EPA PROJECT XL
Final Project Agreement for the Yolo County Accelerated Anaerobic & Aerobic Composting (Bioreactor) Project

Submitted by:

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I. Introduction to the Agreement

A. Description of the Project and Its Purpose

The County of Yolo Planning and Public Works Department (Yolo County), proposes to operate its next 20-acre landfill module near Davis, California as a controlled bioreactor landfill to attain a number of superior environmental and cost savings benefits. Co-sponsors of the project with Yolo County are the Solid Waste Association of North America (SWANA) and Institute for Environmental Management (IEM, Inc.). As part of this proposal, Yolo County is requesting that U.S. EPA grant site-specific regulatory flexibility from the prohibition in 40 CFR 258.28 Liquid Restrictions, which may preclude addition of useful bulk or non-containerized liquid amendments. The County is proposing to supplement the liquid addition with ground water, but would like to obtain the flexibility to possibly utilize other liquids such as gray-water from waste water treatment plant, septic waste, gray water, and food-processing wastes that is currently land applied. Liquid wastes such as these normally have no beneficial use, may instead beneficially enhance the biodegradation of solid waste in a landfill for this project.

Yolo County also requests similar flexibility on liquid amendments from California and local regulatory entities. Several sections of the California Code of Regulations (CCR), Title 27, Environmental Protection, address the recirculation of liquids in lined municipal waste landfills. While the regulations do not specifically endorse bioreactors like the regulations in the State of Washington, regulatory flexibility is provided. This portion of the agreement will describe specific regulations in Title 27 regarding recirculation.

Title 27, Chapter 3, Subchapter 2, Article 2, Section 20200, Part (d)(3), *Management of liquids at Landfills and Waste Piles* states the following:

"Liquid or semi-solid waste (i. e. waste containing less than 50% solids, by weight), other than dewatered sewage or water treatment sludge as described in § 20220 (c), shall not be discharged to Class III landfills. Exceptions may be granted by the RWQCB if the discharger can demonstrate that such discharge will not exceed the moisture holding capacity of the waste either initially, or as the result of waste management operations, compaction, or settlement, so long as such discharge is not otherwise prohibited by applicable state or federal requirements".

The above regulation specifically allows the Regional Water Quality Control Board, Central Valley Region (RWQCB) the ability to grant an exception regarding the discharge of liquids into a Class III landfill providing the moisture holding capacity is not exceeded. The previous demonstration project at the Yolo County Central Landfill provided a working demonstration as to the feasibility of the proposed bioreactor project. Through monitoring, instrumentation, and testing, it was demonstrated that liquid could be added in such a way that the holding capacity of the refuse is not exceeded. The same equipment and procedures will be utilized for the Module D bioreactor. Specific sections of this agreement details regarding the method of liquid recirculation.

It should be noted that the preceding Part in the regulations (Section 20200, Part (d)(2) addresses the discharge of waste containing free liquids and does not apply to this application. The County is not proposing to discharge wastes containing free liquids, but is instead proposing to add liquids or semi-solid waste to the refuse already in-place. While the regulations state that wastes containing free liquids must be discharged to a Class II waste pile, the addition of liquids to existing waste in a Class III landfill is allowed by the regulations if an exception is granted by the RWQCB.

Title 27, Chapter 3, Subchapter 2, Article 4, Section 20340, Part (g)(1,2,3), *Leachate Collection and Removal Systems* states the following:

"Leachate Handling – Except as otherwise provided under SWRCB Resolution No. 93-62 (for MSW landfills subject to 40CFR258.28), collected leachate shall be returned to the Unit(s) from which it came or discharged in another manner approved by the RWQCB. Collected leachate can be discharged to a different Unit only if:

1. *the receiving Unit has an LCRS, contains wastes which are similar in classification and characteristics to those in the Unit(s) from which leachate was extracted, and has at least the same classification (under Article 3 of this subchapter) as the Unit(s) from which leachate was extracted;*
2. *the discharge to a different Unit is approved by the RWQCB;*
3. *the discharge of leachate to a different Unit shall not exceed the moisture-holding capacity of the receiving unit, and shall comply with § 20200 (d)."*

The above section of Title 27 specifically allows the RWQCB to approve the discharge of leachate from other Units within a landfill to a receiving Unit as long as the wastes have similar classification and characteristics, the receiving Unit has an Leachate Collection and Removal System (LCRS), and the moisture-holding capacity of the refuse is not exceeded. These conditions are satisfied in that the wastes are similar throughout the landfill and Module D has a LCRS. Based on satisfying all of the conditions listed in the above regulatory requirement, the County is seeking approval from the RWQCB to discharge leachate generated from other Units within the Yolo County Central Landfill into Module D.

Title 27, Chapter 3, Subchapter 2, Article 5, Section 20937, Part (b)(4), *CIWMB – Control* states the following:

"A gas control system shall be designed to: Provide for the collection and treatment and/or disposal of landfill gas condensate produced at the surface. Condensate generated from gas control systems shall not be recirculated into the landfill unless analysis of the condensate demonstrates to the satisfaction of the EA, that it is acceptable to allow recirculation into landfills which have a liner and an operational leachate collection system and the RWQCB approves such discharge pursuant to § 20200 (d)."

Based on the design and operation of the Module D bioreactor, the LCRS and liner system are in place to allow for the recirculation of gas condensate. The County has submitted the analysis of constituents within the gas condensate in the site monitoring reports. Based on these factors, the County is seeking approval from the RWQCB to recirculate the condensate.

In reviewing the regulations regarding the recirculation of leachate and gas condensate, it appears that the County has satisfied all criteria enabling the RWQCB to grant approval for leachate/condensate recirculation in Module D. However, as previously discussed, the refuse deposited at the Yolo County Central Landfill is relatively dry. In order to have proper operation of a landfill bioreactor, the waste must attain its moisture holding capacity. This moisture level can not be reached with the addition of leachate and condensate alone. Such flexibility is justified based on composting performance, available controls, and multiple environmental safeguards that have already been demonstrated in the smaller-scale 9000-ton test program at the Yolo County Central Landfill.

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

The Yolo County Central Landfill (YCCL) is an existing Class III non-hazardous municipal landfill with two Class II surface impoundments for disposal of selected non-hazardous liquid wastes. This site encompasses 722 acres and is owned and operated by Yolo County. It is located at the intersection of Road 104 and Road 28H, 2 miles northeast of the City of Davis. The YCCL was opened in 1975 for the disposal of non-hazardous solid waste, construction debris, and non-hazardous liquid waste. Existing on-site operations include an eleven-year old landfill methane gas recovery and energy generation facility, a drop-off area for recyclables, a metal recovery facility, wood and yard waste recovery and processing area, and concrete recycling area.

Adjacent land uses include a wastewater disposal area (spray irrigation fields) operated by Hunt-Wesson west of the site until December 1999, and the City of Davis Wastewater Treatment Plant lagoons located immediately east and south of the landfill, which will be continuing in operation. The Willow Slough By-pass runs parallel to the southern boundary of the site. The remainder of land uses adjacent to the site are agricultural (row crops).

There are approximately 28 residences scattered within a 2-mile radius of the landfill. The closest residence is located 1,600 feet south of the landfill and city treatment plant lagoons, on the West Side of Road 105 south of the Willow Slough By-pass.

Groundwater levels at the facility fluctuate 8 to 10 feet during the year, rising from lowest in September to highest around March. Water level data indicate that the water level table is typically 4 to 10 feet below ground surface during winter and spring months. During summer and fall months, the water table is typically 5 to 15 feet below ground surface. In January 1989, the County of Yolo constructed a soil/bentonite slurry cutoff wall to retard groundwater flow to the landfill site from the north. The cutoff wall was constructed along portions of the northern and western boundaries of the site to a maximum depth of 44 feet and has a total length of 3,680 feet, 2,880 feet along the north side and 800 feet along the west. In the fall of 1990, irrigation practices to the north of the landfill site were altered to minimize the infiltration of water.

Additionally, sixteen groundwater extraction wells were also installed south of the cutoff wall in order to lower the water table south and east of the wall. The purpose was to depress the water table to provide vertical separation between the base of the landfill and groundwater.

Prior to placement of the slurry wall and dewatering system, the groundwater flow direction was generally to the southeast. Under current dewatering conditions, the apparent groundwater flow paths are towards the extraction wells located along the western portion of the northern site boundary. In essence, a capture zone is created by the cone of depression created by the ground water extraction system, minimizing the possibility of off-site migration of contamination.

C. Purpose of the Agreement

This Final Project Agreement (" the Agreement") is a joint statement of the plans, intentions and commitments of the U.S. Environmental Protection Agency ("EPA"), the state of California, and

Yolo County to carry out this project approved for implementation at the county's solid waste landfill site in Davis, California. This Project will be part of EPA's Project XL program to develop innovative approaches to environmental protection.

The Agreement does not create legal rights or obligations and is not an enforceable contract or a regulatory action such as a permit or a rule. This applies to both the substantive and the procedural provisions of this Agreement. While the parties to the Agreement fully intend to follow these procedures, they are not legally obligated to do so. For more detail, please refer to Section VI (Legal Basis for the Agreement).

Federal and State flexibility and enforceable commitments described in this Agreement will be implemented and become effective through a legal implementing mechanism such as a rule modification or permit.

All parties to this Agreement will strive for a high level of cooperation, communication, and coordination to assure successful, effective, and efficient implementation of the Agreement and the Project.

D. List of the Parties that Will Sign the Agreement

The Parties to this Final Project XL Agreement are the United States Environmental Protection Agency (EPA), County of Yolo Planning and Public Works Department, and the State of California.

E. List of the Project Contacts

County of Yolo, Planning and Public Works Department
U. S. Environmental Protection Agency
Solid Waste Association of North America (SWANA)
Institute for Environmental Management (IEM)
National Energy Technology Laboratory (NETL, previously FETC), U. S. Department of Energy
California State Regional Water Quality Control Board, Central Valley Region 5
California Integrated Waste Management Board
Yolo County Department of Environmental Health
Yolo-Solano Air Quality Management District

II. Detailed Description of the Project

A. Summary of the Project

Sanitary landfilling is the dominant method of solid waste disposal in the United States, accounting for about 217 million tons of waste annually (U.S. EPA, 1997). The annual production of municipal solid waste in the United States has more than doubled since 1960. In spite of increasing rates of reuse and recycling, population and economic growth will continue to render landfilling as an important and necessary component of solid waste management.

In a Bioreactor Landfill, controlled quantities of liquid are added, and circulated through waste as appropriate, to accelerate the natural biodegradation and composting of solid and liquid waste components. This process significantly increases the biodegradation rate of waste and thus decreases the waste stabilization and composting time (5 to 10 years) relative to what would occur within a conventional landfill (30 years, to 50 years or more). If the waste decomposes (i. e., is composted) in the absence of oxygen (anaerobically), it produces landfill gas (biogas). Biogas is primarily a mixture of methane, a potent greenhouse gas, carbon dioxide, and VOC's, which are local air pollutants. Methane is also a fuel. This by-product of landfill waste decomposition (composting) can be a substantial renewable energy resource that can be recovered for electricity or other uses. Other benefits of a Bioreactor Landfill composting operation include increased landfill waste settlement and therefore increase in landfill capacity and life, improved opportunities for treatment of leachate liquid that may drain from fractions of the waste, possible–reduction of landfill post-closure efforts required, landfill mining, and abatement of greenhouse gases through highly efficient methane capture over a much shorter period of time than is typical of waste management through conventional landfilling.

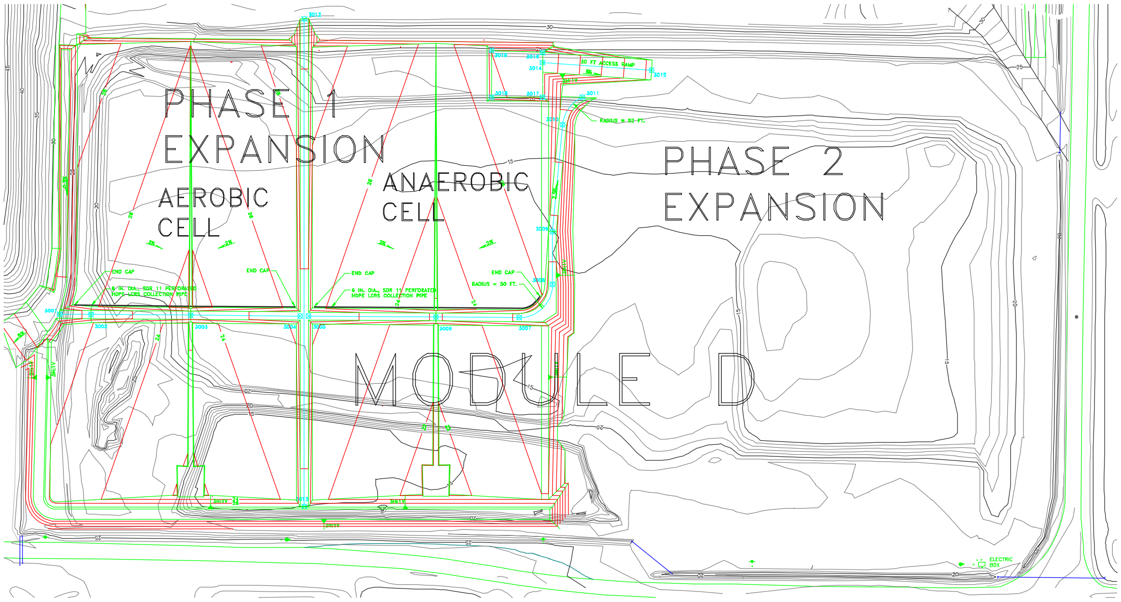
B. Specific project elements

Yolo County proposes to operate its next full-scale 20-acre landfill module as both anaerobic and aerobic bioreactor. In the first phase one of this project, 12-acres of the 20-acre module has been constructed. Two 3 to 6-acre modules will be used as part of the landfill bioreactor module. One 3 to 6-acre module will be operated anaerobically and the other 3 to 6-acre aerobically. Depending on the available funds for this full-scale demonstration project the size of each module may be reduced. The anaerobic and aerobic design and operations are summarized below:

DESIGN AND OPERATIONS OF PROPOSED MODULE D BIOREACTOR

The bottom liner system was designed to exceed the requirements of Title 27 of CCR and Subtitle D of the Federal guidelines and was upgraded from other liner systems used previously at the site. The County believes that given the constructed configuration discussed herein and the stringent monitoring and operational requirements proposed for Module D, the proposed liner system will be suitable for use in the bioreactor operations.

Figure 1- Module D Expansion, Phase 1 & 2

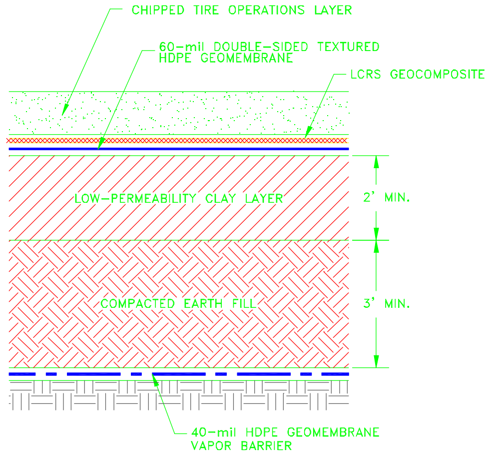


Under current plans, the first phase of Module D will be further subdivided into two independent bioreactor systems the aerobic system and the anaerobic system. Module D was designed and constructed in a ridge and swale configuration to optimize landfill space and to maintain good drainage for the collection system. The blanket drainage layer slopes at 2% inward to two central collection v-notch trenches. Each of the trenches drain at 1% to their prospective leachate collection sumps located at the south side of the module. This grading configuration is an upgrade from previous designs at the site because it is steeper, thus, maintaining better drainage throughout its design life. Phase 2 of Module D will also be constructed in a similar manner with two additional collection trenches and sumps.

Liner and Leachate Collection and Removal System (LCRS) Components

The prescriptive liner for Class III landfills consists, from top to bottom, of an operations/drainage layer capable of maintaining less than one foot of head over the liner, a 60-mil high density polyethylene (HDPE) liner, and 2 feet of compacted clay (k< 1 x 10^{-7} cm/sec).

Figure 2- Module D Bottom Liner Cross-section



The Module D liner and leachate collection system consists, from top to bottom, of a 2 foot thick chipped tire operations/drainage layer (k> 1 cm/sec), a blanket geocomposite drainage layer, a 60-mil HDPE liner, 2 feet of compacted clay (k<6 x 10^{-9} cm/sec), 3 feet of compacted earth fill (k< 1 x 10^{-8} cm/sec), and a 40 mil HDPE vapor barrier layer[1] (see Figure 2). The chipped tire operations layer was not placed during construction but will be placed immediately before waste placement, which is scheduled for spring of the year 2000.

As shown, the permeability of the clay liner, as constructed, was on the average about 6 x 10^{-9} cm/sec and the earth fill averaged about 1 x 10^{-8} cm/s. These two layers in effect provide a 5 foot thick composite liner. This fact, coupled with the lower permeability, will result in a significantly more effective barrier to leachate migration than the prescriptive liner system.

The liner system within the collection trenches and sump areas was upgraded further to a double composite liner to account for infringement on the 5 foot groundwater offset and to minimize potential leakage in these critical collection areas where head on the primary liner will be at its greatest. The liner and leachate collection system in the collection trenches and sumps consists from top to bottom of a minimum of 2 feet of gravel drainage material, a protective geotextile, a blanket geocomposite drainage layer, a primary 60-mil HDPE liner, a geosynthetic clay liner (GCL) (k< 5 x 10^{-9} cm/sec), a secondary 60-mil HDPE liner, 2 feet of compacted clay (k< 6 x 10^{-9} cm/sec), a minimum of 0.5 feet of compacted earth fill (k< 1 x 10^{-8} cm/sec), and a 40-mil HDPE vapor barrier layer (see Figure 3). The thickness of the compacted earth fill actually varies from a minimum at the south end of the trench of 0.5 feet to a maximum of about 2.5 feet at the upper, north end of the leachate collection trench. Leachate collection pipes were also placed in the collection trench and at other locations on top of the primary liner to transport leachate immediately to the sumps for recovery, removal, and recirculation, as needed.

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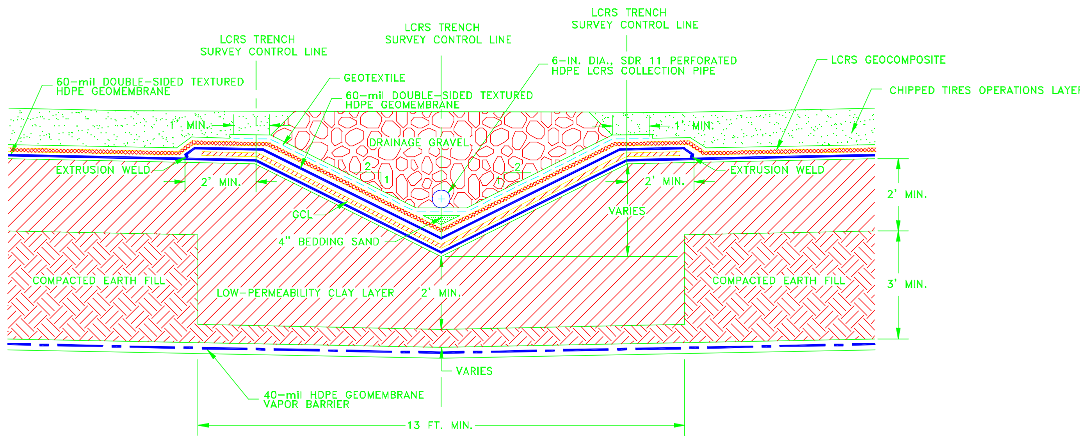
[1] Golder Associates, "Final Report, Construction Quality Assurance, Yolo County Central Landfill, WMU 6, Module D, Phase 1 Expansion", December 1999.

Figure 3- Module D Bottom Liner and Leachate Collection Trench Cross-Section



LCRS and Liner Performance

As described above, the more rigorous Module D LCRS and liner system will outperform the Title 27 and Subtitle D prescriptive liner. The leachate collection and recovery system (LCRS) has been designed and constructed to be free-draining throughout the life of the module and will maintain less head over the primary liner system than prescribed by Title 27 and Subtitle D.

The LCRS system has been constructed with a geocomposite layer, which has over 10 times the required capacity and will maintain the head over the liner system to less than 0.3 inches during liquid application periods. In addition, the chipped tire layer will provide a level of redundancy in the event that the geocomposite becomes clogged or otherwise nonfunctional. The tire chips alone will maintain less than 4 inches of head over the primary liner. These issues are discussed in more detail in the following paragraphs.

For the anaerobic operation, it is estimated that the peak liquid addition, up to 10 gallons per minute (gpm) of liquid per 10,000 square feet (44 gpm per acre) of disposal area will be typically delivered to the waste once the module has reached its design height. Based on the demonstration cell performance the amount of liquid added would be in the range of 30 to 50 gallons per ton of waste. According to results of the bioreactor demonstration project by Moore et al[2], the average leachate generated during liquid introduction peaked at about 47% of the liquid delivery rate, which would equate to approximately 20 gpm per acre for the proposed program. Given a 6-acre drainage area, the total anticipated flow into any given sump would be approximately 120 gpm (173,000 gallons per day).

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[2] Moore et al, "Hydraulic Characteristics of Municipal Solid Waste Findings of the Yolo County Bioreactor Landfill Project.", Thirteenth International Conference on Solid Waste Technology and Management, Philadelphia, PA, November 1997.

For the aerobic operation, liquid will be added to waste at a faster rate since the aerobic reaction uses much of the water in the evaporation of liquid added. It is estimated that the range of water used will be 200 to 400 gallon of water per ton of waste.

Based on the estimated leachate production, drainage into the leachate collection layer will be about 4.6×10^{-4} gpm per square foot of disposal area. It is approximately 200 feet between the ridge and collection trench. Using these values, the peak flow through the geocomposite will be about 0.09 gpm per linear foot of trench. The geocomposite for Module D has a measured capacity of 1.0 gpm per foot[3]. Therefore, the geocomposite has over 10 times capacity required under peak conditions.

The flow rate provided assumes that depth of the water over the liner does not exceed the compressed thickness of the geocomposite. The geocomposite has an uncompressed thickness of approximately 0.3 inches. When compressed, the geocomposite will be somewhat less than this value; therefore, the water level or head over the main portion of the liner will be less than this value.

Although clogging of the geocomposite layer is not anticipated, the LCRS has been designed under the conservative assumption that clogging may occur. In the event that the geocomposite were to become clogged or otherwise nonfunctional, the proposed chipped tire operations layer will also provide adequate drainage. Due to the large particle size of the chipped tires (>6 inches), the permeability of the tire layer is estimated to be greater than 1.0 cm/sec. Given this value, it has a flow rate capacity on the order of 0.025 gpm per inch of thickness per one foot width. Therefore, at the calculated maximum inflow rate of 0.09 gpm per foot width, the head over the liner would not exceed 4 inches. Typically, collection systems are designed to maintain less than one foot of head over the liner. Therefore, this system has over three times the required flow capacity at the allowable prescriptive level of one foot.

In addition to the upgraded LCRS, the primary composite liner is better than the Title 27 prescriptive system. This is based on the reduced permeability (k) of the clay soil used during construction of the module. The permeability of the clay soil used in construction of the Module D liner is significantly lower than the prescriptive 1×10^{-7} cm/sec. Based on the results of the laboratory testing performed during construction of Module D, the clay liner has an average permeability on the order of 6×10^{-9} cm/sec. Using standard leakage rate analyses by Giroud and Bonaparte[4], the leakage from the Title 27 system (with one foot of head over a HDPE geomembrane and 1×10^{-7} cm/sec clay liner) would be 1×10^{-4} gpm from a standard 1 cm^2 hole in the liner. With the Module D liner (4 inches of head over a HDPE geomembrane and 6×10^{-9} cm/sec clay liner), the leakage would be 5×10^{-6} gpm; less than 1/20 of the flow.

In the event that leakage were to occur through the 5-foot thick primary composite liner, the vapor barrier would provide secondary containment. Secondary containment is not required by Title 27 or Subtitle D. As constructed, the vapor barrier will minimize further downward migration and aid in detection of migrating leachate. The 40-mil HDPE vapor barrier was

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[3] Golder Associates, "Final Report, Construction Quality Assurance, Yolo County Central Landfill, WMU 6, Module D, Phase 1 Expansion", December 1999.
[4] Giroud, J.P. and Bonaparte, R., "Leakage Through Liners Constructed With Geomembranes – Part I. Geomembrane Liners." Geotextile and Geomembranes, Eslvier Science Publishers Ltd., England, 1989.

sloped to mirror the primary liner. Geocomposite strip drains were also installed diagonally across the top of the vapor barrier to act as drainage pathways to the pan lysimeter located immediately beneath each of the leachate collection sumps. The strip drains and lysimeter will act as a vadose zone monitoring system for early detection of leakage across the entire Module D disposal area. This added feature provides another level of protection to the groundwater that standard Title 27 systems do not have.

Specialized Design Considerations During Operation

Liquid will be applied during strategic periods to temporarily raise the moisture content of the waste to provide optimum conditions for rapid degradation and improved gas production. This liquid will initially consist of a mixture of leachate and condensate from other WMUs and ground water delivered through a series of pipes and drip irrigation or other application system either after the landfill reaches its design height or after an interim cover and gas collection system has been constructed to control landfill gas generated. The typical chemical composition of potential liquid amendments are listed below in Table 1. The water will continually be introduced (as needed) to raise the moisture content within the waste to near its field capacity (estimated to be about 50% by dry weight). The liquid application system will be constructed such that solution can be applied or discontinued at designated locations to raise and lower the moisture within the waste.

Moisture content will be monitored throughout the life of the module through the use of a network of moisture sensors to be installed during waste placement. The moisture sensor system used during the bioreactor demonstration project in Module B proved to be very effective and will be the basis for the layout in Module D. At this time, the moisture sensors are planned to be installed at 20-foot increments of depth at a spacing of about 100 feet on center. Using these sensors, the County can determine where liquid application can be increased or decreased to optimize the effectiveness of the system and to prevent build-up of head over the liner.

The quantity of leachate and applied liquid will be measured throughout the life of the module. Once leachate is produced, it will supplement the system and be re-circulated; thereby, reducing the amount of clean water used. Liquid will be quantified using flow sensors installed on the leachate discharge line, re-circulation line, and liquid application line. These sensors will provide direct flow readout for determining flow rates in the pipelines and flow totalizing to quantify all of the liquid used and leachate produced.

Table 1- Typical Chemical Composition of Potential Liquid Amendments

Inorganics and Metals	Leachate & Condensate	Groundwater
Potassium (mg/L)	69.3	2.7
Nitrate/Nitrite as Nitrogen (mg/L)	<0.05	3.9
Chloride (mg/L)	785	427
Sulfate (mg/L)	190	278
Total Alkalinity as $CaCO_3$ (mg/L)	1920	950
Temperature	20.9	18.6
pH	7.10	8.26
Electrical Conductivity	5370	2070

Dissolved Oxygen (mg/L)	3.21	8.61
Bicarbonate (mg/L)	2340	628
Total Dissolved Solids (mg/L)	3365	1233
Ammonia (mg/L)	17	0.02
Total Kjeldahl Nitrogen (mg/L)	140	0.19
Cobalt (μg/L)	<50	<3.2
Copper (μg/L)	<2.1	<4.9
Iron (μg/L)	4950	<14
Manganese (μg/L)	1175	9.4
Nickel (μg/L)	77	20.1
Vanadium (μg/L)	20	8.3
Zinc (μg/L)	323	10.8

Due to the critical nature of this project, the head over the liner will also be monitored after waste placement using a network of pressure transducers. These devices will installed on the primary liner, immediately before waste placement, to provide measurements of the leachate depth. Several of these transducers were installed in the LCRS during the Module D construction.

In the event that the transducers indicate that the head is going to exceed the allowable value, the system will automatically start pumps to reduce the liquid level and shot-off valves to reduce the liquid application rate. These measures would include but not be limited to reducing the liquid application rate across the entire module or specifically, in the area of head build-up. Generally, application of the liquid will only be continued until the gas generation phase of the unit is complete at which time leachate production is anticipated to continually decrease until conclusion of the post-closure period. The quality of the leachate will also be closely monitored to evaluate the system, determine the methods for future leachate treatment, and provide a basis for future use of similar bioreactors at the site or elsewhere.

In addition to liquid delivery to the waste, air will be delivered to the aerobic half of the bioreactor disposal area. This will "in effect" dry out the waste mass. Since the decomposition of the waste and gas generation is also dependent on keeping it moist, the liquid addition will be increased to accommodate any drying effects. However, the leachate generated within the aerobic bioreactor LCRS is not anticipated to increase significantly compared to the anaerobic area.

The degradation and gas production of the waste is also related to the temperature within the decomposing waste. The effectiveness of both aerobic and anaerobic bioreactors is dependent on keeping within optimum temperatures; therefore, temperature gauges will also be installed to aid in operation of the system. As with the moisture sensors, temperature gauges were also placed in the waste of the demonstration bioreactor and proved to be very effective. The temperature gauge network will be placed in a similar pattern to the moisture sensors at designated intervals throughout the waste mass.

In the aerobic half, during filling, horizontal gas conduits will be installed in similar manner to those of the anaerobic bioreactor. However conduit spacing may be closer. After filling, chipped tires and conduits will be used to pull or push atmospheric air through the waste under a impermeable cover. It is expected that this will increase the rate of degradation but inhibit methane formation.

As with the aerobic half, horizontal gas wells will also be incorporated in the waste as filling proceeds in the anaerobic area. Waste will be placed at 10 feet high lifts. The gas well spacing will be 50 feet on center or closer. Gas will also be extracted from the base LCRS layer via the conduit collection pipe as filling proceeds. The purpose of this extraction is to lower methane emissions that would normally occur to the atmosphere during filling.

Separation of the two bioreactor systems will be performed using a low permeability isolation layer that is advanced as waste is placed. This layer may include but would not be limited to a compacted clay berm, a clay filled trench, or geomembrane. Final selection will be based on its ability to appropriately isolate each area, ability to accommodate settlement, ease of installation, and cost.

Daily cover operations will be performed in a similar fashion to the methods currently employed at the landfill. This includes the use of alternative daily covers such as greenwaste and tarps. Final cover will consist of a gas collection layer of constructed using chipped tires and piping. The liquid injection system will also be placed on this layer to allow continued delivery of liquid to the waste. This layer will be overlain with a flexible geomembrane cover to control moisture conditions, control gas emissions, and satisfy regulatory requirements to control vectors, fires, odors, blowing litter, and scavenging.

As areas of the module reach their design grade, monuments will be installed to monitor settlement caused by degradation of the waste. These monuments will be checked at a higher (quarterly) at first and less often (biannually) as the rate of settlement begins to slow. Annual aerial topographic surveys will also be performed to aid in the evaluation of settlement and the effectiveness of the bioreactor system.

With all of these operational systems in place, the performance of the bioreactor and effectiveness of the LCRS and gas collection system can be thoroughly monitored. These operational systems far exceed the requirements of Title 27 and Subtitle D; thus, providing another basis for allowance of the Module D bioreactor project.

The instrumentation and monitoring frequency of the bioreactor project are listed in Table 2 and Table 3 respectively.

Table 2- Instrumentation Type and Location for the Bioreactor Project

Type of Instrumentation	Location	Description
Pressure transducers	Above primary liner and leachate collection system in both the aerobic and anaerobic landfill cells	A series of pressure transducers will be installed on top of the primary liner in the LCRS trench in both the aerobic and anaerobic landfill cells to measure the head or depth of leachate above the liner. Total of eight pressure

		transducers will be installed, four in each cell at 200 feet spacing. A gas pressure transducer in each cell will be used to correct the liquid head for gas pressure.
Moisture and Temperature Sensors	Sensors will be placed on top of the primary liner and within the waste mass at three different depths at 20 feet intervals.	A series of moisture and temperature sensors will be installed within the waste mass to monitor the biological activity of each cell. Instrumentation will be installed directly on top of the bottom primary liner and at three different depths within the waste mass at an interval of 20 feet.
Gas Composition, Gas Pressure, and Gas Flowmeter	Gas extraction and collection pipelines	Chipped tire as part of the gas collection system will be installed at every lift to either collect landfill gas or inject air in the landfill. Pipes will be installed in each lift after placement of waste and chipped tires. Gas will be sampled from either the main collection pipe or each individual lift of waste to determine gas composition or measure gas pressure. The gas pressure and composition will be measured manually. Gas flow measurement will be continuos and automated.
Leachate Flow Measurement	Outflow and inflow from each cell is measured at each sump and at the injection manifold.	The quality of leachate added or collected from the LCRS is measured by flowmeters from each cell. The volumes of liquids are monitored from each cell continuously through a data collection system.

Table 3- Monitoring Parameters and Frequency for the Bioreactor Project

Monitoring Parameter	**Frequency**	**Description**
Leachate: • PH • Conductivity • Dissolved Oxygen • Dissolved Solids • Biochemical Oxygen Demand • Chemical Oxygen Demand • Organic Carbon • Nutrients(NH_3, TKN, TP) • Common Ions • Heavy Metals • Organic Priority Pollutants	 • Weekly • Weekly • Monthly, Quarterly • Monthly, Quarterly • Monthly, Quarterly • Monthly, Quarterly • Monthly, Quarterly • Monthly, Quarterly • Monthly, Quarterly • Monthly, Quarterly • Monthly, Quarterly	Leachate samples will be collected from each cell (aerobic or anaerobic) sump and tested. For the first six months tests will be done monthly and the next six months will be done quarterly. After the first year test will be done on semi-annually. The frequency of testing will also depend on the level of funding available.
Landfill Gas: • CH_4, CO_2, O_2, and N_2 • NMOCs • N_2O	 • Weekly • Semi-annually • Semi-annually	Landfill gas will be tested routinely from both the aerobic and anaerobic cell. Semi-annually other gas emissions will be measured by using either an integrated combustible gas surface scan test or a flux box test.
Solid Waste Stabilization and decomposition: • Volume of Gas Generation • Landfill surface topographic survey • Moisture Content • Biochemical Methane Potential • Cellulose • Lignin • Hemi-cellulose • Volume of gas	 • Hourly • Annually • Annually • Annually • Annually • Annually • Annually	In the anaerobic cell the total volume of CH_4 and CO_2 will be measured continuously to determine the degree of solid waste stabilization. In the aerobic cell the volume of CO_2 and N_2 will also be measured continuously to establish degree of solid waste stabilization. Another means to measure the degree of decomposition will be to conduct a topographic survey of the two cells to determine the total percent change in volume over time. Annual topographic survey will be done on the top surface of each cell. If funding available solid waste samples may be collected to determine the degree of stabilization. Samples of waste may also be tested for heavy metals and organic pollutants.

<u>The full-scale Yolo County Bioreactor project will combine two key elements:</u>

a) Acceleration of waste decomposition and leachate treatment, via liquid amendments and recirculation through pipe network serving the waste mass. This is to accomplish rapid completion of composting, stabilization and generation of methane to the maximum practical yield.

b) Efficient capture of nearly all generated methane, withdrawn at slight vacuum from a freely gas-permeable shred tire collection layer beneath low-permeability cover. The shred tire collection layer has gas permeability from 3 to 5 orders of magnitude higher than overlying cover. Near-complete extraction with this approach has already been demonstrated in the 9000-ton test cell at the Yolo County Bioreactor Demonstration Project.

The planned anaerobic cell proposes larger-scale replication of the 9000-ton anaerobic controlled bioreactor landfill demonstration at Yolo. This demonstration has now operated for over three years. Some of the data from the demonstration project are summarized below:

(a) Enhanced methane/ gas recovery (an index of anaerobic composting) at a rate about tenfold that normally seen with conventional landfill practice. Based on the collected data to date, the anaerobic bioreactor stabilization may be reduced by severalfold, possibly to less than 1/5 of the conventional landfilling. Table 4 below summarizes some of the landfill gas data for the enhanced and control cell.

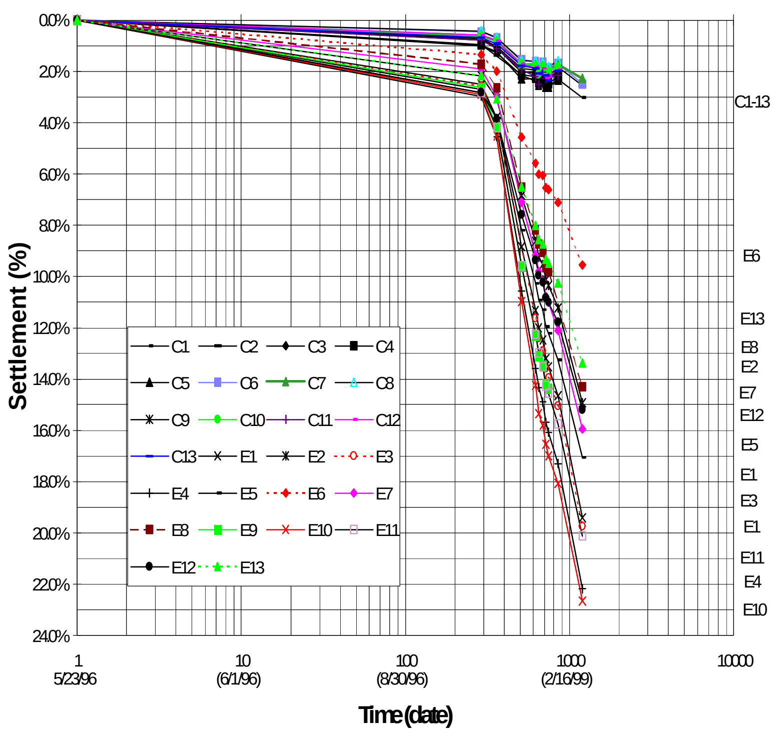
Table 4- Landfill Gas Data for the 9000-ton Bioreactor Demonstration Project

YEAR	1997	1998	1999-May
ENHANCED CELL LFG VOLUME (Million SCF)	12.2	24.8	30.7
CONTROL CELL LFG VOLUME (Million SCF)	9	14.9	15.2
ENHANCED CELL AVERAGE FLOWRATE (SCFM)	35	22	7
CONTROL CELL AVERAGE FLOWRATE (SCFM)	22	5	1
ENHANCED CELL AVERAGE METHANE CONTENT	53%	54%	53%
CONTROL CELL AVERAGE METHANE CONTENT	47%	45%	47%

(b) Reduction to close to zero of fugitive landfill methane and VOC emissions with the chosen collection means. Collection is by extraction from a freely gas-permeable surface layer, kept at slight vacuum, overlying the waste and beneath a very low-permeability surface cover. This approach allows recovery of all gas generated beneath the permeable layer, hence nearly all the gas generated by the waste.

(b) With the same collection approach, reductions in emissions of local air pollutants in landfill gas by at least the same fraction that landfill methane is reduced.

Figure 4- Percent Settlement versus Time for the 9000-ton Bioreactor Demonstration Project



(d) Volume and waste mass loss of over 18% in the first 3 years of the enhanced operation, as compared to 3% for the control cell (see Figure 4). This suggests a difference of landfill life extension of over 15% possible by taking advantage of the extra air space made available.

(e) Bioreactor liquid additions can be slow and very carefully managed while still attaining excellent methane enhancement. In the Yolo anaerobic cell demonstration project liquid was carefully added at a slow rate. At the highest liquid injection rate of 10 gpm resulted in an output leachate flow rate of less than 3 gpm for short periods, less than three days. Data shows that by careful liquid injection rates the outflow rate could rapidly be controlled or reduced (clearly evident in Moore et. al. 1997).

(f) No measurable leakage in the primary liner system of the enhanced cell. This is consistent with data from Othman et. al. showing primary composite liner leakage rates of 0-50 liters/hectare day, most values in Othman et. al. are consistent with negligible or no leakage (below detection limits, less than 2 liters/hectare day) for monitoring periods within the first few years after base composite clay-geomembrane lining construction.

(g) Leachate pollutants stabilize rapidly, usually in under a year to concentrations well beneath those typifying the surrounding conventional landfill at the same site. Table 5 below shows typical leachate chemistry data over the past four years.

Table 5- Landfill Leachate Data for the 9000-ton Bioreactor Demonstration Project

YEAR	1996	1997	1998	1999
PH	5.8	7.0	7.2	7.2
BOD (mg O/L)	5,020	820	140	80
COD (mg O/L)	20,300	2,860	3,130	2,650
TDS (mg/L)	19,800	7,600	7,500	7,250
TOC (mg/L)	9,830	611	1,130	1,080
Iron (mg/L)	152,000	933	504	206
Manganese (µg/L)	41,900	4,000	1,170	1,060
Calcium (mg/L)	1,400	480	220	198
Toluene (µg/L)	160	75	24	15

The aerobic bioreactor differs from the anaerobic, as noted, in being a process of "in-landfill composting" by introducing air and water to the landfill. Recent representative references on aerobic bioreactor processes include Johnson and Baker, 1999 and Bernreuter and Stessel. 1999.

Results indicate that "in-landfill" aerobic composting is feasible. Landfill methane energy is sacrificed, but advantages include the desired waste destruction as well as suppression of landfill methane generation by heat and oxygen. Also, in contrast to anaerobic operation, significant waste fractions such as lignin and ligneous materials, and leachate COD components, not degradable anaerobically, are degradable aerobically. Thus it should be possible to achieve greater waste and leachate organics reduction by aerobic processing compared to anaerobic. These advantages of aerobic bioreactors are expected based on well-established fundamental scientific knowledge, but large-scale data to confirm advantages are limited. There are fewer key measurements to date on aerobic processes, and even basic data such as on material balances and flows are limited. However lysimeter tests, such as Stessel and Murphy, 1992 and other citations of Bernreuter and Stessel, 1999 are ongoing field operations show that landfilled waste is degraded aerobically by passing air and liquid through landfills. Remaining questions include how fast and completely landfilled waste can be composted aerobically. Potential drawbacks such as VOC and other emissions are not well established.

III. How the Project Will Meet the XL Acceptance Criteria

A. Superior Environmental Performance

1. Tier 1: Is the Project Equivalent?

The existing information on the Yolo County demonstration project identifies no significant adverse environmental impacts, that is, worsening of environmental impacts relative to conventional practice. Although leachate may be recovered in quantities at times greater than that with conventional practice it can be well-controlled; further, all recovered leachate can be re-used, being re-imbibed by waste, in the process. The other issue to be considered is any extra pollutant increment emitted if there is gas energy use that is greater than would otherwise occur. Here there are several factors and tradeoffs to consider. Landfill gas energy use is accepted and specifically encouraged by EPA. The destruction by weight of VOC's by IC engines is estimated to be an order of magnitude greater than the weight of NOx emitted and it is still better for other energy uses. Gas energy will offset fossil fuel (the most likely "swing" energy that would be displaced) thus pollutant and greenhouse emissions somewhere else. Advanced power generation approaches such as fuel cells can limit pollutant emission to still greater extents in the future. It is also important to recognize that a major part of "greenhouse" and pollutant benefit comes from abatement of methane and VOC's. If the fugitive emissions are lowered, even with the incremental captured gas only flared, it is clear from regulatory attitudes and present regulations that emission abatement by flaring is environmentally much preferable to landfill gas emission in the alternative of "conventional" operation.

This particular XL project will provide environmental performance at least equivalent to Tier 1, in all areas.

2. Tier 2: Superior Environmental Performance

For convenience the various aspects of superior environmental performance are summarized in Table 6.

The benefits to Yolo County are potentially greater energy revenue from the anaerobic operation which could result from more electricity generation or other energy uses, and landfill life extension. Present landfill capacity is sufficient until the year 2040, and the County would like to see its ability to landfill waste extended farther into the future. The County is also very interested in reducing the anticipated post-closure expenses and liabilities that are presently associated with conventional landfilling.

With a Bioreactor Landfill, superior environmental and waste management results include: a) Maximizing landfill gas control and fugitive methane and VOC emissions. (b) Greater recovery of landfill methane (c) Landfill life extension and/or reduced landfill use, d) Leachate-associated benefits, e) More rapid waste stabilization, f) Lessened long-term risk and, associated with this, potentially lessened monitoring effort. These are summarized in Table 6 and discussed further below.

a. Maximizing landfill gas control and minimizing fugitive methane and VOC emissions. Landfill gas contains roughly 50% methane, a potent greenhouse gas. In terms of climate effects methane is second in importance only to carbon dioxide. Landfill gas also contains volatile organic compounds (VOC's) that are local air pollutants. Landfill gas capture is maximized by a surface permeable gas collection layer overlain by a cover of soil with embedded membrane. Gas is withdrawn to maintain this permeable layer beneath surface containment at slight vacuum. The capture of methane is further facilitated and eased by a shortened generation interval, from 30 to 50 years to between 5 to10 years through enhanced decomposition. With this gas capture approach, it is expected that fugitive landfill gas emissions will be reduced for reasons that include:

- Reduction in emissions through installation and operation of gas collection system before the final fill height has reached.

- Efficiency improvements with the proposed horizontal gas extraction method over vertical gas well efficiency (default vertical well efficiency are often estimated and accepted at about 75% in both US EPA and California commissioned documents/publications).

- Reduction in long term emissions, from landfill gas generation occurring slowly beyond 30 years post-closure, that are not easily controlled.

The demonstration project has already shown close to a tenfold increase in methane recovery rate which suggest a tenfold reduction in interval of methane generation. Available indications as well as basic physical principles suggest that capture effectiveness approaches 100% so long as vacuum is maintained under the permeable layer.

b. Expedited methane generation/recovery. Methane recovery is maximized by use of permeable layers as discussed above and also facilitated by methane generation over much shorter terms. This is expected to minimize long-term low-rate methane generation often lost to energy use in conventional landfill practice. The reliability of methane recovery of fuel for energy generation should reduce the uncertainty and improves economics of landfill gas projects. Greater use of methane to full potential can add still more greenhouse benefit by "offsetting" fossil CO_2 otherwise emitted with fossil energy use elsewhere.

A recently completed study for the Federal Energy Technology Center (FETC) (presently becoming the National Energy Technology Laboratory, NETL) of the U. S. Department of Energy indicates that wide application of controlled landfilling could reduce US greenhouse gas emissions by 50-100 million tons of CO_2 equivalent when both emission prevention and fossil CO_2 offsets are taken into account. This major reduction in CO2 emissions is also cost-effective. In the analysis for FETC (IEM, 1999), over a range of representative landfill conditions, greenhouse gas abatement was estimated as attainable at a cost of $1-5/ton CO_2 equivalent which represents extremely low (by more than tenfold) cost compared to most other options presented in the recent EIA Report (USDOE Energy Information Agency. 1998)

c. Landfill life extension and/or reduced landfill use. The more rapid conversion of greater quantities of solid waste to gas reduces the volume of the waste. Settlement in the Yolo test cell is already over 18% in three years. Volume reduction translates into either landfill life extension and/or less landfill use. Thus bioreactor landfills are able to accept more waste over their working lifetime. Alternatively, fewer landfills are needed to accommodate the same inflows of waste from a given population

d. Leachate-associated benefits: Bioreactors promise more rapid leachate stabilization in terms of pollutant load, reduced leachate environmental impact, and elimination of need for most discharges to treatment facilities. The bioreactor processes, both anaerobic and aerobic, have been shown in studies at many scales to reduce the content of many leachate pollutants. These include organic acids and other soluble organic pollutants. Since a bioreactor operation brings pH to near-neutral conditions, metals of concern are largely precipitated and sequestered/ immobilized in waste. Thus free liquid concentrations and mobility of metals of concern are

Table 6- Superior Environmental Performance

		Conventional Landfill (Yolo without XL)	Proposed Bioreactor Project (with XL)	
			Anaerobic bioreactor	Aerobic bioreactor
A	Control of emitted landfill "greenhouse" methane and VOC's.	Fugitive gas ≈ 20-45% of gas generated, due to emissions before and after extraction/ control period; and incomplete recovery [70-85%] during extraction.	Efficient gas recovery ≈ 90-95+%, fugitive gas ≈ 5-10% of generated total. Capture begins early in filling. Efficient recovery from permeable layer ongoing through entire gas generation cycle of 5-10 years).	N/A- (little or no methane expected)
B	Methane generation/ recovery	Recovery ca. 55-80% of total generated. Slow generation over very long term (25-70 yrs)	High generation rate over short period (5 to 10 years) allows near-maximum recovery	N/A- (little or no methane expected)
C	Life extension for 20 year landfill	0 years gained	For a 20-year "conventional" design, ca. 5 years additional life obtained	Over 7 years life extension expected.
D	Future Leachate Contamination Risks	Medium to high (organics and metals) over long term	Lower organics and lower metals for shorter term	Lower organics and lower metals for shorter term.
E	Lessened long-term risk; and need for Monitoring	25 to 70 years stabilization period with ongoing monitoring	5 - 10 years for stabilization (from process initiation); Substantially less monitoring expected (more data needed)	Ca. 2-6 yrs (but not enough data yet)
F	Landfill Gas Energy Project Potential	Moderate	High; Superior economics of scale with better gas energy predictability	N/A

reduced compared to "conventional" landfill practice where more contaminated lower-pH leachate is often observed to be generated slowly for years. For example, in the Yolo test cell demonstration leachate reached near-neutral (pH 7) conditions within four months after liquid additions and recirculation commenced.

A need for offsite leachate treatment should be avoidable altogether as long as waste landfilling continues concurrently with bioreactor operation. Because bioreactors almost invariably require extra liquid for optimum performance, and leachate and condensate reintroduction are permissible (40 CFR 258.28), continuing operation of a landfill as a bioreactor allows generated leachate and condensate to be reintroduced so long as new dry waste continues to flow into the landfill. Additionally, calculations indicate that operation of even a small fraction of the landfill aerobically can consume leachate so long as generated, because of the high capacity of the aerobic reactions to evaporate liquid.

e. Lessened long-term risk and need for monitoring. The bioreactor approaches (anaerobic and aerobic) offer potential substantial reductions in postclosure care needs and costs. With present conventional practice, it is highly likely that gas management will be required for at least a mandated 30 year post-closure period. This entails all of the associated expense of continuing monitoring and gas well adjustment. Higher pollutant strength leachate must continue to be managed. A number of other management needs occur as waste continues to decompose, including dealing with subsidence, gas collection line breakage caused by subsidence, and the like.

f. Landfill Gas Energy Project Potential. Yolo County is considering several other alternatives for energy projects such as: (1) Self-wheeling of generated power, (2) Using increased generation at the landfill for sale to the grid (2MWe are being generated but the permit would allow up to 12 MWe), (3) Local boiler use of gas (4) Sale of power to the adjacent City of Davis Wastewater treatment facility, and (5) Sale of landfill gas to greenhouse farmer adjacent to the landfill.

g. Landfill Mining Potential: Although landfilling mining is not listed in Table 6, the removal and re-use of waste for beneficial purposes, such as compost or landfill daily cover is a distinct possibility. If landfill mining is carried out, it would occur when stabilization has sufficiently being achieved. For the anaerobic cell this could be beyond the expected 5-year term of the XL agreement. However, landfill mining or other beneficial use of the waste could also qualify for credit as composting. County has discussed this with the state regulators and agencies and will be conducting a mining pilot project to mine waste from the older section of the landfill. Feasibility of this operation will be determined to estimate the cost for possibly mining the aerobic cell in less than 5 year period.

3. How We Will Measure the Superior Environmental Performance of our Proposal

Superior Environmental Performance will be measured using the baseline (Tier 1, without Project XL) against the actual results of the project (Tier 2, proposed Project XL). To determine specific bioreactor performance attributes of Table 6, planned monitoring are listed in Table 3 and are discussed below:

(**a). Maximizing landfill gas control and minimizing fugitive methane /VOC emisssions**

Two possible tests for comparing emission performance of the anaerobic and aerobic bioreactors to the conventional landfilling approach are: (1) an integrated combustible gas surface scan of the test cell versus the surrounding landfill, using the surrounding landfill as a control and (b) distributed multi-point flux box tests using the surrounding landfill as a control. Of these two options, the Yolo Project Team considers the flux box approach the more precise, providing enough surface points are sampled.

As to fractional control, i. e., the fraction of gas collected, the fraction of surface emissions as determined from "flux box" readings would be compared to gas recovery from the bioreactor sections and other surrounding landfill sections of interest.

One factor to be compensated for in any emissions comparisons is that faster methane generation or greater emissions for short intervals can still represent lowered emission to the atmosphere. More rapid bioreactor generation and greater emission rate could still reach a final endpoint much sooner with fugitive bioreactor emissions aggregating to much lower total. This will need to be taken into account in calculating emissions since it is the total "life cycle" emission per pound of waste that is of actual interest.

b. Expedited methane generation/recovery. This can be seen clearly from the comparison of the generated and recovered methane from the anaerobic bioreactor with the generated and recovered methane from the surrounding landfill.

c. Life extension for a 20-year landfill. This will be based on annual topographical surveys. Total volume loss occurring within this time interval will be calculated.

d. Leachate contamination risk. One measurement of this, comparison of leachate from the bioreactor and surrounding areas, is straightforward. However there could also be estimation of future risk from "entombed" waste. This could be inferred using generated gas data to indicate what fraction of waste remains undecomposed in the surrounding landfill vs. the bioreactor (i. e. greater normalized gas generation means more complete decomposition and less future risk). Another way to examine this may be to examine leachate from samples of both the bioreactor and conventional landfilled waste in laboratory lysimeters. This general approach should be valid but is not planned for this study.

e. Landfill gas energy project potential. An indicator of this will be the amount of gas generated from both bioreactor and conventionally filled waste at comparable intervals.

B. Flexibility and Other Benefits

As noted, project results (to date) from smaller-scale demonstration projects are very encouraging and have demonstrated a tenfold increase in landfill gas generation, increased landfill settlement, improved leachate chemistry, and highly cost-effective abatement of greenhouse gases. Economic analysis of the project shows that implementing bioreactor landfilling operations can have significant cost savings and environmental benefits for the Yolo County Central Landfill.

C. Stakeholder Involvement and Support

Stakeholder involvement and support for this concept has already been demonstrated by previous federal, state, and local support of this bioreactor concept. For example, in 1994, the Yolo County Planning and Public Works Department, initiated a bioreactor landfill demonstration project to evaluate the Bioreactor Landfill concept for its Central Landfill near Davis, California. The construction phase of the project was funded by Yolo and Sacramento Counties ($125,000 each), the California Energy Commission ($250,000), and the California Integrated Waste Management Board ($63,000). More recent grant funding for the monitoring phase of the project has been received from the U. S. Department of Energy through the Urban Consortium Energy Task Force ($110,000), and the Western Regional Biomass Energy Program ($50,000). Greenhouse gas and emission abatement cost-effectiveness studies have recently been completed with $48,000 in support from the Federal Energy Technology Center/National Energy Technology Laboratory (hereafter, NETL). Further support, $462,000 recently committed by NETL, is enabling operation of the test cells for approximately 2 more years as well as helping prepare for larger module operation.

In January 26, 2000 the California Integrated Waste Management Board granted Yolo County $400,000 for the construction and testing of the full-scale bioreactor demonstration project.

Concerning local support for this XL project, Yolo County has held several public meetings for the full-scale demonstration project. These meeting have been held during the regular Waste Advisory Committee meetings to locate potential members of the local stakeholder group. The County will convene periodic meetings of the stakeholder group to obtain comments on this proposal, as well as to brief the group on their progress during the duration of the XL agreement.

Yolo County has recognized the following as a list of potential stakeholders:

Direct Participants:

County of Yolo, Planning and Public Works Department
U. S. Environmental Protection Agency
Solid Waste Association of North America (SWANA)
Institute for Environmental Management (IEM)
California State Regional Water Quality Control Board, Central Valley Region 5
Yolo County Department of Environmental Health
Yolo-Solano Air Quality Management District

Commentors:

California Integrated Waste Management Board
California State Water Resources Control Board
California Air Resources Board
National Energy Technology Laboratory (NETL, previously FETC), U. S. Department of Energy
SWANA–California Gold Rush Chapter and Southern California Chapter
Yolo County Waste Advisory Committee
University of California at Davis
Geosynthetic Institute, Drexel University

Members of the General Public:

Yolo County Citizens
Natural Resources Commission
Sacramento County Public Works Department, Solid Waste Management Division
California Energy Commission

D. Innovation and Pollution Prevention

Yolo County intends, as part of this project, to continue our ongoing pollution prevention efforts. Regardless of whether a particular component is directly regulated as part of an XL agreement, the County will continue our process of reviewing all pollution prevention opportunities and will report on our pollution prevention progress.

E. Transferability

Yolo County believes that with the approval of this proposed bioreactor landfilling concept by Federal EPA and the state, many other public and private landfill owners and operators should be able to implement this type of technology. The technology is expected to yield substantial economic and environmental benefits for nearly all regions of the U. S., and as noted, worldwide. Results from Yolo County's Bioreactor Landfill pilot project results have already been shared among many other jurisdictions as well as the private sector throughout the U.S. and internationally. Results of the project have been published in technical and trade journals and magazines worldwide.

Following an evaluation of this XL Project by EPA, and the first progress report by the County, and assuming the overall success of the Project, the bioreactor landfill technology used in this project could be transferable to a subset of landfills where conditions are favorable for actively managing the decomposition process and where groundwater protection and gas control are ensured. Based on early inquiries, application is likely outside as well as within the US.

F. Feasibility

The project sponsor, co-sponsors, and regulatory agencies as designated in the Final Project Agreement, agree to support the project, subject to any review procedures necessary to implement the legal mechanism for this project. Further, each XL participant has the financial capability, personnel and senior management commitment necessary to implement the elements of this Bioreactor Landfill XL Project.

G. Evaluation, Monitoring, and Accountability

The parties intend to implement as enforceable commitments, federal and state regulatory flexibility, monitoring, record-keeping, and reporting provisions of this FPA through a site specific rulemaking to implement this project. The XL agreement will contain both enforceable and aspirational requirements and will establish certain limits and goals for Yolo County's performance. The County will ensure compliance with legal requirements and ensure implementation of processes seeking to meet aspirational goals. The project sponsor will establish a record keeping system to ensure compliance, as well as accurate reporting of environmental performance. While the nature and extent of such reporting will be subject to negotiation, Yolo County will make any such reports available publicly and will specifically discuss our performance with the local stakeholder group.

H. Shifting of Risk Burden

No shifting of the risk burden will occur.

IV. Description of the Requested Flexibility and Implementing Mechanisms

A. Requested Flexibility

This section is primarily intended to describe federal flexibility needed for this XL project. It does also discuss State and local flexibility believed to be necessary to authorize this project. To the extent such action is necessary and appropriate, it will be provided as part of this project and subject to public notice and comment.

In general, Yolo County proposes to be able to undertake a proposed bioreactor landfill project that falls within the limitations established in the XL agreement. Yolo County is requesting specific flexibility under the current state and/or federal regulations requirements for liquid addition as described below.

Liquids Addition:

Yolo County is requesting that U.S. EPA grant site-specific regulatory flexibility from the prohibition in 40 CFR 258.28 Liquid Restrictions, which may preclude addition of useful bulk or non-containerized liquid amendments. The County is proposing to supplement the liquid addition with ground water, but would like to obtain the flexibility to possibly utilize other liquids such as gray waters from waste water treatment plant, septic waste, gray water, and food-processing wastes that is currently land applied. Liquid wastes such as these normally have no beneficial use, may instead beneficially enhance the biodegradation of solid waste in a landfill for this project.

Yolo County also requests similar flexibility on liquid amendments from California and local regulatory entities. Several sections of the California Code of Regulations (CCR), Title 27, Environmental Protection, address the recirculation of liquids in lined municipal waste landfills. While the regulations do not specifically endorse bioreactors like the regulations in the State of Washington, regulatory flexibility is provided. This portion of the agreement will describe specific regulations in Title 27 regarding recirculation.

Title 27, Chapter 3, Subchapter 2, Article 2, Section 20200, Part (d)(3), *Management of liquids at Landfills and Waste Piles* states the following:

"Liquid or semi-solid waste (i. e. waste containing less than 50% solids, by weight), other than dewatered sewage or water treatment sludge as described in § 20220 (c), shall not be discharged to Class III landfills. Exceptions may be granted by the RWQCB if the discharger can demonstrate that such discharge will not exceed the moisture holding capacity of the waste either initially, or as the result of waste management operations, compaction, or settlement, so long as such discharge is not otherwise prohibited by applicable state or federal requirements".

The above regulation specifically allows the Regional Water Quality Control Board, Central Valley Region (RWQCB) the ability to grant an exception regarding the discharge of liquids into a Class III landfill providing the moisture holding capacity is not exceeded. The previous demonstration project at the Yolo County Central Landfill provided a working demonstration as to the feasibility of the proposed bioreactor project. Through monitoring, instrumentation, and testing, it was demonstrated that liquid could be added in such a way that the holding capacity of the refuse is not exceeded. The same equipment and procedures will be utilized for the Module D bioreactor. Specific sections of this agreement details regarding the method of liquid recirculation.

It should be noted that the preceding Part in the regulations (Section 20200, Part (d)(2) addresses the discharge of waste containing free liquids and does not apply to this application. The County is not proposing to discharge wastes containing free liquids, but is instead proposing to add liquids or semi-solid waste to the refuse already in-place. While the regulations state that wastes containing free liquids must be discharged to a Class II waste pile, the addition of liquids to existing waste in a Class III landfill is allowed by the regulations if an exception is granted by the RWQCB.

Title 27, Chapter 3, Subchapter 2, Article 4, Section 20340, Part (g)(1,2,3), *Leachate Collection and Removal Systems* states the following:

"Leachate Handling – Except as otherwise provided under SWRCB Resolution No. 93-62 (for MSW landfills subject to 40CFR258.28), collected leachate shall be returned to the Unit(s) from which it came or discharged in another manner approved by the RWQCB. Collected leachate can be discharged to a different Unit only if:

1. *the receiving Unit has an LCRS, contains wastes which are similar in classification and characteristics to those in the Unit(s) from which leachate was extracted, and has at least the same classification (under Article 3 of this subchapter) as the Unit(s) from which leachate was extracted;*
2. *the discharge to a different Unit is approved by the RWQCB;*
3. *the discharge of leachate to a different Unit shall not exceed the moisture-holding capacity of the receiving unit, and shall comply with § 20200 (d)."*

The above section of Title 27 specifically allows the RWQCB to approve the discharge of leachate from other Units within a landfill to a receiving Unit as long as the wastes have similar classification and characteristics, the receiving Unit has an Leachate Collection and Removal System (LCRS), and the moisture-holding capacity of the refuse is not exceeded. These conditions are satisfied in that the wastes are similar throughout the landfill and Module D has a LCRS. Based on satisfying all of the conditions listed in the above regulatory requirement, the County is seeking approval from the RWQCB to discharge leachate generated from other Units within the Yolo County Central Landfill into Module D.

Title 27, Chapter 3, Subchapter 2, Article 5, Section 20937, Part (b)(4), *CIWMB – Control* states the following:

"A gas control system shall be designed to: Provide for the collection and treatment and/or disposal of landfill gas condensate produced at the surface. Condensate generated from gas control systems shall not be recirculated into the landfill unless analysis of the condensate demonstrates to the satisfaction of the EA, that it is acceptable to allow recirculation into

landfills which have a liner and an operational leachate collection system and the RWQCB approves such discharge pursuant to § 20200 (d).”

Based on the design and operation of the Module D bioreactor, the LCRS and liner system are in place to allow for the recirculation of gas condensate. The County has submitted the analysis of constituents within the gas condensate in the site monitoring reports. Based on these factors, the County is seeking approval from the RWQCB to recirculate the condensate.

In reviewing the regulations regarding the recirculation of leachate and gas condensate, it appears that the County has satisfied all criteria enabling the RWQCB to grant approval for leachate/condensate recirculation in Module D. However, as previously discussed, the refuse deposited at the Yolo County Central Landfill is relatively dry. In order to have proper operation of a landfill bioreactor, the waste must attain its moisture holding capacity. This moisture level can not be reached with the addition of leachate and condensate alone. Such flexibility is justified based on composting performance, available controls, and multiple environmental safeguards that have already been demonstrated in the smaller-scale 9000-ton test program at the Yolo County Central Landfill.

B. Legally Implementing Mechanisms

To implement this Project, the parties intend to take the following steps:

1. EPA expects to propose for public comment and promulgate a site specific rule amending 40 CFR 258.28 for Yolo county’s facility. This site specific rule will describe the project requirements and any other aspects of the rulemaking. It is expected that the site specific rule will provide for Withdrawal or Termination and a Post-Project Compliance Period consistent with Section VII, and will address the Transfer procedures included in Section X. The standards and reporting requirements set forth in Section II (and any attachments to this FPA) will be implemented in this site specific rulemaking.

2. The State under its relevant authority expects to promulgate the appropriate rule changes, permit modifications, etc. to implement this FPA needed by Yolo County for this project.

3. Except as provided in any rule(s), compliance order(s), permit provisions or other implementing mechanisms that may be adopted to implement the Project, the parties do not intend that this FPA will modify or otherwise alter the applicability of existing or future laws or regulations to Yolo county’s facility.

4. By signing this FPA, EPA, Yolo county, the state of California and its local authorities acknowledge and agree that they have the respective authorities and discretion to enter into this FPA and to implement the provisions of this project, to the extent appropriate.

V. Discussion of Intentions and Commitments for Implementing the Project

A. Yolo County’s Intentions and Commitments

Yolo County would like to operate its next 20-acre landfill module near Davis, California as a controlled bioreactor landfill to attain a number of superior environmental and cost savings benefits. The county is committed to working with federal, state, and local governments to demonstrate, with regulatory flexibility, how a bioreactor landfill can demonstrate more desirable environmental results than a conventional landfill.

B. EPA's, the state of California's Intentions and Commitments

EPA intends to propose and issue (subject to applicable procedures and review of public comments) a site-specific rule, amending 40 CFR Part 258.28, that applies specifically to the Yolo county's solid waste landfill site in Davis. The site specific rule will also provide for withdrawal or termination and a post-Project compliance period consistent with Section XII of this Agreement, and will address the transfer procedures included in Section IX. The standards and reporting requirements set forth in Section V.E. will be implemented in the site specific rule.

C. Project XL Performance Targets

See Table 6, Superior Environmental Performance.

D. Proposed Schedule and Milestones

This project will be developed and implemented over a time period necessary to complete its desired major objectives, beginning from the date that the final legal mechanism becomes effective, unless it is terminated earlier or extended by agreement of all Project Signatories.
An expected timeline is shown in below, Table 7.

Table 7- Project XL Delivery Schedule

Project Task	Delivery Date
• Final draft FPA circulated to Stakeholders for comments	February 23, 2000
• California Environmental document circulated for comments	February 23, 2000
• Comments received for environmental document and final FPA	March 24, 2000
• Finalize FPA and certify environmental document	April 4, 2000
• RWQCB approve permit revision and all parties sign FPA document	April 13, 2000
• Begin project waste filling phase	April 17, 2000
• EPA rule change for Yolo County XL project	June 19, 2000
• Finish project waste filling phase	December 31, 2000
• Liquid addition and monitoring begins	January 1, 2001

E. Project Tracking, Reporting and Evaluation

The project tracking, reporting and evaluation will be accomplished for project sponsors including EPA in accordance with, among other things, EPA requests and the reporting requirements set by the (to-be-determined) funding agencies. The topics tracked, reported and evaluated have been referred to earlier in the section on "how we would measure improved environmental performance" (see Table 3).

F. Periodic Review by the Parties to the Agreement

The Parties will hold periodic performance review conferences to assess their progress in implementing this Project. Unless they agree otherwise, the date for those conferences will be concurrent with annual Stakeholder Meetings. No later than thirty (30) days following a periodic performance review conference, Yolo County will provide a summary of the minutes of that conference to all Direct Stakeholders. Any additional comments of participating Stakeholders will be reported to EPA.

G. Duration

This Agreement will remain in effect for 5 years after signing, unless the Project ends at an earlier date, as provided under Section VIII (Amendments or Modifications), Section XI (Withdrawal or Termination), or Section IX (Transfer of Project Benefits and Responsibilities). The implementing mechanism(s) will contain "sunset" provisions ending authorization for this Project [X] years after the effective date of the [*implementing mechanism(s)*]. They will also address withdrawal or termination conditions and procedures (as described in Section XI). This Project will not extend past the agreed upon date, and Yolo county will comply with all applicable requirements following this date (as described in Section XII), unless all parties agree to an amendment to the Project term (as provided in Section VIII)."

VI. Legal Basis for the Project

A. Authority to Enter Into the Agreement

By signing this Agreement, all signatories acknowledge and agree that they have the respective authorities, discretion, and resources to enter into this Agreement and to implement all applicable provisions of this Project, as described in this Agreement.

B. Legal Effect of the Agreement

This Agreement states the intentions of the Parties with respect to Yolo county's XL Project. The Parties have stated their intentions seriously and in good faith, and expect to carry out their stated intentions. This Agreement in itself does not create or modify legal rights or obligations, is not a contract or a regulatory action, such as a permit or a rule, and is not legally binding or enforceable against any Party. Rather, it expresses the plans and intentions of the Parties without making those plans and intentions binding requirements. This applies to the provisions of this Agreement that concern procedural as well as substantive matters. Thus, for example, the Agreement establishes procedures that the parties intend to follow with respect to dispute resolution and termination (see Sections X and XI). However, while the parties fully intend to adhere to these procedures, they are not legally obligated to do so.

EPA intends to propose for public comment a site specific rule making needed to implement this Project. Any rules, permit modifications or legal mechanisms that implement this Project will be effective and enforceable as provided under applicable law.

This Agreement is not a "final agency action" by EPA, because it does not create or modify legal rights or obligations and is not legally enforceable. This Agreement itself is not subject to judicial review or enforcement. Nothing any Party does or does not do that deviates from a provision of this Agreement, or that is alleged to deviate from a provision of this Agreement, can serve as the sole basis for any claim for damages, compensation or other relief against any Party.

C. Other Laws or Regulations That May Apply

Except as provided in the legal implementing mechanisms for this Project, the parties do not intend that this Final Project Agreement will modify any other existing or future laws or regulations.

D. Retention of Rights to Other Legal Remedies

Except as expressly provided in the legal implementing mechanisms described in Section IV, nothing in this Agreement affects or limits Yolo county's, EPA's, the State's, or any other signatory's legal rights. These rights include legal, equitable, civil, criminal or administrative claims or other relief regarding the enforcement of present or future applicable federal and state laws, rules, regulations or permits with respect to the facility.

Although Yolo county does not intend to challenge agency actions implementing the Project (including any rule amendments or adoptions, permit actions, or other action) that are consistent with this Agreement, Yolo county reserves any right it may have to appeal or otherwise challenge any EPA, state of California, or local agency action to implement the Project. With regard to the legal implementing mechanisms, nothing in this Agreement is intended to limit Yolo county's right of to administrative or judicial appeal or review of those legal mechanisms, in accordance with the applicable procedures for such review.

VII. Unavoidable Delay During Project Implementation

"Unavoidable delay" (for purposes of this Agreement) means any event beyond the control of any Party that causes delays or prevents the implementation of the Project described in this Agreement, despite the Parties' best efforts to put their intentions into effect. An unavoidable delay can be caused by, for example, a fire or acts of war.

When any event occurs that may delay or prevent the implementation of this Project, whether or not it is avoidable, the Party to this Agreement who knows about it will immediately provide notice to the remaining Parties. Within ten (10) days after that initial notice, the Party should confirm the event in writing . The confirming notice should include: 1) the reason for the delay; 2) the anticipated duration; 3) all actions taken to prevent or minimize the delay; and 4) why the delay was considered unavoidable, accompanied by appropriate documentation.

If the Parties, agree that the delay is unavoidable, relevant parts of the Project schedule (see Section V.) will be extended to cover the time period lost due to the delay. If they agree, they will also document their agreement in a written amendment to this Agreement. If the Parties don't agree, then they will follow the provisions for Dispute Resolution outlined below.

This section applies only to provisions of this Agreement that are not implemented by legal implementing mechanisms. Legal mechanisms, such as permit provisions or rules, will be subject to modification or enforcement as provided under applicable law.

VIII. Amendments or Modifications to the Agreement

This Project is an experiment designed to test new approaches to environmental protection and there is a degree of uncertainty regarding the environmental benefits and costs associated with activities to be undertaken in this Project. Therefore, it may be appropriate to amend this Agreement at some point during its duration.

This Final Project Agreement may be amended by mutual agreement of all parties at any time during the duration of the Project. The parties recognize that amendments to this Agreement may also necessitate modification of legal implementation mechanisms or may require development of new implementation mechanisms. If the Agreement is amended, EPA and Yolo county expect to work together with other regulatory bodies and stakeholders to identify and pursue any necessary modifications or additions to the implementation mechanisms in accordance with applicable procedures (including public notice and comment). If the parties agree to make a substantial amendment to this Agreement, the general public will receive notice of the amendment and be given an opportunity to participate in the process, as appropriate.

The parties to this FPA agree to evaluate the appropriateness of a modification or "reopener" to the FPA according to the provisions set forth below.

1. During the minimum project term, Yolo county may seek to reopen and modify this FPA in order to address matters covered in the FPA, including failure of the project to achieve superior environmental results, or the enactment or promulgation of any environmental, health, or safety law or regulation after execution of this FPA which renders the project legally, technically, or economically impractical. To do so, Yolo county will submit a proposal for a reopener under this section to EPA, California, and all applicable local agencies for their consideration. EPA, California, and all applicable local agencies will review and evaluate the appropriateness or such proposal submitted by Yolo county. EPA, California, and all applicable local agencies may also elect to initiate withdrawal or termination under Section VII of this FPA, which shall supersede application to this section.

2. In determining whether to reopen and modify the FPA in accordance with any reopener proposal(s) submitted by Yolo county under this section, EPA, California, and all applicable local agencies will base their decision upon the following: (a) whether the proposal meets Project XL criteria in effect at the time of the proposal, (b) the environmental benefits expected to be achieved by the proposal, (c) the level of emissions or effluent included in the proposal, (d) other environmental benefits achieved as a result of other activities under the proposal, and (e) and adverse environmental impacts expected to occur as a result of the proposal.

3. All parties to the FPA will meet within ninety (90) days following submission of any reopener proposal by Yolo county to EPA, California, and all applicable local agencies (or within such shorter or longer period as the parties may agree) to discuss the Agencies' evaluation of the reopener proposal. If, after appropriate stakeholder involvement, the Agencies support reopening of this FPA to incorporate the proposal, the parties (subject to any required public comment) will take steps necessary to amend the FPA. Concurrent with amendment of this FPA, EPA, California, and all applicable local agencies will take steps consistent with this Section IV to implement the proposal.

4. It is noted at this point that the intent by Yolo County, upon successful results, to operate the ensuing landfill module as a bioreactor could be a "reopener". If this is agreeable to all parties to the present agreement, it would be most convenient to extend the agreement to cover subsequent module or modules at the Yolo County Central Landfill, with a minimum of stakeholder work.

IX. Transfer of Project Benefits and Responsibilities to a New Owner

The parties expect that the implementing mechanisms will allow for a transfer of Yolo county's benefits and responsibilities under the Project to any future owner or operator upon request of Yolo county and the new owner or operator, provided that the following conditions are met:

A. Yolo County will provide written notice of any such proposed transfer to the EPA, the state of California, and all applicable local agencies at least ninety (90) days before the effective date of the transfer. The notice is expected to include identification of the proposed new owner or operator, a description of its financial and technical capability to assume the obligations associated with the Project, and a statement of the new owner or operator's intention to take over the responsibilities in the XL Project of the existing owner or operator.

B. Within forty-five (45) days of receipt of the written notice, the parties expect that EPA, the state of California, and all applicable local agencies in consultation with all stakeholders, will determine whether: 1) the new owner or operator has demonstrated adequate capability to meet EPA's requirements for carrying out the XL Project; 2) is willing to take over the responsibilities in the XL Project of the existing owner or operator; and 3) is otherwise an appropriate Project XL partner. Other relevant factors, including the new owner or operator's record of compliance with Federal, State and local environmental requirements, may be considered as well. It is expected that the implementation mechanism will provide that, so long as the demonstration has been made to the satisfaction and unreviewable discretion of EPA, the state of California, and all applicable local agencies and upon consideration of other relevant factors, the FPA will be modified to allow the proposed transferee to assume the rights and obligations of Yolo county. In the event that the transfer is disapproved by any agency, withdrawal or termination may be initiated, as provided in Section XI.

It will be necessary to modify the Agreement to reflect the new owner and it may also be necessary for EPA, the state of California, and all applicable local agencies to amend appropriate rules, permits, or other implementing mechanisms (subject to applicable public notice and comment) to transfer the legal rights and obligations of Yolo county under this Project to the proposed new owner or operator. The rights and obligations of this project remain with Yolo county prior to their final, legal transfer to the proposed transferee.

X. Process for Resolving Disputes

Any dispute which arises under or with respect to this Agreement will be subject to informal negotiations between the parties to the Agreement. The period of informal negotiations will not exceed twenty (20) calendar days from the time the dispute is first documented, unless that period is extended by a written agreement of the parties to the dispute. The dispute will be considered documented when one party sends a written Notice of Dispute to the other parties.

If the parties cannot resolve a dispute through informal negotiations, the parties may invoke non-binding mediation by describing the dispute with a proposal for resolution in a letter to the Regional Administrator for EPA Region 9, with a copy to all parties. The Regional Administrator will serve as the non-binding mediator and may request an informal mediation meeting to attempt to resolve the dispute. He or she will then issue a written opinion that will be non-binding and does not constitute a final EPA action. If this effort is not successful, the parties still have the option to terminate or withdraw from the Agreement, as set forth in Section XI below.

XI. Withdrawal From or Termination of the Agreement

A. Expectations

Although this Agreement is not legally binding and any party may withdraw from the Agreement at any time, it is the desire of the parties that it should remain in effect through the expected duration of 5 years, and be implemented as fully as possible unless one of the conditions below occurs:

1. Failure by any party to (a) comply with the provisions of the enforceable implementing mechanisms for this Project, or (b) act in accordance with the provisions of this Agreement. The assessment of the failure will take its nature and duration into account.

2. Failure of any party to disclose material facts during development of the Agreement.

3. Failure of the Project to provide superior environmental performance consistent with the provisions of this Agreement.

4. Enactment or promulgation of any environmental, health or safety law or regulation after execution of the Agreement, which renders the Project legally, technically or economically impracticable.

5. Decision by an agency to reject the transfer of the Project to a new owner or operator of the facility.

In addition, EPA, the state of California, and all applicable local agencies do not intend to withdraw from the Agreement if Yolo county does not act in accordance with this Agreement or its implementation mechanisms, unless the actions constitute a substantial failure to act consistently with intentions expressed in this Agreement and its implementing mechanisms. The decision to withdraw will, of course, take the failure's nature and duration into account.

Yolo county will be given notice and a reasonable opportunity to remedy any "substantial failure" before EPA's withdrawal. If there is a disagreement between the parties over whether a "substantial failure" exists, the parties will use the dispute resolution mechanism identified in Section X of this Agreement. EPA, the State of California, and all applicable local agencies retain their discretion to use existing enforcement authorities, including withdrawal or termination of this Project, as appropriate. Yolo county retains any existing rights or abilities to defend itself against any enforcement actions, in accordance with applicable procedures.

B. Procedures

The parties agree that the following procedures will be used to withdraw from or terminate the Project before expiration of the Project term. They also agree that the implementing mechanism(s) will provide for withdrawal or termination consistent with these procedures.

1. Any party that wants to terminate or withdraw from the Project is expected to provide written notice to the other parties at least sixty (60) days before the withdrawal or termination.

2. If requested by any party during the sixty (60) day period noted above, the dispute resolution proceedings described in this Agreement may be initiated to resolve any dispute relating to the intended withdrawal or termination. If, following any dispute resolution or informal discussion, a party still desires to withdraw or terminate, that party will provide written notice of final withdrawal or termination to the other parties.

If any agency withdraws or terminates its participation in the Agreement, the remaining agencies will consult with Yolo county to determine whether the Agreement should be continued in a modified form, consistent with applicable federal or State law, or whether it should be terminated.

3.The procedures described in this Section apply only to the decision to withdraw or terminate participation in this Agreement. Procedures to be used in modifying or rescinding any legal implementing mechanisms will be governed by the terms of those legal mechanisms and applicable law. It may be necessary to invoke the implementing mechanism's provisions that end authorization for the Project (called "sunset provisions") in the event of withdrawal or termination.

XII. Compliance After the Project is Over

The parties intend that there be an orderly return to compliance upon completion, withdrawal from, or termination of the Project, as follows:

A. Orderly Return to Compliance with Otherwise Applicable Regulations, if the Project Term is Completed

If, after an evaluation, the Project is terminated because the term has ended, Yolo county will return to compliance with all applicable requirements by the end of the Project term, unless the Project is amended or modified in accordance with Section VIII of this Agreement (Amendments or Modifications). Yolo county is expected to anticipate and plan for all activities to return to compliance sufficiently in advance of the end of the Project term. Yolo county may request a meeting with EPA, the state of California, and all applicable local agencies to discuss the timing and nature of any actions that they will be required to take. The parties should meet within thirty days of receipt of Yolo county's written request for such a discussion. At and following such a meeting, the parties should discuss in reasonable, good faith, which of the requirements deferred under this Project will apply after termination of the Project."

B. Orderly Return to Compliance with Otherwise Applicable Regulations in the Event of Early Withdrawal or Termination

In the event of a withdrawal or termination not based on the end of the Project term and where Yolo county has made efforts in good faith, the parties to the Agreement will determine an interim compliance period to provide sufficient time for Yolo county to return to compliance with any regulations deferred under the Project. The interim compliance period will extend from the date on which EPA, the state of California, and all applicable local agencies provides written notice of final withdrawal or termination of the Project, in accordance with Section XI of this Project Agreement. By the end of the interim compliance period, Yolo county will comply with the applicable deferred standards set forth in 40 CFR Part 258.28. During the interim compliance period, EPA, the state of California, and any applicable local agency may issue an order, permit, or other legally enforceable mechanism establishing a schedule for Yolo county to return to compliance with otherwise applicable regulations as soon as practicable. This schedule cannot extend beyond 6 months from the date of withdrawal or termination. Yolo county intends to be in compliance with all applicable Federal, State, and local requirements as soon as is practicable, as will be set forth in the new schedule.

XIII. Signatories and Effective Date

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