final report

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Benchmarking of Environmental Performance

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Table Of Contents

Appendices

1 Purpose of this Report

1.1 Introduction

The primary aim of this benchmarking project is to help achieve environmental best practice in the red meat processing industry

This project was structured to:

- determine suitable environmental performance measures (benchmarking parameters and comparators)
- select plants suitable for trial of the benchmarking criteria
- evaluate the performance of each of the plants with respect to the benchmark criteria
- feed back information to the plants surveyed

The former Meat Research Corporation (MRC) commissioned Gutteridge Haskins & Davey Pty Ltd (GHD) in 1997 to conduct this benchmarking study. The report was published by Meat & Livestock Australia.

This report:

- defines a set of benchmarking criteria that can be used to assess environmental performance at red meat processing plants
- provides managers with a tool to track and measure environmental performance
- will enable a plant to collect benchmarking data so that self-evaluation of environmental performance can be undertaken.

The environmental benchmarking criteria established in this project are designed to be used by all red meat processing industry groups in a wide range of situations, locations and plant types

1.2 Why Environmental Benchmarking?

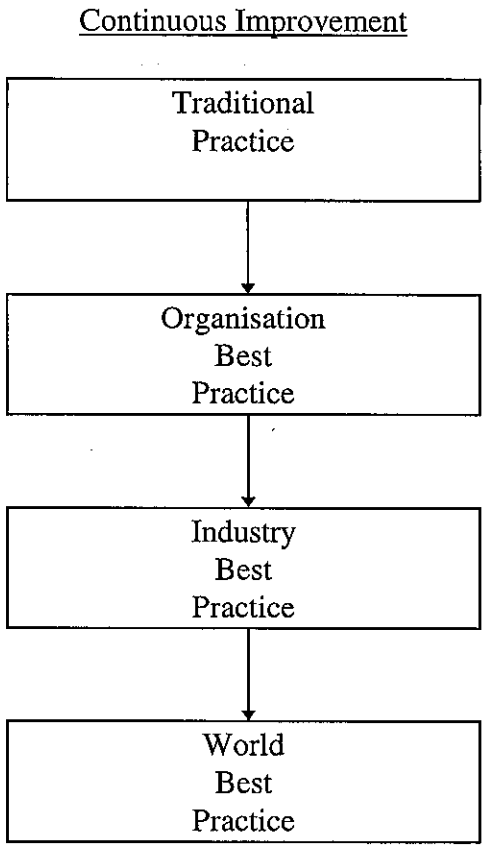
Benchmarking is part of the process of continuous improvement of environmental performance

Recognise current level of practice and have the desire to improve the environmental performance of your organisation and plant.

Be able to consistently repeat your organisation's own best practice.

Ensure that your organisation's environmental activities and processes are equal to or better than those throughout the entire Australian Red Meat Processing Industry.

Seek to match or exceed the capabilities of the world's best performers for each environmental activity or process (irrespective of the industry they come from)



Continuous improvement is a gradual process, taken as a series of increasingly challenging steps

Document: 11361f.doc, v1
Job No: 211/024524/00

1.3 Methodology

This project was conducted in six stages. Interim reports were presented to the MRC at the completion of each stage.

The project initially involved a literature review to determine appropriate environmental benchmarking criteria and available environmental information relevant to the Red Meat Processing Industry in Australia and overseas.

This was followed by selection of benchmarking criteria* (parameters and comparators) which would be appropriate for a range of industry sectors including abattoirs, rendering and meat processing plants.

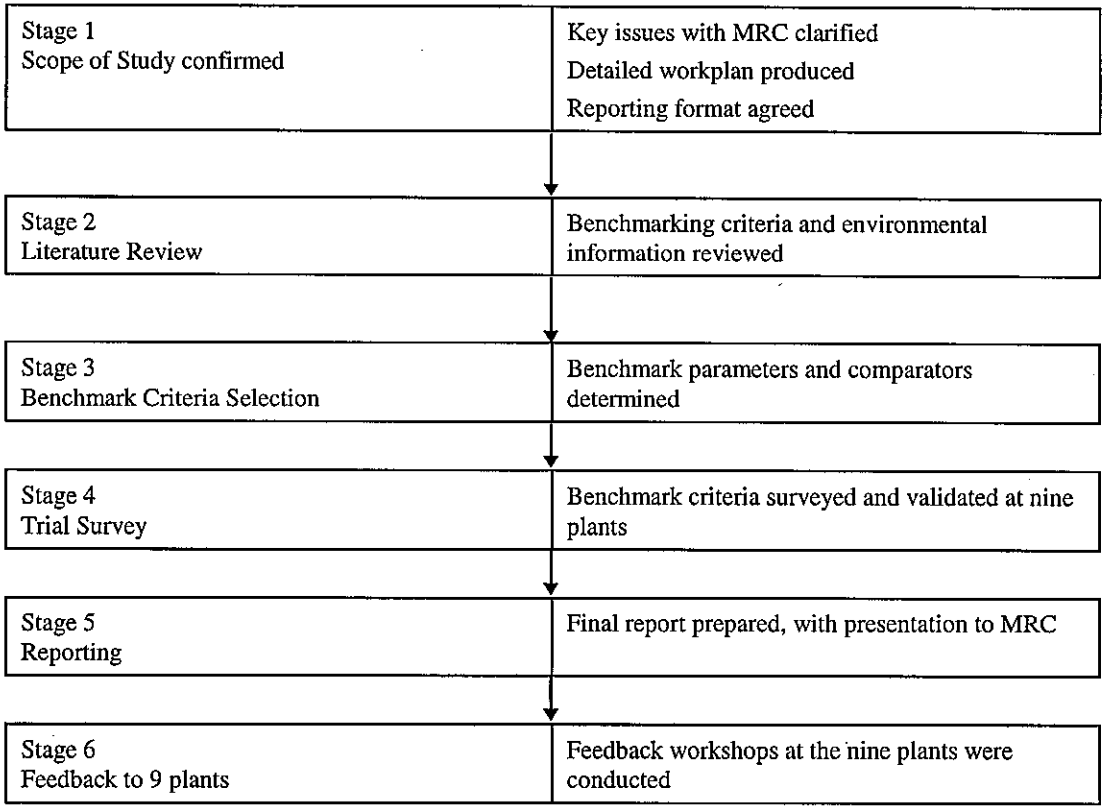
Nine firms were then selected to trial the benchmark criteria and validate environment performance. The plants included a range of large and small companies, 2 in NSW, 4 in Queensland, 2 in Western Australia and 1 in South Australia.

Managers of each firm were asked to complete a questionnaire which covered environmental data and performance. The information obtained was supplemented by site visits to each plant, followed by collection of further data. The findings were collated and analysed to determine whether the benchmark criteria were generally suitable and whether the information could be obtained easily.

Each plant was rated on its environmental performance for each of the benchmark criteria.

**** The terminology used in this benchmarking project is explained in Section 2.4. A list of abbreviations is given in Appendix E.***

The approach used for this study is set out in the adjacent flow chart.



2 Results of Benchmarking Survey

2.1 Overall Performance

This section summarises the overall performance of the nine plants that were surveyed

2.1.1 Numerical Benchmark Criteria

Eight numerical benchmark criteria were established and the overall results for the 9 plants are summarised adjacent. The method of rating environmental performance is fully explained in Appendix A.

Criteria	Performance		
	Average	Range	Benchmark
Status of Environmental Management	3	2-5	Score=1
Energy Usage	3400	1200-4800	1700 MJ/tHSCW
Water Usage	11.8	6-15	12 kL/tHSCW
Wastewater Generation	10.1	6-13	8 kL/tHSCW
Wastewater Loads:			
Phosphorus	0.3	0.1-0.5	0.5 kg/tHSCW
Nitrogen	1.7	0.9-3.4	1.5 kg/tHSCW
BOD	30	8-66	15 kg/tHSCW
SAR	5.5	3-7	5
Number of annual odour complaints	1	0-2.7	0
Number of annual noise complaints	1	0-2	0
Solid waste to landfill	7	2-17	5 kg/tHSCW

For reasons of confidentiality, individual companies are not identified in this report. Individual companies were issued with performance summaries on a confidential basis.

2.1.2 Management-based Benchmark Criteria

Seven other benchmark criteria were established based on management of environmental issues. The method of rating performance is fully explained in Appendix A.

Performance was assessed according to the response given to the questionnaire in Appendix A5. For each environmental issue, a percentage performance score was measured.

Criteria	Performance (%)		
	Average	Range	Benchmark
General Environmental Management	44	17-70	20
Energy Management	57	8-100	20
Water and Wastewater Management	47	27-79	20
Irrigation Management	67	25-92	20
Solid Waste Management	55	8-100	20
Management of Noise Emissions	64	0-100	20
Management of Air Emissions	44	12-60	20
Overall Performance	49	17-74	20

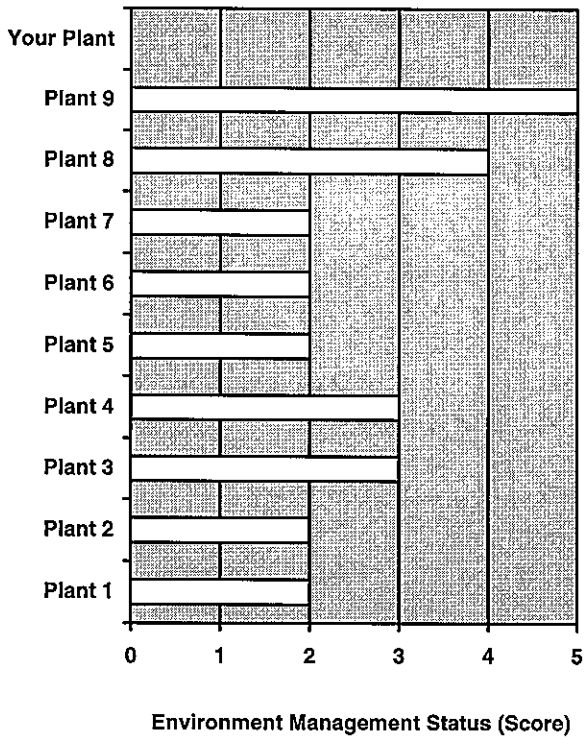
Note that the survey population was small and the survey was not extensive. Conclusions reached on the basis of a single benchmark criterion may be misleading.

2.2 Numerical Benchmark Criteria

2.2.1 Environmental Management Status

Environmental management status was rated according to the level of Environmental Management System (EMS) used at the site. The scores used are:

Status	Score
Certified EMS	1
EMS	2
Environmental Management Plan	3
Standard Operating Procedures	4
No formalised environmental management documents	5



The target benchmark is a score of 1. No plants met the benchmark value, but 5 out of 9 plants used an Environmental Management System of some type.

2.2.2 Energy Usage

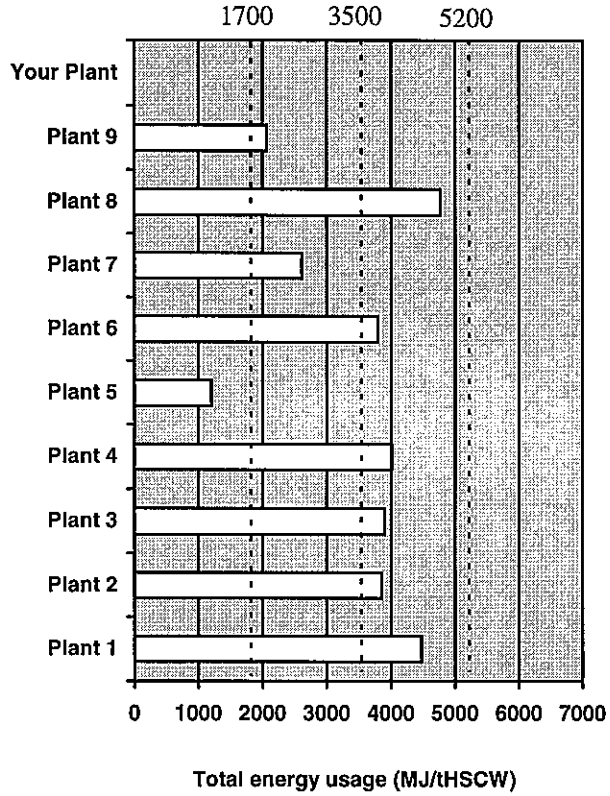
Total energy usage was measured at each site and included usage of electricity, gas, coal, diesel and other fuels (in megajoules of energy per tonne of Hot Standard Carcass Weight, MJ/tHSCW).

Target benchmark values are:

- 1700 MJ/tHSCW (no rendering)
- 5200 MJ/tHSCW (with rendering)

All plants with rendering facilities used less than 5200 MJ/tHSCW which implies the benchmark (derived from literature) should be revised, say to 3500 MJ/tHSCW.

Note that the calculated values do not take into account plants that undertake contract rendering.



Variable factors include:

- ***presence of rendering***
- ***contract rendering***
- ***use of waste heat recovery***
- ***secondary processing activities***
- ***presence of cold stores***
- ***capacity of cold stores***

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Job No: 211/024524/00

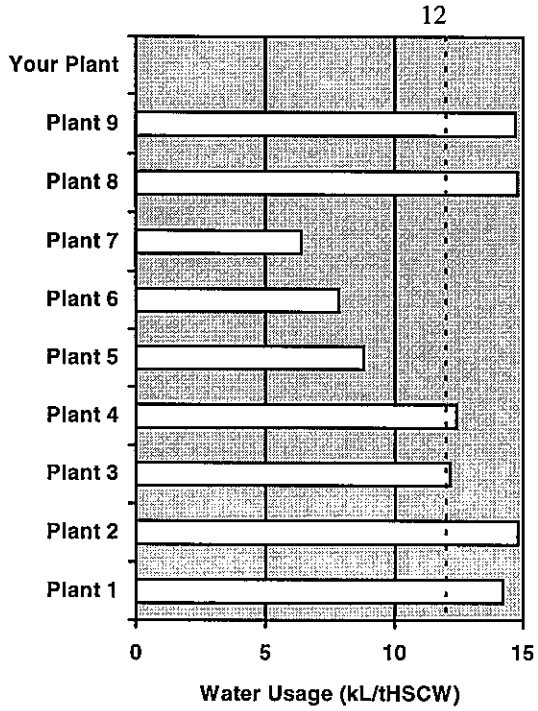
2.2.3 Water Usage

Water usage was assessed as the quantity used in kilolitres per tonne of Hot Standard Carcass Weight (kL/tHSCW).

Target benchmark value is 12 kL/tHSCW.

Three plants met the benchmark value and two plants were only marginally above the benchmark.

The average water usage was 11.8 kL/tHSCW.



Variable factors include:
- ***water source and cost***
- ***whether a domestic or export plant***

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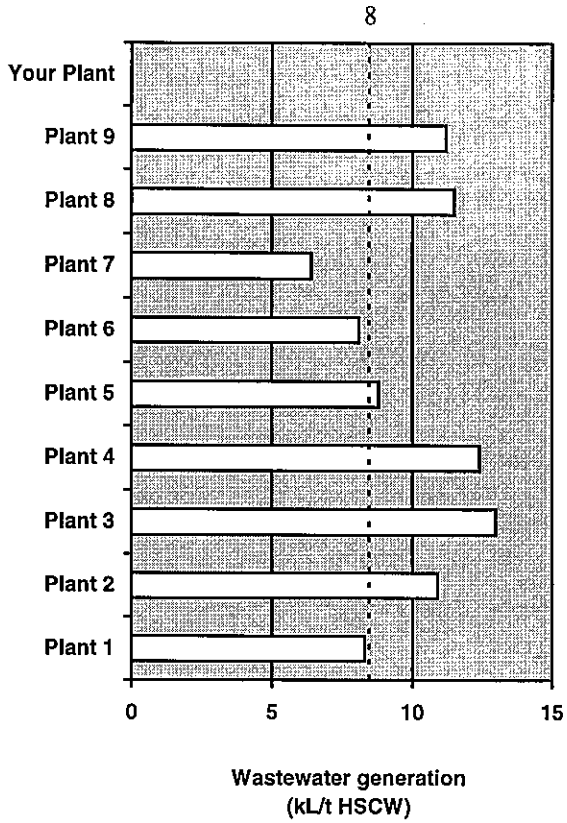
2.2.4 Wastewater Generation

Wastewater generation was assessed as the quantity in kilolitres per tonne of Hot Standard Carcass Weight (kL/tHSCW).

Target benchmark value is 8kL/tHSCW.

Three plants met the benchmark value and one plant was only marginally above the benchmark.



Variable factors include:

- ***capacity of plant***
- ***presence of rendering facilities***
- ***degree of wastewater recycling***

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Job No: 211/024524/00

2.2.5 Wastewater Loads

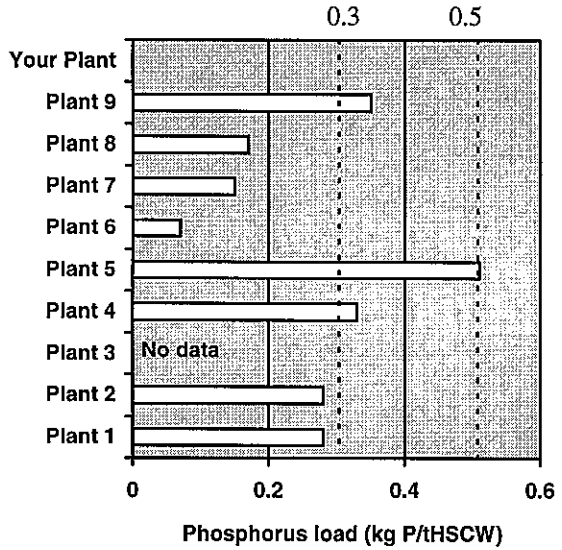
The loads of pollutants in wastewater reflect the efficiency of the red meat processing plant and degree of cleaner production implemented. Loads are measured after screening but prior to saveall or dissolved air flotation units.

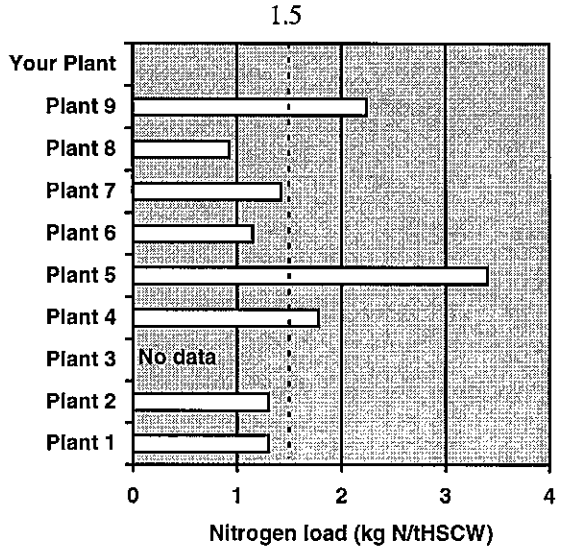
Target benchmark values are:

- 0.5 kg P/tHSCW
- 1.5 kg N/tHSCW
- 15 kg BOD/tHSCW
- Sodium Absorption Ratio (SAR) of 5 for plants irrigating with wastewater.

All plants met the benchmark value for phosphorus, which implies it should be lowered to around say 0.3 kg P/tHSCW.

A majority of plants met the benchmark nitrogen value.

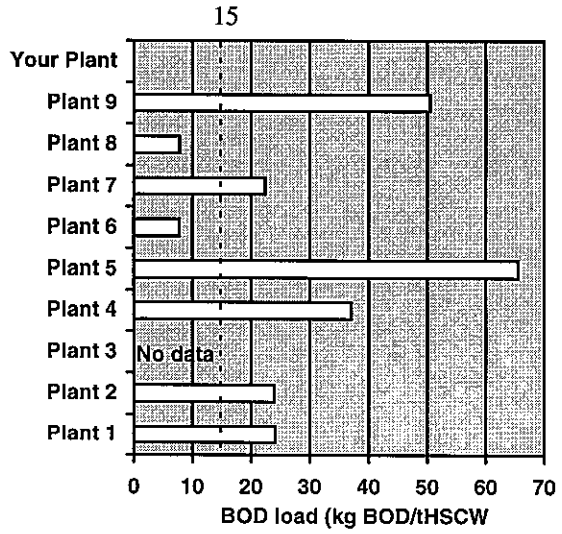


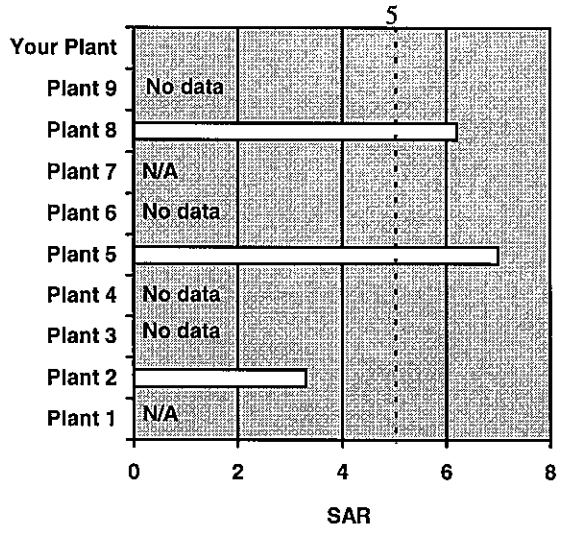


The BOD load graph shows the greatest range in values and only two plants met the benchmark value.

Insufficient data was available on SAR to draw any conclusions. (N/A implies that the plant does not use irrigation).

Note that at some plants, there was very little information on wastewater loads or SAR. Figures for some plants are based on single readings only.





Variable factors for BOD and nutrient loads include:

- ***presence of rendering facilities***
- ***type of rendering plant***

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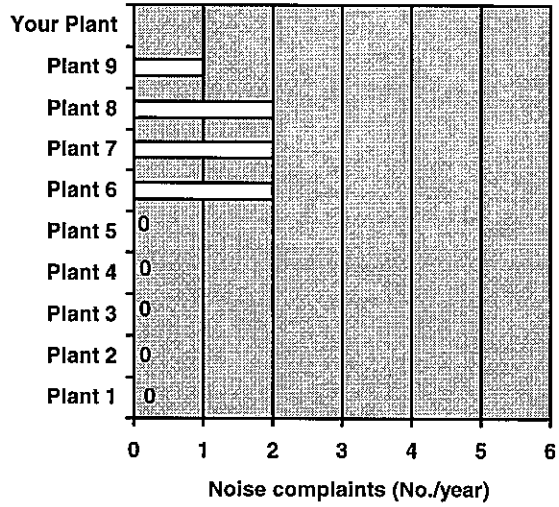
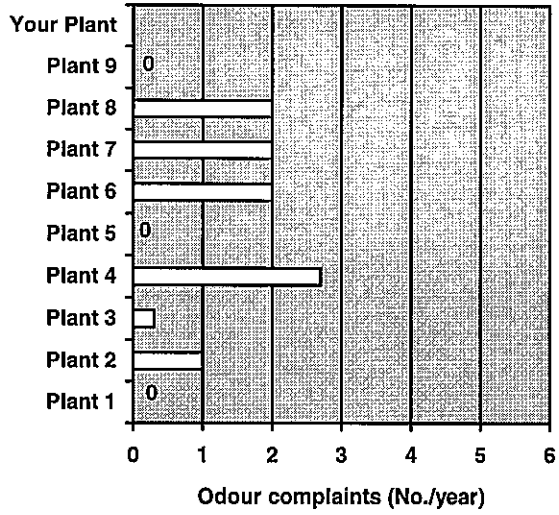
Job No: 211/024524/00

2.2.6 Noise and Odour Complaints

The average numbers of noise and odour complaints were assessed. The target benchmark value is zero complaints per year for both criteria. If there is no system for receiving, internally reporting and recording complaints then the plant was automatically scored as "inadequately monitored" and received a score of 2.





Variable factors include:

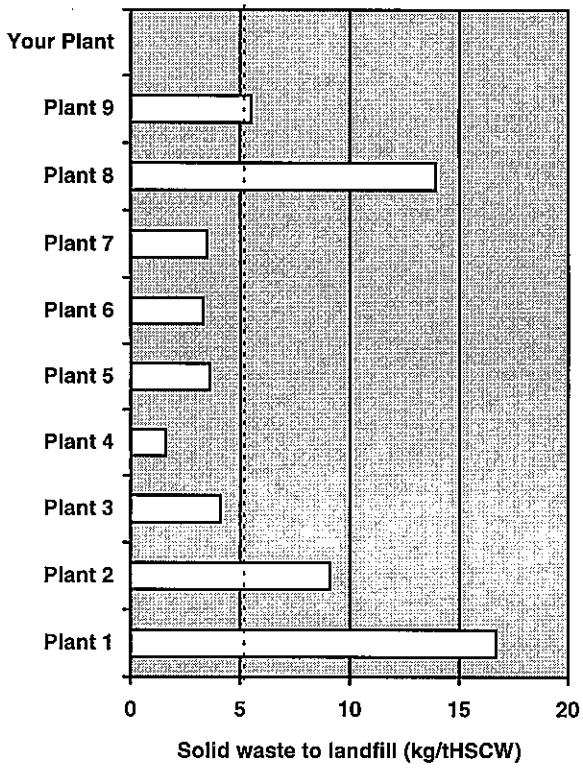
- ***proximity to nearby residences***
- ***other nearby industries***
- ***presence of odour control facilities***
- ***use of noise attenuation devices***

2.2.7 Solid Waste to Landfill

The quantity (mass) of solid waste disposed of at landfills was measured in kilograms of waste per tonne Hot Standard Carcass Weight (kg/tHSCW). Since a large proportion of organic wastes can be recycled or reused, the target benchmark value was set at a nominal value of 5 kg/tHSCW.

Note that data on solid wastes generated and disposed to landfill at most plants were not accurate and were based on reasonable estimates.

Five plants met the nominal benchmark value.



Variable factors include:

- ***available market for recycling of organic material***
- ***cost of landfill disposal***
- ***availability of local Council recycling facilities***

2.3 Management-based Benchmark Criteria

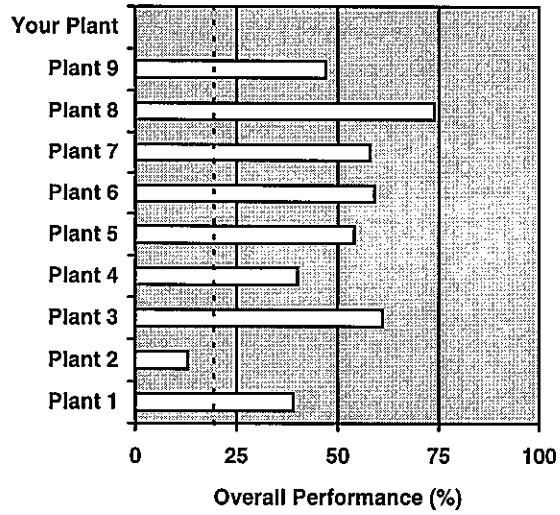
These benchmark criteria are based on how well environmental issues are managed. Seven categories were used:

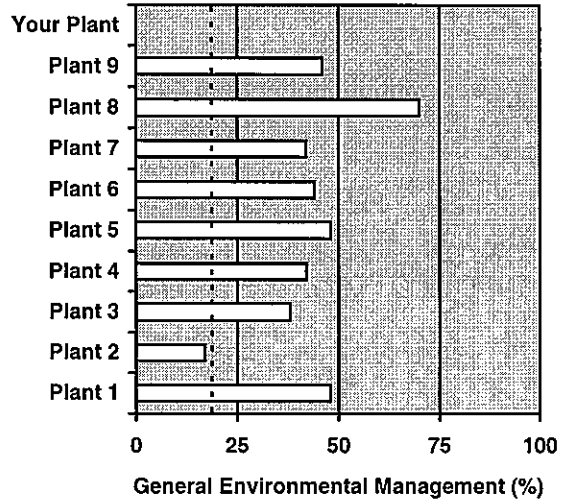
- general environmental management
- energy management
- water and wastewater management
- irrigation management
- management of solid wastes
- management of noise emissions
- management of air emissions

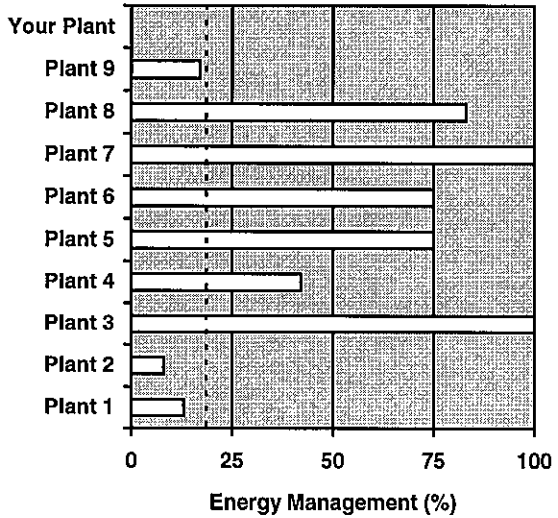
The overall performance of the plants are shown in adjacent graphs. Performance for each category is also given in the following graphs. The method of calculating the percentage performance score is explained in section A5.

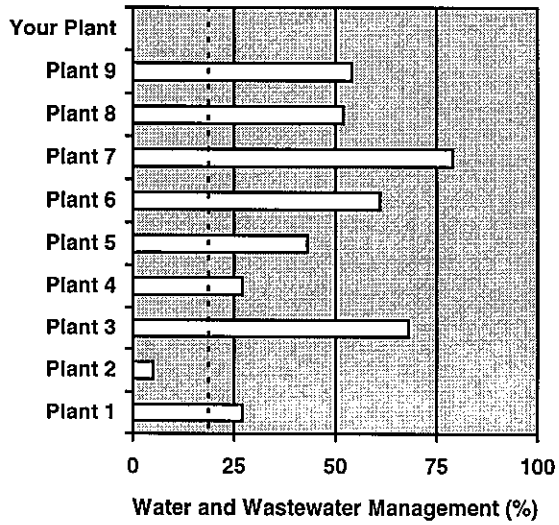
Note that a different number of questions was used for each environmental management criterion. Therefore, some criteria are more sensitive to the method of scoring than others.

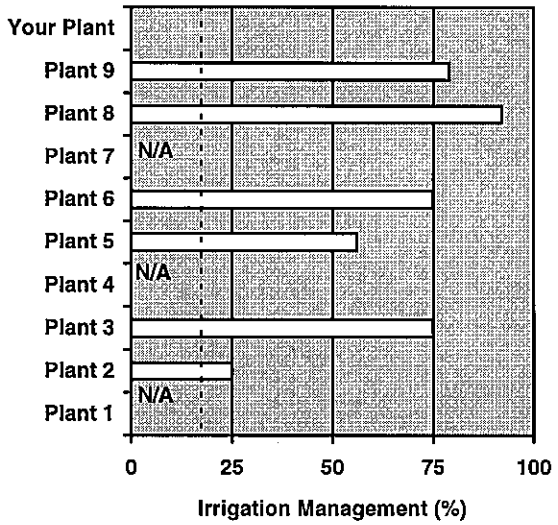
Note that a lower percentage score indicates better performance. The benchmark criteria has been set at a nominal score of 20%.

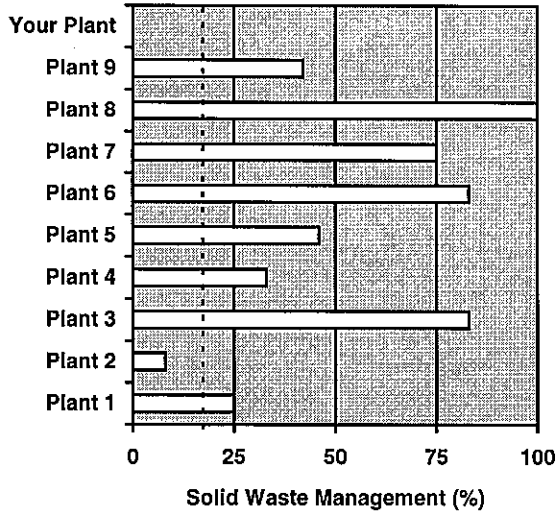












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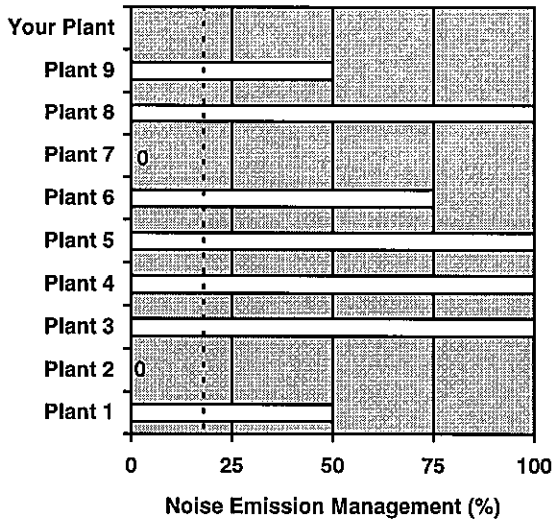
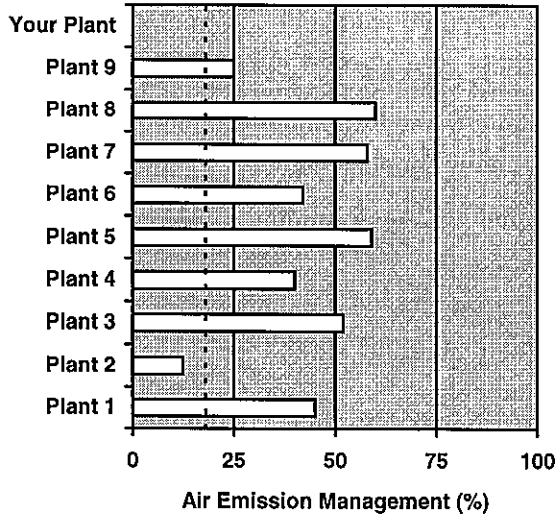
Job No: 211/024524/00


Your Plant
Plant 9
Plant 8
Plant 7
Plant 6
Plant 5
Plant 4
Plant 3
Plant 2
Plant 1
0
0
0
25
50
75
100
Noise Emission Management (%)


Your Plant
Plant 9
Plant 8
Plant 7
Plant 6
Plant 5
Plant 4
Plant 3
Plant 2
Plant 1
0
25
50
75
100
Air Emission Management (%)

2.4 Benchmarking Terminology

Some of the terms used in the benchmarking process are explained

Benchmark	A reference point, a criterion by which to measure something
Benchmarking	"An ongoing, systematic process to search for and introduce international best practice into your organisation, conducted in such a way that all parts of your organisation understand and achieve their full potential" - IBM
Benchmark Comparator	A baseline measurement that allows benchmark parameters to be compared on a consistent basis, for example, tonne Hot Standard Carcass Weight (t HSCW) or Live Weight Killed (LWK).
Benchmark Parameter	A measurable factor, such as kilolitres of wastewater produced per day, number of odour complaints per year, percentage compliance with licence conditions etc.
Benchmark Criteria	The benchmark comparators and parameters used to set a desired performance level.
Best Practice	Continually improving the way work is done and higher levels of performance achieved.
Gap	The difference between a company's performance level and the benchmark criteria used as best practice.
Variable Factors	Factors that affect the performance and the benchmark criteria (usually outside the control of management in the intermediate term). For example, the proximity of residents may affect the number of noise and odour complaints received.

Essentially, benchmarking involves comparing your own performance with that of other organisations and generating and implementing methods of improvement.

Document: 11361f.doc, v1
Job No: 211/024524/00

3 How to Apply the Benchmarking Process to Your Plant

3.1 Resources Commitment

The resources, costs and time requirements associated with conducting the benchmarking process are outlined

The benchmarking exercise requires a variable range of resources to collect and collate the data effectively. The resources commitment is very dependent on the amount of data readily available, the size of the company's operations and whether a monitoring programme has to be set up to obtain the data. An outline of the resources expended by the plants surveyed is set out below to give an indication of the range of resources required.

Management Commitment

It is essential that the CEO or Managing Director be involved from the outset to allow:

- adequate time and resources to collect and collate data
- authorisation of the budget for monitoring equipment that may be required
- authorisation of the budget and resources to implement improvements based on results
- ongoing commitment to continual improvement in environmental performance

Initially the CEO/Managing Director must commit time to understand the environmental benchmarking process and appreciate and value the desired outcomes of the exercise. He/she must be instrumental in directing effort to obtain the required information in the most cost effective and expedient manner.

Personnel must be allocated to collect the information: these may include line managers, maintenance foremen, environmental officers and/or financial controllers.

Benchmarking exercises are not fruitful unless the CEO/Managing Director is fully committed to the process

Time Requirements

The amount of time taken to conduct the initial benchmarking exercise and obtain the data is set out in the table.

Activity	Time Requirement
	Range (hours)
Initial familiarisation with the benchmarking process	1-8
Answer survey questionnaire and chase up initial data	1-5
Conduct site audit (involving 2-3 people from various sections of the plant)*	5-8
Implement monitoring programme	0-10
Collect and collate outstanding information and compare with benchmark criteria	2-8
Analyse results and conduct feedback workshop with plant personnel *	8-16
Target areas for improvement	ongoing

* Note: These activities were facilitated by a GHD auditor during this benchmarking exercise. The time required may actually be longer than stated if no external facilitator is involved.

Cost Requirements

As well as staff costs, other costs were expended to obtain the required environmental information. Actual costs will be very site specific.

Typical costs included:

- Purchase of monitoring equipment
- Hire of monitoring equipment
- Travel costs for senior staff from the firm's other plants to attend the benchmarking exercise.
- Laboratory testing and interpretation of results.

3.2 Conducting the Benchmark Study

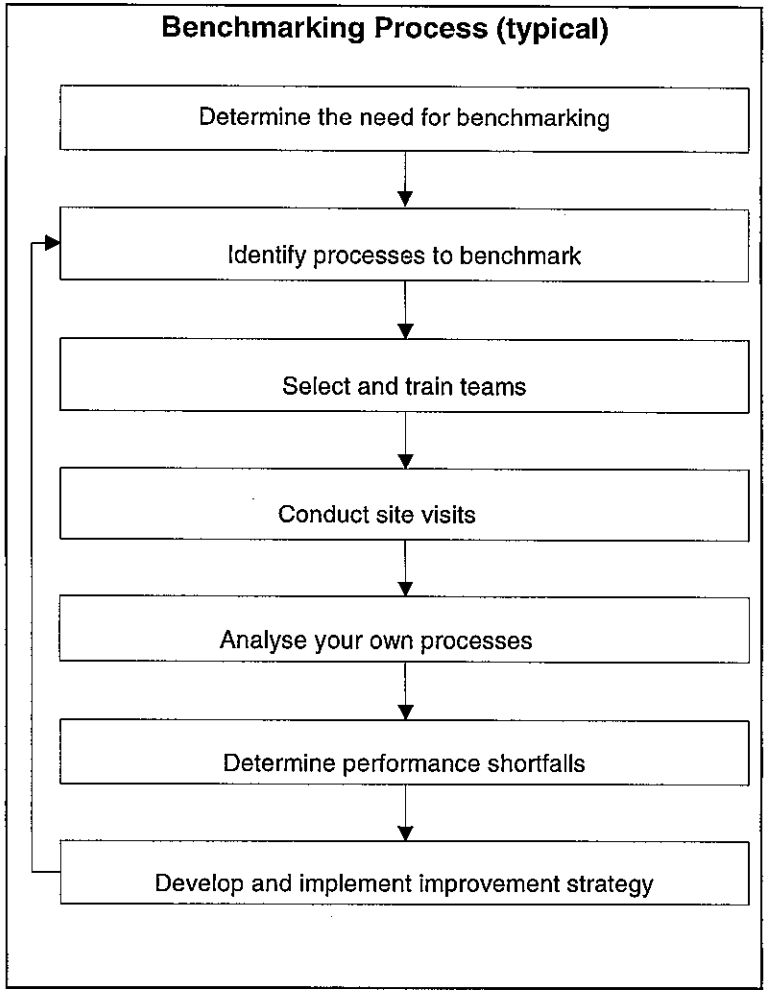
The methodology for conducting the benchmarking study is explained

The steps in the benchmarking process are illustrated adjacent.

This project has identified the areas and processes to benchmark, using eight numerical benchmark criteria and seven management-based benchmark criteria.

The method of analysing your environmental performance is explained in the step-by-step questionnaires included in Appendix A3. Once you have worked out your score for each benchmark criteria, you can compare how you performed with the nine plants surveyed. Room has been left on the graphs included in Sections 2.2 and 2.3 to plot your performance. If there are significant gaps between your measured performance and the nominated benchmark, you then need to evaluate methods for generating and implementing improvements (not nominated for investigation in this project).

Once an improvement strategy has been developed and implemented, the benchmarking exercise should be repeated annually to determine how the improvement(s) has affected environmental performance.



3.3 Where to from here?

Recommendations for future benchmarking exercises are discussed here

Several recommendations arose from the study:

- adopt an energy usage benchmark of 3500 MJ/tHSCW (rather than 5200 originally proposed)
- adopt a phosphorus wastewater load benchmark of 0.3 kgP/tHSCW (rather than that originally proposed)
- red meat processing plants need to keep better environmental records
- make allowance for contract rendering activities in the calculation of tHSCW
- recalibrate the benchmark criteria in 3 years time to ensure continuous improvement
- expand the numerical benchmark criteria to encompass waste recycling rates (and total weight prevented from landfill disposal) and percentage compliance with environmental licences
- expand the management-based benchmark criteria to include issues such as management of site contamination, dangerous goods, greenhouse gas emissions, ozone depleting substances and National Pollutant Inventory reporting.

Appendix A: The Benchmarking Process

A1 Benchmarking Overview

Managers of red meat processing plants are faced with ever increasing environmental pressures: stricter water quality requirements; tighter environmental emission regulations; and higher community expectations with respect to environmental performance. The red meat processing industry must undergo changes to meet these environmental challenges. Benchmarking has been proven to be an effective management tool to help improve performance and assist industry to become more efficient and competitive.

This project sets out appropriate benchmark criteria with which to evaluate environmental performance in the red meat processing industry.

The red meat processing industry in Australia is familiar with the concept of benchmarking, having recently completed a benchmarking survey of operational management (MRC Project M.896).

There is a need to periodically and systematically recalibrate the benchmark criteria in order to ensure continuous improvement.

Benefits of Environmental Benchmarking

- Provides an effective tool to improve performance
- Reduces costs (such as waste disposal and wastewater treatment costs)
- Reduces wastage of materials (improved materials control)
- Keeps ahead of competitors (who are also improving)
- Manages environmental issues in a systematic manner.

Document: 11361f.doc, v1
Job No: 211/024524/00

A2 Prerequisites for Benchmarking

The CEO/Managing Director must be committed to the benchmarking process for it to work.

Various studies have shown that benchmarking of management does not always have a positive effect. For companies already aiming for best practice management the effect of benchmarking is positive resulting in improved profitability, productivity and quality.

However, for poor performers the benchmarking process has had a negative effect, merely reinforcing a company's poor performance record and discouraging employees from improving performance if the gap between existing performance and desired performance is too wide.

The same effects could be anticipated for environmental benchmarking projects.

"The most successful organisations are those which adopt benchmarking as an integral part of a broader improvement program, centred on strategic concerns to the organisation, and those whose CEO provides the necessary resources and takes a leadership role in supporting the efforts being made."

Prerequisites for successful environmental benchmarking

- Commitment of the CEO and senior managers to the benchmarking process
- Willingness to commit the necessary people, time and other resources
- An ability to analyse processes thoroughly
- An ability to initiate (and follow through) process improvements
- Experience in convening and managing teams
- Ideally, already instigated environmental improvements
- Motivation of the workforce to continue making environmental improvements
- Ideally be linked to other plant improvement activities.

Form 2 Energy Usage

Issue	Working and Calculations	Answer
1 Electricity Usage 1.1 What is your annual electricity consumption? (as measured by on-site meter) 1.2 What is your quarterly electricity consumption? (Usually from your electricity bill) -First quarter -Second quarter -Third quarter -Fourth quarter 1.3 Total Annual Usage Check this totals with your answer above, in 1.1 To convert from kWh to MJ, multiply kWh by 3.6 to give MJ	.....kWh .....kWh .....kWh .....kWh .....kWh	.....MJ
2 Gas Usage 2.1 Is Gas used on site? 2.2 What was your quarterly consumption for the last four quarters? (Usually available from your gas bill) -First quarter -Second quarter -Third quarter -Fourth quarter 2.3 Total Annual Usage	Yes / No (circle one) .....MJ .....MJ .....MJ .....MJ	.....MJ
3 Fuel Usage 3.1 Are diesel or other liquid fuels used on site? If yes - state fuel type and annual consumption 3.2 Total Energy Usage Multiply litres by 38.6 MJ/L for diesel. (For other fuels, refer attached table)	Yes / No (circle one) .....fuel type .....L/yr	.....MJ
4.Coal Usage 4.1 Is coal used on site? If yes - state annual consumption 4.2 State coal type 4.3 What is the calorific value? (Conversion factors is 1kcal/kg=0.0042MJ/tonne) 4.4 Total Energy Usage Multiply quantity (tonnes) by calorific value(MJ/tonne)	Yes / No (circle one) .....t/yr .....type .....kJ/kg	.....MJ
5.Other Energy Usage 5.1 Are there any other energy sources (eg. recycled timber waste) If yes - state type and annual consumption 5.2 Convert quantity to energy value	Yes / No (circle one) .....type	..... MJ
6. Total Energy Usage 6.1 Sum of Annual consumption 6.2 Insert Annual HSCW	 .....t HSCW	..... MJ
Calculate Benchmark Divide Total Energy (MJ) by HSCW		....MJ/tHSCW

TYPICAL CONVERSION FACTORS AND ENERGY VALUES

Product	Gross Energy per:	
	Unit Mass MJ/kg	Unit Vol MJ/L
LPG - Propane	50.0	25.5
LPG - Butane	49.5	28.7
Aviation Gasoline	47.5	33.0
Petrol - *Super*	46.5	34.0
- *Unleaded*	46.5	34.2
- *Premium Unleaded*	46.5	34.9
Aviation Turbine Fuel	46.4	36.9
Lighting Kerosene	46.4	36.7
Heating Oil	45.9	37.2
Automotive Diesel Fuel	46.0	38.6
Fuel Oil - *Low Sulphur*	44.5	40.1
- *High Sulphur*	42.9	42.0

Source: Australian Institute of Petroleum Ltd Technical Data Sheet TDS 5-1990.

Form 3 Water Usage

Issue	Working and Calculations	Answer
1 What is Your Water Source? (please tick)	Town water supply Borewater On-site dam Other.....(please state)	
2 What is your annual water usage?		.....kL/yr
3 How has this been estimated? (please tick)	Water meters Water Bills Other.....(please state)	
4 Do you have daily water usage records? If yes, do the daily water usage records correlate with the annual water usage?	Yes / No (circle one) Yes / No (circle one)	
Total Water Consumption **Insert annual HSCW**		.....kL/yr .....t HSCW

Calculate Benchmark Divide Total Water Usage (kL) by HSCW		..... **.....kL/tHSCW**

kL/yr = kilolitres per year
HSCW = Hot Standard Carcass Weight in tonnes

Form 5 Wastewater Loads

Issue	Answer
1. What is your average number of production days per year	**.....days**
2. Is your raw wastewater quality measured (just after screening, but prior to savealls, dissolved air flotation, ponds or other treatment systems)? If yes, please supply the following information in the attached table: • Phosphorus, nitrogen and BOD concentrations in the raw wastewater • Flowrate corresponding to the date of sampling (if you do not have daily flowrate information, insert your average daily wastewater flow) • Calculate the daily wastewater load in kg/d Daily Loading (kg/d) = concentration (mg/L) x flow (kL/d) / 1000 • Now calculate your average wastewater load • Multiply the average wastewater load by your annual production days per year, then divide by your annual production (tHSCW/yr): Unit Loading (kg/tHSCW) = Average Load (kg/d) x No. production days / year divided by production (tHSCW)	**Yes / No (circle one)**
3 Record the following Information: -Were the samples grab or composite samples? -If composites, over what period were they collected? -If composites, were they time weighted or flow weighted? -What form of nitrogen was measured? -What form of phosphorus was measured?	Grab / Composite (circle one) .....hours Time / Flow (circle one) TKN / TN (circle one) TP / ortho or reactive P (circle one)
4 Is treated water used for irrigation? If yes, please supply the following information for your final effluent quality:	Yes / No (Circle one)
Sampling Date	**SAR**

A3 Benchmark Parameters

Benchmark Parameters need to be objective performance criteria, based on data that can be readily and accurately measured.

A3.1 General

Initially a number of parameters potentially suitable for benchmarking were identified. These were reviewed with respect to the amount of information available on each and whether they were commonly used nationally or internationally (or in other industries); easy to measure; easy to obtain accurate data; appropriate to all sizes of plants; able to be used in the long term, (so that trends over time could be identified) etc. Following the review, the list was reduced to eight numerical criteria.

As this is the inaugural environmental benchmark study conducted for the Red Meat Processing Industry, it was deemed appropriate to use numerical performance benchmarks as the primary criteria, rather than measurements of the success or status of environmental management. For example:

- the number of annual environmental complaints was nominated as a primary criterion. How the complaints were handled or responses made to complaints was considered as a secondary criterion.
- the amount of wastewater generated was nominated as a primary criterion, and the way in which the wastewater was managed was considered as a secondary criterion.

The benchmark criteria are designed to cover a broad range of environmental issues, including:

- Environmental management
- Energy usage
- Solid waste management
- Wastewater generation and management
- Odour and air emissions
- Noise generation

Site contamination matters were not considered in this inaugural benchmarking exercise.

In order to allow comparison between different red meat processing industries, a common basis of measurement was selected. The benchmark comparator selected was tonnes of Hot Standard Carcass Weight (t HSCW) or carcass weight as it leaves the slaughter floor. This is commonly available for different grades and weight of stock from all abattoirs (information on Live Weight Killed (LWK) was also obtained during benchmarking).

Eight main benchmark criteria were established, based on numerical values. Numerical benchmark criteria need to be easy to measure and readily achievable.

A3.2 Numerical Benchmark Criteria

Numerical criteria are as follows:

1) Status of Environmental Management

Target benchmark value is score of 1

Status	Score
Certified Environmental Management System	1
Environmental Management System	2
Environmental Management Plan	3
Standard Operating Procedures	4
No formalised environmental management documents	5

2) Energy usage (in MJ per tonne HSCW)

Target benchmark values:

- 1700 MJ/t HSCW (no rendering)
- 5200 MJ/t HSCW (with rendering)

3) Water usage (in kL per tonne HSCW)

Target benchmark value 12 kL/t HSCW

4) Wastewater generation (in kL per tonne HSCW)

Target benchmark value 8 kL/t HSCW

5) Wastewater loads (in kg per tonne HSCW)

Target benchmark values (after screening):

- 0.5 kg P/t HSCW
- 1.5 kg N/t HSCW
- 15 kg BOD/t HSCW
- SAR < 5 (for plants that irrigate)

6) Number of annual odour complaints

Target benchmark value is zero complaints per year.

7) Number of annual noise complaints

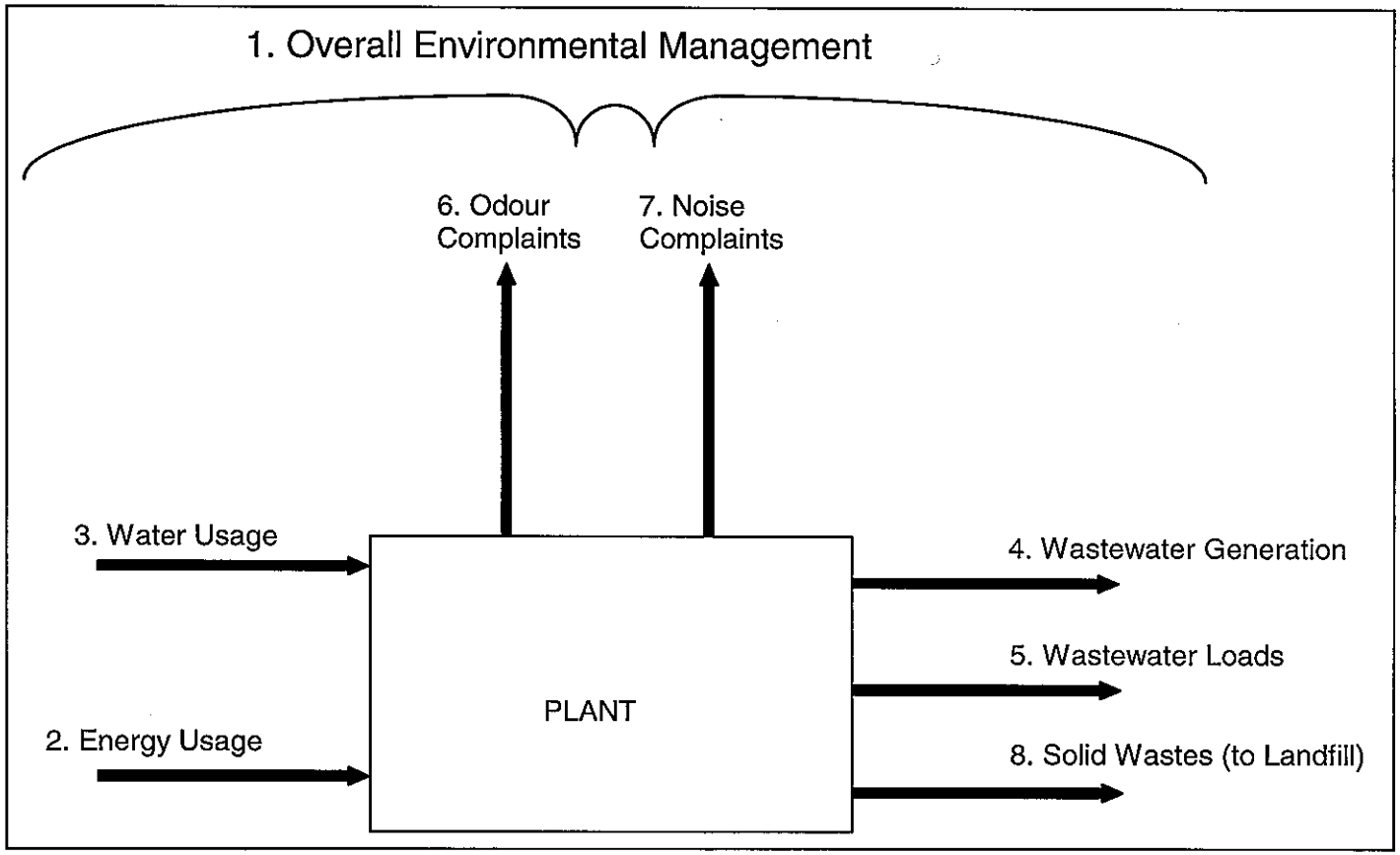
Target benchmark value is zero complaints per year (for 6 and 7, if there is no system for receiving, internally reporting and recording complaints, then the plant will automatically be scored as "inadequately monitored" and receive a score of 2)

8) Solid waste to landfill (in kg per tonne HSCW)

Target benchmark value is 5 kg/tHSCW.

Numerical benchmark criteria are illustrated diagrammatically on the following page.

Generally a high numerical score will indicate poor performance.



Numerical Benchmark Criteria Schematic

Seven benchmark criteria were established based on environmental management criteria

A3.3 Management-based Benchmark Criteria

These benchmark criteria are based on how well the following environmental issues are managed.

1) General Environmental Management
2) Energy Management
3) Water and Wastewater Management
4) Irrigation Management
5) Management of Solid Wastes
6) Management of Noise Emissions
7) Management of Air Emissions

A percentage score can be assigned to each issue so that red meat processing industry plants can be compared. The secondary benchmarks and method of scoring are described in the questionnaire included in A5.

Generally a high score will indicate poor performance

A4 Survey Questionnaire - Numerical Criteria

Detailed survey questionnaires have been developed to obtain information on the numerical and management-based benchmark criteria. They were used in surveys of plants with the aim of collection of consistent, comparable and comprehensive data. The questionnaires have been designed to obtain all the necessary environmental data in order to calculate or determine the benchmark criteria. The numerical benchmark survey questionnaire is reproduced in the following pages.

Detailed survey questionnaires have been developed for numerical and management-based benchmark criteria.

Form 1 Environmental Management

Issue	Answer
1 Do you have a certified ISO 14000 Environmental Management System? If yes, to which certification body is it accredited? If yes, your score is 1. Now go to form 2	Yes / No (circle one) ....
2 Do you have an Environmental Management System (or an Integrated EMS approved by the Queensland Department of Environment)? If yes, record details. If yes, your score is 2. Now go to Form 2	Yes / No (circle one) ....
3 Do you have an Environmental Management Plan (also referred to as a site-based environmental management plan in some states)? If yes, record details of document. If yes, your score is 3. Now go to Form 2	Yes / No (circle one) ....
4 Do you have "Standard Operating Procedures" or "Work Instructions" for environmental issues, or other environmental management documents? If yes, record details. If yes, your score is 4. Now go to Form 2.	Yes / No (circle one) ....
5 You have no formal management documents or procedures. Your score is 5	
Record your score here	

Form 4 Wastewater Generation

Issue	Working and Calculations	Answer
1 What is your daily wastewater generation)?	Average.....kL/d Range.....kL/d	
2 What is your annual wastewater generation?		.....kL/yr
3 How has this been estimated? (please tick)	Flowmeter Emission factor (proportion of water used) Sewer charges Other.....(please state)	
Total wastewater generated		.....kL/yr
Insert annual HSCW		.....t HSCW

Calculate Benchmark Divide Total wastewater generated (kL) by HSCW		..... **.....kL/tHSCW**

A5 Survey Questionnaire - Management-based Criteria

The management-based benchmark criteria questionnaire is reproduced in the following pages. To use the questionnaire:

- Circle the most appropriate answer to each question
- Determine your score and write in Column 7
- Note any evidence to support your answer (for future reference). You may need some or all of the nominated evidence
- If there are any comments and/or mitigating factors that may affect your answer, write these in the last column
- Add up your total score for each section and record in the box labelled "Score Total"
- Convert your total score to a percentage by:

$$\frac{\text{score total}}{\text{maximum score}} \times 100 = \text{percentage score (\%)}$$

- Note that some questions may not be applicable to your plant so you will need to adjust the values used as the maximum score
- Fill in form 9 to find your overall environmental management score.
- Now compare your percentage scores with those of other plants shown in Section 2.3

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1) GENERAL ENVIRONMENTAL MANAGEMENT

Evaluation Criteria	Score					Your Score	Required Evidence to Support Your Answer	Comments/ Mitigating Factors
	4	3	2	1	0			
1.1 Are regular environmental audits conducted?	Never done an audit	A full audit has been conducted in the last 4 years or a partial audit in the last 2 years	Once every 3 years	Once every 2 years	Once per annum		Copy of environmental audit	
1.2 Have agreed audit recommendations been implemented?*	No action	Commenced but not yet completed	50% agreed recommendations completed	80% agreed recommendations completed	All major, agreed recommendations completed		List of agreed recommendations. Status of action	
1.3 Are regular written environmental reports submitted to management?	No written reports	Annual Reports	Twice per year	Quarterly	Monthly		Reports for last year	
1.4 What is the frequency of environmental incidents that may have an off site impact and/or result in a complaint?	No records kept	A regular weekly occurrence	Once or twice per month	Once in last 6 months	None in last 6 months		Incident register	
1.5 Have there been any breaches of Environmental Licences?	No records kept	None in last 2 years	None in last 3 years	None in last 4 years	None in last 5 years		File of correspondence with environmental authority	
1.6 Are requirements for cleaner production and environmental care included in Work Instructions (WI) or Standard Operating Procedures?	Work instructions not available	Work instructions available but do not include requirements for cleaner production and environmental care	Formal work instruction only available for Environmental Processes (waste handling, waste water treatment, air discharges, etc)	Some WI have requirements for cleaner production and environmental care included. WI available for all environmental processes	All relevant WI have requirements for cleaner production and environmental care included		Work Instructions	

Form 5 Continued

Sampling Date	Concentration (mg/L)			Flowrate	Loading (kg/d) = Concentration (mg/L) x flow (kL/d) ÷1000		
	Phosphorus	Nitrogen	BOD	(kL/d)	Phosphorus	Nitrogen	BOD
				Average Daily Loading (kg/d)			
				Unit Loading (kg/tHSCW)			

Form 6a Odour Complaints

Issue	Working	Answer
1 Do you maintain an odour complaint register? If no (that is, there is no system for receiving, internally reporting and recording complaints) then the plant will automatically be scored as "inadequately monitored" and receive a score of 2. If no, record your answer as 2.	Yes / No (circle one)	.....
2 Have you had any odour complaints in the last 3 years? If yes, how many? How many were attributable to your plant? Work out the average number of complaints per year attributable to your plant and record your answer.	Yes / No (circle one) .....No. .....No. Total Number / 3 years	.....No. / yr

Form 6b Noise Complaints

Issue	Working	Answer
1 Do you maintain a noise complaint register? If no (that is, there is no system for receiving, internally reporting and recording complaints) then the plant will automatically be scored as "inadequately monitored" and receive a score of 2. If no, record your answer as 2.	Yes / No (circle one)	.....
2 Have you had any noise complaints in the last 3 years? If yes, how many? How many were attributable to your plant? Work out the average number of complaints per year attributable to your plant and record your answer.	Yes / No (circle one) .....No. .....No. Total Number / 3 years	.....No. / yr

Form 7 Solid Waste

1 What quantity of solid waste is sent to landfill?
(Provide a breakdown of solid wastes wherever possible)

Issue	Working	Answer
Organic wastes		.....kg/yr
carcass parts		.....kg/yr
NCV skins		.....kg/yr
cardboard & paper		.....kg/yr
anaerobic pond crust		.....kg/yr
wastewater pond sludge		.....kg/yr
paunch solids		.....kg/yr
manure / yard wastes		.....kg/yr
Other		.....kg/yr
Subtotal		**.....kg/yr**
Non-Organic wastes		.....kg/yr
rubber (boots/aprons/etc)		.....kg/yr
coal ash		.....kg/yr
plastic		.....kg/yr
waste salt (from hide salting)		.....kg/yr
scrap metal		.....kg/yr
demolition wastes		.....kg/yr
general wastes		.....kg/yr
Other		.....kg/yr
Subtotal		**.....kg/yr**
Total organic and non-organic wastes	**Total**	.....kg/yr
Calculate Benchmark	**Divide waste amount (kg/yr) by HSCW**	**.....kg/tHSCW**

Note: Landfill dockets may require collation to answer this section

2 Keep a record of the method of calculation

eg: No. bins x volume x bulk density

Form 8 Numerical Benchmark Summary

Record your answers from the previous sections

Form	Section	Score/Benchmark	Units
1	Environmental Management		-
2	Energy Usage		MJ / tHSCW
3	Water Usage		kL / tHSCW
4	Wastewater generation		kL / tHSCW
5	Wastewater Loads -Phosphorus -Nitrogen -BOD -SAR (if applicable)		 kg / tHSCW kg / tHSCW kg / tHSCW -
6a	Odour complaints		No.
6b	Noise complaints		No.
7	Solid waste to landfill		kg / tHSCW

Evaluation Criteria	Score					Your Score	Required Evidence to Support Your Answer	Comments/ Mitigating Factors
	4	3	2	1	0			
1.7 Is there a trained and experienced environmental manager on site with management level authority?	No one person responsible	One person responsible but little authority	Responsible manager but no formal environmental training	Responsible manager but has limited environmental knowledge	A manager with appropriate knowledge and authority has clearly defined responsibility for environmental management		Environmental manager's job description/ responsibilities	
1.8 Has an environmental complaint system been established?	No records kept	Some records kept, but no formal system	Formalised complaint registration but no corrective action	System in place but corrective actions not followed up	Complaints recorded and corrective actions implemented		Complaints register. Corrective Action Responses	
1.9 Is a centralised site environmental file kept?	No records kept	-	Environmental records available but not centralised	-	Environmental records kept in central file(s)		Environmental file(s)	
1.10 Are staff trained in environmental management?	No training	Some training for selected staff	All staff have received at least one training session in last 5 years	Regular training program established but not fully complied with	All staff receive formal and documented training at least once/year		Training program outline. Staff training records.	
1.11 Is site landscaped and maintained in a clean and tidy manner?	No attempt to maintain a clean site or visual amenity	Some evidence of site cleanup and landscaping	Site clean and tidy but no landscaping	Site clean and tidy, buildings maintained but landscaping not well established	There is an active program to maintain visual amenity and site cleanliness		Grounds and buildings maintenance plan	
1.12 Are there environmental contingency procedures (for spill management - chemicals, wastes, by-products)	No contingency procedures	Contingency procedures documented but not disseminated	Contingency procedures disseminated	Contingency procedures documented and tested occasionally	Contingency procedures documented, disseminated and tested annually		Contingency Procedures	
					SCORE TOTAL			
					MAXIMUM SCORE	**48****		
					PERCENTAGE	**%**		

* Do not answer Question 1.2 if you scored 4 in Question 1.1.

** If Question 1.2 was not applicable the maximum score is 44.

2) ENERGY MANAGEMENT

Evaluation Criteria	Score					Your Score	Required Evidence to Support Your Answer	Comments/ Mitigating Factors
	4	3	2	1	0			
2.1 Has an energy audit been conducted?	Never	In last 6 years	In last 5 years	A full audit has been conducted in the last 4 years or a partial audit in the last 2 years	In last 3 years		Audit report	
2.2 Have agreed audit recommendations been implemented?*	No action	Commenced but not yet completed	50% agreed recommendations completed	80% agreed recommendations completed	All major, agreed recommendations completed		Implementation Plan. Design/ Commissioning report	
2.3 Have energy efficiency measures been incorporated at the plant?	No measures taken	Waste heat capture eg, heat exchangers	Co-generation utilised	Energy Management system installed to reduce electricity consumption	Total Energy use per unit of production is decreasing		Records of energy usage	
					SCORE TOTAL			
					MAXIMUM SCORE	**12****		
					PERCENTAGE	**%**		

* Do not answer Question 2.2 if you scored 4 in Question 2.1.
** If Question 2.2 was not applicable, the maximum score is 8.

3) WASTEWATER MANAGEMENT

Evaluation Criteria	Score					Your Score	Required Evidence to Support Your Answer	Comments/ Mitigating Factors
	4	3	2	1	0			
3.1 Has a wastewater/water use audit been conducted?	Not conducted	In last 5 years	A full audit has been conducted in the last 4 years or a partial audit in the last 2 years	In the last 3 years	In last 2 years		Audit report	
3.2 Have agreed audit recommendations been implemented?*	No action	Commenced but not yet completed	50% agreed recommendations completed	80% agreed recommendations completed	All major, agreed recommendations completed		List of agreed recommendations. Implementation Plan	
3.3 Is wastewater flow measured?	Not routinely measured	Quarterly	Monthly	Weekly	Daily		Wastewater flow records	
3.4 Is final wastewater quality measured?	Not routinely measured	Twice per annum	Once per quarter	Once per month	Twice per month		Wastewater quality records	
3.5 Has treatment efficiency for major treatment process units been measured?	Never	After plant commissioning only	In last five years	In last two years	Once per annum		Commissioning/ testing reports	
3.6 Is wastewater reused wherever possible?	0%	25%	50%	75%	100% of non potable water requirement is supplied by reused wastewater		Reuse records	
3.7 Is potentially-contaminated stormwater collected and treated? (do not include "clean" stormwater from roofs)	No collection or treatment	Site stormwater directed to wastewater treatment ponds	Stormwater from stock holding areas sent directly to wastewater treatment ponds	Stormwater from stock holding areas collected in catch pond or first flush system for later treatment	All stormwater from all potentially contaminated areas directed to catch pond or first flush system for later treatment		Stormwater management plan. Site drawings showing stormwater catchment areas	
					SCORE TOTAL			
					MAXIMUM SCORE	**28****		
					PERCENTAGE	**%**		

* Do not answer Question 3.2 if you scored 4 in Question 3.1.
** If Question 3.2 was not applicable, the maximum score is 24.

4) IRRIGATION MANAGEMENT (If Applicable)

Evaluation Criteria	Score					Your Score	Required Evidence to Support Your Answer	Comments/ Mitigating Factors
	4	3	2	1	0			
4.1 Are appropriate licences and records kept?	No licence and no records	Irrigation system approved by Local Authority	Irrigation system approved by State Environmental and Local Authority	Fully approved irrigation system. Records of irrigation time and amount of wastewater applied kept	As for previous, plus records of environmental factors such as rainfall, evaporation, soil moisture kept		Completed form A-3 (MRC Irrigation Manual). Copies of records.	
4.2 Are nutrients (phosphorus and nitrogen) and salt adequately managed?	No modelling or monitoring done	Modelling done but no monitoring	Two parameters accumulating in or lost from irrigation area	One parameter accumulating in or lost from irrigation area	No unplanned accumulation in or loss from irrigation area		Completed forms A-4.1, A-4.2, A4.3 (MRC Irrigation Manual)	
4.3 Is irrigation area hydraulically balanced and is there sufficient wet weather storage?	No modelling or monitoring of hydraulic balance	Wet weather storage or irrigation area under 50% of required capacity	Wet weather storage or irrigation area under 75% of required capacity	Storage dam and irrigation area can cope with average year	Storage dam and irrigation area can cope with 1 in 10 wet year		Completed form A-5 (MRC Irrigation Manual)	
4.4 Does the irrigation system result in groundwater pollution?	No groundwater investigations conducted	Groundwater not routinely monitored	Effects on groundwater not significant	Irrigation of nutrients not planned and monitored but sampling of groundwater indicates no problems	Irrigation of nutrients planned and monitored and groundwater sampling indicates no problems		Completed forms A7.1, A7.2 (MRC Irrigation Manual)	
4.5 Is surface water runoff adequately managed?	No runoff management	Irrigation area has catch drains but no collection and reuse	Runoff collected but not reused	Runoff collected in a natural depression and later reused	Runoff collected in a separate pond and later reused		Completed forms A-8.1, A8.2 (MRC Irrigation Manual)	
4.6 Are there emergency procedures for the irrigation system?	No emergency procedures	Emergency procedure documented but not disseminated	Emergency procedures disseminated	Emergency procedures disseminated and tested occasionally	Emergency procedures documented, disseminated and tested annually		Completed form A-9 (MRC Irrigation Manual)	
					SCORE TOTAL			
					MAXIMUM SCORE	24		
					PERCENTAGE	%		

5) MANAGEMENT OF SOLID WASTES

Evaluation Criteria	Score					Your Score	Required Evidence to Support Your Answer	Comments/ Mitigating Factors
	4	3	2	1	0			
5.1 Has a waste audit been conducted?	None conducted	In last 5 years	A full audit has been conducted in the last 4 years or a partial audit in the last 2 years	In last 3 years	In last 2 years		Audit report	
5.2 Have agreed audit recommendations been implemented?*	No action	Commenced but not yet completed	50% agreed recommendations completed	80% agreed recommendations completed	All major, agreed recommendations completed		Implementation Plan	
5.3 Are organic and nutrient loading rates for land based disposal areas measured and recorded? (This question only applies to land spreading of organic wastes such as manure or compost).	No records kept	Quarterly	Monthly	Weekly	Daily		Records of organic wastes disposed	
5.4 Are records kept of solid wastes disposed off site?	No records kept for any solid wastes	-	Records not kept but estimates can be readily made	Records for some solid wastes kept	Records of all solid wastes kept		Waste records	
					SCORE TOTAL			
					MAXIMUM SCORE	**16****		
					PERCENTAGE	**%**		

* Do not answer Question 5.2 if you scored 4 in Question 5.1

** If Question 5.2 was not applicable, the maximum score is 12.
If Question 5.3 was not applicable, the maximum score should be reduced by 4.

6) MANAGEMENT OF NOISE EMISSIONS

Evaluation Criteria	Score					Your Score	Required Evidence to Support Your Answer	Comments/ Mitigating Factors
	4	3	2	1	0			
6.1 Have noise emissions from plant been measured at plant boundary and recorded?	No noise measurements taken	Noise measurements taken of specific events	Noise measurements taken of specific events over a period of time	Comprehensive measurements taken of specific events over 3 years ago	Comprehensive measurements taken in last 3 years		Noise monitoring reports	
6.2 Have noise attenuation measures been undertaken?	No noise measurement or attenuation action taken	Noise measurements taken but no action taken	Attenuation action taken only if complaints received	Attenuation action taken for specific known events	Ongoing program of noise measurement and reduction in place		Noise reduction action plan	
					SCORE TOTAL			
					MAXIMUM SCORE	8		
					PERCENTAGE	%		

7) MANAGEMENT OF AIR EMISSIONS

Evaluation Criteria	Score					Your Score	Required Evidence to Support Your Answer	Comments/ Mitigating Factors
	4	3	2	1	0			
7.1 Are byproducts odour emissions controlled?	No odour treatment	Management procedures enforced rigorously to reduce odour	Some emissions treated for odour	Most emissions treated for odour	Fully enclosed system with odour treatment (or all odour generation points enclosed with odour treatment)		Details of odour treatment system	
7.2 Is odour removal efficiency of 90% achieved in the odour treatment system?	Not measured/ no data	50% efficiency	70% efficiency	90% efficiency	>90% efficiency		Design and commissioning report. Actual test data	
7.3 Is odour treatment system inspected regularly?	Not inspected	Inspected regularly but no records kept	Twice per year	Once per month	Once per week		Inspection records. Instrumentation calibration records	
7.4 Are odour levels at plant boundary measured?	No odour measurements taken	Odour measurements taken in response to complaint	Odour measurements taken in specific areas on plant	Comprehensive measurements taken more than 5 years ago	Comprehensive measurements taken in last five years		Odour measurement reports	
7.5 Are pond system odours controlled? (for systems using traditional anaerobic ponds)	Pond system produced odours but unknown cause	Overloaded pond with no crust	Anaerobic ponds with no crust	Anaerobic ponds with crust	Anaerobic ponds and system functioning at design capacity and odour free		Odour investigation reports	
7.6 Are animal holding areas/stock pens sealed, and washed regularly?	Not cleaned regularly or not sealed	Stock holding areas cleaned on irregular basis	Stock holding areas cleaned daily	All stock holding areas are sealed, and cleaned at least weekly	All stock holding areas are sealed and cleaned on a daily basis		Holding area cleaning procedures	
					SCORE TOTAL			
					MAXIMUM SCORE	24		
					PERCENTAGE	%		

Form 9 Overall Environmental Management

Add up all your scores from the previous sections

SECTION	YOUR SCORE	MAXIMUM SCORE
1. Environmental Management		
2. Energy Management		
3. Wastewater Management		
4 Irrigation Management (if applicable)		
5 Management of Solid Wastes		
6 Management of Noise Emissions		
7 Management of Air Emissions		
TOTAL		

Your percentage score = your total score / total maximum score x 100

Percentage Score =_____%

Note: Remember to enter the correct maximum score. If questions 1.2, 2.2, 3.2, 5.2, and / or 5.3 were not applicable, then use the maximum score indicated in the footnote at the bottom of each sheet

Appendix B: Literature Review

B1 Literature Review

Little information on environmental performance in the Australian Red Meat Processing Industry has been published. Most published information relates to wastewater treatment.

B1.1 Scope

Australian and International literature were reviewed to identify environmental performance Benchmark Criteria. Sources of information included computer databases, library holdings and publications from technical societies. Information was sought from the following organisations:

- ANZECC
- Meat Research Corporation
- NSW Agriculture
- European Union Delegation of the European Commission in Australia
- Environment Management Industry Association of Australia
- Clean Air Society of Australia and New Zealand
- New Zealand Retail Meat and Allied Trades Federation
- Environment Protection Authority (or equivalent) for each Australian State and Territory
- Australian Meat and Livestock Corporation
- Waste Management Association of Australia
- Water Environment Research Foundation
- International Association of Water Quality

B1.2 Findings

The findings of the literature review are:

- There is a lack of recent, reliable environmental data or published information on benchmark criteria for the red meat processing industry in Australia and overseas.
- Some of the information used in this project has been derived from unpublished sources.
- A number of different industries routinely use environmental benchmark criteria (see below). However, these criteria are either not applicable to the red meat processing industry or values are not comparable.
- Environmental benchmark studies have concentrated on evaluating the management of environmental issues rather than on establishing numerical benchmark values.

B1.3 Other Industries

Commonly used benchmark criteria in some other industries are listed below.

Industry	Benchmark Criteria
Beverage	Litres product per kL wastewater Litres product per kWh energy
Paper manufacturing	kL wastewater per tonne product
Steel manufacturing	kWh energy per tonne product
Fruit and vegetable processing	Water consumption per tonne processed
Sewage treatment	% biosolids reused % licence compliance % wastewater recycled

B1.4 Summary of Available Information

1.) Environmental Management Systems

Certified Environmental Management Systems (EMS) have not been established for any Australian red meat processing plants, according to the JASANZ register. A generic EMS specifically for red meat processing plants is currently being developed (MRC Project RPDA.302), but is not anticipated to meet the full requirements of the ISO14001 standard. Recent Environmental Impact Statements (or equivalent) have indicated the need to establish site specific Environmental Management Plans (EMP) for new red meat processing plants.

Based on available information, the presence or absence of an EMS, EMP or other environmental operating procedures would be appropriate for use as an environmental benchmark.

2.) Energy Usage

A comprehensive report on fuel and electricity in the red meat processing industry was produced a number of years ago (CSIRO, 1979). The data are still regarded as representative of the industry generally, and are summarised adjacent. The use of fuel was influenced by the presence or absence of rendering and waste heat recovery. Primary processors (killing, chilling, boning, freezing) used less fuel energy than secondary producers (as for primary processing plus canning, smallgoods, fellmongering, etc). The use of electrical energy was influenced by the presence or absence of rendering and cold stores and the capacity of the cold stores.

Total energy usage (from electricity, diesel fuel, gas, coal and other energy sources) was considered an appropriate benchmark criterion. To simplify matters, two benchmark values were established, one for a plant with rendering and one for without rendering.

Energy Usage

Fuel Energy Used	Range MJ/tonne*	Average MJ/tonne*
Primary Processors	460 - 10 510	4120
Water heating only (no rendering)	460 - 11 560	1090
Rendering with waste heat recovery	2 080 - 7 060	4 440
Rendering without waste heat recovery	3 400 - 10 510	5 140
Secondary Processors	5 160 - 13 540	7 708
Electrical Energy Used		
Primary Processors	170 - 2 100	1 030
No rendering, no cold store	170 - 630	420
Rendering, no cold store	740 - 1 000	842
No rendering, cold store	620 - 1 120	837
Rendering, cold store	480 - 2 100	1 083
Secondary Processors	1 550 - 4 100	2 400
* tonne of dressed carcass weight (equivalent to tHSCW)		

3.) Water Usage

A comprehensive survey (CSIRO, 1979) indicated an average water usage of 16.6 (range of 4.1-43.0) kL/t HSCW. Secondary processors had a higher average water use of 25.9 (range of 20.2-30.9) kL/t HSCW. Water usage has decreased over recent years, with levels of 8-10 kL/t HSCW now readily achieved. A recent study (MRC Project M.445) of seven abattoirs indicated an average water use of 7.7 (range of 3.3-13.8) kL/t HSCW. Plant size (based on annual capacity) and plant utilisation (ratio of actual production to maximum production capacity) have been found to have little influence on water use. Water usage is affected by the product market as export plants use more than domestic plants. A benchmark value of 12 kL/t HSCW was adopted.

4.) Wastewater Generation

Wastewater quantities are affected by the presence or absence of rendering, the degree of wastewater recycling, and the annual plant capacity. For large abattoirs, wastewater generation ranged from 5-16 (average 10) kL/t HSCW and for small abattoirs, wastewater generation ranged from 2-14 (average 6) kL/t HSCW (refer to Wastewater Manual, GHD 1998). A benchmark value of 8 kL/t HSCW, (irrespective of plant size), was adopted.

5.) Wastewater Loads

The loads of pollutants in wastewater reflect the efficiency of the red meat processing plant and degree of cleaner production implemented. Pollutant loads are affected by the presence or absence of rendering. MRC Project M.445 indicated that there were no obvious differences in wastewater loads due to the type of animals processed or the type of rendering plant (except COD is higher with an LTR plant). The project evaluated wastewater loads from key areas within abattoir and rendering plants. Wastewater pollutant loads were surveyed as part of the Wastewater Manual project (GHD, 1998) and are summarised in the following table.

Wastewater Loads in kg/t HSCW

Parameter	Large Abattoirs		Small Abattoirs	
	Ave	Range	Ave	Range
COD	53	15-117	38	10-43
BOD	36	6-66	28	7-70
SS	33	18-55	33	3-124
TN	2.7	1.2-4.6	1.1	0.2-3
TP	0.5	0.08-1.0	0.7	0.2-1.5

Raw wastewater loads were measured after screening but prior to saveall or dissolved air flotation units. Based on the range of loads, target benchmark criteria were adopted for a number of pollutants as follows:

- 0.5 kg P/t HSCW
- 1.5 kg N/t HSCW
- 15 kg BOD/t HSCW.

In addition, for plants that utilise wastewater irrigation, sodium adsorption ratio (SAR) is an important environmental parameter. A target SAR of less than 5 was adopted. (SAR reflects the proportion of sodium to magnesium and calcium ions).

6.) Odours

There is plenty of information available on odours generated from red meat processing industries, including sources, types of odour, treatment, control and minimisation (MRC Odour Minimisation Manual). However, there is little published material dealing with environmental performance criteria for odours. A number of State environmental protection authorities have established maximum odour levels (in terms of "odour units") at the plant boundary. However, as definitive odour units are difficult to measure this is not a practical environmental performance measure. Performance with respect to odour can be determined by the frequency of odour complaints which has been proposed as a benchmark criterion.

7.) Noise

The red meat industry has determined noise levels at various areas within abattoirs (MRC Noise Control for Abattoirs). A high proportion of work areas have noise levels in excess of 85 dB(A).

Plant boundary daytime and night time noise level limits have been established by State and Territory environmental authorities. These limits are normally incorporated into the plant's environmental licence. However, as for odours as discussed above, direct measurement of noise levels is costly and a simpler environmental performance criterion is the frequency of noise complaints.

8.) Solid Wastes

There is some published information on the quantity of solids wastes generated per unit of production. A recent MRC project on packaging waste (MRC Packaging Issues Project) indicated the following waste quantities:

- cardboard 0.90 kg/tonne meat packed
- plastic 0.10 kg/tonne meat packed
- strapping tape 0.02 kg/tonne meat packed.

(Correlations of these wastes with t HSCW are not available).
Other wastes that are generated during meat processing such as by-products and paunch material are either renderable, can be composted, or are otherwise recovered. A large proportion of wastes can be recycled or reused with potentially little waste going to landfill. Therefore, an appropriate benchmark value would be zero waste going to landfill. However, this is not likely to be readily achieved in the short term, so a nominal benchmark value of 5 kg/tHSCW was set.

9.) Recycling

As an extension of the criterion for solid wastes, a 100% recycle rate target benchmark criterion would be appropriate. Solid wastes for recycling include purchased consumables (oil, cans, chemical drums, paper, cardboard, plastics, other packaging materials) and residuals produced during processing (such as by-products, animal faeces, composted materials, wastewater treatment plant sludges, and other organic solids). Information on quantities of waste recycled was not available in the literature or from the sites surveyed. Therefore, recycle rate was not included as a benchmark criterion for this project. (Recycle rates could however be used as a benchmark criterion in future assessments).

Appendix C: Selection of Plants for Trial Survey

C1 Scope of Survey

For the survey, representational diversity of plants was required in order to ensure the results could be used Australia wide.

The project involved surveys of nine plants, using the benchmark criteria developed above, to establish inaugural benchmark data for the Australian Red Meat Processing Industry.

Initially a range of plants was reviewed to determine a suitable cross section for the trial benchmarking survey. The plants selected needed to encompass:

- a range of abattoirs and rendering plants
- a mix of animal types processed (sheep/cattle)
- a mix of ultimate markets (domestic/export)
- a spread of size/capacity, consistency of operation and age
- geographic and meteorological diversity (eg coastal/well watered; inland/dry) distributed throughout Australia
- a spectrum of final effluent disposal or reuse (eg for irrigation, to municipal sewers or to receiving waterways)
- desirably, having already carried out or been subject to assessment of environmental performance (eg water balances; wastewater treatment improvement programmes; waste reduction measures etc)

The plants were screened initially on the basis of representational diversity and the perceived ease of obtaining environmental information. The preliminary screening survey questionnaire is set out below.

General Plant Information

Plant Name: . . . . . .

Location . . . . . .

State: . . . . . .

Plant Activities (tick box):

- Abattoir ☐
- Rendering ☐
  - wet ☐
  - LTR ☐

Plant Capacity

- Average . . . . . t HSCW/year
- Maximum . . . . . t HSCW/year
- Average . . . . . LWK/year
- Maximum . . . . . LWK/year

Animal Types Processed (tick box):

- Sheep ☐
- Cattle ☐
- Other ☐ (please state)

Age of Plant (years) . . . . . .

Major Plant Upgrades . . . . . .

. . . . . .

Final Effluent Disposal Route (tick box):

- Sewer - small town ☐
- Sewer - large city ☐
- Irrigation/land disposal ☐
- Recycled ☐
  (state percentage recycled) . . . . . .
- Surface Water ☐
  (state watercourse) . . . . . .

Environmental Assessments and Projects Already Undertaken

- Water balances ☐
- Wastewater treatment improvement programs ☐
- Wastewater sludge reduction ☐
- Packaging reduction investigations ☐
- Other solid waste reduction measures ☐
- Odour studies and/or reduction/treatment programs ☐
- Flue gas emission reductions ☐
- Noise studies and/or reduction programs ☐
- Energy Audits ☐
- Environmental Audits ☐
- EMS or EMP establishment ☐

Other (please state) . . . . . .

LTR=Low Temperature Rendering, HSCW=Hot Standard Carcass Weight, LWK=Live Weight Killed
EMS=Environmental Management System, EMP=Environmental Management Plan

C2 Site Visits

Site visits were conducted at the nine plants in order to:

- confirm data given in the questionnaire
- obtain outstanding information
- physically inspect the age, condition and efficiency of the plant and equipment
- observe and qualitatively assess air, odour, noise, wastewater and stormwater emissions and impacts
- review existing environmental reports, programmes and systems
- determine "best" environmental practices at each site
- investigate superior performance, activities and programs that could be implemented at other plants
- liaise with senior management about the progress of the study.

Site visits were conducted over the period of October 1997 to April 1998. Return site visits were conducted over the period June to July 1998 to feed back information to the plants. A typical site survey plan is presented adjacent.

Site visits were conducted at the 9 plants to verify information provided in the questionnaire.

Site Visit Survey Plan

Step	Activity	Duration
1	Brief session to overview the benchmarking process, introduce the "auditor", review objectives of the study.	0.5h
2	Tour of the site with plant personnel	2 - 3h
3	Discussions with plant personnel to determine data sources, verify data, review documents, etc	2 - 3h
4	On site debriefing of findings	0.5h
5	Return site visit to feed back information	1.5-3h
	Total	**6.5 - 10h**

Document: 11361f.doc, v1
Job No: 211/024524/00

Appendix D: References

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- MRC Project M.476 "Effluent Irrigation for Meat Processing Plants", prepared by Lyall & Macoun Consulting Engineers, November 1995.
- MRC Project M.896 "Benchmarking of Leadership and Management Skills of Meat Processing Organisations in Australia", prepared by Leadership Development Group, July 1996.
- MRC "Odour Minimisation Manual for the Meat Processing Industry", August 1997.
- MRC Project RPDA.308 "Best Practice Wastewater Treatment - Wastewater Manual", prepared by Gutteridge Haskins & Davey Pty Ltd, December 1997.
- MRC Project RPDA.302 "Development and Trial of a Generic Environmental Management System for Red Meat Processing Plants", prepared by Dames & Moore Pty Ltd, TBA 1998.
- MRC "Trends and future regulatory issues concerning packaging material used in the Australian meat industry", prepared by Coopers & Lybrand Consultants, June 1996.
- MRC "The Australian Meat Industry Occupational Health and Safety Best Practice Project, Noise Control for Abattoirs", prepared by David Caple & Associates Pty Ltd, undated.

Appendix E: Abbreviations

Abbreviations used throughout this report are explained

ANZECC	Australian & New Zealand Environment & Conservation Council
BOD	Biochemical Oxygen Demand
CEO	Chief Executive Officer
COD	Chemical Oxygen Demand
CSIRO	Commonwealth Scientific & Industrial Research Organisation
dB	decibel
EMP	Environmental Management Plan
EMS	Environmental Management System
EPA	Environment Protection Authority
GHD	Gutteridge Haskins & Davey Pty Ltd
h	hour
HSCW	Hot Standard Carcass Weight =animal-(head+feet+hide+blood+viscera)
IBM	International Business Machines
ISO	International Organisation for Standardisation
JASANZ	Joint Accreditation Service of Australia and New Zealand
kg	kilogram
kL	kilolitre
kWh	kilowatt hour
LTR	Low Temperature Rendering
LWK	Live Weight Killed
MJ	Megajoule
MRC	Meat Research Corporation
N	Nitrogen
NSW	New South Wales
P	Phosphorus
SAR	Sodium Absorption Ratio
SEMP	Site Environmental Management Plan
SOP	Standard Operating Procedure
t	tonne
WI	Work Instruction
WWTP	Wastewater Treatment Plant

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Job No: 211/024524/00