Plasticizer Market Update

SPI Vinyl Products Division
22nd Annual Vinyl Compounding Conference
July 10-13, 2011

Calvin Emanuel, PhD
BASF Corporation
Agenda

- Global Plasticizer Market – Consumption, Capacities, Trends
- North American Plasticizer Overview
- Phthalate Esters Issues Update
Global Plasticizer Market Structure 2010

34 Mio. t PVC  
5.8 Mio. t Plasticizers  
4.9 Mio. t Phthalates

- Flexible (36%)
- Rigid (64%)
- Others

- Phthalates (84%)
- DOP (54%)
- DINP (27%)
- DPHP, DIDP (11%)

Source: SRI, CMAI, BASF estimates
World Plasticizer Market
Estimated Consumption 2010

<table>
<thead>
<tr>
<th>Region</th>
<th>Americas</th>
<th>Europe, M.E., Africa</th>
<th>Asia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consumption</td>
<td>1.1 Mio. t</td>
<td>1.4 Mio. t</td>
<td>3.5 Mio. t</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td>~ 6.0 Mio. t</td>
</tr>
</tbody>
</table>

Source: SRI, CMAI, BASF estimates
## Aspects Effecting Plasticizer Growth

<table>
<thead>
<tr>
<th></th>
<th>North America</th>
<th>Western Europe</th>
<th>Asia</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Politics, legislation</strong></td>
<td>Neutral to negative PVC considered as versatile, “phthalate issue” discussions increasing</td>
<td>Negative PVC and phthalates under pressure, replacements pursued actively</td>
<td>Neutral to positive PVC and phthalates gaining marginal attention, mfg growth oriented policies</td>
</tr>
<tr>
<td><strong>Demographics</strong></td>
<td>Positive 475 Mio., ~ 0.97 % population growth</td>
<td>Neutral 450 Mio., limited population growth, aging population</td>
<td>Positive 4000 Mio., 1.2 % growth, young &amp; growing population</td>
</tr>
<tr>
<td><strong>Economic structure</strong></td>
<td>Negative Manufacturing less a driver of the economy, Asian imports replace domestic production (USA)</td>
<td>Neutral Migration of some manufacturing to Far East is partially off-set by CEE and MEA growth. Strong manufacturing base</td>
<td>Positive Strong manufacturing and increasing exports / domestic consumption</td>
</tr>
<tr>
<td><strong>Expected consequences for growth</strong></td>
<td>Plasticizer demand will grow but less than GDP GDP (2010-15): 3.3 % CAGR</td>
<td>Plasticizer demand will grow slowly approx 1.5% GDP (2010-15): 2.4 % CAGR</td>
<td>Plasticizer demand will grow with GDP GDP (2010-15): 7.7% CAGR</td>
</tr>
</tbody>
</table>
Growth around GDP. Phthalates remain dominant.

Demand for non-phthalate plasticizers will increase around the globe

CAAGR (2010-2022)  
- Americas: 2.1%  
- EMEA: 3.2%  
- Asia: 4.6%

Source: SRI, CMAI, BASF estimates
C9 and C10 phthalates will remain key products

Demand:
- C9 and C10 phthalates growing at expense of C8 (DEHP)

Supply:
- EMEA/Americas: sufficient capacities available, capacity reductions expected
- Asia: high plasticizer overcapacities (2.2 Mio. t in 2010)

Currently available capacities sufficient to cover projected future demand

Source: SRI, CMAI, BASF estimates
Trends:

- DOP replacement by C9/C10 phthalates.
- Selection of alternative plasticizers for sensitive applications will continue.
- Activists pressure on PVC and phthalates requires increased efforts on advocacy.
- Asia has 65% of the global Plasticizer capacity - the key driver for future growth is Oxo capacity.
- Access to C8 - C10 plasticizer alcohols key success factor.

<table>
<thead>
<tr>
<th>%</th>
<th>USA</th>
<th>Western Europe</th>
<th>Asia</th>
</tr>
</thead>
<tbody>
<tr>
<td>DOP</td>
<td>19</td>
<td>16</td>
<td>60</td>
</tr>
<tr>
<td>C9/C10 Phthalates</td>
<td>33</td>
<td>63</td>
<td>21</td>
</tr>
<tr>
<td>Linears/other Phthalates</td>
<td>19</td>
<td>6</td>
<td>9</td>
</tr>
<tr>
<td>Non-Phthalates</td>
<td>28</td>
<td>16</td>
<td>10</td>
</tr>
<tr>
<td>TOTAL</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>

Source: SRI, CMAI, BASF estimates
Major Global Manufacturers of Alcohols 2010
C8-C10 Plasticizer Alcohols

Exxon

BASF

Eastman

Evonik

Oxea

Kyowa

Hakko

LG

Qilu

Nan Ya

Zaklady

Mitsubishi

Oxo-Chimie

Perstorp

360

280

230

275

170

340

300

170

125

125

270

265

260

190

145

220

190

60

Source: SRI, CMAI, BASF estimates

* Combined capacity share of all shown producers

NA (100 %)*

Europe (95 %)*

Asia (77 %)*
Major Global Producers of Plasticizers 2010

**Americas (42%)***
- BASF: 345 kt/a
- Exxon: 160 kt/a

**EMEA (45%)***
- BASF: 375 kt/a
- Aekyung: 330 kt/a
- Shandong Qilu: 302 kt/a
- LG: 30 kt/a

**Asia (56%)***
- UPC: 960 kt/a
- Exxon: 90 kt/a
- Nan Ya: 590 kt/a
- Shandong Qilu: 475 kt/a
- LG: 385 kt/a
- Eastman: 240 kt/a
- Shandong Hongxin: 220 kt/a
- Evonik: 200 kt/a

*Cumulative capacity share of shown competitors

Source: SRI, CMAI, BASF estimates
Published Ester Capacities NA (name-plate [kt]):

- BASF
- ExxonMobil
- Eastman
- Ferro
- Teknor Apex
- Others

- Market consolidations occurring in NA

Source: SRI, CMAI, BASF estimates
Plasticizer Imports into US
2002 – YTD

- DINP is major imported plasticizer
- Regional arbitrage or regional shortages drives trade balance

Source: SRI, CMAI, BASF estimates
North American Plasticizer Market
Relative Market Size

USA 87%
Canada 7%
Mexico 6%

Source: SRI, CMAI, BASF estimates
Plasticizer End Use Applications

2010

- Wire & Cable: 19%
- Flooring & Wall Coverings: 20%
- Film & Sheet: 19%
- Coated Fabric: 11%
- Consumer Goods: 9%
- Others: 22%

Trends

- Wire & Cable and Flooring weak due to housing market
- Gradual shift in medical applications from DOP to alternatives expected

Source: SRI, CMAI, BASF estimates
Phthalate Esters Issues Update

- CPSC Chronic Hazard Advisory Panel – phthalates and alternative plasticizers (complete in late 2012)

- EPA Chemical Action Plan
  - TSCA 5(4)b “chemicals of concern” proposal – in review by OMB since May 2010. Strong support by SPI, VI, ACC, RFCI, and others
  - EPCRA 313 Toxic Release Inventory – add new phthalates (2011/2012)
  - Design for the Environment (DfE) assessment – starts in August 2011. EPA: non-regulatory way to move away from phthalates

- Further action – possibly in 2012 with input from CPSC, FDA, and EPA assessments

- REACH – major high molecular weight phthalates, DINP, DPHP, DIDP have been registered and are not subject to authorization
BASF Global Production Facilities for Plasticizer and Plasticizer Raw Materials (as of Jan 2011)

Kuantan  
(JV BPC, 60% share)  
PA: 40  
2-EH: 80  
Plasticizers: 100

Ludwigshafen  
PA: 110  
Higher Alcohols: 390  
Plasticizers: 300  
Hexamoll DINCH: 100

Freeport  
2-EH: 160

Cornwall  
Plasticizers: 35

Pasadena  
2-PH: 120  
PA: 120  
Plasticizers: 125 (DPHP)

Nanjing  
(JV BYC, 50% share)  
2-EH: 110

Kuantan  
(JV BPC, 60% share)  
PA: 40  
2-EH: 80  
Plasticizers: 100

(all capacities as name-plate [in kt/a])
BASF Plasticizers North America
Manufacturing Structure

**Production**
- **Pasadena, TX**
  - 2-PH: 120 kt/a
  - Phthalic Anhydride: 120 kt/a
  - Plasticizers: 125 kt/a

- **Freeport, TX**
  - Oxo-C4: 300 kt/a
  - thereof 2-EH: 160 kt/a

- **Cornwall, ON**
  - Specialty Plasticizers: 35 kt/a

- **Neville Island, PA**
  - Main Terminal for NE customers

- **Houston Area**
  - Distribution

(all capacities as name-plate [in kt/a])
**BASF Plasticizer Portfolio North America**

**Branched Phthalates**
for cost-sensitive applications
- Palatinol® DPHP (C10)
- Palatinol® N (C9)

**Adipates**
for improved low temp performance
- Plastomoll® DOA
- Plastomoll® DNA

**Trimellitates**
for improved high temp performance or use in medical (non P)
- Palatinol® TOTM
- Palatinol® 610TM

**Polymerics**
for low migration applications
- Palamoll® 652
- Palamoll® 654
- Palamoll® 656

**Non-Phthalates**
for highly sensitive applications
- Hexamoll® DINCH

**Specialty Linear Phthalates**
for improved low- and high-temp performance
- Palatinol® 610P
- Palatinol® 911P
- Palatinol® 111P (DUP)
Plasticizers
Outlook

- Asia is and will remain the dominant consumer of plasticizers – Oxo alcohol availability is the key driver for plasticizer growth.

- Post economic recovery, plasticizer demand in North America expected to grow slowly at ~2.0 % CAGR.

- Politics and legislation on PVC and phthalates will continue to require increased advocacy.

BASF remains highly committed to plasticizers and plasticizer raw materials as a core business globally.
Thank You!