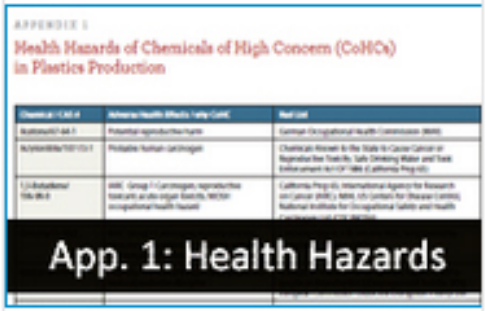
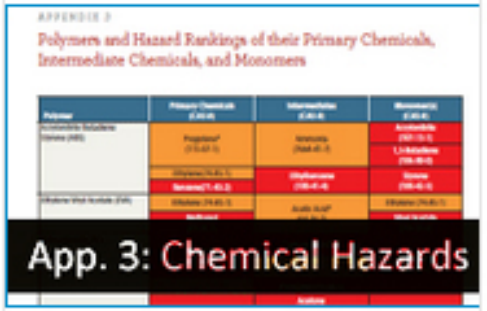
Mark Rossi, Ph.D.

&

Ann Blake, Ph.D.

July 1, 2014

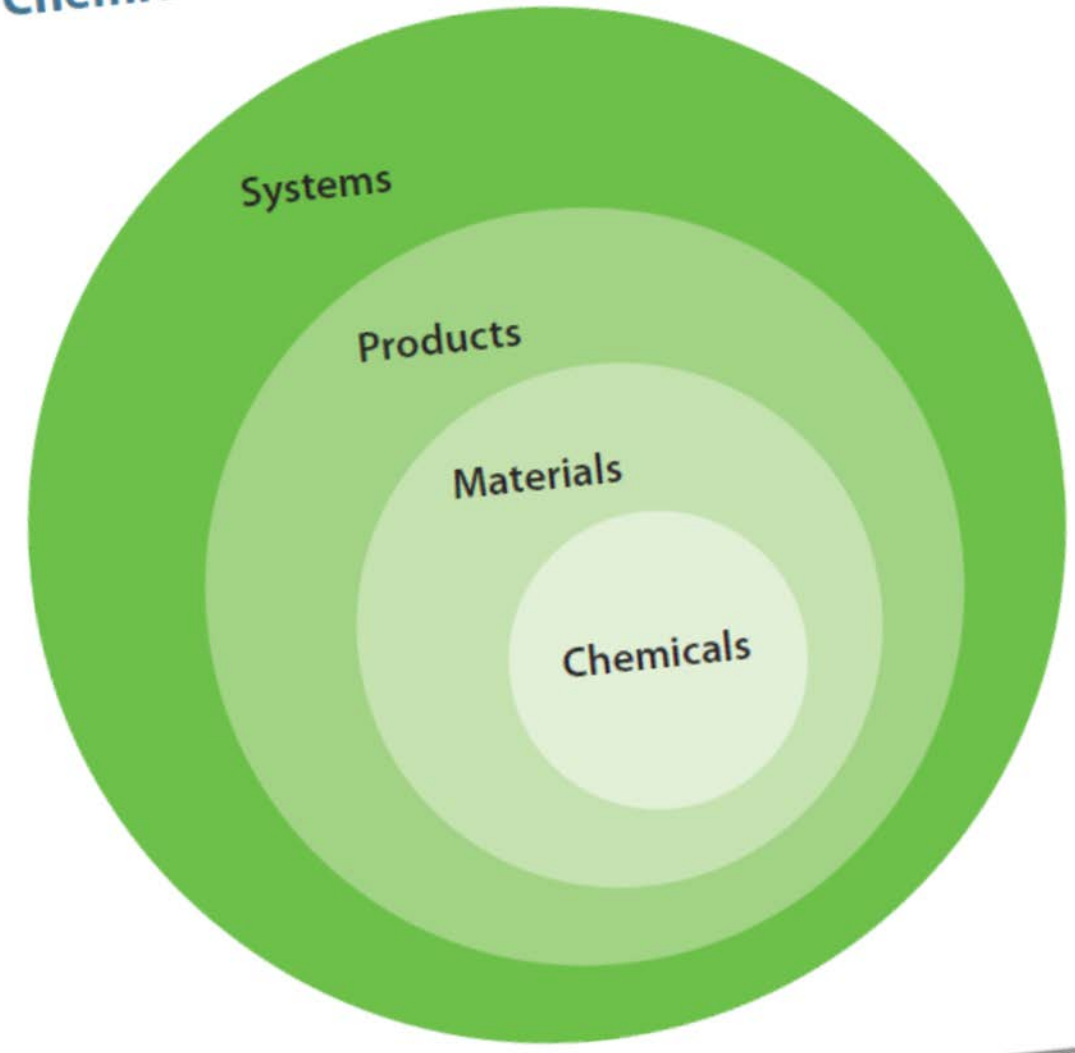




www.bizngo.org/sustainable-materials/plastics-scorecard

FIGURE 1

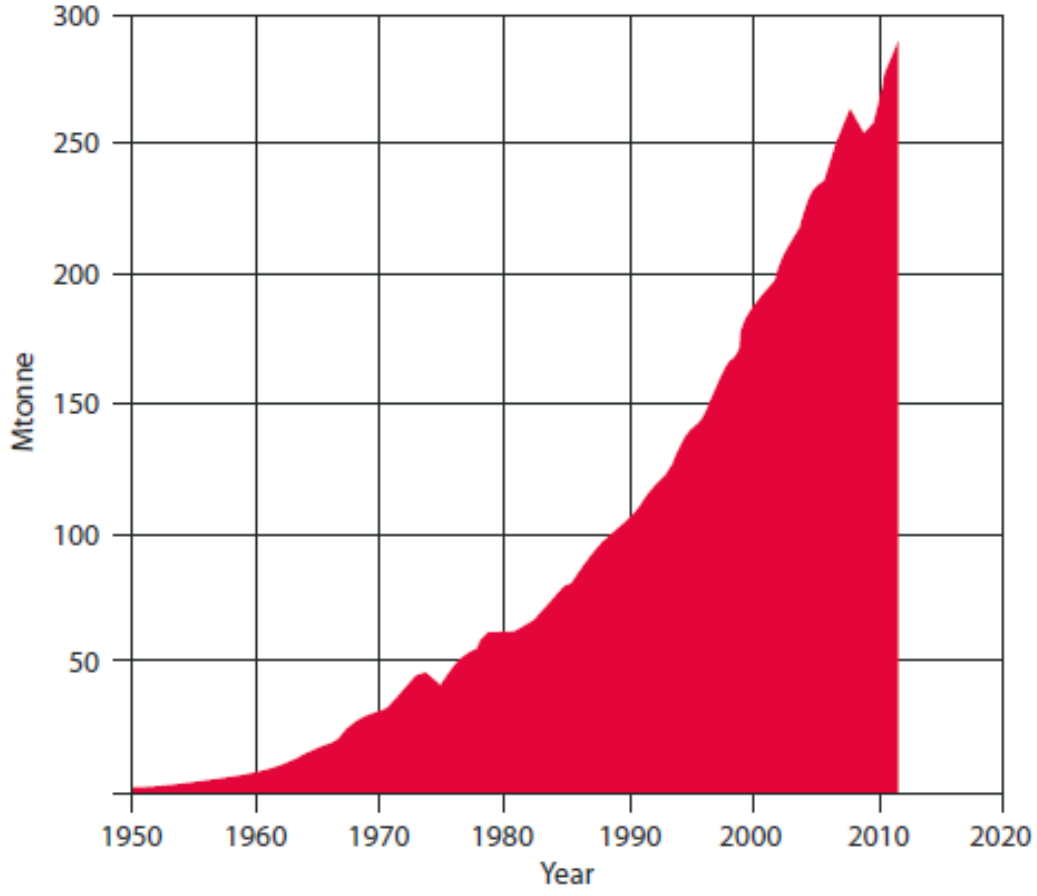
Chemicals at the Core of Systems Change



CLEAN PRODUCTION ACTION

Plastics Scorecard

FIGURE 2 **World Plastics Production 1950–2012**



Includes thermoplastics, polyurethanes, thermosets, elastomers, adhesives, coatings and sealants and PP-fibers. Not included PET-, PA- and polyacryl-fibers.

Source: Plastics Europe, 2013.

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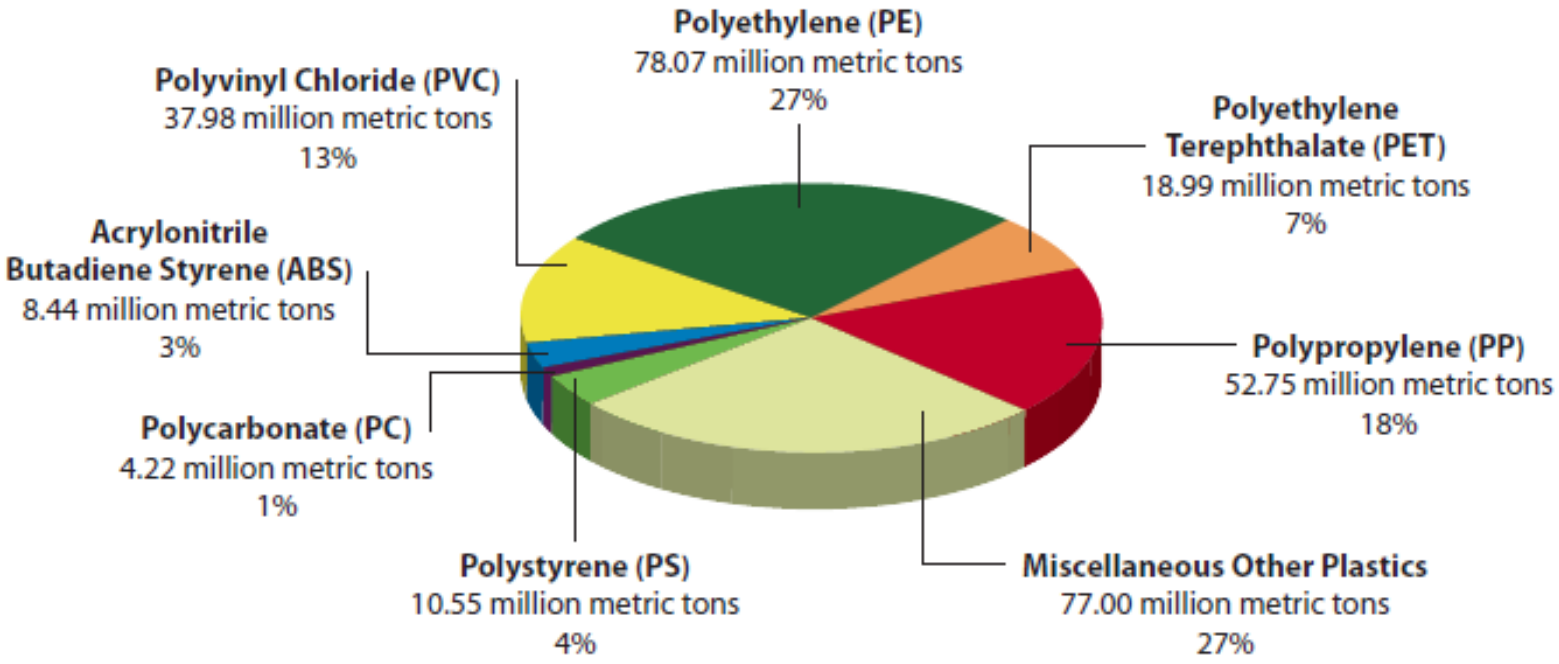
Plastics Scorecard

FIGURE 3 **Global Production of Plastics (2012)**



Total = 288 Million Metric Tons

Sources: Plastics Europe, 2013; Sagel, 2012.

CLEAN PRODUCTION ACTION

Plastics Scorecard

TABLE 3 Plastics and the Chemicals of High Concern they Consume

Chemicals of High Concern (plastics)	Total Global Consumption (million metric tons)	Consumed by Plastics (%)	Consumed by Plastics (million metric tons)
Ethylene dichloride (PVC)[b]	43.45	97%	42.14
para-Xylene (PET)[b]	42.89	88%	37.62
Benzene (PS)[b]	39.67	85%	33.52
Vinyl chloride monomer (PVC)[b]	32.79	97%	31.80
Ethylbenzene (ABS, PS)[b]	27.57	99%	27.29
Styrene (ABS, PS, SAN, SBR)[b]	23.63	91%	21.38
Ethylene glycol (PET, Nylon)[a]	21.00	80%	16.80
Cumene (PC)[b]	12.23	84%	10.27
Butadiene (ABS, SBR)[b]	9.28	94%	8.75
Acrylonitrile (ABS)[a]	5.35	96%	5.16
Phenol (PC)[c]	8.90	55%	4.88
Bisphenol A (PC, epoxy resins)[c]	4.04	96%	3.86
Acetone (PC)[d]	5.67	45%	2.53
Total	**270.79**	**90%**	**243.48**

"Chemicals of High Concern" to human health or the environment = carcinogen, mutagen, reproductive / developmental toxicant; persistent, bioaccumulative, toxicant (PBT); endocrine disruptor; or chemical of equivalent concern.

Source: Chemical Economics Handbook articles (c), (d), (e), (f), (g), (l), (m), (n), (o), (p), (q), (s), (t).

...vlonitrile Butadiene Styrene
...onate
...e
...erephthalate
PLA = Polylactic Acid
PP = Polypropylene
PS = Polystyrene
PVC = Polyvinyl Chloride
SAN = Styrene Acrylonitrile
SBR = Styrene Butadiene Rubber

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Plastics Scorecard

"workers carry a body burden of plastics-related contaminants that far exceeds those documented in the general public . . . existing epidemiologic and biological evidence indicates that women in the plastics industry are developing breast cancer and experiencing reproductive problems at elevated rates as a result of these workplace exposures" (DeMatteo, et al., 2011).

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Plastics Scorecard

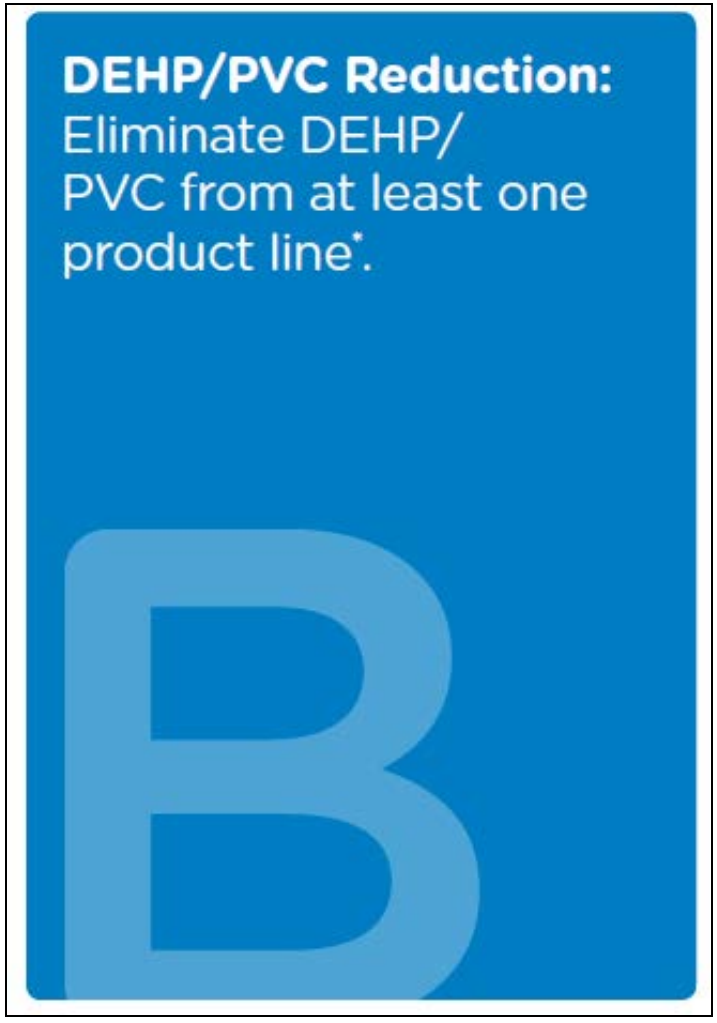
Healthier Hospitals INITIATIVE

PRACTICE Greenhealth™

Standardized Environmental Questions for Medical Products

Chemicals of Concern

- PVC
- Phthalates
- Halogenated Organic Flame Retardants
- Carcinogens/Reproductive Toxicants



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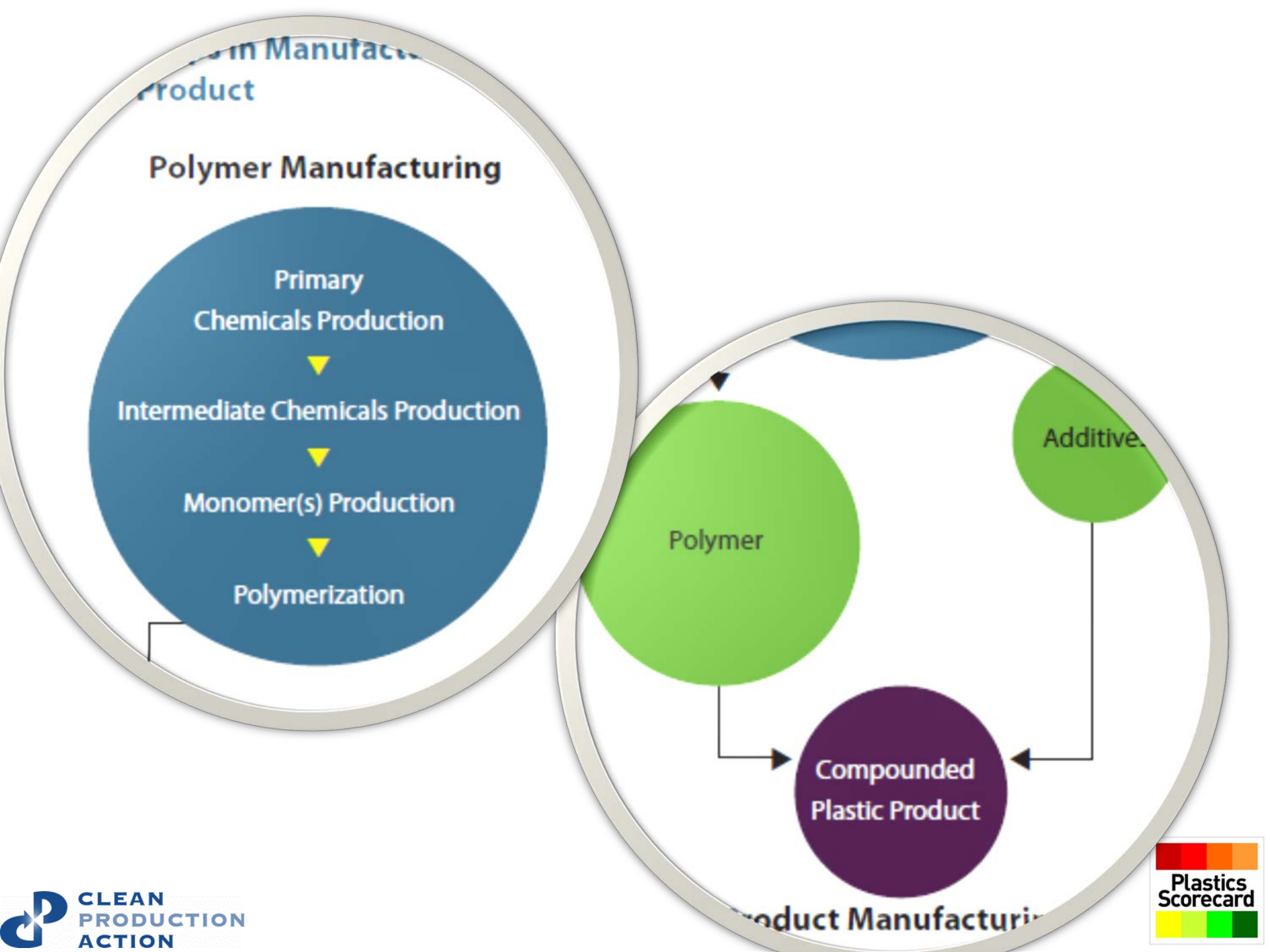
Plastics Scorecard



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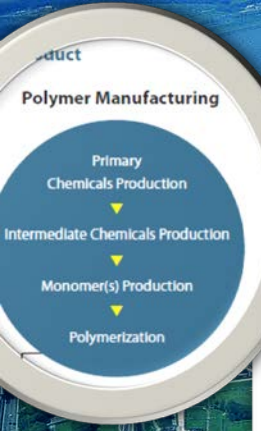
Plastics Scorecard



RE 6 Progress to Safer Chemicals in Polymer Manufacturing

Most Benign

100

50

0

Most Hazards

Polylactic Acid
58.33

Polyethylene
50.00

Polypropylene
50.00

Ethylene Vinyl Acetate
16.67

Styrene Butadiene Rubber
0

Acrylonitrile Butadiene Styrene
0

Polyethylene Terephthalate
8.33

Polycarbonate
0

Polystyrene
0

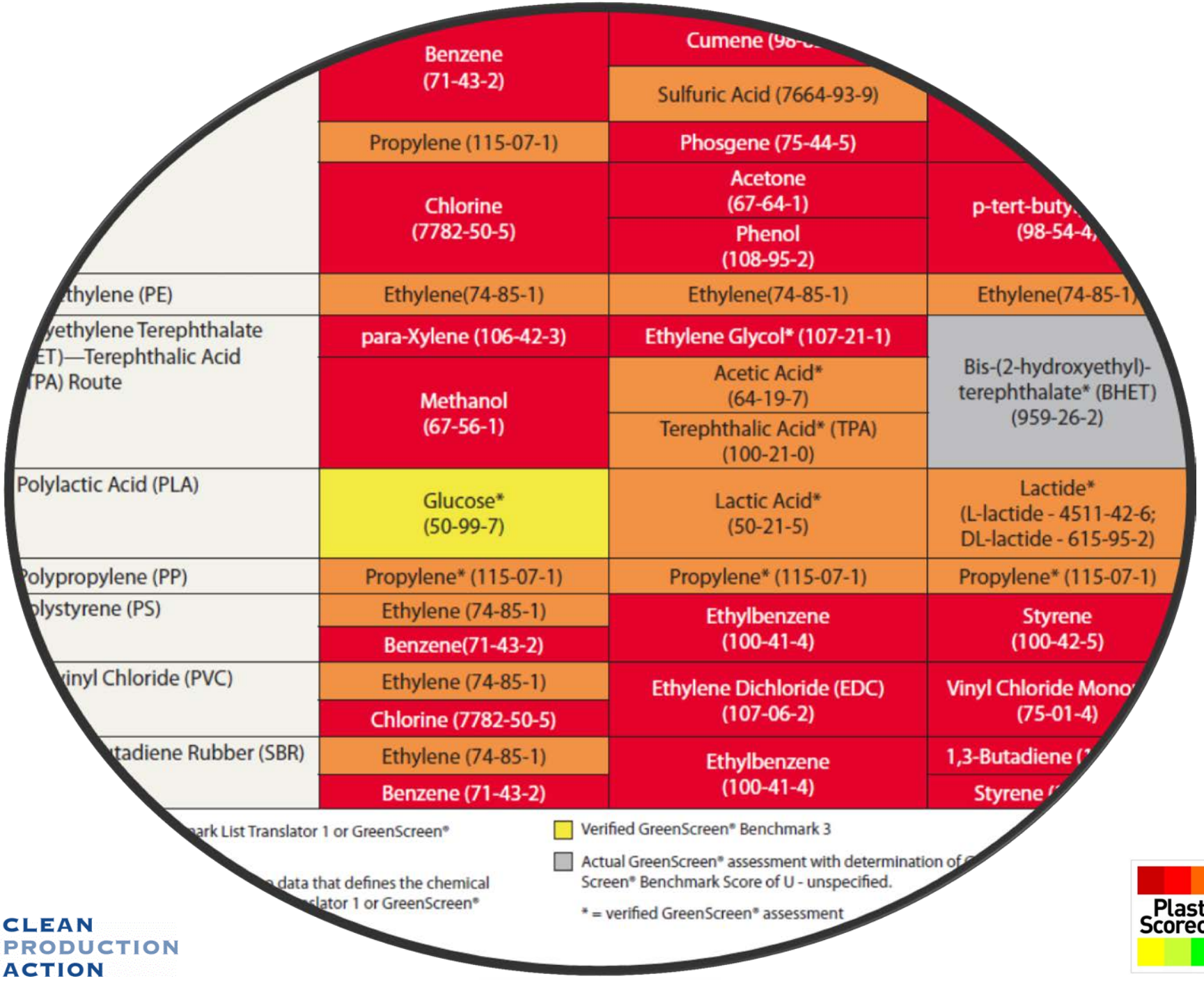
Polyvinyl Chloride
0

Less Production

More Production

For each manufacturing step, no core chemical inputs are chemicals

Every manufacturing step involves the use of chemicals of high



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Plastics Scorecard

CLEAN PRODUCTION ACTION

Plastics Scorecard

FIGURE ES-2 Estimated Chemical Footprint of IV Bags Made from PVC/DEHP and Polyolefins

PVC

3

Polyolefins

0

	Number of Chemicals of High Concern	Chemicals of High Concern by Weight

PVC = Polyvinyl chloride; DEHP = di(2-ethylhexyl) phthalate

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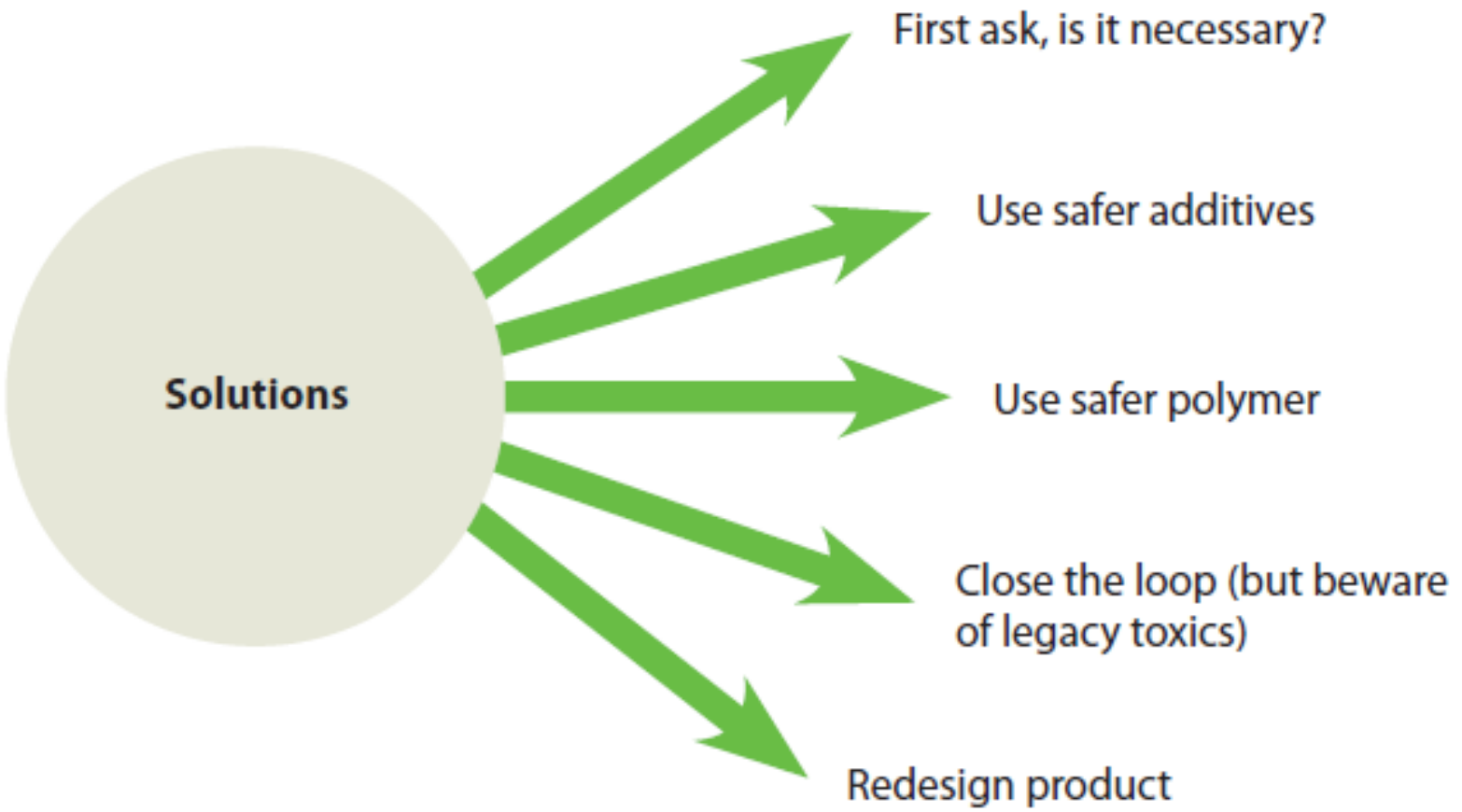
Plastics Scorecard

FIGURE 9 Solutions to Reducing Chemical Footprint of Plastics



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Is it Necessary?

Lynne Peeples ♥ Become a fan
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Posted: 06/03/2014 7:50 pm EDT | Updated: 06/03/2014 7:59 pm EDT

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Use Safer Additives

FIGURE ES-3 **Estimated Chemical Footprint of Electronic Enclosures Made from HIPS with DecaBDE & PC/ABS with RDP**

	Number of Chemicals of High Concern	Chemicals of High Concern by Weight
HIPS with Deca BDE	5	16%
PC/ABS with RDP	5	1%

ABS = Acrylonitrile Butadiene Styrene; DecaBDE = Decabromodiphenyl Ether; PC = Polycarbonate; RDP = Resorcinol Diphenylphosphate

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Plastics Scorecard

Use Safer Polymer

PVC = Polyvinyl chloride; DEHP = di(2-ethylhexyl) phthalate

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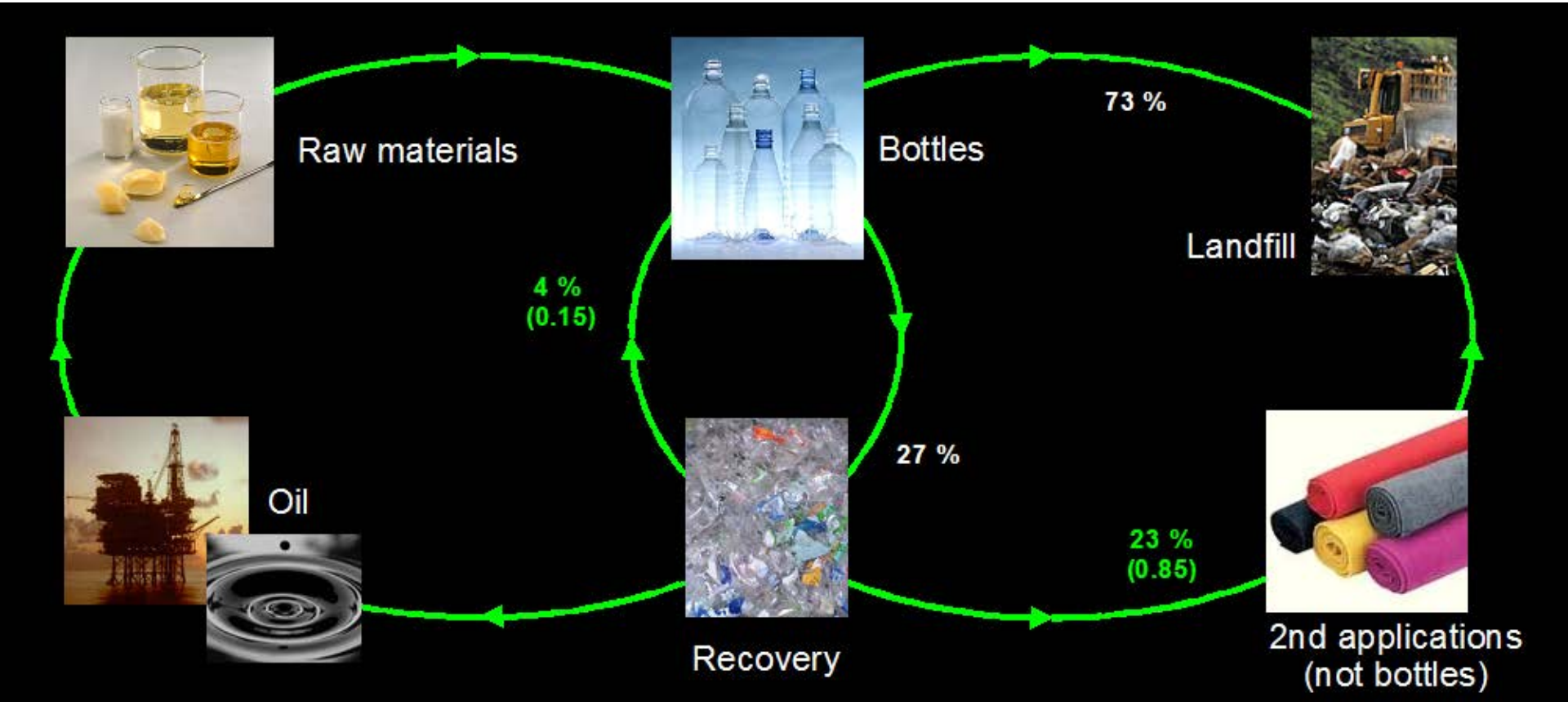
Plastics Scorecard

Close the Loop



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Plastics Scorecard

Close the Loop (beware of toxics legacy)

CLEAN PRODUCTION ACTION

Plastics Scorecard

Re-design Product

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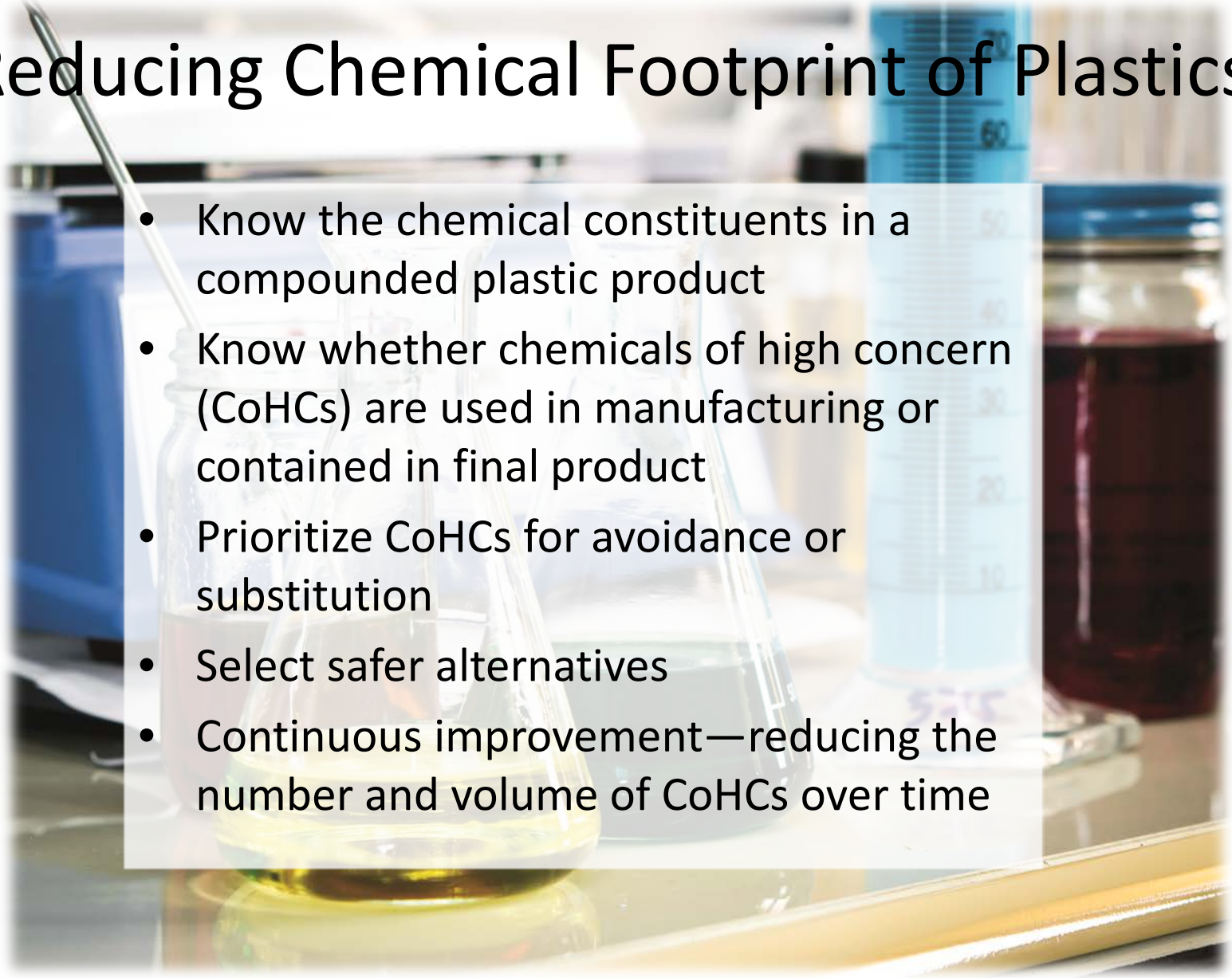
Plastics Scorecard

Reducing Chemical Footprint of Plastics



- Know the chemical constituents in a compounded plastic product
- Know whether chemicals of high concern (CoHCs) are used in manufacturing or contained in final product
- Prioritize CoHCs for avoidance or substitution
- Select safer alternatives
- Continuous improvement—reducing the number and volume of CoHCs over time

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Plastics Scorecard

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