BAT Assessment

for Pfizer Nutritionals Ireland Limited

Final

24th October 2011

Environet
Solutions

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TABLE OF CONTENTS

1 Introduction

Pfizer Nutritionals Ireland Limited (Pfizer) is an IPPC licensed facility based at Askeaton, Co. Limerick.

Pfizer has an IPPC licence issued by the EPA on 23 January 2004 for the following activities;

The manufacture of dairy products where the processing capacity exceeds 50 million gallons of milk equivalent per year

and

The operation of combustion installations with a rated thermal input equal to or greater than 50 MW.

The EPA has initiated a review of the IPPC licence with a view to bringing the licence into compliance with recent amendments to legislation protection waters as listed below;

SI 272 of 2009 – European Communities Environmental Objectives (Surface Waters) Regulations 2009

and

SI 9 of 2010 – European Communities Environmental Objectives (Groundwater) Regulations 2010

Section D.2 Environmental Considerations and Best Available Techniques (BAT), of the form requires that the facility treatment of process effluent in its wastewater treatment plant (WWTP) complies with the requirements of the relevant EPA BAT document, in this case;

'BAT Guidance Note on Best Available Techniques for the Dairy Processing Sector', EPA, 2008

2 BAT Overview

BAT was introduced as a key principle in the IPPC Directive, 96/61/EC. This Directive has been incorporated into Irish law by the Protection of the Environment Act 2003. To meet the requirements of this Directive, relevant Sections of the Environmental Protection Agency Act 1992 and the Waste Management Act 1996 have been amended to replace BATNEEC (Best Available Technology not Entailing Excessive Costs) with BAT.

BAT is defined in Section 7 of the Protection of the Environment Act 2003 and Section 5(2) of the Waste Management Acts 1996 to 2005 as the "most effective and advanced stage in the development of an activity and its methods of operation, which indicate the practical suitability of particular techniques for providing, in principle, the basis for emission limit values designed to prevent or eliminate or, where that is not practicable, generally to reduce an emission and its impact on the environment as a whole", where:

B = 'best' in relation to techniques, means the most effective in achieving a high general level of protection of the environment as a whole.

A = 'available techniques' means those techniques developed on a scale which allows implementation in the relevant class of activity under **economically and technically viable** conditions, taking into consideration the costs and advantages, whether or not the techniques are used or produced within the state, as long as they are reasonably accessible to the person carrying on the activity.

T = 'techniques' includes both the technology used and the way in which the installation is designed, built, managed, maintained, operated and decommissioned.

At the facility/installation level, the most appropriate techniques will depend on local factors. A local assessment of the costs and benefits of the available options may be needed to establish the best option. The choice may be justified on:

- the technical characteristics of the facility;
- its geographical location;
- local environmental considerations;
- the economic and technical viability of upgrading existing installations.

The overall objective of ensuring a high level of protection for the environment as a whole will often involve making a judgement between different types of environmental impact, and these judgements will often be influenced by local considerations. On the other hand, the obligation to ensure a high level of environmental protection including the minimisation of long-distance or

transboundary pollution implies that the most appropriate techniques cannot be set on the basis of purely local considerations.
The guidance issued in this note in respect of the use of any technology, technique or standard does not preclude the use of any other similar technology, techniques or standard that may achieve the required emission standards.

3 Scope of Work

The BAT Assessment work was undertaken as follows:

- Site Visit
- Review of the EPA BAT Guidance Document and the existing IPPC Licence.
- Preparation of the BAT Assessment Report.

Preparation of the BAT Assessment Report

Environet has prepared this draft BAT assessment report, identifying compliance with BAT based on the information obtained from our detailed review. The assessment is presented in Sections 4 of this report. Environet utilised, a tabular style approach, designed to facilitate easy comparison with the BAT Guidance document.

A detailed description of the WWTP operation is included as Attachment C of the Application Form.

Environet has included detailed activity descriptions only where necessary in the context of identifying and assessing BAT.

Environet has excluded any detailed impact assessments and monitoring or analysis in the event of describing BAT deviation or where techniques identified are not considered BAT. Environet have instead relied on information and data readily available from site records.

3.1 BAT Assessment Table

The BAT Assessment table is structured as follows:

- Column 1 (Questions) questions on each topic are presented in order to obtain the information necessary to assess the level of BAT on site for each topic.

- Column 2: (Techniques Observed). For each question, this is effectively an answer and with answers as closely as practicable linked to the BAT guidance (Column 3).
- Column 3 (BAT Guidance): This is the BAT guidance as set out in the BAT Guidance document.
- Column 4 (BAT, Y/N): Is the technique as described considered BAT.
- Column 5 (Justification/Comment): Where necessary a comment or justification is inserted regarding the BAT conclusion reached.

QUESTIONS	TECHNIQUE OBSERVED	BAT GUIDANCE	BAT (Y/N)	JUSTIFICATION/ COMMENTS
Is there a management system in place?	Pfizer Askeaton has a certified EMS to ISO 14001:2004	That a management system is in place	Y	
Are screens installed to remove gross solids?	Screens are installed upstream to reduce gross solids and a rope skimmer is used to remove grease prior to the main WWTP.	Install screens to remove gross solids where necessary	Y	
Is flow and load balancing in place?	There is a dedicated Balance Tank to balance both flow and load variations throughout the day	Ensure that flow and load balancing systems are in place in wastewater discharge systems	Y	
Is there adequate mixing to prevent stratification and maintain dissolved oxygen in the balancing tank?	The balancing tank uses a Venturi Jetting pump aeration system to keep the contents mixed and to maintain aerobic conditions	Ensure adequate mixing and aeration in order to prevent stratification within the balance tank and to maintain a positive dissolved oxygen level	Y	

QUESTIONS	TECHNIQUE OBSERVED	BAT GUIDANCE	BAT (Y/N)	JUSTIFICATION/ COMMENTS
For streams > 1500 mg/l BOD was anaerobic digestion considered?	Average wastewater BOD concentration in the balance tank is approx 1000 mg/l. While certain wastewater streams have a higher BOD the wastewater treatment strategy for the site is that all streams are mixed prior to treatment to optimize treatment and reduce the quantity of chemicals required for pH correction.	For waste streams > 1500 mg/l BOD consider the use of anaerobic processes	Y	Considered anaerobic treatment but not suitable for site wastewater strategy
Is there activated sludge treatment of low strength streams?	Yes activated sludge is the secondary treatment employed at the site. The method used is SBR (Sequencing Batch Reactors)	Activated sludge system is used for lower strength wastewater streams	Y	

QUESTIONS	TECHNIQUE OBSERVED	BAT GUIDANCE	BAT (Y/N)	JUSTIFICATION/ COMMENTS
Is primary treatment compliant with BAT guidance?	The following primary treatment steps are used at the facility WWTP; - Screens - Separators for oil and grease - Flow and load equalisation - Neutralisation - Mixing & Aeration - Storage Capacity - Cooling	One or more of the following steps are typically employed - Bar racks and screens - Separators - Flow and load equalisation - Neutralisation - Diversion Tank - Floatation - Sedimentation - Centrifuges - Wetland system	Y	

QUESTIONS	TECHNIQUE OBSERVED	BAT GUIDANCE	BAT (Y/N)	JUSTIFICATION/ COMMENTS
Is secondary treatment compliant with BAT guidance?	The following secondary treatment steps are used at the facility WWTP; - Sequencing Batch Reactors	One of the following systems are typically employed - Sequencing batch reactor - Lagoons - Biotowers - Submerged aerated filters - Membrane bioreactor - Loose media systems - Wetlands systems	Y	
Is tertiary treatment compliant with BAT guidance?	Tertiary treatment is usually associated with removal of nutrients. The wastewater at the facility is nutrient deficient and theoretically requires nutrients to be added to the biological process in order to promote biological growth.	Not Applicable	Y	

QUESTIONS	TECHNIQUE OBSERVED	BAT GUIDANCE	BAT (Y/N)	JUSTIFICATION/ COMMENTS
Are sludge treatment methods compliant with BAT guidance	Excess activated sludge is thickened in a picket fence thickener and then dewatered using a filter belt press. The sludge is then composted and used as a capping material for landfills or landspread.	Examples of sludge treatment methods are given below; - Conditioning - Sludge thickening - Sludge dewatering - Stabilisation - Drying - Landspreading - Composting - Anaerobic digestion - Wetlands	Y	
Are techniques for treatment of air emissions from the WWTP compliant with BAT guidance?	Both the balancing tanks and SBR system are adequately aerated and do not appear to generate any nuisance odours. Sludge dewatering is operated in such a way as to minimize the generation of anaerobic conditions which could result in the generation of odorous compounds.	Not applicable	Y	

QUESTIONS	TECHNIQUE OBSERVED	BAT GUIDANCE	BAT (Y/N)	JUSTIFICATION/ COMMENTS
Are noise abatement techniques in compliance with BAT guidance?	All noise generating equipment such as pumps and surface aerators are the subject of routine maintenance under the sites Preventative Maintenance system. This ensures that the site remains in compliance with its noise limits as defined in the IPPC licence. Noise abatement enclosures have been fitted to aeration blowers. Annual noise monitoring demonstrates compliance with IPPC licence limit values.	- Implement a noise management system - Carry out routine monitoring and maintenance to reduce noise emissions - Insulate to reduce noise emissions	Y	
Is energy use optimized in the WWTP?	With regard to the facility in general please find attached the most recent Energy Audit in Appendix A. With regard to the WWTP the main energy use is the blowers used to aerate the SBRs. These blowers are run on the basis of dissolved oxygen readings from the DO probes, minimizing energy requirements.	That energy use is minimized.	Y	

QUESTIONS	TECHNIQUE OBSERVED	BAT GUIDANCE	BAT (Y/N)	JUSTIFICATION/ COMMENTS
Is there a management system for accidental releases?	The following systems are in place at the facility - bund register and bund testing programme - spill response procedure - emergency response plan - investigation of accidents procedure - corrective and preventative action procedure - environmental risk assessment programme	- that potential accidental releases are identified - that control measures are identified to reduce their risk - that an Emergency Plan is developed - that all incidents/near misses are investigated	Y	

QUESTIONS	TECHNIQUE OBSERVED	BAT GUIDANCE	BAT (Y/N)	JUSTIFICATION/ COMMENTS
Are Emission Limit Values in compliance with BAT guidance?	The following ELVs are in place and are complied with; - BOD 40 mg/l (giving > 96% removal) - SS 50 mg/l - Total N 15 mg/l - Total P 2 mg/l - Oils. Fats & Greases 15 mg/l - Ammonia 10 mg/l	- BOD 20-40 mg/l or > 90% removal - SS 50 mg/l - Total N 5-25 mg/l or > 80% removal - Total P 2-5 mg/l or > 80% removal - Oils, Fats & Grease 10-15 mg/l - Ammonia 10 mg/l	Y Y Y Y Y Y	

4 Conclusions

Environet was commissioned to undertake a BAT assessment of the Pfizer WWTP located at Askeaton, Co. Limerick. The assessment was undertaken with a view to its inclusion with the submission of an IPPC license review application to the EPA.

In general, there is a high degree of BAT implementation at Pfizer in the context of an existing installation. Particular aspects of the implementation of BAT worthy of note are:

1. The significant focus on energy management;
2. The very good degree of IPPC licence compliance;
3. The site has implemented an ISO 14001:2004 accredited Environmental Management System;
4. Pfizer has incorporated detailed change control procedures that require a significant environmental review and which identifies opportunities for raw materials usage efficiency;
5. Pfizer has in place a very rigorous waste management audit protocol requiring that only approved waste management companies can manage waste on behalf of Pfizer;

Appendix A – Energy Audit

Strategic Energy Analysis of: Pfizer Askeaton – Ireland

Prepared by: JCI Energy Services

April 2010

Johnson Controls

Contents

Introduction & Executive Summary

The Pfizer Askeaton Nutritional facility has and continues to be proactive in reducing energy costs. The facility energy and engineering team has participated to the fullest in the Corporate Energy Program and has implemented many energy cost savings projects, notably the 5MW combined heat and power (CHP) system which was developed as a Build, Own, Operate and Maintain (BOOM) contract by a specialist packager and which has provided nearly €6 million in savings since it began operation in November 2004. The contract which minimized up front investment for 20 years with a buy out clause after 3 years was developed in response to capital constraints.

The facility has also worked with the Corporate Energy program to manage the purchased cost of energy as a single facility and through a group of Irish legacy Wyeth facilities with greater leverage through increased quantities. The facility energy purchasing philosophy has been to protect the budget and now welcomes the more aggressive approach pursued by the Pfizer purchasing group (via Core Energy). Askeaton engineering personnel were forces behind the Corporate Irish Energy Council and behind the management of emissions credits made available through the European Emissions Trading Scheme.

The facility has also participated in the Nutritionals energy users group with other similar legacy Wyeth facilities. Through benchmarking in this group the facility has recognized the need to reduce specific steam consumption, not only in the generation and distribution but in the end use in the actual process.

Johnson Controls (JCI) in conjunction with Eirdata undertook an energy assessment of the facility in February 2010 with the goal of identifying projects that would reduce carbon emissions in line with the Pfizer corporate goal. This assessment took into account the most important underlying factor regarding energy strategy at Askeaton: the CHP contract. In exchange for the reduced electricity price that has brought about the nearly €6 million in savings, the site agreed to a twenty year contract to purchase electricity and steam from the CHP plant. The most restrictive aspect of the agreement is that the site agreed to pay for a minimum of 13 tonnes of steam per hour, five days per week, fifty weeks per year whether it used it or not. There are also provisions for discounting the price of steam for greater consumption. During the first five years of operation, the steam agreement has discounted the overall price of steam for the plant, but any scenario that reduces steam consumption at the site should take this contract into account. Pfizer has the option to purchase the plant from the developer at pre-negotiated prices at any point throughout the contract.

The assessment identified several low cost energy reduction opportunities listed in the final section of the report totalling over 296,000 euros savings per year. It is recommended that the site undertakes these savings project as soon as possible. The most promising is related to the shutdown of dryer 2. In order to achieve maximum savings it is recommended that a cross functional energy team be formed including representatives from operations, technology, and maintenance. The first opportunity is to eliminate as much steam load as possible from the proposed shut down of dryer 2, and then on to various other opportunities in changes of operations (such as optimization of the CIP process). The responses to the process questionnaire in Appendix B can help with this analysis.

Several other capital intensive opportunities were also identified .These should be evaluated and prioritized by the site energy team and a strategy developed for the analysis and implementation of the most promising projects. To this end, the facility has recognized the need to achieve a greater understanding of the chilled water system and is requesting a detailed analysis of its performance and through that identification of energy efficiency improvements. A similar in depth analysis was thought to be required around the HVAC systems particularly those supporting the process areas and for heat optimization in wet processing .

There were several process energy efficiency projects identified which will need the technology group involvement and leadership. It is of real interest to fully understand the energy distribution of the facility in the form of a sankey diagram or similar. However without a great deal of measurement and metrics the results may not provide sufficient granularity for accurate response. The technology group have adopted a different strategy and have drilled down to specific equipment and in partnership with the equipment vendors are working to improve the efficiency of the equipment. They chose the driers and evaporators as their first priority as they probably use over 50% of the steam. As an example, the most recent evaporator designs operate at an efficiency of 8:1 (8 kg of water evaporate per 1 kg of steam used). By determining the existing evaporator performance, an assessment can be made on improvement and energy savings opportunity.

In addition the site should continue to migrate to the Stark metering system from some of the manual and virtual meters particularly on the electricity. This will obviously help the site to continue to monitor specific energy uses towards an overall KPI

A water mapping analysis is also recommended as a precursor to the sites commitment to reduce water usage related to the IPPC license

II. Askeaton Energy Program

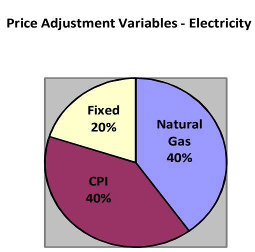
The Askeaton site has been actively working on energy management for at least ten years. In addition to receiving five outside energy surveys over the course of eleven years, the site has implemented approximately 30 energy projects saving approximately €1 million / year excluding the CHP project described below. It has been actively involved in the CorporateEnergy Program, the Irish Energy Council, and various programs of Sustainable Energy Ireland and has analyzed opportunities for innovative energy projects such as wind power, biomass, CHP fuel switching, and certification of its energy program under the IS393 program.

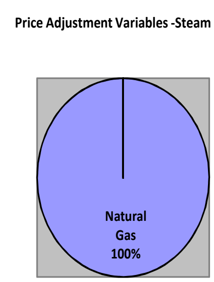
All of these efforts have limited the impact of energy price increases while reducing the CO2eq emissions from the site by 38% from 2001 to 2009 for similar volumes of production. The CO2 emissions breakdown is shown in Section IV. For 2009 the breakdown of costs were as follows:

Electricity cost:	€2.6 million
Steam cost:	€4.2 million
CHP Facility Charge:	€0.2 million
Total:	€7.0 million

III. Supply Side Energy

Since the inception of operations in November 2004, the 5 MW CHP plant operated by Askeaton Power at the site has provided approximately 90% of the electricity and steam for the plant. The steam output is optimum at 16 tons/hour, with a minimum requirement of 12 tons/hour and the plant would receive a financial reward over 23 tons/hour.Because of this, the CHP agreement is the most important element in the supply side energy strategy. The electricity and steam provided by the plant are priced based on the initial contract price and adjustments over time. The adjustment variables are as follows:

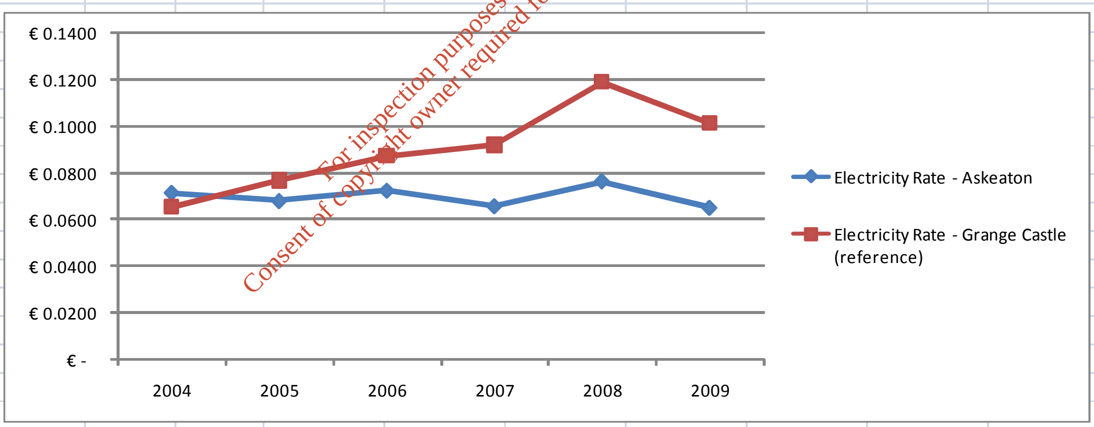




These charts show the importance of natural gas purchasing to the overall cost structure of the site's utilities. While the market index price cannot be controlled, the site has managed its exposure to gas prices by negotiating aggressive producer margins and by prudently forward purchasing natural gas for the facility. The success of this effort (and the value of the CHP facility) is shown below. While grid electricity prices (driven heavily by gas prices) has increased by 54% over the five years of operation of the Askeaton CHP facility, Askeaton's price has ***decreased*** by 9%, which includes amortization of the cost of the gas pipeline into the unit cost.

CHP and Related Financial Impacts - Wyeth, Askeaton

Category	2004	2005	2006	2007	2008	2009	Five Year Change
Electricity Rate - Askeaton	€ 0.0715	€ 0.0680	€ 0.0724	€ 0.0658	€ 0.0764	€ 0.0651	-9.0%
Electricity Rate - Grange Castle (referenc	€ 0.0654	€ 0.0767	€ 0.0875	€ 0.0919	€ 0.1190	€ 0.1012	54.7%
Annual Electricity Savings		€ 578,064	€ 865,370	€ 1,576,388	€ 1,598,973	€ 1,371,842	
WPDRS Savings		€ 105,411	€ 43,812	€ 14,972	€ 2,395	€ -	



The site's process for determining when and how much gas to purchase forward is sound. The site procurement team solicits input from multiple outside sources and compares prices against budget in order to make a decision. Purchases are layered in order to reduce the risk of purchasing at a bad time, and at least 25% is purchased on the Day Ahead or Within Day market in order to minimize the risk of having to sell gas back to the market.

The site, through Askeaton Power, signs one to three year agreements with a gas supplier who can provide flexible purchasing options and makes its purchases for the CHP and boilers through that contract. Top-up electricity for the remaining 10% of the site's load is bid out every one or two years and a contract is signed with the low price provider.

IV. GHG Review

Purchased Natural Gas Emissions (Direct):	42,755 tonnes CO2eq
Purchased Electricity Emissions (Indirect):	1,526 tonnes CO2eq
Total Emissions:	44,282 tonnes CO2eq

The direct emissions from gas is slightly below the site's allowance as determined by the Irish EPA (43,007 tonnes). If that number is verified, the site would have 252 tonnes of allowances available to sell on the market. At the current price of approximately €13 / tonne, the sale would produce €3,276 before brokerage fees. Essentially, then, the carbon emissions are a break-even for the site.

The site's allowance for Phase I of the EU Emissions Trading Scheme (ETS) was more generous, because it received an additional allowance for the CHP, which was new at the time. Until the acquisition by Pfizer, the four Wyeth sites under the ETS would exchange allowances internally and then conduct a market trade for the balance in order to minimize transaction costs.

The current allowance was based on actual emissions during Phase I, which have remained essentially flat into Phase II. The EU is currently determining policy for the program beyond 2012, when Phase II of the ETS expires. This is when carbon emissions constraints can expect to become a significant factor in the site's cost structure.

V. 2010 F&P (Fuel & Power) budget overview

The 2010 fuel and power budget was initially established in June 2009 based on production plans, equipment efficiency, exchange rates and forward gas prices. Projections are made regularly throughout the year to track against the budget. The current projection for 2010, compared with the original budget, is shown below.

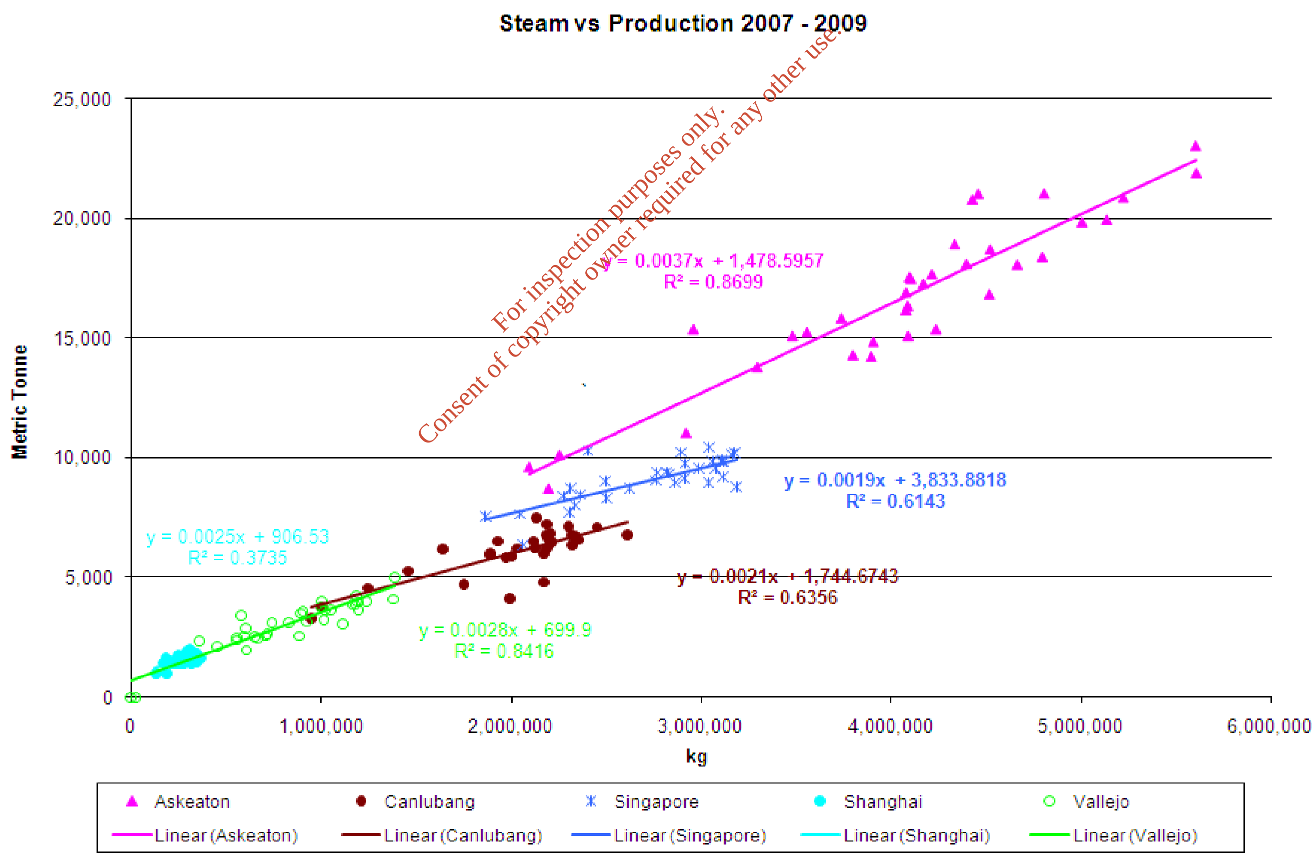
As of end of March			Askeaton Energy - Budget Overview						
		Production	Electricity		Steam		Total	Nat Gas	Nat Gas
		kg	kWh	Cost	Tonnes	Cost	Cost*	€/ therm	Forward
YTD	Budget	16,727,696	12,542,888	€ 1,015,137	66,574	€ 1,456,582	€ 2,471,719		
	Actual	13,090,909	11,315,700	€ 760,798	66,370	€ 1,331,294	€ 2,092,091		
	Variance	-3,636,787	-1,227,188	€ (254,340)	-204	€ (125,288)	€ (379,628)		
	% Variance	-21.7%	-9.8%	-25.1%	-0.3%	-8.6%	-15.4%		
DEC	Budget	3,327,918	2,964,669	€ 229,668	15,003	€ 330,660	€ 560,328	€ 1.270	
	Actual	3,409,091	2,812,500	€ 199,061	16,209	€ 337,012	€ 536,072	€ 0.595	*100%*
JAN	Budget	4,335,530	3,371,382	€ 287,195	17,502	€ 389,958	€ 677,153	€ 1.371	
	Actual	4,090,909	3,210,800	€ 222,906	20,569	€ 424,292	€ 647,198	€ 0.604	100%
FEB	Budget	4,472,308	3,032,430	€ 244,792	16,505	€ 363,024	€ 607,816	€ 1.377	
	Actual	3,636,364	2,901,900	€ 179,046	17,360	€ 322,939	€ 501,985	€ 0.607	100%
MAR	Budget	4,591,940	3,174,407	€ 253,482	17,564	€ 372,940	€ 626,422	€ 1.323	
	Actual	1,954,545	2,390,500	€ 159,786	12,232	€ 247,050	€ 406,836	€ 0.465	100%
APR	Budget	4,812,480	3,257,136	€ 255,926	18,182	€ 365,754	€ 621,680	€ 1.233	
	Projection	2,954,545	2,724,659	€ 197,607	19,288	€ 192,334	€ 389,941	€ 0.452	58%
MAY	Budget	4,796,025	3,484,255	€ 271,848	18,345	€ 362,274	€ 634,122	€ 1.163	
	Projection	2,318,182	2,835,886	€ 186,237	18,237	€ 187,884	€ 374,121	€ 0.452	33%
JUN	Budget	4,405,005	3,569,930	€ 280,458	18,984	€ 372,133	€ 652,591	€ 1.137	
	Projection	3,090,909	3,156,182	€ 220,025	16,826	€ 213,074	€ 433,099	€ 0.511	58%
JUL	Budget	2,765,037	2,531,275	€ 212,632	12,784	€ 269,289	€ 481,921	€ 1.143	
	Projection	2,318,182	2,460,886	€ 194,840	11,810	€ 180,010	€ 374,849	€ 0.484	50%
AUG	Budget	3,226,221	2,722,833	€ 215,728	14,194	€ 288,365	€ 504,093	€ 1.155	
	Projection	2,636,364	2,592,773	€ 205,846	12,838	€ 185,400	€ 391,246	€ 0.469	50%
SEP	Budget	4,812,480	3,240,390	€ 252,298	18,057	€ 353,180	€ 605,478	€ 1.164	
	Projection	4,363,636	3,308,727	€ 258,571	18,419	€ 258,120	€ 516,691	€ 1.270	50%
OCT	Budget	4,796,370	3,597,915	€ 300,841	19,193	€ 461,910	€ 762,751	€ 0.748	
	Projection	4,136,364	3,589,523	€ 271,876	18,765	€ 301,885	€ 573,761	€ 1.270	*50%*
NOV	Budget	4,506,700	3,239,389	€ 269,577	18,049	€ 434,773	€ 704,350	€ 1.273	
	Projection	4,181,818	3,233,364	€ 230,475	17,831	€ 298,721	€ 529,196	€ 0.561	*50%*
TOTA	Budget	50,848,014	38,186,011	€ 3,074,445	204,342	€ 4,364,260	€ 7,438,705		
	Projection	39,090,909	35,217,700	€ 2,526,274	200,383	€ 3,148,721	€ 5,674,995		
OTHER	CO2 Emissions				Tonnes	Cost at			
	Market Price	€ 10.00		Allowance:	43,007	€ 430,070			
				Projected:	40,580	€ 405,799			
				Net:	(2,427)	(€ 24,271)			
	WPDRS			Expected:		€ 0			
				Realized:					
	Facilities Charge					€ 189,326			
	Total Annual			**Budget:**		**€ 7,603,760**			
				Projected:		**€ 5,840,050**			
PROJECTED	<u>BENCHMARKS</u>		Electricity (kWh)		Steam (tonne)				
			Use / kg	Cost / MWh	Use / kg	Cost / tonne			
	Budget		0.751	€ 80.51	4.02	€ 21.36			
	Actual / Proj		0.901	€ 71.73	5.13	€ 15.71			
	Variance		20.0%	-10.9%	27.6%	-26.4%			

Note: Budget vs. actual may show significant variance because projections are made on a weekly basis to reflect production numbers.

The most recent projection, based on significant reductions in production and gas prices, was made in February at just over €6.0 million.

VI. Energy Use and Benchmarking

The Nutritional engineering team have been tracking specific energy use as Key Performance Indicators for each Nutritional facility and as can be seen the Askeaton facility has an approximately 28% higher specific steam use an estimated 12% may be due to the additional space heating requirements over and above the other facilities in warmer climates. However the Askeaton engineering team are interested in defining the difference and if possible closing up the difference.



In addition the Nutritional engineering team had been aware that any reduction in production reduced the KPI in part due to the affect of a seemingly constant base load with a reduced incremental load as indicated below

Monthly unit energy usage Summary 09 vs 08

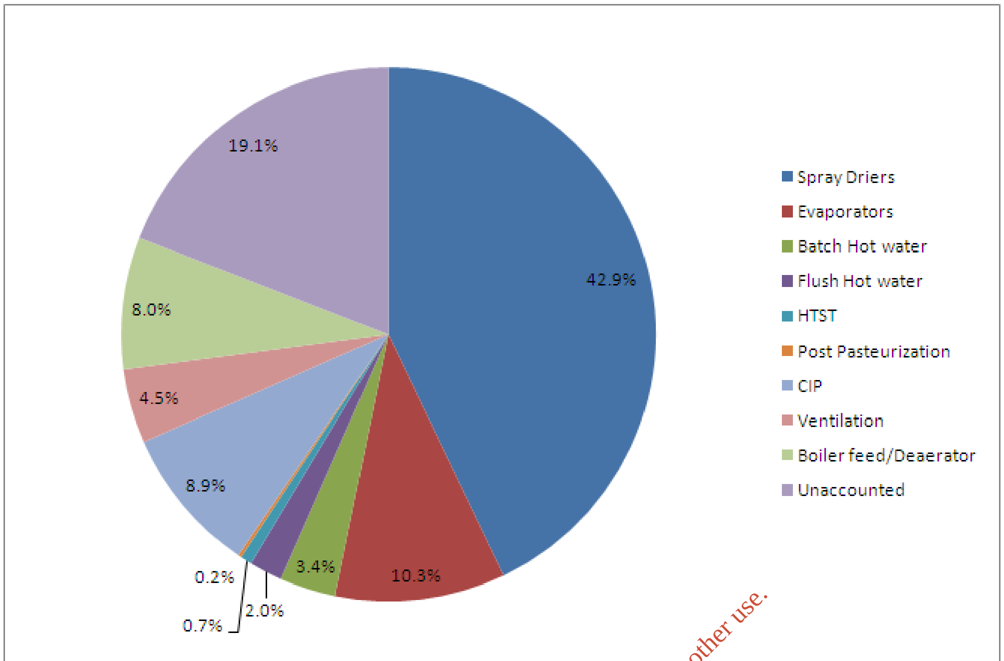
Facility	Year	Production Vol Ton / Month	'09 Vs '08 %	Electrical KPI KWh/kg	'09 Vs '08 %	Steam KPI kg/kg	'09 Vs '08 %	Water KPI L/kg	'09 Vs '08 %	Notes
Askeaton	2008	4203		0.74		4.10		18.8		Jan-Aug, 08
	2009	3909	-7.00%	0.78	5.44%	4.13	0.88%	19.0	1.38%	Jan-Aug, 09
Canlubang	2008	1844		1.16		3.05		19.0		Jan-Aug, 08
	2009	2050	11.14%	1.18	2.08%	3.08	0.87%	18.3	-3.66%	Jan-Aug, 09
Mexico City	2008	1061		0.76		3.41		12.3		Jan-Aug, 08
	2009	949	-10.60%	0.77	1.34%	4.21	23.69%	14.6	18.93%	Jan-Aug, 09
Shanghai	2008	289		1.78		6.16		34.8		Jan-Aug, 08
	2009	226	-22.02%	2.07	16.19%	6.72	9.11%	41.5	19.18%	Jan-Aug, 09
Singapore	2008	2752		1.34		3.19		13.5		Jan-Aug, 08
	2009	2533	-7.96%	1.46	8.86%	3.68	15.28%	14.4	6.65%	Jan-Aug, 09
Subtotal	2008	10156		1.03		3.63		17.6		Jan-Aug, 08
	2009	9409	-7.35%	1.07	4.14%	3.83	5.52%	17.8	1.10%	Jan-Aug, 09

As a result of this Askeaton have undertaken an analysis in 2009 to attempt to identify the steam base load and the results of the analysis are included in Appendix C and can be summarized as:

- Steam load needed for support facilities such as the office heating , showers and cleaning including CIP
- Steam losses from steam trap failures, leaks and standby losses
- Steam losses from interrupted or partial production

The Wyeth Energy Program attempted to undertake a heat balance of production in the Singapore facility but could not validate the calculated uses with actual metered data in part because of the overlapping batch processes. The Nutritional engineering team reviewed the outcome and elected not to undertake the process. Instead it was decided that analysis should be undertaken in conjunction with the equipment vendors on the known high energy users, the dryer and evaporator.

However the Askeaton site did undertake an exercise to determine the distribution of steam load which is summarized below



As can be seen and as expected the driers and evaporators constitute over 50% of the steam load. The unaccounted losses would include base load such as standing , steam and trap losses as well as loads from interupted production but requires further definition.

The foregoing represents the distribution of exported steam from the CHP and boiler house. The conversion efficiency is analysed below:

The site generates steam at 17 Barg from the CHP heat recovery boiler, 15 Barg from Boiler No. 1 and 10.5 Barg from boiler No 3. The steam is reduced to 11 bar from each point of generation to site distribution header. At the users the steam is reduced further as required by end users. Boiler blowdown is estimated at 3% of feed water and discharged through blowdown separator. Flashed steam is exhausted to atmosphere and water is quenched and discharged to drain. Condensate return is calculated at 75% of total steam generation.

Boilers 1 and 3 fuel consumption for 2009 is shown in table 1

Table 1 Boiler 1 and 3 Fuel usage

	Gas Used	Gas Used	Gas Used	Liquid Fuel	Liquid Fuel	Total
	M3	kWh	Adjusted kWh	Liter	kWh	kWh
Boiler 1	582,946	6,461,925	7,390,879	10,229	109,036	7,499,915
Boiler 3	374,568	4,152,066	4,748,959	311	3,315	4,752,274

Based on the site steam meters boilers 1 and 3 have produced steam as shown in table 2. The accuracy of the steam meters could not be verified since the site only meters the make up and not the feedwater and/or the condensate. Steam meters are not very reliable and need frequent calibration to maintain a fair degree of accuracy. Water meters are much more reliable and inexpensive to install and should be used to check steam meters performance. The fuel heating value is 11.085 kW/M3 as reported by Bord Gais Energy.

Table 2 Boiler 1 steam production

	Steam	Enthalpy	Steam	Efficiency
	Tonnes	kW/kg	kWh	
Boiler 1	8,643	0.679555	5,873,115	78.31%

Based on the data in table 2 above, the fuel to steam efficiency of boiler 1 is reasonable considering the employment of this boiler as mainly top off of the CHP heat recovery boiler.

The performance of the CHP is shown in table 3 and 4 for the gas turbine and heat recovery boiler respectively.

Table 3 Gas turbine fuel input and electric generation

	Total	Fired	Fuel Input	Electrical output	Avail.	Electrical Eff.	Average
	Hours	Hours	(kWh)	(kWh)			kW
Turbine (LHV)	8,767	8,131	132,128,950	39,587,500	92.75%	29.96%	4,869
Turbine (HHV)	8,767	8,131	145,758,164	39,587,500	92.75%	27.16%	4,869

Table 4 Heat Recovery Boiler fuel input and steam generation

	Fuel Input	Steam output	Enthalpy	CHP eff	Unfired steam	Average total	Average unfired	Unfired Eff
	(kWh)	kWh	kW/kg		kWh	kg/h	kg/h	
Boiler (LHV)	61,750,386	128,388,740	0.680675	86.64%	8,196	23,198	12,040	80.40%
Boiler (HHV)	68,119,990	128,388,740	0.680675	78.54%	7,747	23,198	11,382	70.38%

In general the derived efficiencies for the CHP and the heat recovery boiler are satisfactory and compare well with similar equipment in the industry. There are a few opportunities addressed in the next section of the report that will increase the efficiency. In addition for consistency it is recommended that the thermal efficiencies are derived using the Higher Heat Value (HHV) since gas is purchased with that value.

VII. Opportunities for energy cost reduction

The energy saving opportunities have been divided into three strategic phases:

- Projects that can be done without delay with minimal expenditure from operational funds
- Projects requiring capital expenditure
  - As a precursor to this and for the chilled water system, the site team believes there is a need to fully examine the chilled water system in an in depth analysis. This would also apply to the HVAC system
- Projects that require input from the technology group
  - As part of this initiative the Askeaton Team has prepared a questionnaire (appendix B) which will be forwarded to the other Nutritional facilities to determine any major process differences that would affect energy use.
  - The Technology group is undertaking a similar exercise with the CIP, which when completed will be reviewed for opportunities.

A summary list of the energy projects identified during the assessment is included at the end of this section. The following is an overview and description of the potential energy savings opportunities identified.

Steam and Condensate energy savings opportunities

<u>Blowdown heat recovery</u>
The heat from estimated 3% blowdown is not recovered. The flashed steam from the blowdown can be routed to the deaerator and the water can be utilized to heat the makeup water before it enters the condensate storage tank. The flashed steam is estimated to be approximately 60% of the total heat recovered.

<u>Condensate recovery</u>
Condensate recovery could be increased from the current calculated 75% (based on observed instantaneous value). This project assumes an additional 5% condensate/heat recovery. As part of this project it is recommended that the boiler feed water is metered which can be compared with the existing make up water meter to determine and monitor the condensate return

<u>Steam pressure reduction</u>
Steam pressure reduction can be implemented for the CHP heat recovery boiler from the current 17 bar to 15 bar. In lieu of boiler operating pressure reduction, the site may want to consider the installation of a back pressure steam turbine to generate electricity in place of the current PRV to reduce the pressure from 17 bar to 11 bar. In addition to this

turbine, a similar back pressure turbine can be installed to generate electricity in the steam line that feed the deaerator to reduce the pressure from 11 bar to 0.5 bar.

Boiler 3 operation

Boiler 3 is used primarily as a second backup boiler The cost savings for shutting off this boiler are estimated at 30% of the fuel input. The savings are €27,000.

Steam traps

The site has made great progress in surveying and repair traps. The reports indicate that 434 traps were surveyed (15 passing steam) in 2008, 258 traps (10 passing steam) in June of 2009 and 199 traps (2 passing steam) in January of 2010. It is recommended that all traps be identified and tagged and categorized. The frequency of trap surveys should be accomplished as follow to limit the steam losses:

Pressure above 10 bar survey traps at least quarterly
Pressure between 2 and 10 bar at least semi-annually
Pressure below 2 bar to be performed annually

It is important to be very aggressive in surveying traps with the highest pressure because these traps when failed blow-off the greatest quantity of steam.
Savings shown are based on last surveyed losses.

Flash steam Vents

Flash steam vent represent great loss of steam. Routinely inspect the site for flash steam vents and repair/isolate them as soon as possible to limit the amount of steam loss. Saving for the project reflect the flashing steam vent located adjacent to the RTF building, the elimination of this vent will require an alternative to the present process requirement which necessitated the continual bleed of steam

Deaerators Operation

The site utilize two deaerators in parallel for feed water generation. Shutting down one deaerator for at least 60% of the time will provide energy savings.

Compressor and compressed air savings opportunities

The compressed air generation efficiency has improved greatly since the installation of a Variable Speed Drive (VSD) compressor, a central compressor control and heat regenerative compressed air dryer. However, a comprehensive compressed air program shall be institute and include the following:

Compressed air leaks

Site estimates 165 cfm(280 M3/h) of compressed air leakage. Savings assume reducing the loss by 60% by repairing leaks and changing the plastic tubing, which are a constant sources of leaks.

Heatless Dryer Operation

Heatless dryer require 15% dry compressed air for regeneration where as heat regenerate dryer require 7% plus the penalty of the electric heater. The most efficient dryer are the Heat of Compression (HOC), which utilize the heat from the compressors for regeneration. When ever possible this type of dryers should be installed for energy savings. The average flow of the facility for 2009 was 2015 scfm. This flow, with all dryers in operation, will be divided amongst the dryers based on pressure equalization. Presently the four heat regenerative dryer have a capacity of 2240 scfm, which is just above the average and therefore additional drying capacity is required to eliminate the operation of the heatless. If the installation of the additional drying capacity is not possible in the near future then the operation of the compressed air drying should favour the heat regenerative dryer as much as possible to reduce energy cost. The project assumes that on the average 250 scfm will be dried by the heat regenerated dryer in lieu of the heatless.

Raise the dew point (-30 presently) to the highest allowable and also regenerate dryer based on the mixed air dew point rather than dryer outlet dew point.

Chillers and chilled water savings opportunities

The site has indicated that they would like an in depth review of the system to ascertain it's performance and correct operation. However it is believed that reducing the condensing pressure can be implemented ahead of the analysis

Reduce condensing pressure

Decrease compressor discharge pressure to increase chillers' COP(10.5 bar vs 9 bar) as outlined by the Seagull report. The savings for this project are based on chillers running hour for 2009 as report by site. The hour are 3277 or a total of 359,190 kWh of power consumption. This appear to be very low for this system and it should be confirmed to verify savings.

An in depth analysis of the chilled water should include the following

- Compressor operation sequences

Change compressors' operation sequence to improve overall system efficiency. A two (2%) percent improvement has been assumed for computing the savings for this project.

- Other system consideration

Review replacement of reciprocating compressor with screw type to be included in the facility utility master plan

Assess the risk for cross-connecting the two system (screw with reciprocating system)

- Assess risk for continued use of ammonia refrigerant versus standard refrigerant.

Process Optimization savings opportunities (In conjunction with the Nutritionals Technology Group)

The investigation for energy savings for the following process related opportunities will be accomplished in conjunction with the process team.

Johnson Controls

Cooler Heat Recovery
Assess the use of process water in place of tower water for heat recovery. This has been done in other facilities and the original facility design included this mode of operation. This was previously employed at the site, but was removed from operation.

- Investigate how it is employed at other Nutritional sites in the network – An initial contact with the Singapore site did indicate that the heat recovery system was in operation but more operational information is being sought
- Review reasons why the operation of this system was discontinued

Heat Recovery on dryer exhaust
The exhaust air of the product dryer system is approximately 90 °C. Heat from this source is not recovered and therefore exhausted to atmosphere.

- Evaluate best alternatives and feasibility of heat recovery
- Conservative savings estimates of 15% of heat input can be achieved

Dryer 4 Optimization
Dryer 4 air process fans are fixed speed units. Due to size and process condition, these units can be equipped with VF Drive to provide energy savings opportunity.

- Assess installation of VFD on dryer 4 fan and wall and cone sweeps

Real Time Control (Advanced process control)
Product quality control sampling analysis is presently done on a batch basis. Implementing a continuous real time product sampling analysis will enhance product flow.

- Investigate rapid closed loop control to enhance product flow.

Reuse intermediate/final rinse for pre-rinse
CIP water rinses are once through process, It may provide water conservation if intermediate/final rise can be used as pre-rinse.

- Review CIP sequence and operation in relation to the comparison study done acroos the plants by a specialist vender

Dehumidification of Product Dryer Air
The dryer, in the process, is utilized to dry the product to a powder of 3% moisture. To accomplish this, air is heated and utilized to remove moisture from the product. Preconditioning inlet air may provide benefit in energy reduction.

- Investigate cost effectiveness of dehumidification of product dryer air

Compounding/Process Optimization
Presently compounding of products achieves a concentration of approximately of 40%. Increasing the concentration during compounding will result in reduced operation energy

requirement in either the evaporator or the dryer or may eliminate the use of the evaporator in the process. In addition, product is compounded primarily from powder products. It may be of interest the utilization of liquid and local raw materials to reduce/eliminate energy associated with the compounding process.

- Investigate compounding concentration improvement to reduce energy requirement and possibly eliminate to use of the evaporator.
- Investigate use of liquid versus solid raw materials

Evaporators heat/condensate recovery

The condensate form the evaporators is not returned for fear of contamination with product. The condensate outlet temperature varies with evaporator vacuum setting. Evaporator 4 was operating at 140 mBar and the condensate temperature was 49 °C, instead evaporator 5 was operating at 300 mBar and the condensate temperature was 59 °C

- Investigate condensate and/or heat recovery
- Set vacuum on condenser column to lowest possible as allowable by product type. This mode of operation will insure lowest steam consumption

Water Conservation

Due to the amount of waste water flow, it is necessary to run both water treatment plants. However, the water composition indicates that non-process leaks contribute to high hydraulic load. Eliminating these leaks will result in reduced hydraulic loading and may lead to the operation of one water treatment plant only.

- Investigate and repair water leaks.
- Investigate the opportunity to operate one water treatment only.

Johnson Controls

Project List

Site Projects Summary

Site Name: Askeaton Ireland

Project No.	Description	Electricity Reduction (kWh)	Steam/gas Reduction (kWh)	CO2 Reductions Tonnes/year	CO2 Reduction %	Estimated Savings (Euro/yr)	Estimated Implement Cost (Euro)	Simple Payback (yrs)	Cost Euro/Tonne	Steam/gas Reduction	Electricity Reduction
Specific Projects											
1	Steam Traps		1,173,000	219		23,460	2,000	0.1	9	0.52%	
2	Reduce steam pressure from 17 to 15 bar or		588,199	110		11,764	3,000	0.3	27	0.26%	
3	Isolate flash steam blowoff, near RTF Bldg		1,350,109	252		27,002	12,000	0.4	48	0.60%	
4	Boiler 3 shut-down, assumed 30% of 2009 energy input		1,425,682	266		28,514	1,000	0.0	4	0.63%	
5	Reduce chiller condenser pressure from 10.5 to 9 bar	50,796		30		5,080	-	0.0	0		0.13%
6	Sequence chiller operation to most efficient	6,168		4		617	-	0.0	0		0.02%
7	Decommision Dryer Note 1	911,099	3,023,962	1,098		151,589	20,000	0.1	18	1.34%	2.38%
8	Compressed Air Leak Program	187,464		110		18,746	30,000	1.6	273		0.49%
9	Increase condensate return by 5%		881,253	164		17,625	20,000	1.1	122	0.39%	
10	Shut down one D/A 60% the time		416,450	78		8,329	-	0.0	0		
11	Favor heat reactivate in lieu of heatless dryer (250 scfm)	38,392		23		3,839	-	0.0			
	Total no cost/Low cost project	**1,193,918**	**8,858,656**	**2,351**	**5.35%**	**€ 296,565**	**€ 88,000**	**0.30**	**501**	3.92%	3.11%
12	Install a reduction steam turbine for CHP PRV in lieu of pressure reduction	1,983,964		1,165		198,396	500,000	2.5	429	0.00%	5.18%
13	Install a reduction steam turbine for D/A feed	823,440		483		82,344	200,000	2.4	414	0.00%	2.15%
14	Blowdown heat recovery		1,260,305	235		25,206	25,000	1.0	106	0.56%	0.00%
15	Product dryer exhaust air heat recovery										
16	VFD on dryer 4 fan and wall and cone sweeps										
17	Effectiveness of dehumidification of product dryer air										
18	Reuse intermediate/final rinse for pre-rinse for CIP										
19	Cooler Heat recovery										
20	Evaporators heat/condensate recovery and efficiency										
21	Compounding/Process Optimization										
22	Water conservation										
	Total	**4,001,322**	**10,118,961**	**4,234**	**9.6%**	**602,511**	**813,000**	**1**	**1,450**	4.47%	10.44%

2009 Gas/Steam Usage	226,247,041	kWh	0.1863	Tonnes CO2 eq/MWh	€ 0.02	/kWh	42,150
2009 Purchased Electric Usage	3,052,078	kWh	0.5870	Tonnes CO2 eq/MWh	€ 0.10	/kWh	1,792
Estimated Total Annual Energy Usage	229,299,119	kWh		Total Tonnes CO2 eq			43,941
2009 Total Electricity usage	38,334,578	kWh					

(yellow) = Low cost/no cost projects

(green) = Capex projects

(white) = Projects requiring input from technology group

Note 1 The calculation for the savings are based on the facility KPI for plant 1 and reduced to 60% for dryer/evaporator 2

VIII. Appendices

Appendix A – Assessment Exit Meeting Project List

Appendix B – Process Questionnaire

Appendix C – Base Load Analysis

Appendix A – Assessment Exit Meeting Project List

Followup and Priority List

Utilities		Next step	Responsibility	priorty
CHP				
Conversion efficiency				1
	86% check and compare with good efficiency EU rating		JCI	
	drop test			
Projects				
	Reduce steam generation pressure		JCI	
	Use step down steam turbine to reduce steam pressure and generate electricity		JCI	
	increase duct burner capacity		JCI	2
Boiler steam				
Conversion efficiency				1
	Check using gas and steam numbers		JCI	
Projects				
	Take boiler 3 off line	energy use of boiler 3	JCI	1
	Keep boiler 3 warm using steam coil and damper		JCI/ ED	2
	Keep boiler 1 warm using replacement crown valve, steam coil and damper (needs a 18 minute start up?)	energy use of boiler 1	JCI/ ED	2
	Boiler blow down heat recovery	3% on CHP	JCI	2
	Metering on boiler feed/ make -up	feed water meter	TM	1
Compressed air				
	Check conversion efficiency – Atlas Copco		TM	3
	Install permanent compressed air meters	2 more meters for information	TM	3
Projects				
	Replace purge driers with heated driers		JCI	2
	Replace 55 kW compressors	Part of utilities master plan		
Chilled water				
	Check CSOP	Detailed review of system	ED/Seagull	1
Projects				
	Decrease discharge pressure	check with initial design	TM/Seagull	1
	Sequence compressors	reliability and loading	TM/Seagull	1
	Replace recip machines with screw machine	Part of utilities master plan		
	Check piping configuration or by-pass		ED/Seagull	2
	Risk assessment particularly re ammonia		TM	2
Process				
Benchmarking and efficiency				
	No known comparison outside of network			
	SEI may provide information		ED	
Projects				
	Mix product/process water heat exchange	Need to get feedback and assurance of quaility and process water flow		1
	Review with Singapore and Suzhou on type of heat exchanger		JCI/JK	1
	ACA via SEI capital assistance		ED	
	Project development for May		ED	
	Dryer Heat Recovery		JCI	1
	Support Technology group on review with Niro	Prelimenary		

Followup and Priority List

	Suzhou ?	check with studies undertaken	JCI	
	Eliminate high pressure pump to dryer		Technology	
	QA/QC		Technology	
	Size of pump and hours of operation needed		Technology	
	Compounding/process optimization to reduce pumping and enhance compounding		Technology	
	Real Time control(Advanced process control) to provide rapid closed loop control (PAT)		Technology	
	Reuse intermediate/final rinse for pre-rinse	review of CIP sequence and tank sizes	JCI	2
	CIP review optimization and harmonization			
	Dehumidification of dryer air	JCI to update enrgy analysis	JCI	
	Energy Champion on process improvement project team	Fred Kilpatrick	TM	
	Evaporator condensate reuse/ heat recovery?	48-59 degC . Need to know quantity and suitable demand for heat	JCI	
	VFD on Dryer 4 fan and wall and cone sweeps fans	75 kW but review of actual loading	ED	1
Nutri Plant of the future		Technology to review and globilize	Technology	
	Improved compounding to eliminate evaporator		Technology	
	Liquid versus solid raw material		Technology	
process energy questionnaire			Technology/BS	
Distribution				
	BMS ON AHU – review functional operation sequences		ED	
	Compressed air/gases leak program formalization		TM/ED	2
	Reporting		TM/ED	
	Access to production areas		TM/ED	
	Replacement of tubing		TM/ED	
	In house		TM/ED	
	Atlas Copco		TM/ED	
	Steam Trap Program	Review of effectiveness	ED	2
	Condensate Return	obtain from TM known areas requring improvement	ED/TM	
	Camfil filter proposal	review of applicability to Askeaton HVAC systems	ED	3
	Process air filtration	review of pressure control both in and outside of dryer	ED	
	Savings on a non cv/vfd system		ED	
	M&T system		TM/ED	
	Phase 3 and onwards		TM/ED	
Water Balance	**Limit all of the known water wastes**		TM	1
	Develop first phase mapping of water use			2
	Determine additional metering required			2
WWTP	**Review following water balance**			3
Chemical use				

Appendix B – Process Questionnaire

Process Questionnaire

Process	Question	Askeaton Response	Other Facility Response
Compounding	What temperature is the fat held at? Provide a description of the heating arrangement of the day tanks and the fat blending tanks (electric or hot water).	45º C - 55º C Hot water and electrical heat tracing	
Pasteurization	What is the steam / hot water temperature for pasteurisation? What is the pasteurisation product temperature? What is the % regeneration of each pasteuriser? What is the product feed temperature to the homogeniser? Is there heat recovery from first stage cooling to process hot water? If so, what is the temperature increase in process water?	Water temp 92º C - 104º C Varies by product Product temp 90º C - 102º C Regeneration ?% 65º C No heat recovery	
Storage	What is the storage temperature of process hot water? Are the finished product mixed tanks insulated? Are these tanks refrigerated? At what temperature is the product kept within the mix storage tanks? What is the final total solids %	76º C Yes No Less than 12º C 38% - 42%	
Cooling	What is the mix product temperature from product coolers?	8º C -11º C	
CIP (Technology group is undertaking a CIP review)	Provide a functional Design specification for the stations. Required and the capacity of tanks, flow rates, etc. Number of caustic and acid	No formal FDS (Denis) 5000 lts	

	washes per week? What are solution strengths? What is CIP temperature? What system is in place to maintain the required temperature of the CIP system when not in use? What is your policy in relation to the completing CIP of Dryer chambers, inter-batch cleaning, mix product tanks, compounding systems?	Log sheets ??? Caustic 2% Actual ??? 76º C Question the makeup and strength of caustic soda verses a blended product, wetting agents temperature. Formalize current FDS, challenge current methods with Eco-lab	
Evaporator	What solids are the evaporators running at? What is evaporator product temperature? How many effects and stages are in the evaporation process? Is condensate recovered from the evaporator process? If so define its uses.	Changes solids from 38% up to 52% - 58% 76º C - 63C One effect and 3 passes No condensate recovery, low quality heat available to allow heat recovery	
Spray Drying	What is dryer capacity (kg/hr)? What is dryer inlet and outlet temperature? Define the average moisture content of the following products. First Age Second Age Third Age	3,100 to 3,600 kgs /hr Inlet 170º C / Outlet 88º C (120,000kgs of air)	

Process Questionnaire

Specific site process narrative- description of any unique energy related process issues and applications

Appendix C – Base Load Analysis

Nutritionals
Base Load

Nutri Engineering and Maintenance Meeting

October 2009

Wyeth

Wyeth

Base Load
Overview

- Impact of production on KPI is significant

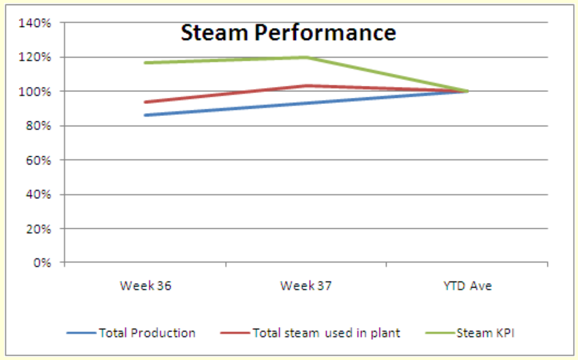
Monthly unit energy usage Summary 09 vs 08

Facility	Year	Production Vol Ton / Month	'09 Vs '08 %	Electrical KPI KWh/kg	'09 Vs '08 %	Steam KPI Btu/kg	'09 Vs '08 %	Water KPI L/kg	'09 Vs '08 %	Notes
Askeaton	2008	4528		0.70		9035		18.1		Jan-Apr, 08
	2009	4662	2.94%	0.71	1.47%	9011	-0.27%	17.7	-2.22%	Jan-Apr, 09
Canlubang	2008	1935		1.07		6339		19.03663181		Jan-Apr, 08
	2009	2004	3.59%	1.18	10.86%	6488	2.35%	18.6	-2.21%	Jan-Apr, 09
Mexico City	2008	1055		0.76		7403		12.90335301		Jan-Apr, 08
	2009	762	-27.80%	0.83	8.83%	9192	24.16%	16.1	24.91%	Jan-Apr, 09
Shanghai	2008	286		1.49		13442		32.5		Jan-Apr, 08
	2009	229	-19.70%	1.69	13.71%	15195	13.04%	33.7	3.56%	Jan-Apr, 09
Singapore	2008	2422		1.47		7095.404167		15.9		Jan-Apr, 08
	2009	2252	-7.02%	1.63	10.60%	7907	11.44%	15.6	-1.81%	Jan-Apr, 09
Subtotal	2008	10225		0.98		8,020		17.6		Jan-Apr, 08
	2009	9909	-3.10%	1.04	6.69%	8,407	4.82%	17.7	0.20%	Jan-Apr, 09

Wyeth

Base Load
Overview

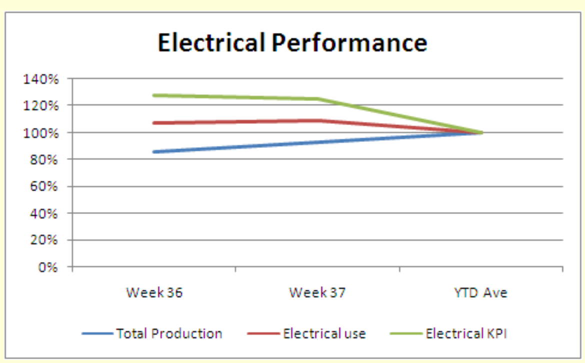
- Impact of production on KPI is significant



Wyeth

Base Load
Overview

- Impact of production on KPI is significant



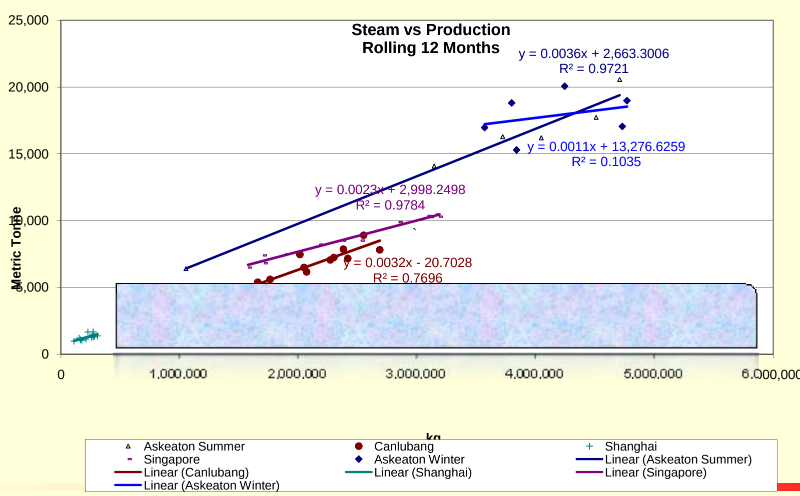
Wyeth

Base Load
Overview

- **The Base load affects the KPI**
- **Energy use profile should to follow production profile**
- **To reduce the effect of the base load on KPI**
  - Increase production
  - take base load out of the calculation
  - *Reduce base load*

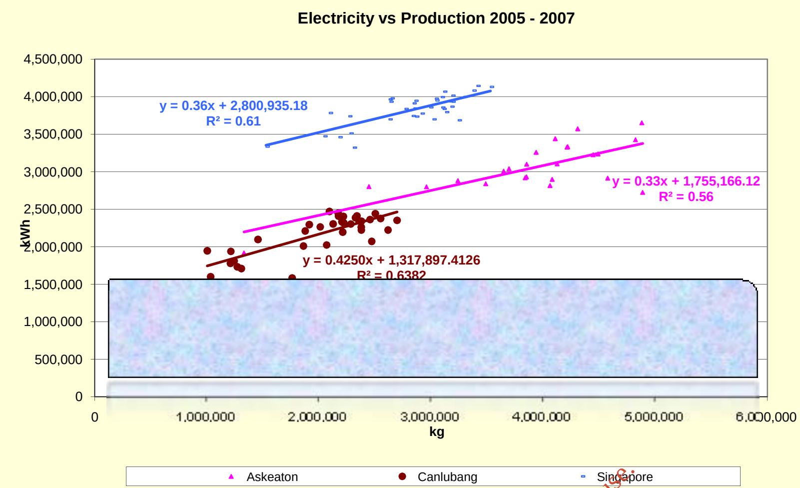
Wyeth

Base Load
KPI Comparison



Wyeth

Base Load
KPI Comparison



Wyeth

Base Load
Definitions

- **Energy not directly used to make product but necessary**
  - CIP , WWTP, Lighting, HVAC, standby boiler
- **Energy not directly used to make product and not necessary**
  - Compressed leaks and misapplication
  - Energy use outside of production times
- **Reduced throughput**
  - Breakdowns, part load production, CIP, standby energy use

Wyeth

Base Load
Askeaton Base Load Study

- **Tom Moore has been working on this for some months using information from the metering system to:**
  - Indentify Base load
  - Determine the magnitude of the base load

Wyeth

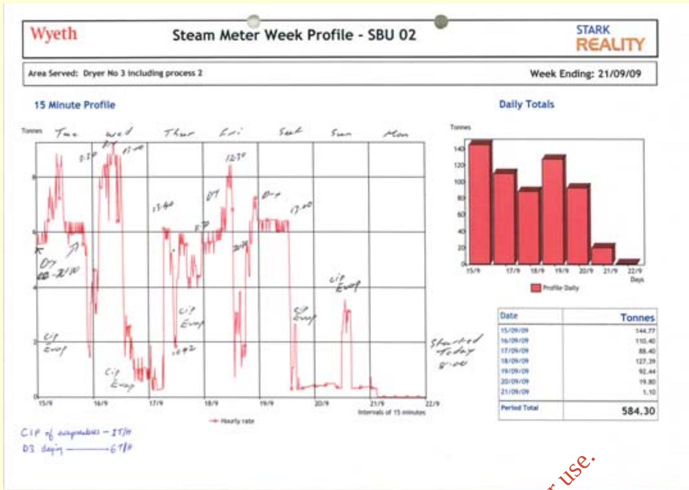
Base Load
Askeaton Metering system

- **Steam**
  - Accurate (fiscal) main metering from CHP
  - 11 meters on steam production and Business Units capable of remote trending
- **Electricity**
  - Accurate (fiscal) main metering from CHP
  - 44 totalizing meters – manual reading

Wyeth

Base Load

Askeaton Metering system



Wyeth

Base Load

Askeaton Characterisitics

Production	Average Steam Tons/hr	Average Electricity MW	Comments
All 5 driers	30	5..2	Normal weekday
2 driers	17	3.9	Driers 4 & 5 make up 70% of the output
No production	3	1.5	Plant shut down

Wyeth

Base Load
Askeaton - Findings

- Askeaton has worked hard to reduce base load losses and no further significant savings have been identified (outside of the production areas) Activities include :
  - Review and modify run times of HVAC every 6 months
  - Compressed air leak repair- to be improved
  - Steam trap program including change to GEM traps
  - Boiler standby – reduced starts
  - Increased condensate return

Wyeth

Base Load
Askeaton - Findings

Need to work with production to progress any further

  - *70% + of the energy use resides in Production*
- Need an updated electric schematic
- Need to automate and calibrate meters for accuracy
  - Some meter readings were used as proportioned data
- Need to simplify metering information - Can get bogged down with data and get inconsistencies – If the information is not used don't collect it

Wyeth

Base Load

Askeaton - Findings

A definitive number for the base load was not possible to evaluate. However, energy use at Askeaton varies with Production quite well.

To improve this even further it will be necessary to look at production improvements

The process was useful in defining areas of investigation based on measurable data

Attachment F – Schedule of Agreements

Condition No.	Existing Condition	Proposed Wording (where appropriate)	OEE Agreement Reference	Description
9.1.2	Yes	N/A	PO395-02/gc25ld	Letter to OEE regarding surface water discharges - attached
-	No	N/A		Letters to OEE and Shannon Regional Fisheries Board regarding backwash discharge – attached Email to EPA regarding backwash water - attached

Wyeth Nutritionals Ireland
Askeaton, Co. Limerick
Ireland
061 392168 tel
061 392440 fax

Wyeth

Office of Environmental Enforcement
South/South West Region
EPA
Inniscarra
Co. Cork

IPPC Licnece Reg. No.: P0395-02

Subject: Informatiion Update

Date: November 2, 2006

Dear Ms. McDonnell,

During a recent review of operations here at Wyeth Nutritionals Ireland (WNI) a number of anomalies were noted which I would like to redress.

The following omissions were noted in the IPC Licence application submitted in July of 2003:

1. *Section C – Emissions, Sub-section 17 Waste Management*
   Table 17A(ii) Waste Emissions – Other Waste Disposal does not list bio-hazardous waste generated from operations in the Microbiology Laboratory. This waste is currently treated on site in an autoclave to render sterile and then disposed along with general waste from the site.

2. *Section C Emissions, Sub-section 12 Emissions to Atmosphere*
   Table 12A(v): Minor Atmosphere Atmospheric Emissions does not include a number of minor emission points from the dry powder charging operations, the acid scrubber on the hydrochloric acid storage tank and the welding/grinding extracts from the fabrication workshop.

   Table 12A (vi): Potential Atmospheric Emissions does not include potential emissions from the pressure relief valves on the ammonia refrigeration plant.

3. *Section C Emissions, Sub-section 13 Emissions to Surface Waters*
   Tables 13A(i-iii) does not include the backwash discharges from the on-site Water Treatment Plant to the River Deel.

Wyeth

4. *Section B Plant, Processes & Procedures, Sub-section 10 Raw Materials and Product.*
Table 10: Details of Process Related Raw Materials, Intermediates, Products Etc., Used or Generated on Site does not include ammonia previously mentioned in 2 above.

The relevant sections of the licence application listed above are currently being amended to reflect these changes. Please advise if the amended sections should be sent to Licencing or the OEE section of the Agency.

In addition to the above, Sharps (EWC 18 02 01) was mistakenly listed in *Table 5 (AER summary of non-hazardous waste generated on site during 2005)* of the 2005 AER. Instead, this waste should have been listed in *Table 8 (Summary of hazardous waste generated on site in 2005).*

This error has been corrected and the relevant tables in section 2.2.4 of the 2005 AER have been amended. Three copies of the amended section of the AER are enclosed with this letter for your files.

Finally, WNI requests that Product Tailings, currently listed as a waste in *Schedule 3(ii) (Other Wastes for Disposal/Recovery)* of the IPPC Licence, be removed from the waste register as this commercial output is classified as Category 3 material under the Animal By-product Regulations 1774/2002 and is regulated by the Dept. of Agriculture & Food. In this context, such output should not be categorised as a waste material.

Should you require any clarification or additional information on any of the above, I can be contacted by telephone at 061 601 307 or by email at shielb@wyeth.com.

Yours sincerely,

Brian Shiel
EHS Manager – Environment

c.c: Dr. Anne Kilroy, Wyeth Corp.

Encl.: Copies of letter x 2
Revised section 2.2.4 of the 2005 AER x 3

Brian Shiel - Re: Questions

From: Brian Shiel
To: McDonnell, Siobhan
Date: 05/06/2007 16:36
Subject: Re: Questions

Siobhan,

With reference to our telephone conversation last week and your email dated 28/05/07, the following are answers to your questions.

On the acid scrubbers:

1. Scrubbers on both tanks (HCl and Nitric acid) are only used when the tanks are being filled.
2. The volume of the hydrochloric acid storage tank is 42 cubic meters and the nitric acid storage tank is 20 cubic meters.
3. Hydrochloric acid is delivered around once per week and nitric acid is delivered every 7-9 days.
4. The HCl day tank (there is no nitric acid day tank) is connected to the scrubber.

On the water treatment plant:

1. The discharge from the water treatment plant has never been characterised/analysed.
2. The volume of the discharge is made up of discharge from back washing the filters and regeneration of the softeners. The filters, of which there are two, are usually back washed twice in every 24-hour period (however the frequency may vary depending on loading) resulting in a discharge of around 14 cubic meters per filter per backwash totaling around 56 cubic meters per day. The softeners are regenerated every around 3 times per day and discharge around 23 cubic meters per regeneration cycle totaling around 69 cubic meters per day. Total discharge per day totals around 125 cubic meters and is not continuous (only at times of backwash or regeneration).
3. The treatment steps are typical for any municipal water treatment plant except for softening. The first treatment step at the plant is coagulation/flocculation/clarification. Next the clarified water is passed through the filters and finally a portion of the water (2/3) is softened and re-blended with the unsoftened water before being disinfected and stored.
4. Aluminium sulphate and polyelectrolyte is used at the coagulation/ flocculation/clarification step. Salt is used to regenerate the softener resins and sodium hypochlorite is used for disinfection.
5. The waste streams outlined in 2 above are discharged to the river. Desludgeing waste from the clarifiers is drained for treatment on site where it is first thickened and then belt pressed. The resultant sludge is sent along with the sludge from the waste water treatment plant for composting (Ref: our letter to the Agency dated October 23rd 2006).

I hope the above answers are satisfactory. Should you require any additional information or clarification don't hesitate to contact me.

Regards,

Brian.

Brian Shiel
Wyeth Nutritionals Ireland
Tel: 353 (0)61 601 307

>>> "Siobhan McDonnell" <S.McDonnell@epa.ie> 28/05/2007 14:57 >>>
Brian

Further to our discussion earlier regarding your letter dated 02/11/06: I can provisionally state that the majority of points raised can be noted by the Agency without a requirement for amendment to the Licence via Technical Amendment/Review. I will put this in writing within the week, but require the following additional information:

In addition to the detail you will email on the acid scrubber, could you also provide detail on the backwash discharge. Have you had this discharge characterised/analysed? What is the flow/volume of the discharge? It is continuous or occasional? Where is the filter located - at the start of the treatment plant or at the end? Can you specify exactly what treatment occurs in the plant and list what chemicals are added (aluminium sulphate etc). Also clarify what is sent offsite and what is discharged.

It is possible it might need connecting to the outlet of the wwtp, and for aluminium to be added to the suite of parameters monitored there.

Kind Regards

Siobhán

Siobhán McDonnell
Inspector
Office of Environmental Enforcement
Environmental Protection Agency
Regional Inspectorate
Inniscarra
County Cork
Ireland

ph: 00 353 21 487 5540
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Agency.

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Wyeth

The Shannon Regional Fisheries Board
Ashbourne Business Park
Dock Road
Limerick

Date: October 3, 2008

Dear Mr. O'Neill,

I acknowledge the receipt of your letter dated 25th September 2008 (*RE: Discharge from Wyeth Premises into Deel River 23rd September 2008*) and respond to your request for an explination as to the nature and frequency of the discharge as follows:

- The discharge witnessed by your representative arises form the normal backwashing of filters and the regereration of softeners used to treat water for use on site. The Water Treatment Plant at Wyeth Nutritionals has been operating and discharging its backwash to the river at this location since 1974. It is a typical water treatment process that may be found in any municipal water treatment plant with the exception of water softening for a portion of the throughput.

- After passing through the first step of coagulation/flocculation/clarification in the treatment process the water passes through sand filters and finally a portion is softened before further treatment and storage.

- The two sand filters used in the treatment process are backwashed with water twice in every 24-hour period (frequency may vary depending on loading) resulting in around 14m^3 (per filter per backwash) discharged to the river.

- Two thirds of the water that has been filtered is softened before further treatment and storage. Water saturated with salt is used to regenerate the softeners and this occurs around three times per day (depending

Wyeth

on throughput) resulting in 23 m^3 per regeneration of discharged to the river.

As evident in the photograph (fig.1) in your letter, the presence of salt in the discharge can cause some foaming from time to time as it cascades down the steep rocky slope where it discharges to the river. However, the foam abates quickly when it mixes with the estuarine water in the river.

I hope the above offers a satisfactory explanation, however, if you require any additional information please contact me.

If you wish, you are welcome to visit Wyeth Nutritionals to view the water treatment process or other aspects of our operation. Please contact me for an appointment and I will arrange a tour.

My contact details are: Phone 061 601 307 or email at shielb@wyeth.com.

Yours Sincerely,

Brian Shiel
EHS Manager

C.C. Ms. Siobhán McDonnell, EPA Inspector.

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Wyeth

Office of Environmental Enforcement
South/South West Region
EPA
Inniscarra
Co. Cork

IPPC Licnece Reg.: No. P0395-02

Your ref.: P0395-02/gc25ld

Date: June 4th 2010

Dear Ms. McDonnell,

To close out part of the corrective action required for observation No. 5 in the Licence Audit Report [Audit Ref. No. (Po395-02)10ar02ld]:

"Submit a copy of the correspondence both to and from the Agency referred to above confirming that monitoring of the surface water discharge is only required at the sump in question."

Please find a copy of an excerpt from Section 5 of the IPC Application Form submitted to the Agency in July 2003, attached to this letter. Under the heading *Aqueous Emissions* a continuation of the methodology for monitoring surface water discharges from the site was proposed. There was no change indicated to the proposed methodology included in the licence granted.

Should you require any additional information I can be contacted by telephone at 061 601 307 or by email at brian.shiel@pfizer.com .

Yours sincerely,

Brian Shiel
EHS Manager

Encl. / Copies of this letter x 2

Bulk gases stored on site include Nitrogen and Propane. Other gases are stored on site in smaller quantities for use by Laboratory, Utilities and Maintenance Departments.

Environmental procedures are in place to ensure that chemical storage areas are monitored and maintained on an ongoing basis. All relevant emergency equipment is available on site to deal with spills/releases. There is also an Emergency Response Team on site which is fully trained in dealing with fire, spillage and other foreseeable emergencies on site.

Emissions to the Environment:

Emissions to Atmosphere:

Emissions to atmosphere from the CHP Plant are detailed later in this section.

The dominant emissions of environmental significance are summarized as follows:

6 Emission Sources	Particulates
5 Emission Sources	Total Organic Carbon
4 Emission Sources	Sulphur dioxide, Nitrogen oxides

The main emission sources at the plant are the Dryers, the Aggolmerator, the CHP Plant and boilers. Emissions to atmosphere from the CHP Plant and boilers are detailed later in this section. The particulate emissions from the Dryers and the Agglomerator are monitored regularly and have always been found to be extremely low. Emissions are well within BATNEEC Guidance Limits.

Emissions to atmosphere from the other emission sources are classified as Minor Emissions in view of the low mass emission rates from these sources. Emissions to atmosphere from six minor emissions which were monitored are all relatively low and fall within the relevant BATNEEC Guidance Limits where applicable. The organic substances present in the gas stream emitted from the five Can Manufacturing sources are relatively low and are comprised mainly of substances which fall into TA Luft Class II and Class III organic substance classifications.

In conclusion, it is not anticipated that any adverse health or environmental effects will occur as a result of emissions to atmosphere from sources at the Wyeth Nutritionals Ireland plant.

Aqueous Emissions:

All water used in the operations is extracted from the Deel river and is treated on-site. There are seven emission points to surface water from the site. Trade effluent, sewage effluent and contaminated waste water are discharged via one discharge point. All of this effluent is treated in the on-site waste water treatment plant prior to discharge to the River Deel.

Daily monitoring of effluent quality is carried out by collecting composite samples which are analyzed in-house by Wyeth laboratory personnel.

The other six discharges contain only rainwater/stormwater. All uncontaminated stormwater is discharged from the site in a separate stormwater pipeline system from the premises to the tidal estuary of the River Deel.

A sample is taken from one stormwater outlet , once per week. The location of the outlet point that is used for taking samples has being agreed with the EPA and is a good representative sample of all stormwater entering the river Deel. The weekly sample is tested by Wyeth laboratory personnel. If test results are found to be significantly different from normal , the cause is investigated and the incident is reported to the EPA. There were no abnormal results during 2002.

Wastes Management:

Wastes are generated within this facility. These have been reviewed to determine their regulatory classification. Operators are responsible for segregating wastes at source. Used materials which are not deemed recoverable under our recycling programme are disposed of by licensed contractors. Recoverable materials are accumulated on-site and removed at regular intervals for treatment/recycling by licenced contractors. The Utilities department is responsible for day-to-day management of wastes.

All wastes are either recycled or disposed of in a responsible manner.

Waste quantities removed from the site are consistent throughout the year - there is no significant seasonal variation. Toxic and dangerous solvent waste at present is minimal and primarily associated with laboratory activities.

Non Hazardous Wastes:

Non hazardous solid wastes are generated onsite as a result of our production processes. Types generated include biological sludge (60%), Solid waste (28%), Metal (6%), Cardboard (4%), Plastic (1%), Glass (1%).

85% of non hazardous waste is currently being recycled, with 4700 tones of sludge being composted in 2002.

Hazardous Wastes:

Hazardous waste generated on site include small quantities of waste oil, solvent from laboratories and our can manufacturing process, light tubes, medical sharps from our medical center, COD vials from effluent lab and small quantities of laboratory chemicals. All wastes are removed from site by licensed waste undertakers. The current licenses of all our hazardous waste contractors are held on file and regular audits of their premises are carried out. All wastes are disposed of in accordance with the site IPC Licence.

Environmental Noise:

Plant boundary noise levels are monitored by an independent company on an annual basis, at a number of locations around the plant to ensure that environmental noise is not causing an impact in the locality. Recommended standards (ref. IPC License) for