

**USEPA PROJECT XL
FINAL PROJECT AGREEMENT**

Leachate Recirculation/Gas Recovery (“Bioreactor”) Project

**Buncombe County Solid Waste Management Facility
Alexander, North Carolina**

September 18, 2000

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I. Introduction to the Agreement

A. Description of the Project and Its Purpose

Under this proposed XL Project, Buncombe County, North Carolina proposes to construct the necessary infrastructure and operate a combined leachate recirculation and gas recovery system (commonly referred to as a "bioreactor" system) at its Subtitle D landfill. Research has shown that there are numerous environmental benefits that can result from operating a sanitary landfill in such a manner. The primary goal of this project will be to demonstrate that leachate can be safely recirculated over an alternate liner system at a full-scale level (something that is not currently allowed under the Subtitle D landfill regulations, 40 CFR Part 258), and provide more data to substantiate the expected superior environmental and cost savings benefits. It is further hoped that data from this project can be used to support regulatory changes that will allow this type of project to be implemented at similar facilities across the country. It should be noted that, because the County will be making tremendous capital investments in facilities, it is requesting that it be allowed to expand the system to future cells assuming the project is successful and if enabling regulations are not promulgated in the meantime. This could potentially extend the term of the agreement to more than 25 years. Prior to implementation beyond cells 3, 4 and 5, the parties to the agreement will evaluate the progress to that point to determine whether or not to proceed with the remaining cells.

Buncombe County proposes an accelerated stabilization full-scale landfill pilot. The pilot would potentially encompass all 10 cells of the Buncombe County Municipal Solid Waste Management Facility. While other bioreactor studies have been conducted within this country and in Europe, many of those other bioreactor studies have been developed only at the bench scale or as pilot-scale studies which focused on a smaller, more controlled area. Buncombe County is seeking regulatory flexibility through Project XL. Project XL allows regulated entities to conduct pilot projects, within a specified scope, time, and on a site-specific basis to identify better ways to accomplish environmental benefits. The value in proposing the accelerated stabilization landfill at Buncombe is that it would provide superior environmental benefits (e.g., monitoring, gas collection, available data), in addition to cost savings to the County and the local residents.

First, one of the obvious differences between this pilot and other bioreactor landfills would be the scope of the experiment to be conducted. Buncombe proposes to conduct a large-scale (10 cell), fully controlled bioreactor landfill site. Buncombe County is the only known site to propose a full-scale pilot, in the true sense of the word. There is value in that alone. Second, the value in conducting a bioreactor pilot project at Buncombe County landfill in spite of other existing bioreactor experiments is because there are differences in the geographical context, and in State requirements for most projects. Third, another difference between the Buncombe site and others includes the proposed comparison between several existing and proposed cells on their own site. This comparison

would involve recirculating leachate and comparing Cell 1 and Cell 2 (composite liner), with Cells 3-10 (alternate, State-approved liner).

Buncombe County has developed their proposal for the bioreactor landfill based on the inclusion of all ten cells of the landfill. The infrastructure for the accelerated stabilization would require a substantial investment in the landfill of one million dollars. Buncombe County has conducted their research, has the necessary technical expertise to run such a bioreactor landfill, and is confident of the projected results. If the project were to be scaled-back to be less inclusive than the ten cells (e.g., cells 3-5), much of the cost effectiveness of the project would be lost.

Characteristics of waste streams change over time. As market preferences shift, and consumer interests change, the overall characteristics of waste going in to the landfill over time may change. By allowing a project that contemplates the life of the landfill (as opposed to a few cells) information concerning the behavior and effectiveness of bioreactors, EPA hopes to gain information about impact these types of changes have on the bioreactor.

EPA is also taking into account the long-term fiscal and physical planning necessary to optimally design and run a landfill. Viewing the whole landfill as a system, EPA has determined that this project provides an good opportunity to pilot the use of bioreactor technology over an alternative liner system. All other current safeguards and regulatory requirements that apply to bioreactors will remain in place.

Description of the Project Site:

The Buncombe County Solid Waste Management Facility was opened in September 1997. In addition to a Subtitle D landfill disposal area, the facility has a C&D landfill, a wood waste mulching facility, a convenience center for residential waste disposal and recycling, and drop-off areas for white goods and tires. The Subtitle D landfill disposal area comprises approximately 100 acres of the more than 600-acre site. The landfill has been designed with 10 separate disposal cells that will be constructed sequentially over the estimated 30-year life of the facility. Cells 1 and 2, which comprised Phase I of the landfill, were constructed with the standard Subtitle D composite liner system (i.e., two feet of clay with a permeability less than or equal to 1×10^{-7} cm/sec in combination with a 60-mil HDPE synthetic liner) as described in 40 CFR 258.40(b) and Section 1600 of the North Carolina Solid Waste Management Rules. In 1999, Cell 3 was constructed with an alternate composite liner system (18-inches of 10^{-5} cm/sec clay, a geosynthetic clay liner [GCL], and a 60-mil HDPE synthetic liner). The State of North Carolina did not allow alternate liners until 1998. The County recently bid and expects to begin construction by August, 2000 on Cells 4 and 5 which will also be constructed with the alternate liner system. This agreement is intended to potentially cover all ten cells of the landfill, with a decision point for the parties and stakeholders contingent upon a review and evaluation of data

from cells 1-5 as well as an assessment of project success every five years which will coincide with the decisions to renew the landfill's operating permits.

As noted previously, both the Federal and State regulations allow leachate recirculation over the standard composite liner system prescribed in Subtitle D, however, neither allow it over cells constructed with alternate liners. On Cell 3, the alternate liner system saved Buncombe County nearly \$400,000 as compared with the standard composite system. It is estimated that the County will save a total of \$5 million through build-out of the facility if the alternate liner system is used. Other potential cost savings from the project include:

- \$5 - \$10 million in reduced construction costs for additional landfill capacity if an increase of 20%-30% in additional waste volume can be achieved due to rapid waste decomposition during operations; and,
- \$9 million if leachate hauling and off-site treatment can be eliminated.

Maintaining the region's pristine surface water and groundwater, and clean air, are high priorities for the County's elected officials and staff. The proposed leachate recirculation and gas recovery system will serve to support these goals.

Combining leachate recirculation with gas recovery at a Subtitle D landfill has been shown at the pilot scale to provide numerous environmental benefits. Currently however, the Subtitle D regulations restrict leachate recirculation to only those landfills that have been constructed with the standard composite liner system prescribed in the regulations (i.e., two feet of clay with a permeability of not more than 10^{-7} cm/sec and a 60-mil HDPE synthetic liner). The goal of this XL Project will be to demonstrate that leachate can be safely recirculated over equivalent, alternate liner systems (which in many cases are less expensive than the conventional Subtitle D composite liner system) and thus provide the basis for future regulatory changes that will allow this superior environmental performance to be achieved at similar facilities across the country. The superior environmental benefits that Buncombe County expects to achieve with this project are:

- Rapid organic waste conversion/stabilization leading to rapid settlement, increased gas yield and capture, improved leachate quality, reduced post-closure costs, and reduction in the potential for uncontrolled releases of leachate and/or gas to contaminate the ground water or air during the post-closure phase should a containment system failure occur.
- Maximizing landfill gas capture for better and more efficient energy recovery and reduction of fugitive air emissions. Studies to determine the market and feasibility for use of the enriched gas produced during recirculation of leachate will be conducted as part of

this XL project. Reduction in air quality impacts from the facility is of primary importance since air inversions and the resulting degradation in air quality are common in the mountains.

- Increased landfill disposal capacity due to rapid settlement during the operational period that leads to more economical operations, deferred capital costs for additional landfill capacity, and delay in the siting and construction of a new facility.
- Improved leachate quality and a reduction in leachate quantity. Research has shown that leachate recirculation allows for more time for decomposition of organic contaminants; adsorption of certain inorganic contaminants into the soil/waste matrix; and, enhanced chemical reactions such as metals precipitation. All of these processes will improve the quality of the leachate that is discharged to the local publicly owned treatment works (POTW) which should reduce any strain on the facility caused by the leachate. The quantity of leachate is reduced through adsorption by the waste and soil as well as by consumption during biological activity. Because leachate from the Buncombe County facility is hauled by tanker truck to the POTW, a reduction in the amount of leachate requiring treatment will result in fewer tanker trucks on the roads creating a safer situation for nearby residents.
- Reduction in post-closure care, maintenance, and risk through rapid waste stabilization.

Therefore, to realize these superior environmental benefits as well as the cost savings discussed previously, Buncombe County is requesting that U.S. EPA and the State of North Carolina, Department of Environment and Natural Resources (NCDENR) grant site-specific regulatory flexibility from the prohibition in 40 CFR 258.28, Liquid Restrictions, which prohibits the recirculation of leachate over cells constructed with an alternative liner.

Some studies indicate that the amount of leachate generated at most landfills, even those in wet climates, will not be enough to totally saturate the waste mass thereby not achieving maximum waste decomposition. Buncombe County is requesting additional flexibility in 40 CFR 258.28 to allow the addition of supplemental liquid to the waste mass should the amount of leachate available become limiting at any time during operations. Water diverted from the neighboring French Broad River will be the only source of supplemental liquids circulated. Buncombe County requests similar flexibility from NCDENR for supplemental liquid addition if needed.

It is recognized that the addition of supplemental liquids may decrease the strength of the waste mass and, if not designed properly, decrease the stability of the landfill. Prior to adding any supplemental liquids to the facility, Buncombe County will prepare a comprehensive landfill stability analysis under recirculation conditions with supplemental liquids. Buncombe County will

submit this analysis to two of the three following university professors who are recognized as experienced in the field of geotechnical engineering in general and landfill slope stability specifically: Dr. Timothy Stark, University of Illinois; Dr. Craig Benson, University of Wisconsin, and, Dr. Robert Koerner, Drexel University. The County will incorporate comments from these professors into a final stability analysis for their final review. The County will forward the analysis along with letters from the reviewing professors stating that the landfill should remain stable under the operating plan developed by the County, to the USEPA and the State of North Carolina for concurrence prior to adding any supplemental liquids. Should two of the professors mentioned above be unable to conduct the review, the County will suggest an alternate that is acceptable to USEPA and the State.

Finally, Buncombe County intends to continue to recirculate leachate consistent with this agreement and in compliance with all applicable regulations throughout the landfill as long as gas generation data shows that biological activity continues and leachate flow and quality data show that improvements in leachate quality and reductions in quantity are occurring. It is expected that this will occur long after each cell has reached its permitted final grade. As long as these processes are ongoing, it is expected that waste decomposition and the resulting settlement will continue to occur. As mentioned above, one of the superior environmental benefits expected from this project is the additional airspace for waste disposal made available by more rapid waste settlement.

B. Description of the Facility and Facility Operations/Community/Geographic Area

The Buncombe County Solid Waste Management Facility (BCSWMF) is an existing Subtitle D landfill permitted by NCDENR, Solid Waste Section. The 600+ acre facility is located in northern Buncombe County about two miles from the Madison County line. NC 251 borders the facility to the south and west. Access to the site is from the northwest off of Panther Branch Road (SR 1745). A prominent physical feature of the facility is the French Broad River that borders the site to the south and west. The BCSWMF accepts non-hazardous municipal solid waste generated within the County for disposal in the Subtitle D landfill portion of the site. Construction and demolition waste is accepted and disposed of in an approved construction and demolition debris landfill also located on the site. Tires and white goods are accepted as well and they are processed prior to being shipped off-site for recycling and/or disposal. Wood and yard wastes are processed into mulch and sold to the public. Common household recyclables are also collected at the facility.

Since opening in September 1997, the Buncombe County Solid Waste Management Facility has received several prestigious awards including:

- 1998 Honors Award for Engineering Excellence from the North Carolina Consulting Engineers Council.

- 1999 Gold Award for Outstanding Integrated Solid Waste Management Program from the North Carolina Chapter of the Solid Waste Association of North America (NC SWANA)
- 1999 Bronze Award for Excellence in Solid Waste Management in North America, Landfill Category, from the Solid Waste Association of North America (SWANA).
- 2000 Award for Outstanding County Program from the North Carolina Association of County Commissioners for its Hazardous Waste Handling, Reduction, and Education Program.

The Subtitle D landfill portion of the BCSWMF comprises 100 acres. The site has been segregated into 10 distinct cells of varying size depending on topography. Cells 1 and 2, which combined are approximately 14 acres in size, were constructed as part of the initial facility construction. Both of these cells were constructed with the standard Subtitle D composite liner system. Two feet of crushed stone was used to construct the protective cover/leachate collection and drainage system. The synthetic liner is protected against abrasion and puncture from the stone and waste by a 28-oz. fabric cushion. Leachate is drained to a sump area located in each of the ten cells and then pumped to an on-site lined, leachate storage lagoon with 1.5 million gallons of capacity. Leachate is currently hauled approximately seven miles by tanker truck to a wastewater treatment plant owned and operated by the Metropolitan Sewerage District of Buncombe County (MSD).

The majority of ground water underlying the BCSWMF lies within a fractured bedrock aquifer system. Depth to ground water varies considerably across the site ranging from about five feet in the low lying areas to as much as 200 feet along the ridge lines. Because of the complexity of the ground water flow regime, it was decided during permitting that a standard perimeter network of ground water monitoring wells would need to be supplemented by an additional monitoring system. The alternative monitoring system agreed upon consists of a synthetically lined collection area located three feet below the bottom of the composite liner system. The lined area mirrors the bottom grades of each cell. The extent of the liner was determined by the wetted perimeter in the cell under precipitation from the 100-year storm. Any water collected in the alternative monitoring system drains to a sump and then out of the landfill through a sealed pipe. Samples are taken from the pipe during each semi-annual ground water monitoring event. There are currently nine ground water monitoring wells located around the perimeter of the site. Additional wells will be added as the Subtitle D portion of the site is expanded.

The BCSWMF is located in a rural part of Buncombe County. Surrounding land uses within one mile of the site are predominantly rural residential with some small agricultural activities. In 1992,

