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AMPUERO DAIRY PIN
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Introduction

AMPUERO (AMPUERO S.P.R DE R.L DE C.V.) is a modern 2,100-milk cow dairy in central Mexico near the city of Torreon. AMPUERO needs to solve its animal waste disposal and odor problems as well as its energy needs.

TESA (TECNOLOGIA EN SISTEMAS AMBIENTALES, S.A. DE C.V.) a corporate subsidiary of Grupo Domos, is an engineering construction firm that provides water, wastewater, and solid waste services to industry and municipalities throughout Mexico. TESA has agreed to finance and construct the facilities required by AMPUERO to produce energy and solve its odor and waste disposal problems for a percentage of the income from products produced by the EQI waste management process.

EQI (ENVIRO-QUEST INTERNATIONAL) is a Vancouver, BC Environmental Corporation (Civil, Agricultural, and Chemical Engineering) that has been engaged to develop the PDD and monitoring plan.

This report presents the existing site conditions, environmental and power needs, technology required to meet those needs, and Green House Gas (GHG) credits necessary to finance the development.

Location of Facility

The Ampuero dairy is located in central MEXICO in the State of COAHUILA, Province of TORREON, approximately 6 miles Southeast of the city of Torreon, Mexico at latitude, 25º 27' 29" N, and longitude, 103º 22` 22" W. The general location of the facility is shown in Figure 1.

Figure 1 – Ampuero Dairy in Central Mexico

The climate is warm to hot throughout the year. The area is arid with little water and low annual precipitation. The topography is rugged with numerous hills and mountains with sparse vegetation.

Facility

The Ampuero dairy is a large modern 2,100-milk cow dairy. Dry and young stock are housed in a separate location. The dairy has five large buildings. The main building has a large state-of-the-art carousel milk parlor, animal hospital, conference room, and office. The other four buildings house the 2,100 milk cows in a free stall - open corral arrangement. Each building has two feed lane's that are flushed daily. There are six water storage flush tanks adjacent to the milk parlor. The facility also includes manure-handling structures such as a solids removal screen and an anaerobic lagoon with a floating pump. Figure 2 presents

an aerial view of the Ampuro dairy. Figure 3 is an exterior view of one of the open corral dairy housing units.

Figure 2 – Arial view of the Ampuero Dairy

Figure 3 Exterior of Corral Buildings

The Ampuero dairy uses a large number of cooling fans to maintain a proper

environment for the milk cows. The dairy also has two large wells, one producing 70 L per second and the other producing at least 80 L per second. The fresh well water is pumped to six large aboveground flush tanks where the water is held for flushing the milk parlor, conduction alley, animal hospital, and the 8 feed lanes in the corral housing buildings. The total capacity of the flush tanks is 78,000 L. The rotary (carousel) milk parlor is flushed twice per milking or eight times per day for 40 seconds at the rate of 255 L per second through each of the four flush valves. The total flush volume for the milk parlor is 198,400 L per day. Likewise, the total flush volume for the conduction alley between the milk parlor and housing units is 18,600 L per day. The hospital also uses 18,600 L per day of flush water. The second largest water use is the 148,800 L per day used to flush the 8 feed lanes once a day. The total water use is 384,004 L per day, which is discharged with the manure to the anaerobic holding pond. Periodically the contents of a holding pond are pumped through an overhead screen and discharge to the irrigation channel. The floating pump removes the top liquid from the anaerobic pond while the solids remain in the pond for anaerobic decomposition. Figure 4 presents a schematic of the Ampuero dairy flush water and manure handling process, as it exists today.

Figure 4 Schematic of Ampuero Dairy

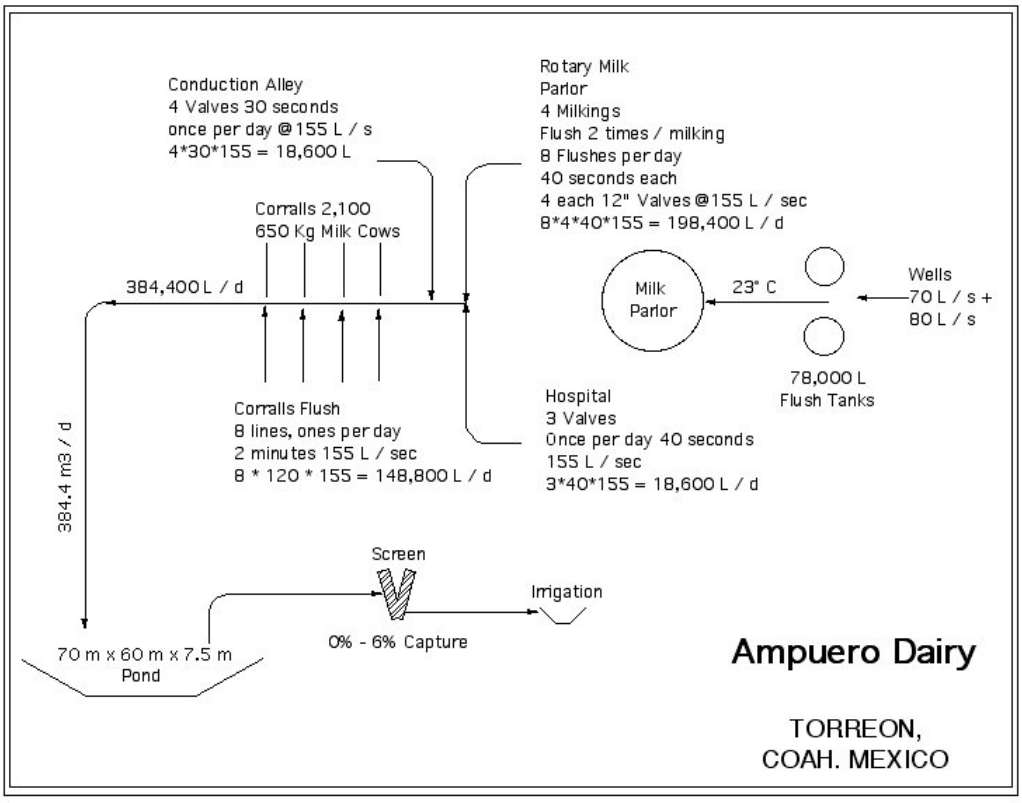

Figure 5 shows the flush water outlet from a typical feed lane. Generally, the cows deposit a majority of their manure in the feed lane that is flushed with fresh water as described above.

Figure 5 Flush Feed Lane

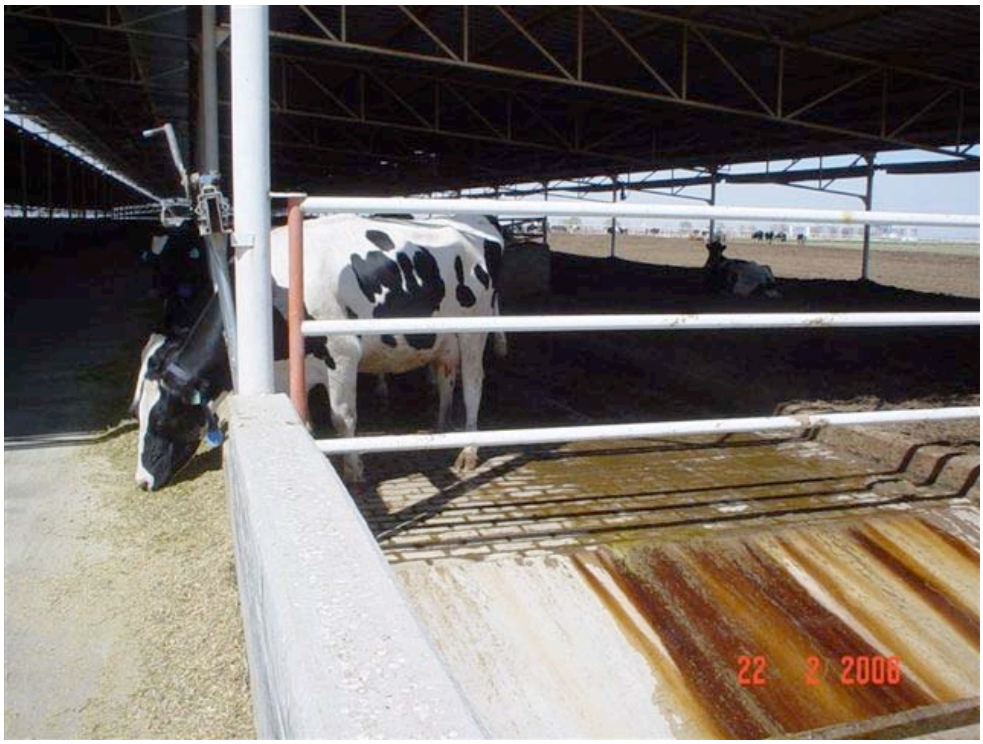

Figure 6 Anaerobic Lagoon with crust showing methane gas breakthrough

Figure 6 shows the anaerobic holding pond with the thick crust capable of supporting empty drums. Figure 6 also shows gaps in the crust where methane and other gases escape.

Figure 7 – Solids Screening

Figure 8 – Discharge to Irrigation Channel

Figure 7 shows the overhead screen used to remove course solids prior to discharge to the irrigation channel shown in Figure 8.

Development Needs

The Ampuro dairy needs a modern waste management system that will reduce the time and expense involved in manure handling. The dairy also needs power for the cooling fans that were recently installed throughout the dairy.

Options

Three options are available to Ampuero. The first is to operate the system as it is today. The second is to install a conventional ambient temperature anaerobic digestion system and the third is to install a high rate heated anaerobic digester. Each are discussed below:

Continue to Operate the Existing System.

If Ampuero continues to operate the existing system they will continue to discharge pollutants throughout the year when crops do not require nutrients. Consequently ground and surface waters will be polluted. This alternative is common practice in Mexico and dairies are not prohibited from irrigating land throughout the year provided it does not affect drinking water quality. This practice will also contribute significant quantities of methane gas and N_2O to the atmosphere. Ampuero will not generate renewable energy but will continue to purchase power from the grid, contributing further to GHG emissions. This option has no cost and produces no income. Consequently, there is no investment and no annual income from this option. It is the lowest cost option and thus the baseline scenario.

Conventional Anaerobic Digester

The Ampuero dairy uses large quantities water to maintain a clean dairy environment free of manure and flies. Unfortunately, the uses of large volumes of water severely restrict the options available for waste treatment. Only two proven options are available, aerobic or anaerobic biological waste treatment. Aerobic waste treatment uses large quantities of energy to produce a significant quantity of waste sludge that must be disposed. On the other hand, anaerobic biological treatment reduces the volume of solids that must be disposed while at the same time producing methane gas, which can be converted to power. The cost of aerobic and anaerobic digestion facilities is approximately the same. Aerobic treatment has a significant annual operating cost due to high-energy costs. Ambient temperature conventional anaerobic treatment has a lower

annual operating cost and will produce gas that can be used to produce power. However the very low internal rate of return is not sufficient to obtain financing.

High Rate Anaerobic Digester

The use of large quantities of relatively cold water will normally result in very large anaerobic digesters that require significant amounts of heat and mixing energy to achieve mesophilic anaerobic digestion conditions. TESA will obtain a license to proven technology, for dilute waste streams, that can reduce the volume of the anaerobic digester by three to four times the conventional size, and at the same time, reduce the quantity of heat and mixing energy required to maintain completely mixed mesophilic conditions. It is that proven technology that will be applied to the Ampuero dairy waste treatment system. The system will capture more gas that will be converted to power at a lower capital cost and thus improve the IRR for the project. The IRR however does not meet the required rate of return on investment (RRR) necessary to obtain project financing in Mexico. With CER revenues the RRR can be met and financing obtained.

Analysis

The baseline scenario is the existing open lagoon / storage system which is common practice in Mexico. The baseline scenario has no capital cost and produces no income. Aerobic treatment has a negative IRR since it produces no products of value. Ambient temperature anaerobic digestion and mesophilic high rate anaerobic digestion produce power and reduce GHG emissions. However, only high rate anaerobic digestion produces sufficient amounts of power income to meet the RRR if CER income is obtained.

The facility will treat 464 m³ per day of flush water and manure having a COD concentration of 1.8 %. The treatment facility will produce 1750 m³ per day of methane gas, which will be utilized to operate a 230KW engine generator capable of producing 5600 kWh per day of electrical power. The power will be used to displace the electricity currently purchased at 0.8 Peso a kilowatt-hour. Waste heat from the engine generator will be used with solar energy to provide the necessary heat to maintain the digester at 35° C.

The facility will reduce greenhouse gas emissions by at least 10,100 metric tons of CO_2 equivalent per year. Additional reductions can be achieved by providing nitrogen sequestration facilities. Calculations supporting additional credits will be presented in the forthcoming PDD.

Conclusion

The proposed project will remove a minimum of 10,000 metric tons per year of CO^2 e while generating 5,500 kWh per day of electrical power. The power will be

used to offset existing electrical power purchases produced from fossil fuels. The proposed project will also meet the environmental needs of the community and industry while minimizing potential health hazards. New technology will be introduced to Mexico while reducing GHG emissions and improving air quality.