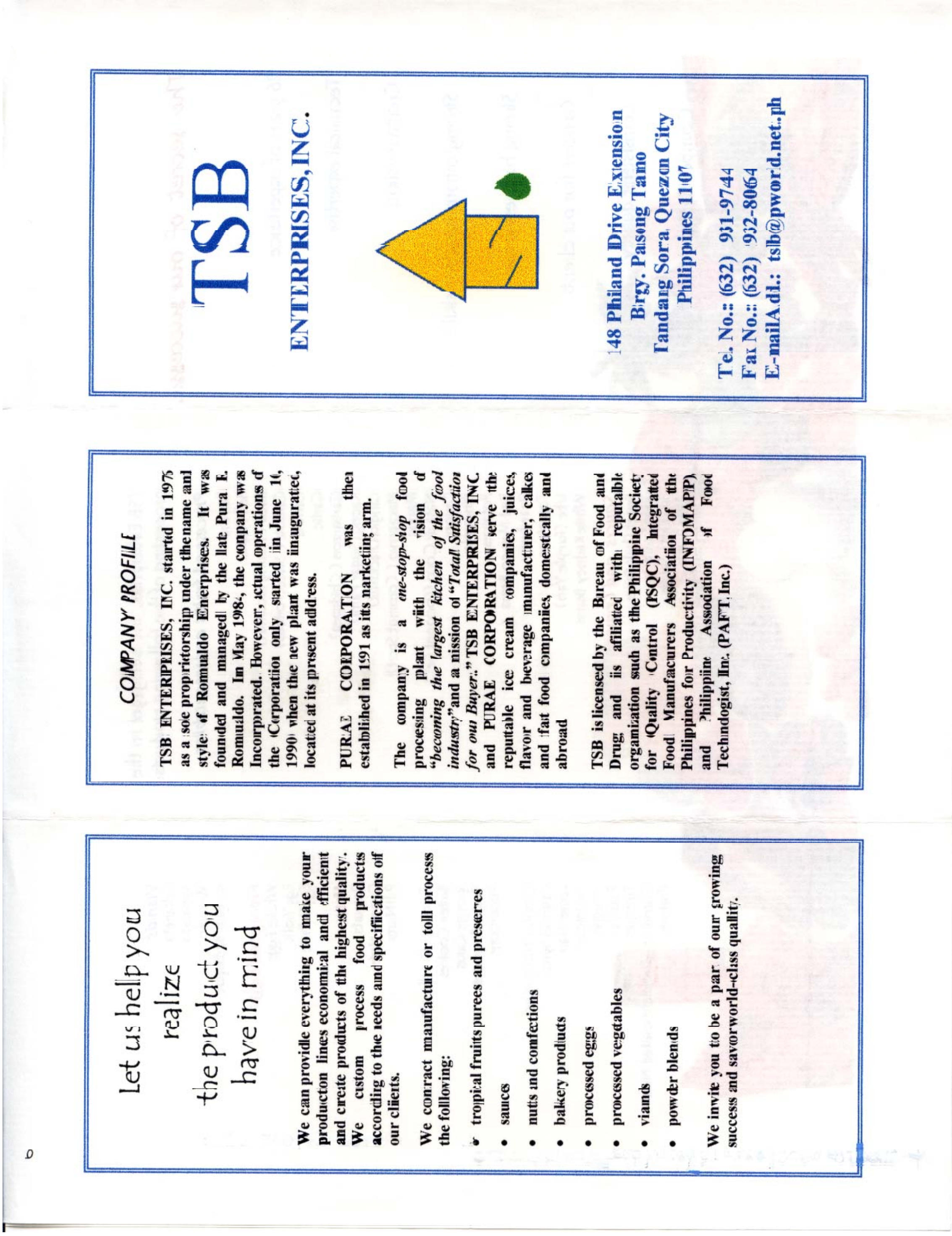
3. TSB Enterprise



Let us help you realize the product you have in mind

We can provide everything to make your production lines economical and efficient and create products of the highest quality. We custom process food products according to the needs and specifications of our clients.

We contract manufacture or toll process the following:

- tropical fruits purees and preserves
- sauces
- nuts and confections
- bakery products
- processed eggs
- processed vegetables
- viands
- powder blends

We invite you to be a part of our growing success and savor world-class quality.

COMPANY PROFILE

TSB ENTERPRISES, INC. started in 1975 as a sole proprietorship under the name and style of Romualdo Enterprises. It was founded and managed by the late Pura E. Romualdo. In May 1984, the company was Incorporated. However, actual operations of the Corporation only started in June 10, 1990 when the new plant was inaugurated, located at its present address.

PURAE CORPORATION was then established in 1991 as its marketing arm.

The company is a *one-stop-shop* food processing plant with the vision of *"becoming the largest kitchen of the food industry"* and a mission of *"Total Satisfaction for our Buyer."* TSB ENTERPRISES, INC. and PURAE CORPORATION serve the reputable ice cream companies, juices, flavor and beverage manufacturer, cakes and fast food companies, domestically and abroad

TSB is licensed by the Bureau of Food and Drug and is affiliated with reputable organization such as the Philippine Society for Quality Control (PSQC), Integrated Food Manufacturers Association of the Philippines for Productivity (INFOMAPP), and Philippine Association of Food Technologist, Inc. (PAFT, Inc.)

TSB

ENTERPRISES, INC.

148 Philand Drive Extension
Brgy. Pasong Tamo
Tandang Sora, Quezon City
Philippines 1107

Tel. No.: (632) 931-9744
Fax No.: (632) 932-8064
E-mail Add.: tsb@pworld.net.ph

The secret of our success...

26 years of experience

Technical expertise

Creative vision

Strong communication skills

Strong business sense

Concern for our clients

Consistent quality

Competitive pricing sche...

TSB Enterprises, Inc is engaged in the processing of the following products:

Processed fruits and vegetables

Banana
Bell Pepper
Buco (Young coconut)
Camote ((Sweet Potato)
Carrots
Garlic
Garbanzos (Chickpea)
Kaong (Sugar Palm)
Langka (Jackfruit)
Macapuno (Coconut Sport))
Mango
Nata de Coco (Coconut Gell)
Onions
Pineapple
Potatoes
Red Mongo Beans
Stawberry
Tomatoes
Ube (Purple Yam)
White Kidney Beams

Sauces and Gravies

Sweet Chili Sauce
Taco Sauce
Spaghetti Sauce
Pizza Sauce
Chicken and Steak Gravies

Viands

Caldairea
Mechado
Menudo
Korean Barbeque

Processed Eggs

Wholle Eggs
Egg Yolk
Egg White

Nuts

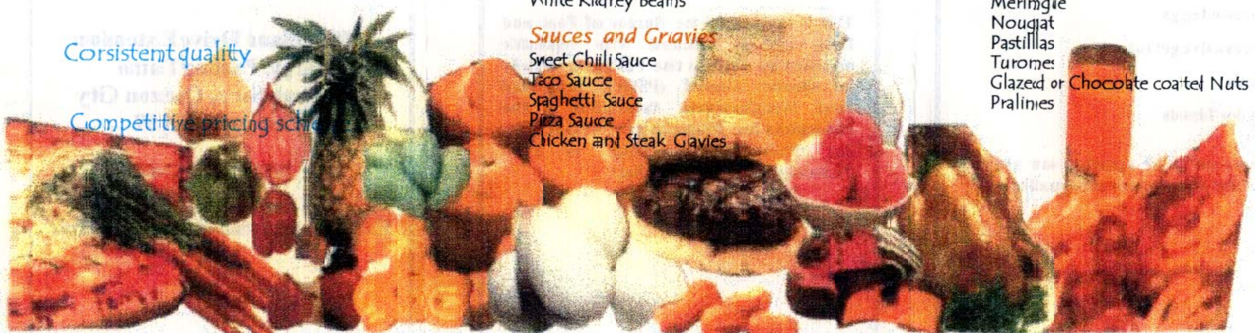
Peanuts
Cashew Nuts
Pili Nuts

Bakery Products

Butter Cookies
Sponge Cakes
Fudge Brownies
Macaroons

Confectioneries

Carame Syrup
Leche Fan
Meringue
Nougat
Pastillas
Turones
Glazed or Chocoate coated Nuts
Pralines



1.4.3. Project Operational Procedure

All materials purchased are inspected; weighed or counted for volume inventory. Accepted products are brought to warehouse prior to processing.

Puree and Processed Foods

Raw materials such as ube, pineapple and mango are taken out from the warehouse. Sorting of the products are made to remove spoiled or over-ripe fruits. Good quality fruits are washed to remove dirt and dust. Washed fruits are peeled manually and if specified, it is cut into desired size prior to cooking. Sugar is added into the sliced fruits and cooked for about an hour into the steam jacketed kettle at 82°C. The products packed into 1000 ml. plastic liner and pail, then cooled. The packed purees are chilled/frozen in the cold storage and ready to be delivered to ice cream manufacturers and food processing plant.

Pasteurized Egg

Major food processing plant purchase pasteurized eggs to prevent salmonella contamination in their products. Pasteurization of egg involves a simple process. Eggs from the farm are cracked and put into a container. Eggs are cooked at about 65°C for 30 minutes to eliminate any salmonella bacteria and other pathogenic organisms. Cooked eggs are cooled to 10 C to preserve its quality.

Roasted Nut

Raw nuts are roasted for 30 minutes and cooled. The nut skin are removed manually. Skinned nuts are chopped or ground into desired sizes Chopped nuts are packed and brought to the warehouse for storage until it is pulled-out for delivery.

Caramel Syrup

Sugar is melted in the vessel. Water and other ingredients are mixed and boiled for 30 minutes. Product are packed into 20 ml. plastic sachet and cooled in the water bath. Caramel syrups are stored in the warehouse and ready for delivery.

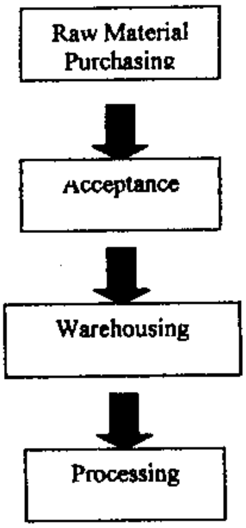
1.4 Project Operation Flowchart

The detailed food processing flow and operation are shown in the following pages.

PROCESS FLOW

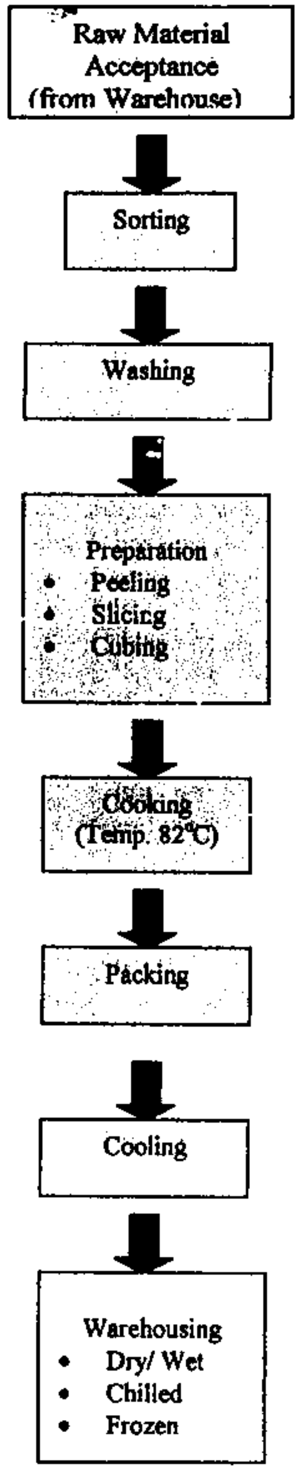
A. General Procedure

Puree/Processed Fruit, Vegetables, Eggs

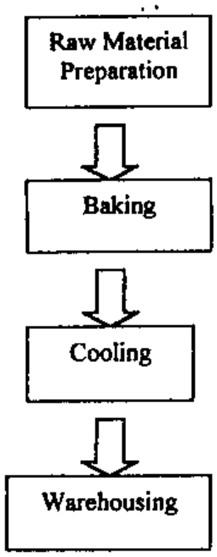


B. PROCESSING

1. Processed Foods (fruits, vegetables and sauce)



2. Bakery Products



3. Roasted Nuts

1.4.4 . Raw Material and Consumption

The list of raw materials and the average consumption in kilogram per year are as follows:

1. Buco	------------------	1,800
2. Calamansi	------------------	50
3. Camote	------------------	1,700
4. Carrots	------------------	120
5. Cavendish	------------------	530
6. Eggs	------------------	16,500
7. Green Bell Pepper	------------------	330
8. Kaong	------------------	7,600
9. Lacatan	------------------	6,600
10. Langka	------------------	7,200
11. Macapuno	------------------	3,900
12. Mango	------------------	612,500
13. Nata de Coco	------------------	7,450
14. Papaya	------------------	4,300
15. Peanuts	------------------	6,600
16. Pineapple	------------------	58,300
17. Potato	------------------	200
18. Red Mongo Beans	------------------	2,800
19. Red Bell Pepper	------------------	1,500
20. Saba	------------------	4,500
21. Strawberry	------------------	3,200
22. Tomato	------------------	5,000
23. Ube	------------------	14,400
24. White Kidney Beans	------------------	750
25. White Onion	------------------	1,650
26. Refined Sugar	------------------	105,700

TSB ENTERPRISES, INC.
ATTACHMENT A

A. Sampling Date: 15 February 2001

STATION NO.	STATION IDENTIFICATION	CHARACTERISTIC		
		BOD, mg/L	COD, mg/L	TSS, mg/L
1	Mango Washing	345	524	-
2	Mango Pulping	5,504	8,600	-
3	Mango Puree Cooking	5,904	8,800	-
4	Pineapple Peeling/De-eyeing	1,204	1,824	-
5	Pineapple Cube Cooking	330	440	-
6	Cooling Bath	15	24	-
7	Combine Pailwashing	375	592	-
8	Pailwashing-3rd Rinse	20	32	-
9	P.E. Bag Washing	5,616	8,960	-
10	Composite-Production	225	320	140
11	Composite-Pailwashing	1,616	3,120	250

B. Sampling Date: 16 May 2002

STATION NO.	STATION IDENTIFICATION	CHARACTERISTIC			
		BOD, mg/L	COD, mg/L	TSS, mg/L	COLOR, PCU
1	Mango Washing	31	375	-	-
2	Mango Pulping	56,220	62,150	-	-
3	Mango Puree Cooking	2,022	4,322	-	-
4	Pailwashing Tub	6	96	-	-
5	Pailwashing Drain	944	1,179	186	250*
6	Steel Drain	1,122	2,608	156	250*

TSB ENTERPRISES, INC.
MONTHLY WATER CONSUMPTION
2002

	Process Water (cu.m.)	Water Consumption (cu.m.)	Wastewater (cu.m.)
January	4.5465	842.1046	670.50
February	4.5961	686.5800	544.36
March	10.2890	1 665.8377	1 469.54
April	25.6329	1 232.2275	963.47
May	27.8112	1 908.3894	1 615.85
June	15.0746	1 582.4592	1 344.96
July	14.9673	1 956.6464	1 687.66
August	5.6664	1 280.4792	1 065.70
September	6.8108	1 235.4285	1 017.44
October	5.6308	1 810.9172	1 580.02
November	6.1268	1 677.7826	1 483.54
December	5.8965	1 547.8215	1 351.57
TOTALS	133.0488	17 426.6738	14 794.6240

Monthly Average Consumption
FDK THE YEAR 2002

Month	KW-hr
January	28,560
February	25,920
March	32,520
April	43,080
May	43,920
June	41,640
July	38,400
August	37,200
September	27,720
October	38,880
November	30,720
December	29,160
Total	417,720

Average Consumption: $\frac{\text{Total}}{\text{No. of Month}} = \frac{417{,}710}{12}$

= 34,810 Kw-Hr

TSB ENTERPRISES, INC.
CONSOLIDATED WASTE WATER ANALYSIS RESULT

DATE OF SAMPLING	DATE ANALYZED		PAILWASHING						STEEL DRAINAGE					
			COD	BOD	COLOR	TSS	OIL & GR	pH	COD	BOD	COLOR	TSS	OIL & GR	pH
		STD	150 ppm	50 ppm	150 PCU	70 ppm	5 ppm	6.5-9.0	150 ppm	50 ppm	150 PCU	70 ppm	5 ppm	6.5-9.0
08-Mar-99	04/9/99-04/13/99		-	-	-	-	-	-	92	63.5	92	60	3	-
29-Apr-99	04/29/99-05/05/99		762	334	100	31	1.3	-	51	35	15	1	2	-
27-May-99	05/27/99-06/02/99		1428	656	100	144	18	-	927	516	75	76	2.2	
17-Jan-00	01/18/00-01/24/00		-	-	-	-	-	-	-	-	-	-	-	-
13-Apr-00	04/14/00-04/19/00		-	-	-	-	-	-	-	-	-	-	-	-
27-Jun-00	06/28/2000		-	-	-	-	-	-	-	-	-	-	-	-
15-Feb-01	02/28/2001		732	303	150	187	21.2	-	858	682	25	124	3.8	
16-May-02	05/16/2002		1,179	944	250	186	-	-	2,608	1,122	250	156	-	-

tsb/wastewater/analysis
page 1 of 2

TSB ENTERPRISES, INC.
CONSOLIDATED WASTE WATER ANALYSIS RESULT

CONCRETE DRAINAGE						COMPOSITE						PRODUCTION
COD	BOD	COLOR	TSS	OIL & GR	pH	COD	BOD	COLOR	TSS	OIL & GR	pH	
150 ppm	50 ppm	150 PCU	70 ppm	5 ppm	6.5-9.0	150 ppm	50 ppm	150 PCU	70 ppm	5 ppm	6.5-9.0	
54	32	20	14	3	-	-	-	-	-	-	-	stab. macapuno string, adobong mani, pail/crate washing, caramel packing
67	51	100	16	4	-	-	-	-	-	-	-	mango sorting/cubing/pulping, mango puree cooking, salsa, tomato cubing, onion cubing, stab. strawberry whole, adobong mani, pail/crate washing
180,430	66,800	750	4,280	3.2	-	-	-	-	-	-	-	mango sorting/cubing/pulping, mango puree cooking, adobong mani kaong washing/cubing/cooking/boiling/coloring, mango toppings, pineapple cubing, saba, fruit salad, saba boiling/cubing, lacatan cubing, pail/crate washing
-	-	-	-	-	-	658	364	150	59	4.7	7.03	tomato cubing, camote cubing/cooking, pail/crate washing, mango puree cooking
-	-	-	-	-	-	458	351	50	58	1.8	7.85	pail/crate washing, sugar coated pinipig, peanut chopping/grinding/roasting, mango sorting/cubing/pulping, mango puree cooking, fruit mixes
-	-	-	-	-	-	24-8,960*	15-5,904*	-	140-250*	-	-	mango sorting/cubing/pulping, mango puree cooking, pail/crate washing, pineapple washing/peeling/cubing/cooking
-	-	-	-	-	-	-	-	-	-	-	-	brownies, fruit mixes, tomato cubing, stab. pineapple cube, mango puree, choco mousse, chili soy paste, pail/crate washing
-	-	-	-	-	-	96-62,150*	6-56,220*	-	-	-	-	mango sorting/cubing/pulping, mango puree cooking, pail/crate washing choco mousse, toffee crunch, macapuno shredding/cooking, butter cake

* Samples were taken at different locations/stations/processes/activities
* See Attachment A

Prepared by:
Catherine E. Abrantes

Noted by:
Maria Bernardita R. de Guzman

tsb/wastewater/analysis
page 2 of 2

4. Acetech Metal Industries Corporation

ACETECH
METAL INDUSTRIES CORPORATION
Tatalon Road, Bo. Ugong, Valenzuela City

ALEXANDER D. RELUCIO
Vice President for Sales

*

NAPOLEON J. TANGANCO
Vice President for Production

For your foundry needs in ...

* Ferrous Casting
  - Carbon Steel
  - Low & High Alloy Steel
  - Stainless Steel
  - Manganese Steel
  - Gray Cast Iron
  - Ductile Cast Iron
  - Ni-Hard
  - White Iron
* Non-ferrous Casting
  - Copper
  - Bronze
  - Brass
  - Aluminum
  - Zinc
* Technical Services
  - Layout & Equipment Selection
  - Plant Installation & Commissioning
  - Project Supervision
  - Consulting

Telephone: (632) 984-1743;
984-1744
0917-8135142

Fax: (632) 937-3387

Company Profile

Name: ACETECH METAL INDUSTRIES CORPORATION

Location: 6013A Tatalon Road, Barrio Ugong, Valenzuela City
Metro-Manila, Philippines

Telephone Number: (632) 984-1744
Facsimile Number: (632) 984-1743

e-mail address: naptanganco@edsamail.com.ph

Incorporated: November 9, 1998
Start of Operation: July 1, 2002

Managing Director: Napoleon J. Tanganco

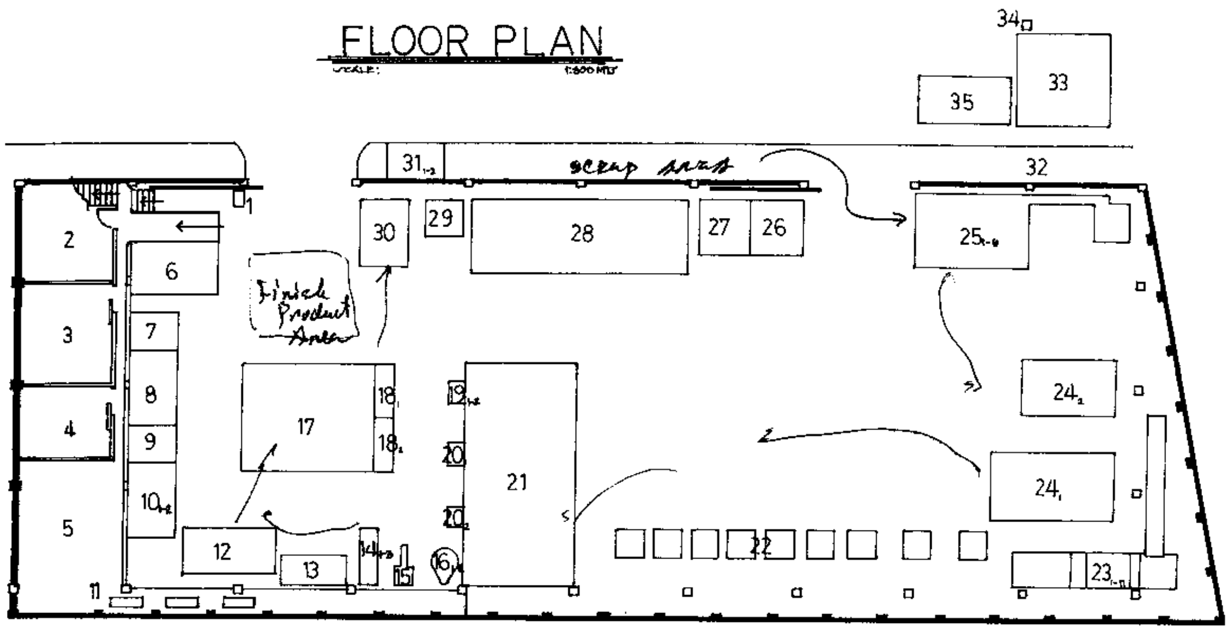
Employee: 14 → 16

Business Line: Ferrous Casting- Gray Cast Iron
Ductile Cast Iron
Carbon Steel
Low Alloy Steel
High Alloy Steel

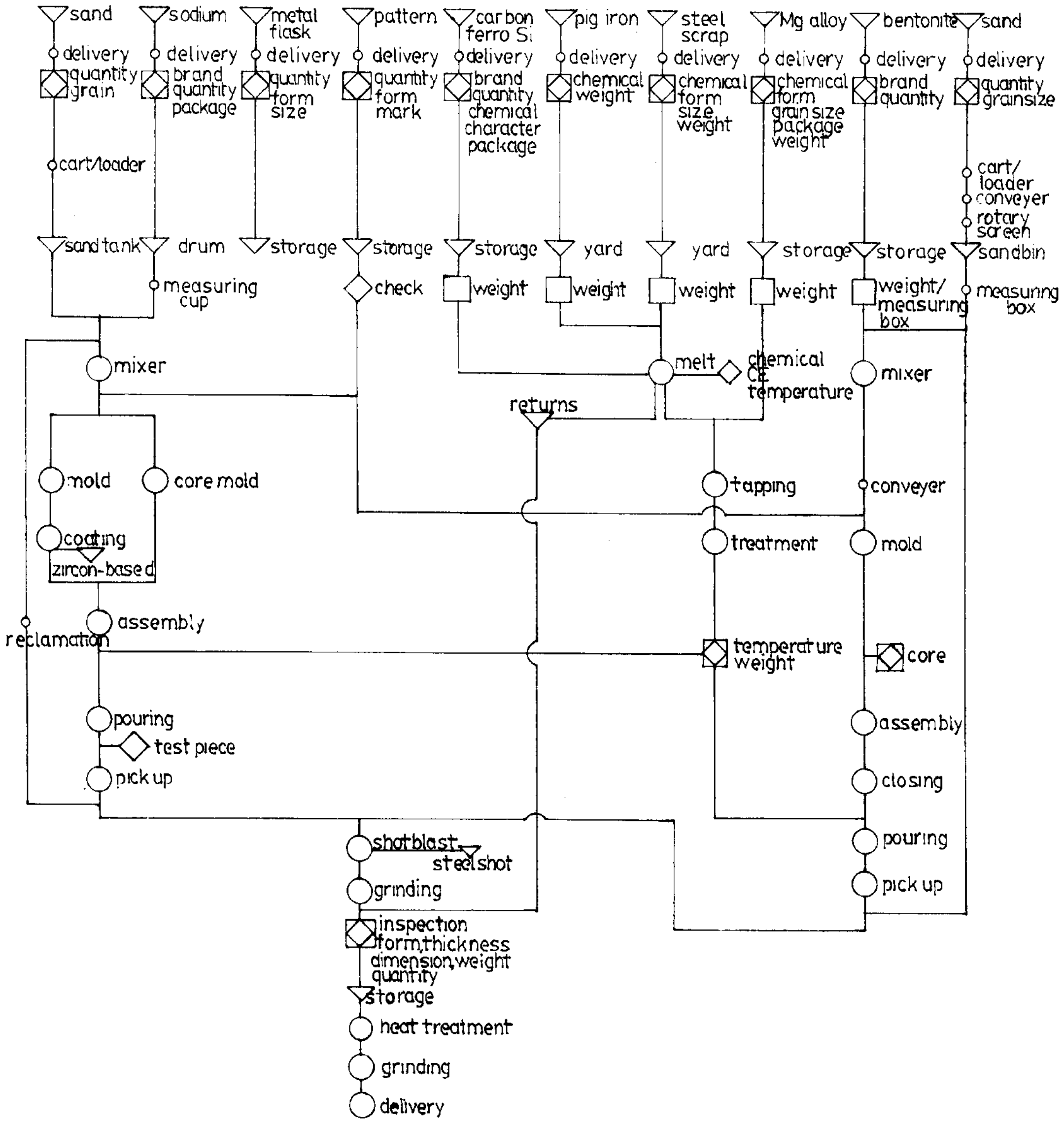
Facilities:
Lot Area- 4320 Square Meter
Plant Area- 1300 Square Meter

Machineries and Equipment:
1 unit Cupola 1.4MT/hr with Dry-Type Pollution Control Equipment
1 unit Medium Frequency Induction Furnace 500kg & 300kg (Shangli,Taiwan)
1 unit Medium Frequency Induction Furnace 1.5 MT (Pillar,USA)
1 set Green Sand Conditioning System - Muller
Rotary Screen
Sand Blender
Conveyors
2 units F3 Strip Mold Jolt Squeeze Molding Machine
1 unit F3 Jolt Squeeze Molding Machine
2 units F2 Semi-automatic Jolt Squeeze Molding Machine
3 units F2 Jolt Squeeze Molding Machine
1 unit CO2-Sodium Silicate Sand Mixer
1 unit Continuous Mixer
1 unit Core-sand Mixer
1 unit Tumblast Machine
1 unit Shot Blast Machine
1 unit Shell Mold Machine
2 units Shell Core Machine
1 unit Oil-fired Annealing Furnace
1 set Wood Pattern Making Machines

FLOOR PLAN



1. RECEIVING AREA
2. PATTERN STOCK AREA
3. SUPPLIES STOCK ROOM
4. TOOL ROOM
5. FINISHED CASTINGS STOCK AREA
6. PATTERN SHOP
7. FINAL GRINDING AREA
8. WELDING AREA
9. PRELIMINARY GRINDING AREA
10. CUTTING AREA
   10.1 OXY-GAS CUTTING
   10.2 ARC-AIR CUTTING
11. AIR COMPRESSORS
12. SHOT BLAST MACHINE
13. TUMBLAST MACHINE
14. CO2 SAND RECLAMMATION AREA
   14.1 RECLAMMATION MACHINE
   14.2 BAG HOUSE DUST COLLECTOR
   14.3 SAND BIN
15. CONTINUOUS MIXER
16. CO2-SODIUM SILICATE SAND PREPARATION AREA
   16.1 SAND MIXER
   16.2 SODIUM SILICATE STORAGE AREA
17. CO2 MOLDS SHAKE –OUT AREA
18. CO2 STORAGE AREA
   18.1 FULL TANKS AREA
   18,2 EMPTY TANKS AREA
19. CORE MAKING AREA
   19.1 CORE SHOOTER
   19.2 RESIN COATED SAND STORAGE AREA
20. CORE SAND MIXERS
21. CO2 FLOOR MOLDING AREA
22. JOLT-SQUEEZE MOLDING MACHINES
23. GREEN SAND CONDITIONING SYSTEM
   23.1 CONVEYOR
   23.2 VIBRATING TABLE
   23.3 BUCKET ELEVATOR
   23.4 ROTARY SCREEN
   23.5 DUST COLLECTOR
   23.6 SAND BIN
   23.7 SAND MULLER
   23.8 SAND BLENDER
   23.9 WATER
   23.10 BENTONITE
24. GREEN SAND FLOOR MOLDING AREA
   24.1 FLOOR AREA 1
   24.2 FLOOR AREA 2
25. CUPOLA MELTING AREA
   25.1 CUPOLA FURNACE
   25.2 CYCLONE
   25.3 HEAT EXCHANGER
   25.4 BAG HOUSE DUST COLLECTOR
   25.5 COKE STORAGE AREA
   25.6 LIMESTONE STORAGE AREA
26. LADLES STORAGE AREA
27. STEEL SCRAP AREA
28. ELECTRIC INDUCTION FURNACE
29. STAINLESS STEEL SCRAP AREA
30. OIL-FIRED HEAT TREATMENT FURNACE
31. FUEL TANK
   31.1 DIESEL FUEL TANK
   31.2 LPG CYLINDERS
32. CAST IRON SCRAP AREA 1
33. OVERHEAD WATER TANK
34. WATER JACK PUMP
35. CAST IRON SCRAP AREA 2



◉MATERIAL FLOW CHART◉

MELTING SCHEDULE

CHARGE NO.	CHARGE TIME	COKE (KG)	SCRAP IRON (KG)	FE-Si (KG)	LIMESTONE (KG)	OTHER FERRO-ALLOYS (KG)
1		16-A	140	1	8	
2		16-A	140	1	8	
3		16-A	140	1	8	
4		16-A	140	1	8	
5		16-A	140	1	8	
6		16-A	140	1	8	
7		16-A	140	1	8	
8		16-A	140	1	8	
9		16-A	140	1	8	
10		16-A	140	1	8	
11		**16-C**	**160**	1	8	
12		**16-C**	**160**	1	8	
13		**16-C**	**160**	1	8	
14		**16-C**	**160**	1	8	
15		**16-C**	**160**	1	8	
16		**16-C**	**160**	1	8	
17		**16-C**	**160**	1	8	
18		**16-C**	**160**	1	8	
19		**16-C**	**160**	1	8	
20		**16-C**	**160**	1	8	
n		**16-C**	**160**	1	8	

CO2-SODIUM SILICATE SAND MIXTURE

FACING SAND AND CORE SAND 25%	
SILICA SAND	25 KGS.
* SODIUM SILICATE 50B	2 KGS.
WATER	1 KG.
BACKING SAND 75%	
RIVER SAND	22.5 KGS.
* SODIUM SILICATE (water glass)	2 KGS.
WATER	1 KG.

GREEN SAND MIXTURE

MATERIAL	WEIGHT
SILICA SAND	190 KGS.
BENTONITE	2.2 KGS.
WATER	5.6 KGS.
DEXTRINE*	900 GRAMS
SEA COAL*	1 KG.

* WHEN REQUIRED

6.4.2. WM Assessment Report for 4 Model Companies

(1) Kemwerke

1.0 INTRODUCTION

The Philippine Board of Investment (BOI) of the Department of Trade and Industry and the Japan International Cooperation Agency (JICA) are jointly pursuing Environmental Management with Public and Private Sector Ownership (EMPOWER) whose goal is to promote voluntary industrial environmental management (IEM) from all industrial sectors and disseminating the concept of IEM all over the Philippines.

One component of EMPOWER is the Waste Minimization Pilot Project (WMPP), which aims to integrate productivity and waste minimization by carrying out waste reduction assessment and planning in four key industry sectors:

- Food processing
- Foundries
- Pulp and paper
- Chemicals

The WMPP is a training cum technical assistance for local industries to promote waste minimization using a pool of experts and a network of industry associations. The Philippine Business for Environment (PBE) is the lead implementer of the WMPP and the Industrial Technology Development Institute (ITDI) of the Department of Science and Technology serves as the local partner organization.

One significant activity of WMPP is the conduct of one day WM Assessment to volunteer companies. The objective of the WM Assessment is to identify opportunities for reducing pollution using a waste management hierarchy in which waste minimization is the dominant component. Effective waste treatment and disposal are also important components of the hierarchy. The EM Assessment presents opportunities to implement low cost/no cost responses to waste management challenges.

On January 31, 2003, PBE, JICA and ITDI-DOST experts (Mr. Tanaka, Mr. Uchiyama and Ms. Ongo) conducted the one-day WM Assessment at Kemwerke, Inc. located at 233 AC. De Guzman St., Malibay, Pasay City. The WM Assessment Team worked closely with the Kemwerke, Inc. representatives to conduct the one-day WM Assessment and to develop waste minimization opportunities. By minimizing waste prior to treatment or disposal, a company can reduce the amount of waste entering the end-of-pipe treatment or disposal facilities (TDF). This can result to smaller, more efficient and less expensive TDFs. In addition, waste minimization saves raw materials and other resources.

At the start of the WM assessment, the Team met with company top management and key personnel to explain the purpose of the assessment and the type of assistance that EMPOWER is providing the company. The meeting was followed by a comprehensive walk-through at the facility to identify waste minimization opportunities. The walk through was followed by a meeting between the Waste Assessment Team and the key representatives from Kemwerke, Inc. to discuss the findings during the walkthrough. At the end of the one-day WM Assessment, the Team submitted to Kemwerke, Inc. top management the initial findings and recommendations.

The final version of these findings and recommendations are integrated into this WM Assessment Report. Information gathered before, during and after the one-day WM Assessment is summarized in this Report. The WM Assessment Report contains the following:

Section 2 Facility Description, Background and Process Flow
Section 3. Waste Stream Description and Current Waste Management Practices
Section 4. Recommended Waste Minimization Options
Section 5. Future WM Activities

2.0 FACILITY DESCRIPTION

2.1 Facility Background and Location

Kemwerke, Inc. (KWI) is a 100% Filipino-owned SME Corporation. The plant is occupying a lot area of 3,412 m^2 at 233 AC. De Guzman St., Malibay, Pasay City (see figure 1). It was established in 1983 to manufacture alkyd resin, polymerized vegetable oils, emulsion resins, saturated polyester, di-octyl phthalate, aluminum paste, penta ester, ester gum for the paint, ink and adhesive industry.

In 1998, a new product, No-bake Furan Resin, was introduced for the Metal Casting/Foundry Industry.

In the year 2000**,** Kemwerke used the locally available and abundant indigenous material like the coconut oil in the manufacturing of their main product the alkyd resin, also called Cocoalkyd Resin. Other products based on coconut are Coco Methyl Ester (CME), Coco Diethanol Amide (CDEA), Coco Mono Ethanol Amide (CMEA), used for the soap, shampoo and detergent industry.

On the same year, Kemwerke was awarded the global ISO-9002 standard certificate, assuring their customer of international standard products.

2.1 Facility Layout and Equipment

KWI facilities consist of three (3) Universal Reaction Kettles of varying capacities all equipped with controls necessary for the manufacture of its products. Administration building is also found inside the plant. The vacant space at the back of the warehouse building was occupied for the storage of raw materials and used containers while the wastewater treatment facility was constructed at the corner of this site. The plant layout of the company is illustrated in figure 2.

2.3 Process Description

The only product that will be discussed in this report is the production of coconut alkyd resin. Coconut alkyd resin is an environment-friendly synthetic polymer resin based on coconut oil and is combined with an alcohol and acid basically used in alkyd paints. Varying percentage of this resin in paints gives an excellent film properties, durable exterior oil paint or varnish, usually in gloss, which are easy to brush. They are fast drying and have good weather and abrasion resistance, as well as low permeability to water vapor.

The cocoalkyd resin is produced in batch reactor at 200-240 ºC for about 10-12hrs reaction-time. Manufacturing process consists of the following steps.

1. Polyol, polybasic acid, solvent, and catalyst are charged in an insulated universal reaction kettle.
2. Coconut oil is co-reacted with the polyhydric alcohol to extract the remaining water.
3. An inert gas such as nitrogen is introduced by bubbling it up through the mixture.
4. After cooking the completed alkyd is transferred to a thin-down tank where it is mixed with aliphatic solvents.
5. Waste solvents are steam-distilled for recovery.
6. The resin is then passed in a final filtering process to removed unwanted by-product.
7. The resultant polymer solution is filled into steel drums for storage and shipment.

Detailed process flow diagram of alkyd resin is presented in figure 3.

3.0 Waste Stream Description and Current Waste Management Practices

3.1 Waste Stream Description

Waste stream releases to the environment occurred at a number of stages along the production and distribution line. Empty raw material packages, spills, off-specification product, equipment cleaning wastes, and volatile organic compounds emission are the primary wastes associated in the process.

3.2 Solid Waste

The raw materials are usually packed in a small container such as drum, sack, carboys paper bag and others. After unloading process, leftover raw materials still remain inside the empty containers which some are classified as hazardous. This container is typically stored in an isolated place and returned back to the original raw material manufacturer, others are recycled and reused. Another concern of the plant is the accumulated solid waste that occupies ample storage area prior to disposal (see pictures below). Based on data, about 1,000 kg/month of waste paper bag was accumulated by the plant.

The used filter cloth is an additional waste generated in the process which requires extra attention for study. This waste is temporarily placed in a container and collected by interested user. The filter cloth waste serves as a start-up fuel in the cooking process.

Empty Containers of Raw Materials

Raw Materials Storage Area

3.3 Liquid Waste

After batch process, considerable amount of chemical left clinging inside the tank. Extensive washing of the tank is essential before starting the new product to prevent product contamination. Cleaning method uses solvent washing, caustic washing, and water washing. Equipment cleaning wastes are a dominant liquid waste stream in the process. About 468 m^3/yr of water is depleted for the equipment cleaning process.

Chemical spills are due to accidental or inadvertent discharges usually occur during loading and filling operations or equipment leaks. Spilled chemical and resulting clean up wastes are discharged to the wastewater abatement facility.

Spray water for nitrogen gas tank is another liquid waste generated in the plant. Cooling water in the process is continuously recycled since it is a non-contact water.

3.4 Air Emission

The potential sources of air emissions are the reactor kettles and filling station. Although synthesis takes place in a closed system, possible diffusion of volatile organic compounds to the atmosphere might occur during alkyd resin synthesis. The use of solvent as diluent for the resin is a major contributor of VOC emission.

3.5 Current Waste Management Practices

Kemwerke demonstrates a commitment in caring the environment by identifying, minimizing, reusing and treating all waste streams generated in the plant.

- Evaporated solvent in the reactor is collected, recovered and recycled as cleaning solvent.
- Fume scrubbers are installed near the universal reactor tank to protect the workers for any possible exposure to air emissions
- Solid waste generated is segregated and recycled
- Wastewater treatment facility is installed to address the liquid waste generated by the plant

4.0 Recommended Waste Minimization Options

In every endeavor made by the company, the main objective is to minimize the quality and quantity of waste generated hence reduce the associated problem in waste disposal and increase production efficiency. Despite such concerns, the team recommends additional measures that must be prioritized by the plant to demonstrate firm dedication and support in their goal of being an international standard company. Such waste minimization measures are presented in Table 6.4. 1 including the rationale and environmental impact.

Table 6.4. 1Waste minimization measures

Waste Minimization Options/Recommendations	Rationale	Environmental Impact
Establishing spill and leak control policy such as frequent scheduling of inspection and maintenance of equipment, pumps and pipelines and providing emergency responses and cleanup procedures in the event of accidental spills or leaks.	To avoid accidental or inadvertent releases of chemicals resulting to material losses and exposure of workers to hazard. Proper management of hazardous waste	Ensure safe workplace and avoid potential emission of hazardous chemicals to the environment

Waste Minimization Options/Recommendations	Rationale	Environmental Impact
Employing a mechanical devices such as rubber wiper in the reactor kettles	Recovery and recycling of residual resin inside the tank, production efficiency	Reduce the volume and concentration of wastewater to be generated in the equipment cleaning process
Maximizing the usage of the reactor to specific type of product or provide a reactor kettle that is dedicated to a certain product	Avoid regular cleaning of the kettle resulting to clean-up cost reduction	Reduce the volume of wash water to be generated
Recovery and recycling of nitrogen tank spray water or reuse treated water in this purpose	Savings on the consumption of water	No more liquid waste will be collected in this process
Attempt to rework or convert raw material containers to a safer material wastes by using a double packaging of hazardous chemicals (plastic bag first before paper bag)	To recycle and reuse the non-contact packaging material (paper bag) and washings of plastic bag can be collected and returned in the process	Reduce the volume of hazardous solid waste to be generated
Regular monitoring of volatile organic compounds emission specially xylene emission in the workplace	To ensure safety of the workers and monitor material losses	Ensuring that the exposure standards set by the government will not exceed in the workplace
Provide general ventilation and conservation vents in the production, bulk storage and filling stations	Provide safe workplace and lessen the possibility of direct inhalation of workers to solvent fumes	Implement treatment measures to ensure safe workplace and compliance to regulation
Improving or reorganizing existing storage area of raw materials by separating the hazardous to non-hazardous materials.	Avoid contamination of other materials and compliance to DAO 29	Prevent possible spills of hazardous chemicals

5.0 MONITORING AND TESTING REQUIREMENTS

To be able to track down the quality and quantity of wastes generated, the company shall conduct periodic monitoring. A source inventory of all types of wastes from the different processing areas through waste audit shall be done by composite sampling. By this way, the assessment team will be able to identify waste sources that are problematic and also they will be able to decide at what stage of the process waste minimization could be started. To know whether waste reduction has been achieved, measurement of water consumption and wastewater generation shall be done regularly. Benchmarking on every process shall also be made in order to identify which process has not made any progress in the waste reduction effort of the team. To know the quality of wastewater generated, the following physico-chemical parameters shall be determined: biological oxygen demand (BOD), chemical oxygen demand (COD), total suspended solids (TSS), alkalinity and pH. BOD, COD and TSS are measurements of the organic matter components of the wastewater. The greater the COD, BOD and TSS values, the higher is the pollutive property of the wastewater.

Also, for strict compliance to clean air act, much attention must be considered in monitoring the volatile organic compounds specially xylene emission in the workplace.

The cost of testing and analysis of samples is shown in Table 6.4. 2.

Table 6.4. 2 Cost of testing and analysis of samples

Parameters	Cost of Testing (Pesos)
BOD	P850.00
COD	P850.00
TSS	P420.00
Alkalinity	P420.00
VOCs	P2,500.00
(Air Sampling Fee)	(P8,200.00/man-day)

Testing and analysis of samples could be done by private and government laboratory. Currently, the Standard and Testing Laboratory (STD) of the Industrial Technology Development Institute (ITDI) does not conduct the above tests, which is delegated to private water quality laboratories.

6.0 ORGANIZATION OF WASTE MINIMIZATION TEAM

An in-house minimization team shall be organized to oversee all the activities in the implementation of the waste minimization program of the company. To generate a strong involvement among the personnel, team members must be selected from the different company's departments or processing sections. In this regard, the JICA-PBE-ITDI team will conduct an in-house seminar to discuss on how waste minimization program will be set-up in the company.

7.0 FUTURE ACTIVITIES

Table 6.4. 3Future activities

ACTIVITIES	TIME FRAME
1.In-depth assessment of foundry model company	3 months
2. In-house training	2 days
3. Organize in-house team	1 day
4. Facility walk through (for process validation)	2 days
5.Brainstorming and formulation of waste minimization options	1 day
6. Prioritization and Implementation of Options	Perpetual

Table 6.4. 4. Problems Encountered and Immediate Actions to be Taken

Problems Encountered	Causes	Immediate Actions to be taken by the Company	Suggested Solution by the ITDI Team	Status
1. Kettle 8				
▪ Solvent leak on the shafting	Loose shafting	Tighten the shafting	Replace the shafting with new one to prevent emission of solvent	Repaired (Tighten the shafting)
▪ Vibration of Shafting during Start-up operation	Mechanical problem	To be repaired immediately	This probable due to the loose shafting. It is necessary to replace the loose shafting with new one to permanently fix the shafting.	Repaired (Tighten the shafting)
▪ Leakage on the Pipeline from the decanter tank	Wastewater passing through the pipeline is too acidic	Repair the leakages	Adjust the pH by installing a neutralization tank after the decanter tank to avoid pipeline	Repaired (Replaced the pipe)

Problems Encountered	Causes	Immediate Actions to be taken by the Company	Suggested Solution by the ITDI Team	Status
to the wastewater Holding tank	which causes the material to corrode		damage	
▪ Leak in the condenser line (exhaust)	The material is made of GI sheet only. Aside from this, the probable cause may be due to pressure drop when the two kettles are operated both at 400 ℃	Replace the condenser line with other suitable materials probably stainless steel	Use a stainless steel material for the condenser line to avoid any obstruction in the system	Prevented the leak by operating one kettle at lower temp. about 350 ℃ while the other is at normal temp. of 400 ℃
▪ Leaks in the storage tank of dirty solvents	Worn out tank already	For replacement	Replace with new tank, choose a material that is highly resistant to solvent and corrosion.	Replaced with new tank
▪ Waste solvents and diesel can not be re-used as fuel	The draw off diesel in the tank contains water and other contaminants	Cover the day tank to prevent contamination	Handle waste solvent properly by providing cover and catchment for spills. To re-use this waste, transfer the upper layer (oil) to another tank to remove the water and residue at the bottom.	Removed the water and other contaminants and provided cover of the tank.
2. Kettle 9 Portion of Solvent (SMT) Rinsing still retain in the reaction kettle	The pump at the bottom of the reactor tank is not sufficient to transport the liquid to the another tank	Lower the suction point or temporarily transfer the remaining solvent rinsing to the thinning tank manually	Transfer the rinsing solvent by pump rather than by hand to reduce the chances of inadvertent spillage and direct exposure to solvent. Install a high capacity suction pump that can fully drain and transport the solvent to the thinning tank.	The remaining solvent cleaning is transferred manually in the thinning tank
3. Kettle 10 Leakage around the crown of the reactor	Old unit	For replacement	Select a new unit with better gasket around the crown of the reactor, use a Teflon gasket.	Requisition of new reactor tank has been made and delivery of unit is expected by June
4.Warehouse ▪ Leakage in the Coco fatty totes	Old unit	To be repaired and addition unit to be fabricated	Immediate repair of the coco fatty totes	Cleaned and fixed the unit
▪ Storage tank of Coco fatty oil is not	Permanently located outside the production	To be relocated near the production area	Relocate and provide container jacket wherein hot water can pass	KWI is planning to fabricate jacketed storage

Problems Encountered	Causes	Immediate Actions to be taken by the Company	Suggested Solution by the ITDI Team	Status
installed in a proper location	area		through to prevent solidification of the fatty oil and ease in the transportation of fatty oil.	tank to maintain the coco fatty oil in liquid form.

(2) Noah's Paper Mills

(3) TSB Enterprise, Inc.

(4) Acetech Metal Casting Inc.

6.4.3. WM Assessment Reports for Sixteen (16) Volunteer Companies

(1) Cebu City District

1. Cebu Legacy Marketing Corporation (Cebu Legacy)

1.0 Facility Lay-Out and Equipment

The following equipment/facilities are used for the production of dried mangoes:

- Stainless tables for peeling and slicing mangoes
- Kettles and stoves for the preparation of syrup
- Drying trays
- Dryers with LPG as fuel

2.0 Process Description

The major raw materials for the production of dried mangoes are mango and sugar. The fresh mangoes are delivered to the plant contained in reusable plastic cases. About one ton of mangoes are washed manually using about 500 gallons or 1,900 liters of water per day. Peeling and slicing are done manually. Syrup is prepared by mixing and cooking sugar and water. LPG is used as fuel for cooking. Syruping of the flesh of mangoes takes about 30-45 minutes per batch after which the syrup is drained. About 1,000 gallons per day of water is consumed as process water. The mangoes are spread in trays and dried in dryers at 65-70 ^{o}C temperature. The fuel of the dryer is LPG. The drying usually takes about 1.5 days or until the moisture content of the mango ranges from 12-15 %. The dried mangoes are packed manually in plastic bags and ready for marketing.

The process flow diagram for the production of dried mangoes is shown in Fig. 6.4. 1

3.0 Waste stream description and current waste management practice

The major solid and liquid wastes generated during the production of dried mangoes and discussed below.

◇ Solid Wastes

Mango peelings and seeds (fruit pit) are the major solid wastes generated during the production of dried mangoes. These wastes comprise about 35 % of the weight of fresh mangoes. Currently, these wastes are disposed in a controlled dumpsite located within the property of Cebu Legacy. In addition, Cebu Legacy also generates spent packaging materials, which they sold to buyers.

◇ Liquid Wastes

Cebu Legacy generates three major liquid wastes: spent fruit wash water, general cleaning water, and spent syrup. Spent wash water and general cleaning water comprise the effluent of Cebu Legacy. Spent wash water is generated from the mango washing process.

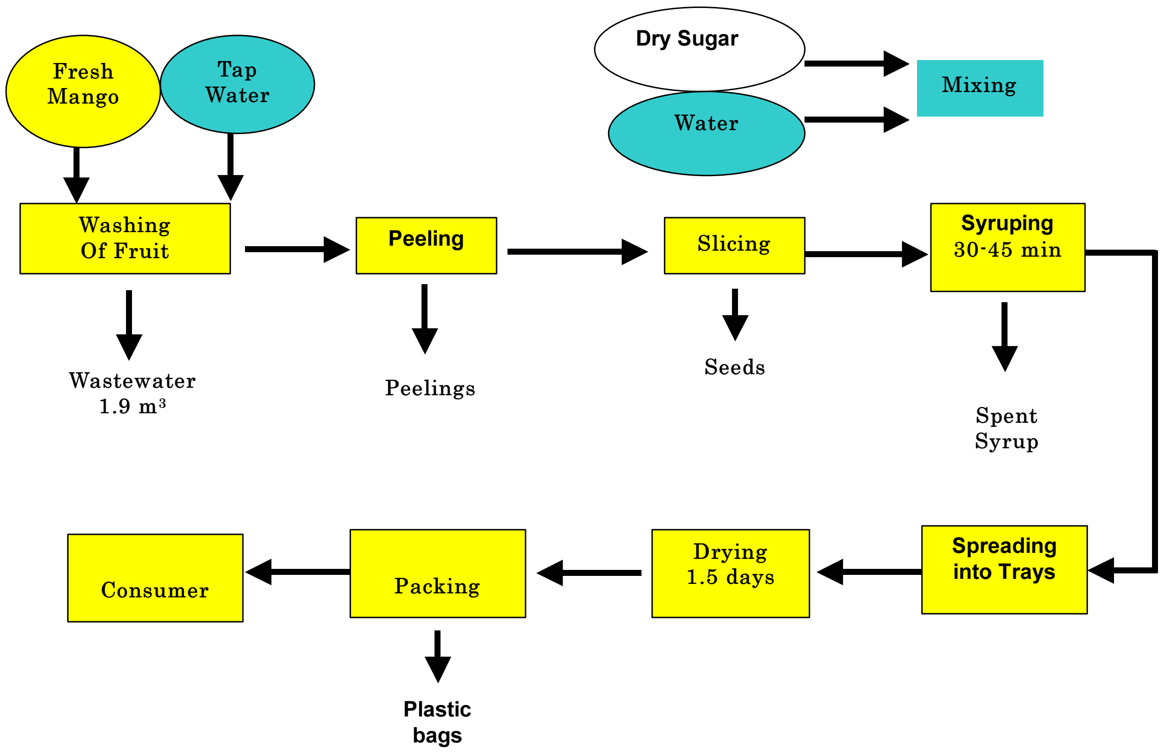
The general cleaning water, which is used to clean the process equipment, contains chlorine. Around 30 ppm chlorine is added to the wash water for every equipment cleaning.

Table 6.4. 5.shows the volume of generation per day of operation.

Table 6.4. 5.Various Wastewater Generated

Sources	**Volume (m^3 per day)**
Washing of mangoes	1.9
Wash water	1.9
General cleaning	0.19
Total	**3.99**

Fig. 6.4. 1Process Flow Diagram



The combine wastewater passes through a series of screens and contained in a 2-chamber 9 m3-septic tank (3 x 3 x 3). With an estimated 4 m^3/day discharge, the wastewater's retention time in the septic tank is approximately 2.25 days.

The septic tank's effluent after passing through an open channel designed to have a semi-cascading effect flows by gravity to Butuanon River. The estimated biochemical oxygen demand (BOD) of wastewater (influent) is 300 to 400 ppm, which exceeds the BOD standard for Class C waters.

The other liquid waste that Cebu Legacy generates is the spent syrup. Spent syrup are contained in 210-L drums inside the processing area and sold to buyers when enough volume is achieved.

◇ Air Emissions

Air emission from the plant is minimal. The potential source of air emission is the cooking and drying process. The fuel used for these processes is liquefied petroleum gas (LPG). The plant consumes about 3,000 kg LPG/month. Gas emissions from LPG are relatively clean.

◇ Current Waste Management Practices

The management of Cebu legacy, under the leadership of Ms. Gaw, has been planning and implementing waste minimization efforts. A number of cost-reducing waste minimization practices have already been planned for implementation, pending budget allocation. This includes:

- Use of sprayer or sprinkler in the mango washing process
- Mechanize the transfer of fruit from one process to the next
- Use of spent wash water to clean the floor
- Composting of the solid wastes

In addition, Cebu Legacy is already implementing the use of plastic cases for transporting and storing mangoes. These are reusable and eliminate the use of wooden crates or baskets, which become solid wastes.

4.0 WM Recommendation

The following options are recommended for the management of wastes generated by the processing plant of Cebu Legacy (Table 6.4. 6).

◇ Waste Minimization Options

Table 6.4. 6 Waste Minimization Options

Option	Rationale	Expected Impact
1. Implement a system to allow the continuous use of the syrup, instead of one time use.	Although the spent syrup is being sold, maximizing its service can reduce time, labor, materials, and energy in preparing the syrup.	Reduce raw material inputs and waste.
2. Recycle wash water: use of countercurrent washing.	Countercurrent washing is more efficient than washing with the current of water.	Significantly reduce water consumption and wastewater generation. However, the quality of recycled water must be monitored to prevent bacteria growth.

Option	Rationale	Expected Impact
3. Recycle water used in the spreading of trays.	This water is relatively clean and can still be used in other process that have less stringent water requirements	Significantly reduce water consumption and wastewater generation. However, the quality of recycled must be monitored to prevent bacteria growth.
4. Study the utilization of mango peelings as livestock feed or compost material. Collaborate with piggeries and other livestock companies within the area for possible use of peelings.	Utilization of waste eliminates waste.	Eliminate the current practice of dumping the waste in the backyard, which causes emission of odor. However, this may take a substantial investment.
5. Conduct R&D for the potential use of mango seeds.	Utilization of waste eliminates waste.	Aside from eliminating the current practice of dumping waste in the backyard causing emission of odor, action has potential to generate additional revenues. This needs further study.
6. Encourage the immediate collection of spilled mango parts to prevent them from mixing with water thereby adding to the organic load of the wastewater.	The meat, peel, and/or peel of mangoes are highly organic. Preventing these from mixing with water can reduce organic load.	Reduce organic load to the septic tank. This may require employee training and constant supervision.
7. Monitor the wastes from each process	The information derived from monitoring will help in identifying options for waste minimization and planning for the new plant/expansion.	Improve and sustain the waste minimization program in the company.

◇ Wastewater Treatment Options

Although the focus of this activity is assessing waste minimization opportunity, the Team was also able to identify practices or opportunities where Cebu Legacy can enhance its over-all waste management practices, including improving the operations of their wastewater treatment process (Table 6.4. 7).

Table 6.4. 7Wastewater Treatment Options

Options	Rationale	Expected Impact
1. Divert chlorinated from septic tank and channel it to tank beside the septic tank. Let the water from the septic tank flow into the tank with chlorinated water.	Chlorinated water might kill the microorganisms in septic tank and reduce its efficiency in the biodegradation of organic pollutants in the wastewater.	Improve the efficiency of the septic tank in the biodegradation of organic pollutants. Reduce further the BOD. Disinfect the wastewater prior to its discharge to the creek.
2. Segregate waste streams	Various waste streams may need different strategies for waste management	Improve waste management.

5.0 Future WM activities

The recommended waste minimization options developed for Cebu Legacy was the result of the rapid one-day WM assessment. It is highly recommended that a more comprehensive assessment be conducted in support to what the EMPOWER WM Pilot Project has initiated. In preparation and in support to this endeavor, the team is recommending some post WM assessment activities. The succeeding sections present these activities.

◇ Monitoring And Testing Requirements

One critical aspect of WM is monitoring. The monitoring process helps the company track down and record progress in their WM implementation. For Cebu Legacy, it can start by performing a more comprehensive source inventory of all types of wastes from the different processing areas. This can be done through waste audit.

In addition, the assessment team will be able to identify waste sources that are problematic and decide at what stage of the process waste minimization could be started.

The Team encourages CEBU LEGACY to establish benchmarks or performance indicators. The following performance indicators can be used by CEBU LEGACY in their monitoring process:

- Volume of water use per metric ton of production (m3/MT)
- Volume of wastewater generated per metric ton or production (m3/MT)
- Quantity of chemicals per metric ton of production (kg/MT)
- Pollution load per ton of production (ex: kg BOD/MT product)

Benchmarking on every process will help CEBU LEGACY identify which process has made significant progress in the waste reduction effort.

To establish the quality of wastewater generated, the following physico-chemical parameters are suggested to be periodically monitored both in the influent and effluent: biological oxygen demand (BOD), chemical oxygen demand (COD), total suspended solids (TSS), alkalinity and pH. BOD, COD and TSS are measurements of the organic matter components of the wastewater. The greater the COD, BOD and TSS values, the higher are the pollutive property of the wastewater.

6.0 Organization Of Waste Minimization Team

To ensure sustainability, an in-house waste minimization team shall be organized to oversee all the activities in the implementation of the waste minimization program of the company. To generate a strong involvement among the personnel, team members must be selected from the different company's departments or processing sections.

7.0 Implementation Schedule

The activities listed in **Table 6.4. 8** presents the short and medium term actions that CEBU LEGACY can do to support the WM activities initiated though the WMPP. These activities will also help CEBU LEGACY sustain WM in the plant.

Table 6.4. 8 Short and Medium Term Actions

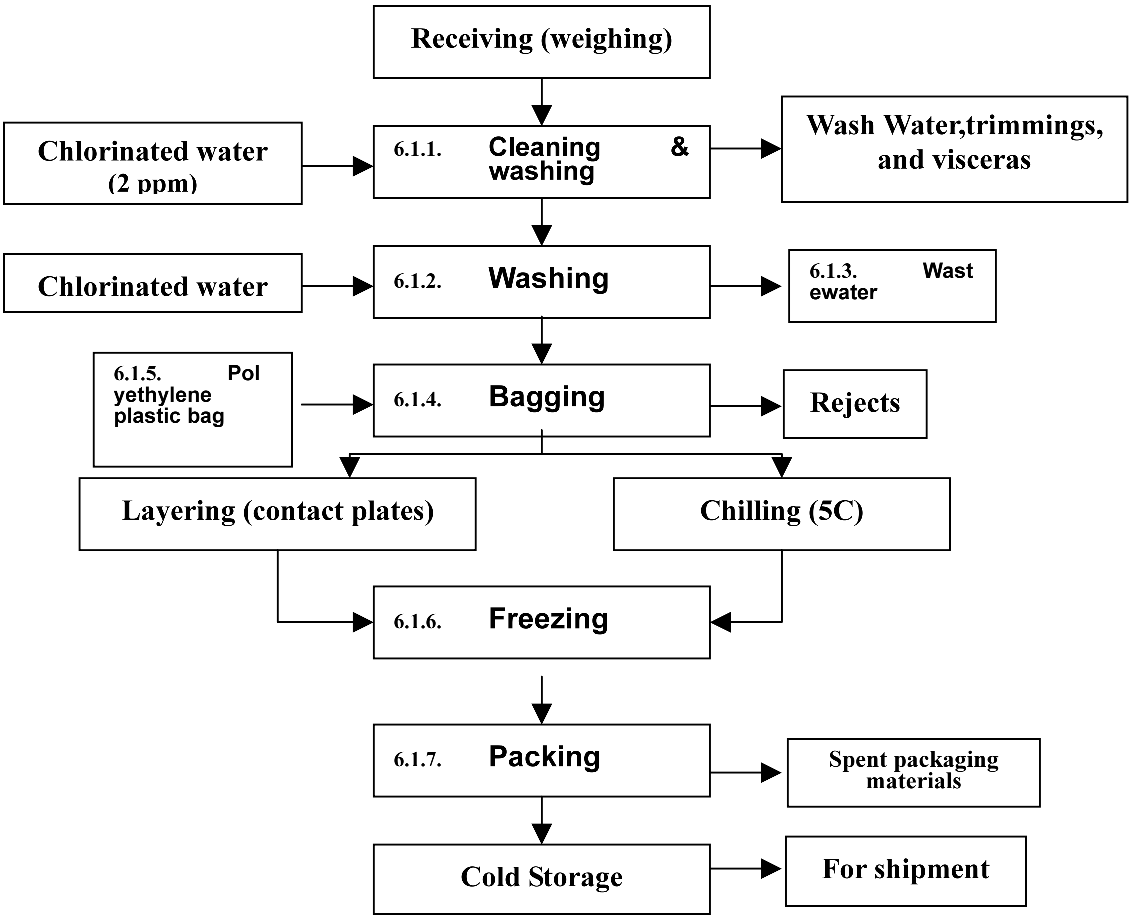
ACTIVITIES	TIME FRAME/DURATION
1. In-house training	Immediate/2 days
2. Organize in-house team	Immediate/1 day
3. In-depth WM assessment	1 to 3 months/2 to 3 days
4. Benchmarking/establishing performance indicators	1 to 3 months/2 to 3 days
5. Facility walk through (for process validation)	1 to 3 months/2 days
6. Brainstorming and formulation of waste minimization options	1 to 3 months/1 day
7. Prioritization and Implementation of Options	1Continuous

2. Central Seafood, Inc.

◇ Octopus Processing

When the fresh octopuses are received at CSI, they are then weighed, cleaned by removing the visceral organs and washed with water then disinfected with 10 ppm of chlorine solution. After which, they are then placed in polyethylene plastic bags for cooling. CSI employs two methods for cooling: layering using contact plates and chilling (5 ^{o}C). The layering method is prioritized over the chilling. Chilling is only used when the layering plates are full. After this cooling process, the products undergo subsequent freezing and then packed and then ultimately placed in the cold storage.

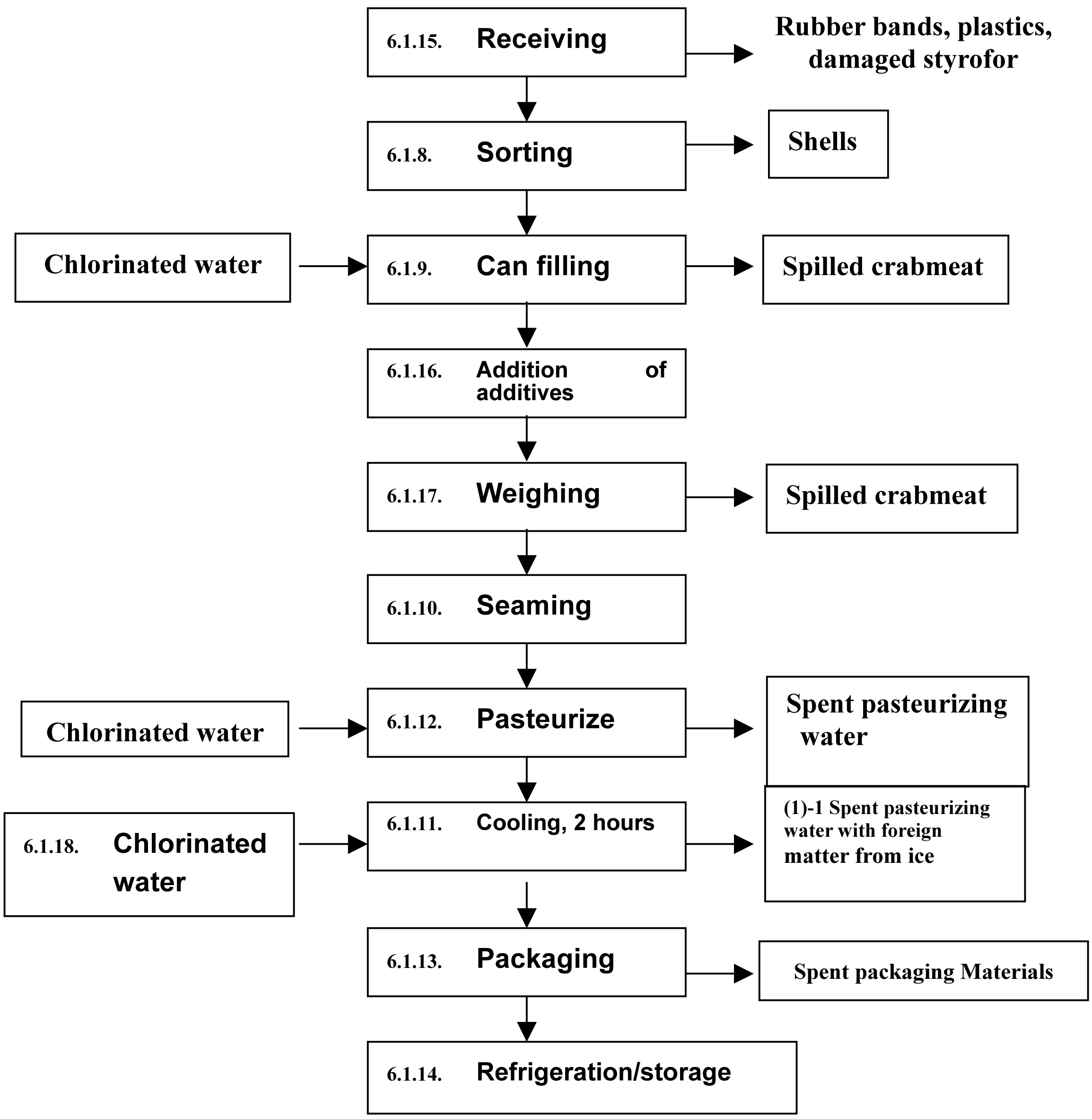
Fig. 6.4. 2. Octopus Processing Flow Diagram



◇ Crabmeat Processing

Crabmeat in canisters, which are pre-cleaned in Bantayan, Cebu is received at the CSI. Impurities such as bits of shells, rubber bands, plastics and pieces of styrofor that are mixed with the product are removed. Chlorinated water and additives like color enhancer, citric acid, sodium acid pyrophosphate are added. Then 1 lb is weighed from the mixture and packed in several plastic bags. Pasteurization of crabmeat is done in one hour and 65 minutes at $155^{o}C$. After pasteurization, the crabmeat is cooled for 2 hours at $0^{o}C$ to $3^{o}C$ using deep well water with crushed ice. The product is refrigerated at $34\,^{o}C$ to $47\,^{o}C$ prior to export.

6.4.4. **Fig. 6.4. 3 Crabmeat Processing Flow Diagram**



1.0 Waste Stream Description and Current Waste Management Practices

◇ Solid Wastes

The common solid wastes generated in bulk volume are the silicon rubber trimmings, spent ceramic and rubber moulds. Other wastes are found in the polishing and finishing operations such as scrubbing pads, sand paper, cartons, cotton gloves, steel brush and metal dust. Modeling wax is recovered and recycled to produce another carving. Most wastes except metal dust, spent ceramic moulds and slag are disposed as garbage. Accumulated metal dust and slag are sold to scrap buyer while spent ceramic and rubber moulds and trimmings are identified as the most pressing waste problem. The volume of some solid wastes generated in the plant is shown in Table 6.4. 9

Table 6.4. 9. Type and Volume of Solid Wastes Generated

Type of Solid Waste	Volume of Solid Waste Generated
Scrubbing Pad	200 pcs/month (2kg/month)
Steel Brush	60 pcs/month (3 kg/month)
Sand Paper	3,000 sheet/month

Type of Solid Waste	Volume of Solid Waste Generated
Cartons	50 kg/month
Cotton Gloves	1000 pcs/month
Silicon cuouts	“not yet quantified”
Spent ceramic molds	“not yet quantified”
Slags	“not yet quantified”

◇ Liquid Wastes

The main source of liquid wastes is the dewaxing process wherein non-contact cooling water is directly discharged to the canal. This waste stream has high temperature and is relatively clean.

Chemical spills, water runoff from cleaning process also contributed to the liquid wastes generated by the plant. These liquid wastes are also discharged directly to the canal.

San Gabriel has no facility to treat wastewater. The restraining factor in not investing into this is that San Gabriel is renting the building and other facilities where they have their operation. Even process improvement that may require permanent fixture may not be viable at this time due to this situation.

◇ Air Emission

The major sources of air emissions came from vapors from metal melting and airborne dust in the pouring, shakeout, polishing and finishing processes. The use of solvents and other chemicals in the finishing section also emitted volatile organic compounds (VOCs) to the environment.

As of this time, the plant has not characterized and documented the wastes generated in the production process and there is no pollution abatement device installed within the workplace except for the dust collector. Chimney is also mounted in the metal melting process.

2.0 WM Recommendation

The following Table 6.4. 10. presents the recommended waste minimization options to manage the wastes generated by the processing plant of San Gabriel. These recommended options can also be used by San Gabriel when they transfer to a more permanent plant location.

Table 6.4. 10.Recommended Waste Minimization Options

Waste Minimization Options/Recommendations	Rationale	Expected Impact
Provide scrubber in the melting process of metal	To ensure safe workplace	To prevent emissions of smokes and hazardous gases within the plant
Recirculate cooling water in the dewaxing process.	Reduce water consumption	No wastewater will be discharged in this process
Sand reclamation from the spent ceramic shell mould	Material recovery and reduce solid waste disposal problem and cost	Generated solid waste will be minimized
Improve he storage area of solvents and other chemicals	To properly handle hazardous and non-hazardous materials	Prevent possible chemical spills in the workplace
Provide ventilation and conservation vents in the finishing section	To ensure workers safety	To prevent direct exposure of workers to solvent and chemicals
Regular monitoring of volatile	To properly monitor material	Ensuring that the exposure limit set by

Waste Minimization Options/Recommendations	Rationale	Expected Impact
organic compounds (VOC's)	losses and air emissions in the plant	DENR will not exceed in the workplace
Optimize the recycling of wax	Improving the collection system can still increase the current 80% recycling efficiency.	Minimize wasted wax.
Properly segregate and venture into recycle opportunities for the following solid wastes: • Spilled sand • Ceramic duct • Spent sand paper • Damaged packaging materials • Used steel brush • Used plastic brush • Used scrubbing pads	These solid wastes are currently accumulated within the site. Others like ceramic shells and dust are used as landfill materials. Exploring the opportunity for reselling has potential for additional revenue that may be used as positive reinforcement for the waste minimization team and help WM in the plant.	Minimize waste Utilization of waste and save on costs. Generate revenues from wastes
Optimize the use of finishing chemical solutions by regularly monitoring its quality and extending its bath life	The finishing chemical solutions are directly discharged to the drainage canal. Optimizing this, if possible zero draining, can reduce chemical consumption and more importantly, eliminate the discharge of hazardous wastes into the environment, thereby improving compliance.	Eliminate the discharge of hazardous materials. Minimize chemical consumption and costs.
Recover heat from the dewaxing process to: ▪ Preheat the boiler ▪ Preheat the caustic soda cooking	This may entail investment for the piping and heat exchanger systems	Save energy and costs
Recover waste steam and use as boiler feed water.	This option is dependent on the quality of the waste steam water and the water quality criteria of the boiler feed water. If the boiler feed water can accept the quality of the waste steam water, this option is most viable because the boiler is located near the dewaxing. Initial investment would probably only require holding tank, pipes and pumps.	Savings in water and energy. The most significant environmental impact is the elimination of discharging very high temperature waste stream in the receiving body of water – thereby preventing thermal pollution.
Change schedule of operation. Accumulate more molds for casting and make more castings per day.	Initial heating of melting furnace takes a long time and without output. But the subsequent melting takes a shorter time. Reducing the initial heating by making more melting per day will save fuel and energy.	Save on fuel, energy, and costs.

2.0 Future WM activities

The recommended waste minimization options developed for SAN GABRIEL were the result of the rapid one-day WM assessment. It is highly recommended that a more comprehensive assessment be conducted in support to what the EMPOWER WM Pilot Project has initiated. In preparation and in support to this endeavor, the team is recommending some post WM assessment activities. The succeeding sections present these activities.

3.0 Monitoring And Testing Requirements

One critical aspect of WM is monitoring. The monitoring process helps the company track down and record progress in their WM implementation. For SAN GABRIEL, it can start by performing a more comprehensive source inventory of all types of wastes from the different processing areas. This can be done through waste audit.
In addition, the assessment team will be able to identify waste sources that are problematic and decide at what stage of the process waste minimization could be started.

The Team encourages SAN GABRIEL to establish benchmarks or performance indicators. The following performance indicators can be used by SAN GABRIEL in their monitoring process:

- Volume of water use per metric ton of production (m3/MT)
- Volume of wastewater generated per metric ton or production (m3/MT)
- Quantity of chemicals per metric ton of production (kg/MT)
- Pollution load per ton of production (ex: kg TSP/MT product)
- Solid wastes generated per ton product (ex. Kg slags/MT product)

Benchmarking on every process will help SAN GABRIEL identify which process has made significant progress in the waste reduction effort.

To know the quality of air emission, the following parameters will be determined: total suspended particulates (TSP), sulfur dioxides (SO2), oxides of nitrogen (NOx) and lead

4.0 Organization Of Waste Minimization Team

To ensure sustainability, an in-house waste minimization team shall be organized to oversee all activities in the implementation of the waste minimization program of the company. To generate a strong involvement among the personnel, team members must be selected from the different company's departments or processing sections.

5.0 Implementation Schedule

The activities listed in presents the short and medium term actions that San Gabriel can do to support the WM activities initiated though the WMPP. These activities will also help San Gabriel sustain WM in the plant.

Table 6.4. 11. Short and Medium Term Actions

ACTIVITIES	TIME FRAME/DURATION
1) In-house training	Immediate/2 days
2) Organize in-house team	Immediate/1 day
3) In-depth WM assessment	1 to 3 months/2 to 3 days
4) Benchmarking/establishing performance indicators	1 to 3 months/2 to 3 days
5) Facility walk through (for process validation)	1 to 3 months/2 days
6) Brainstorming and formulation of waste minimization options	1 to 3 months/1 day
7) Prioritization and Implementation of Options	1Continuous

3. Cebu Iron Foundry Corp.

Fig. 6.4. 4. Layout of Office and Plant

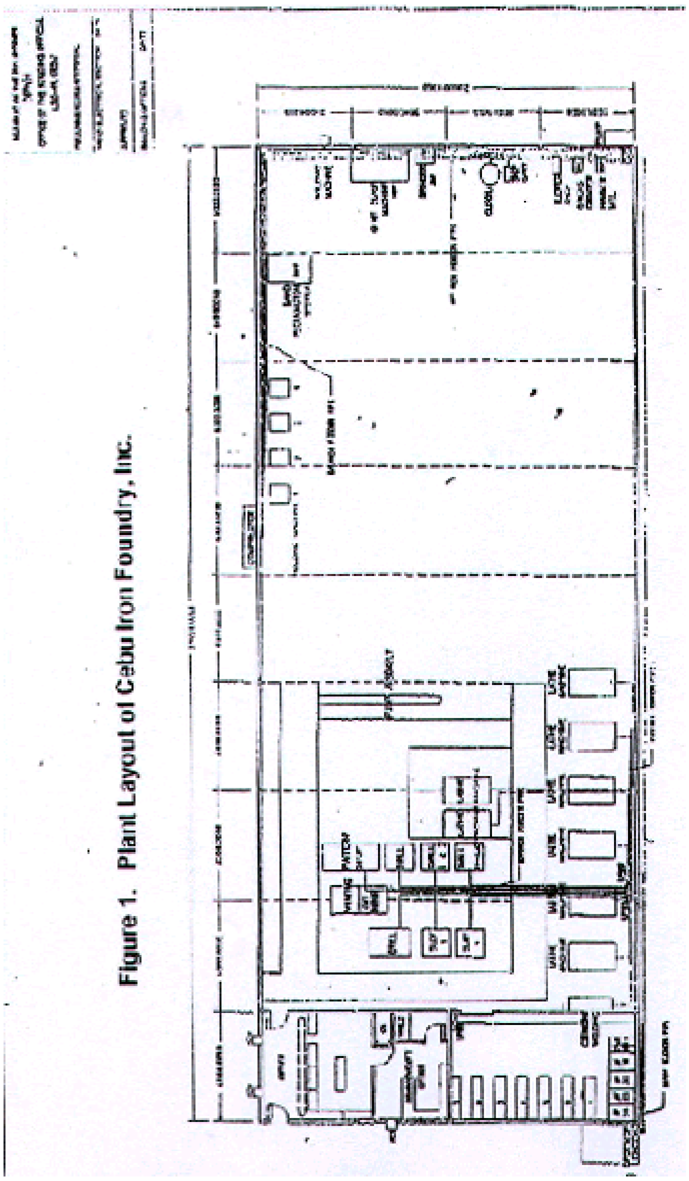


Fig. 6.4. 5. and
Fig. 6.4. **6** show the production block diagram and the material process flow chart, respectively, of the company.

Fig. 6.4. 5. Production Block Diagram

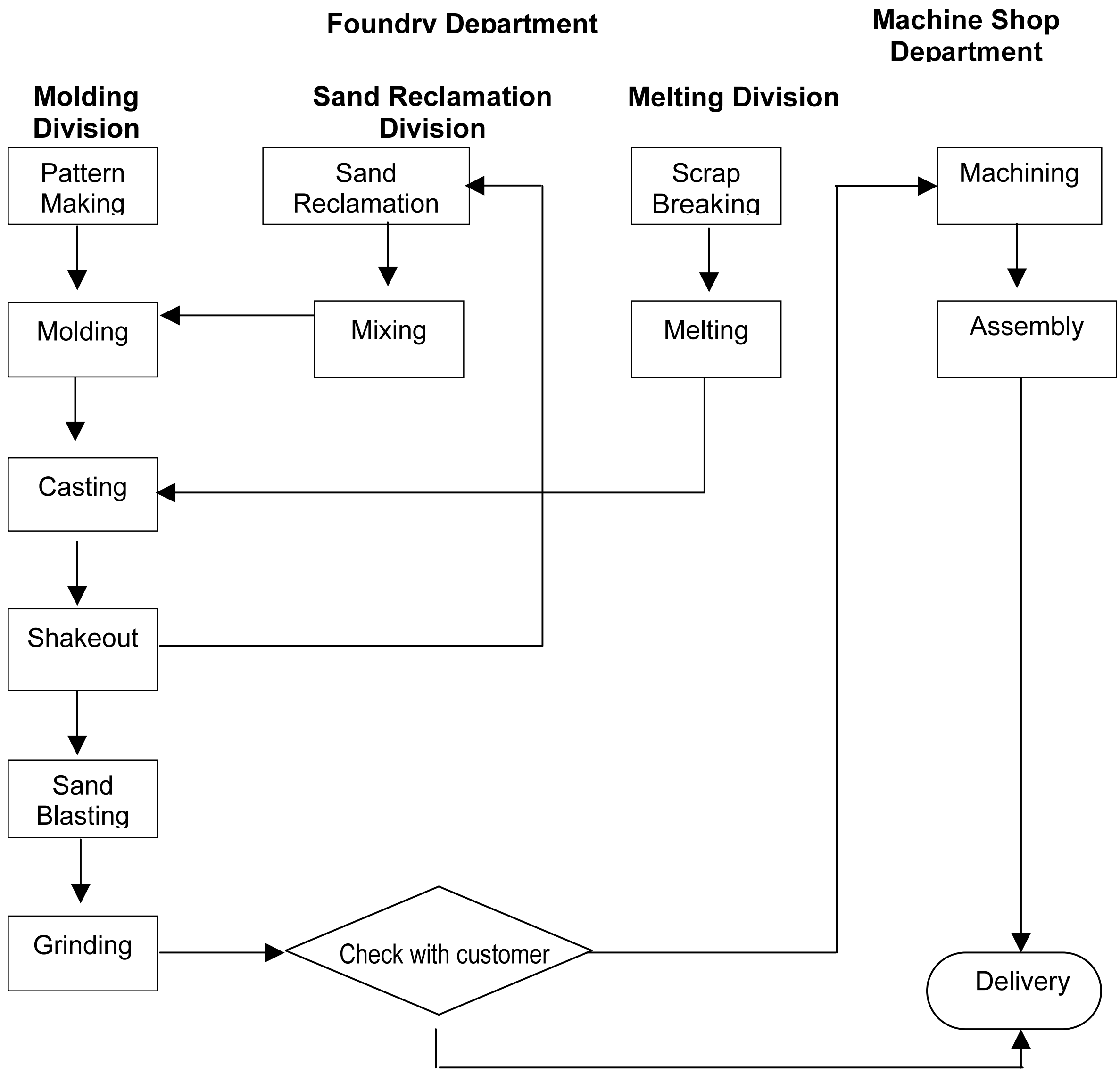


Fig. 6.4. 6. Material Process Flow Chart