Teknologi Pengolahan Limbah Industri dan Waste Minimization

Oleh:
Ir. M. Razif MM

Disampaikan pada PELATIHAN MANAJEMEN LINGKUNGAN DI KEGIATAN INDUSTRI 5 - 6 Juli 2007
Skema Sumber Limbah

Energi → Industri → Landfill
Bahan Baku → Industri → Landfill

Lingkungan

Emisi ke
Udara → Landfill
Air → Landfill
Tanah → Landfill

Waste Prevention and Minimization

Energi → Waste Prevention → Landfill
Bahan Baku → Eco Design → Landfill

Lingkungan

Emisi ke
Udara → Landfill
Air → Landfill
Tanah → Landfill
Konsep Minimisasi Limbah

Preventif

Waste minimization

Prevention

Reduction at source

Products reused for the same purposes

On-site recycling

Source-oriented waste quality improvements

Disassembly of complex products and reuse of components for the same purpose

Products reused for other purposes

Off-site recycling

Waste-oriented waste quality improvement

Pre-treatment

Energy Recovery

Preventif

Waste Management
Hirarki Manajemen Limbah

1. Uncontrolled Release
2. Controlled Disposal
3. Waste Treatment
4. External Waste Recycling and Reuse
5. Waste Prevention (including internal waste recycling)
Integrated Waste Minimization

I W M

Energy recovery
Materials recovery

Landfill

Lingkungan

Emisi ke

Udara
Air
Tanah

Energi
Bahan Baku
Sustainable production and consumption

Task for product design → ECO-DESIGN → PRODUCTION → CONSUMPTION → Product
CERITA SUKSES U. S. Steel Corporation

- Didirikan pada 1901

- Kapasitas produksi 2,8 juta ton pertahun, dengan pegawai 2.400 orang

- Dapat mengurangi pemakaian Lead, sehingga dapat menghemat $32.000 setiap tahun.

• Membuat lapisan sangat tipis lead-tin alloy, pada saat proses coating dengan menggunakan ‘flux box’ agar didapat campuran lead-tin yang tepat.


• Dinamakan ‘lead dross’. Diklasifikasikan sebagai B3.
Mengurangi ‘lead dross’

Coba-coba korelasi antara flux dengan ‘lead dross’
Keuntungan yang diperoleh

• Kualitas produksi terjaga. Konsumen puas.

• Industri melakukan penghematan pemakaian lead, dan penghematan biaya pengolahan limbah.

• Menyelamatkan lingkungan dari logam berat (B3)
Raw steel

Cutting Machining

Arc Welding

Sandblasting

Cleaning

Part

Scrap metal recycled offsite

Spent coolant recycled offsite

Spent welding rods and slag

Spent sand

Cleaning

Spent petroleum naphtha recycled offsite

Expanded metal

Coating

Painting

Contaminated hydraulic oil recycled offsite

Paint overspray, plastic & filters

Part

Spent xylene from paint gun cleaning recycled offsite

Conveying and transportation equipment
## Summary of Current Waste Generation

<table>
<thead>
<tr>
<th>Waste Generated</th>
<th>Source of Waste</th>
<th>Waste Management Method</th>
<th>Annual Quantity Generated (lb/yr)</th>
<th>Annual Waste Management Cost¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scrap metal, paint cans</td>
<td>Machining, painting</td>
<td>Sold to metal recycler</td>
<td>420,000</td>
<td>-$17,160</td>
</tr>
<tr>
<td>Sand</td>
<td>Sandblasting</td>
<td>Shipped to nonhazardous landfill</td>
<td>3,650,000</td>
<td>55,030</td>
</tr>
<tr>
<td>Rags</td>
<td>Cleaning sandblasted parts</td>
<td>Laundered offsite</td>
<td>unknown</td>
<td>13,520</td>
</tr>
<tr>
<td>Paint wastes</td>
<td>Paint line</td>
<td>Shipped offsite as hazardous waste</td>
<td>6,000</td>
<td>6,000</td>
</tr>
<tr>
<td>(overspray, filters,</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>plastic sheets, rags)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>General trash</td>
<td>Welding, packaging,</td>
<td>Shipped to nonhazardous landfill</td>
<td>1,500,000</td>
<td>18,300</td>
</tr>
<tr>
<td></td>
<td>and office activities</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coolant</td>
<td>Machining</td>
<td>Shipped to waste oil reclaimer</td>
<td>9,600</td>
<td>3,720</td>
</tr>
<tr>
<td>Grease/sludge</td>
<td>Machining</td>
<td>Shipped to waste oil reclaimer</td>
<td>45</td>
<td>negligible</td>
</tr>
<tr>
<td>Petroleum naphtha</td>
<td>Cleaning of small parts</td>
<td>Reclaimed offshore by supplier</td>
<td>4,220</td>
<td>3,600</td>
</tr>
<tr>
<td>Hydraulic oil</td>
<td>Contaminated during assembly</td>
<td>Shipped to waste oil reclaimer</td>
<td>10,500</td>
<td>5,040</td>
</tr>
<tr>
<td>Motor oil</td>
<td>Vehicle maintenance</td>
<td>Shipped to waste oil reclaimer</td>
<td>19,440</td>
<td>1,470</td>
</tr>
<tr>
<td>Xylene and paint solids</td>
<td>Cleaning of paint guns</td>
<td>Offsite reclamation</td>
<td>4,750</td>
<td>2,550</td>
</tr>
<tr>
<td>Unused paint</td>
<td>Paint line</td>
<td>Shipped offsite as hazardous waste</td>
<td>195</td>
<td>1,200</td>
</tr>
</tbody>
</table>

¹ Includes waste treatment, disposal, and handling costs, and applicable lost raw material value.
<table>
<thead>
<tr>
<th>Minimization Opportunity</th>
<th>Waste Reduced</th>
<th>Annual waste reduction</th>
<th>Net Annual Savings</th>
<th>Implementation Cost</th>
<th>Simple Payback (yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Modify the paint spray system by using a low pressure, airmix system. Implementation of this opportunity would lead to reduced overspray.</td>
<td>Paint wastes</td>
<td>2,000 50</td>
<td>$8,860</td>
<td>$12,000</td>
<td>1.4</td>
</tr>
<tr>
<td>Replace the naphtha-based parts washer with a mechanical agitation system utilizing an aqueous biodegradable non-toxic detergent. The proposed unit should include an oil skimmer for oil removal; following skimming, the spent detergent solution can be sewerated.</td>
<td>Petroleum naphtha</td>
<td>4,220 100</td>
<td>3,100</td>
<td>5,080</td>
<td>1.6</td>
</tr>
<tr>
<td>Use di-basic esters instead of naphtha in the parts washer. Di-basic esters have a lower volatility than naphtha and are nontoxic, thereby lowering costs associated with evaporative losses and disposal. A dibasic ester waste stream will be generated if this WMO is implemented.</td>
<td>Petroleum naphtha</td>
<td>4,220 100</td>
<td>1,340</td>
<td>750</td>
<td>0.6</td>
</tr>
</tbody>
</table>