New Developments in Coatings with Soybean Oil

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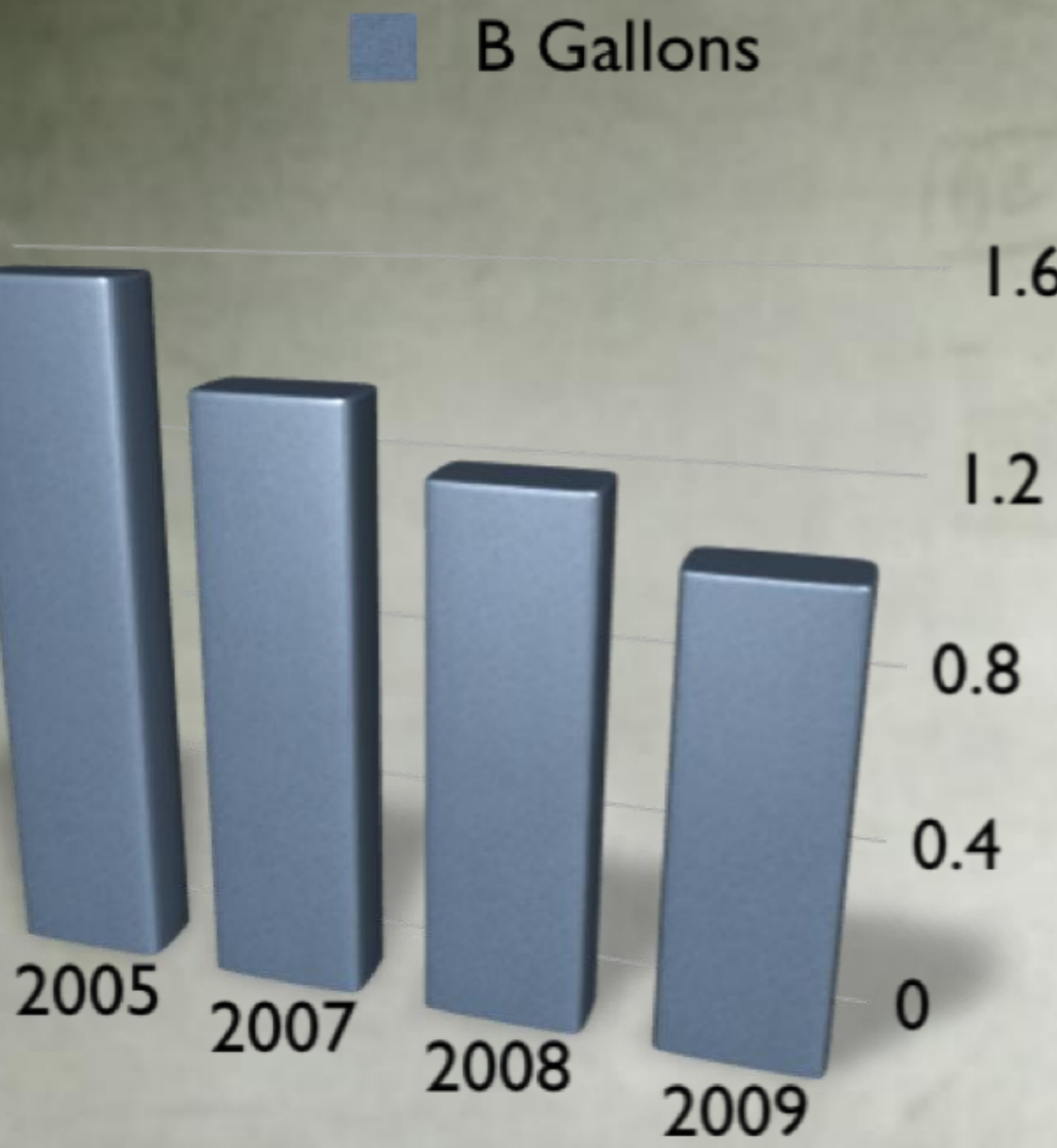
American Coatings Association Classification

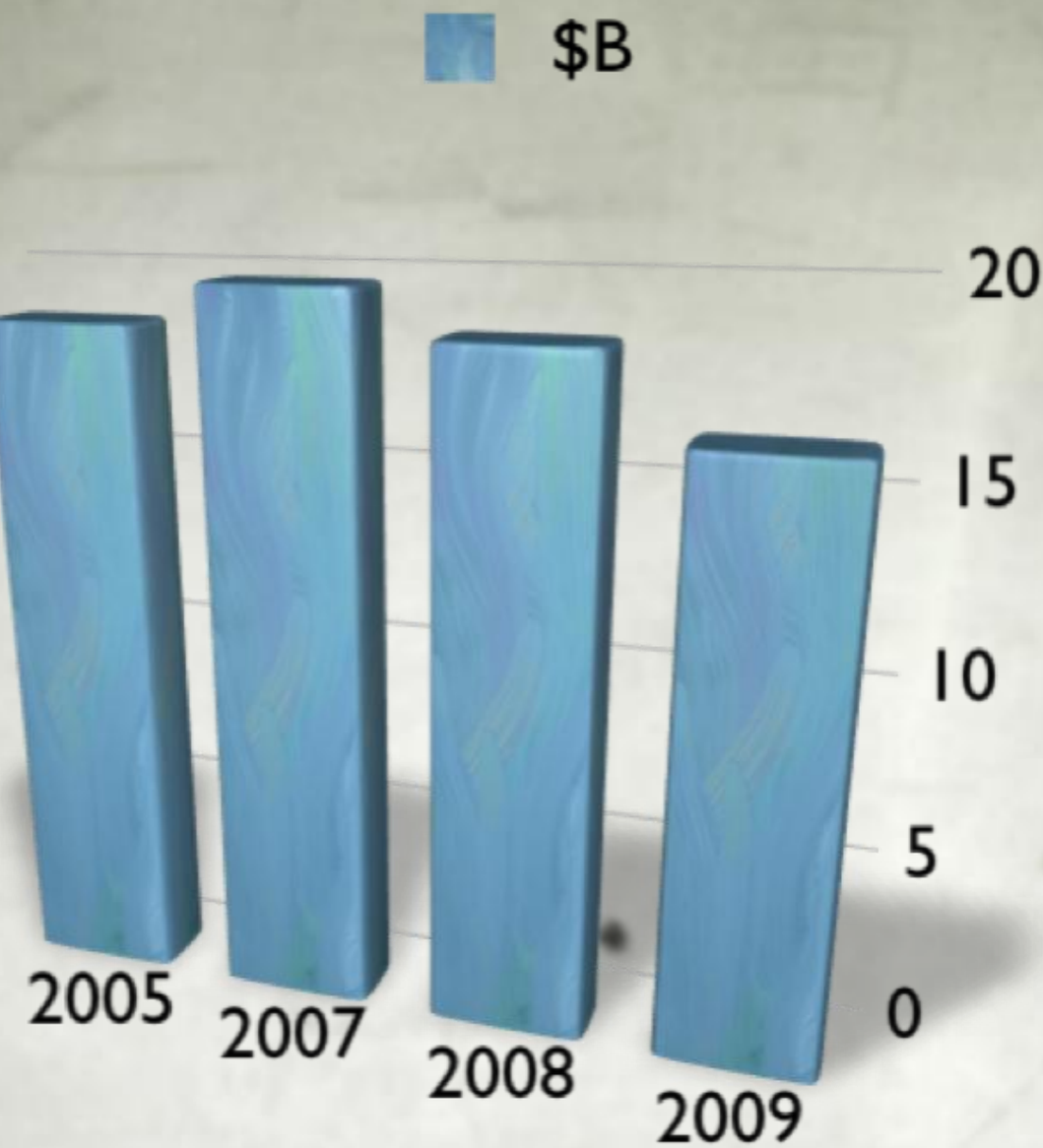
- Architectural
  - DIY type paints/coatings
- Industrial
- Special Purpose
  - Industrial maintainence
  - Aerosols
  - Traffic marking
  - Marine

Areas of Architectural Finishes

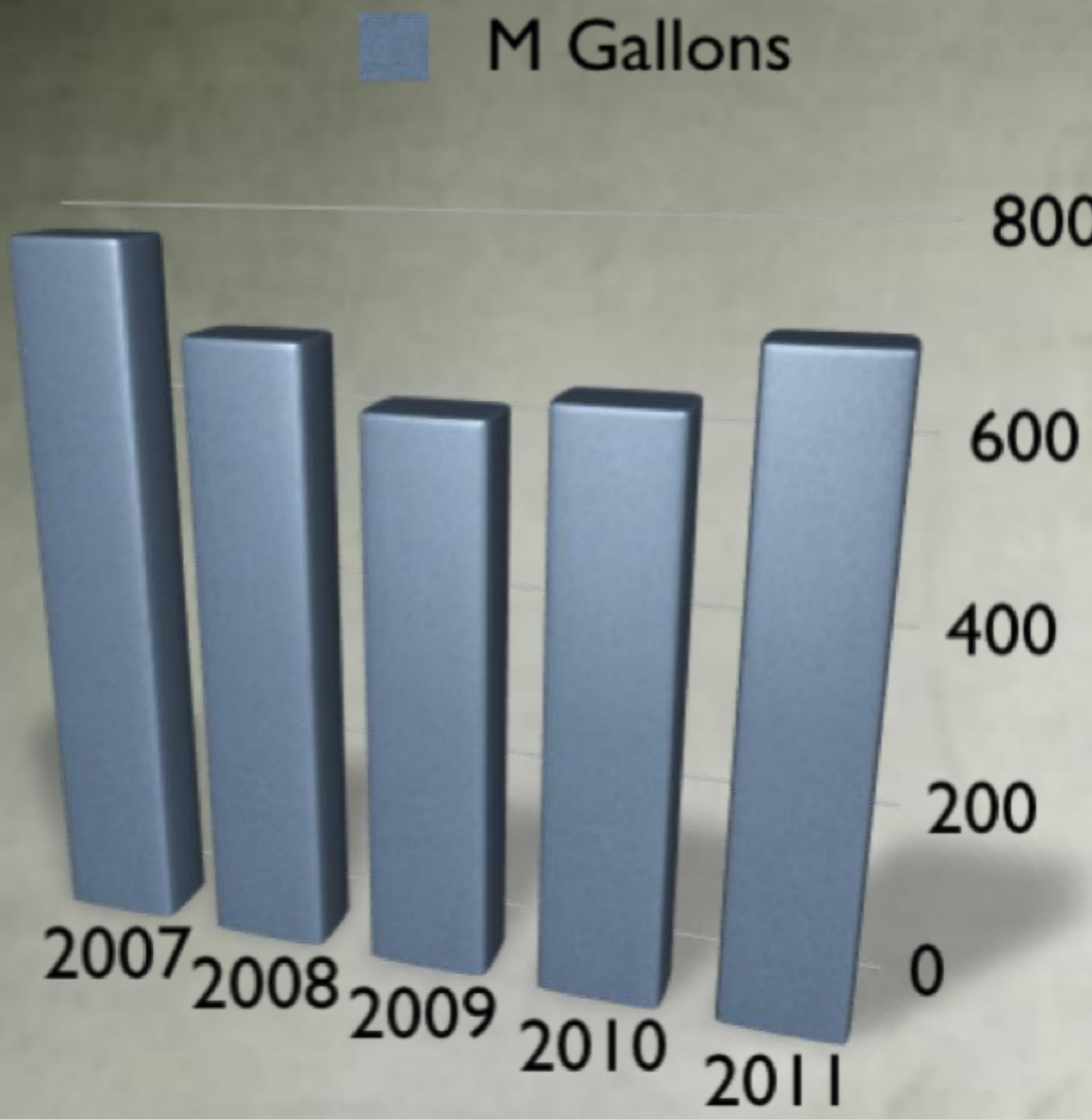
- Interior Products
  - Paints – wall and trim
  - Wood stains
  - Polyurethanes
- Exterior Products
  - Paint - siding
  - Deck stains
  - Waterproofers and sealers
  - Concrete coatings

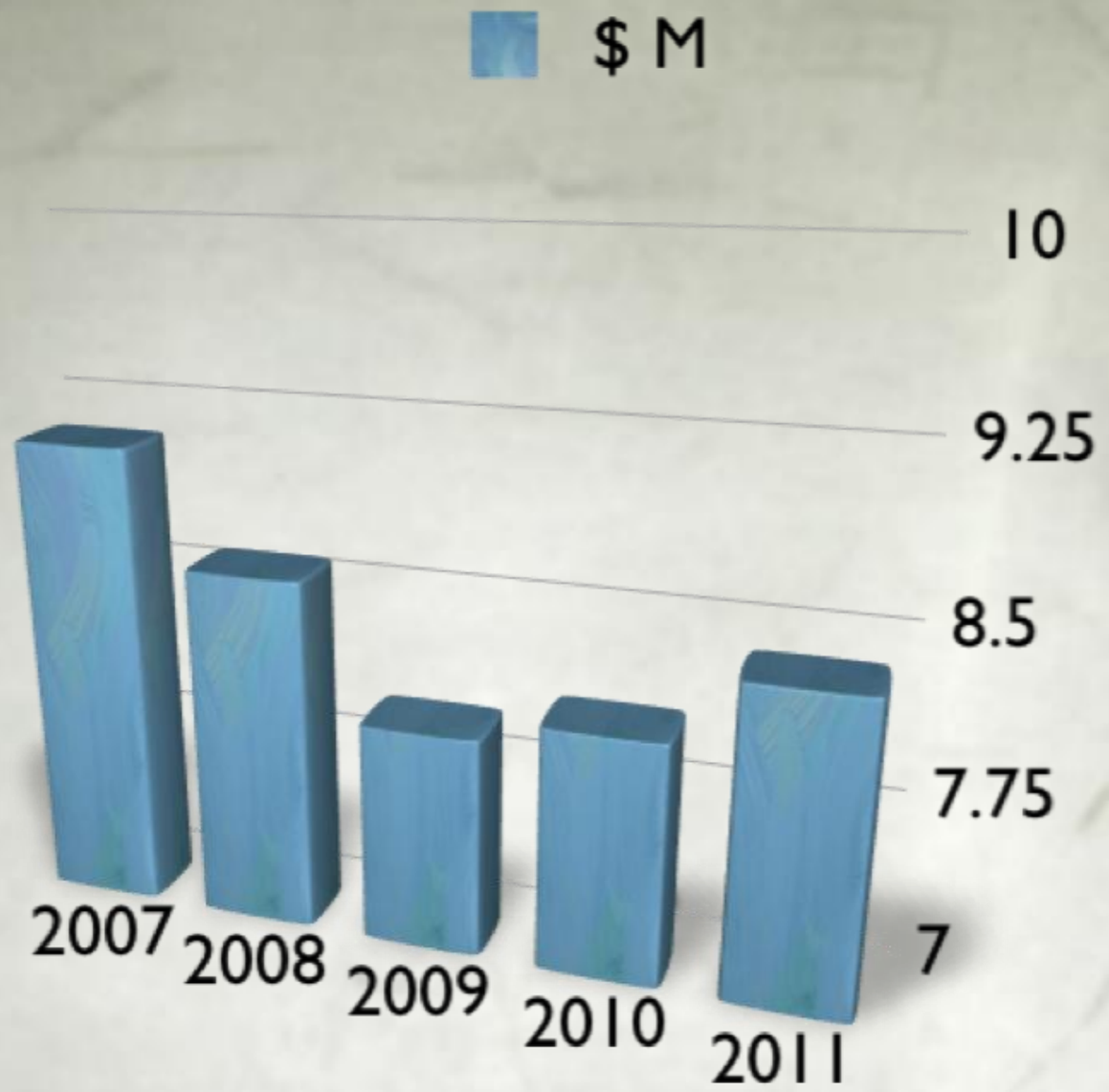
Paint and Coatings Market





Architectural Market





Drivers of the Market

- VOC Regulations
- Volatility in petroleum feedstocks
- Monomer shortages 2009-2010
- Water based finishes becoming larger contributor

VOC Regulations

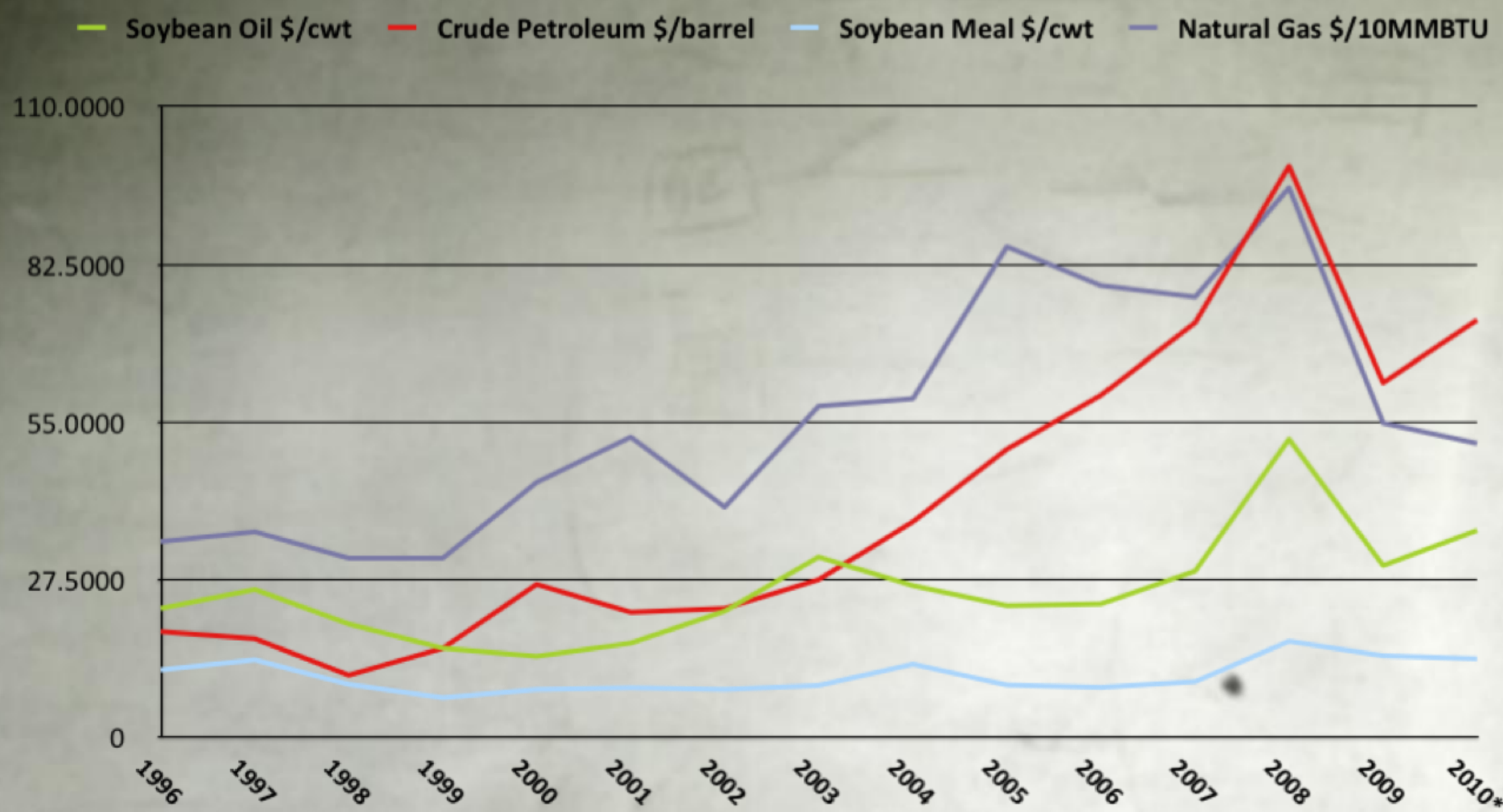
- SCAQMD
  - Most stringent
- US AIM
  - All categories dropping
- CARB - OTC
  - Seem to work in concert with each other
- Air Canada
  - First ever “regulations” on paints

Soy oil - Better than Crude

- Price stability
- Sustainable
- Multiple sources
- Cleaner process
- Contributes to the GDP

Cash Price Changes – FY 1995-2009

USDA or DOE annual average (2009 estimate)



Acrylic Monomer Shortage

- Only a few domestic monomer plants
- Lucite plant shutdown due to fire
- R&H plant shutdown for maintenance
- Market very tight still due to plants producing strictly on demand
- China/EU demand

Traditional Oils used in Coatings Resins

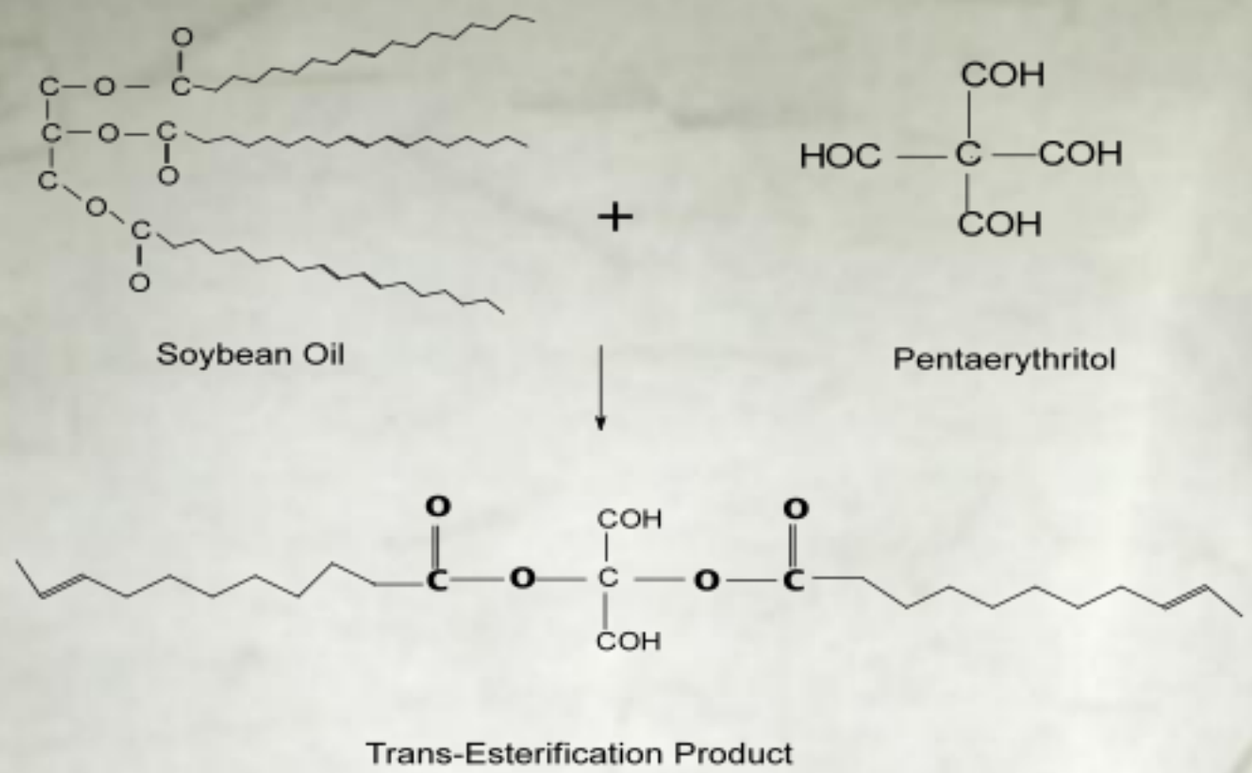
- Soybean
- Linseed
- Castor
- Tall Oil
- Sunflower/Safflower/Canola
- Coconut
- Fish

Soybean Usage Currently

- Alkyds
- Oil Modified Polys
- Acrylics

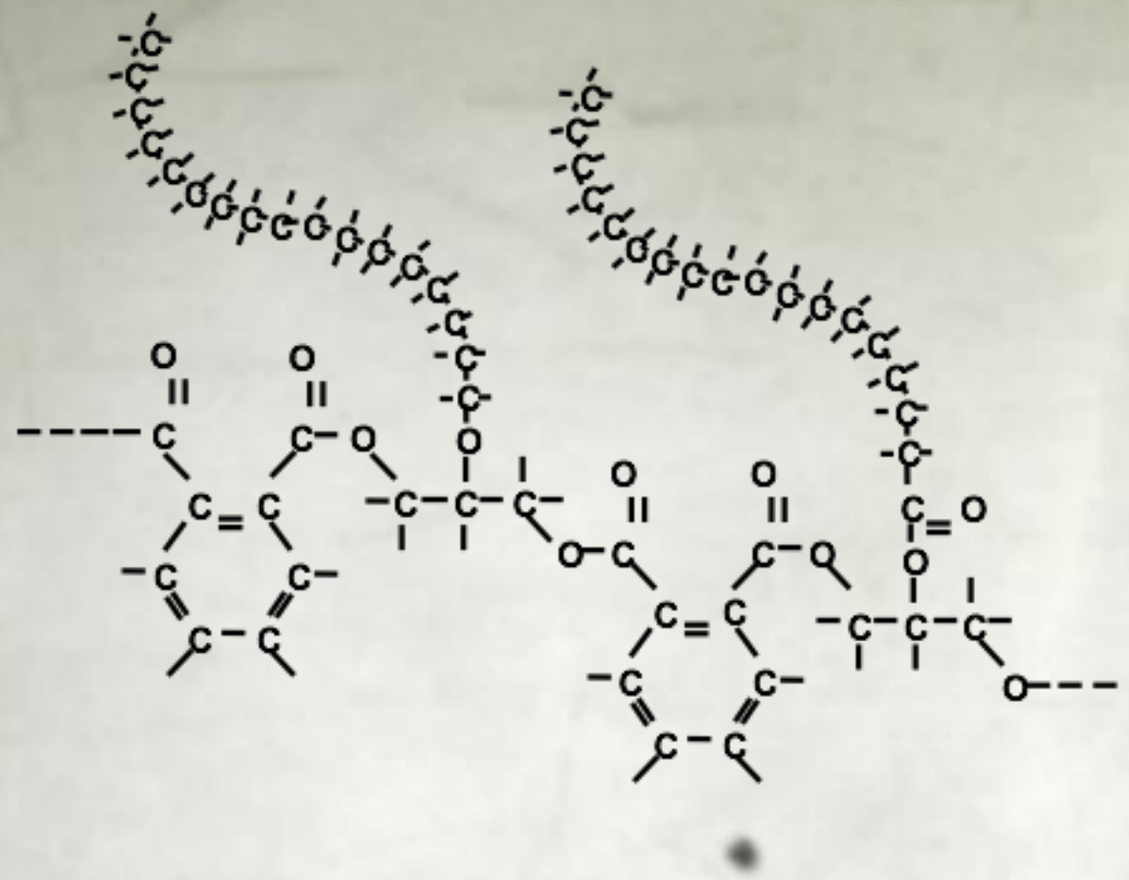
Alkyd Evolution

- Oil created in 1927
- Waterborne 1950s
- Reaction of-
  - Phthalic anhydride
  - Polyol
  - Fatty acid oil
  - Solvent



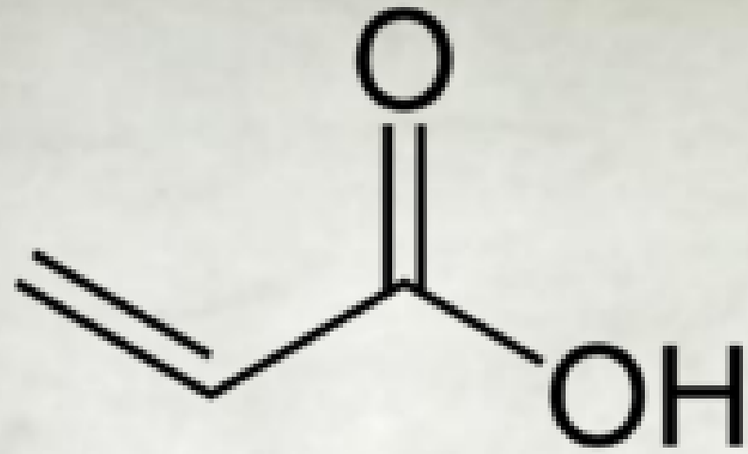
Polyurethane Evolution

- Oil created in 1937
- Waterborne 1950s
- Reaction of-
  - Fatty acid oil
  - Isocyanate
  - Solvent



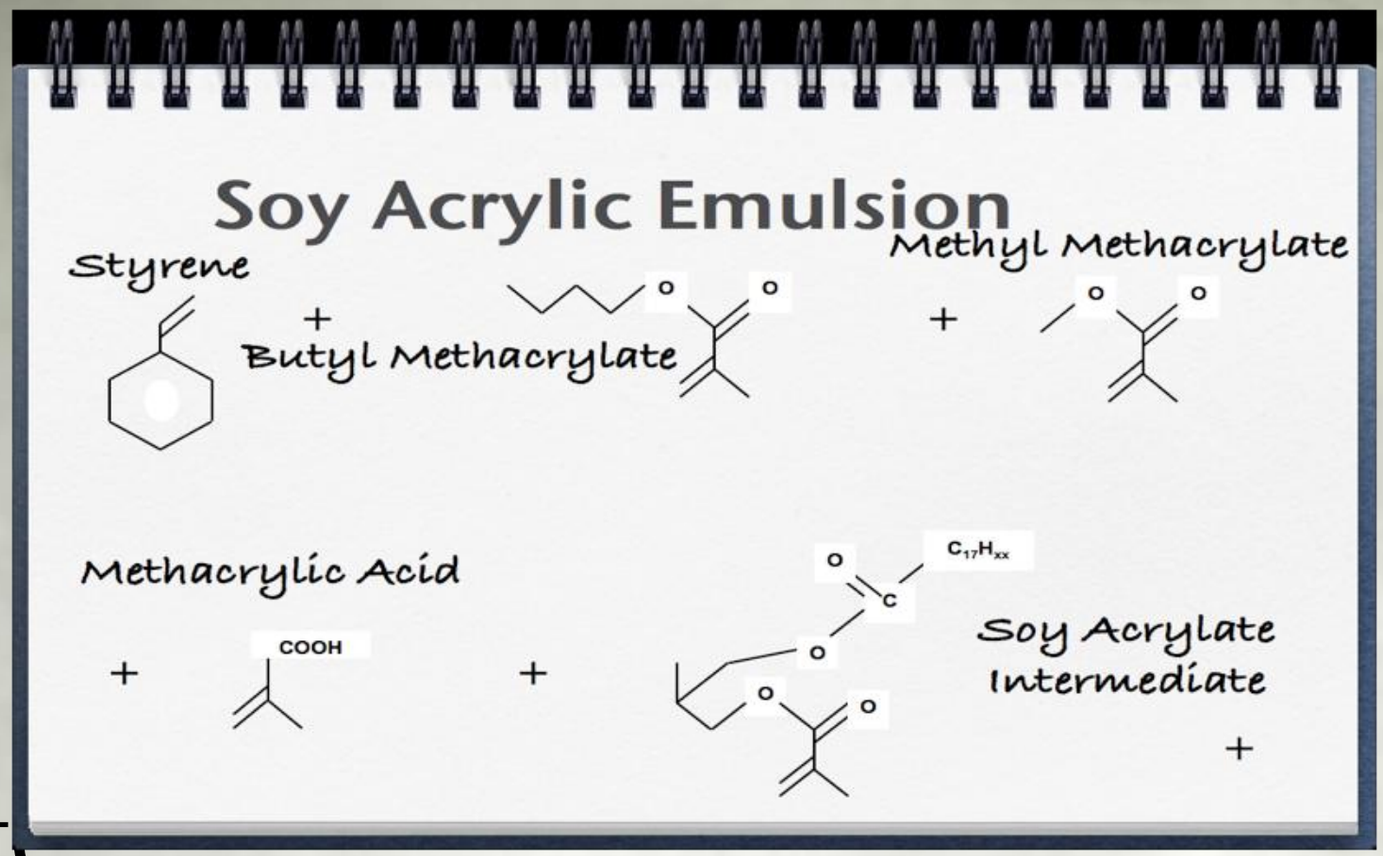
Acrylic Evolution

- Created in 1933
- Reaction of-
  - Acrylic acids
  - Methacrylates
  - Other monomers



Soy Acrylic Evolution

- Created in 2008
- Reaction of-
  - Soy fatty acid
  - Epoxy acrylate
  - Styrene
  - Butyl methacrylate
  - Methyl methacrylate
  - Methacrylic acid



Water based Soy Alkyd Applications

- Metal finishes
  - General purpose
- Wood Products
  - Decking
  - Siding
- Concrete coatings

Water vs Oil Alkyd Testing

Property	Oil Based	Water Based
Soy Content	65%	60%
Solids	60%	55%
VOC at 125 cps	375 g/l	50 g/l
Sward Hardness (Higher is harder)	20	20
Composite Chemical (50 points total)	50	49
Dry Time	8 hours	4 hours
Gloss Potential (For high gloss product)	93	88

Water based Soy Poly Applications

- Wood Products
  - General purpose
  - Flooring
- Concrete coatings

Water vs Oil Poly Testing

Property	Oil Based Product	Water Based Product
Soy Content	51%	40%
VOC at 125 cps	470 g/l	180 g/l
Hoffman Scratch (Higher is better)	3000 grams to rupture	2800 grams to rupture
Taber Abrasion (1000 grams & 1000 cycles)	125 mg loss	100 mg loss
Sward Hardness (Higher is harder)	30	31
Composite Chemical (50 points total)	50	48
Dry Time	6 hours	4 hours
Gloss Potential (For high gloss product)	93	87

Water based Soy Acrylic Applications

- Wood Products
  - General purpose
  - Flooring
  - Decking
- Metal coatings
- Concrete coatings
  - Stains

Soy Acrylic Physical Testing

Test	Soy Water Product	Oil Based Product	Water Based Product
Soy Content	28% (55% of the product at 50% of the polymers)	51% (85% of the product at 60 % of the polymer)	0%
Petro Content	22% (coalescent, additives, polymer)	49% (solvent, additives, polymer)	38% (coalescent, additives, polymer)
Hoffman Scratch (Higher is better)	3200 grams to rupture	3000 grams to rupture	2800 grams to rupture
Taber Abrasion (1000 grams & 1000 cycles)	48 mg loss	125 mg loss	64 mg loss
Sward Hardness (Higher is harder)	26	24	24
Composite Chemical (50 points total)	48.5	50	48
Dry Time	2 hours	4 hours	2 hours
Gloss Potential (For high gloss product)	91	93	84

Future for Soy water based resins

- Performance comparable with oil counterparts
- More options for resins as suppliers are working with these materials
- Volatility in petroleum used in many oil systems as well as water based acrylic