

# Collaboration Opportunities with Non-Competitive Industrial Partners

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**Background**

High Efficiency (HE) washing machines are becoming more prominent in the U.S. marketplace

Making 3 major styles of washer in the U.S.



**Standard Efficiency Vertical Axis Drum and Agitator**



**High Efficiency Vertical Axis Drum No Agitator**

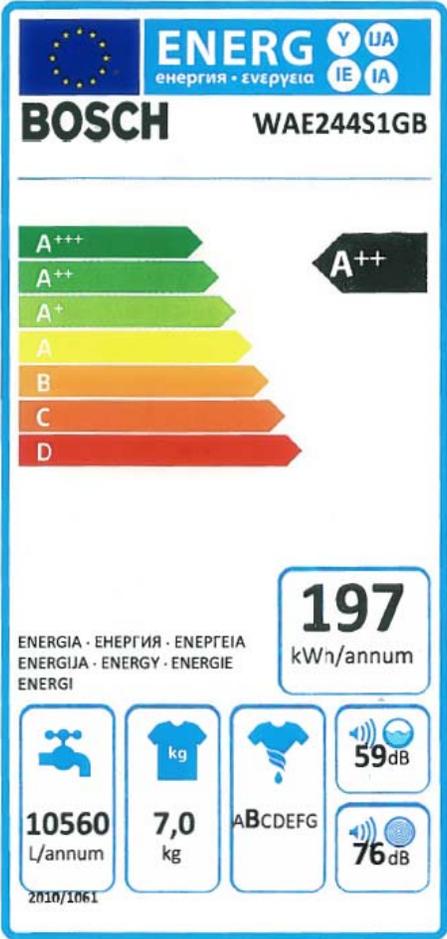


**High Efficiency Horizontal Axis Drum**



Background

Resource conscious trends present in European market as well



2013 Bosch WAE244S1GB



## Purpose

Quantify differences in

- Water Use
- Cycle Time

How these differences affect

- Soil and stain removal performance
- Redeposition

What collaborative opportunities do we see in this data?



## Test Machines – U.S.

Four models of U.S. washing machines were tested



**Kenmore 80 Series Standard  
Efficiency Washer**



**Whirlpool Cabrio  
WTW6600SW Vertical Axis HE  
Washer (2008)**



**Whirlpool Cabrio  
WTW8800YW1 Vertical Axis  
HE Washer (2013)**



**LG TROMM WM2688HWM  
Horizontal Axis HE Washer  
(2008)**



## Test Machines – Europe

Two models of European washing machines were tested



1997 Miele Novatronic W 1918



2013 Bosch WAE244S1GB



## Test Design - Dunnage



Dunnage – 2.6 kilograms mixed fabric

Percent	Raw material
61.1	Softened Water
28.0	95.5% Dodecylbenzene Sulfonic Acid
10.9	Diethanolamine

Formula for stripping detergent

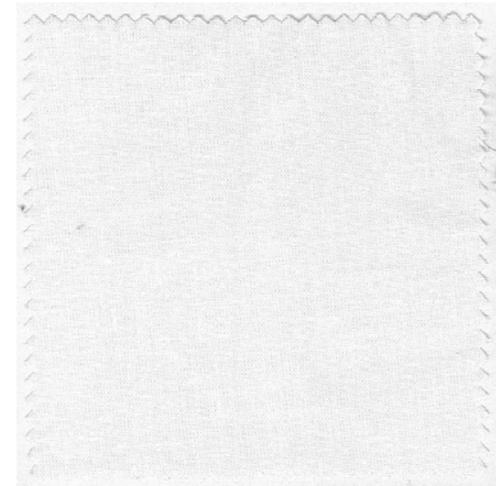


## Test Design - Redeposition



Redeposition Cloths

### Soil redeposition testing



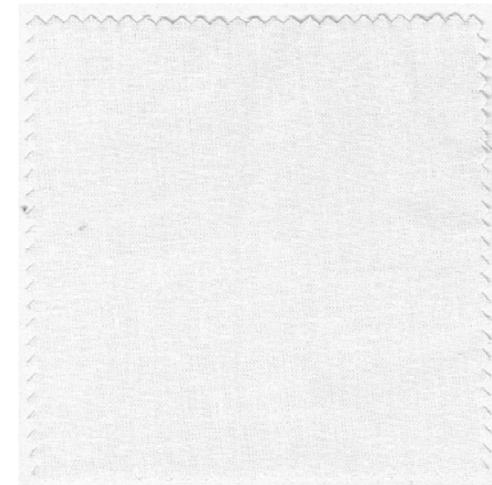
Polyquat Soiled Redeposition Cloths



## Test Design – Soil Removal



Soil and Redeposition Cloths



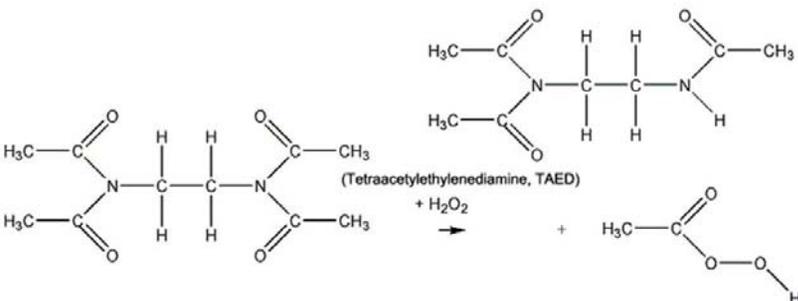
Polyquat Soiled Redeposition Cloths



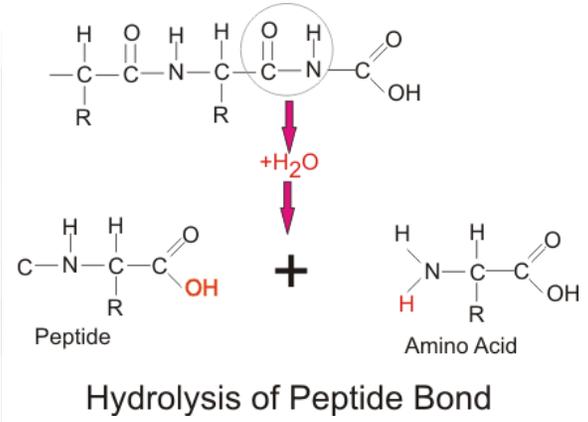
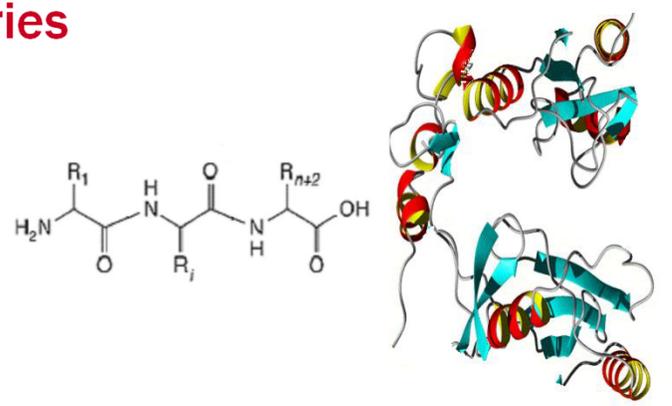
# Test Design – Detergent Chemistries



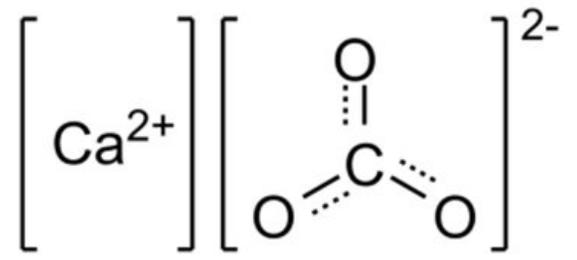
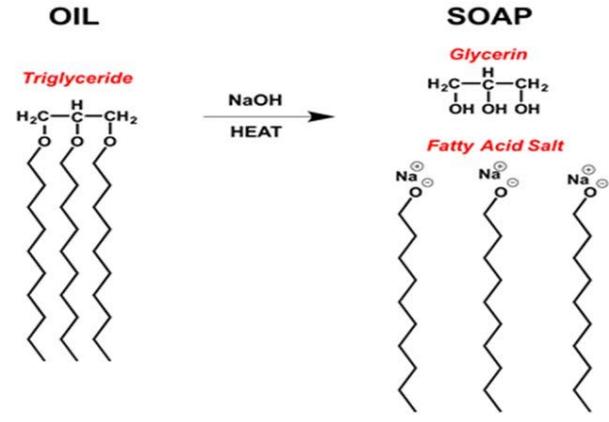
Soil Cloths



Activated bleach – TAED forms peracid when reacting with peroxide



Enzymes – Bio-based (polypeptides) proteins that catalyze the hydrolysis of stain molecules



Builders – Alkalinity to saponify some soils and to control water hardness



# Test Design - Method



Hunter ColorFlex EZ

## Ingredients

Name	CAS #
Sodium Carbonate	497-19-8
C10-16 Alcohol Ethoxylate	68002-97-1
Citric Acid	77-92-9
Fumaric Acid	110-17-8
Hydrated Silica	112926-00-8
Water	7732-18-5
Sodium Carboxymethyl Cellulose	9004-32-4
Sodium Chloride	7647-14-5
Sucrose	57-50-1
Fragrance	Proprietary See IFRAorg.org
Starch	9005-25-8
Protease Enzyme	9014-01-1
Sodium Sulfate	7757-82-6
Disodium Distyrylbiphenyl Disulfonate	27344-41-8

## Amway's Global Bleach Free Detergent



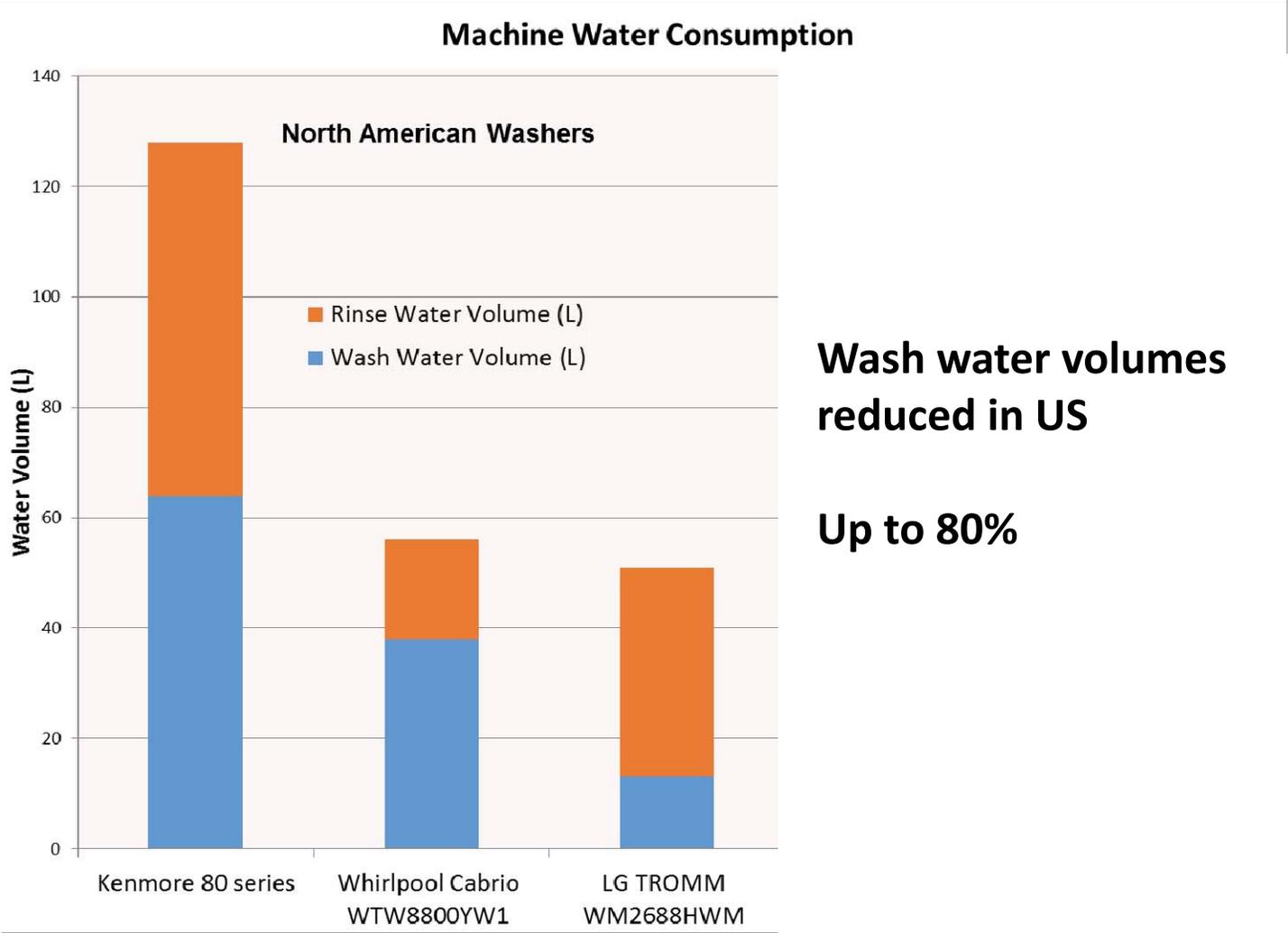
Print Dryer



Water Collection Device



# Results – Wash Water Reduced in US

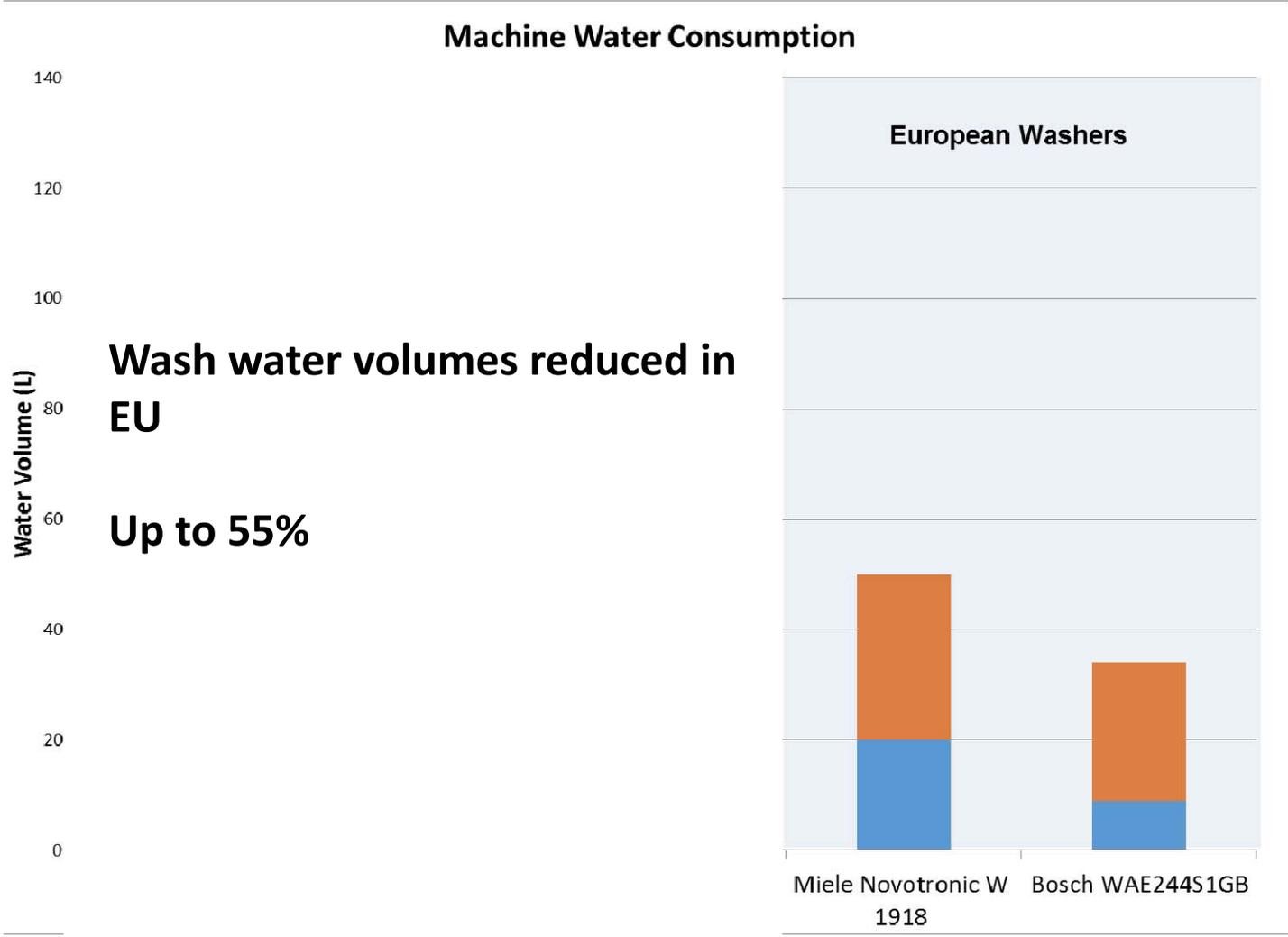


**Wash water volumes reduced in US**

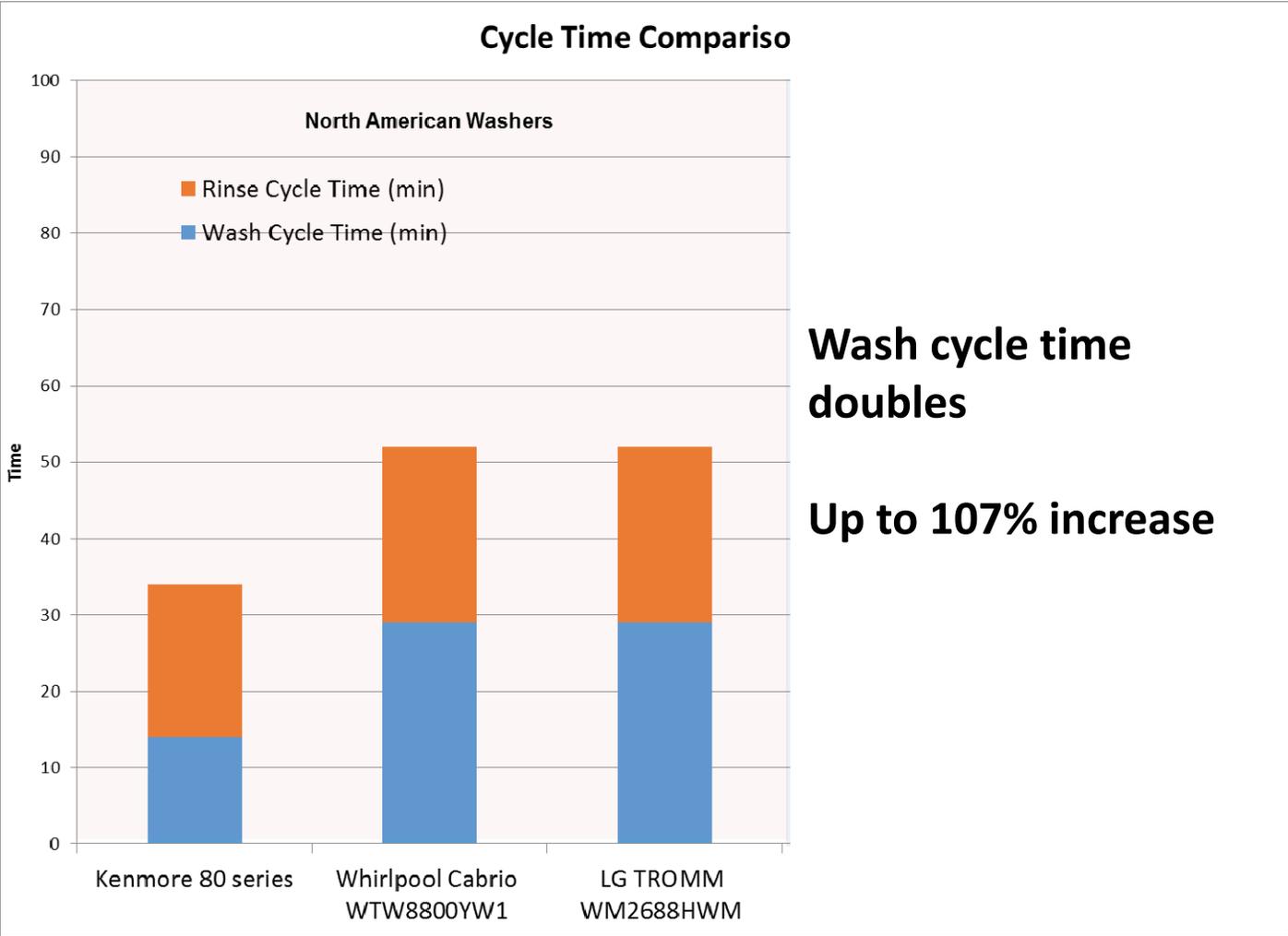
**Up to 80%**



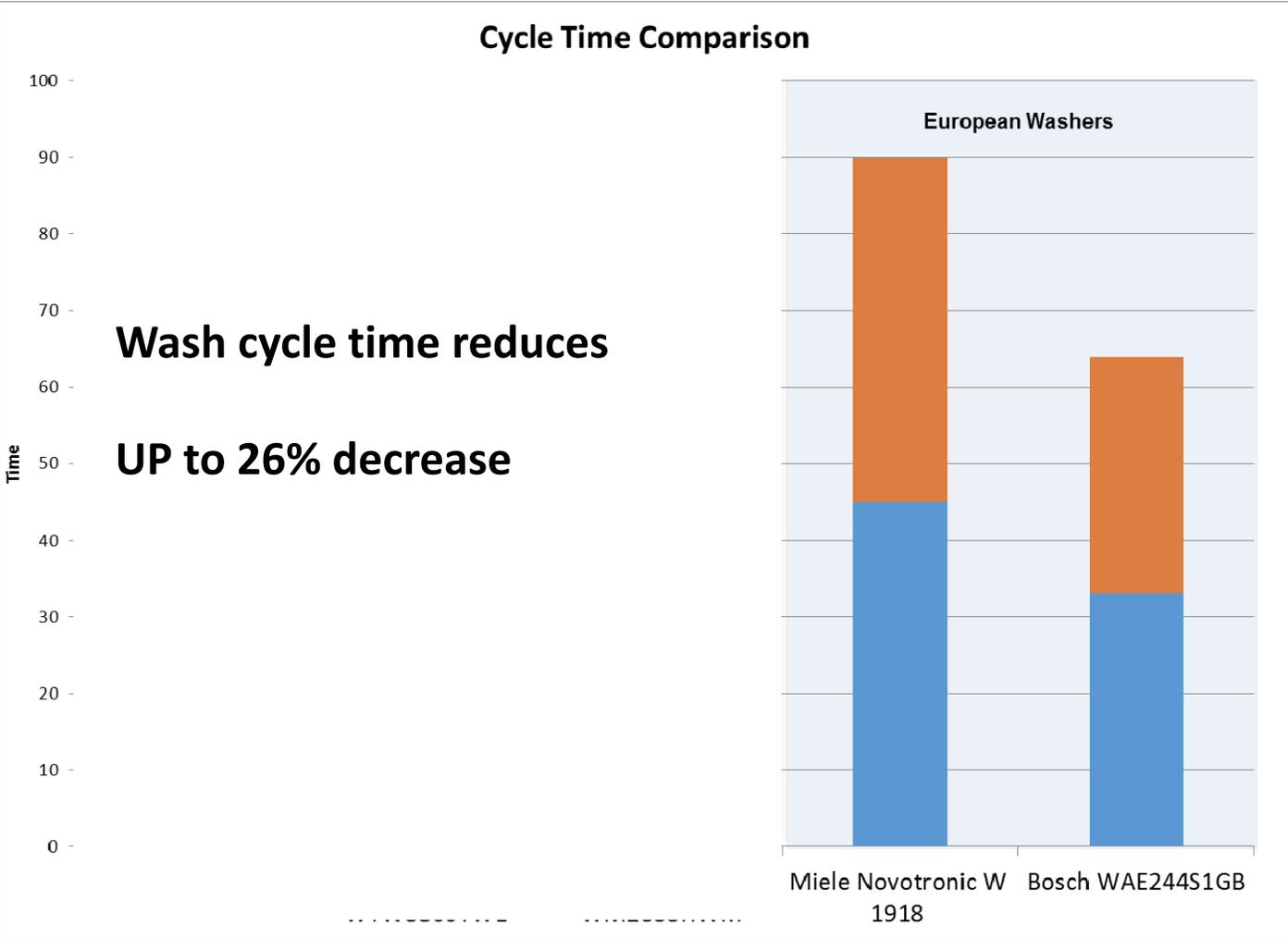
# Results – Wash Water Reduced in EU



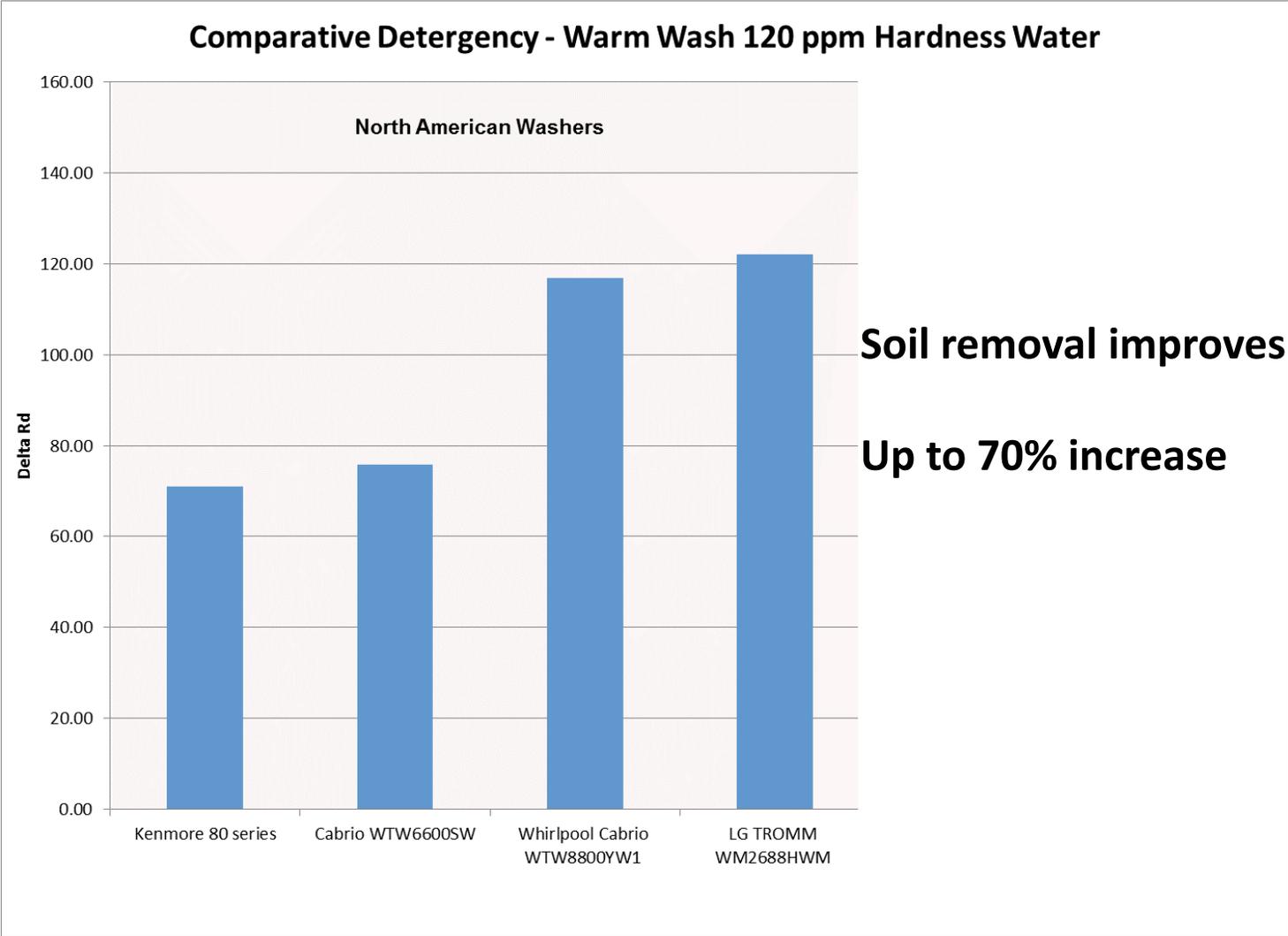
# Results – Cycle Time Increased in US



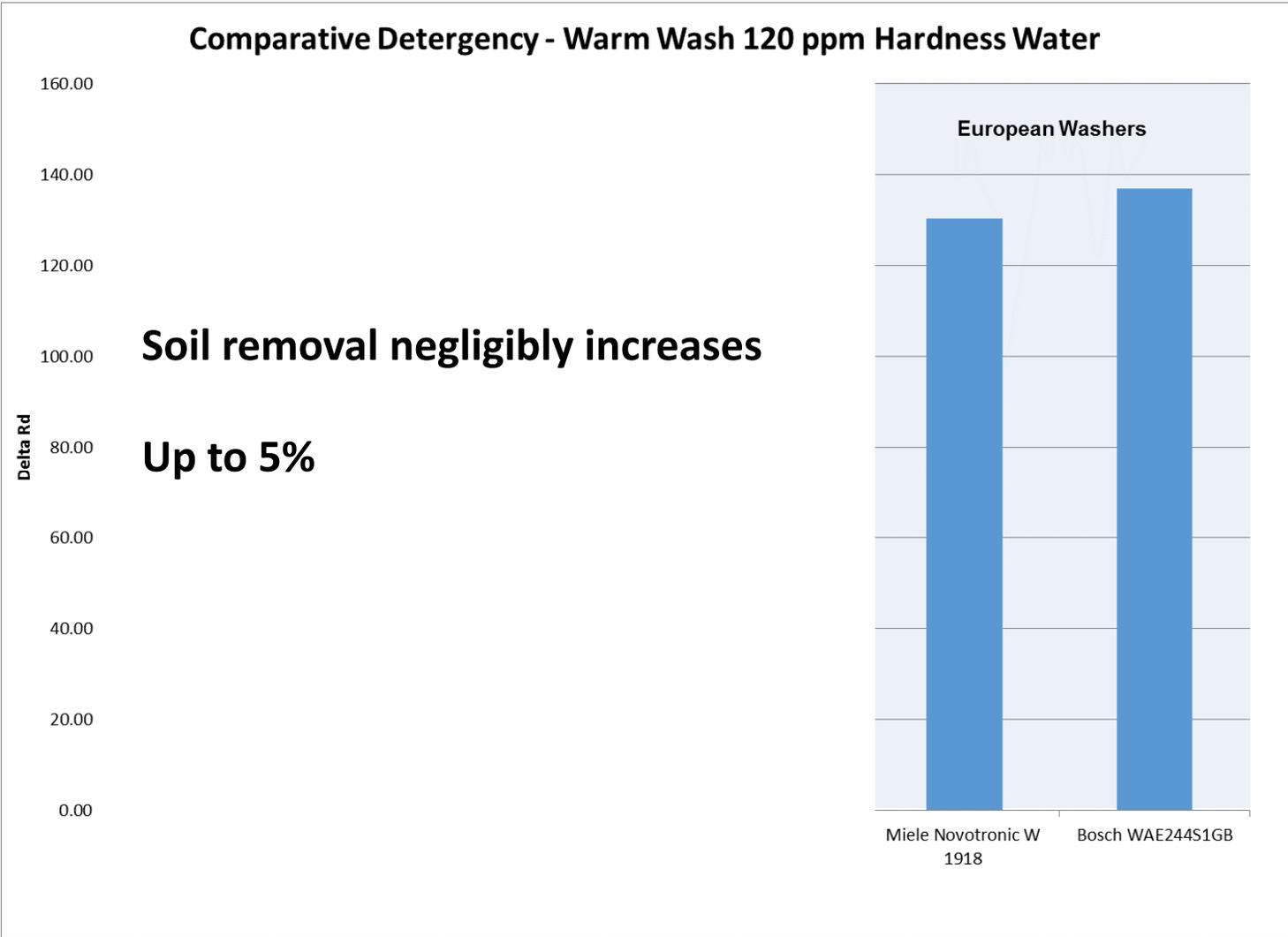
# Results – Cycle Time decreased in EU



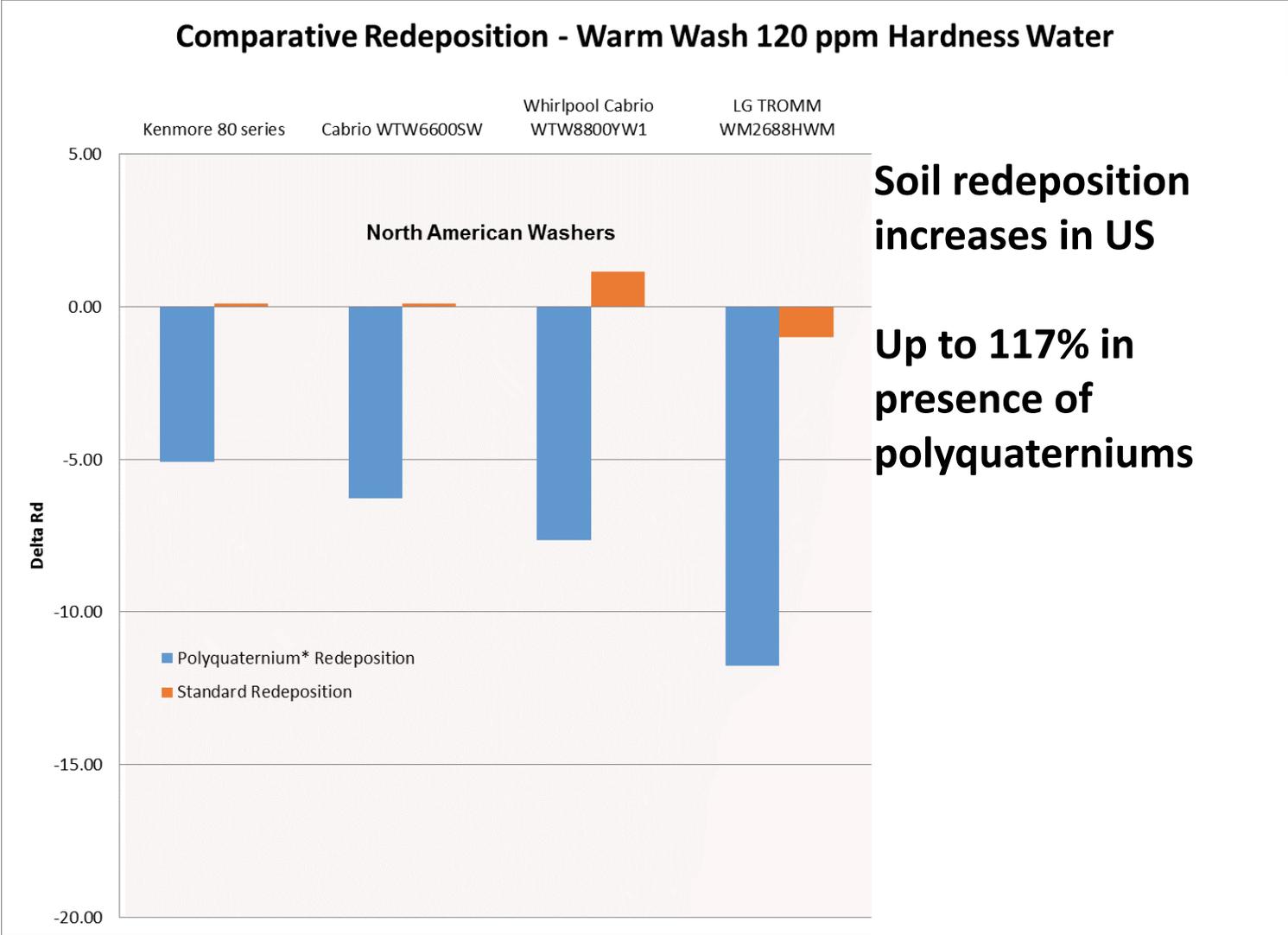
# Results – Soil Removal North America



# Results – Soil Removal Europe



# Results – Redeposition Increase in US

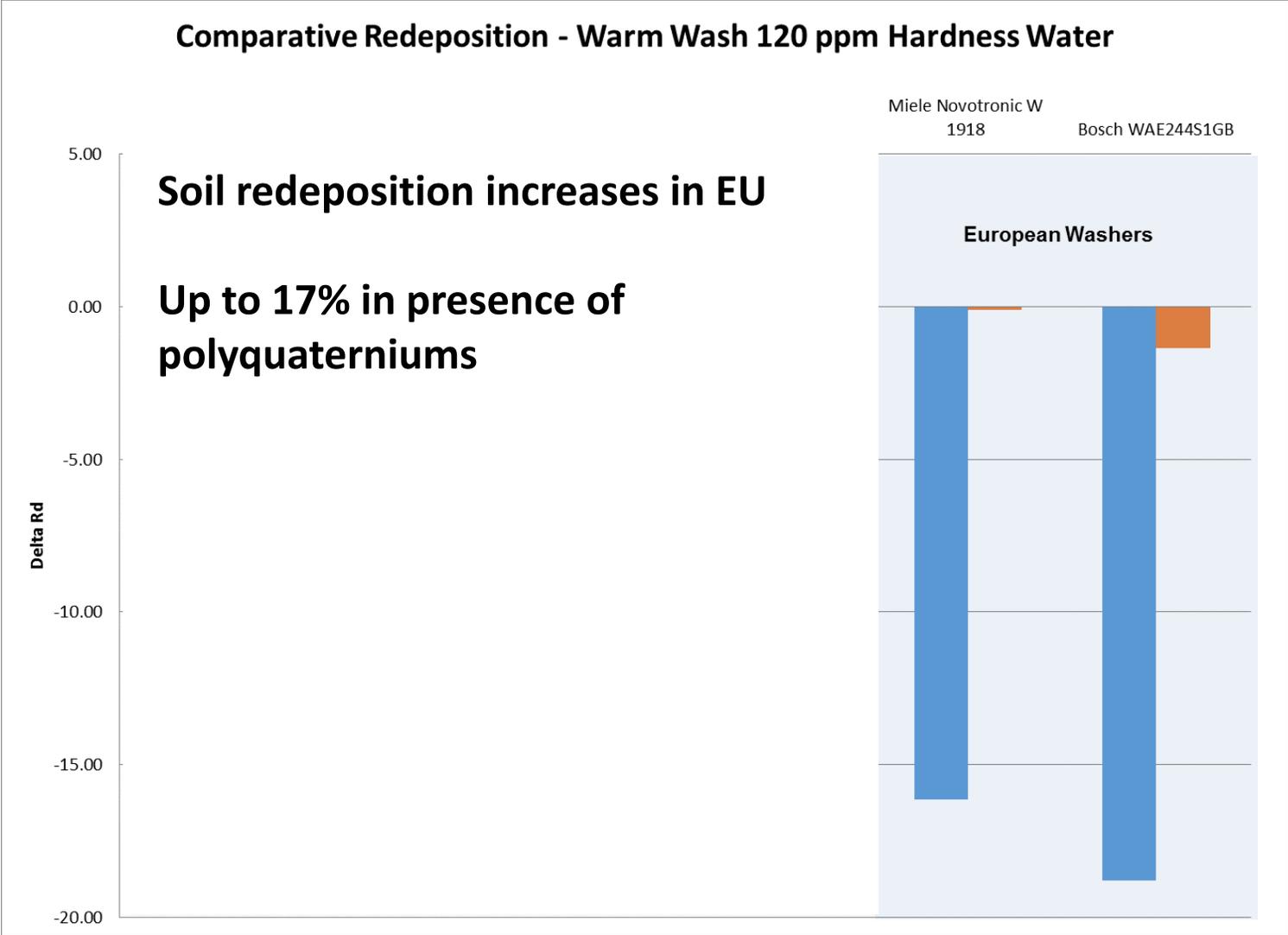


**Soil redeposition increases in US**

**Up to 117% in presence of polyquaterniums**



# Results – Redeposition Increase in EU



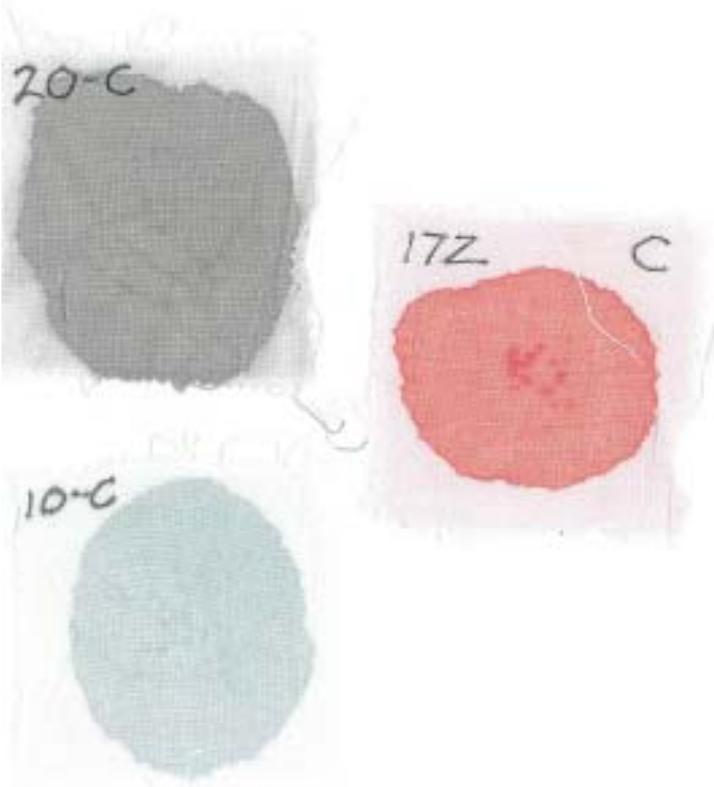
# Results – Redeposition Increase in US and EU

A picture is worth 1,000 charts...



Sample of in the field complaint

German Consumer Test Swatches  
Color Load



Swatches from consumer test



## Summary

### Quantify differences in

- Water Use – both US and EU decreased
- Cycle Time – US increased and EU decreased

### How these differences affect

- Soil and stain removal performance – both US and EU Increased
- Redeposition – trends towards higher redeposition

**What collaborative opportunities do we see in this data?**



# Opportunities – Collaboration with raw material suppliers and formulators

## Concentration impact

- Fabric integrity
- Color retention
- Dye bleeding



Liquid Color Care Laundry Detergent

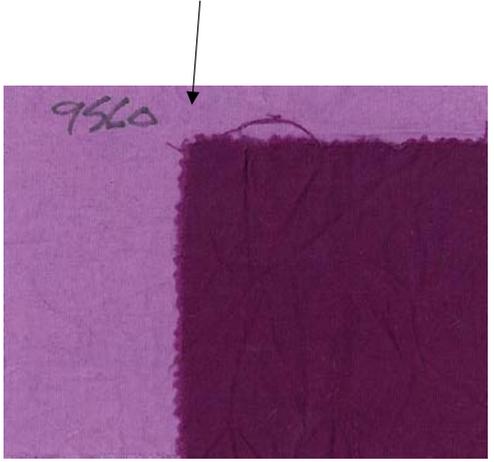


Powder Detergent with Activated Bleach #1



Powder Detergent with Activated Bleach #2

White receptor swatch



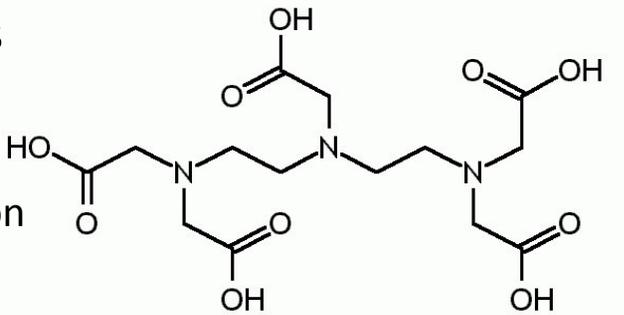
Single Cycle Dye Transfer



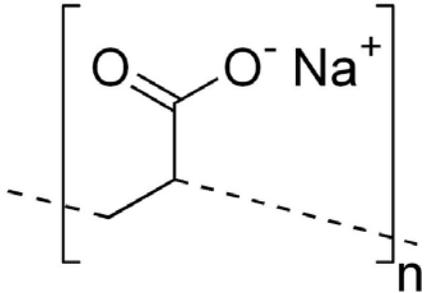
# Opportunities – Collaboration with raw material suppliers

Higher in-wash detergent concentrations may make certain chemistries viable solutions

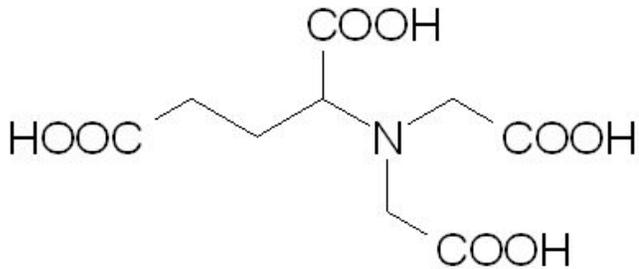
- Chelants and Polymers
  - Bleaching
  - Hardness Control
  - Encrustation prevention
  - Redeposition Control



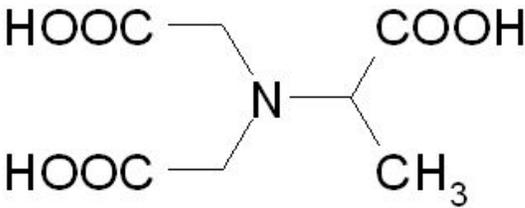
DIETHYLENE TRIAMINE PENTAACETIC ACID - DTPA



SODIUM POLYACRYLATE



GLUTAMIC ACID, N,N-DIACETIC ACID - GLDA



METHYLGLYCINEDIACETIC ACID - MGDA

POLYSULFONATED COMPOUNDS  
[PROPRIATERY STRUCTURE]



## Opportunities – Collaboration with raw material suppliers – Anti-wrinkle

Higher spin speeds in the US may open opportunities



## Opportunities – Collaboration with machine manufacturers

How do higher detergent concentrations affect machine reliability?

How do the newer machine formats affect clothing longevity?



# Questions?



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