Utilization Industry Hazardous Waste

Part of Krakatau Industrial Estate Area, A Mosaic of Chemicals – Petrochemical – Steel Industry with 1500 Ha

Courtesy KIEC
Out Line Presentation

- Map Indonesia, Demography
- Chemical – Other Industry In Indonesia with Hazardous Waste Potential
- Indonesian Regulation on Hazardous Waste
- Bottom Up Effort to Rationalize waste Disposal Management
- 3R
- Case in Industry Utilization Hazardous waste in Indonesia
  - Krakatau Steel
  - Utilization Fly Ash in Cement Plant – Co Processing
Upstream PetroChemical
Distribution in Indonesia

ABS 15
Acrylic Acid 60 PET 52
Acrylic Esters 100 PET Film 30
Alky Benzenes 180 POLYDL 10
BB 380 PP 70
EDC 625 Polypropylene 90
ED 216 PS 104
EPS 18 PTA 1440
Ethylene 150 PVC 225
Ethyl Acrylate 70 Propylene 150
Ethylene 580 SAN 30
HDPE 100 SBR 100
Heavy Alkylates 48 SBR Latex 30
LLDPE 650 SM 340

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Ethylene 150 PVC 225
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Ethylene 580 SAN 30
HDPE 100 SBR 100
Heavy Alkylates 48 SBR Latex 30
LLDPE 650 SM 340
### Industry Related Scope

<table>
<thead>
<tr>
<th>Main Product</th>
<th>Number of Factories/Industry</th>
<th>Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Indonesia</td>
<td>Banten</td>
</tr>
<tr>
<td>Pulp - Paper</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PULP Industry</td>
<td>14</td>
<td>1</td>
</tr>
<tr>
<td>Paper Industry</td>
<td>79</td>
<td>2</td>
</tr>
<tr>
<td>Chemicals - Petrochemicals</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Medium - Big</td>
<td>50</td>
<td></td>
</tr>
<tr>
<td>Medium - Big</td>
<td>34</td>
<td></td>
</tr>
<tr>
<td>Medium - Big</td>
<td>30</td>
<td></td>
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<tr>
<td>Fertilizers Industry</td>
<td>13</td>
<td></td>
</tr>
<tr>
<td>Steel Industry (Integrated)</td>
<td>1</td>
<td>1</td>
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<tr>
<td>Electricity Generating Plant</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sugar Industry</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rafinated Sugar</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sugar cane base</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Data Source:
- TEMPO - 16 September 2007
- Indonesian BPS
- Various Data Internet
Petrochemical Products ease our Modern Life

*National Geographic Magazine, June 2004*
<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Capacity</td>
<td>As per World</td>
</tr>
<tr>
<td></td>
<td>Million Ton/Year</td>
<td>Percentage (%)</td>
</tr>
<tr>
<td>INDONESIA</td>
<td>0.53</td>
<td>0.4</td>
</tr>
<tr>
<td>Japan</td>
<td>7.60</td>
<td>6.3</td>
</tr>
<tr>
<td>United States of America</td>
<td>28.74</td>
<td>23.9</td>
</tr>
<tr>
<td>China</td>
<td>7.27</td>
<td>6</td>
</tr>
<tr>
<td>India</td>
<td>3.53</td>
<td>2.9</td>
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<tr>
<td>South Korea</td>
<td>6.01</td>
<td>5</td>
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<td>Thailand</td>
<td>2.26</td>
<td>1.9</td>
</tr>
<tr>
<td>Singapure</td>
<td>1.90</td>
<td>1.6</td>
</tr>
<tr>
<td>Malaysia</td>
<td>1.70</td>
<td>1.4</td>
</tr>
<tr>
<td>Arab Saudi</td>
<td>6.95</td>
<td>5.8</td>
</tr>
<tr>
<td>Rest of The world</td>
<td>55.00</td>
<td>45.3</td>
</tr>
<tr>
<td>Total</td>
<td>121.48</td>
<td>100</td>
</tr>
</tbody>
</table>

Concern On indication of illegal Industrial Waste Disposal

- AMC/CMA initiate process improvement by bottom up effort
- Review regulation & its detail
  - Check TCLP
  - Check LD 50
  - Bring issue to get Political support

- Heidelberg Acquire Semen Cibinong Holcim Acquire Indocement Technology of Solid Waste Co Processing introduced

- SK 928 KLH on Permit Processing Iron Slag with Atomizing Technology Signed

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### 2002 and beyond

- Very High Waste Disposal Cost
- Only single Company for Disposal
- Only single Class of Waste Disposal
- Only Industry Liquid Waste used for Fuel Blending in Cement Kiln

- Krakatau Steel Group establish Puma Baja Hacket to process its waste

### 2003

- Initiate AMC Meetings
  - Organize visit local Parliament (Legislative body to PPLI)
  - Communicate to Industrial Community

### 2004

- Co Processing in Cement Kiln is initiated

### 2005

- Inception Meeting 3 R for Indonesian

### 2006

- Invite Holcim to AMC/CMA meeting

### 2007

- MoE Indonesia granted PBH No objection letter for Export Iron Concentrate
- Various Effort to Reuse - Recycle Industry Hazardous Waste is Through PPLI - TLI - Cement Industry

### 2008

- MoE issue no objection letter Processing and Utilization steel Slag residue in Indonesia as well Export

### 2009

- PBH revise its Company Statutes To produce and sell Steel Slag - slurry residue in Indonesia as well Export
Documentation of Visit AMC/CMA with Chairman – Members of DPRD (Parliament) Cilegon /Banten to PPLI, 12th July 2004

(Indonesian Waste Management System)

Main Objectives to support Industry Campaign getting reasonable – realistic Hazardous Waste Disposal cost, that PPLI only provide Class I for all kind Industrial wastes which drives illegal disposal due to too high waste disposal cost.

Then after shared to Mo E Indonesia possibility to review amend Regulation PP 18 - 85/1999 on criteria Industrial Hazardous Waste
Indication Illegal Waste Disposal - Dumping
The objective preparing a Category II Landfill is to provide a competitive priced and needed service to industrial and commercial waste producers, at that time in Indonesia only have three options:

1. Disposal in Category I Landfill
2. On site disposal
3. Illegal disposal

At the same time the aim is to increase the volume of waste treated by providing a more economical option for customers. While Indonesian legislation dictates that hazardous (B3) waste must be correctly treated and disposed, the high costs of proper waste disposal mean that much B3 waste is improperly disposed at inadequate facilities.

By designating landfill facility for Category II waste, waste producers will have the ability to dispose suitable waste at a more reasonable cost than a Category I landfill. The Category II landfill should be in compliance with World Bank, WTO, Indonesian and other international standards. This will encourage more waste producers to utilise the proper treatment and disposal facilities.
ACUTE TOXICITY TEST LD₅₀ SUMMARY

Client: PT. CLARIANT INDONESIA (CIPEGON PLANT)
Reference: 38/002340/09/09
Test Type: ACUTE TOXICITY TEST LD₅₀
Test Initiation: October, 2003

SAMPLE
Identification: FILTER CAKE
Amount Received: 1 KG
Date Collected: September 16, 2005
Date received: Net Solid/Solution
Solubility in Water: Suspension
TotalDosage: 10 (ml) dosage and 1 (one) control

CONTROL
pH: 6.08

TEST SPECIES INFORMATION
Organism: Mus musculus
Source: BSL/PP - Beagle
Collected Date/Time: October, 2005
Age: 1.0 - 1.3 months
Conditioned on Laboratory: 10 (ten) days
Means of weight: 5.67 gram

TEST CONDITION
Temperature: 24 - 28°C
Humidity: 60.0 - 85.0 %
Noise: 60.0 - 70.0 dB

Toxicity Test Result (Calculated by Probit Analysis): 11,641.26 mg/kg BW
Base on Acute Toxicity test LD₅₀, this sample has LD₅₀ values above 50.00 mg/kg Body Weight
refer to Government Regulation of Indonesia No. 74/2001 is practically non toxic

KEMAL MUSTAFA

SCIENCE LABORATORY
Material Transformation

Hazardous Raw Materials List

- Commonly Used Mat'l - 229 CAS Number
- Limited Use - 45 CAS Number
- Prohibited Use - 10 CAS Number

PROCESS Transformation

- Production
- Fail Product
- Spill - Road Accident
- Consumption - disposal

PRODUCT

- Hazardous Waste

Characteristics

- Explosives
- Flammability
- Reactives
- Toxic
- Carcinogenic
- Corrosives

Characteristics Test

- TCLP
  - 2 < pH > 12.5

Fuel Substitution

- Calori >> 2500 Kkal / Kg
  - No Halogenated component
  - Water content << 15 %

Overall Characteristics

- Pass Toxicology Test
  - LD50 < 15 gram/Kg
### STATUS Hazardous Material in INDONESIA *
Based On Government Regulation PP no 74 tahun 2001

<table>
<thead>
<tr>
<th>Prohibited</th>
<th>Limited</th>
<th>Common Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 Tipe - generik</td>
<td>45 Tipe - generik</td>
<td>209 Tipe - generik</td>
</tr>
</tbody>
</table>

**Example:**
- Aldrin
- DDT
- Endrin
- PCB

- Ethylene dibromide
- Penta chloroPhenol
- Ethylene Oxide
- Ethylene Dichloride
- Carbon tetra Chlorida
- CFC, Halon
- Methyl Bromide

- Methanol - Propanol - Ethanol
- Chlorine, Formalin
- KOH, NaOH
- Asam (Akrilat, Asetat, Formiat)
- Chlorida, Phosphat, dll)
- Ethyl Acrylate,
- Amoniak, Vinyl Acetate
- Acryl Nitril, Dimethyl Sulphate
- Benzena, Toluena

*Catatan: Not include percusor, food, pharmaceuticals*
Hazardous Waste Based on Government Regulation

*(PP 18/1999, PP 85/1999), soon may need to be reviewed with adaptation of UN-GHS*

- Exhibits characteristics such as being explosive, ignitable, reactive, toxic, by Toxicity Leaching Characteristics Procedure (TLCP, Infectious, Corrosive, and/or toxicity by Lethal Doses-50 (LD$_{50}$) test;

- Is a non specific source which includes generic wastes generated by a variety of general process, such as spent halogenated solvents tetrachloroethylene, trichloroethylene, etc;

- Is a specific source which is generated from specific industrial process, such as bottom sediment sludge from the treatment of wastewaters from wood preserving industry process that use pentachlorophenol; and

- Is a specific commercial chemical product or intermediate, discarded commercial chemical products, off-specification species, container residues, and spill residues thereof.
**Hazardous Raw Material - Waste**

<table>
<thead>
<tr>
<th>Criteria Hazardous Materials - Waste</th>
<th>INDOONESIAN GOVERNMENT REGULATION</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>HAZARDOUS Raw Materials Status</strong></td>
<td><strong>Hazardous WASTES</strong></td>
</tr>
<tr>
<td>Hazards</td>
<td>Man Power Reg.186 - 1999</td>
</tr>
<tr>
<td>Unit - Measurement</td>
<td>PP 74 - 2001</td>
</tr>
<tr>
<td></td>
<td>PP 18 - 85 - 1999</td>
</tr>
<tr>
<td></td>
<td>KLH 02 - 2008</td>
</tr>
<tr>
<td></td>
<td>Managing Hazard. Materials</td>
</tr>
<tr>
<td></td>
<td>Hazardous Management</td>
</tr>
<tr>
<td></td>
<td>3 R Related</td>
</tr>
</tbody>
</table>

**Prohibited**
- 10 CAS Number

**Limited Utilization**
- 45 CAS Number

**Common Utilization**
- 209 CAS Number

**Hazardous**
- Practically Non Toxic
  - 5001 - 15,000 mg/Kg

**Raw Materials**
- Slightly Toxic
  - LD50: 25 - 200 mg/Kg
  - LC50: 0.5 - 2 mg/L
  - Store Quantity Level (NAK): 10 Ton

**Status**
- Toxic
  - LD50: 25 - 200 mg/Kg
  - LC50: 0.5 - 2 mg/L
  - Store Quantity Level (NAK): 10 Ton

- Highly Toxic
  - LD50: < 25 mg/Kg
  - LC50: < 0.5 mg/L
  - Store Quantity Level (NAK): 5 Ton

- Extremely Toxic
  - LD50: < 1 mg/Kg

- Highly Flammable
  - Titik Nyala, 1 atm: < 21 oC
  - NAK: 100 Ton

- Flammable
  - Titik Nyala, 1 atm: 21oC < T < 55 oC
  - Store Quantity Level (NAK): 200 Ton

- Readily to Explode
  - Store Quantity Level (NAK): 10 Ton

- Oksidator
  - Store Quantity Level (NAK): 10 Ton

- Reaktive
  - Store Quantity Level (NAK): 50 Ton

- Flammable Gas
  - Store Quantity Level (NAK): 50 Ton

**Hazardous Waste**
- Toxicity
  - LD 50
  - < 15,000 mg/Kg

- Corrosive
  - pH
    - pH<2 or pH > 12.5
    - pH<2 or pH > 12.5

- Exemption
  - Caloric Value, Kcal/Kg
    - 2500

- Exemption
  - Halogenated Component
    - None
Typical In Site Production WWT Plant

- **Settling Pit**: 100 M³
- **Floculation**: 20 M³
- **Floculation**: 14 M³
- **Sludge**: 10 M³
- **Clarifier**: 14 M³
- **Outlet**: Incinerator / PT. PPLI
- **Filter Press**: Sludge
- **Filter Cake**: Incinerator / PT. PPLI
- **Equalization Basin**: 100 M³
- **Compressed Air**: 75 M³
- **Bio Aerator**: 75 M³
- **Floculation**: 14 M³
- **Settling Pit**: 100 M³
- **Sand Filter**: 45 M³
- **Recycle**: / Bilas alat-alat kerja
- **Saluran KIEC**: Image of a typical wastewater treatment plant.
<table>
<thead>
<tr>
<th>Typical Waste Parameters</th>
<th>Equalization</th>
<th>1st Step</th>
<th>2nd Step</th>
<th>3rd Step</th>
<th>Standard Effluent</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Physical Separation</td>
<td>Chemical Degradation</td>
<td>Clarifier dan Filtration</td>
<td></td>
</tr>
<tr>
<td>Average waste Characteristic within Outlet Process, COD in ppm</td>
<td>10 000 - 20 000</td>
<td>800 - 1 400</td>
<td>60 - 140</td>
<td>60 - 140</td>
<td>300</td>
</tr>
<tr>
<td>Total Dissolved Solid in ppm</td>
<td></td>
<td></td>
<td>4000 - 10000</td>
<td>1000 - 2000</td>
<td>4 000</td>
</tr>
<tr>
<td>Outlet BOD in ppm</td>
<td>5 000 - 10 000</td>
<td></td>
<td>11 - 50</td>
<td>150</td>
<td></td>
</tr>
<tr>
<td>Outlet Nitrat in ppm</td>
<td></td>
<td></td>
<td>3 - 15</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>Outlet Nitrit in ppm</td>
<td></td>
<td></td>
<td>1 - 2</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>pH</td>
<td>4 - 5</td>
<td></td>
<td>7 - 8</td>
<td>6 - 9</td>
<td></td>
</tr>
<tr>
<td>Hydolic Flow in M3 per day</td>
<td>20 - 500</td>
<td></td>
<td></td>
<td>not specified</td>
<td></td>
</tr>
<tr>
<td>COD Flow in Kg per day</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Process Efficacy</td>
<td></td>
<td>100.00%</td>
<td>100.00%</td>
<td>100.00%</td>
<td></td>
</tr>
<tr>
<td>Effectiveness COD Reduction</td>
<td></td>
<td>92.00%</td>
<td>92.00%</td>
<td>99.00%</td>
<td></td>
</tr>
</tbody>
</table>
**Typical Material – Energy Balance of Production Plant**

**Raw Material:** 9,240 Tons

**Raw Water:** 42,544 Tons

**Electricity:** 2,454,560 kWh

**Steam:** 3,424 Tons

**Product:** (Polymer Dispersion): 18,560 Tons

**Waste Water:** 13,047 m³

**Solid (TDS):** 13 Ton

**Nitrat:** 104 Kg

**Solid Waste:** 328 Tons

**Domestic & Sanitary:** 9,833 m³

**Vapor Release:**
- SO\textsubscript{x} = 5.79 Kg
- NO\textsubscript{x} = 3.47 Kg
- HCl = 8.25 Kg
- NH\textsubscript{3} = 1.14 Kg
- Particulate = 13.91 Kg
- H\textsubscript{2}O = 10,186 m³
We target our 3R Program contributes to Environment Sustainability through Economic Concept emphasizing to fulfill our reasonable need and; Ecology Concept emphasizing on Ecosystem Balance - Environment Conservation

- Safe
- Universally Accepted
- Stable
- Technology that benefits all
- Antipolution
- Improvement in Quality of Life
- Nontoxic
- Awareness
- Beautiful
- Indeginious Knowledge
- Least Cost Production
- Income
- Total Quality
- Youth
Pollution Prevention Cycle

Ideal Industry Cycle

Courtesy Prof. Tjandra Setiadi PhD
<table>
<thead>
<tr>
<th>Plant Type</th>
<th>Manageable Waste with 3R approach</th>
<th>Generation T/d</th>
</tr>
</thead>
</table>
| Chemical / Petro Chemical Plants | 1. Contaminated Packaging, Junk Chemical, Lamp, etc. to Land Fill or Recycle Disposal.  
                                      2. Sludge / Filter Cake from WWT Plant                                                           | +/- 20         |
| Coal Fire Steam Power Plant | 1. Fly – Bottom Ash, with average 600 000 Ton stock in Site, manage through Co Processing          | +/- 1600       |
| Integrated Steel Plants    | 1. Steel Sludge  
                                      2. Steel Slag  
                                      3. EAF Dust                                               | +/- 1000       |
### Stock Balance HW in Integrated Steel Industry

<table>
<thead>
<tr>
<th>Material</th>
<th>Stock without 3 R Management</th>
<th>Stock with 3 R Management</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Iron Sludge</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>01.01.2006</td>
<td>01.01.2007</td>
</tr>
<tr>
<td></td>
<td>970,000</td>
<td>1,043,000</td>
</tr>
<tr>
<td></td>
<td>01.01.2008</td>
<td>01.01.2009</td>
</tr>
<tr>
<td></td>
<td>1,118,000</td>
<td>1,124,000</td>
</tr>
<tr>
<td></td>
<td>970,000</td>
<td>977,526</td>
</tr>
<tr>
<td></td>
<td>101,558</td>
<td>64,287</td>
</tr>
<tr>
<td><strong>EAF Dust</strong></td>
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<td></td>
</tr>
<tr>
<td></td>
<td>01.01.2006</td>
<td>01.01.2007</td>
</tr>
<tr>
<td></td>
<td>80,000</td>
<td>104,000</td>
</tr>
<tr>
<td></td>
<td>01.01.2008</td>
<td>01.01.2009</td>
</tr>
<tr>
<td></td>
<td>129,000</td>
<td>157,000</td>
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<td></td>
<td>80,000</td>
<td>88,433</td>
</tr>
<tr>
<td></td>
<td>51,630</td>
<td>37,021</td>
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<tr>
<td><strong>Steel Slag</strong></td>
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<tr>
<td></td>
<td>01.01.2006</td>
<td>01.01.2007</td>
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<tr>
<td></td>
<td>2,200,000</td>
<td>2,402,500</td>
</tr>
<tr>
<td></td>
<td>01.01.2008</td>
<td>01.01.2009</td>
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<tr>
<td></td>
<td>2,614,500</td>
<td>2,836,950</td>
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<td></td>
<td>2,200,000</td>
<td>2,207,526</td>
</tr>
<tr>
<td></td>
<td>2,062,061</td>
<td>1,178,875</td>
</tr>
</tbody>
</table>
Chemicals/ Steel >>> Automotive / Electronic/Textile Industry

- Upstream Chemical / Steel Industry
- Intermediate Industry
- Consumer Product Industry
- Industry Waste
- Co-processing / Landfill / etc.

- Recycle Packaging
- Indonesia Waste Final Disposal
- Waste ex Industry Product, Packaging, etc

35% of 172,000 ton/day

Public Consumer

Recycle Packaging

Indonesia Waste Final Disposal
End Point Waste Disposal - LandFill

Landfill Processes

- Secure Landfills Class I and Class II – construction standard US-EPA (United States Environmental Protection Agency)

- Guaranteed Closure and Post Closure Funds for waste disposal at secure landfills for 30 years

- Mandatory monitoring for: groundwater, surface water leachate, air quality, landfill gas, effluent discharge

Courtesy of PPLI - DOWA