



# The Cost of EU Regulation of Siloxanes (D4/D5) in Personal Care Products & Dichlorobenzene Toilet Blocks

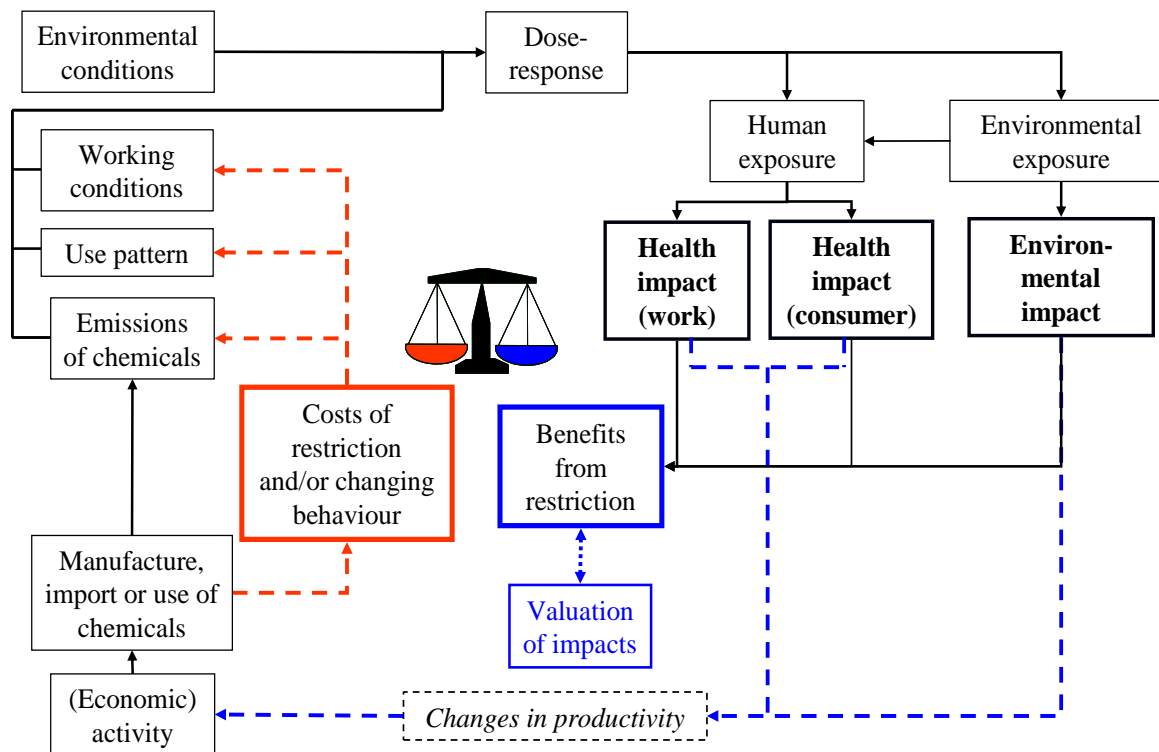
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assessment of chemicals management**

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# Economic Analysis of Chemicals Regulation



- To provide support to decision-making as to whether it is a good idea for society as whole to:
  - impose a restriction (compared to continued use or using other risk management options)
- Focus on difference in impacts ( $\Delta$ ) between the two scenarios, e.g.
  - What happens if a restriction on use is introduced (alternatives, relocation etc.)
  - In which ways and how much the positive and negative impacts change



# Costs Assessment of EU Regulation: D4/D5 and DCB

## Case Study 1

### Chemicals:

- Cyclotetrasiloxane (D4)
- Cyclopentasiloxane (D5)

### Use:

- improve the quality of personal care products: shampoo, Conditioners, etc

### Environmental Concern:

- PBT/vPvB:
- Washes off and builds up in sediment and water bodies
- Potential to enter bird and mammal food chain

## Case Study 2

### Chemicals:

- 1,4 Dichlorobenzene

### Use:

- air fresheners and toilet blocks used to deodorise public and domestic toilets.

### Health Concern:

- Category 2 Carcinogen

# Case Study I: Impact of restriction (concentration limit) on market for wash-off PCPs containing D4/D5

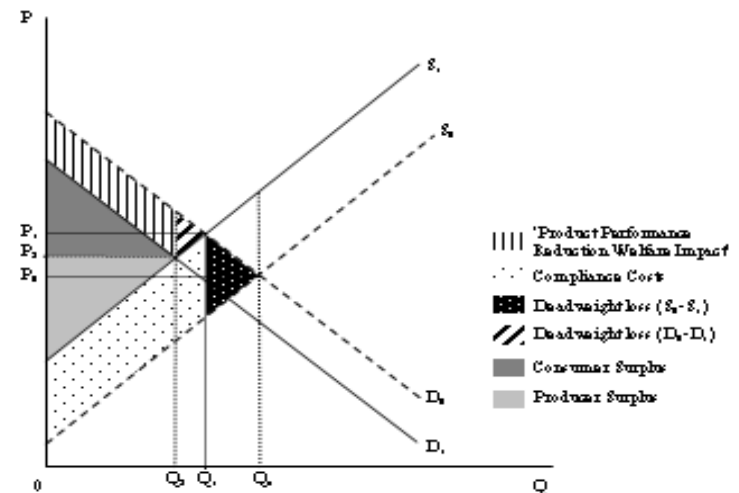
## Producers (Supply):

- reformulate product
- remove product from mkt!

Firms choose option that maximises their net benefits (profit)

## Consumers (Demand):

- $\Delta$  Price  $\rightarrow \Delta$  selection of products
- $\Delta$  Quality  $\rightarrow \Delta$  WTP for product



Partial Equilibrium Analysis

# D4/D5: Cost Estimation (I)

## Total Costs of Restriction

- = 1. Raw material substitution costs
- + 2. Reformulation costs
- + [3. Product performance (quality) welfare loss]

## I. Raw material substitution costs - additional costs from purchasing D4/D5 substitutes

- Based on difference in unit cost (adjusted by use ratio of substitute) x amount of D4/D5 eliminated
- Industry consultation suggests <50% Price ↑
- No Direct 'like-for-like' substitute
- Assume 100% Price ↑ to account for uncertainty

# D4/D5: Cost Estimation (2)

## 2. Reformulation costs – one time investment to reformulate products to replace D4/D5

- Gross Reformulation Costs = Reformulation cost per product<sup>1</sup> x total number of products reformulated<sup>2</sup>
- Subtract ‘baseline’ reformulation costs<sup>3</sup> (in absence of restriction) → Net Reformulation costs
- Convert to annualised basis<sup>4</sup>

<sup>1</sup> Based on studies from literature and industry consultation (€50K~500K)  
**assumes no knowledge transfer**

<sup>2</sup> Based on % of All PCP products on Mkt that contain D4/D5 (use tonnage share to estimate) **likely gross overestimate**

<sup>3</sup> Products routinely reformulated → accelerate costs incurred in absence of restriction + some coordination of routine reformulation efforts.  
**Simplified model of reformulation cycle (illustrative of order of magnitude)**

<sup>4</sup> Since reformulation is ‘knowledge’ investment (useful life of formula: t).



## D4/D5: Cost Estimation (3)

### 3. *Product performance (quality) welfare loss*

- Reformulated Products not of equal quality →  $\Delta$  demand and hence in CS+PS
- Welfare loss =  $\Delta$ CS +  $\Delta$ PS  
 $\approx$  WTP for quality attributes of D4/D5
- Estimation of WTP based on (CE) stated preference survey – Tradeoffs between product performance, env accumulation and price (**study validity issues?**)


# Results

- Costs: Compliance (substitution) costs = Raw material substitution costs + Reformulation costs

Compliance period (years)	Compliance Costs per annum			Cost-effectiveness (€/kg)	Total cost of compliance per kg of wash-off PCP sold (€/kg)	% Retail Sales Price increase (%)
	Raw material substitution Costs (€)	Reformulation Costs <sup>1</sup> (€)	Total cost of compliance (€)			
2	3,420,000	19,664,952 - 58,044,340	23,084,953 - 61,464,340	115.66 - 307.94	0.0636 - 0.1692	0.34 - 0.91
5	3,420,000	4,188,567 - 38,307,702	7,608,567 - 41,727,702	38.12 - 209.06	0.0209 - 0.1149	0.11 - 0.62

- Costs: Product quality consumer & producer surplus losses ~ €45 million (pa)?





## Case Study 2: Impact of restriction (Ban) on 1,4 DCB toilet blocks and air fresheners

### Cost Methodology: 2 approaches

- Financial costs of switching from 1,4 DCB to alternative (direct substitution cost)
  - Based on  $\Delta$  market price and equal quantities (tonnage) sold
- Consumer surplus change of switching from 1,4 DCB to alternative
  - Based on  $\Delta$  market price and  $\Delta$  in quantities (tonnage) sold assuming  $\epsilon_p = -1$  and linear demand



# Information on alternatives to DCB

- Alternatives dominate the market
- Alternative products may contain several substances
- Technical feasibility
  - In most of the applications alternatives can provide the same service
  - Alternatives might not provide the same service when strong odour masking is necessary
- Economic feasibility
  - Alternatives are cheaper in most of the applications
  - Alternatives are more expensive for (high traffic) urinals

# Costs of 1,4 DCB Restriction

- For domestic use, it is assumed that alternatives are functionally equivalent to 1,4-DCB
  - Switching to (cheaper) alternatives will result in **savings**
- For professional use, it is assumed that there are no suitable alternatives
  - The restriction will result in **costs**

<b>Restriction Option</b>	<b>Change in consumer surplus (€m)</b>	<b>Substitution costs (€m)</b>
<b>Domestic use only</b>	2.7	2.0
<b>Professional use only</b>	-4.0	-0.6
<b>Domestic and professional use</b>	-1.2	1.4

Note: positive values indicate savings; negative values indicate costs



# Cost Assessment: Lessons learned (I)

- It was possible to estimate the ‘order of magnitude’ of cost impacts for both D4/D5 and 1,4 DCB restrictions
  - Compliance costs and (some) Welfare costs assessed
- In both cases assessment was not straightforward:
  - Data challenges/missing information;
  - Modelling of producer and consumer behavioural changes
  - Realism of assumptions made – scenarios/sensitivity/worst case?
- Understanding and sound estimation of magnitude of cost impacts provides important context for benefit cost comparison in chemicals regulation
  - Benefits assessment v.difficult (esp for Environmental impacts)!
  - Costs may be small or negative (cf 1,4 DCB)!
  - Use (and limits) of Cost-effectiveness/break-even/affordability assessments to assess ‘proportionality’ of restriction



# Cost Assessment Lessons learned (2)

- Importance of collaboration with industry/trade associations
  - Crucial when considering ‘targeted’ restrictions
  - Not a panacea – time consuming and requires trust on both sides
  - Good info on some cost elements/ not for others (problems of confidentiality/competition law to overcome)
  - Problem of aggregated data
  - Collaborate early in process and involve throughout
  - incentives to exaggerate costs remain ?
- Use of Consultants
  - Not a Panacea – can be administratively burdensome and expensive
  - Often good at data collection in short time (removed from regulator; existing industry contacts)



# Recommendations

- Start with theory e.g. D & S (comparative statics diagram)
- Ensure assessment is proportionate to magnitude of impacts – focus on most important sectors/cost elements in practice and use appropriate methodology
- Work with those who are affected and who have the data (industry/trade associations) - Build trust by bringing in at beginning of process and consulting/transparency throughout the process
- Use simplified models of behaviour/reactions and use assumptions, but recognise limitations and build into analysis
- Ensure transparency of all assumptions and highlight uncertainties (make use of worst case/scenarios/sensitivity)

Thank you!





# Components of Regulatory Cost

- **Compliance costs**
  - eg. pollution control equipment; input & process changes; permit applications
- **Government regulatory costs**
  - eg. monitoring, admin & enforcement
- **Social Welfare losses**
  - Loss in Surpluses due to change in price and quantity of goods
    - **Transitional costs**
      - Reallocation of resources e.g. capital obsolescence due to plant closure; production disruptions
- **Indirect costs**
  - Changes in market structure; Product quality; innovation; productivity





# Cost Estimation Methods

## → Compliance costs

- the cost of all policy compliance actions (e.g. abatement; process change).
- may be sufficient when “behavioral response, transitional costs and indirect costs are small”

## → Partial equilibrium/ behavioral response

- Captures behavioral responses, but confined to effects on directly regulated firms or households

## → General equilibrium/ Secondary effects

- Where effects on large number of markets; the net burden once all good and factor markets have equilibrated;