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NATIONAL CLEANER PRODUCTION CENTRE SA

NCPC
national cleaner production centre
South Africa

QUICK-SCAN SUMMARY REPORT FOR

HUDSON AND KNIGHT

Prepared for: Hudson & Knight / NCPC

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23 August 2007

EXECUTIVE SUMMARY

Hudson and Knight is situated in Boksburg, east of Johannesburg and is involved in the production of a wide range of oils for the food industry. The company is ISO 9000 & 14000 certified and has high food safety and hygiene standards. It has also adopted Total Productive Manufacturing (TPM) and has achieved impressive results. Hudson and Knight was selected as one of the case studies for the Cleaner Production Training programme currently hosted by the NCPC. The training programme involves the application of assessment tools developed by UNIDO.

A Quick-Scan assessment was conducted by consultants under the supervision of the NCPC at Hudson and Knight. The aim of the assessment was to get the overview of the production processes at the company and determine the potential for cleaner production.

The Quick-Scan highlighted the following:

- Significant oil losses through solid waste generated at the bleacher and the winteriser.
- The company consumes 6,000 tons of steam per month. The use of steam is not optimal. Steam losses through leaks were observed.
- High consumption of energy at the cooling tower due to poor maintenance and lack of temperature control.
- Company consumes 6,308 kilolitres of water per month. The wastewater is treated at the effluent plant together with other four wastewater streams from different factories.

The Quick-Scan showed that the following process areas have high potential for cleaner production:

- Bleaching process: there is potential to optimise the use of the bleaching chemicals and reduce oil in the bleaching earth (waste).
- Deodorising process: there is potential to improve the technology to maximise capacity and reduce oil splashes.
- Winterising process: there is potential to optimise the process and reduce amount of oil in the waste generated (wax crystals).
- Effluent plant: there is need to segregate the wastewater streams and optimise the treatment process. The effluent from the plant should comply with the standards set by the municipality.

- Cooling tower: it needs to be upgraded and the old equipment should be replaced. A temperature control should be installed to reduce energy consumption.
- Process heat: steam consumption at the factory needs to be optimised and losses through leaks reduced.
- Energy management: improvement in energy management will reduce steam and electricity consumption.

Based on the results of the Quick-Scan, the following focus areas were proposed for detailed assessment.

a) Steam consumption at the factory (steam balance, optimisation of steam use and reduce losses).
b) Oil balance (consider oil losses at bleacher, winteriser & deodoriser and other waste streams).
c) Water consumption at the factory (water balance). Optimisation of effluent treatment.
d) Management of electricity consumption (cooling towers & lighting). Investigate possible energy saving incentives from government (DTI & Eskom).
e) Productivity improvement (man power requirements at specific processes).
f) Benchmarking of technology at Hudson and Knight (how does its current performance compare against best practice).

CONTENTS

1. PREFACE

This Cleaner Production Quick-Scan Summary Report of Hudson and Knight, was performed as part of an awareness and pilot CP project carried out by the South African National Cleaner Production Centre (NCPC - SA). The NCPC was established in 2002 within the framework of UNIDO/UNEP[1] Cleaner Production Centres.

The programme has been designed for the needs of companies ready to analyze and optimize their internal business processes with a view to developing Cleaner Production (CP) techniques and to implement Environmentally Sound Technologies. This will allow the companies to reduce both their operating costs and the environmental performance, thus increasing their productivity and competitiveness. The project provides opportunities for staff training and technical consulting. It is targeted at executives and technically skilled employees (such as managers with a special brief for environmental affairs).

Further information can be found on the internet: www.ncpc.co.za. Before a company is analysed in detail, a Quick-Scan is usually conducted. The Quick-Scan is a short analysis which assesses the quality of the crucial processes, material and energy flows in order to identify the potentials for CP, i.e. with the Quick-Scan the process areas with good optimising potential are found and a possible focus for further analysis can be defined. On the basis of the Quick-Scan, the company will decide on which process areas an in-depth analysis (the CP Assessment) shall be conducted.

2. PROCEDURE

The Hudson and Knight declared an interest for the NCPC to conduct a Quick-Scan performed at its premises. The Quick-Scan was performed on 13 & 21 September 2006, at the company's factory in Boksburg, east of Johannesburg in the presence of the following persons.

From Hudson and Knight:

Noel Alleaume
Shailen Toolsi
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Rabelani Ngobeli
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1 UNIDO – United Nations Industrial Development Organisation
UNEP – United Nations Environment Programme

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Desmond Musetsho (consultant)
Abdul Ebrahim (consultant)
Thomas Burki (UNIDO)
Johannes Fresnser (UNIDO)

The short analysis was performed in the following order:

1. In comprehensive discussions, Hudson and Knight presented its range of products as well as its production methods and other business processes. The crucial parameters and environmental data of the company were taken down. The most important production processes including the relevant material flows and energy consumers were identified.
2. In a subsequent tour through the premises, the consultants from the NCPC had ample opportunity of complementing the data they had obtained during the briefing with personal impressions and of receiving a first-hand insight into the processes of the individual production departments.
3. The further course of action was agreed in a joint meeting.

3. SHORT ANALYSIS

3.1 The Enterprise

Hudson and Knight is a medium size company that is situated in Boksburg with an annual turn over of ZAR 550 million. It has total of 60 employees working in 3 shifts and 24 hours a day. There are three departments: **Administration** (buying / planning / sales & marketing / IT / HR / accounts), **SHEQ** and **Production** (maintenance / instrument & control engineering / two production units / processes).

Hudson and Knight produces a wide range of oils for the food industry. Its main customers are Unilever, Bakers, Simba Chips and other food outlets. The company has a production capacity of 140,000 tons of oil per annum but the focus for 2006 is about 95,000 tons. Hudson and Knight is ISO 9000 & 14000 certified and has high food safety and hygiene standards. It has also adopted Total Productive Manufacturing (TPM) with impressive results (R4.9 million savings).

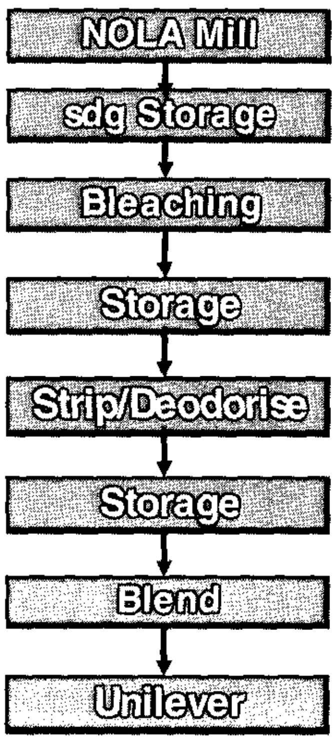
3.2 Manufacturing Processes

3.2.1 Overview

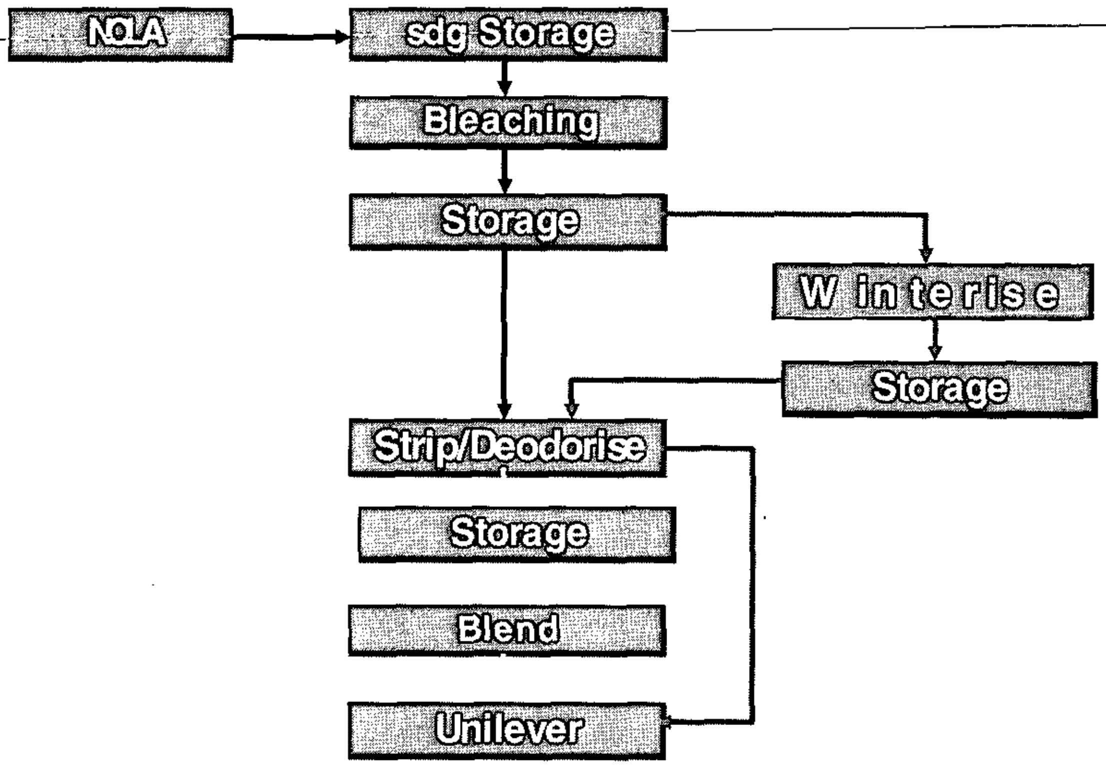
The production at Hudson and Knight is divided into four sections, namely, (a) sunflower oil for blends, (b) sunflower including winterising, (c) sunflower including specialities and (d) tropical oils.

The flow charts below show an overview of the different sections of production at the factory.

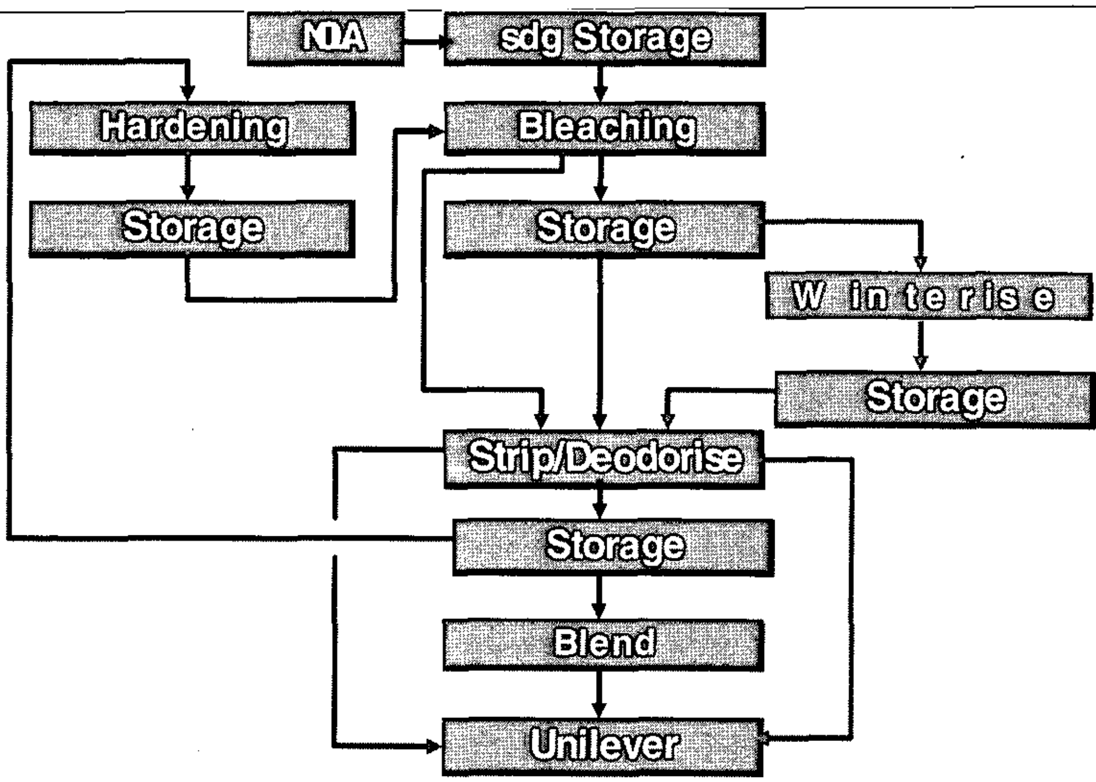
(a) Sunflower oil for blends



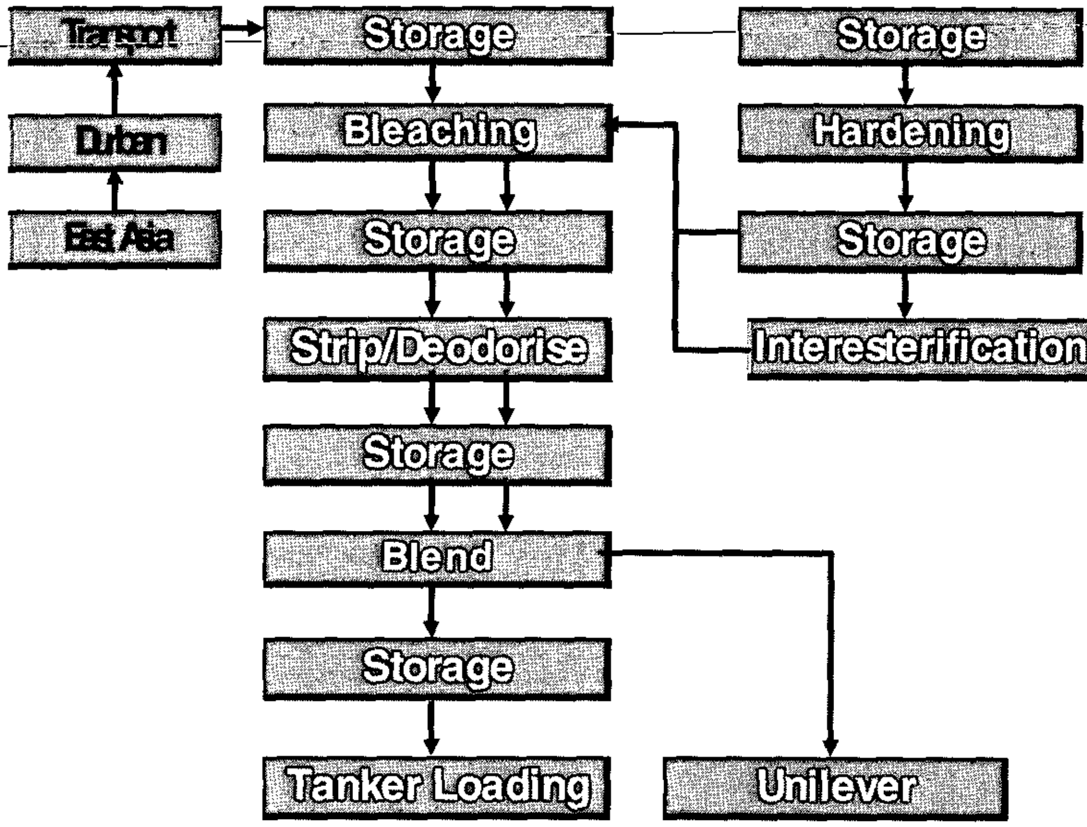
(b) Sunflower including winterising



(c) Sunflower including specialities



(d) Tropical oils



During the Quick-Scan, the individual processes were discussed in general terms only. The major production steps are: bleaching, deodorising, winterising, hardening and blending. Impurities in the raw oil are removed by the bleaching or winterising processes. After the removal of impurities, the oil is either send for hardening and followed by blending depending on the type of oil required. Oil is transported and stored in the factory using stainless steel piping and tanks. All bleaching oil tanks are epoxy coated.

3.2.1 Environmental Relevant Substances

Waste generated from the factory comprises the following:

- Solid waste (bleaching earth, wax crystals)
- Oil in bleaching earth and wax crystals
- Wastewater

Solid waste (bleaching earth, wax crystals)

A significant amount of solid waste is generated from the effluent plant. The solid waste contains a high content of oil. The company produces 36 tons/month of wax crystals from the winteriser and 62 tons/month of bleaching earth. The bleaching earth contains trace metals and a high oil content.

The amount of solid waste generated from the plant need to be quantified and potential uses should be investigated.

Oil in bleaching earth and wax crystals

A significant amount of oil is lost through the waste generated (bleaching earth and wax crystals). Bleaching earth contains about 30% oil. The amount of oil in wax crystals is not known. There is need to determine the exact amount of oil in the waste and find ways of reducing it.

Wastewater

All production processes involve the incorporation of water in the final product as well as the cleaning of the containers and floors. Thus most of the water used for cleaning is discharged via the drains to the effluent plant. The company consumes about 6,300 kilolitres of water every month but the water balance is not clear.

At the effluent plant, there is no segregation of waste streams. There are four different streams coming from four different factories entering the effluent plant. The individual volumes and quality of the wastewater from these factories is not recorded. The streams are treated together. The effluent plant has high levels of Chemical Oxygen Demand (COD) and Biological Oxygen Demand (BOD) and has received several fines from the municipality.

It is recommended to determine the water balance of the factory. The waste streams should be segregated and the quality of each stream should be investigated in order to optimise the treatment process.

3.2.2 Energy management

From the data gathered during the Quick-Scan, it is evident that energy management is required. The company does not have accurate data about energy consumption and losses. An energy balance is required, especially for steam. The company consumes 6,000 tons of steam every month at a cost of ZAR 283,167. A significant amount of the steam is lost through leaks and poor management of the steam distribution system.

3.2.3 Energy provision – Electrical energy

Hudson and Knight consumes an average of 226,968 kWh of electricity per month at a cost of ZAR 62,141. The major electricity consumers in the factory are the cooling towers, effluent plant, pumps and motors. There is no data available on the exact electricity consumption of each process. It is recommended to investigate these processes and determine potential for reducing consumption.

3.2.4 Energy provision – Process Heat

Hudson and Knight buys its steam from Unilever. To compliment the steam requirements at the factory, the company has a lurgi boiler that uses Sasol gas to generate steam. Steam sourced from Unilever is supplied at a temperature of 204°C and pressure of 17 bars. Steam from the boiler is at a temperature of 240°C and pressure of 33 bars. The steam is mainly consumed at the following processes:

- bleachers: 17 ton/week;
- interesterification: 22.5 ton/week;
- hardening: 27.5 ton/week;
- distillation column (vacuum): 115 ton/week.

Steam injection is used to create a vacuum. The condensate is not recycled because it is contaminated with oil. It is reused to heat the storage tanks. All the used steam goes to the barometric condenser for cooling. It is cooled to 35°C and then send to cooling towers. There is need to optimise the use of steam in the factory. It is recommended to do a steam balance in order to determine the potential to reduce the consumption.

3.2.5 Energy provision – Compressed Air

Hudson and Knight does not have a compressor. It gets its compressed air at a fixed cost of ZAR 30,000 per month from Unilever. The exact amount of compressed air consumed is not known. The compressed air is used for valve actuators and line blowing. Although the amount of compressed air consumed at the factory is considerably low, management would like to conduct an audit to determine the potential of reducing consumption.

3.2.6 Energy provision – Cooling Tower

The cooling tower uses water from the municipal supply. The cooling tower does not have a temperature control, thus it is running continuously. The motors at the plant are more than 10 years old and need to be replaced. There is also need for regular maintenance of the plant. The accurate energy consumption of the cooling tower is not known. It is recommended to determine the exact energy requirements of the cooling tower in order to identify energy saving opportunities.

3.2.7 Working Methods

The company is continuously improving the safety and health of its employees. It has very high safety and hygiene standards. It has a department involved in safety, health, environment and quality (SHEQ). It is ISO 14001 certified and is in the process of acquiring a safety standard. Employees are provided with adequate personal protective equipment. They are also regularly trained on occupational health and safety issues. So far no health or safety hazards have been reported.

4. FINDINGS OF THE QUICK-SCAN

4.1 Data Evaluation: Estimation of CP Potentials

4.1.1 Assessment of processes

The data collected during the company visit were evaluated with the software-tool *Eco Inspector*. The CP potential of individual process steps, including that covering energy provision was examined in accordance with the following criteria:

Inputs:

- Are there any problem materials which are hazardous to the environment or to health?
- Are large volumes of raw, auxiliary and operating materials used?
- Is the level of energy consumption high?
- Are major costs incurred on the input side (materials or energy)?

Outputs:

- Are large volumes of (problematic) waste, special waste, wastewater, wastewater components or emissions generated?
- Are high internal/external preparation and disposal costs incurred?

Technology:

- Is the applied technology state of the art?
- What is the level of automation?
- Are there losses incurred through faulty batches or scrap?
- How are the systems serviced or cleaned?
- Are high costs incurred for maintenance, cleaning, and stoppages?

Each process step was qualitatively checked on these criteria and was classified according to the following scale:

Table 1 Potential Points – Assessment of potential level for each criterion

Criterion not applicable to this process area, or no CP potential	Zero points
Moderate CP potential anticipated	1 point
Significant CP potential anticipated	2 points

The next step examines each sub-process as an entity according to the scale in Table 2 to determine the actual level of optimisation already achieved; i.e. whether or not the CP potential is already exhausted. Thus the "relevance" of the identified potential is described and a weighting factor is defined. This is a qualitative estimate and draws on the experience of the person conducting the Quick-Scan (expert opinion).

Table 2 Scale for estimating the level of optimisation of the current process (weighting factor)

Level of optimisation "high"	Optimisation potential largely exhausted	0 Points
Level of optimisation "high to medium"		0.5 Points
Level of optimisation "medium"	Optimisation potential not fully exhausted	1.0 Point
Level of optimisation "medium to low"		1.5 Points
Level of optimisation "low"	Non-optimised process step	2.0 Points

The product of the potential point and weighting factor indicates the *current CP potential* for each criterion point of each sub-process. The average of points for the individual categories (inputs, outputs, technology and cost) gives a benchmark for the CP potential of individual process steps. This enables a rapid comparison of the sub-processes and facilitates selection of the processes for more detailed analysis.

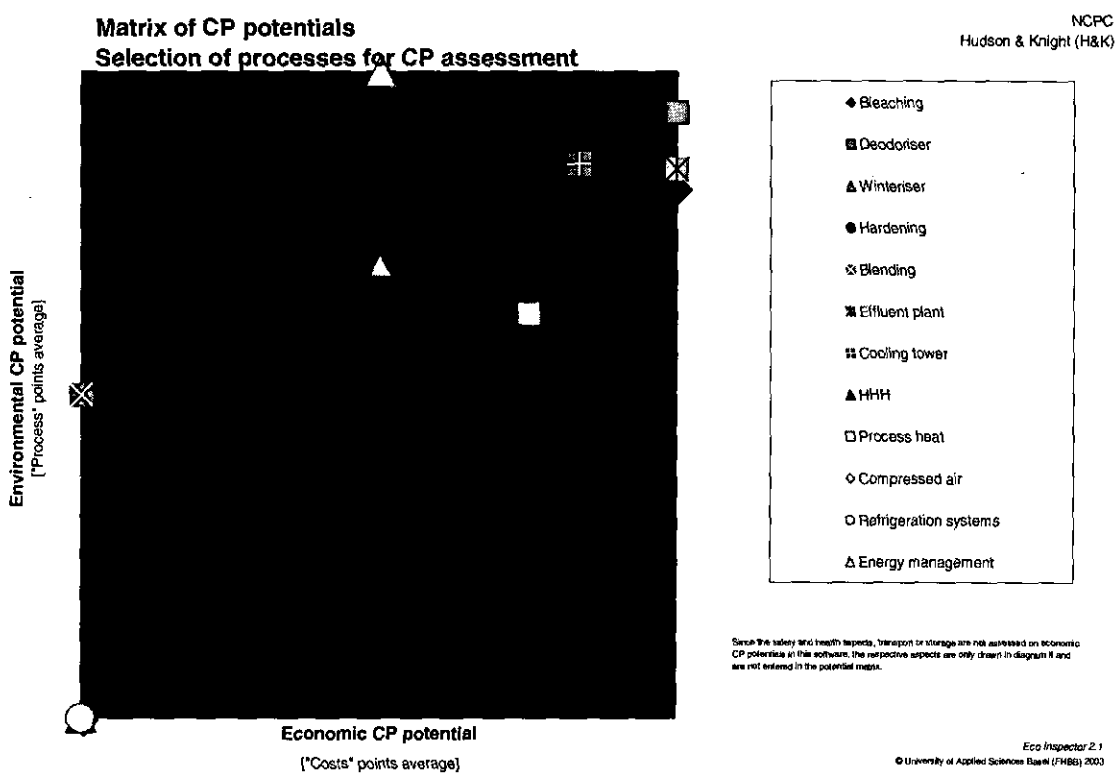
4.1.2 Assessment of the safety & health, material handling, transport and energy management aspects

The procedural principle for the processes is also followed when evaluating the aspects of safety, health, energy management, material handling, transport and storage. The points average gives a benchmark for the level of CP potential and is used as basis for decision to determine whether or not the relevant aspects are to be incorporated in a more detailed analysis.

4.2 Results

The tables and charts enclosed in Appendix 1 show how the individual component processes have been evaluated. Appendix 2 provides a summary of the results. Figure 1 (below) contrasts economic and environmental potentials. The values given correspond with the points average of the individual component processes (see Appendix 2).

Figure 1



The figure above shows that the following process areas have high CP potential:

- Bleaching: there is potential to optimise the use of the bleaching chemicals and reduce oil lost through the bleaching earth (waste product).

- Deodoriser: there is potential to improve the technology to maximise capacity and reduce oil splashes.
- Winteriser: there is potential to optimise the process and reduce amount of oil lost with the waste generated (wax crystals).
- Effluent plant: there is need to segregate the wastewater streams and optimise the treatment process. The effluent from the plant should comply with the standards set by the municipality.
- Cooling tower: it needs to be upgraded and the old equipment should be replaced. A temperature control should be installed to reduce energy consumption.
- Process heat: steam consumption at the factory needs to be optimised and losses through leaks reduced.
- Energy management: improvement in energy management will reduce steam and electricity consumption.

4.3 Discussion of the Results

From the graph and cleaner production assessment it is evident that there is room for improvement in several production areas at Hudson and Knight. Oil is the most cost intensive material at the factory (ZAR 5,000/ton) but a significant amount of it is lost through waste generated at the bleacher and winteriser and through oil splashes at the deodoriser. The exact quantities of oil lost through waste is not known. There is potential to recover some of the oil in the solid waste.

The solid waste (bleaching earth and wax crystals) are not reused on site. They are sold to other companies that recover oil from the waste. Potential uses of the remaining solid waste are being explored.

Steam is widely used in the factory to provide heat to the production processes. The company consumes an average of 6,000 tons of steam every month. Not all the steam is accounted for. Some of the steam is lost through leaks and other inefficiencies in the steam distribution system. A steam audit is necessary to determine the potential savings.

From the graph, it is apparent that a large amount of effluent is generated. The company consumes about 6,300 kilolitres of water every month. The wastewater is treated at the effluent plant together with other three streams of wastewater from three different factories. The volumes and quality of these wastewater streams is not strictly monitored. The operation of the effluent plant is not optimal. The company has been fined several times for not complying with the municipal effluent discharge standards.

A summary of the cleaner production potentials is shown in Appendix 1 and Appendix 2.

5. RECOMMENDATIONS AND FOLLOW UP

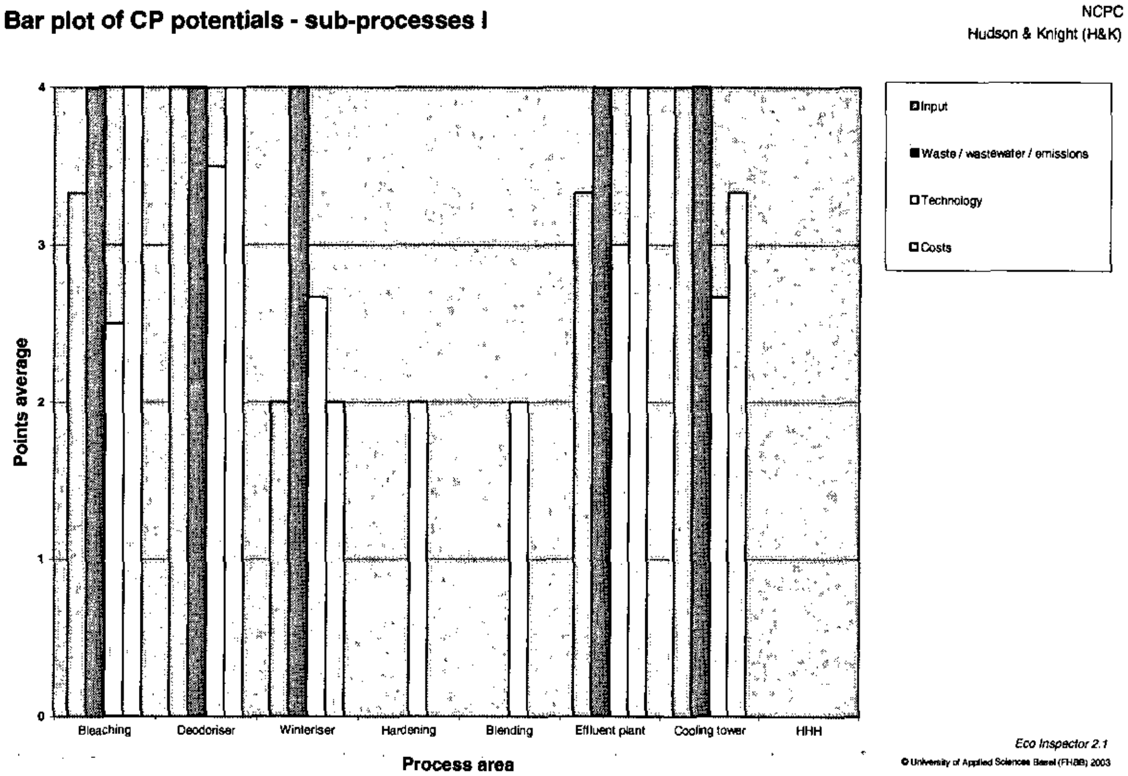
- A high pressure cleaner should be used to clean the floors.
- The cooling tower should be upgraded. A temperature controller should be installed at the cooling tower to reduce energy consumption.
- Preventive maintenance needs to be done more often to avoid steam leaks.
- Hudson and Knight should audit the consumption of compressed air and consider purchasing own compressor.
- *The reuse of the condensate should be optimised.*
- The filtration process after bleaching should be upgraded to improve on efficiency.
- The quality and volume of the different wastewater streams treated at the effluent plant should be determined in order to optimise the treatment process.

The following focus areas should be considered for detailed assessment:

a) Steam consumption at the factory (steam balance, optimisation of steam use and reduce losses).
b) Oil balance (consider oil losses at bleacher, winteriser & deodoriser and other waste streams).
c) Water consumption at the factory (water balance). Optimisation of effluent treatment.
d) Management of electricity consumption (cooling towers & lighting). Investigate possible energy saving incentives from government (DTI & Eskom).
e) Productivity improvement (man power requirements at specific process).
f) Benchmarking of technology at Hudson and Knight (how does the current performance compare against best practice).

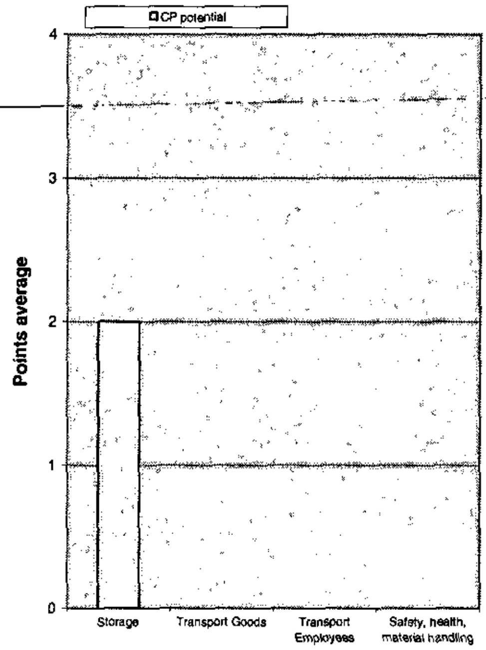
6. APPENDIX

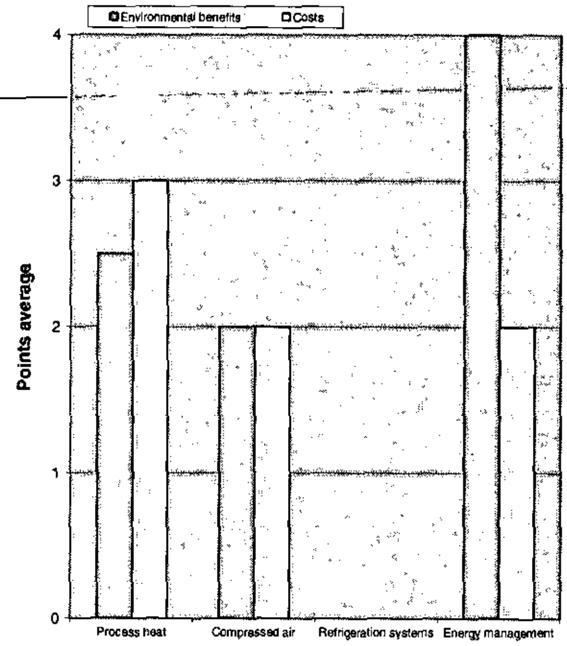
6.1 Appendix 1: Estimated Potentials of Component Processes



Bar plot of CP potentials - sub-processes II

NCPC
Hudson & Knight (H&K)





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6.2 Appendix 2: Summary of Results

Summary of results Hudson & Knight (H&K)

NCPC

Process	CP potential environmental benefits (process)												CP potential economic benefits			Estimation of CP potential*			
	Input			Waste / wastewater / emissions					Technology				Costs						
	(Eco-) toxic problem materials	Raw, auxiliary, operating materials	Energy consumption	Solid waste	Special waste	Wastewater (flow, amount)	Wastewater components	Airborne emissions	Status of technology	Level of automation	Faulty batches, scrap	Maintenance, servicing, cleaning	Input materials, energy	Disposal, preparation	Maintenance, stoppages	Points average of environmental benefits (process)	Points average of economic benefits (costs)	Environmental CP potential	Economic CP potential **
P1 Bleaching	2	4	4	4	-	4	4	4	2	2	2	4	4	4	4	3.3	4.0	XXX	XXX
P2 Deodoriser	-	4	4	4	-	-	4	-	4	2	4	4	4	-	-	3.8	4.0	XXX	XXX
P3 Winteriser	-	2	-	4	-	-	-	-	2	2	-	4	2	-	-	2.8	2.0	XXX	XX
P4 Hardening	-	-	-	-	-	-	-	-	2	2	2	2	-	-	-	2.0	0.0	XX	-
P5 Blending	-	-	-	-	-	-	-	-	2	2	-	2	-	-	-	2.0	0.0	XX	-
P6 Effluent plant	2	4	4	4	-	4	4	-	2	2	4	4	4	4	4	3.4	4.0	XXX	XXX
P7 Cooling tower	-	4	4	-	-	4	4	-	2	2	-	4	4	2	4	3.4	3.3	XXX	XXX
P8 HHH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0	0.0	-	-
P9 Storage	Moderate CP potential anticipated. Additional investigation recommended into storage and stock management.															2.0		XX	
P10 Transport Goods	No CP potential anticipated															0.0		-	
Employees	No CP potential anticipated															0.0		-	
E1 Process heat	High CP potential for environmental benefits or financial savings anticipated. More detailed analysis of the process(es) 'heat provision' urgently recommended.															2.5	3.0	XX	XXX
E2 Compressed air	Moderate CP potential for environmental benefits or financial savings. Additional analysis of the 'compressed air provision' processes recommended.															2.0	2.0	XX	XX
E3 Refrigeration systems	No CP potential anticipated															0.0	0.0	-	-
E4 Energy management	High CP potential for environmental benefits or financial savings anticipated. More detailed analysis of the energy management system recommended.															4.0	2.0	XXX	XX
Safety, health, material handling	No CP potential anticipated															0.0		-	

* Estimation of CP potential	X	low CP potential	Points average "environmental benefits" or "economic benefits"	0.0	to	1.3
	XX	moderate CP potential	Points average "environmental benefits" or "economic benefits"	1.3	to	2.7
	XXX	high CP potential	Points average "environmental benefits" or "economic benefits"	2.7	to	4.0

** The value of "Process points average" corresponds to the environmental CP potential, the value of "points average of environmental benefits" corresponds to the "Economic potential"
The calculation of the points average covers all positions with a value. Positions without CP potential (value = "-") are not taken into account.

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