES

Existing physical features and existing and planned uses of the land within Charles County affect the siting of waste management facilities. Solid waste management facility siting should be planned to minimize impacts on the citizens of Charles County and the environment.

A brief description of these constraints imposed on solid waste acceptance facilities based on technical environmental and land use concerns follows.

4.16.1 Topography

Charles County is located in the Atlantic Coastal Plain, therefore is a relatively low-lying area. Elevations range from 10 feet above sea level near the Potomac River to approximately 230 feet near Waldorf. Large portions of the County are exceedingly flat, with a gentle slope toward the Chesapeake Bay, or toward local drainage features. Broad plateau formations with sides dissected by drainage features are common throughout most of the County. This dissection reflects the nature of the soils underlying the County which are easily eroded clays, sands and gravels. In some areas, dissection is incomplete and flat areas several miles across have not as yet been reached by headward cutting streams. Stream valleys affect local topography throughout the County.

TABLE 4-2
GENERAL PROCEDURE FOR SITING WASTE MANAGEMENT FACILITIES

The process of site selection can be defined in stages or levels by which numerous possible sites is reduced to a few probable sites. Involvement of and communication with Charles County and citizens throughout the entire process is essential to provide input for the site evaluation planning parameters, determination of and ranking of site suitability criteria and the matrix evaluation process.

Establish Site Evaluation Planning Parameters as a framework for the site search direction. These parameters should include, but not be limited to, items such as size, service life, major areas excluded, minimum buffer zone requirements, compatible surrounding and adjacent land uses, preferred site distance from centers of development, acreage requirements.

Data Collection of Baseline Information including previous studies and reports and conducting meetings with the interested county departments, citizen groups, and regulatory agencies to discuss the proposed process.

Prepare Land Use Opportunities and Constraint Maps depicting technical, environmental, economic, and socio-economic concerns relevant to solid waste management facility siting.

Identify Primary Potential Solid Waste Management Facility Sites by a "windshield" survey, U.S.G.S. topographic maps, floodplain maps, aerial photographs, plat maps, zoning maps, project planning parameters, meetings with county officials, and regulatory agency representatives.

Develop Screening Criteria taking the planning parameters into account, several key factors may be identified in screening sites. Key factors which are common to solid waste management facilities are that the site should:

- Have a minimum impact on the community
- Be served by adequate road systems
- Be technically sound, environmentally suitable, and economically feasible
- Have the support of elected officials and citizens groups

First Level Screening (absolutes) involves an inherent constraint which does not allow a solid waste management site at the location due to conditions that, if found, would eliminate a site from further investigation. First level screening criteria may include, but is not limited to, highly developed areas, areas within 5,000 feet of a airport runway, areas within the 100-year floodplain, site boundaries with reasonable direct access beyond two miles of a major arterial road or transportation network, national parks, or critical environmental areas.

Develop a Site Feasibility Matrix to rank and provide a comparison of the sites based on the first level screening criteria. The site comparison will provide for elimination of non-feasible sites from further investigation. This site elimination is important as it would be inefficient (time wise and momentarily) to attempt to investigate all the primary potential sites in terms of the level two screening criteria. The end result is a listing of potential sites for further investigation as well documentation of the non-feasible sites and why they were eliminated.

TABLE 4-2
GENERAL PROCEDURE FOR SITING WASTE MANAGEMENT FACILITIES
(continued)

Conduct Field Inspection of the potential sites with county officials and MDE officials.

Second Level Screening (non-absolutes) involves assessing the constraints which, by virtue of their nature, are not absolutely disqualifying. Second level screening is an evaluative process in qualitative and quantitative terms. Criteria for qualitative evaluation include, but is not limited to, buffer, easements, habitat impact, surface water quality impact, archaeological/historical, surrounding land-use, aesthetics (screening) and land ownership. Quantitative criteria are definable in terms of standard engineering practices and include haul distances, access, site size/shape, soils, availability of site resources (cover soil), site drainage, groundwater/aquifer impacts, site utilization, wetlands impacts, well inventory, proximity to sensitive areas, proximity to residential developments, and development costs.

Determine Matrix Rating Methodology for evaluation of the second level screening criteria as a joint effort of the citizens group, and county officials. Two of the more common matrix rating systems used are the ranking method and the rating method.

The rating method simply assigns an unweighted numerical value for each screening criteria (1 - very good, 2 - good, 3 - fair, and 4- poor). The numbers are tallied and the lesser overall total is the most desirable site. This method assumes that each criteria is of equal importance.

The ranking system uses a weighted numerical value for each criteria. The impact factors (1 - negligible impact, 2 - less significant impact, 3 - significant impact, and 4 - most significant impact) are used to reflect the relative value of each screening criteria. The impact factor is then multiplied by the numerical rating criteria to provide a weighted value.

Develop a List of Preferred Sites based on the matrix evaluation of the sites, a selected number of sites should be selected for further analysis.

Conduct a Workshop with the Charles County Commissioners to present the findings and list of preferred sites and the recommendations of the consultant of the final sites for detailed investigation.

Conduct Final Site Investigation of the sites selected for detailed study.

Conduct Public Participation meetings to obtain community input into the decision making process and to present site-specific data obtained in the final site investigation. The Charles County Commissioners shall oversee this meeting.

Final Site Selection shall be made by the Charles County Commissioners based on the final site investigation data, the recommendations of citizens groups, and public opinion. The site will be selected and procured by the Charles County Commissioners.

Adjacent to the Potomac and Patuxent Rivers are low-lying flats not more than 10 to 25 feet above sea level. Steeply-sided terrace formations are often present in these locations as well. These flats vary in width from a few feet where the river current of the Potomac washes strongly against the shoreline, such as is found at several locations in western Charles County near Indian Head and Potomac Heights, to more than a mile in the southern part of the County, such as Allen's Fresh. The interior of the County, along U.S. Route 301 from Faulkner to the Prince George's County line is predominantly flat. Outward from this plateau, dissection becomes more pronounced and the land is gently rolling and hilly. Approximately 65 percent of the County is nearly level or gently sloping, 24 percent moderately or strongly sloping, and 11 percent is greater than 15 percent.

Landfill sites are generally located in topographic high areas, broad flat plateau areas, and areas which do not have steep ridges. Land which has slopes greater than 15 percent is not considered acceptable for landfills due to excessive site grading required to develop the landfill. Other waste management facilities are not as constrained by the slope of the land; however, cost factors associated with site work must be considered.

Low-lying areas along rivers and waterways may be regulated by federal, state, and county laws protecting these areas due to critical areas, tidal wetlands, and non-tided wetlands. Additionally, low-lying areas within the 100-year flood plain are not acceptable for development as a land disposal facility due to state and federal regulations.

4.16.2 Soils

Predominant soil types of Charles County are gravels, sands, silts, and clays. For landfills, the porous nature of the unconsolidated soils does not provide the impervious layer needed to contain leachate within the waste fill area. However, measures such as geomembranes, leachate collection and treatment systems, and monitoring systems aid in reducing the potential for migration of leachate into the environment.

The *Charles County Soil Survey* provides more detailed information on the types and locations of soils within the County which should be used for the initial stages of siting a landfill. Based on this survey approximately 19 percent of the County has soils with slight or moderate limitations for septic systems indicating that these soils are moderately permeable. The remaining 81 percent of the County is mapped as having poor drainage, and permeability. Approximately one-quarter of the County's land area is characterized as tidal marsh and swamp. However, this survey is somewhat limited as it is primarily concerned with the first 5 feet of the soil profile and more information is required before the final site selection decision can be made.

The properties of the soils on which a landfill is sited should be considered in planning, design, construction operation, closure, and post-closure of the landfill. Soil characteristics such as soil texture, erodibility, load-bearing capacity, resistance to slide, permeability, water table elevation, and quantity should be addressed during the site selection process. Impermeable soils are desirable soils for the base of the landfill; however, landfill operations require a loamy or silty soil which is easily spread and compacted for cover material. Soil types for other waste management facilities are those which can provide adequate support for the building, structure, or concrete pad.

4.16.3 Geologic Conditions

Although landfill facilities can be engineered to be environmentally protective in most geologic settings, it is desirable to have sites in areas in which geologic conditions provide backup attenuation capacity. In Charles County, optimum geologic conditions for a landfill site include adequate depth to groundwater and the presence of a low permeability formation (aquiclude) beneath the site. Geologic conditions should be such that an effective groundwater monitoring system can be established.

The geologic formations beneath Charles County are composed of gravel, sand, silt, and clay. These materials have been transported by streams, particularly the Potomac River, from the Appalachian and Piedmont region west and north of the County throughout the geological history of the County and were deposited in the form of alluvial fans and deltas. Tidal and marine muds and silt layers overlay dense, hard crystalline, metamorphic and igneous rocks of Precambrian age. The crystalline rocks are deep below the surface. Diatomaceous deposits are unique to this part of the state and are found throughout the County.

In the vicinity of Faulkner, there are unique surficial sediments which are a relatively young, thin veneer approximately 30 feet in thickness, occupying elevations of 30 feet above mean sea level and consisting of gravel, sand, and silt. These sediments were deposited by the eastward flowing Potomac River as the river migrated slowly southeastward to its present location. Beneath this granular deposit is the Calvert formation of the Chesapeake Group which is composed of the Fairhaven and Plum Point Marls. This formation overlies and tends to seal the surficial granular deposit from all of the older geologic units.

4.16.4 Location

Locating a site for a solid waste management facility involves the interaction of regulatory, environmental, technical, economic, and socio-political considerations. General regulatory, legal (laws), environmental, technical, and economic concerns for siting a waste management facility are discussed in other chapters of this plan. Socio-political considerations are dynamic and volatile. Charles County encourages and provides procedures and policies for public involvement in considerations associated with proposed solid waste management facilities within the County. In summary, the location of a solid waste management facility is governed by engineering, technical, and economic considerations which are generally straightforward with little controversy. As stated previously, these concerns are addressed in other sections of this Plan. The socio-political issues are very dynamic and are a function of historic and recent events within the County. The variables for siting solid waste management facilities are that of socio-political issues which are constantly changing and are not easily documented.

4.16.5 Aquifers

The geologic formation underlying Charles County are sedimentary sands and gravels, capable of yielding substantial quantities of fresh water. There are five major water-bearing aquifers located in Charles County which slope from west to east. These aquifers are found in the Patuxent, Patapsco, Raritan and Magothy formations of the Cretaceous system, the Aqua Greenstone of the Eocene series, and in the Pleistocene deposits. Contamination of the aquifers within Charles County is a possibility due to geology of the area, and the numerous recharge areas.

4.16.6 Wetlands

Wetlands are of major importance to ecosystems in the County and Chesapeake Bay. The County has approximately 139,800 acres of wetland areas, of which approximately 81 percent are tidal and the remaining 19 percent are non-tidal. The tidal wetlands provide a transition zone between dry land and open water. Non-tidal wetlands are referred to as inland or upland wetlands and included swamps, bogs, and hardwood forests. Solid waste management sites should not encroach upon, or negatively, impact wetlands.

4.16.7 Surface Water and Floodplains

Charles County is bordered by the Patuxent, Potomac and Wicomico Rivers, and has three lakes or reservoirs within the county limits with a surface area of approximately 171 acres. The three lakes, Jamesian, Trinity, and Wheatley were constructed for flood control as part of the Gilbert Run Swamp improvements. The use of the Patuxent, Potomac or Wicomico Rivers as a water source is constrained by their salinity concentrations.

Along these rivers are areas associated with the 100-year flood plain. Facilities located within the 100-year floodplain may hinder the flow, reduce the temporary storage capacity of the floodplain, or wash out the waste within the landfill and endanger human health and the environment.

Floodplains are not suitable for siting solid waste management facilities within Charles County. Federal regulations (*CFR* 40) contains provisions banning the location of solid waste facilities within 100-year flood plains. Additionally, Charles County's Floodplain Management Program establishes floodplain districts within the County and provides for the issuance of permits, and imposes regulations on construction and development within these districts.

4.16.8 Water Quality

As described above for aquifers and surface waters, poorly sited, designed or managed solid waste disposal or processing facilities can cause water quality degradation. While current federal and state regulations and criteria for these facilities require design features to mitigate for potential water quality impacts, it is important, where possible, to site such facilities where they pose the least risk to drinking water supplies and other sensitive water resource areas

As stated in the *Charles County Comprehensive Plan*, it is critical that the County improve and maintain water quality in the coastal, estuarine, and upper basin tributary streams. The County's policy considerations addressing water quality issues include:

- Ensure that point source discharge of pollutants are maintained at safe levels of environmental quality through strict enforcement of state water quality standards for point source discharges.

- Establish effective shoreline erosion-control regulations and work with state and federal agencies to identify and stabilize existing problem areas.

- Protect the County's finfish and shellfish areas by requiring full compliance with state and federal regulations relating to discharge into Class I and Class II waters.

- Encourage the establishment of soil conservation and water quality plans on all farms in Charles County to reduce sediment and nutrient export from agricultural activities.

- Strengthen stormwater management regulations to addresses both quantity and quality control of runoff and incorporate urban best management practices for sites undergoing development or redevelopment.

- Identify and map important aquifer recharge areas and develop protection measures to maintain the quality and quantity of these resources.

- Conduct a thorough analysis to determine the feasibility of developing surface water impoundment sites for potable water, storm water management, recreation, and/or fire flow.

- Continue to implement the recommendations of the *Patuxent River Policy Plan*.

- Continue to implement the recommendations of the *Charles County Comprehensive Water and Sewage Plan.*

Prior to the establishment of any solid waste management facility in Charles County, each of these water quality issues should be considered.

4.16.9 Adjacent Incompatible Land Use

Solid waste management facilities have the potential to create odor, noise, dust, and/or adverse traffic impacts for adjacent land users. Charles County is aware of the problems and nuisances which may be created by solid waste management facilities. The *Charles County Zoning*

Ordinance, *Charles County Comprehensive Plan*, and requirements for public notification of potential new solid waste management facility locations will aid the County in reducing the possibility of adjacent incompatible land uses.
Similarly, new developments or land uses adjacent to existing solid waste management facilities must consider potential impacts due to any existing solid waste facility.

4.16.10 Airports

The U.S. Department of Transportation, *Federal Aviation Authority Order 5200.5, FAA guidance Concerning Sanitary Landfills on or Near Airports* stipulates the following criteria for sanitary landfills.

- Waste disposal sites may not be located within 10,000 feet of any runway end (used or proposed) to be used by a turbine powered aircraft.
- Waste disposed site may not be located within 5,000 feet of any runway end used only by piston powered aircraft.
- Waste disposal sites may not be located within a 5-mile radius of a runway end that attracts or sustains hazardous bird movements from feeding, water, or roosting areas into, or across the runways and/or approach and departure patterns of aircraft.

4.16.11 Hospitals

The *Annotated Code of Maryland* Environment Article, Section 9-225 prohibits the location of any landfill within a 0.5 mile radius of any hospital.

4.16.12 Planned Growth Patterns

The *Charles County Comprehensive Plan* is the planning document designed to plan and direct the development of growth patterns within the County. The planned growth pattern is supported by the *Charles County Zoning Ordinance*.

Planning for land use and growth management in the County will provide the necessary guidance in siting solid waste management facilities. Using the County's development and growth management plan as a basis to site solid waste management facilities, provide assurance that projects do not impact or nullify the County's long-term objectives.

4.16.13 Areas of Critical Federal, State, or County Concern

Critical concern areas established by the State of Maryland are classified into three categories:

- The first category includes those areas which can tolerate little or no interference from human activity due to physical or regulated constraints. This category includes marshes or endangered species habitats.

- The second category comprises conservation areas in which development that does not adversely impact the area, is allowed. Areas such as historic places or recreational areas are included.
- The third category includes lands which are designated for some future use. Generally, such sites are vacant and are designated as such due to its unique location or situation.

The development of a landfill within areas of critical federal, state, or county concern is not allowed due to regulatory requirements. However, certain solid waste management facilities may be located in these areas, provided the facility does not adversely impact the area. For example recycling drop-off centers may be located within parks. Charles County has several areas considered to be of critical concern. These areas are discussed in the following paragraphs.

4.16.14 Chesapeake Bay Critical Area

The Maryland General Assembly adopted the Chesapeake Bay Critical Area Law in 1984. The law requires that Charles County adopt and implement a critical area management program to protect the water quality and wildlife habitats of the Bay and its tributaries. The County is preparing a development guidance system for critical area growth allocations. The critical area is defined as the land along the tidal shoreline extending 1,000 feet inland of mean high tide or the landward boundary of tidal wetlands.

4.16.15 Zekiah Swamp Management Area

The Zekiah Swamp originates in Southern Prince George's County and flows through Charles County forming the headwaters of the Wicomico River. The Zekiah Swamp is part of the watershed of the Wicomico Scenic River, originally designated in 1968 by the Maryland Legislature. The Smithsonian Institution in conjunction with DNR described the Zekiah Swamp as one of the most important ecological areas on the East Coast and the largest natural hardwood swamp in Maryland.

4.16.16 Patuxent River

The County is participating with neighboring counties which border the Patuxent River in protecting the river's resources through land management strategies to control pollution within the watershed. The County was able to acquire an agricultural preservation easement on 222 acres through the State Agricultural Preservation Program and 615 acres with the State Open Space Program.

4.16.17 Parks

Additional areas of critical concern include national, state, and county parks which are located throughout the county.

Benedict Community Park	Maxwell Hall
Bensville Park	Myrtle Grove Wildlife Management Area
Bryantown Soccer Complex	Oak Ridge Park
Cedarville State Park	Pinefield Park
Charlie Wright Park	Piscataway National Park
Doncaster State Forest	Pisgah Park
Friendship Farm Park	Robert B. Stethem Memorial Park
General Smallwood State Park	Ruth B. Swan Memorial Park
Gilbert Run Park	Southern Park
La Plata Park	Strawberry Hills Park
Laurel Springs Regional Park	Thomas Stone National Park
Mallows Bay Park	Tilghman Park
Mattawoman Natural Environmental Area	Turkey Hill Park
Mattingly Park	White Plains Regional Park

4.17 COMPREHENSIVE PLAN REQUIREMENTS

Charles County Comprehensive Plan is a general guidance tool and is not intended to provide specific guidelines concerning solid waste management. The Plan has established guidelines for the County to develop an integrated solid waste system. In general, the Plan encourages the search for short- and long-term solutions for solid waste management. The Plan has established guidelines for the County to develop an integrated solid waste management system. It implies no discouragement from future consideration of new technologies not addressed within it, or of new developments in existing technologies that at present are not recommended, provided they are consistent with goals and objectives of the *Charles County Comprehensive Solid Waste Management Plan*.

4.18 ZONING REQUIREMENTS

Charles County has recognized that solid waste management technologies are in a process of development and evolution. While land filling was the primary mode of solid waste management in past decades, today it is only one component of solid waste management. Solid waste management encompasses waste-to-energy facilities, recycling facilities, reuse facilities and composting facilities, in addition to the more traditional landfills. As the County moves towards the twenty-first century, the need for warehousing facilities, separation and processing facilities, transfer stations, holding and temporary storage facilities, waste-to-energy facilities and compost facilities all may play an important role in current and future solid waste management practices. As technologies and practices evolve, the *Charles County Zoning Ordinance* may need to be revised and amended. Nevertheless, the objectives of the code will remain as stated above, and the County will endeavor to retain flexibility in its zoning provisions in recognition that facilities/processes and the property on which they are located can be tailored to become compatible with a wide variety of surrounding land uses.

4.18.1 Permissible Uses

Section 62 of the *Charles County Zoning Ordinance* states that "Uses such as incinerators, private prison, private landfills and rubblefills, toxic and hazardous waste disposal facilities, private sludge storage facilities, and other uses that have similar impacts that are not listed on the Table of Permissible Uses are not allowed."

4.18.2 Minimum Zoning Standards

The *Charles County Zoning Ordinance Article IX: Minimum Standards for Special Exceptions and Uses Permitted With Conditions* reflects the items in Table 4-3. The minimum standards supplement the base requirements for the zone in which the proposed use is located. The intent of the standards is to minimize the potential impacts which the solid waste management facility may have upon adjacent properties. Items such as minimum setbacks, buffer requirements, hours of operation, security (perimeter fencing), provisions for traffic access, and utility services are addressed.

TABLE 4-3
MINIMUM ZONING STANDARDS

Section 7.06.000 - Pozzolan management facility.

This use is permitted by Special Exception in the AC, RC, IG and IH Zones subject to the following:

(a) *Minimum Area:* 20 acres when the site is in the IG or IH Zones and is completely surrounded by the IG, IH, or BP Zones**.** 50 acres when the site is in the AC, RC, IH or IG Zone and not completely surrounded by the IG, IH, or BP Zones.

(b) The Board of Appeals will establish a maximum time limit on the approval of the application. Extensions of specific periods may be granted if a new Special Exception is applied for and no substantial adverse impact is found in the continuation of the use.

(c) All fixed installations shall be located at least 750 feet from any existing homes and shall not be less than 300 feet from any property line. However, in the case where the site is completely surrounded by the IG, IH, or BP Zones, the fixed installations shall not be less than 100 feet from any property line.

(d) Roads for ingress and egress from the site to public roads shall not be less than 20 feet wide, and shall be hard-surfaced, and shall be maintained for a distance of 150 feet from the public road into the site. All other roads shall be treated as needed to control dust. For any roads which cross a utility right-of-way, the applicant shall obtain a permit for the crossing from the utility company and shall submit copies of the permit with the Special Exception petition.

(e) Operation hours shall be established by the Board. The Board may establish hours of operation based on the impact of noise, traffic, and operation of the use on the surrounding community.

(f) A site plan shall be submitted for approval to the Board with the application, showing the following:

- **i.** Setback area, including screening and fencing.
- **ii.** Portion of tract being used.
- **iii.** Existing and proposed structures and major mechanical equipment.
- **iv.** Existing and proposed access roads.
- **v.** Water supply and sewage disposal.
- **vi.** All necessary pollution control measures.
- **vii.** Stockpile areas and height.
- **viii.** Points of access to the site and provisions to control unauthorized entry to the site along the entire perimeter.

TABLE 4-3
MINIMUM ZONING STANDARDS (continued)

xii. The Board may request that an environmental impact analysis be submitted by the applicant.

xiii. All operations on site, including outdoor storage of machinery and equipment, may be required to be screened from any adjoining land or public street. The applicant shall submit plans showing the location and type of any proposed screening material.

xiv. Leachate collection system discharge point be shown if applicable to the site.

g. All operations shall be conducted in a safe manner with respect to hazard to persons, physical or environmental damage to lands and improvements and all operations shall minimize damage to any street, bridge, or public right-of-way. The Special Exception permit holder shall immediately report to the Board any non-pozzolan residuals in the material being landfilled. The land filling of such residuals may be ground for suspension or revocation of the Special Exception. The escape of any pollutants into the air, ground water or surface water beyond the site, shall require immediate disclosure to the appropriate state regulating agencies, and may be grounds for suspension or revocation of the Special Exception.

h. The applicant must demonstrate conformance with the standards in Article II Sections 31-34.

i. A sediment and erosion control plan shall be reviewed and approved by the Charles County Soil Conservation District.

j. A post-use land reclamation plan reviewed by the Charles County Soil Conservation District and approved by the Charles County Department of Planning and Growth Management is required prior to the commencement of any activity on site.

k. There shall be no land filling within a minimum of 200 feet of any surface water including springs, seeps, or intermittent streams. This buffer shall be modified for steep slopes and soil conditions in the same manner as the Resource Protection Zone is modified in Article VIII. Any existing Pozzolan management facilities are exempt from this requirement; however, the expansion or extension of any existing facility must comply.

l. The maximum number of truck loads hauled to or from a site shall not exceed the following:

Site of more than 100 acres	10-200 loads per day
Site of 51- 100 acres	20-150 loads per day
Site less than 51 acres	100 loans per day or less

The Board may reduce the maximum loads per day after weighing factors such as haul roads, routes, traffic patterns, number of trucks, nature of the community, and proximity to schools, churches, businesses, and inhabited dwellings.

The Pozzolan must be hauled wet so as to prevent any airborne material from escaping from the container.

In the case of sites adjoining or in close proximity to the generation plant, hauling on public roads shall be minimized.

TABLE 4-3
MINIMUM ZONING STANDARDS (continued)

m. A plan to reclaim or mine the Pozzolan may be included and approved with the application. An approval to reclaim or mine the Pozzolan shall expire five years from the date of approval unless renewed as specified in Section 415. If mining the Pozzolan is not approved as part of the original application, a mining plan may be submitted subsequently as a modification to the Special Exception provided all the submittal requirements of use 7.05.110 surface mining of more than 10 acres are met.

n. Only Pozzolan created as a by-product of a power generation facility located in Charles County may be utilized by Pozzolan management facilities located in the County.

o. Compliance with all applicable local, State or federal laws, regulations or permitting requirements including Section 7-464 of the Natural Resources Article, Annotated Code of Maryland, as amended. No Special Exception for a Pozzolan management facility shall be valid unless all necessary operating permits are obtained including an NPDES permit, if necessary.