Section 2
Application Considerations

A number of application methods were considered for the proposed project. The methods vary in cost and required level of expertise to operate. For all the methods considered, leachate is included as a water source, thus creating the added benefit of providing onsite management of this landfill byproduct. Water from the French Broad River, located near the site, and groundwater from an onsite well will also be used for the wetting process. The majority of bioreactor projects in the U.S. have employed one or more of the following methods that were considered for the project:

- Direct application at the working face
- Percolation using ponds or surficial trenches
- Percolation using vertical wells
- Pressure injection using vertical wells or horizontal trenches

2.1 Direct Application at the Working Face

Direct application of water at the working face is an inexpensive option for increasing the moisture content of the waste. The only equipment required for this option is a water truck with a spray bar to disperse the leachate over the exposed waste or a spray applicator such as the type used for hydro-seeding. Staffing and training requirements are minimal. One person can perform the task of spraying the leachate over the daily working face at select times of the day.

Liquid quantities using application at the working face are relatively low in comparison to other options due to the small area of application. Also, evaporation can decrease its effectiveness during the summer months. Nonetheless, applying water at the working face can serve as a supplemental means of wetting the waste for a bioreactor system that employs another method as the primary means of wetting. Application at the working face will aid in eliminating dry pockets in the landfill since all incoming waste will be wetted to some degree. It will also allow the decomposition process to start as soon as the waste is disposed in the landfill.

The application can be performed with leachate or other sources of water such as storm water, surface water, ground water, or a public water supply. The operators will be required to control surface runoff in the area when applying water at the working face. Use of small, temporary soil berms is an effective means of establishing boundaries between application zones and areas that shed runoff to the facility storm water system. If significant ponding is a possibility, the inside slope of the berm should be lined with a plastic tarp to prevent seeps. As the working face progresses, the berms will need to be relocated periodically to border the new application zone.

To prevent exposure to operators, the application should only be performed during periods when haulers and other landfill staff are not present in the area. If leachate is used, direct application should be avoided during windy conditions. It is recommended that the waste be covered with soil or an alternate daily cover shortly after wetting to contain odors.

2.2 Percolation Using Ponds or Surficial Trenches

Percolating leachate into the waste using ponds or trenches is another inexpensive means of adding moisture and managing leachate onsite. Shallow ponds can be excavated in flat areas of the landfill that are inactive. The ponds are then filled with water to allow percolation into the waste. The excavation of the ponds can be performed with onsite equipment such as a dozer or a backhoe. A tanker truck or portable pump and flexible piping can be used to transport the water to the pond location. In some applications, a pond is used for a period of one or two months in an intermediate area and then filled as the filling operation progresses. A new pond is excavated in another location and the process continues. One staff member can easily perform the operation of filling the tanker truck, driving it to the top of the landfill, and off-loading the water. This method is capable of adding significant quantities of water back into the waste. However, this method provides a less uniform distribution of water over the waste and controlling odors may be a problem.

A variation of the pond method is to install surficial trenches. A backhoe is used to excavate a trench 8 to 15 feet below the final grade. A perforated HDPE pipe is installed in the trench with a bedding of crushed stone around the pipe. A vertical pipe is stemmed from the trench to provide an inlet port for adding water. The trench is backfilled with waste and then cover material is placed to match final grade. The advantage of using trenches is that it provides full containment of the wetting process, which eliminates the threat of leachate mixing with surface runoff, and controls odors.

2.3 Percolation Using Vertical Wells

Vertical wells are distributed throughout the landfill and are built up progressively with each new lift of waste. Each well is started by placing a concrete manhole base section on top of the second lift of waste. Perforated manholes sections are added to the wells as the height of the waste increases. The manhole sections are filled with stone to add stability and prevent a safety hazard. The sections can be moved into place using a front-end loader or similar piece of equipment. PVC pipes of varying lengths, combined with vertically spaced barrier layers, can be inserted into each well to serve as the inlet ports for adding water to different levels of the waste. Construction of the wells is relatively easy but still requires the attention of the landfill staff on a monthly basis and equipment to handle the manhole sections, stone, and piping.

For landfills with existing waste, the wells must be installed using some type of drilling technique suitable for waste such as a bucket auger or vibratory drilling. Vibratory drilling is only used for wells with small diameter piping (6-inches or less) and no drainage material around the pipe.

On problem associated with vertical wells is that the hydraulic head created by filling the well with water does not provide significant lateral distribution. To further enhance lateral distribution, stone trenches can be constructed radially from the wells at select elevations in a configuration similar to spokes on a wheel.

2.4 Pressure Injection Systems

Injecting leachate into vertical wells or horizontal trenches is another approach for adding moisture to the waste that is popular for bioreactor operators. A pressure injection system, as the name insinuates, uses a pumping system to force leachate into the waste under an amount of pressure that is dictated by the operator. This provides the operator with some flexibility in controlling the quantity and rate of flow.

Many operators favor the use of horizontal trenches for pressure injection systems. One advantage is that trenches do not interfere with the landfilling operation after they are installed. Once the trench is constructed, waste can be backfilled over the area and traffic may resume without concern of damaging the pipes. Another advantage is that the header piping does not have to be reconnected each time a new lift is placed. The horizontal configuration also provides a more even distribution of leachate when compared to a vertical well in which pressure is greatest at the bottom of the well.

One major advantage of a pressure injection system is that it provides greater lateral distribution of leachate into the waste. This allows more cost-effective spacing of the trenches and reduces the potential for leaving dry pockets of waste. These systems are also capable of injecting large quantities of leachate and are not prone to clogging. Another major advantage is that the trenches or wells can serve a second function as a gas collector by connecting them to a gas header system. The combined liquid injection / gas collection system will provide significant savings over the installation of gas system that is installed at the time of closure.

2.5 Selected Application Methods for the Buncombe County Bioreactor System

A pressure injection system that utilizes horizontal trenches and vertical wells is proposed as the primary method for adding leachate and water to the MSW. Application at the working face and surficial trenches are proposed as the secondary methods. The combined methods offer versatility in operating the bioreactor system that will provide the most complete dispersement of leachate and water throughout the landfill over a relatively short timeframe. Application at the working face will

provide the initial wetting of the waste and the horizontal injection and vertical wells systems will allow continued wetting of the waste so that the optimal moisture content may be obtained and nutrient transfer is maintained. The landfill staff will install the horizontal trenches in a phased construction sequence corresponding to the filling operation. The use of horizontal trenches at intermediate depths will avoid interference with the waste hauler traffic and the compactors. Vertical wells will be installed in areas when final grades are obtained. Surficial trenches will be used to wet areas that cannot be reached by the pressure system. As discussed in Section 4 of this report, the trenches and wells will also be used to collect landfill gas once anaerobic decomposition begins.

A combination of vertical injection wells and surficial trenches are proposed as the means of wetting the waste for the existing areas of waste in Cells 1 and 2 since it would be cost prohibitive to install horizontal trenches using directional drilling techniques. The vertical wells will be installed in clusters with varying screen depths to provide better distribution of liquid between the intermediate soil layers. The well clusters are strategically located between the trenches to maximize the amount of waste wetted.

The surficial trenches will be excavated to a depth of 10 to 15-feet below final grade in the locations shown on the plans. The surficial trench system will providing wetting of the upper layers of the existing waste whereas the vertical wells will target the lower depths.

As stated in the FPA on page 11, the liquid for the pressure injection system will come from the leachate pond which will store leachate collected from the landfill and water pumped from the French Broad River. Also stated in the FPA on page 11, leachate will be restricted in use to the internal injection system to avoid human contact. The surficial trenches and direct application methods will use groundwater pumped from the onsite well at the location shown on the drawings. A separate discharge point will also be established for the river water that can be used by the water trucks during times when water demands are high.