Appendix 1

Worksheet 1

Company:	Input Materials	Date: *3-12-1997*
Don Brake (M) Sdn Bhd	Summary	

	Description of Input Materials				
Name/ID	*Asbestos*	*Glass Fiber*	*Friction Dust*	*Rubber Crumb*	*Barytes*
Form:	*Light fiber*	*Light fiber*	*Light fiber*	*Granular*	*Fine particles*
Hazard Potential: [1] Animal Toxicity Inhale Oral Skin	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Annual consumption rate (kg/annum)	*39,105*	*7,820*	*18,025*	*44,380*	*192,200*
Purchase price (RM/kg)	*1.25/kg*	*14.18/kg*	*4.90/kg*	*2.07/kg*	*0.73/kg*
Annual cost (RM)[2]	*48,881.25*	*110,887.6*	*88,322.5*	*91,866.6*	*140,306*
Delivery mode	*Lorry*	*Lorry*	*Lorry*	*Lorry*	*Lorry*
Shipping container type[3]	*Plastic bag*	*Plastic bag*	*Plastic bag*	*Plastic bag*	*Paper bag*
Storage mode[4]	*Warehouse*	*Warehouse*	*Warehouse*	*Warehouse*	*Warehouse*
Transport mode [5]	*Forklift*	*Forklift*	*Forklift*	*Forklift*	*Forklift*
Empty container disposal /management [6]	*Landfill*	*Landfill*	*Landfill*	*Landfill*	*Landfill*
Expected shelf live	*>5 years*	*>5 years*	*>5 years*	*>5 years*	*>5 years*
Level of inventory maintained on site	*≈15%*	*≈15%*	*≈15%*	*≈15%*	*≈15%*
Would suppliers - accept expired material? - accept shipping container? - revise expiration rate?	*No* *No* *No*	*No* *No* *No*	*No* *No* *No*	*No* *No* *No*	*No* *No* *No*

1 Indicate Yes or No
2 Based on actual usage on 1998
3 e.g. 002 drums, paper bags, tanks, etc
4 e.g. outdoor, warehouse, underground, above ground etc
5 e.g. pump, forklift, pneumatic transport, conveyor, etc
6 e.g. crush and landfill, clean and recycle, return to supplier, etc

Worksheet 2

Company: Don Brake (M) Sdn Bhd	Products Summary	Date: *3-12-1997*

Attribute	Description
Name of product	*Brake lining*
Annual production rate (pcs/year)	*≈ 0.5 million pieces*
Annual revenues (RM)	*≈ 24 million*
On site storage mode[1]	*Warehouse*
Shipping container size and type[2]	*Wrapped by plastic bag and put into carton*
Shipping mode[3]	*Forklift*
Containers returnable? (Y/N)	*No*
Shelf life	*> 10 years*
Rework possible? (Y/N)	*Yes*
Would customer - relax specification? (Y/N) - accept larger containers? (Y/N)	 *No* *No*

1 e.g. outdoor, warehouse, underground, above ground, etc

2 e.g. 002 drums, paper bags, tanks, etc

3 e.g. pump, forklift, pneumatic transport, conveyor, etc

Worksheet 3

Company: Don Brake (M) Sdn Bhd	Waste Stream Assessment	Date: *3-12-1997*

A. Waste Generation

1. Process unit / operation *Brake lining production line.*

2. Waste stream identification *Cutting, Grinding, Drilling, Chamfering.*

3. Waste leaves the process as

( ) Air emission ( ) Wastewater

(✓) Solid waste ( ) Hazardous waste

4. Is the waste mixed with other waste? ( ) Yes (✓) No

(If the answers is yes, fill out a sheet for each of the individual waste streams)

5. Describe how the waste is generated.

The waste is generated during cutting, grinding, drilling and chamfering of the brake lining dust.

B. Waste Characteristics

(Attach additional sheets with composition data, as necessary)

1. Type

( ) Gas ( ) Liquid (✓) Solid ( ) Mixed ( ) Sludge

2. Generation rate

Annual : *318.25 metric tonne/year*

Max : *31.33 metric tonne/month*

Average: *26.52 metric tonne/month*

3. Occurrence ( ) Continuous

(✓) Discrete

( ) Periodic (length of period: _____)

( ) Sporadic/irregular

( ) Non-recurrent

4. Physical appearance

Light fiber and fine particles in greyish color.

5. Chemical components

Contains of heavy metals: Barium, Chromium, Plumbum, Zinc, Copper, Ferum.

organic : Phenol, Formaldehye.

6. Behavior of waste in environment. Please comment on how the waste may behave and affect the environment once it is released. Discuss which of the following apply.

Toxicity/Health Hazard:

Cause lung cancer if exposed for long period.

Biodegradability

N/A

Tendency to accumulate, persist or magnify in the food chain

N/A

Synergistic effect

N/A

Overall environmental risk

Contains of toxic heavy metals and organics, may contaminate ground water if not properly disposed.

C. Waste Management

1. Applicable regulations

Environmental Quality (Scheduled Wastes) Regulations, 1989; First Schedule (Regulation 2), Part 1 Section 20 and Part 2 Section 16.

2. Disposal frequency

Collection of brake lining dust was carried out twice a month.

3. Describe how the waste leaves the site

The brake lining dust are packed in plastic bag and then put into metal drum.

4. Recycling

Is the waste recycled? ( ) Yes (✓) No

If "Yes", please describe the recycling process (e.g. re-use, energy recovery, etc)

There is potential for recycling. Further investigation needs to be carried out.

Is any reclaimed material return to the site?

( ) Yes (✓) No ( ) Used by others

Residue yield *N/A*

Residue disposal *N/A*

5. Waste treatment:

( ) Biological ( ) Precipitation

( ) Oxidation/Reduction ( ) Solidification

( ) Incineration ( ) Evaporation

( ) Neutralization (✓) Other (please describe)_____

6. Final waste receptor and mode of deposition

( ) Landfill ( ) River or ocean

( ) Pond ( ) Atmosphere

( ) Lagoon ( ) Sewer

( ) Deep well (✓) Other (please describe)
(Storage in metal drum)

7. Over-all cost:

Cost Element	Unit Price (RM)
Plastic bag	*1.50/bag*
Metal drum	*15/drum*
Transportation fee	*67/metric tonne*
Disposal fee	*495/metric tonne*

Appendix 2

Dust Ratios	Leachability Indices					
	Ba	Cr	Zn	Pb	Cu	Fe
Cement:Dust						
(60:40)	7.6 ± 0.0	9.3 ± 0.3	8.4 ± 0.1	8.7 ± 0.1	9.1 ± 0.1	9.0 ± 0.1
(50:50)	7.7 ± 0.1	9.1 ± 0.3	8.3 ± 0.1	8.6 ± 0.1	9.0 ± 0.1	8.9 ± 0.1
(40:60)	7.9 ± 0.0	8.9 ± 0.3	8.2 ± 0.2	8.4 ± 0.1	9.1 ± 0.4	8.7 ± 0.1
(30:70)	8.0 ± 0.0	8.7 ± 0.2	8.1 ± 0.2	8.3 ± 0.1	8.8 ± 0.1	8.6 ± 0.1
AC:Cement:Dust						
(4:56:40)	8.3 ± 0.1	9.6 ± 0.2	9.0 ± 0.1	9.2 ± 0.2	9.6 ± 0.1	9.4 ± 0.1
(5:45:50)	8.5 ± 0.2	9.3 ± 0.1	8.9 ± 0.2	9.0 ± 0.1	9.4 ± 0.1	9.4 ± 0.1
(6:34:60)	8.7 ± 0.1	9.1 ± 0.1	8.7 ± 0.1	8.9 ± 0.1	9.3 ± 0.1	9.2 ± 0.1
(7:23:70)	8.8 ± 0.1	8.9 ± 0.1	8.7 ± 0.1	8.7 ± 0.1	9.1 ± 0.1	9.1 ± 0.1
Polymal:Dust						
60:40 (3%)	10.0 ± 0.6	-[a]	9.6 ± 0.5	9.5 ± 0.1	-	-
60:40 (5%)	10.0 ± 0.5	-	9.7 ± 0.3	9.9 ± 0.2	-	-
50:50 (3%)	9.5 ± 0.4	-	9.4 ± 0.4	9.5 ± 0.1	-	-
50:50 (5%)	9.5 ± 0.4	-	9.4 ± 0.4	9.5 ± 0.1	-	-
45:55 (5%)	9.2 ± 0.3	-	9.1 ± 0.4	9.2 ± 0.1	-	-
Hetron:Dust						
60:40 (3%)	9.7 ± 0.5	-	9.6 ± 0.4	9.8 ± 0.2	-	-
60:40 (5%)	9.7 ± 0.4	-	9.6 ± 0.3	9.8 ± 0.1	-	-
50:50 (3%)	9.5 ± 0.4	-	9.3 ± 0.3	9.4 ± 0.1	-	-
50:50 (5%)	9.4 ± 0.4	-	9.2 ± 0.3	9.4 ± 0.1	-	-
45:55 (5%)	9.2 ± 0.4	-	9.0 ± 0.2	9.0 ± 0.1	-	-

a mean ± standard deviation

b The trace metals were not detected in the leachate