MONITORING REPORT

Advanced swine manure treatment in
Maitenlahue and La Manga
Reference no. UNFCCC 0458

Crediting Period to be verified: 1st February 2005 – 31st October 2006

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INTRODUCTION

In December 2000, Agricola Super Limitada (Agrosuper), the largest pork production company in Chile, initiated a voluntary process to implement advanced waste management systems (anaerobic and aerobic digestion of hog manure), in order to reduce greenhouse gas (GHG) emissions into the atmosphere.

The project consists of an advanced improvement to the common practice of swine waste treatment in the country, reducing an important volume of greenhouse gases. The technology implementation is based on the use of an anaerobic digester and an activated sludge treatment.

The anaerobic and aerobic digestion technology is being phased in gradually in some of Agrosuper's facilities. The goal is to eventually implement this technology to capture or avoid GHG emissions from all of the company's swine barns. However, this will depend upon the generation of revenues from the sale of Certified Emission Reductions (CERs), which will be used to partially finance the waste treatment systems.

The decision to consider the implementation of more expensive technology was influenced by the adoption of the Kyoto Protocol and the Clean Development Mechanism. The investment decision was further influenced by the confirmation as part of the Marrakech Agreement *"…that a project activity starting as of the year 2000, and prior to the adoption of this decision, shall be eligible for validation and registration as a CDM project activity if submitted for registration before 31 December 2005. If registered, the crediting period for such project activities may start prior to the date of its registration but not earlier than 1 January 2000*".

The expected result from this project activity will be a significant reduction in the volume of methane (CH_4) and nitrous oxide (N_2O) emissions compared to those emissions that would otherwise occur in a scenario with traditional swine manure treatment systems.

According to the approved methodology (AM0006), and based on a cost analysis, the baseline treatment system is represented by the use of open stabilization lagoons (from now anaerobic lagoon) as the treatment process of liquid waste from swine production. Anaerobic lagoons lead to the direct release of CH_4, N_2O and CO_2 into the atmosphere as result of the anaerobic digestion process that takes place inside the lagoons. Anaerobic lagoon treatment process should be considered as the current national baseline for the agricultural sector, as will be detailed later in this document.

STATUS OF THE PROJECT

The following Table shows the dates in which the project started its operation

Table 1

Project	Treatment system type	Irrigation project	Starting date of the treatment system
Maitenlahue	Activated Sludge Plant	Yes	26th of March 2004
La Manga	Activated Sludge Plant	Yes	26th of March 2004

STATEMENT TO WHAT EXTEND THE PROJECT HAS BEEN IMPLEMENTED AS PLANNED

The project has been completed as planned and described in the Project Design Document (PDD).

The project has been continuously operating since the entering into operation.

Apart from brief stops of the Plant for maintenance purposes, the project has been operating according to schedule and with the parameters mentioned in the PDD.

PARAMETERS MONITORED ACCORDING TO MONITORING PLAN

In order to implement a precise and representative monitoring plan, Agrosuper has established a continual registration of each monitoring parameter as part of its Environmental Management System and its Quality Management System.

The following description details the operational and management structure developed for monitoring the emission reductions during the verification process:

Table 2. Monitored information based on the monitoring plan

DATA VARIABLE	DATA UNIT	DATA ORIGIN
Animal Population	Heads	Daily animal Stock and inlet program of pigs (Net inlet considering mortality). Information managed by Agrosuper
Average Weight of Animals	kg	Pavilion test and growing tendency curves. Information managed by Agrosuper
Manure Flow After Aerobic Treatment Stage	m^3/day	This parameter is calculated with total inlet flow minus sludge volume.
Manure Flow Before Aerobic Treatment	m^3/day	This parameter is monitored from a flow meter installed before the activated sludge.
Flow of Sludge from Aerobic Treatment	m^3/day	Referential volume from sludge transportation requirements. Information managed by POCH Ambiental S.A.
5 days BOD in Manure after Aerobic Treatment Stage	mg/L	Activated Sludge monitoring registers, managed by POCH Ambiental S.A.
Total Nitrogen Content in Manure after Aerobic Treatment Stage	mg/L	Activated Sludge monitoring registers, managed by POCH Ambiental S.A.
Temperature of Manure after Aerobic Treatment Stage	ºC	Activated Sludge monitoring registers, managed by POCH Ambiental S.A.

The monthly average value of the 5 days BOD and the temperature of the manure are presented in the following table:

Table 3. Monthly average monitored 5 days BOD and temperature for Maitenlahue

Month	BOD_5 (mg/l)	Temperature (ºC)
May 2005	61	13.7
June 2005	104	13.6
July 2005	88	13.2
August 2005	156	14.7
September 2005	238	15.6
October 2005	359	16.8
Noevember 2005	289	18.0
December 2005	137	19.4
January 2006	189	22.3
February 2006	143	20.4
March 2006	468	20.3
April 2006	303	17.9
May 2006	296	16.4
June 2006	334	15.9
July 2006	407	17.0
August 2006	377	16.9
September 2006	379	17.9
October 2006	336	19.3

Table 4. Monthly average monitored 5 days BOD and temperature for La Manga

Month	BOD_5 (mg/l)	Temperature (ºC)
September 2005	465	14.2
October 2005	343	14.8
Noevember 2005	400	17.7
December 2005	396	18.7
January 2006	232	23.1
February 2006	162	20.0
March 2006	257	20.3
April 2006	323	19.0
May 2006	544	17.0
June 2006	2,077	15.5
July 2006	831	15.0
August 2006	1,069	14.7
September 2006	1,159	15.2
October 2006	808	16.1

LEAKAGES FROM SLUDGE MANAGED ANEROBICALLY

The sludge from La Manga aerobic treatment was disposed anaerobically between 26/08/06 and 31/10/06. The sludge from Maitenlahue aerobic treatment was disposed anaerobically between 25/08/06 and 31/10/06. According to AM0006, methane leakage emissions due to anaerobic management are calculated based on the biochemical oxygen demand (BOD_5) of the sludge. However, the measurement of BOD_5 of a dehydrated sludge in the laboratory has a high level of uncertainty and local laboratories cannot present certified analysis. For this reason, the BOD_5 of the sludge is calculated by means of a mass balance taking into account the monitored BOD_5 of the influent and the monitored BOD_5 of the effluent of the system. The following equation represents the mass balance use to calculate the BOD_5 of the sludge.

$$Influent\ flow * DBO_{5\ influent} = Sludge\ flow * DBO_{5\ sludge} + Effluent\ flow * DBO_{5\ effluent}$$

Therefore, the BOD_5 of the sludge can be calculated as follows.

$$DBO_{5\ sludge} = \frac{Influent\ flow * DBO_{5\ influent} - Effluent\ flow * DBO_{5\ effluent}}{Sludge\ flow}$$

LEAKAGES FROM ENERGY CONSUMPTION

Leakages from energy consumption are calculated multiplying the energy consumption (kWh/month) by the Emission Factor (0.469 tCO2eq/MWh) for SIC ("Sistema Interconectado Central") grid, obtained from the PDD" Nueva Aldea Biomass Power Plant Phase 2 (Nueva Aldea Power Plant Phase 2)" registered on June 2th, 2006 (methodology ACM0006).

Calculations for activated sludge leakage energy consumption are calculated using energy consumption monitored monthly by Aguas y Riles.

MONITORING PERIOD AND EMISSION REDUCTIONS

The monitoring period goes from Maitenlahue: 01/02/05 – 31/10/06
The monitoring period goes from La Manga: 01/02/05 – 31/10/06

The following table shows emissions for baseline scenario of Maitenlahue and La Manga:

Table 5. Baseline Emissions in Maitenlahue

Summary of baseline emissions Maitenlahue For period comprehended between 2005 - 2006		
Ton CO2eq	2005	2006
JANUARY		7,269
FEBRUARY		6,443
MARCH		7,903
APRIL		8,828
MAY	6,271	8,833
JUNE	5,724	9,385
JULY	6,798	8,482
AUGUST	6,879	8,754
SEPTEMBER	5,715	8,064
OCTOBER	6,805	9,672
NOVEMBER	5,979	
DECEMBER	6,445	
TOTAL	50,616	83,633

Table 6. Baseline Emissions in La Manga

Summary of baseline emissions La Manga For period comprehended between 2005 - 2006		
Ton CO2eq	2005	2006
JANUARY		7,169
FEBRUARY		6,235
MARCH		7,594
APRIL		7,284
MAY		7,711
JUNE		10,357
JULY		7,407
AUGUST		9,082
SEPTEMBER	6,942	10,225
OCTOBER	7,523	9,784
NOVEMBER	7,104	
DECEMBER	5,358	
TOTAL	26,927	82,848

The following tables show emissions for project scenario for Maitenlahue and La Manga.

Table 7. Project Emissions in Maitenlahue

Summary of project emissions Maitenlahue For period comprehended between 2005 - 2006		
Ton CO2eq	2005	2006
JANUARY		19
FEBRUARY		15
MARCH		50
APRIL		49
MAY	12	37
JUNE	14	54
JULY	16	50
AUGUST	27	56
SEPTEMBER	26	44
OCTOBER	38	43
NOVEMBER	29	
DECEMBER	17	
TOTAL	179	417

Table 8. Project Emissions in La Manga

Summary of project emissions La Manga For period comprehended between 2005 - 2006		
Ton CO2eq	2005	2006
JANUARY		19
FEBRUARY		14
MARCH		27
APRIL		35
MAY		66
JUNE		170
JULY		47
AUGUST		111
SEPTEMBER	56	89
OCTOBER	51	74
NOVEMBER	43	
DECEMBER	30	
TOTAL	180	652

The following tables show emissions from electricity consumption for Maitenlahue and La Manga.

Table 9. Leakage estimation electricity Maitenlahue Activated Sludge

Leakage Electricity tCO2eq/mes Maitenlahue For period comprehended between 2005 - 2006		
Ton CO2 eq	2005	2006
JANUARY		120
FEBRUARY		112
MARCH		132
APRIL		145
MAY	95	130
JUNE	87	117
JULY	107	133
AUGUST	123	144
SEPTEMBER	105	114
OCTOBER	101	113
NOVEMBER	108	
DECEMBER	120	
TOTAL	846	1,260

Table 10. Leakage estimation electricity La Manga Activated Sludge

Leakage Electricity tCO2eq/mes La Manga For period comprehended between 2005 - 2006		
Ton CO2 eq	2005	2006
JANUARY		99
FEBRUARY		149
MARCH		163
APRIL		137
MAY		89
JUNE		66
JULY		84
AUGUST		94
SEPTEMBER	124	120
OCTOBER	123	118
NOVEMBER	125	
DECEMBER	110	
TOTAL	482	1,119

The following tables show emissions from anaerobic management of sludge for Maitenlahue and La Manga.

Table 11. Leakage estimation due to Sludge Managed Anaerobically in Maitenlahue

Leakage estimation due to Sludge Managed Anaerobically in Maitenlahue		
Ton CO2eq	2005	2006
JANUARY		0
FEBRUARY		0
MARCH		0
APRIL		0
MAY	0	0
JUNE	0	0
JULY	0	0
AUGUST	0	264
SEPTEMBER	0	1,959
OCTOBER	0	2,111
NOVEMBER	0	
DECEMBER	0	
TOTAL	0	4,334

Table 12. Leakage estimation due to Sludge Managed Anaerobically in La Manga

Leakage estimation due to Sludge Managed Anaerobically in La Manga		
Ton CO2eq	2005	2006
JANUARY		0
FEBRUARY		0
MARCH		0
APRIL		0
MAY		0
JUNE		0
JULY		0
AUGUST		586
SEPTEMBER	0	2,503
OCTOBER	0	2,818
NOVEMBER	0	
DECEMBER	0	
TOTAL	0	5,907

The following tables show the emission reductions during that period

Table 13. Emission Reductions in Maitenlahue

Summary of emission reductions in Maitenlahue considering leakage electricity		
Ton CO2eq	**2005**	**2006**
JANUARY		7,130
FEBRUARY		6,316
MARCH		7,721
APRIL		8,634
MAY	6,164	8,666
JUNE	5,623	9,214
JULY	6,675	8,299
AUGUST	6,729	8,290
SEPTEMBER	5,584	5,947
OCTOBER	6,666	7,405
NOVEMBER	5,842	
DECEMBER	6,308	
TOTAL	**49,591**	**77,622**

Table 14. Emission Reductions in La Manga

Summary of emission reductions in La Manga considering leakage electricity		
Ton CO2eq	**2005**	**2006**
JANUARY		7,051
FEBRUARY		6,072
MARCH		7,404
APRIL		7,112
MAY		7,556
JUNE		10,121
JULY		7,276
AUGUST		8,291
SEPTEMBER	6,762	7,513
OCTOBER	7,349	6,774
NOVEMBER	6,936	
DECEMBER	5,218	
TOTAL	**26,265**	**75,170**

Table 15: Summary of all Emission reductions claimed for the period

Ton CO2eq	1st Feb 2005 – 31st December 2005	1st January 2006 – 31st October 2006	Total
Maitenlahue	49,591	77,622	127,213
La Manga	26,265	75,170	101,435
Total	**75,856**	**152,792**	**228,648**

On behalf of Agrícola Super Ltda.

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