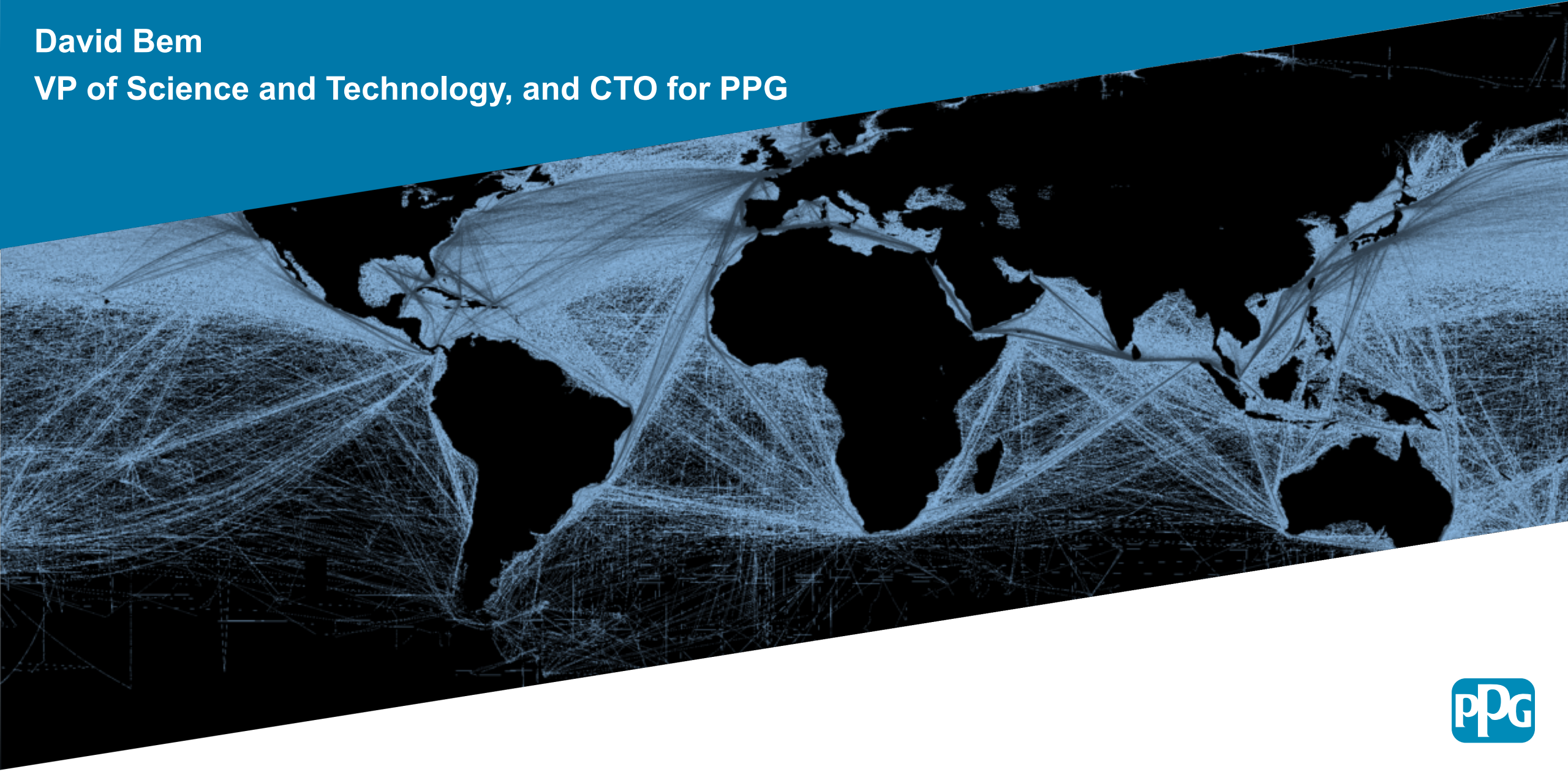


Chemical Supply Chain Risks

David Bem

VP of Science and Technology, and CTO for PPG



The chemical industry is being faced with new challenges



Globalization

- Materials are shipped longer distances
- Regional issues impact world trade much faster



Lean Manufacturing

- Inventory = Working Capital = Waste?
- Forecasting plays a bigger role – swings in capacity



Disruptions

- Hurricanes, tidal waves, industrial incidents, port closures, regulatory changes
- More frequent, with greater impact



Consolidations

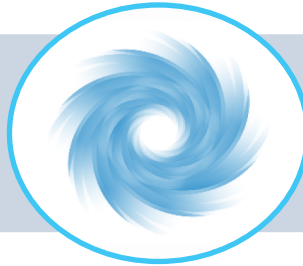
- Feedstock sources are consolidating to optimize footprint and costs
- Vertical integrations less common

Disasters with global impact have been frequent

2011
Fukushima
Tsunami



2017
Hurricane
Harvey



NOW
COVID-19



2015
Tianjin
Port Fire



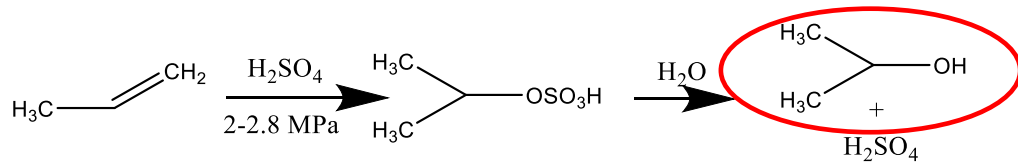
2019
Industrial
Park
Explosion

Each situation had short-term, obvious impacts and ripple effects that resonated in the chemical industry long after the general public had moved on.

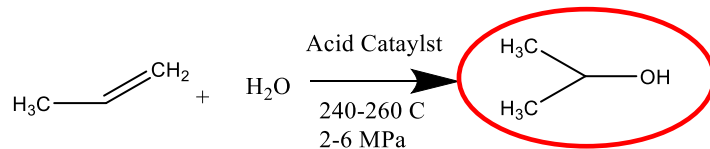
COVID-19 - Focus on Hand Sanitizer Effect

Spike in demand for hand sanitizer

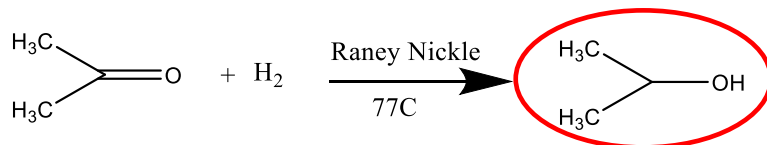
- **Unprecedented impact on IPA**
 - Disproportional increase (back to 1994)
 - 3 main routes
 - Indirect Hydrogenation Propylene



- Direct Hydrogenation Propylene



- Hydrogenation of Acetone



EUROPEAN IPA PRICE JUMPS TO FRESH ALL-TIME HIGH



Comparisons of March 2020 Price in €/MT

Reference Date	IPA
Feb 2020	+380%
2017 peak*	+118%

Price increase driven by demand, feed stock prices are flat

<https://www.spglobal.com/platts/en/market-insights/latest-news/petrochemicals/032520-european-ipa-at-record-high-as-production-of-sanitary-products-ramps-up>

Benzisothiazoline (BIT)* 80% of world supply disappeared permanently **OVERNIGHT**

Hidden risks resulted in a crisis

- **March 2019 - explosion in Jiangsu Province**
- **BIT precursor made next door**
 - Precursor- (o-Nitrochlorobenzene)
- **Multiple BIT producers, all reliant on limited sources**
- **New government restriction on chemical production sites**
- **Ripple effect – Majority of waterborne products that contained BIT had to be reformulated**

Top photo- New York Times/Reuters <https://www.nytimes.com/2019/03/22/world/asia/china-chemical-plant-explosion.html>

Bottom Photo and 80% stat- <https://cpda.com/wp-content/uploads/2019/05/CPDA-Denver-BIT-talk-Kevin-Crosby.pdf>

*BIT = Biocide used in waterborne products

