



Formulating safer alkyd-based coatings  
with Borchers' high-performance catalysts  
and MEKO-free anti-skinning agents

Jiří Prekop — Regional Technical Service Chemist  
20.04.2022

**borchers**  
A MILLIKEN BRAND

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Background on Alkyd Based Formulations

Regulatory Challenges of Cobalt and MEKO

Reformulation Process for Safer Coatings

Catalyst Impact on VOCs

Summary & Questions





## Advantages of alkyd paints:

- 🌿 **Bio-renewable**
- Cost-effective
- Stable with long shelf lives
- Provide relatively hard films
- Good stain block properties

## CAN BE USED ACROSS A VARIETY OF SEGMENTS





## Alkyd formulations are dependent on **cobalt for curing** & **MEKO for storage stability**

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- Alkyd-based coatings dry via **autoxidation** when oxygen reacts with points of unsaturation based on fatty acids in the resin
- Driers such as cobalt and **high-performance catalysts** are utilized to speed up the curing process
- Driers reactive to oxygen require an **anti-skin agent** to prevent the paint surface from forming a film called skin

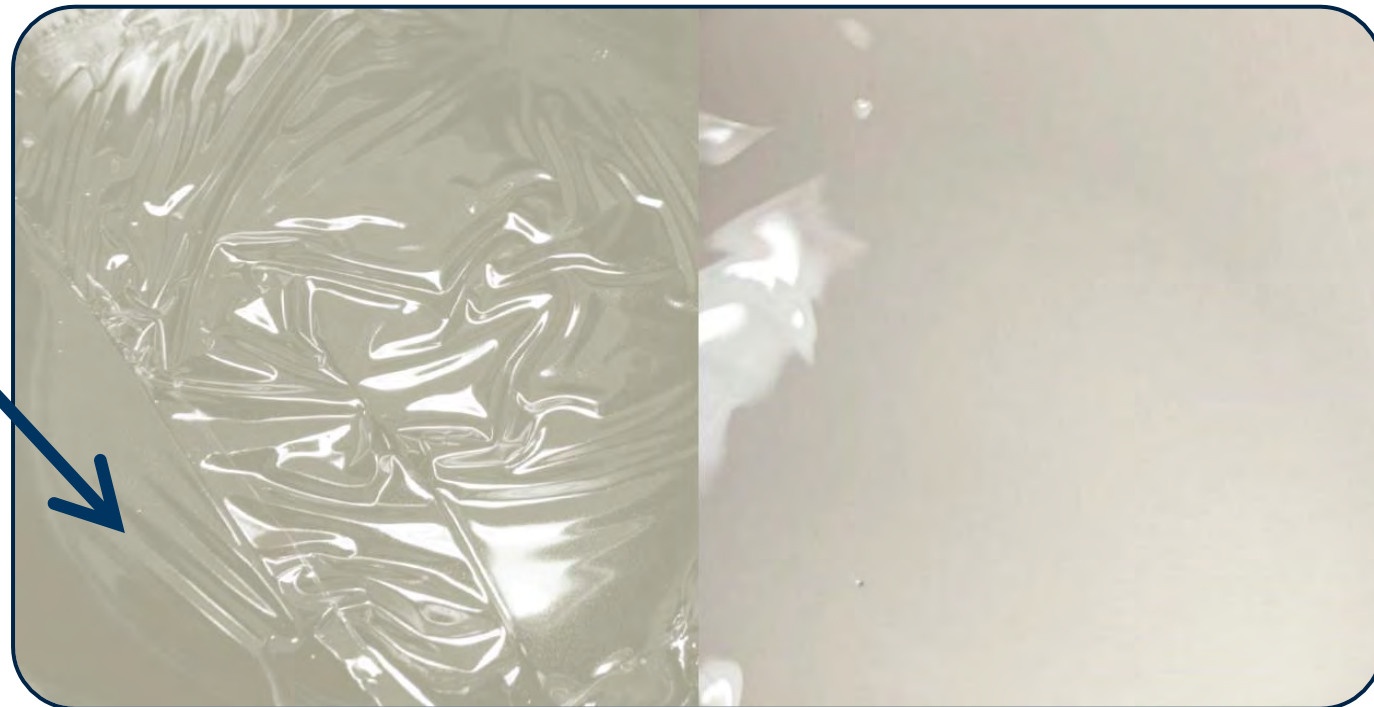


In a container, a solid layer forms on top of the liquid coating.

Common in oxidatively cured coatings, high solids, and low VOC products.

**no anti-skin additive**

**with anti-skin additive**



# Why are **MEKO-free** Anti-skin Agents Needed?

Europe, Canada, and other nations have proposed reduction levels of **MEKO (Methyl-ethyl-ketoxime = 2-Butanone oxime)** in alkyd paints

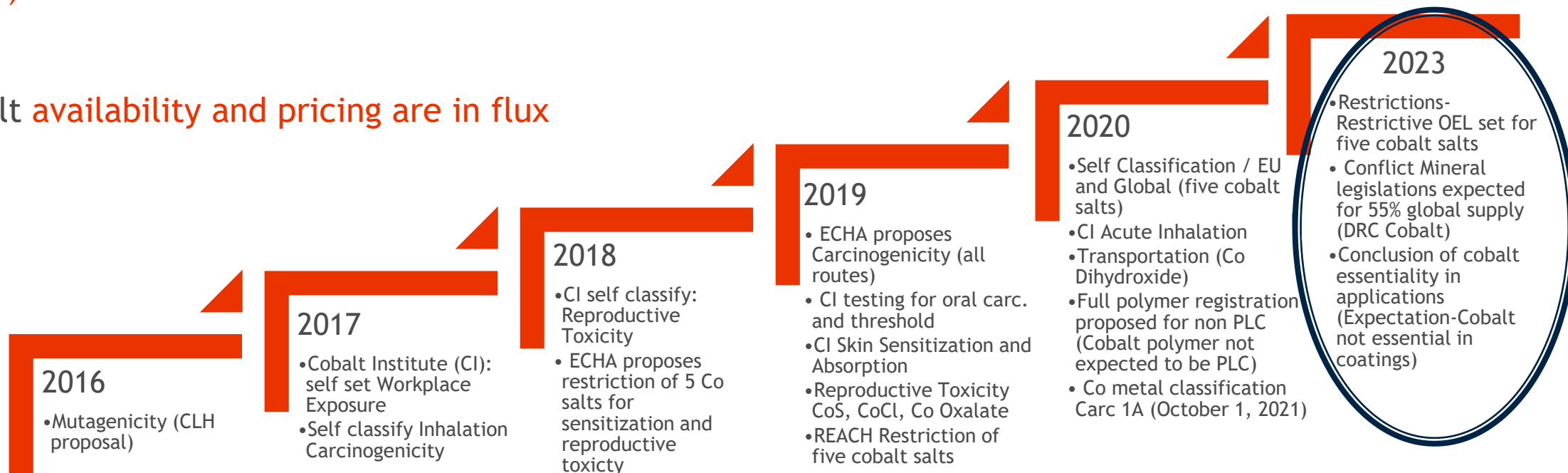
- Carcinogenic & sensitizer
- **Classified as a 1B carcinogen, effective March 1, 2022**, with a concentration limit at  $\geq 0.1\%$  (*European Commission: ATP 15 part 3 Annex VI*)

	Previous Classification	Current (New) Classification
Hazard Pictograms- MEKO		

# The Troubling Cobalt Regulatory Trend

- Stricter cobalt regulations have been proposed over the years in the paint and coatings industry
  - **Full restriction** of certain cobalt salts is **expected by 2023**
- Some cobalt compounds used in paints and coatings are classified as **1B carcinogen** and **Repro. Tox Cat 1B**
  - However, cobalt is still essential and safe for use in applications like tires and electric car batteries
- EU full Polymer registrations for non-PLC (Polymer of Low Concern). **Cobalt polymer not expected to be PLC (2025)**

- Cobalt **availability and pricing are in flux**



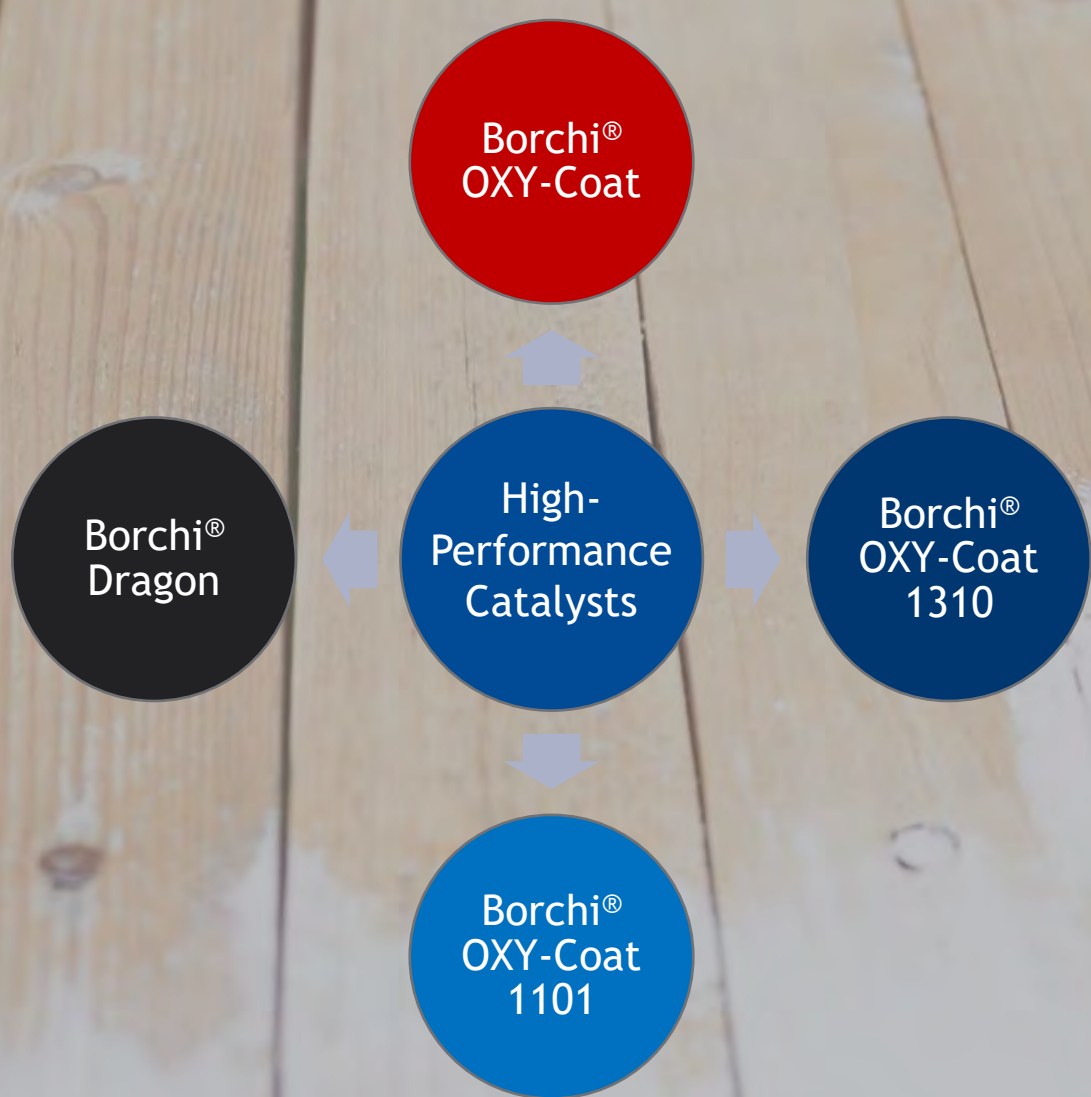




Formulating Alkyds  
to be Cobalt- and MEKO-free



# High-Performance Catalysts



- Patented organometallic ligand technology
- Faster dry times than cobalt-based driers
- Excellent performance under adverse conditions
- Improved loss of dry over stability testing
- Non-yellowing upon aging or initial
- Reduced need for secondary driers & anti-skins
- Non-wrinkling with high solids systems (thick film)

 Cobalt-free



# High-Performance Catalysts in Alkyds

CAN BE USED IN:

- Solvent borne
- Waterborne
- Solvent borne, high solids, low VOC

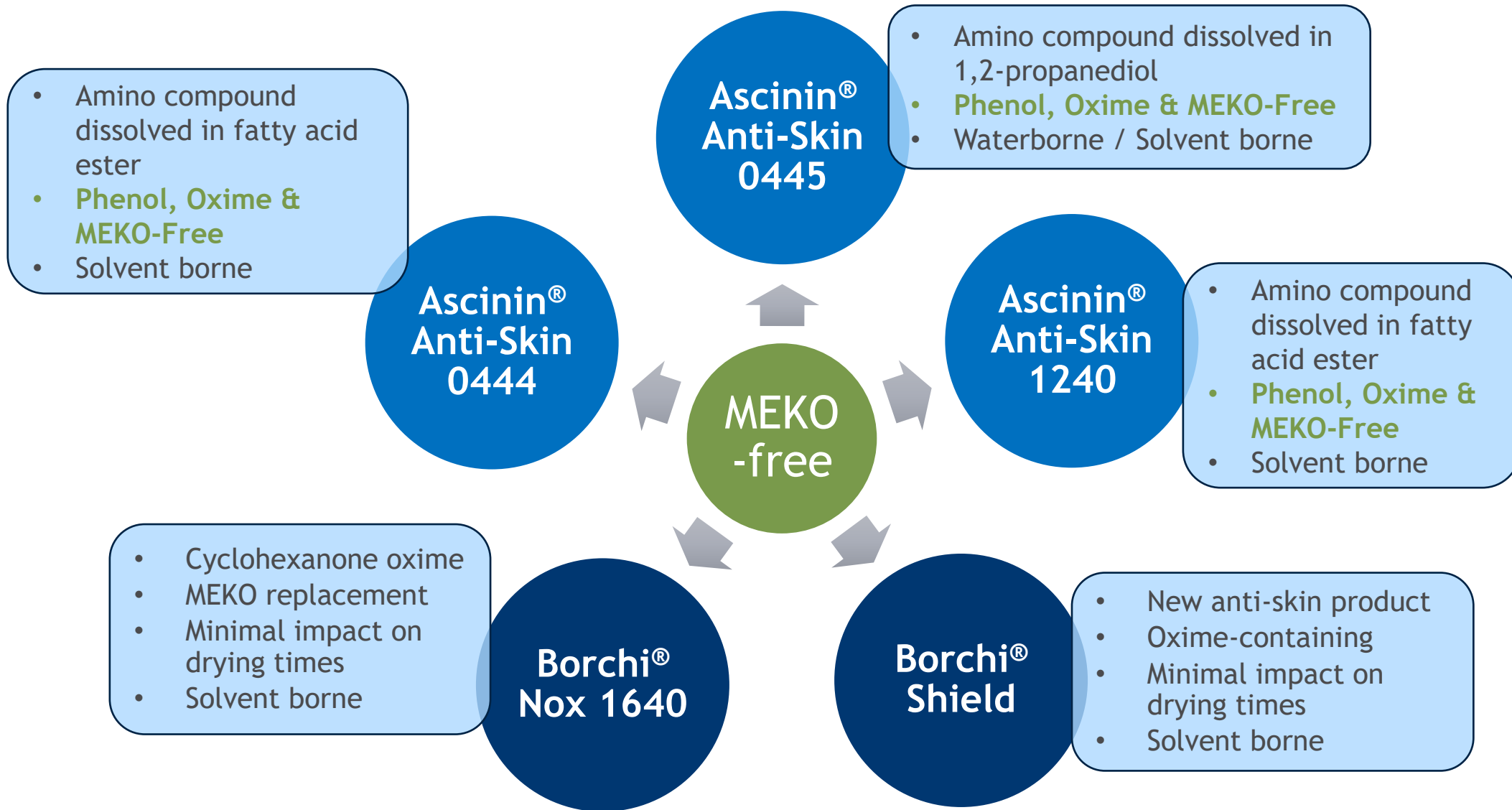


# Formulating MEKO-free

NOT A DIRECT 1:1 REPLACEMENT FOR MEKO



- Calculated as supplied on total formula weight
- Recommended dosage varies from 0.2 - 2%
- Too much anti-skin can inhibit dry performance






**Ascinin® Anti-Skin 0444**

**Ascinin® Anti-Skin 0445**

**Ascinin® Anti-Skin 1240**

- 
- Highly effective antioxidants for solvent borne, high solids alkyds systems and printing inks
  - Recommended to work with High-Performance Catalysts (Borchi® OXY-Coat and Borchi® Dragon)
  - The optimum level should be experimentally determined
  - Overdosing may lead to longer drying times
  - **Recommended dosages:**
    - **0444: 0.2-0.6%**
    - **0445: 0.2-0.6%**
    - **1240: 0.25-1%** (higher volatility than 0444 & 0445)

## Borchi<sup>®</sup> Nox 1640

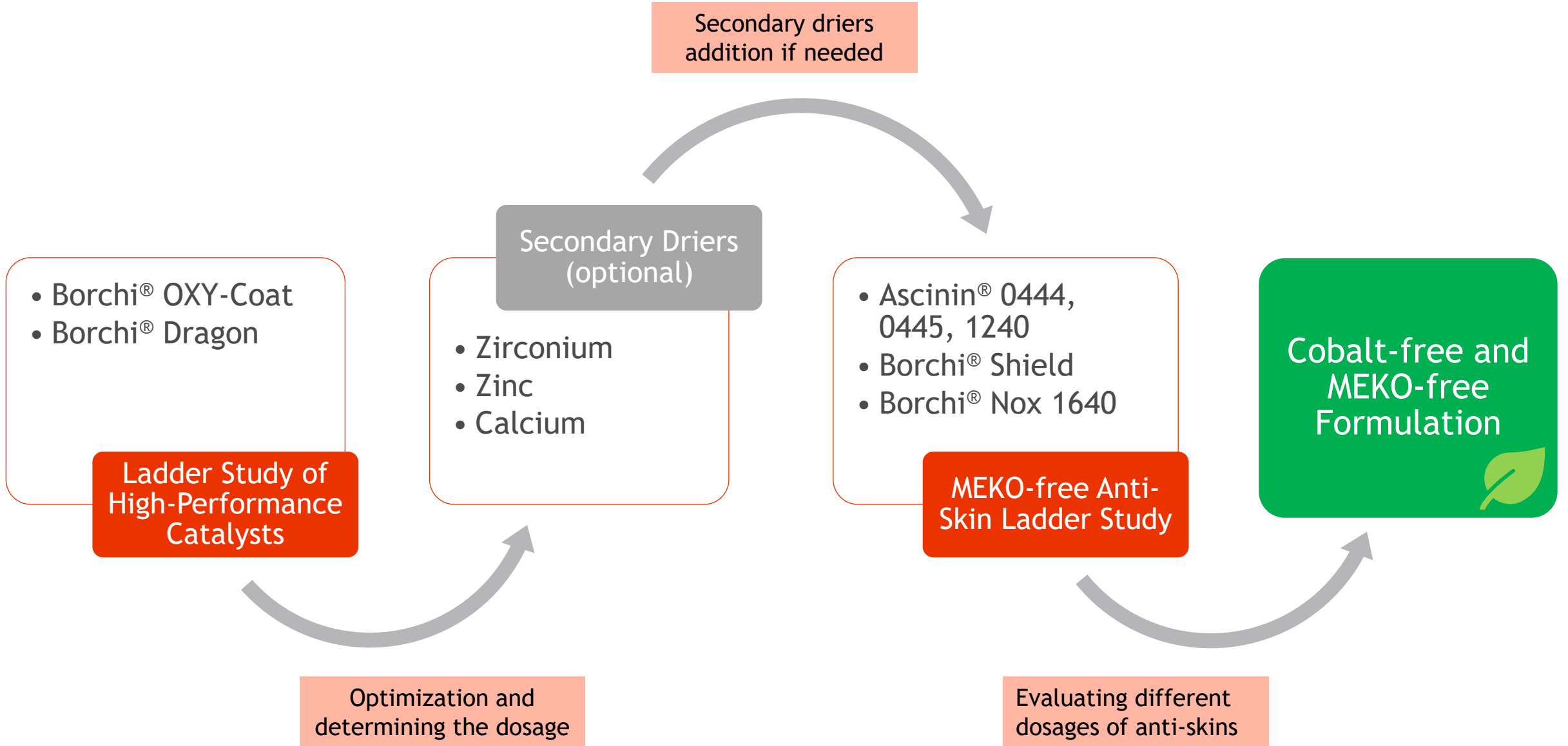


- Higher volatility than Ascinin<sup>®</sup> products
- Minimal impact on dry times
- **Recommended dosage: 0.2-1.5%**





- Designed to prevent skin in high solids and long oil systems with reduced VOC
- *Synergistically designed for use with Borchi® Dragon High-Performance Catalyst*
- Minimal impact on dry times
- Higher volatility than Ascinin® products
- **Recommended dosage: 0.2-1%**



A close-up photograph of a hand holding a paintbrush, applying white paint to a surface. The brush has a wooden handle and a metal ferrule with the number '3' and '1500' visible. The background is a clear blue sky. A dark wooden beam is visible on the left, and a metal chain hangs from the top right. The overall scene suggests a painting or maintenance task.

## Performance Benefits of Cobalt- and MEKO-free Formulations



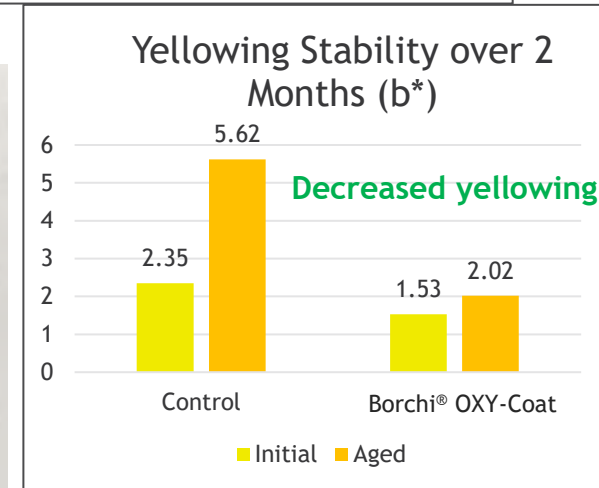
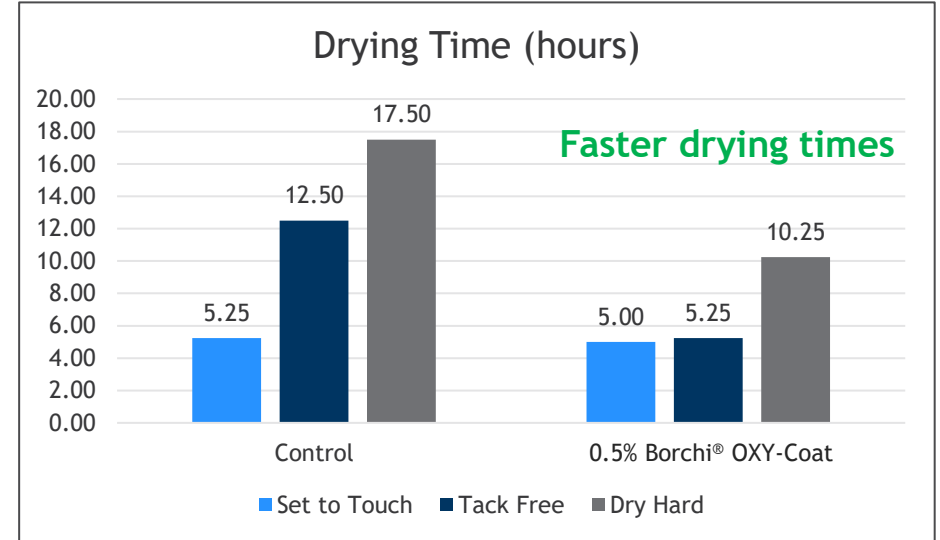
## Solvent borne high gloss white trim paint for decorative use

Cobalt & MEKO free formulation

Ingredients	Control	Borchi® OXY-Coat
Long Oil White Paint	100.00	100.00
15% Co/Zr Carboxylate Blend	0.46	0.00
10% Ca Carboxylate	0.46	0.92
<b>Borchi® OXY-Coat</b>		0.23
MEKO	0.31	0.00
<b>Ascinin® Anti-Skin 1240</b>		0.50
total	101.230	101.650

← Eliminated Zr

- Arkema Synolac 4060 WP 90 - 90% solids long oil alkyd
- 46% resin solids in paint



## Spray application - direct to metal

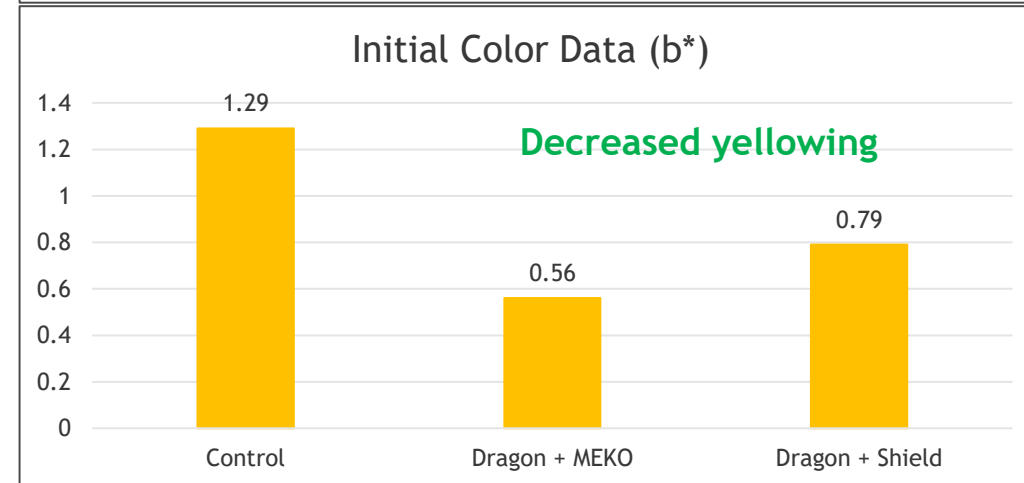
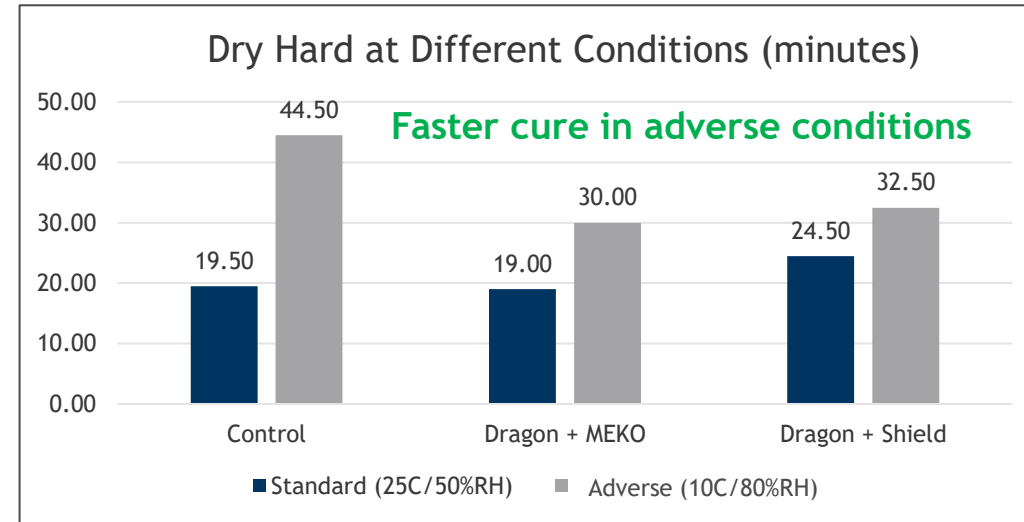
Cobalt and MEKO free formulation

Ingredients	Control	Dragon + MEKO	Dragon + Shield
Short Oil Paint	100.00	100.00	100.00
10% Cobalt	0.30		
12% Zirconium	0.30		
<b>Borchi® Dragon</b>		0.13	0.13
10% Calcium	0.30	0.26	0.26
MEKO	0.50	0.25	
<b>Borchi® Shield</b>			1.10
total	101.40	100.65	101.50

Lowered drier dosage

50% reduction in MEKO dosage

- Short oil alkyd topcoat based on linseed oil and other oils
- 27% resin solids in paint



## Solvent borne wood care products for interior & exterior

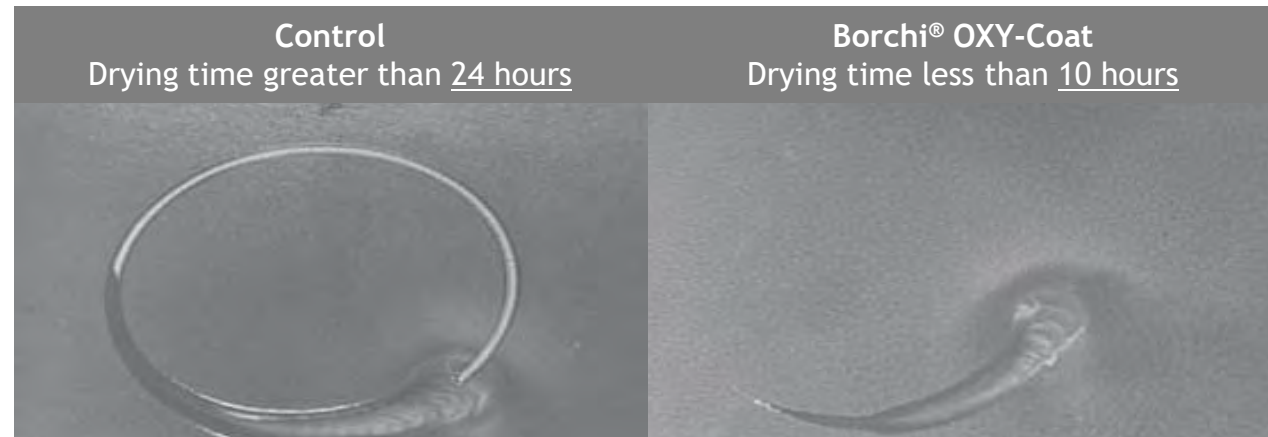
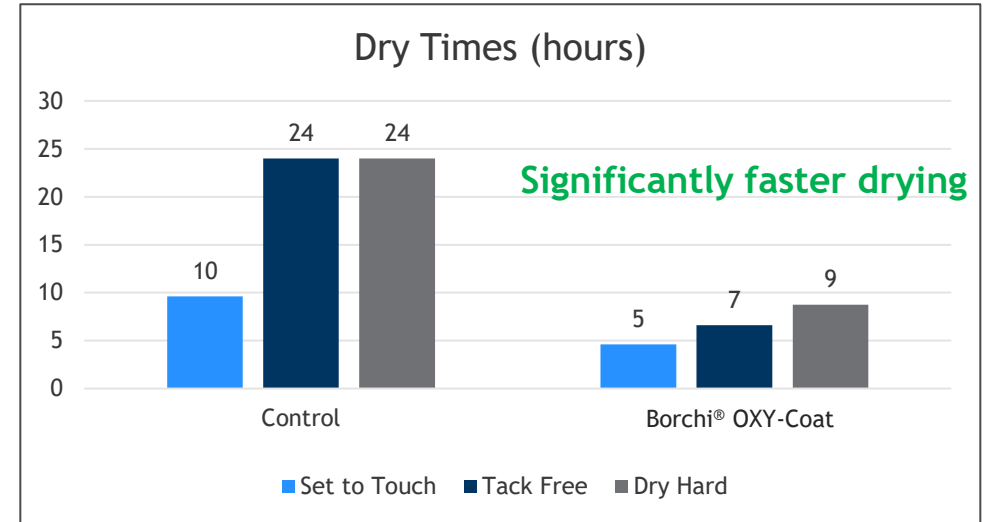
Cobalt and MEKO free formulation

Ingredients	Control	Borchis® OXY-Coat
Wood Stain	100.00	100.00
10% Mn Carboxylate	0.25	
10% Co Carboxylate	0.16	
12% Zn Carboxylate	1.80	
<b>Borchis® OXY-Coat</b>		0.15
MEKO	0.20	
total	102.41	100.15

Elimination of additional driers

- Long oil alkyd wood stain
- 25% resin solids in paint

Anti-skin free formulation







# Catalyst Impact on VOC Emissions

# VOC content analyzed in four model alkyd paint systems based on commercially available resin types

Different catalysts used to crosslink = different autoxidation byproducts. VOC analyzed from the head-space by GC-MS.

## Solvent borne 1



SB long-oil alkyd, acrylic modified

## Solvent borne 2



SB long-oil alkyd, soybean oil based

## Waterborne 1



WB medium-oil alkyd emulsion, soybean oil based

## Waterborne 2

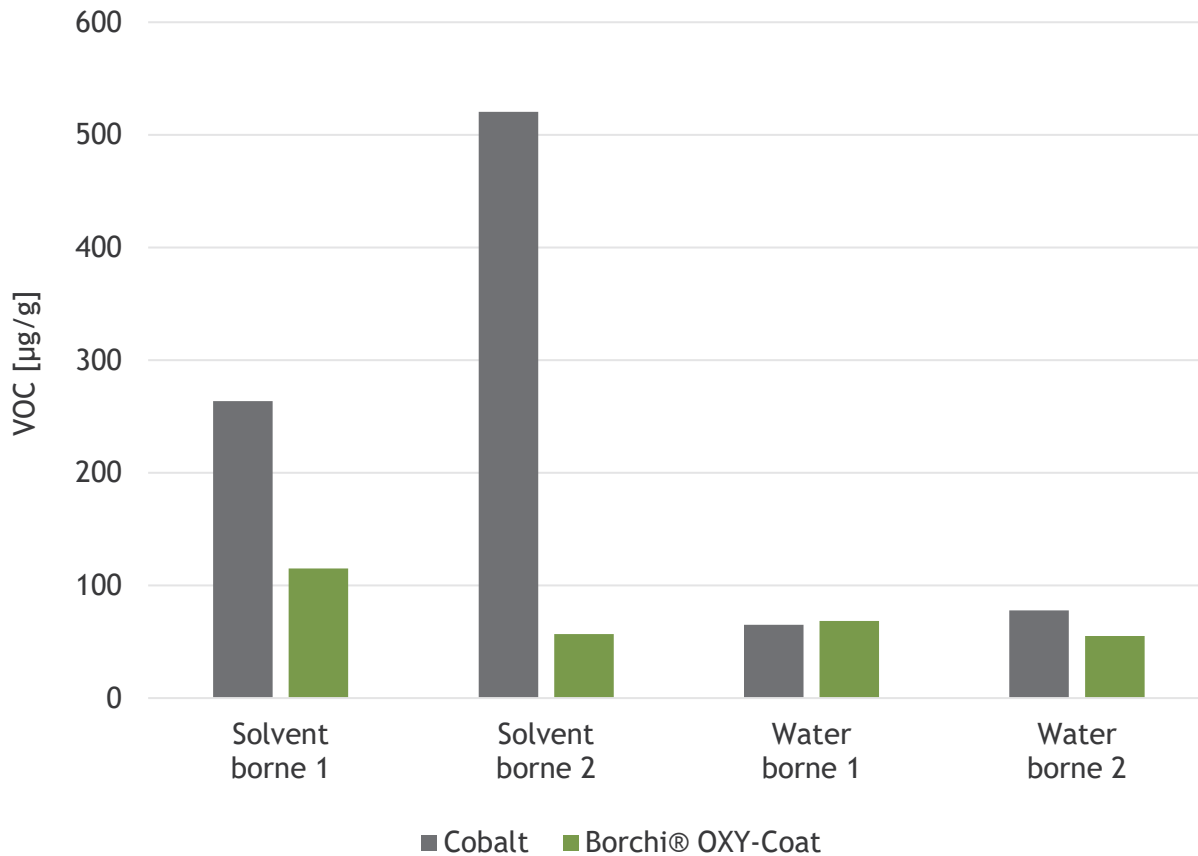


WB short-oil alkyd emulsion



Formaldehyde, Acetaldehyde, Propionaldehyde, Butyraldehyde, Valeraldehyde, Hexanal, Acetone

## Total VOC emissions measured for different paint systems during curing of a coating layer



- Solvent borne paint systems **emitted significantly more VOC with cobalt** than with Borchi® OXY-Coat
- Solvent borne systems were **more sensitive than waterborne systems to a catalyst change**
- Long- vs. medium-/short-oil alkyds follow different reaction paths in hydroperoxide decomposition
- Different spectrum and levels of volatile autoxidation byproducts were detected



## Replacing MEKO and cobalt at once meets current and anticipated regulatory requirements without sacrificing performance



Using HPC and MEKO-free anti-skinning agents together provides:

- Faster dry times
- Improved performance under adverse conditions
- Better color initially and non-yellowing coatings
- Formula complexity reduction

Formulations that improve paint labeling:

- 🌿 Cobalt-free
- 🌿 MEKO-free
- 🌿 Lower VOC emissions

“Future-proofing” alkyd formulations to meet global regulatory requirements



Thank You!

Jiří Prekop

Regional Technical Service Chemist

[jiri.prekop@milliken.com](mailto:jiri.prekop@milliken.com)

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