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NATIONAL CLEANER PRODUCTION CENTRE SA

NCPC
national cleaner production centre
South Africa

CONTRACT REPORT

QUICK-SCAN SUMMARY REPORT OF NAMPAK

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QUICK-SCAN SUMMARY REPORT OF NAMPAK, PAARL

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EXECUTIVE SUMMARY

Nampak DivFood Foodcan is situated in Paarl, north of Cape Town. The company was selected as one of the case studies for the Cleaner Production Demonstration programme currently hosted by the NCPC. The Demonstration programme involves conducting a number of plant assessments on selected plants by a local CP consultant, in conjunction with Austrian based Cleaner Production Consultant Group, FHBB.

The aim of the CP Assessment is to gather data on production and waste generated in order to identify areas where cleaner production can be applied to improve profitability. This report presents the outcome of the first phase of the assessment findings, namely the Prevention Quick Scan.

Nampak DivFood Foodcan produces cans for the fish, fruit, milk products and pet food industry mainly, although there are other customers. The plant manufactures 240-270million cans per annum and is the distribution point for over 500 million cans/yr manufactured by Nampak. The factory is well-managed according to lean manufacturing principles. The Nampak company has an environmental policy applicable to all its operations that is based on the ISO14000 management system. The most important aspects of production are related to cost-effectiveness and food safety (liability implications). The process is HACCP certified (Hazop) and quality of product is of high priority.

The Electricity usage and the Waste streams were investigated, and a number of potential cleaner production options have been identified from the Prevention Quick Scan (PQS), which are documented in the table below. These options will require further analysis and one of these options can be selected by Nampak for a detailed In Plant Assessment to be carried out by the consultants for this UNIDO sponsored demonstration project.

Summary of Identified Cleaner Production Options

Options	Environmental impact reduction	Implementation
PRODUCTION SPOILAGE		
Investigate opportunities for further minimizing spoilage during production. Report on spoilage causes on a regular basis and minimize destructive testing.	Savings in tin-plate use and in various value adding operations. Reduced waste metal.	Recommend monitoring & reporting on causes and metal scrap waste quantities generated. Investigation into minimizing destructive testing. Such a study could be done as an in plant assessment.
ENERGY	10-15% electricity savings potential (Reduced carbon emissions and ~R100,000-150,000/yr in electricity bills)	Undertake an energy saving audit as part of a more detailed IPA.

Options	Environmental impact reduction	Implementation
Recircuit lighting system and do not use lighting where it is unnecessary (i.e. when daylight is sufficient or where areas are not being used). Retrofit lamps with energy-efficient alternatives where feasible.	Potential reduction in energy consumption (max 5% savings)	Recirculting and daylight sensors are already under investigation. The economic feasibility of alternative energy-efficient lamps could be investigated. This could form part of a full energy audit undertaken as part of a more detailed IPA.
Compressor should also be monitored (metered) for consumption and hrs of operation.	Improved energy management.	Can be monitored as part of detailed IPA.
Replace refrigerant in chiller system. Replace current chillers & condensers with ammonia chillers. Evaporative cooler lower temperatures with ammonia (5% saving). New chiller higher COP (15% savings).	Potential reduction in energy consumption	Check refrigerant – should not be R22, R44 or R407. R11 preferable. Investigate economic feasibility of replacing existing older chilling units in near future with ammonia chillers.
Potential for automatic control of return temperatures in refrigeration temperature.		Today control of cooling in welding machines is manual (rotameter and valve), are the return temperatures controlled? (this could be monitored for a few days). Variations would indicate a potential for saving via automatic control (termperature measurement, control, automatic valve)
Vacuum pump should not need to be in operation at all times.	Potential reduction in energy consumption	Monitor need for vaccum pump and minimize operating time. This could form part of more detailed energy-focused IPA.
WASTE		
Minimise packaging used for Ends or consider an alternative recyclable packaging for the Ends.	Minimise volumes disposed to landfill and reduce use of paper & plastic.	An assessment of alternative packaging systems could be carried out as part of a more-detailed In Plant Assessment. Alternatively request alternatives from suppliers.
Keep solvent waste tank covered to minimise evaporation and bund area for collection of spills.	Prevent solvent air emissions and possible spills can be contained - prevented from flowing into storm-water or ground.	Apparently an alternative waste tank is being sourced. Bunding should be put in place after consultantion with health, safety & environment specialist. Alternatively, if solvents to be phased out, this waste could be eliminated completely. No bunding necessary for solid wastes only.
TRANSPORT		

Options	*Environmental impact* **reduction**	*Implementation*
There are opportunities to minimise transport fuel consumption through improved logistics planning. Though contracted out, transport costs are likely to increase significantly in the near future as oil prices increase. It is recommended to consider investigating options for rail transport.	Minimise fuel consumption and transport costs.	Flag as an important issue to consider and to investigate logistics and alternative transport options in the near future.

Recommended Options

- It is recommended that a full energy assessment be carried out to determine the opportunities for energy savings. This would cover the:
  - Lighting
  - Refrigeration system
  - Vacuum pumps
  - Possibly include monitoring & checks on compressed air system
- A study on the quantity of product spoilage over a time period analysed according to key causes & sources could be carried out. This could identify potential opportunities for minimising spoilage in general, and in particular the quantity submitted to destructive testing.
- Alternative packaging options for the Ends could be investigated to identify options for minimising packaging, recycling/reusing packaging.

CONTENTS

1. PREFACE

This Cleaner Production Quick-Scan Summary Report of Nampak DivFood Foodcan, Paarl was performed as part of Demonstration project 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 CP Demonstration programme has been designed for undertaking CP assessments 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 demonstration project provides opportunities for identifying CP opportunities with the assistance of local and international CP specialists.

Further information can be found on the Internet at www.ncpcsa.co.za. As the first phase of the CP Assessment, before the company is analyzed in detail, a *Prevention Quick-Scan (PQS)* is conducted. The PQS 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 potentials are found and a possible focus for further analysis can be defined. On the basis of the Quick Scan, the company will decide whether or not and in which process areas an in-depth analysis (the CP Assessment) shall be conducted.

2. PROCEDURE

Nampak DivFood Foodcan, represented through its manufacturing manager, Brett Smith, declared an interest in a CP Assessment as part of the NCPC Demonstration project. A Prevention Quick-Scan was performed at the Foodcan plant in Paarl on the 20 September 2006, in the presence of the following persons.

From the company Nampak DivFood Foodcan, Paarl:

Mr Brett Smith (Manufacturing Manager)
Mr Edwin Jansen (Quality Manager)

From the NCPC:

Ms Claire Janisch (Lead consultant)
Mr Thomas Büerki (UNIDO consultant)
Mr Johannes Fresner (UNIDO consultant)
Mr Manogaran Ram Reddi (NCPC consultant)
Ms Zubeida Zwavel (BECO ISB consultant)
Ms Budu Manaka (NCPC CTELC consultant)

[1] UNIDO – United Nations Industrial Development Organisation
UNEP – United Nations Environment Programme

The PQS analysis was performed as follows:

1. The manufacturing manager presented the companies range of products as well as the production methods and other business processes. The crucial parameters and environmental data of the company were explained. The most important production processes including the relevant material flows and energy consumers were identified. A Process Flow Chart of the process was provided by the company prior to the visit.
2. In a subsequent tour through the premises, the CP consultants gathered further qualitative and quantitative information about the process.
3. A follow-up questionnaire was provided to the manufacturing manager to obtain the remaining required data for the analysis of CP opportunities.

3. SHORT ANALYSIS

3.1 The Enterprise

Nampak Foodcan, is situated in Paarl, north of Cape Town. It has total of 123 employees comprising Production/Technical departments, warehousing, sales, distribution and administration employees. It produces a wide range of final food can products, mainly for the fish, fruit, milk products and pet food industries. Approximately 240-270 million cans/yr are manufactured on site, a further 250million cans/yr are distributed from this site (manufactured by another Nampak production facility in Gauteng).

During peak season (determined by the fish & fruit industry), usually for 4 months between November and February, the plant operates 24 hours a day during the week and for one 9 hour shift on a Saturday. For the remaining 8 months of the year, the plant operates 18 hrs a day (2x9 hr shifts) during weekdays. The production rate is generally determined by customer demand. There is a Group Nampak company environmental policy and management system based on the ISO 14001 system, but not certified. Cost-effectiveness is of high priority in the company, and the process is managed according to lean-manufacturing principles. Liability around food safety is also of high concern, and the process is therefore strictly quality controlled, according to ISO 9000 certification and HACCP accredited (in order to supply to the European market). Steve Dennis is the Nampak Group environmental manager – there is no environmental officer on site. He is responsible for arranging legally required pollution audits. The company used to have NOSA certification, as after many years it is believed to be no longer necessary. Customers regularly audit the company for safety, health, quality reasons.

The plant includes the following key departments: Manufacturing – Production & engineering, Logistics – Incoming stores, Dispatch, Accounts, and Quality. The building itself is 45 years old. Manufacturing takes place in 12000m^2 (inclusive of office blocks and canteen), while physical dispatching side is 13,000 m^2. The plant used to include 3 coating lines, now these have been centralised, so operation on plant has been reduced to only 5 lines.

3.2 Manufacturing Processes

3.2.1 Overview

The operation receives the tin plate in cut sheet form through the Nampak Vanderbijlpark coil shear factory. The tin plate is either lacquered or plain. Ends are received from a Nampak sister operation (DivFood DBP). The tinplate is then converted into cylinders (through a welding process using copper wire sourced from Malesela) and the end is then placed on the cylinder. The can is then flanged, and some sizes of cans are beaded (for strengthening). The completed cylinders are then sold to customers in the food industry for canning of food products such as fish, fruit, powder milk, condensed milk, petfood, etc. Figures 1a & b below provide an overview of the manufacturing process of Nampak DivFood Foodcan, Paarl. It is the Process Flow Chart provided by the company.

Figure 1a – Process Flow Chart - Overview of main process sections

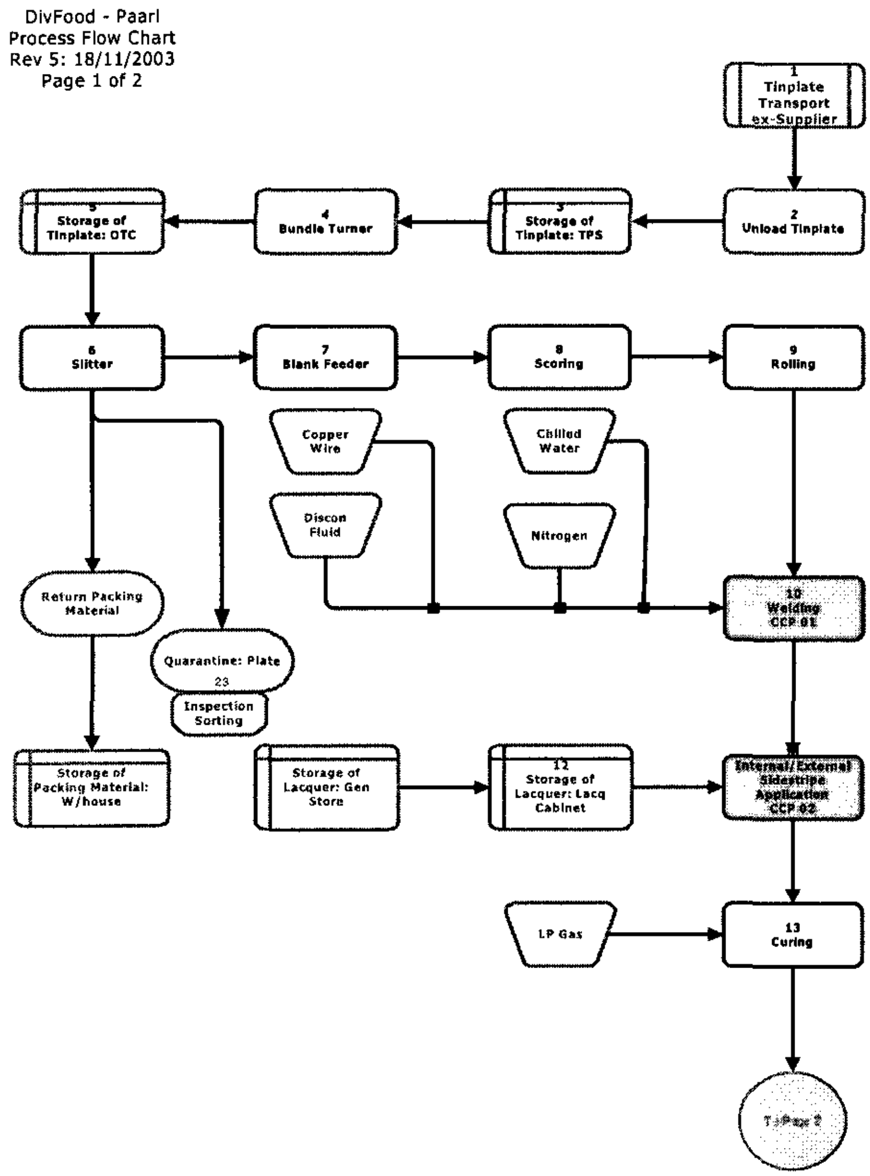
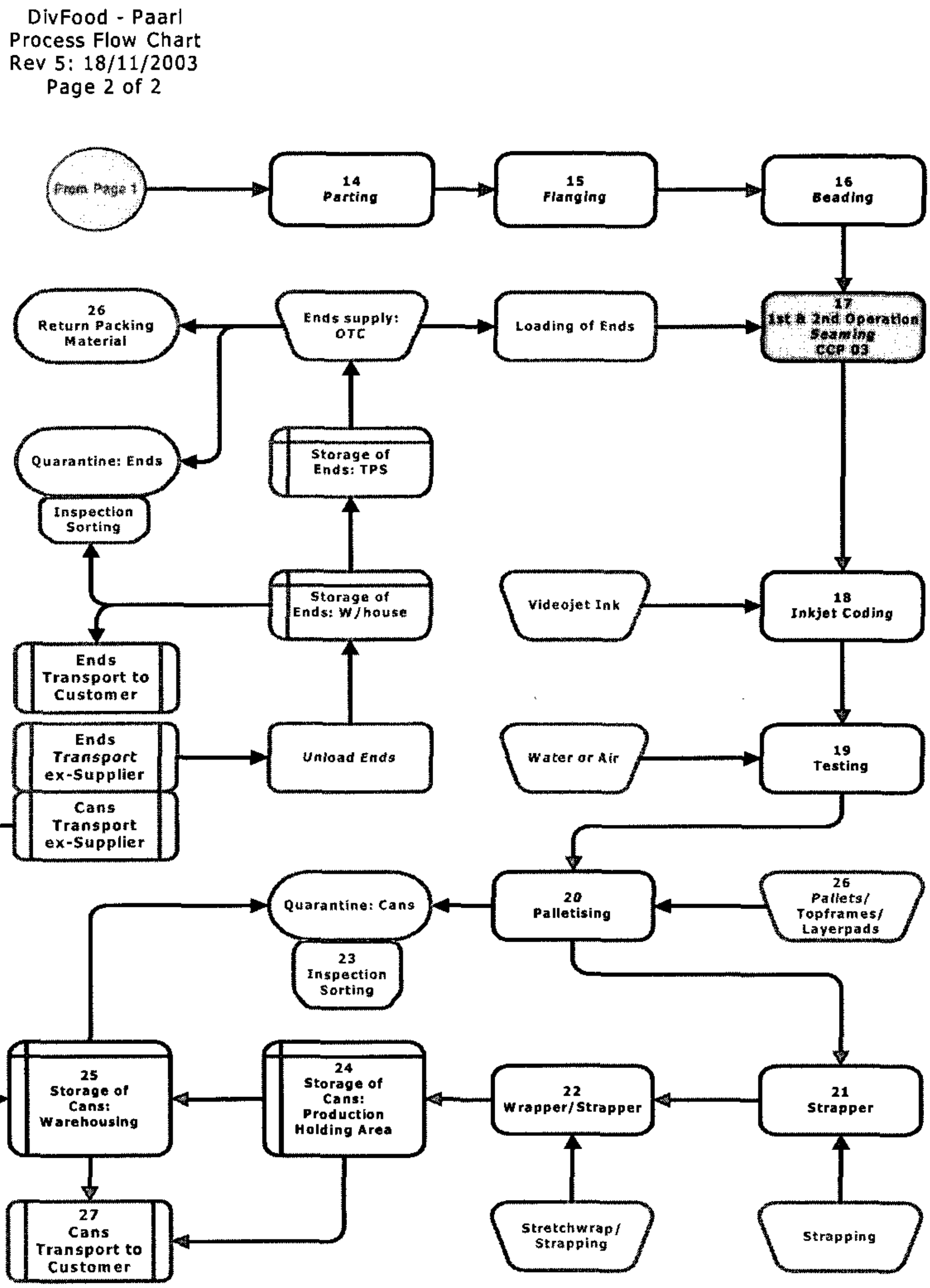


Figure 1b – Process Flow Chart - Overview of main process sections cont…



The main services used are:

- Electricity (for machinery and drive systems, compressed air, cooling units, vacuum pumps & lighting)
- Water (for cooling system – no industrial effluent)
- Gas (for small modular burners to cure cans)
- Compressed air (for machine pneumatics)
- Nitrogen (bottled, for shrouding of the welding of the cylinder)

Every service has a back-up secondary equipment, e.g. 2 compressors, 2 LPG storage tanks, 2 vacuum pumps, etc.

3.2.2 Storage of Tin plate and Ends

Tin plate that arrives from supplier (through the Nampak Vanderbijlpark production facility) is stored in the (tin-plate storage) TPS warehouse. The tin plate is issued to specific can lines according to a works order. There is a 2 week stock holding, managed according to a production schedule – data management through JDEdwards database system. Demand planning pulls raw material from suppliers. The database can also identify what is held by different divisions (all 128 divisions in Nampak are linked to the database) in order to reduce working capital. The central database facilitates central procurement, stock feasibility and shuffling.

3.2.3 Slitter, Blank Feeder & Scoring

The tin plate sheets are slit into operative blank sizes (depending on can size). There are two slitting operations (in the Krupp Cut-O-Matt), both generating trim of minimum 2mm. Efforts to minimise quantity of tin plate as raw material are being investigated – mainly lightweighting options. The tin plate is 60% of cost of production. Spoilage can occur if trim is too small – causes jamming and wasteage.

3.2.4 Rolling, Welding, Internal/External Sidestripe Application, Curing

The blanks are then welded into a bare cylinder using copper wire in a nitrogen shroud. The nitrogen is in bottle from and is used to shroud the weld to prevent oxidation during welding. The purity of nitrogen used is very high at 99.995% to ensure that no oxidization takes place. According to the UNIDO consultants experience, 99,5% would be sufficient and significantly cheaper (35% of the prince of the 99.995N_2). According to the manufacturing manager, the alternative is 95 % Nitrogen and 5% hydrogen. Copper wire is used on welds since steel is tin plated. Cu welding wire rolls are supplied in bobbin form 250kg each. Trim copper is sold as scrap. There is currently a 12-6% loss of Copper in, to Copper value back. The Soudronic welder is not a high-scrap generator, unless tin plate is of inferior quality – which leads to jamming in the machinery. Normally jamming would occur as feeding into the hopper – as rounding, jamming occurs. At the welding roll area, no waste is generated. There are 2 reasons for collection of waste product in the baskets at each line – jamming problems and quality checks (either destructive testing or when faults detected e.g. detection of incorrect thickness of weld – rejected). Quality testing is necessary due to the aggressive nature of product to be canned. The first can on every run is rejected. Even though 60% possibly sufficient quality, time for visual testing is too long, so every one is rejected. Destructive testing is performed for overlap test (rolling match overlap) with a 0.05 size tolerance.

The internal/external sidestripe is applied to the welded section.
This weld is then cured using modular burners – and fumes are captured (lacquer solvent fumes emitted during curing process). The modular burners are fueled with LPG gas. The curer are long u-shaped modular heating systems. Curing is to polymerise the lacquer. The molecular bond is set correctly and then the solvents are burnt off. Wastage can occur if there is a jam. Lacquered cans have generally more wastage here – lacquer has to reach a certain curing specification to be good for the product. It is not possible to check what level of curing was reached before machine breakdown – therefore treated as spoilage.

Spoilage is not monitored continuously but running audits are undertaken regularly and corrections made as problems identified. These are not generally recorded.

3.2.5 Parting, Flanging, Beading, 1st & 2nd Operation Seaming, Inkjet Coding & Testing

The Krupp-Can-O-Mat or older versions of same machinery, take the blank can to perform parting, flanging on both sides (forming of lip) and beading (strengthening of certain can sizes). First and second operation seaming is then performed. This area is not a high potential for scrap generation. Ends are then applied to cylinder – the type of end depending on the product. Scrap can be generated when faults in feeding of ends in. Every can is data coded using inkjet coding. Some cans scrapped due to problems in inkjet coding –e.g. smudged/illegible, etc. The cans are then tested using a light tester, where light is shined on external end with a photocup on the other end. If any light is detected, the can is rejected. This is a very sensitive testing machine such that if there is any slight dent on the flange, the can is rejected.

3.2.6 Palletising, Strapper, Wrapper/Strapper

The completed cans are packaged in layers on pallets. Between each layer are layerpads (which are returned from customers and reused as far as possible). Around the cans, a plasting wrapping is applied. This material has been selected for minimum thickness for maximum strength. Only one layer of wrapping is applied, apart from the top and bottom of the layers. The pallets are also returned by customers and reused (those used by the fish industry are kept separate due to the strong fish odour).

3.2.7 Storage of Cans: Production Holding Area & Warehousing

The warehouse holds 3million cans. Once/week a meeting is held to review slow movers/functionally defunct stock. Management is always looking to keep working capital down. 27 million/month stock on hand – maximum building into pre-season, where this increases to up to 45million /month. The most common sized cans produced are the baked-bean/jam size.

3.2.8 Transport

Generally third party transport is used for receipt and delivery of goods. Trucks have been modified to transport air and tinplate, by combining loads, cost savings of R3million/yr have been realised. Employees use their own transport to commute to work.

3.2.9 Environmental Relevant Substances

- Lacquers used on tin plate are applied at a Nampak sister company. Testing of lacquer done through Nampak R&D section to assure environmental/health standards met.
- Solvents - flush system for flush lacquering. According to the manufacturing manager, Nampak is in process of investigating solvent-free options. The current solvent waste storage skips are open. This is problematic as rainwater can enter and overflow can occur. In addition, other waste is mixed in with the solvent waste. According to the manufacturing manager, these skips are apparently to be modified shortly. The skip storage area is however not bunded to contain spills. This should be checked by a health & safety inspector.
- Oils – for motors and gearboxes on machinery. Waste oil is collected by ROSE Foundation for recovery. No data was provided on quantity of oil used. It is recommended that if this is not done so already, then options such as fine filtration or oil quality monitoring be investigated, to improve efficiencies.
- Refrigerant – Chiller system is labeled says R22. However, manufacturing manager indicates this has been replaced with an alternative but no information as to which alternative.

3.2.10 Energy management

From the data gathered and the cleaner production assessment it is evident that no energy management system is in place. No energy accounting management system exists. Thus, this is one areas that improvements can be made. According to the manufacturing manager, an in-house energy audit was undertaken about 4 years ago, with the result of Power Factor Correction (PFC) being installed. In addition, automatic stop/start systems have been put in place on the high energy consuming machinery. For the curing burner system, an idle cut-in timer has been installed to reduce the idle temperature when the machine is in idle mode. There are 2 transformers on site, each of 1MVA – only one is used as the other is only in case of breakdown.

3.2.11 Energy provision – Electrical energy

The average consumption is 100,000KWh/month or 4.5Wh/can at an average cost of R85,000/month or approximately R1million/year. This is 0.4cent/can. The table below was provided by the company.

It is assumed the water units are kilolitres and the electricity units are kWh. It is not clear what kVA figures are.

Table 1: Summary of monthly electricity & water consumption from municipal bills for 1 year

DRAKENSTEIN MUNICIPALITY FROM OCT'05 - SEPT'06				
	WATER UNITS	VALUE	ELECT UNITS	VALUE
OCT'05	4,488.59	4,625.27	94,277.61	83,051.27
NOV'05	3,094.10	3,399.39	94,371.17	83,135.94
DEC'05	4,302.82	4,462.31	105,834.96	93,191.89
JAN'06	4,302.82	4,462.32	92,969.29	81,906.22
FEB'06	11,859.64	11,091.70	103,525.78	91,166.29
MAR'06	13,819.97	12,810.70	86,308.32	76,063.24
APR'06	14,091.26	13,048.67	99,656.36	87,772.07
MAY'06	7,686.01	7,430.03	93,439.60	82,318.75
JUN'06	3,324.95	3,605.57	100,263.75	88,303.86
JUL'06	3,840.55	4,118.75	107,715.91	94,860.98
AUG'06	2,476.07	2,921.84	101,032.59	88,998.42
SEPT'06	3,114.59	3,481.94	100,048.11	88,211.51
TOTAL :	**76,401.37**	**75,458.49**	**1,179,443.45**	**1,038,980.44**

The electricity consumers for production are process machinery, compressed air, cooling water, chillers/condensers, vacuum pumps and lighting (overhead & machinery). Monitoring of energy use on-site should be done – with targets for reducing energy consumption.

Each manufacturing line runs at 200A on average. Biggest energy user in terms of process machinery is the welder – 52kVA motor out.

Electricity consumption is broken down according to the following scheme (this information was obtained from the manufacturing manager during the visit, and has not been checked against any measurements/monitoring, but the total figure does correlate with the total figure summed from the electricity bills (1,19MW cf 1.18MW), although the table below does not include lighting.

Table 2: Summary of electricity consumption for equipment on site

Main consumers	kW	Hours of operation/yr	Resulting kWh/yr (approximately)	% of Total consumption (excl lighting)
Stand-by-compressors	165	3,600	600,000	50%
6 bar air compressor	195	3,600		
Chillers	4 times 15	8,000	120,000	10%
Vacuum pump I	37	3,600		
Vacuum pump II	18.5	3,600	150,000	13%

Welding lights	48	3,600	170,000	14%
Drives	42	3,600	150,000	13%
Total			**1,190,000**	**100%**

Factory and warehouse lighting was highlighted by the manufacturing manager as an area requiring attention for improved efficiency. The consultants noted that lighting was on during the day, despite adequate daylighting. According to the manufacturing manager the number of lights is as follows: 375 high bays @ 400 and 250 w split. This data is not clear, however what is clear is that there are a large number of lights at relatively high watts. So it appears lighting will be a high proportion of the total electricity bill (>15%?) and therefore a priority for efficiency improvements. The manufacturing manager indicated that the lighting was to be divided into different circuits to facilitate minimizing lighting use (switching lights off in areas where not needed). The current plan for recircuiting the lights is to break up circuits into lanes as required for security. The options for daylight/motion sensors are to have daylight switches with manual override in non operative areas. The manufacturing manager also specified that discipline of staff for turning lights off is what is required. In addition, it is recommended that alternative efficient lamps be investigated for replacing existing high wattage lamps where feasible.

3.2.12 Energy provision – Process Heat

Only a small amount of LPG gas is used for small modular burners to cure cans at 425°C. This appears to be a very high temperature, as according to the consultant's experience, typically 160 to 200 °C is necessary.

The total gas consumption is about 11m^3/month or 40liters/million cans production. There are 5 curers on plant, these are small localized heating units (not furnace/boiler heat) fueled by standard LPG butane/propane supplied from Chevron refinery. There are 2 LPG tanks on site, 19,000L and 9000L capacity. Only the 19,000L tank is used.

3.2.13 Energy provision – Compressed Air

Compressed air is used for machine pneumatics and services, and small solenoids. There are two compressors. All equipment on the plant is doubled-up in case of breakdown. Only one compressor runs at a time. The main compressor runs 75% of the time (4176hrs/yr). It is a Broomwade 6220n screw compressor, nnominal capacity / 28.4 mcube/min – 1005CFM. The second compressor runs 25% of the time (1392hrs/yr) and is a Broomwade RA 220a screw compressor with nominal capacity /25.7mcube/min 909 CFM. Power consumption data was provided by the manufacturing manager: 165kW for an average of 3,600hrs amounts to a total consumption of 600,000kWh/yr, or close to 50% of total electricity consumption (excluding lighting). The compressor is the largest consumer of electricity.

The compressor system runs at 6bar. According to the manufacturing manager, the operating pressure cannot be changed as all the machines require 6 bar. The compressor runs load no load and compressors were installed plant, so apparently are correctly sized. The piping is the correct size (diameter) for the system operation requirements. Leak checks are part of scheduled maintenance and weekly Dad's army walk about. No information was provided on the maintenance of filters, so it is unknown if these are cleaned regularly. This can have a significant effect on the efficiency of the system. If filters are regularly cleaned, then there do not appear to be obvious efficiency improvements for the compressor system.

3.2.14 Energy provision – Cooling unit/refrigeration

The cooling unit is a closed circuit cooling of machines with a secondary circuit cooling that water again through heat exchangers and chillers. It consists of 4 Darkin condensers, 3 phase 50/60Hz 400-440V. Daiken UW40EGAE, nominal capacity / 126KW. Operating hours = 5568hrs/yr in total, but not all 4 chillers are in operation at all times. The power consumption figures provided by the manufacturing manager during the site visit indicate the following: 4*15kW for 8000hrs/yr = 120,000kWh/yr or about10% of total electricity consumption (excluding lighting). The chillers are banked as the cooling unit is controlled by switching on each chiller as needed. There are very large variations in ambient temperature. The critical cooling area is the rolling machine which must ensure that the overlap at the weld section is exactly 0.5mm. The brass units which controls this size must be kept cool to ensure the overlap is exact. The cooling system is therefore specifically for the welding bodymaker Soudronic, to remove heat generated during operation. The insulation is adequate. A 5000L tank contains chilled water. The chiller plant aircon pump runs continuously: 345 days per year. The flow of cooling water to machines is controlled through temp switches and master-slave load requirement. The flow in the main pipes is constant, while the flow to machines is controlled by rotameter & valves.

No data was provided on what refrigerant is currently being used. R22 should be replaced with an alternative. However, refrigerants R404/R407 can burn out the compressors very quickly, so R11 is recommended. There is an oopportunity to replace the current system with more efficient units. Current ones are old (1985), should be replaced within next 5 years – recommendation is to replace with ammonia chillers (far more efficient). Should not have a water circuit for cooling towers – should be ammonia.

3.2.15 Energy provision – Vacuum Plant

There are 2 vacuum pumps – doubled up in case of breakdown of one. Only one is in operation at a time. The two differ in size considerably, and only the smaller vacuum pump is needed, as the other one is sized for when the plant operated more manufacturing lines. The smaller one is operated as far as possible, as the larger one would be over consuming energy. The vacuum pump load is 18kW. The vacuum pump system is operated whenever lines are running. The manufacturing manager provided figures for hours of operation that amount to 150,000kWh/yr for the vacuum plant, or 13% of total consumption (excluding lighting).

3.2.16 Working Methods

The plant is very well-managed according to quality and hazop standards of production. During the PQS visit, the consultants noticed that the workers were not wearing hearing protection in areas that definitely required it. There were also some strong lacquer fumes noticeable around line 5. The degree of fumes apparently varies depending on which product is being processed, and it is unclear what the safety levels or control systems are.

3.2.17 Water Consumption

Water is used only for cooling so there are no industrial effluents produced. The cooling unit is a closed circuit cooling of machines with a secondary circuit cooling that water again through heat exchangers and chillers. The water consumption is around 4000kL/month for the bulk of the year, but according to data for early 2006, this almost triples to around 12-14,000kL/month between Feb-May. This appears to be due to double increase in production hours during these peak months, but in addition, these are the high temperature months of Summer, that require more chillers in operation to maintain temperature. This could mean 300 m^3 per day in summer of water for backcooling, which is reasonable. Alternatively it is needed for the vacuum pumps when water is warmer in summer.

3.2.18 Waste Generation

- Gaseous emissions (lacquer/solvent emissions during curing - captured)
- Packing materials – Ends are transported from VanderBijl Park in paper sleeves and plastic mesh – thrown away. Opportunities for alternative packaging materials that allow for reuse/recovery/recycling should be investigated. Layerpads, topframes & pallets are all on a deposit system for reuse. Fish industry – problems around fish odour permeating pallets – therefore the fish pallets & layer pads are sorted separately. Packaging wrap on final product has been selected for minimum practical thinkness of 13microns to minimize plastic use. However all this plastic goes to waste, and is not recyclable. Possible option to investigate an alternative that is recyclable or minimized packaging? No data was provided on quantity of this packaging as it is unknown. This could be measured as part of an IPA. If not, monitoring this waste generation in general is recommended.
- Metals - tin plate & ends – metal waste is sold for scrap to local and Japanese market. Defects on lacquering form are sold to India to make battery jackets – higher value than straight scrap. Scrap from different divisions of Nampak is sold such that greater quantities for a better prices. Waste metal is generated as trim (minimum 2mm) when slitting blanks. The amount of trim depends on sheet size and can size. Larger amounts of trim are generated when the tin plate size is not correct for can size – usually only when minimizing working capital by using older unused sheets rather than ordering new ones. Spoilage on line is measured as sheet in compared to expected cans for a works order. Data was not provided on how much waste is included in planning, and how actual waste correlates to this number. Obviously, spoilage quantities are higher for larger sized cans. This is a sum of destructive testing for quality as well as general faults in production/failed quality checks. The 1st can from every batch is always scrapped for quality reasons. The top sheet of every stillage pile is also thrown away for quality reasons. Skips are provided for waste product. Total quantity varies according to production. According to manufacturing manager, the spoilage quantity is below international benchmark of 1.2% at 0.8%. 0.6% recently. Currently experiencing problems with quality of tin plate received from Mittal steel – resulting in 25% reject ratio of tin plates. Considering importing tin

plate. Quality is of high importance for customers, if a truckload of 28 stillages x 38 cans is found to have one can faulty, the entire load is scrapped. Some scrap cans with defects are turned into money boxes for charity collections. No data was provided on quantity of waste generated and no indication of proportion of waste that is from destructive testing. This could form measured as part of an IPA. If not, monitoring this waste generation in general is recommended.

- Metals – copper wire – 750kg or 45km per line, 5 lines. Container is used every 3 weeks: 21x750kg/container = 15,000 tons/3 weeks approximately 20,000tons/month (low season). 30tons/month Copper wire in peak periods.
- Solvent lacquer wastewater – not well stored at moment – needs to be covered and area should be bunded. Apparently storage container is to be changed.
- Mixed wastes (general solid waste, plastic bottles, etc. – including a large amount of packaging waste that is not recycled). No data provided on quantity of general waste generated. It is not a priority area, but monitoring waste generation in general is recommended.

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 those covering energy provision and storage management, 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 potentials 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

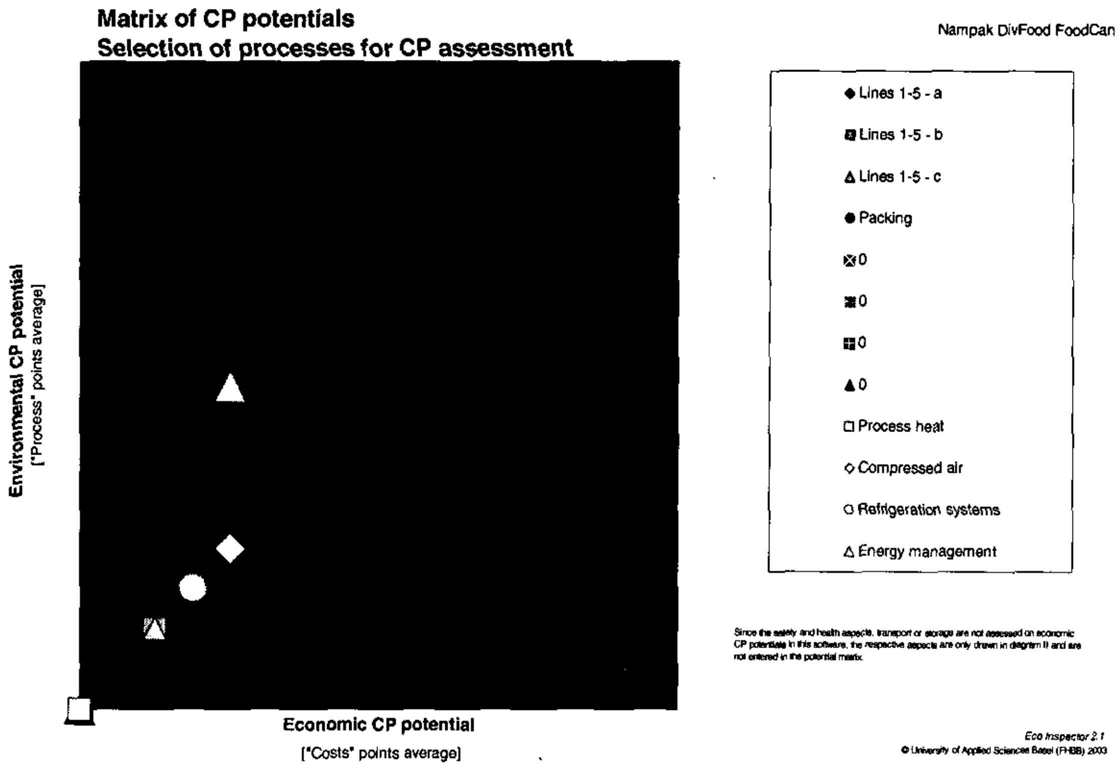
The product of the potential point and weighting factor indicates the *current CP potential* for each criterion point of each sub-process.
The average of points for the individual categories (Inputs, outputs, technology and cost) gives a benchmark for the CP potential of individual process steps. This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

4.1.2 Assessment of the S&H, 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 point's 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

Figure 2: Matrix of CP Potentials according to data analysis in Eco-Inspector.



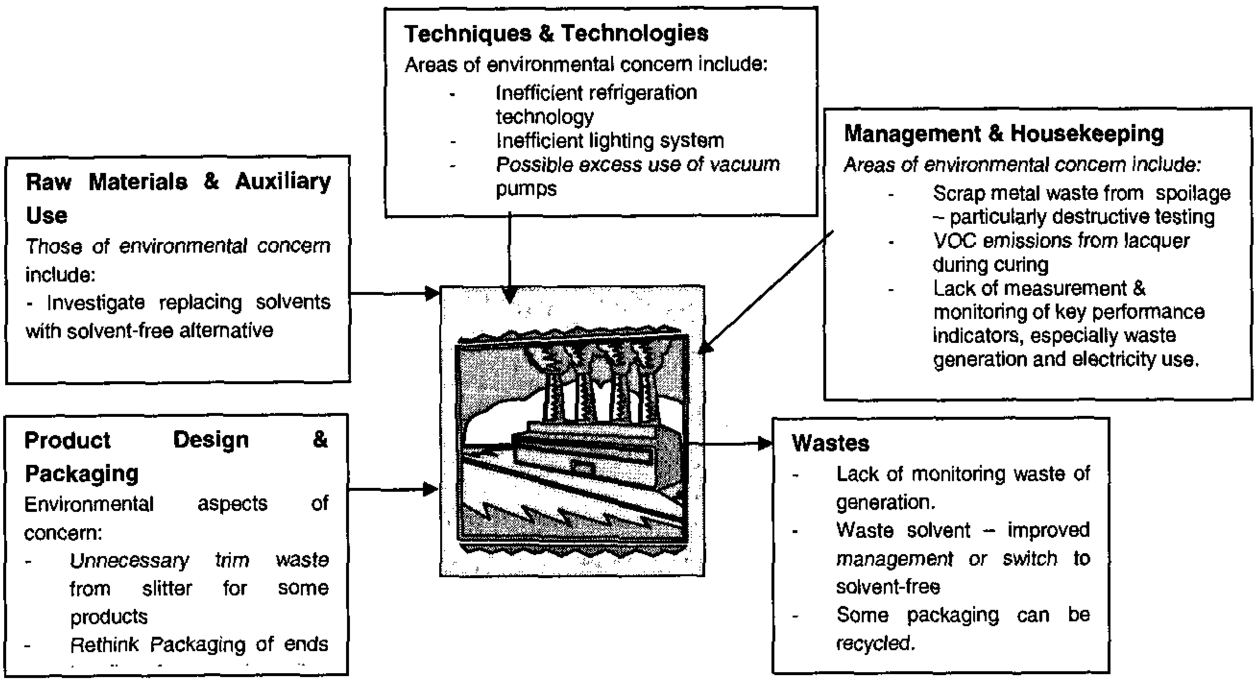
Lines 1-5 – a: Slitter, Blank feeder, Scoring
Lines 1-5 – b: Rolling, Welding, Internal/External sidestripe application
Lines 1-5 – c: Parting, Flanging, Beading, 1st & 2nd Operation seaming, Inkjet coding, testing
Packing: Palletising, strapper, wrapper/strapper

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 2 (above) contrasts economic- and environmental potentials. The values given correspond with the point's average of the individual component processes (see Appendix 2).

4.3 Discussion of the Results

From Figure 2 above and the cleaner production assessment it was evident that the one area for Cleaner Production opportunities to be implemented is around energy management. The lighting system can be improved significantly and is apparently in the process of being recircuited and connected to daylighting switches so that lighting can be switched off when not necessary in certain areas. The refrigeration system is relatively old and a high consumer of electricity, it is recommended that when it is replaced, that ammonia chillers are used as they are the most energy efficient. The compressed air system appears to be optimized, though information on maintenance of filter systems was not provided. Filters should be cleaned and maintained regularly as dirty filters can significantly increase energy consumption. The running time of the vacuum pump could possibly be optimized. Although the graph indicates that the economic potential for improvement is not high, the cumulative savings in electricity that will result and the benefits in the long-term as energy costs rise will be significant. Apart from energy, the following graph indicates the areas for additional CP focus that were identified from the CP PQS.

Figure 2: Key areas for Cleaner Production



Cleaner Production Priorities

Nampak Foodcan is a very well managed company and there were generally few CP opportunities identified during the PQS for the production process.

- The main opportunities identified are for the auxiliary operations, in particular energy efficiency options for chillers/condensers, lighting and possibly vacuum pumps.
- Regarding waste generation, there is concern around the state of the solvent wastewater storage, though it is understood that this is being addressed. However, the container where the solvent wastewater is stored, should be within a bunded area.
- The general packaging solid waste generated by Nampak Foodcan is also a priority for minimisation due to the high volume generated and the high potential for reuse/recycling. Although the bulk of packaging is reused/recycled, the packaging on ends is not, and there is significant scope to reconsider how the ends are packaged to minimise the amount of packaging used in the first place, and secondly to institute packaging reuse/recycling as far as possible.
- Regarding scrap metal waste, there is a concern as to the amount of scrap waste generated from destructive testing. Although the overall spoilage figures are apparently below International benchmark figures, the total amount of scrap waste generated is still a large quantity, and there may still be further opportunities for minimising unnecessary waste generation which would have economic benefits. Current systems in place for monitoring spoilage are random checks, and there is not much need for more checks, but rather for a

reporting on the results of these checks with meaningful KPI's around scrap waste generated/ton production that could be separated according to waste generated from destructive testing, versus spoilage. Through investigation of the sources and causes of the spoilage, and setting up a reporting system for the random monitoring processes, waste minimisation options could be identified.

Cleaner Production Options

The following is a summary of the CP options identified. The further assessment and implementation of these will depend on the priorities of Nampak Foodcan. These options will require further analysis and one of these options can be selected by Nampak for a detailed In Plant Assessment to be carried out by the consultants for this UNIDO sponsored demonstration project.

Summary of Identified Cleaner Production Options

Options	Environmental impact reduction	Implementation
Investigate opportunities for further minimizing spoilage during production. Report on spoilage causes on a regular basis and minimize destructive testing.	Savings in tin-plate use and in various value adding operations. Reduced waste metal.	Recommend monitoring & reporting on causes and metal scrap waste quantities generated. Investigation into minimizing destructive testing. Such a study could be done as an in plant assessment.
PRODUCTION SPOILAGE		
Investigate opportunities for further minimizing spoilage during production. Report on spoilage causes on a regular basis and minimize destructive testing.	Savings in tin-plate use and in various value adding operations. Reduced waste metal.	Recommend monitoring & reporting on causes and metal scrap waste quantities generated. Investigation into minimizing destructive testing. Such a study could be done as an in plant assessment.
Replace refrigerant in chiller system. Replace current chillers & condensers with ammonia chillers. Evaporative cooler lower temperatures with ammonia (5% saving). New chiller higher COP (15% savings).	Potential reduction in energy consumption	Check refrigerant – should not be R22, R44 or R407. R11 preferable. Investigate economic feasibility of replacing existing older chilling units in near future with ammonia chillers.
Potential for automatic control of return temperatures in refrigeration temperature.		Today control of cooling in welding machines is manual (rotameter and valve), are the return temperatures controlled? (this could be monitored for a few days). Variations would indicate a potential for saving via automatic control (termperature measurement, control, automatic valve)

Vacuum pump should not need to be in operation at all times.	Potential reduction in energy consumption	Monitor need for vaccum pump and minimize operating time. This could form part of more detailed energy-focused IPA.
Options	**Environmental impact reduction**	**Implementation**
WASTE		
Minimise packaging used for Ends or consider an alternative recyclable packaging for the Ends.	Minimise volumes disposed to landfill and reduce use of paper & plastic.	An assessment of alternative packaging systems could be carried out as part of a more-detailed In Plant Assessment. Alternatively request alternatives from suppliers.
Keep solvent waste tank covered to minimise evaporation and bund area for collection of spills.	Prevent solvent air emissions and possible spills can be contained - prevented from flowing into storm-water or ground.	Apparently an alternative waste tank is being sourced. Bunding should be put in place after consultantion with health, safety & environment specialist. Alternatively, if solvents to be phased out, this waste could be eliminated completely. No bunding necessary for solid wastes only.
Options	**Environmental impact reduction**	**Implementation**
TRANSPORT		
There are opportunities to minimise transport fuel consumption through improved logistics planning. Though contracted out, transport costs are likely to increase significantly in the near future as oil prices increase. It is recommended to consider investigating options for rail transport.	Minimise fuel consumption and transport costs.	Flag as an important issues to consider and to investigate logistics and alternative transport options in the near future.

5. RECOMMENDATIONS AND FOLLOW UP

- It is recommended that a full energy assessment be carried out to determine the opportunities for energy savings. This would cover the:
    - Lighting
    - Refrigeration system
    - Vacuum pumps
    - Possibly include monitoring & checks on compressed air system

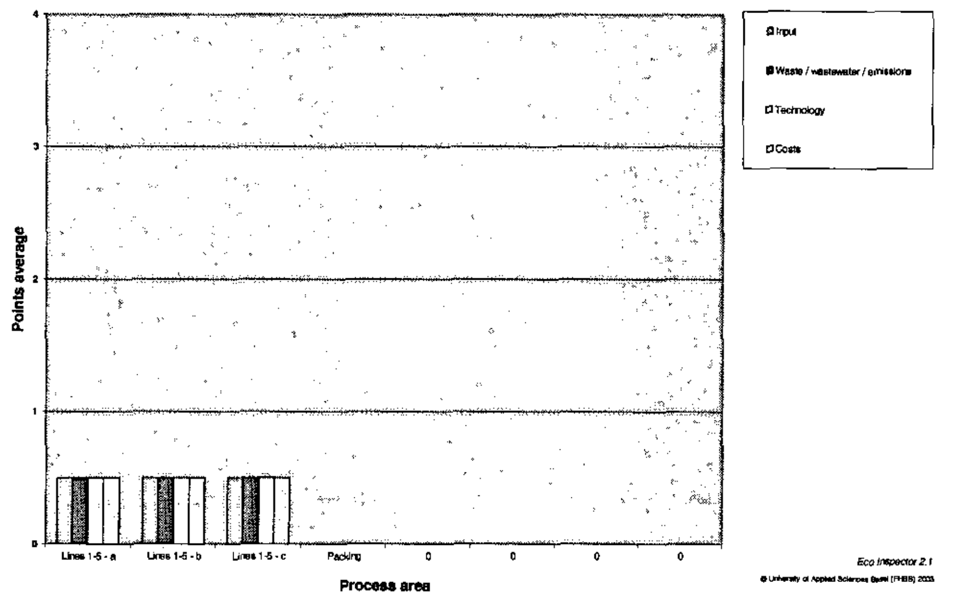
- A study on the quantity of product spoilage over a time period, analysed according to key causes & sources could be carried out. This could identify potential opportunities for minimising spoilage in general, and in particular the quantity submitted to destructive testing.

- Alternative packaging options for the Ends could be investigated to identify options for minimising packaging, recycling/reusing packaging.

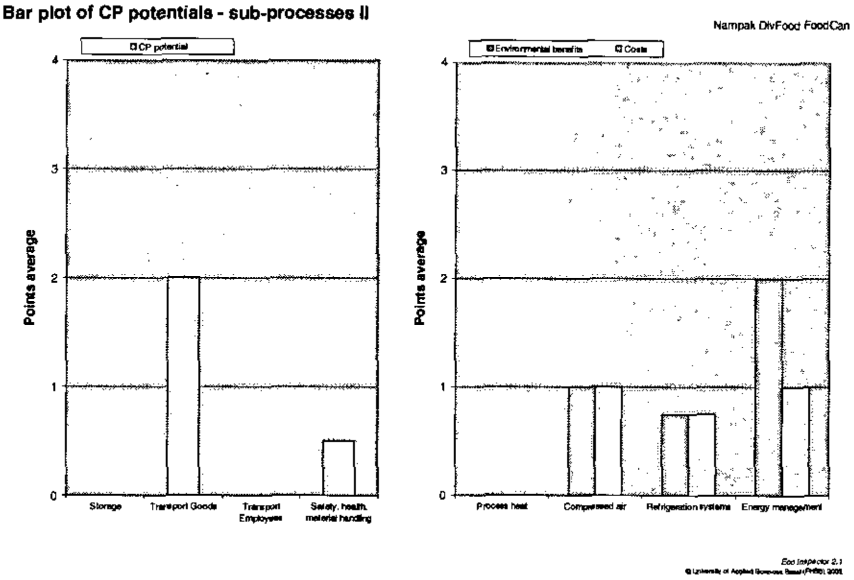
6. APPENDIX

Appendix 1 Estimated Potentials of Component Processes

Bar plot of CP potentials - sub-processes I



Bar plot of CP potentials - sub-processes II



Appendix 2 Summary of Results

Summary of results Nampak DivFood FoodCan

Process	CP potential environmental benefits (process)												CP potential economic benefits		
	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
P1 Lines 1-5 - a	-	0.5	0.5	0.5	-	-	-	-	-	-	0.5	-	0.5	-	-
P2 Lines 1-5 - b	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	-	-	0.5	-	0.5	0.5	-
P3 Lines 1-5 - c	-	-	0.5	0.5	-	-	-	0.5	-	-	0.5	-	0.5	-	-
P4 Packing	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P5 0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P6 0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P7 0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P8 0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P9 Storage	No CP potential anticipated														
P10 Transport Goods	*Moderate CP potential anticipated. Additional analysis of goods transport system recommended.*														
Employees	Low CP potential available for further analysis														
E1 Process heat	No CP potential anticipated														
E2 Compressed air	Low CP potential for more detailed analysis														
E3 Refrigeration systems	Low CP potential for more detailed analysis														
E4 Energy management	Moderate CP potential for environmental benefits or financial savings. Additional analysis of the energy management system recommended.														
Safety, health, material handling	Low CP potential for more detailed analysis														

* 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.