PCBs in Consumer Products

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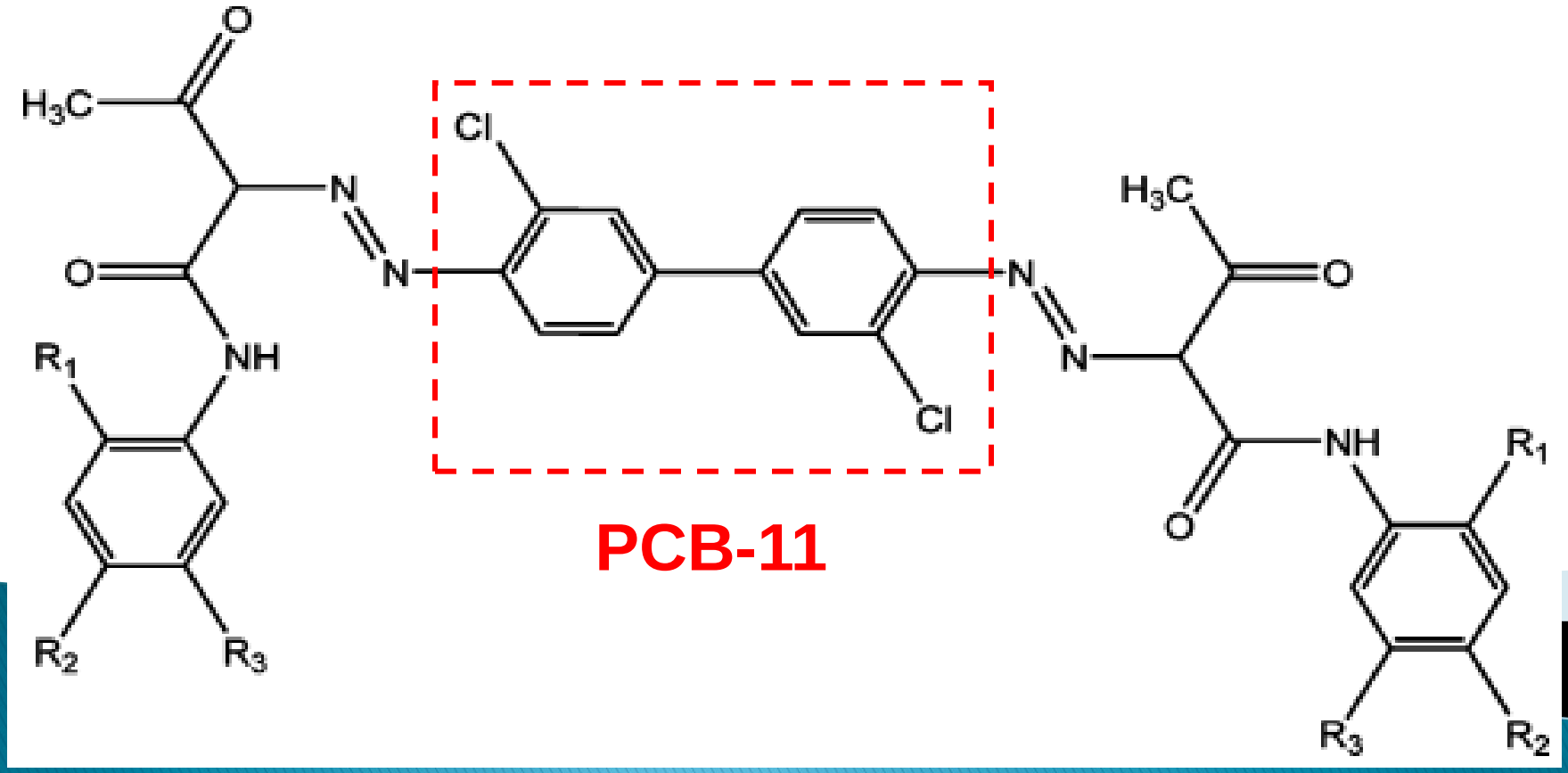
Background

- PCBs contaminant in pigments and dyes
  - PCB 11 in yellows and oranges
  - Higher substituted PCBs in blues, greens and titanium dioxide
- Concerns about distribution and concentrations affecting environment
- May contribute to PCB exceedance of water quality discharge limits
- Products analyzed using EPA High Resolution GC/MS Method 1668

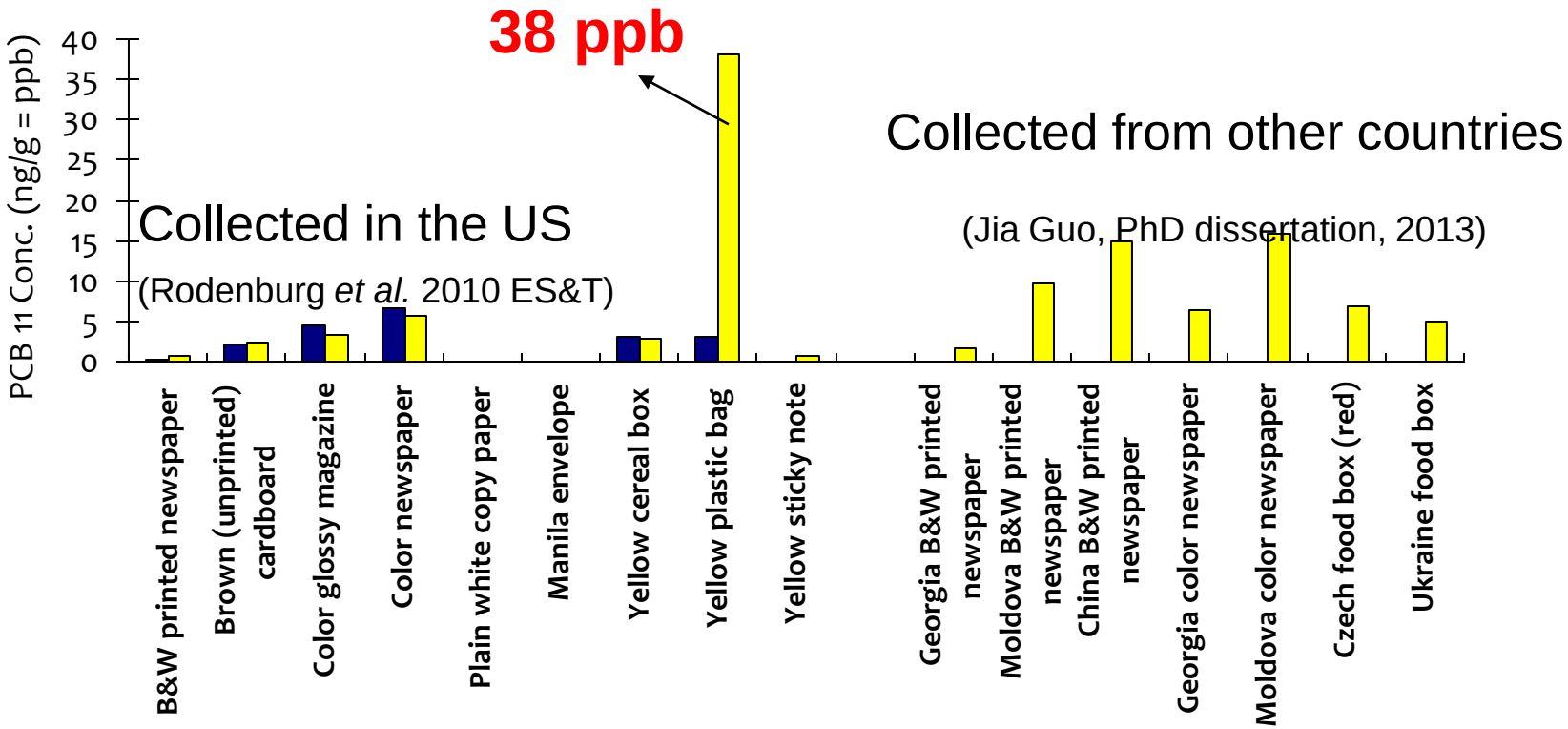
PCBs in Consumer Products (cont.)

Structure of Diarylide yellow



Source: Lisa A. Rodenburg, Rutgers University, 'Inadvertent PCB production and its impact on water quality', ECOS meeting, 2012.

PCB 11 in Printed Materials



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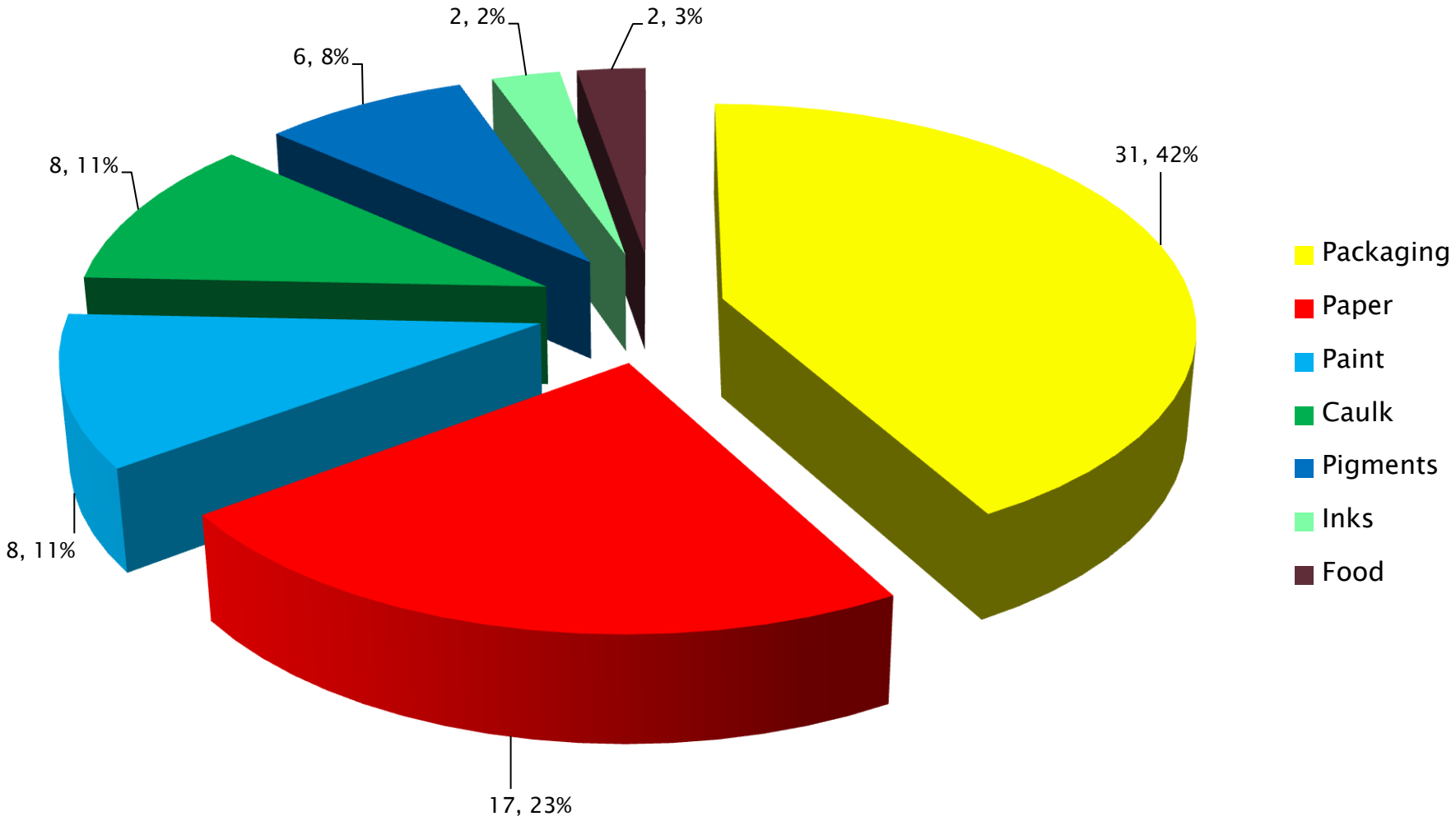
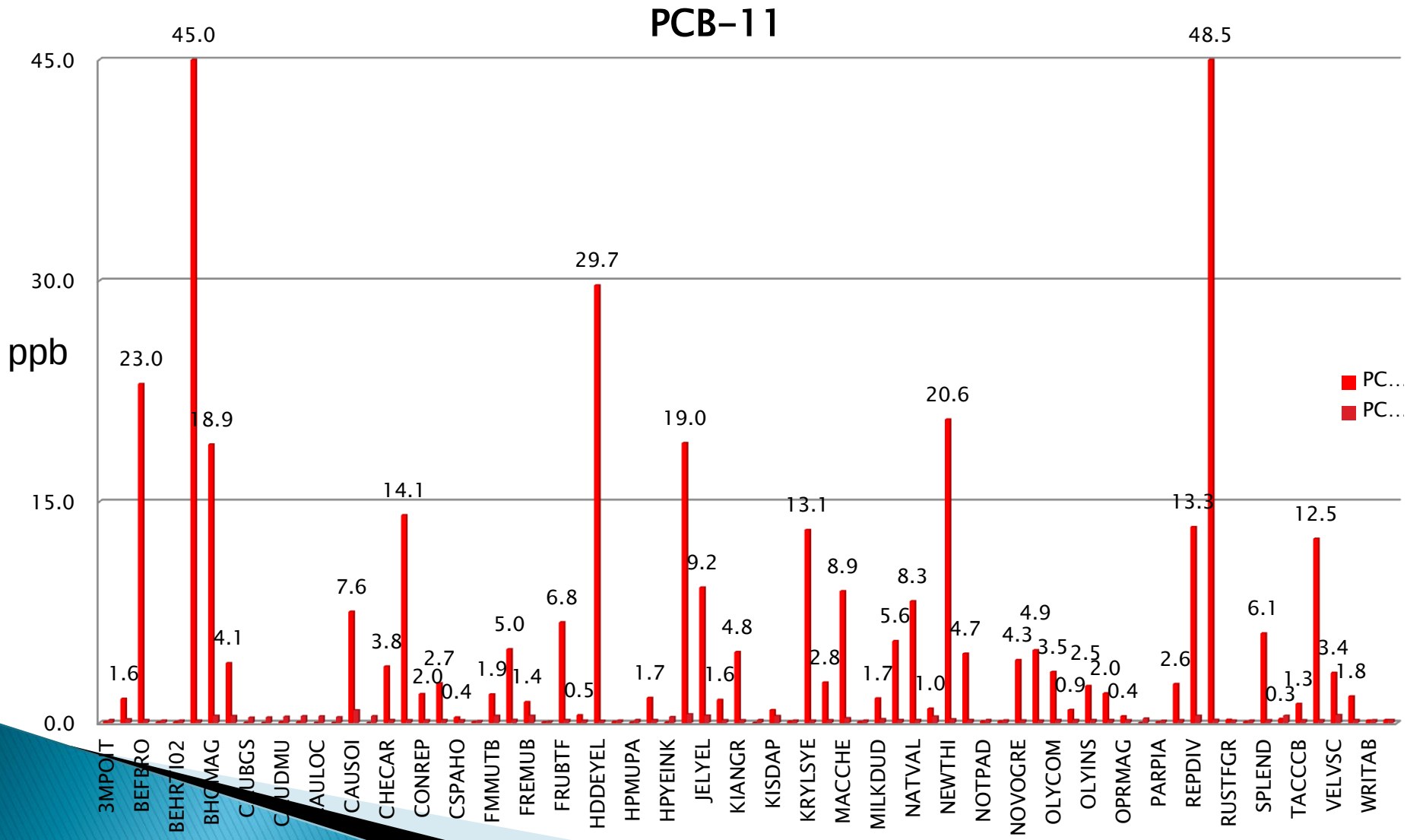
Sample Breakdown

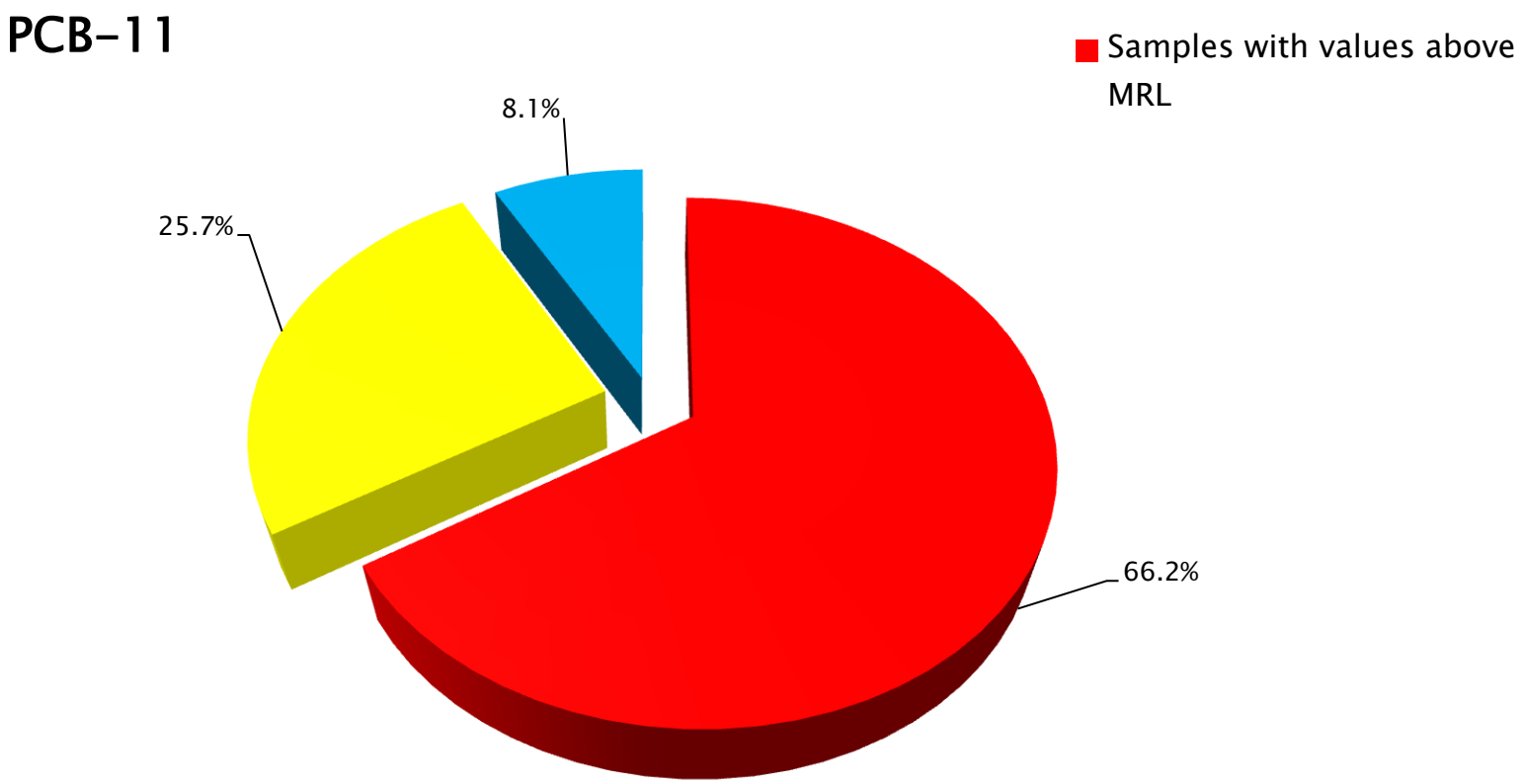
- 74 Product Samples



PCB-11 in All Products

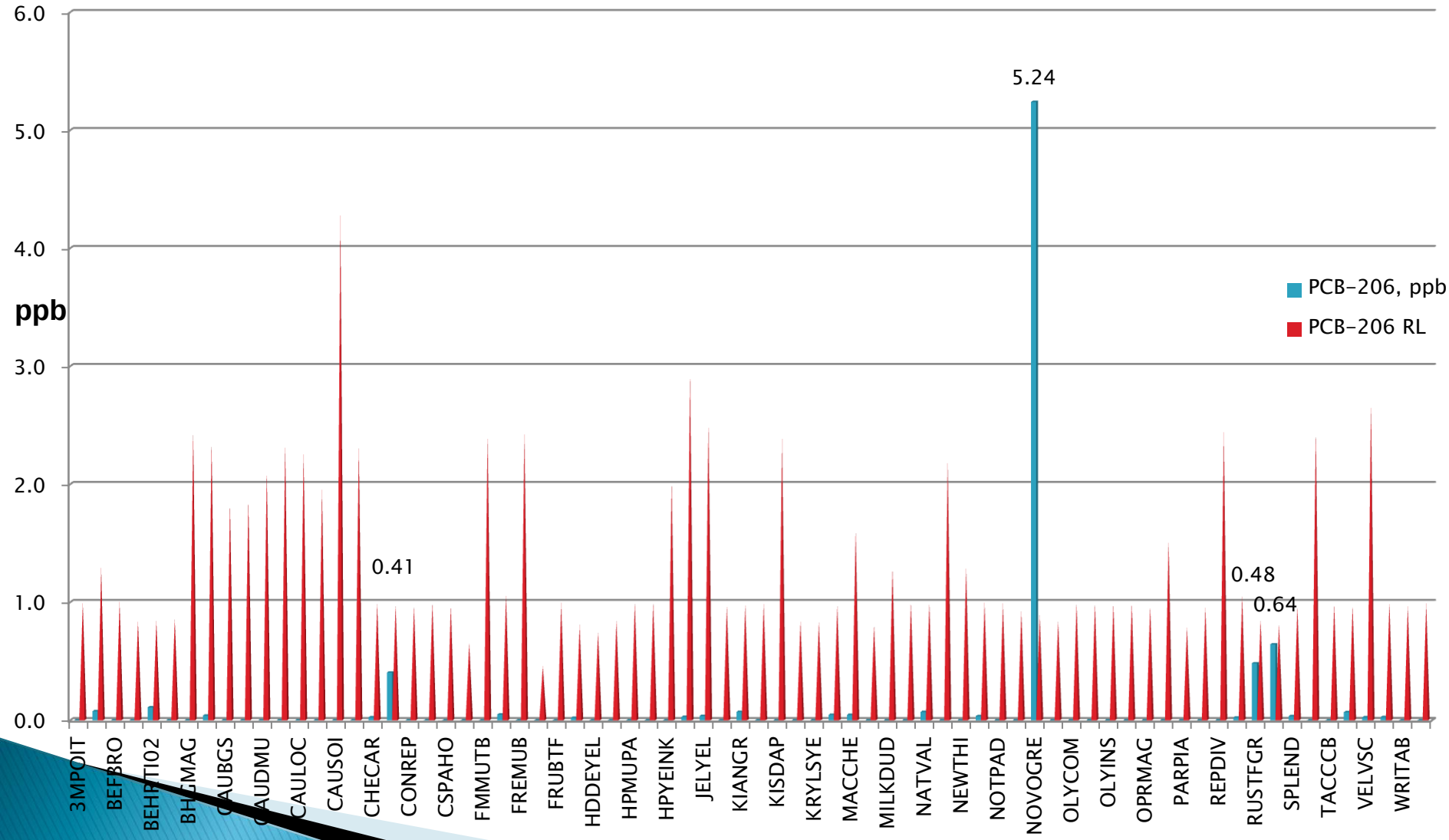


PCB-11 in All Products

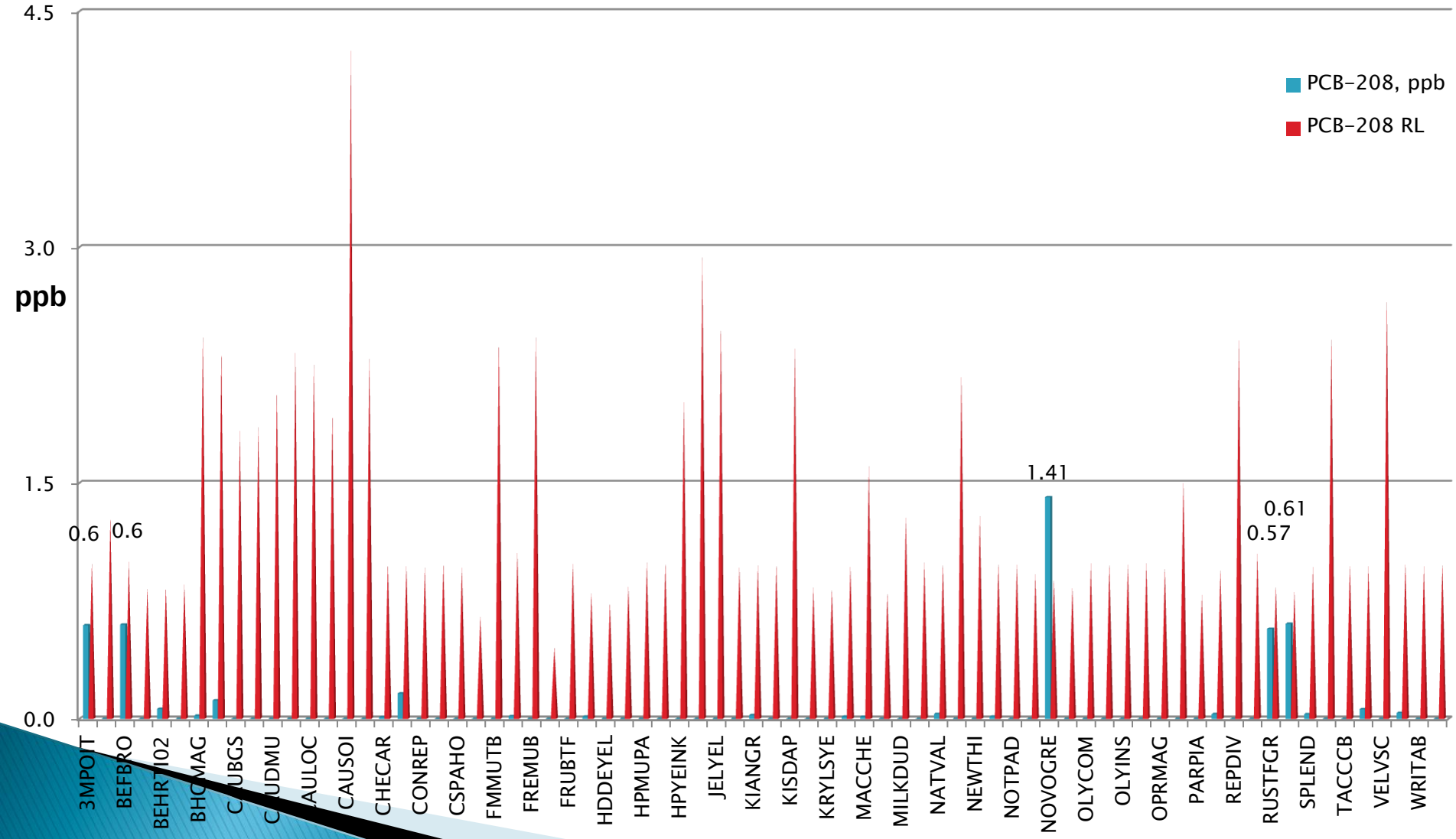


	ppb
PCB-11 Minimum	0.03
PCB-11 Maximum	48.50
PCB-11 Average	5.20
PCB-11 Mean	1.66

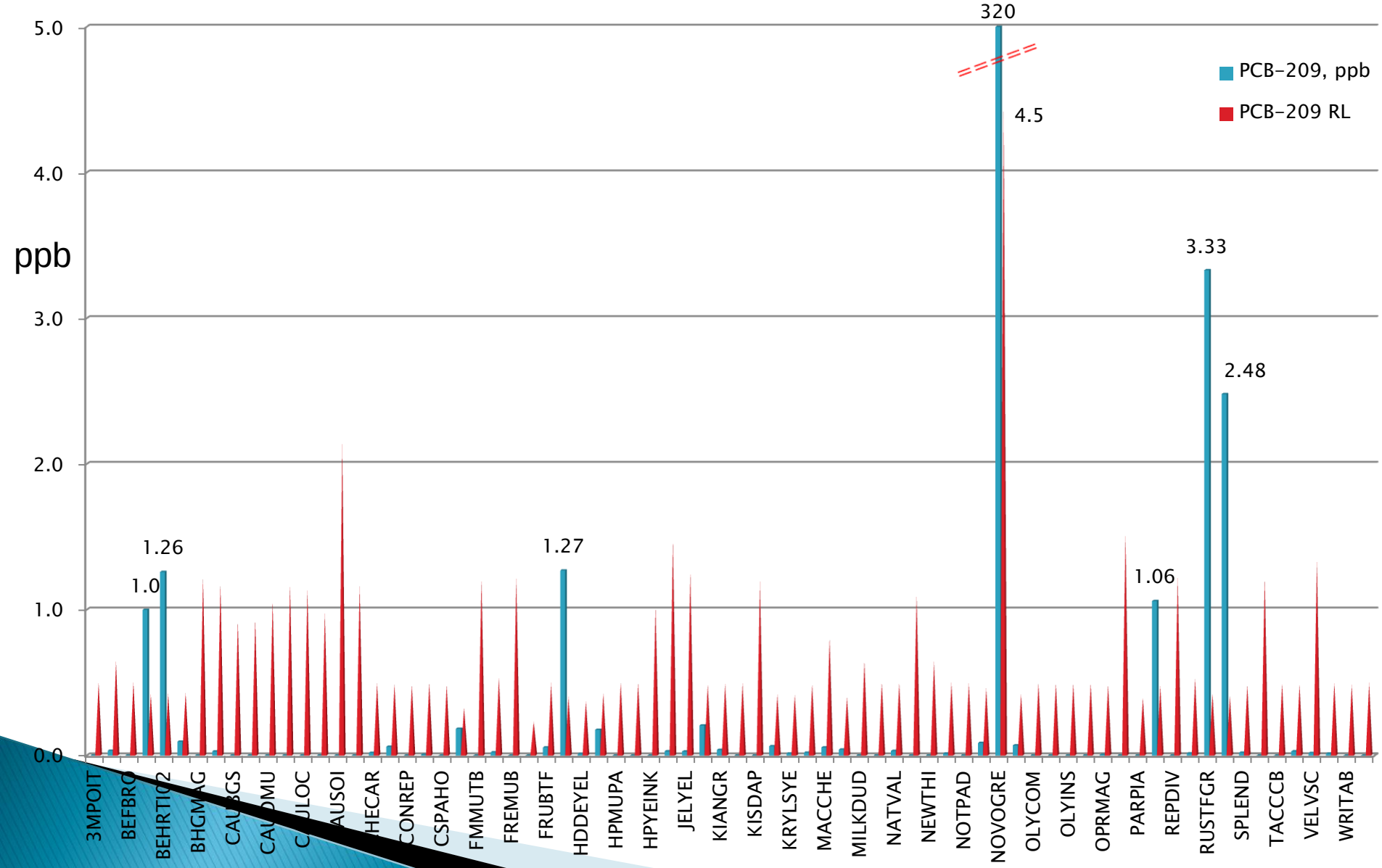
PCB-206 in All Products



PCB-208 in All Products



PCB-209 in All Products

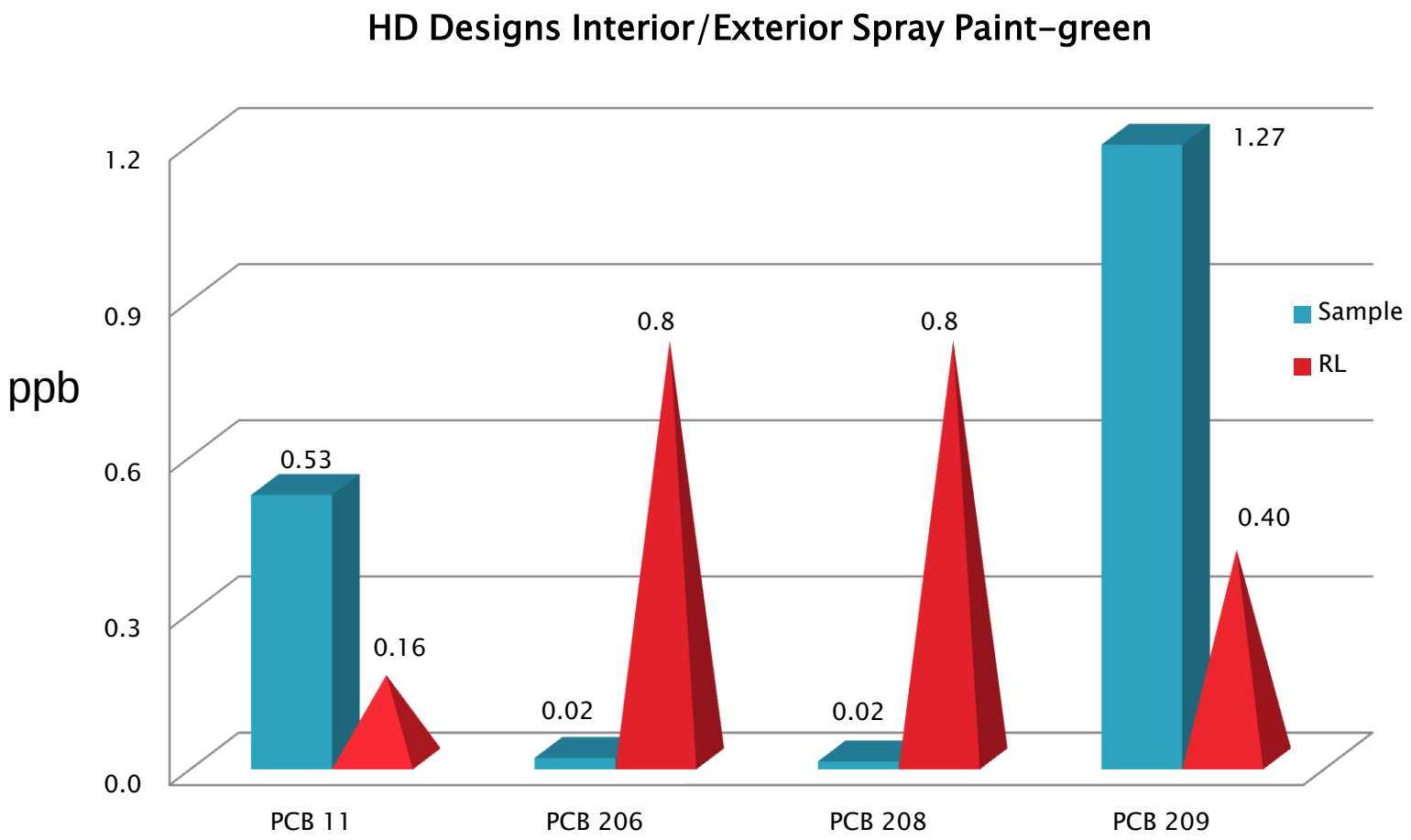


PCBs in Products

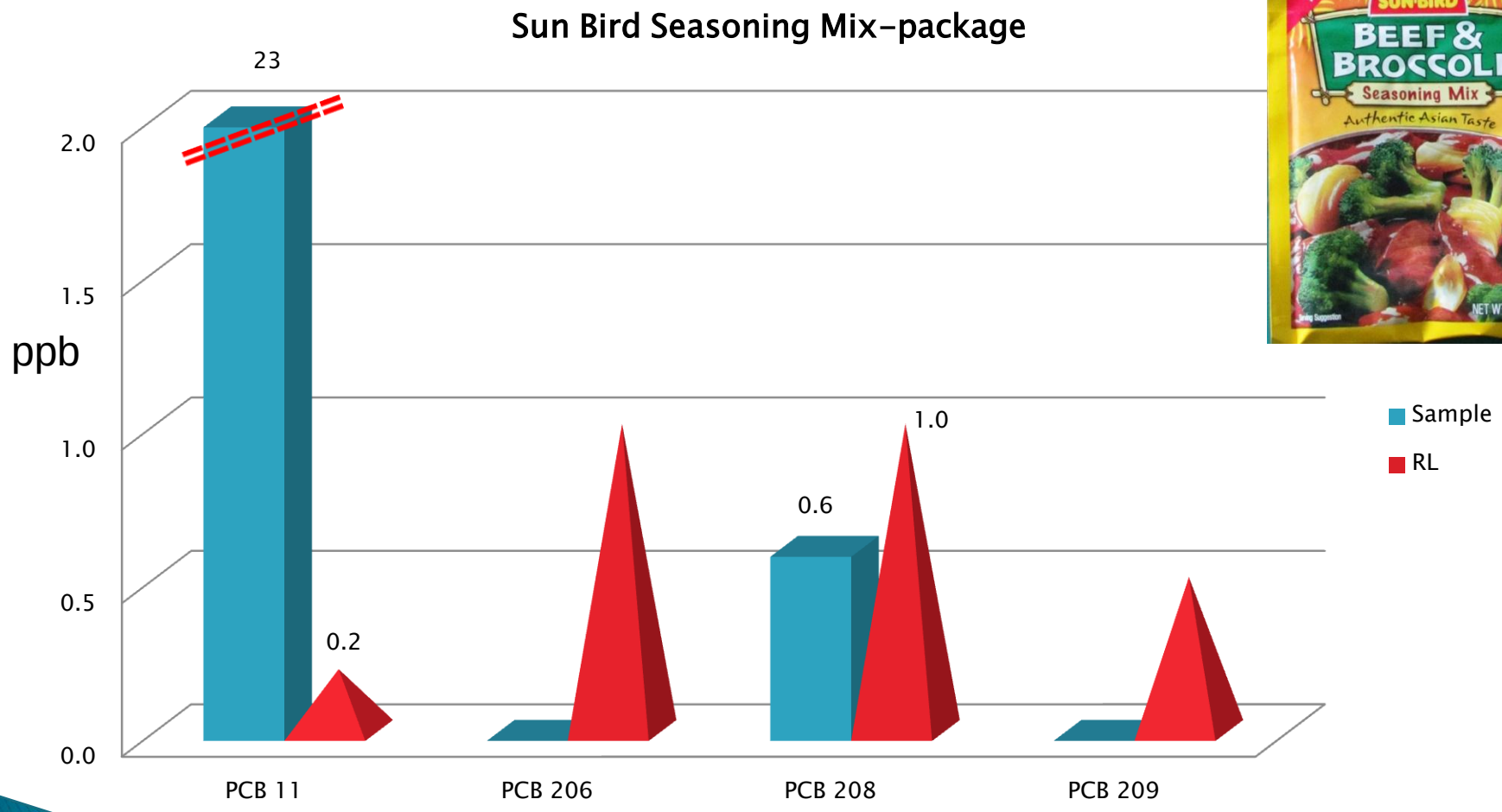
	Nr. PCB-11	PCB-11 %	Nr. PCB-206	PCB-206 %	Nr. PCB-208	PCB-208 %	Nr. PCB-209 %	PCB-209 %
Values above MRL	49	66.2	1	1.4	1	1.4	7	9.5
Values below MRL but above MDL	19	25.7	21	28.4	20	27	30	40.5
No detectable amounts above MDL	6	8.1	52	70.3	53	71.6	37	50

MRL = Method Reporting Limit
MDL = Method Detection Limit

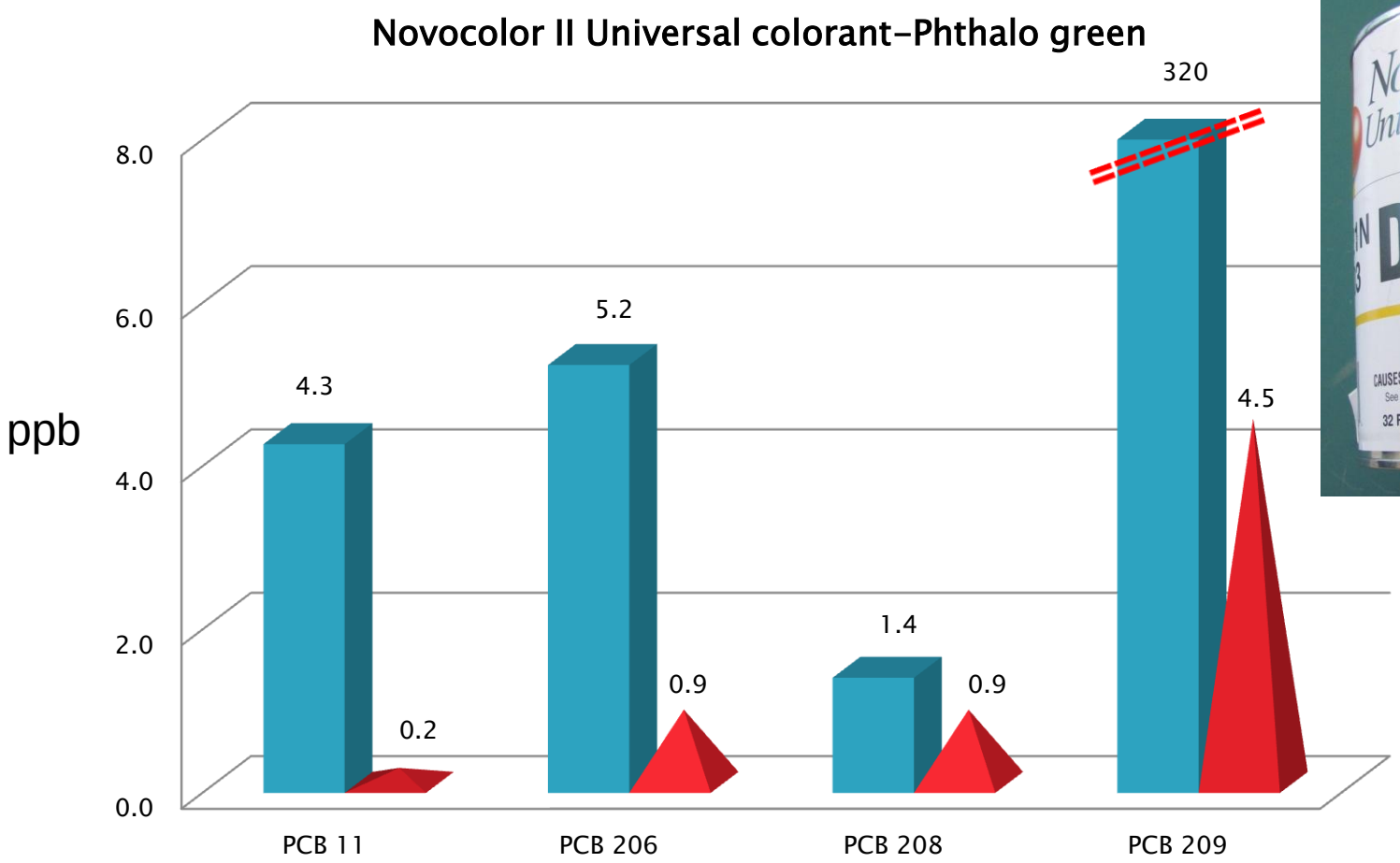
Individual Products



Individual Products



Individual Products

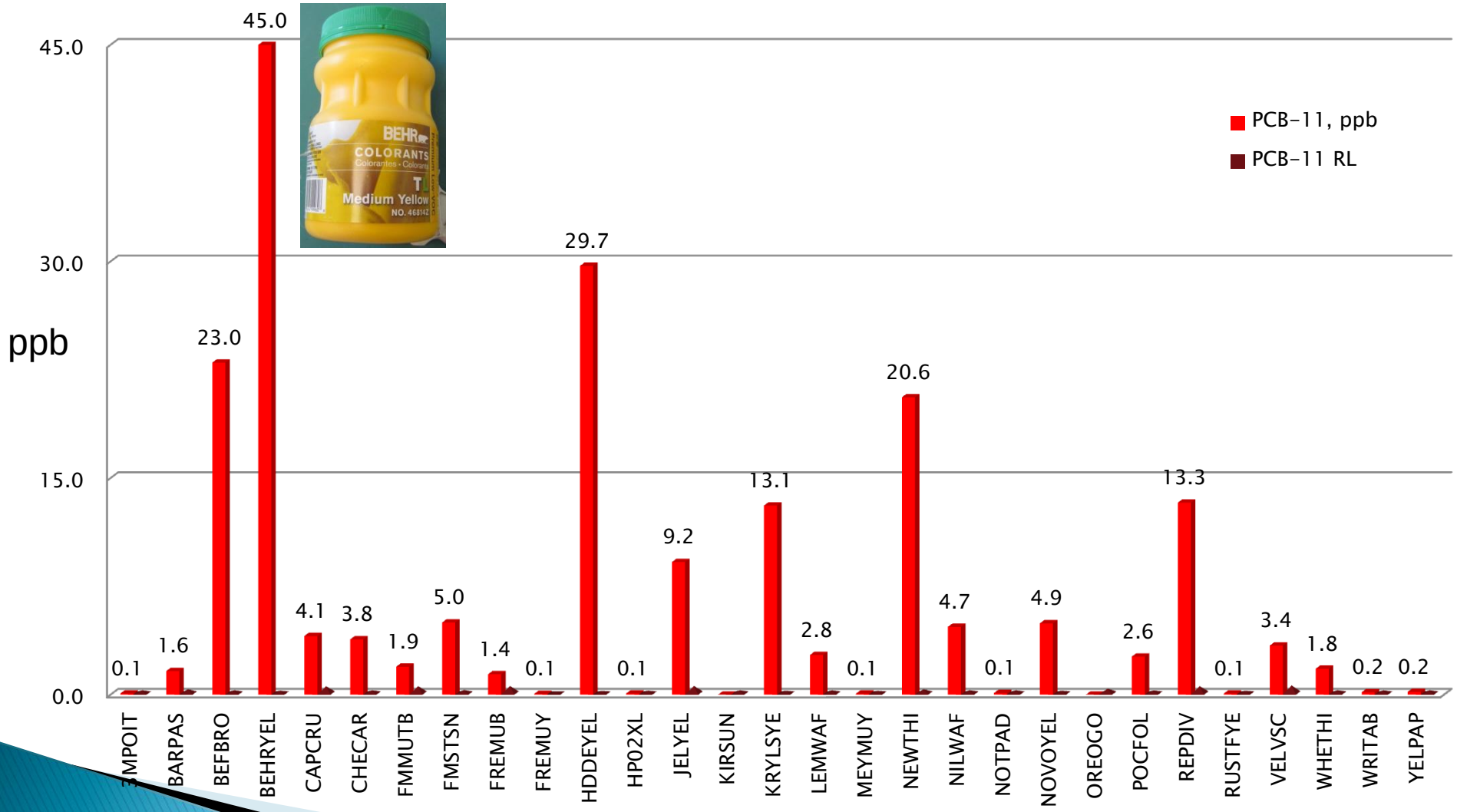


PCBs by Color

Category	Nr.	%
Primarily yellow products	29	39.2
Yellow and other colors, mostly red	13	17.6
Primarily blue products	2	2.7
Primarily green products	8	10.8
Primarily white products	12	16.2
Misc. products, primarily paper	10	13.5

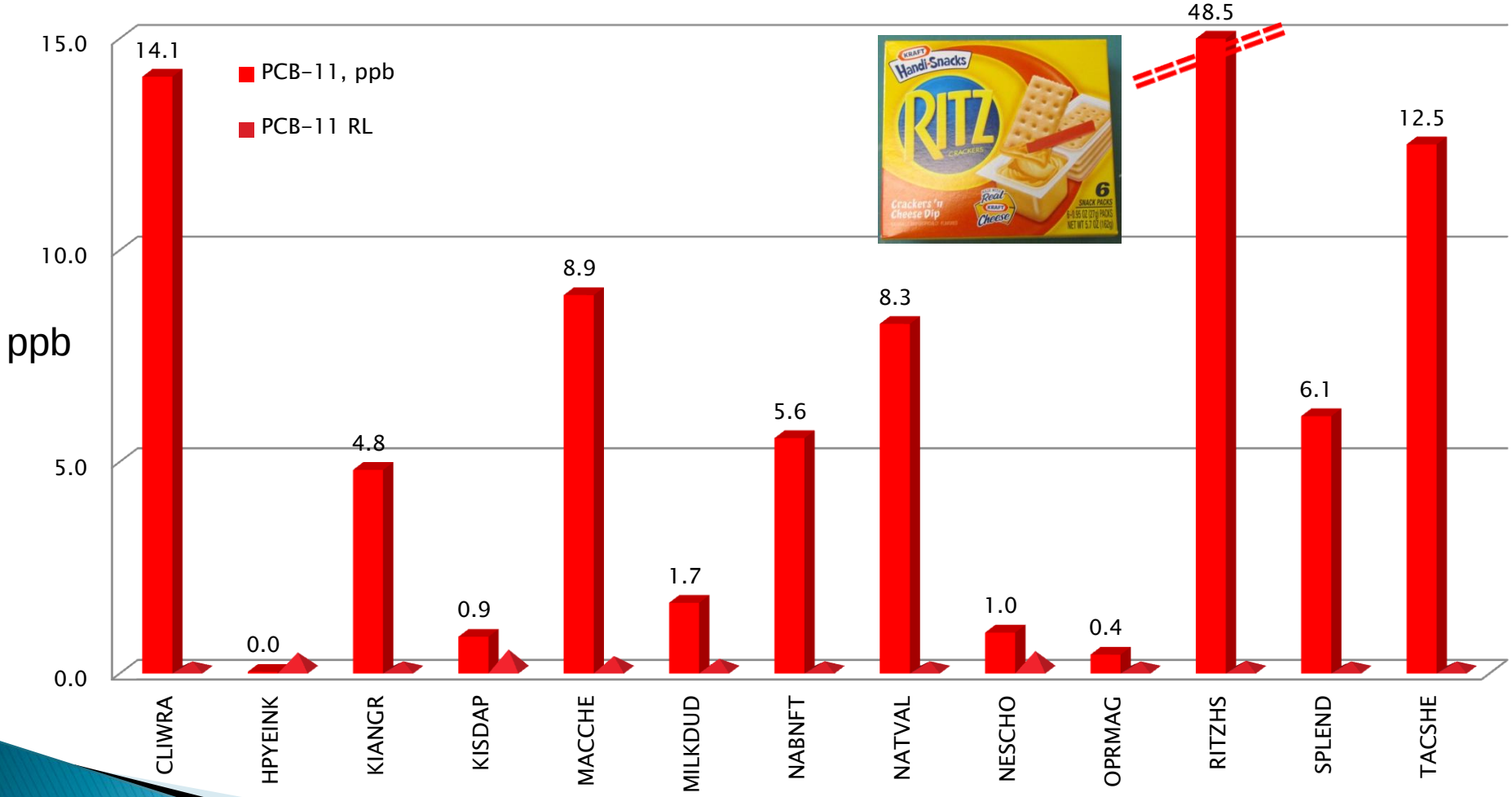
Yellow Products

Yellow Products

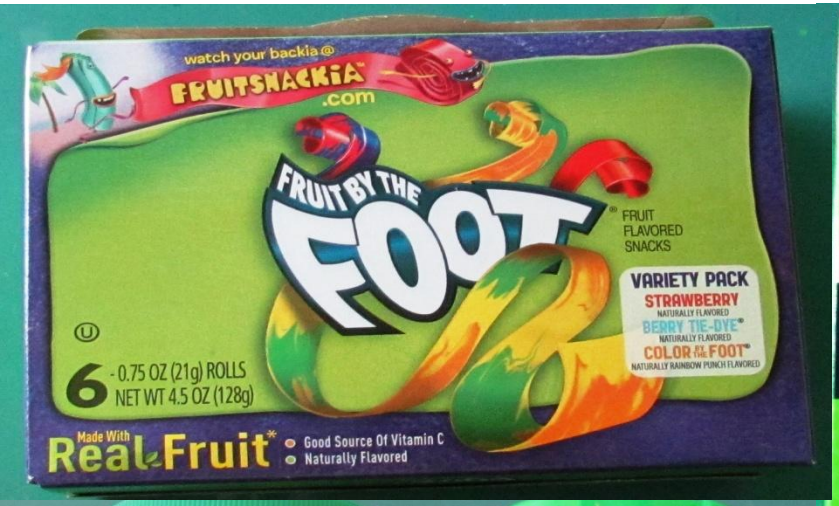


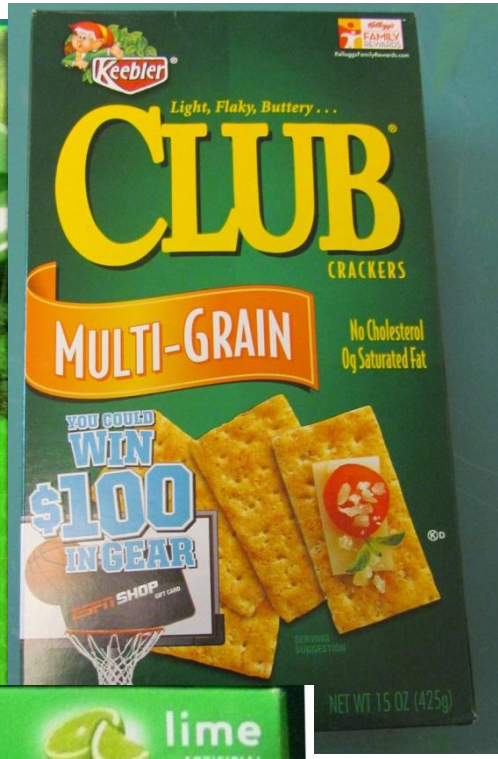
Yellow & Other Colors Products

Yellow & Other Color Products

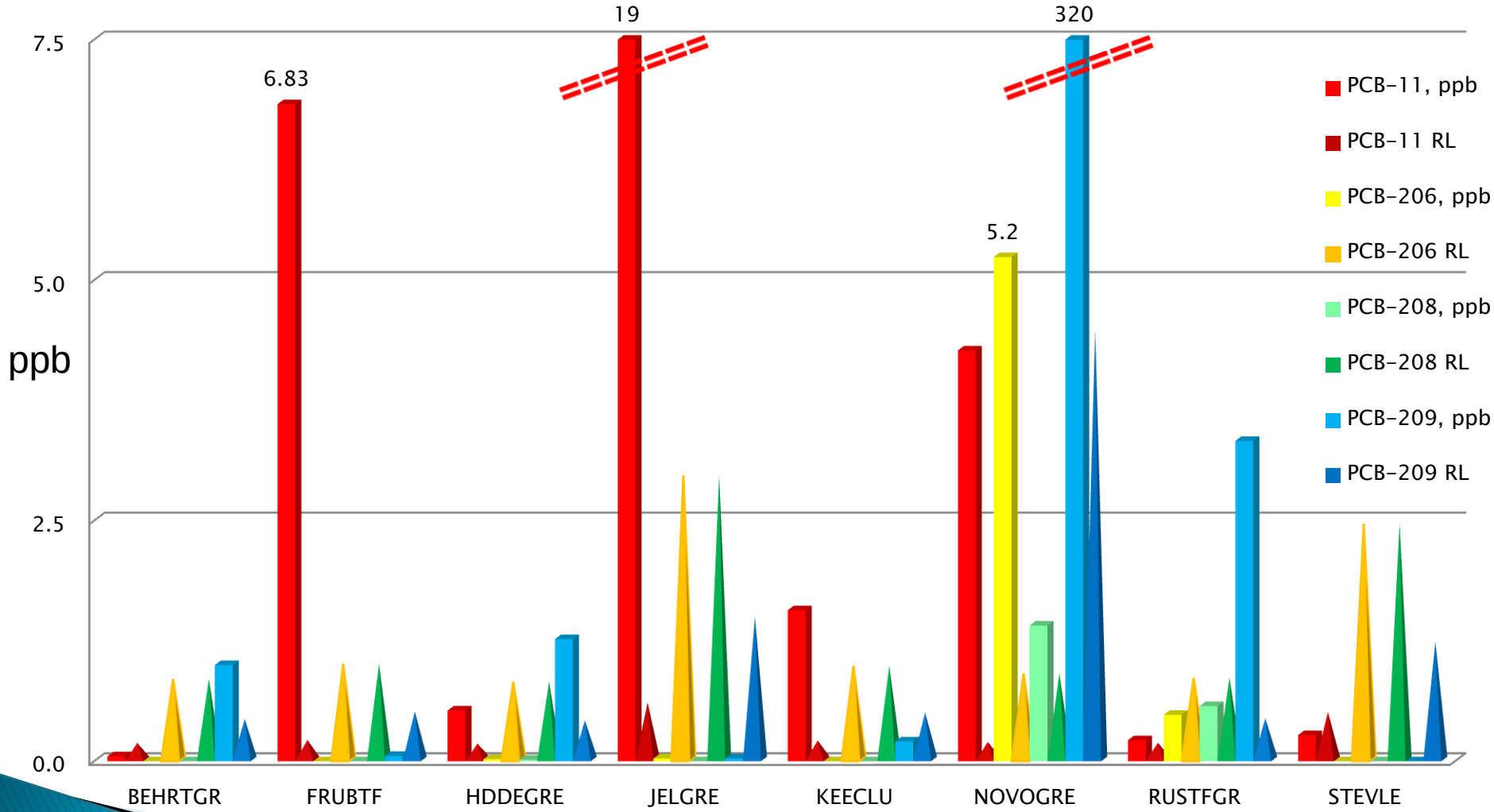


Green Products



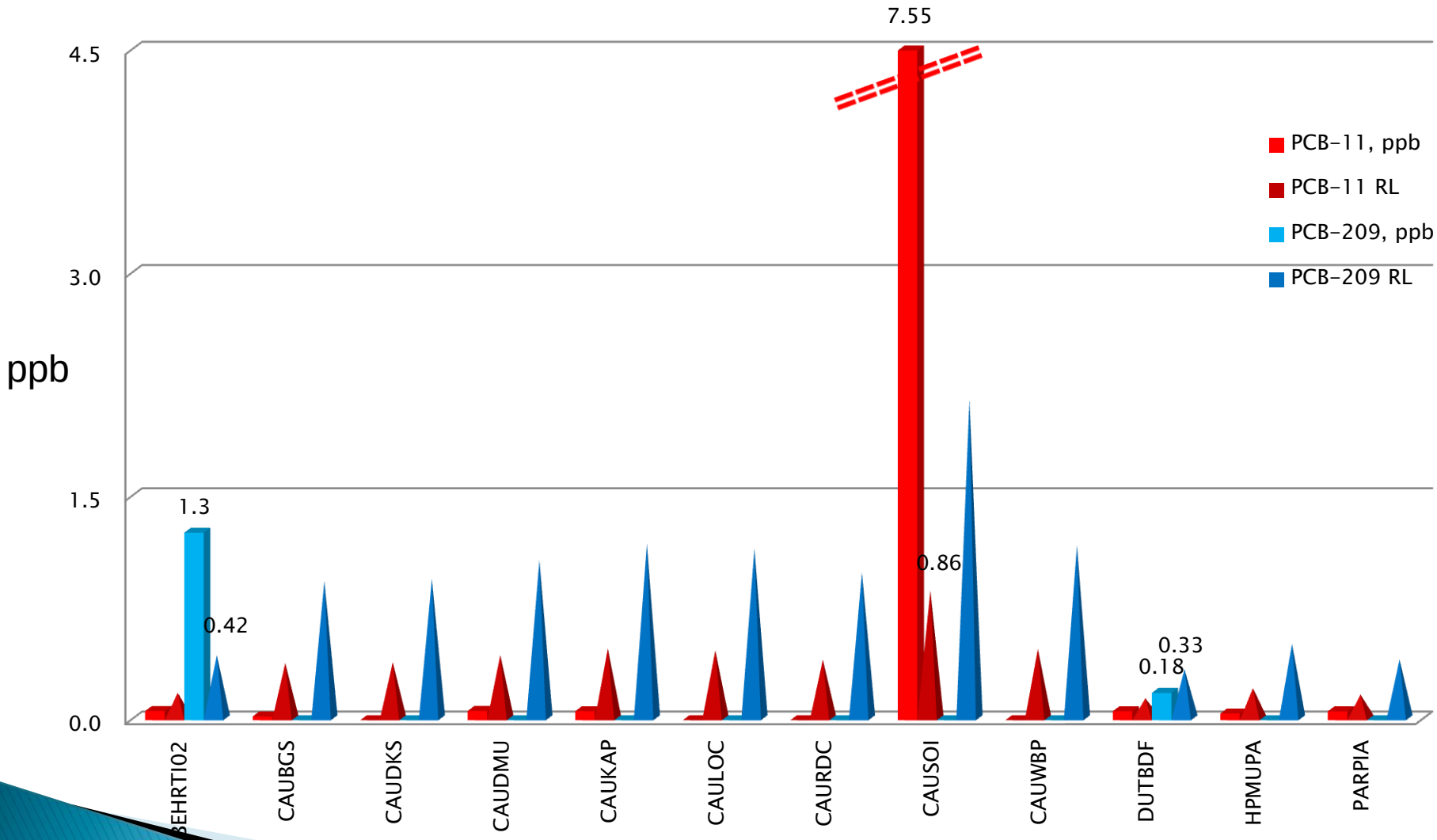


Green Products

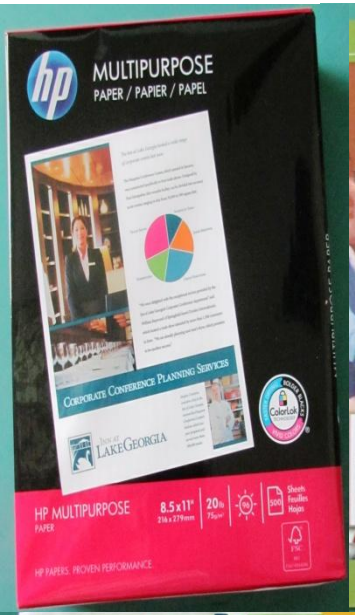


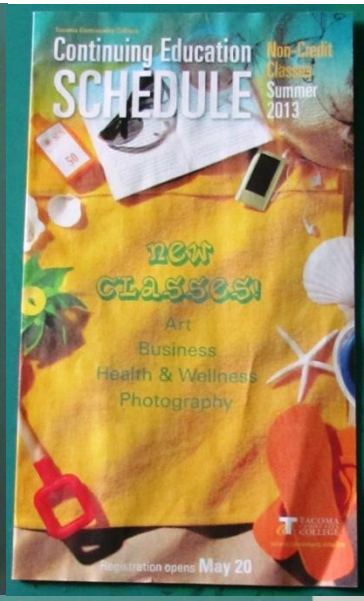
White Products

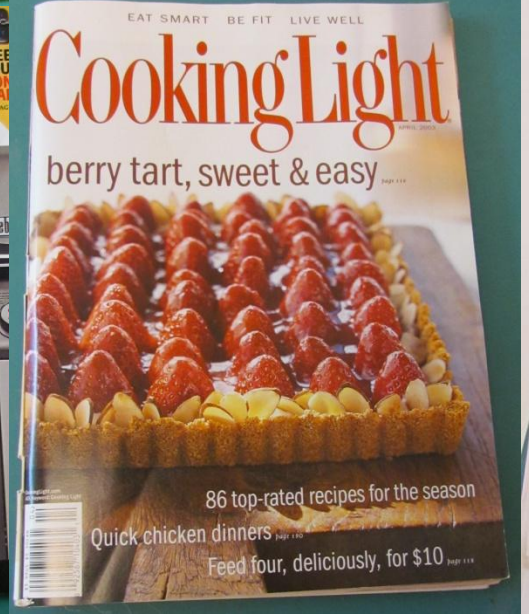
White Products



Miscellaneous Products







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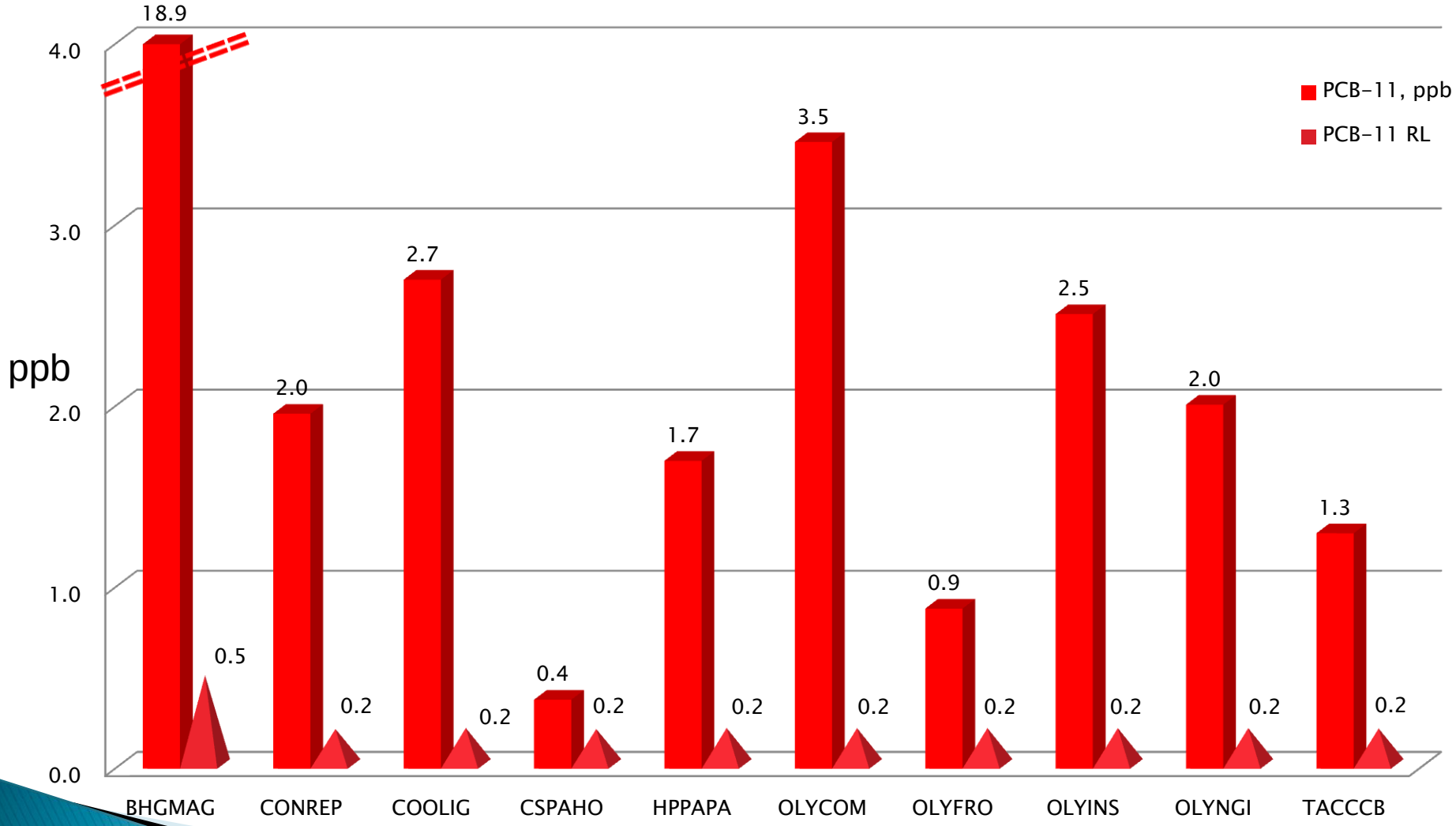
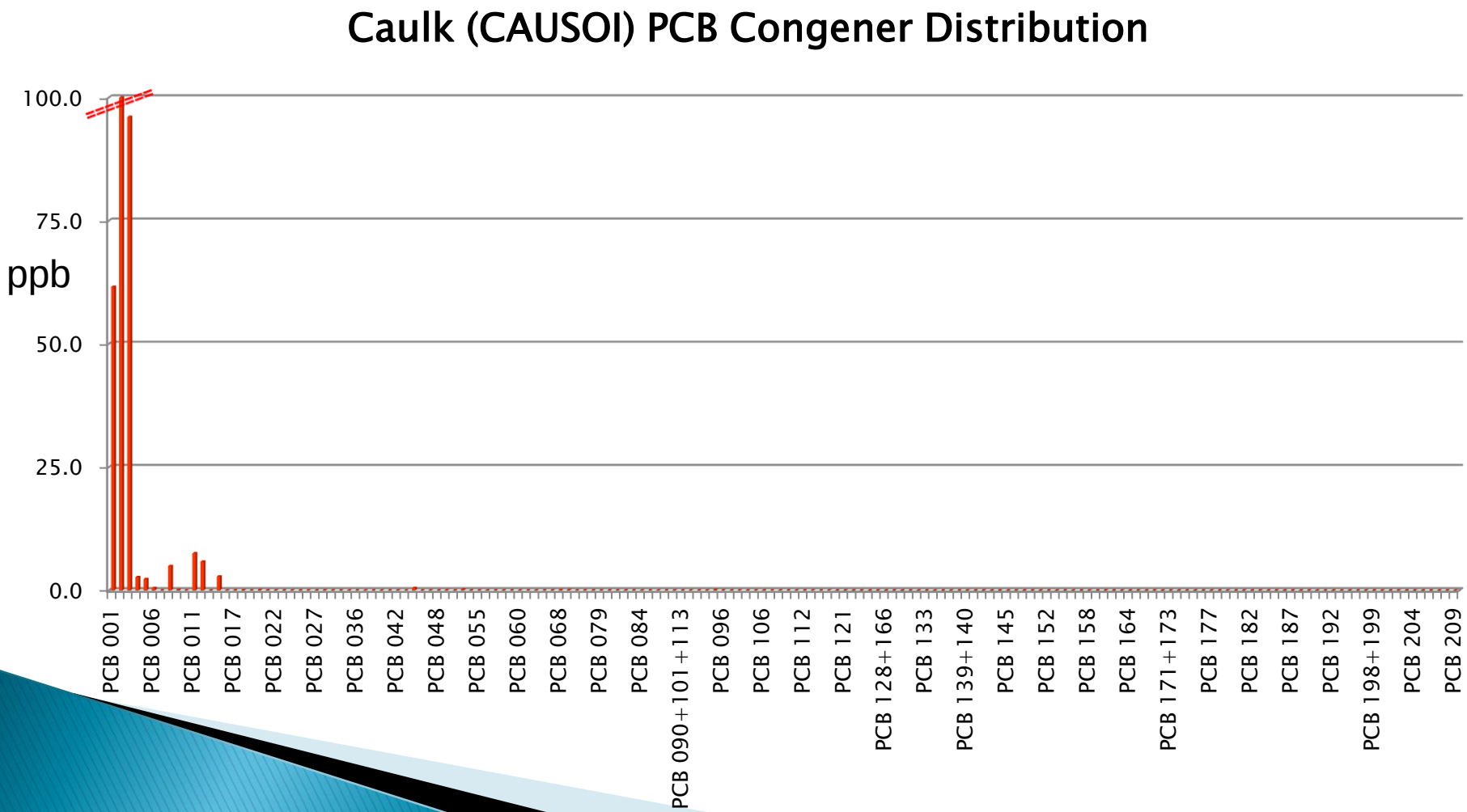


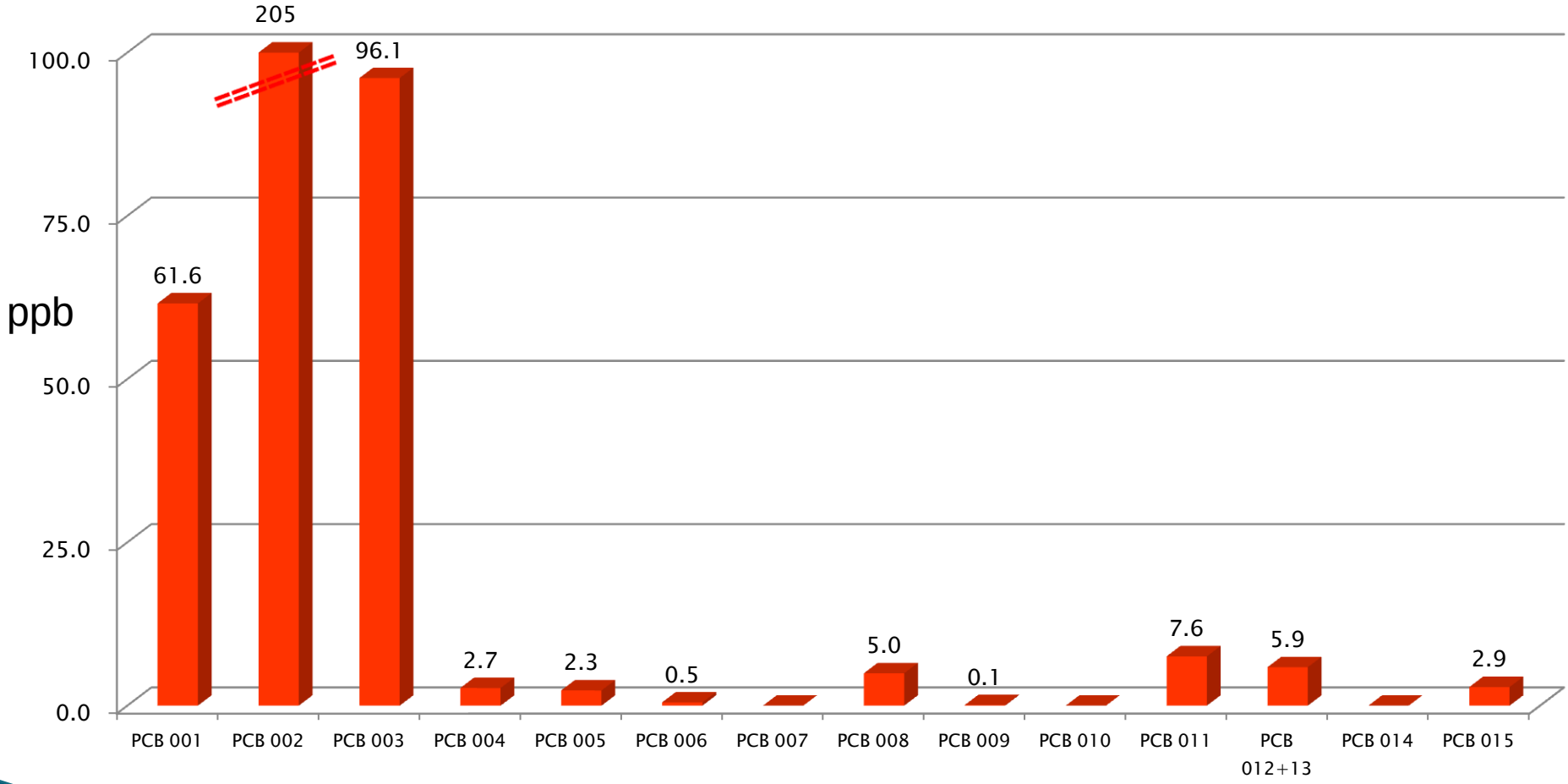
Full Congener Analysis

- Data yet to come but some intriguing results



Full Congener Analysis (cont.)

Caulk (CAUSOI) PCB Congener Distribution



What caused this distribution?

Status

- Four congener data received for all products
- Awaiting full congener data on 17 products
- Will summarize results in two reports
  1. Four congeners presented today
     Completed by end of April

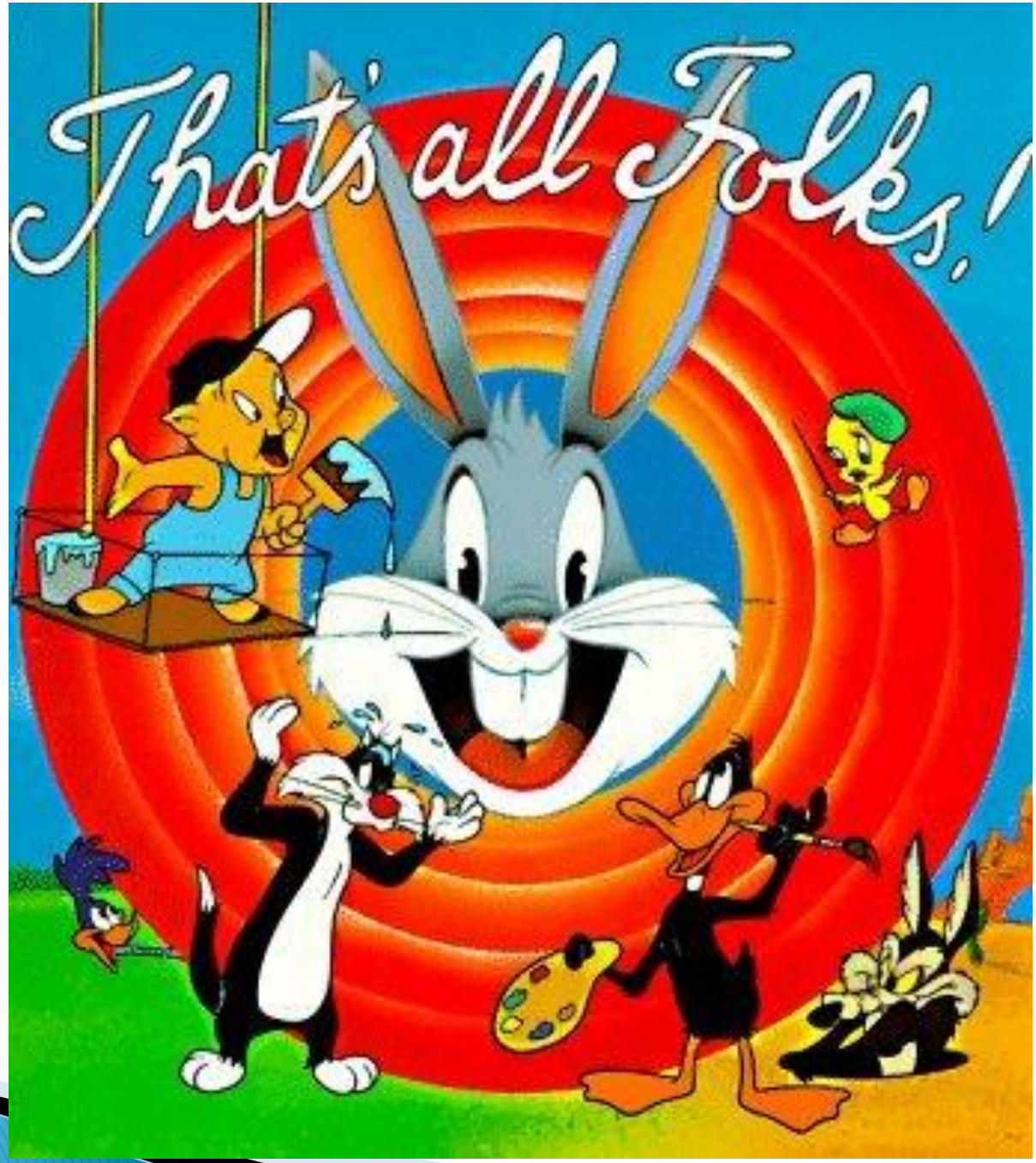
  2. Full congener distribution
     Report 1 month after remaining data received

Conclusions

- PCB-11 found in wide range (66%) of products beyond those containing yellow dye
- Green Pigment contained both highest level of a single PCB (209, 320 ppb) and all four PCBs (339 ppb) of interest
- 50% tested had detectable levels of PCB-209
- TiO_2 paint pigments contained PCB-209
- Newsprint contained PCB-11at appreciable levels
- With one exception, no PCB-206 and -208 found

Potential Future Sampling

- More review of blue and green products
- Additional sampling of:
  - White paint
  - Clothing
  - Paper products


That's all Folks!

Contacts

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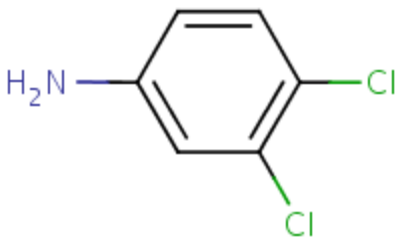
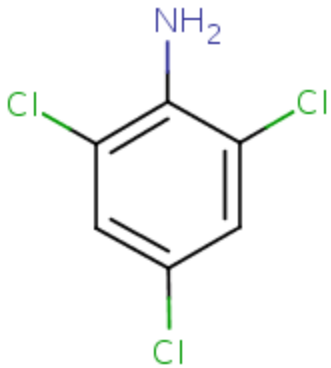
Arylide & Diarylide Pigments

- Monoazo pigments (arylides) derived from either di- or trichloroaniline



Dichloroaniline



Trichloroaniline

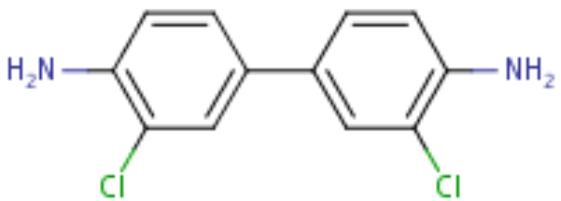
Information on this and the following slides was taken from:

'*Alternatives for elimination of polychlorinated biphenyls (PCBs) in pigments used for printing inks and architectural paints*'

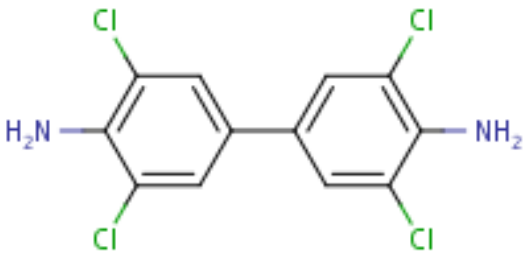
by Robert M. Christie

Arylide & Diarylide Pigments

- Diazo pigments (diarylides) derived from either 3,3'-dichlorobenzidine or 3,3',5,5'-tetrachlorobenzidine

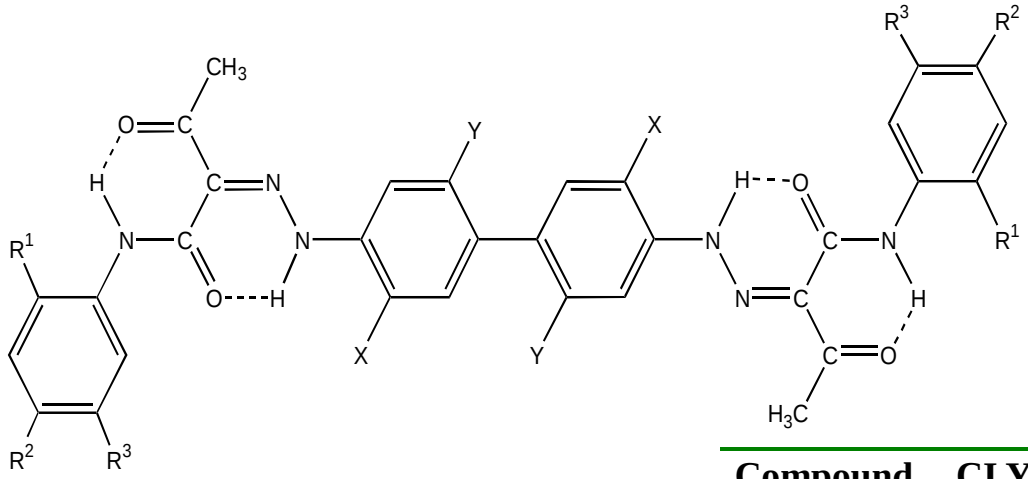


3,3'-dichlorobenzidine



3,3',5,5'-tetrachlorobenzidine

Diarylides



4

Compound	CI Yellow or Orange	R^1	R^2	R^3	X	Y
4a	Y12	H	H	H	Cl	H
4b	Y13	CH_3	CH_3	H	Cl	H
4c	Y14	CH_3	H	H	Cl	H
4d	Y17	OCH_3	H	H	Cl	H
4e	Y55	H	CH_3	H	Cl	H
4f	Y63	Cl	H	H	Cl	H
4g	Y77	CH_3	H	Cl	Cl	H
4h	Y81	CH_3	CH_3	H	Cl	Cl
4i	Y83	OCH_3	Cl	OCH_3	Cl	H
4j	Y113	CH_3	Cl	H	Cl	Cl
4k	Y124	OCH_3	OCH_3	H	Cl	H
4l	Y152	H	OC_2H_5	H	Cl	H
4m	Y170	H	OCH_3	H	Cl	H
4n	Y171	CH_3	Cl	H	Cl	H
4o	Y172	OCH_3	H	Cl	Cl	H

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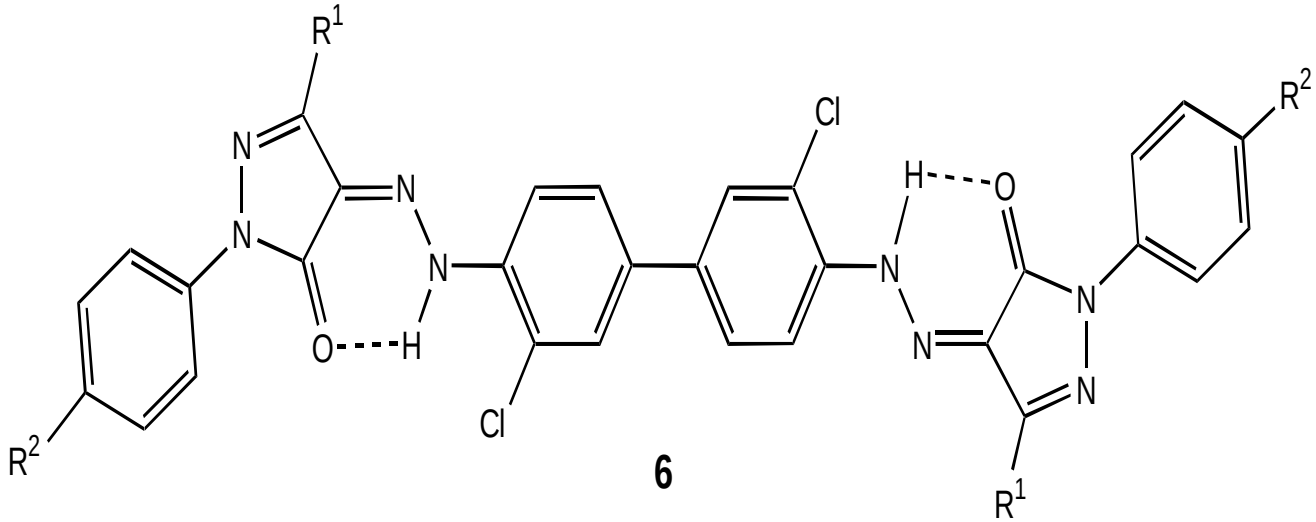
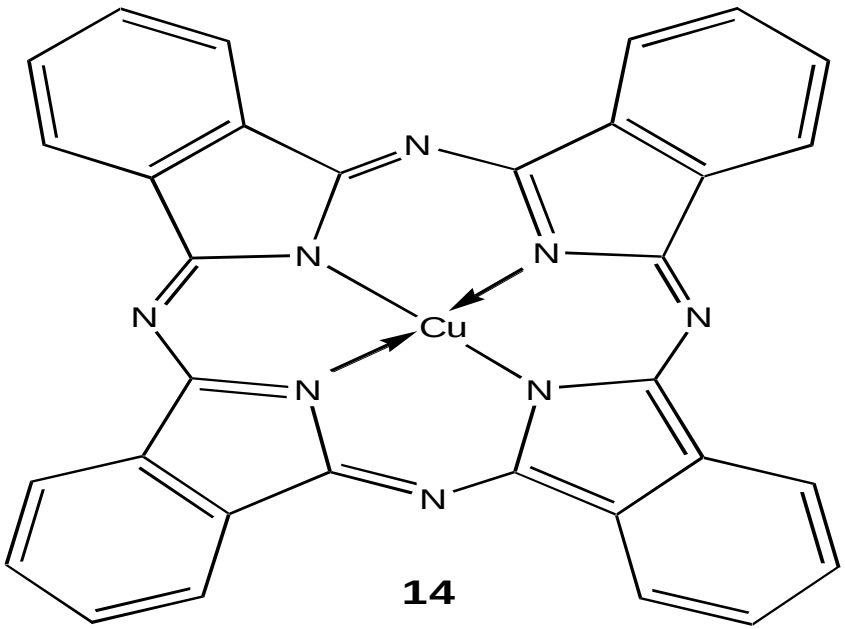
Diarylides



6

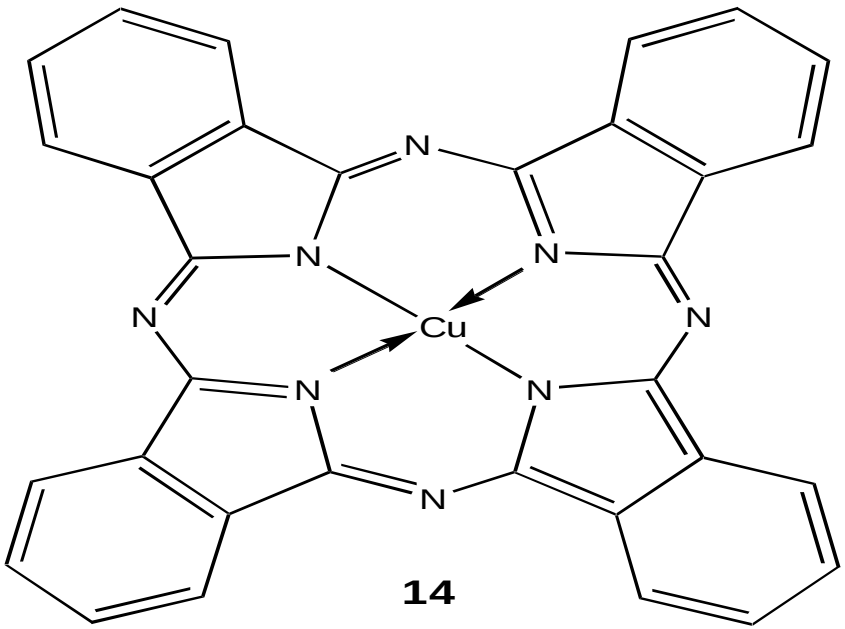
Compound	CI Pigment	R^1	R^2
6a	Orange 13	CH_3	H
6b	Orange 34	CH_3	CH_3

Copper Phthalocyanine Blue



- Brilliant intense blue colour
- Exceptionally high stability to light, heat, solvents, acids and alkalis
- Modest cost
- Universal use in the range of pigment applications

Copper Phthalocyanine Green



- 16 hydrogen atoms replaced with chlorine or combination of chlorine and bromine
- No PCBs included in structure