

2nd International Symposium on Alternatives Assessment
1 - 2 November 2018 – Sacramento CA USA

Implementation of Quantitative Hazard Assessment Scoring Methods for High-throughput Chemical Alternatives Assessment

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Topics

1. Chemical screening is changing
2. Qualitative frameworks are helpful
3. Quantitative approaches compliment
4. Brands are collaborating for scale

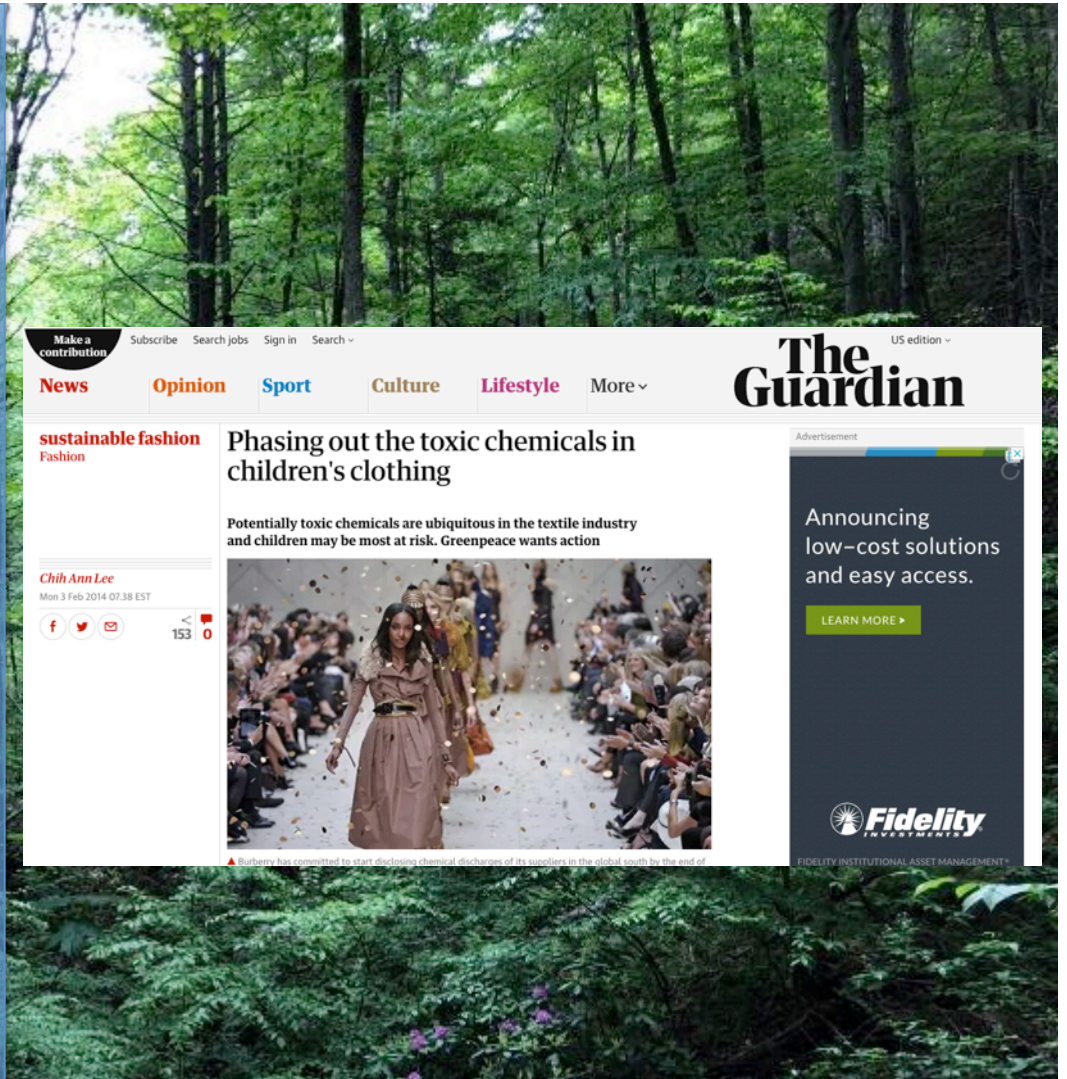
GOAL: Understand through examples how quantitative hazard scoring is leading to rapid expansion of alternatives assessment and preferred chemicals selection for consumer products.

Process transformation



Multiple non-regulatory drivers of safer chemicals action

- NGOs
- Consumers
- Leadership



Multiple non-regulatory drivers of safer chemicals action

- NGOs
- Consumers
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20 June, 2012

Beware toxic chemicals in imported clothing

CHOICE says Australia lags behind overseas regulation

CHOICE says that inadequate chemical regulation for imported textiles, clothing and footwear means that consumers are unaware that they could be wearing toxic chemicals.

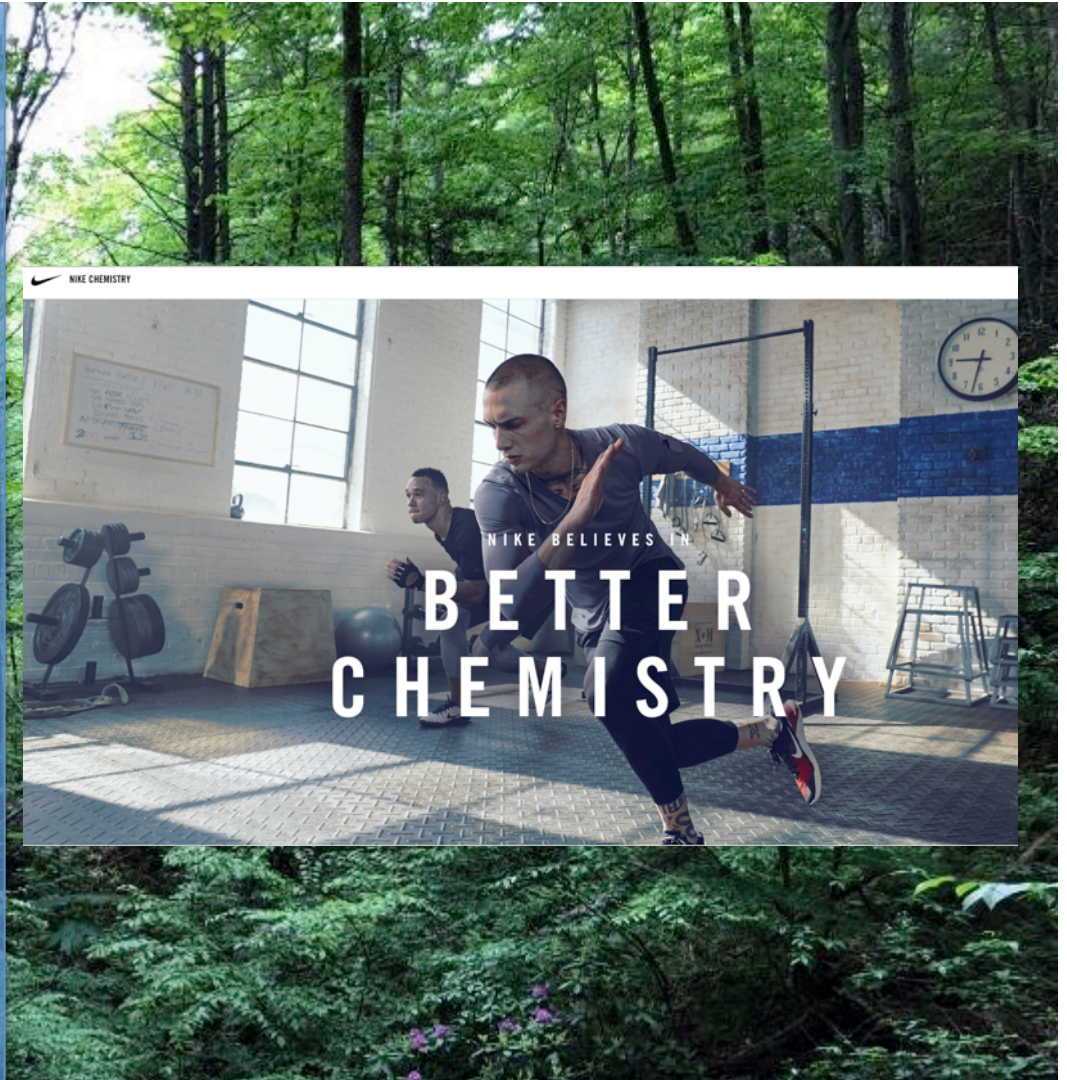
In a report into chemicals in textiles, clothing and footwear (TCF), the people's watchdog says Australian chemical regulation lags behind other countries. As a result, Australians are exposed to higher risks of allergic reactions to chemicals in new clothes, footwear and even furniture.

"Over ninety percent of the clothes on Australian shelves are imported. The trend for 'fast fashion' also means that retailers are under pressure to put more stock on shelves, more often," says CHOICE spokesperson, Ingrid Just.

"That pressure, combined with our inadequate chemical regulation for apparel, means that consumers have less protection than people in other countries where regulation is stronger."

Multiple non-regulatory drivers of safer chemicals action

- NGOs
- Consumers
- Leadership



Qualitative chemical screening

1. US EPA Safer Choice® Program
2. UN GHS System
3. GreenScreen® for Safer Chemicals
4. Cradle to Cradle® Certification
5. Bluesign® Certification
6. Scivera GHS+ Hazard Assessment

Qualitative screening categorization



A photograph of a dense forest with tall, thin trees and lush green undergrowth. The scene is captured from a low angle, looking slightly upwards. The trees are mostly deciduous with vibrant green leaves. The ground is covered in a thick layer of ferns and other forest floor plants. The lighting is soft and diffused, suggesting an overcast day or a shaded forest interior.

“I just need a number.”



Quantitative chemical screening

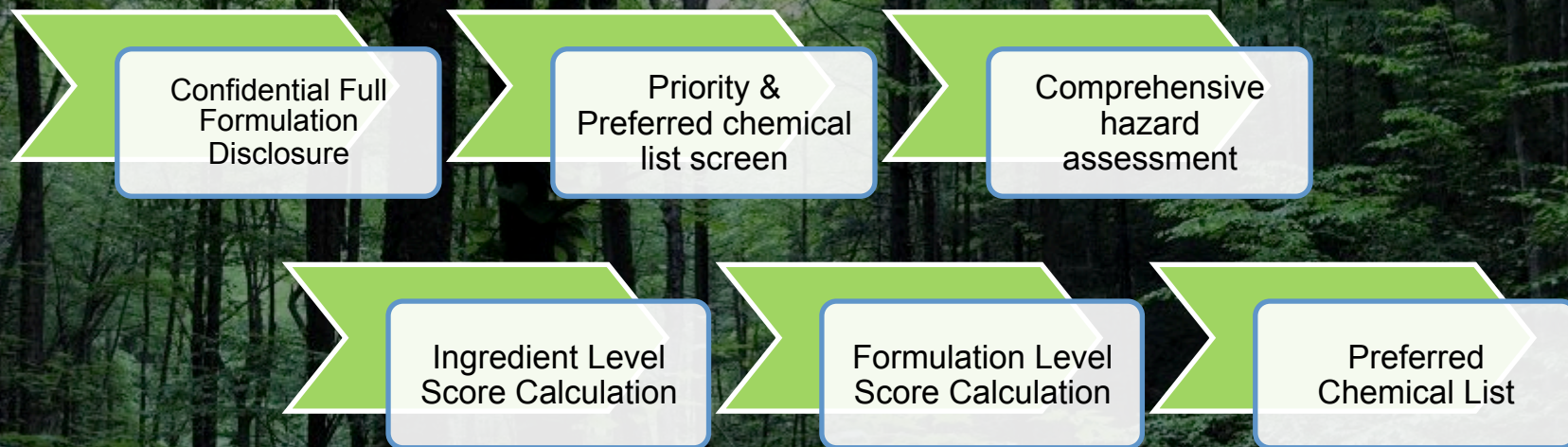
1. Compliment qualitative frameworks
2. Result in a numeric score
3. Enable easier comparative review of chemicals and formulations



Quantitative screening examples

1. Screened Chemistry
2. NIKE Priority Chemistry
3. Scivera Quantitative Chemistry Index

Screened Chemistry Steps



- ❑ Ensures RSL & ZDHC MRSL Conformance
- ❑ Hazard based instead of Risk
- ❑ Identifies Best in Class Chemicals
- ❑ Increases Transparency in Supply Chain
- ❑ Creates a tool for continuous improvement
- ❑ Protects Chemical Supplier IP

Ingredient score

| GreenScreen® | SciveraLENS® | EPA Safer Chemical Ingredient List (SCIL) | Screened Chemistry Ingredient Score |
|--------------------|---|---|-------------------------------------|
| Benchmark 4 | Rapid Screen Hazard Category Green | ----- | 50 points |
| Benchmark 3 | Rapid Screen Hazard Category Yellow/Green | ----- | 40 points |
| ----- | ----- | Full Green Half Green Circle | 35 points |
| Benchmark 2 | Rapid Screen Hazard Category Yellow | Yellow Triangle | 20 points |
| Benchmark U | Rapid Screen Hazard Category Gray | ----- | 15 points |
| Benchmark 1 / LT-1 | Rapid Screen Hazard Category Red | ----- | 10 points |

Formulation score

| Chemical Formulation | % | Hazard Ingredient Rating | Points | Total |
|---|----|--------------------------|--------|--------------|
| CASNR Ingredient #1 | 5 | EPA Yellow Triangle | 10 | 0.5 |
| CASNR Ingredient #2 | 10 | EPA Acceptable | 30 | 3 |
| CASNR Ingredient #3 | 15 | EPA Full Green Circle | 35 | 5.25 |
| CASNR Ingredient #4 | 20 | BM3 | 40 | 8 |
| CASNR Ingredient #5 | 50 | BM2 | 20 | 10 |
| Formulation Score: Needs improvement | | | | 26.75 |

| Formulation Score | Rating | Definition |
|-------------------|--------|--------------------|
| 35 to 50 | Green | Preferred Chemical |
| 20 to 34 | Yellow | Needs Improvement |
| 19 to -50 | Red | Phase Out |

* Formulations with BM1/LT-1/HC Red ingredient automatically score below 20 for target Phase out

Preferred Chemical List:

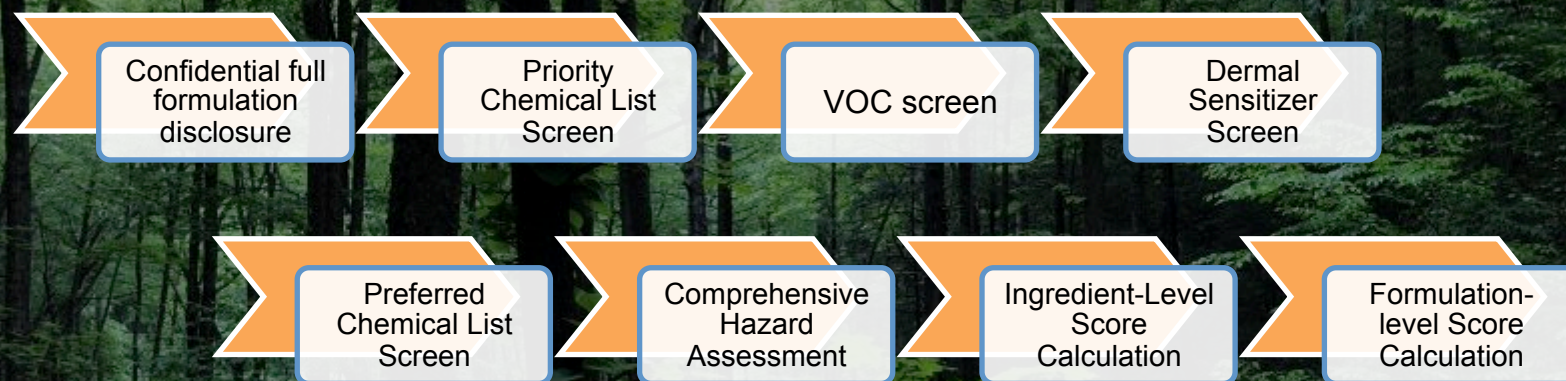
| Formulation Tradename | Supplier | Chemical Function | Score |
|-----------------------|------------|-------------------|-------|
| Softener 1 | Supplier A | Softener | 26 |
| Softener 2 | Supplier B | Softener | 30 |
| Softener 3 | Supplier C | Softener | 35 |
| Softener 4 | Supplier D | Softener | 40 |
| Softener 5 | Supplier E | Softener | 16 |



Benefits of Formulation Scores

- Vendors are able to select chemicals based on their hazard score and not just M/RSL conformance, cost and performance – allowing them to go beyond compliance
- Scores allow suppliers and developers to select better/best alternatives and compare ingredients and formulations
- Identifies R&D opportunities with suppliers and allows hazards to be screened out in the design stage before entering into the supply chain
- Creates a Preferred Chemical List vs a Negative Restricted List

Nike Priority Chemistry Steps



- ❑ Ensures MRSL and RSL Conformance
- ❑ Supports 1/2 impact moonshot goals
- ❑ Promotes hazard based approach
- ❑ Provides guidance on desired attributes
- ❑ Moves from reactive to proactive
- ❑ Allows Suppliers to “tinker”

Nike Formulation Score

| Details | Nike | | | | | | | | | | |
|---------|----------------------------|-------------|-------|-----------|------|-----|----|----|-----|-----|--|
| ROW | CASRN | COMMON NAME | % | Nike ▲ | NRSL | RSL | HC | DS | NCR | KPS | |
| | Formulation Example | | 100.0 | ▲ | ▲ | ▲ | ● | ● | ● | 5.8 | |
| 1 | redacted | redacted | 20.0 | ▲ | ▲ | ▲ | ● | ● | ● | 20 | |
| 5 | redacted | redacted | 0.5 | ▲ | ▲ | ▲ | ● | ● | ● | 20 | |
| 6 | redacted | redacted | 0.5 | ▲ | ▲ | ▲ | ● | ● | ● | 20 | |
| 7 | redacted | redacted | 0.5 | ▲ | ▲ | ▲ | ● | ● | ● | 0 | |
| 8 | redacted | redacted | 6.0 | ▲ | ▲ | ▲ | ● | ● | ● | 0 | |
| 3 | redacted | redacted | 10.0 | ▲ | ▲ | ▲ | ● | ● | ● | 90 | |
| 4 | redacted | redacted | 5.0 | ▲ | ▲ | ▲ | ● | ● | ● | 90 | |
| 2 | redacted | redacted | 5.0 | ▲ | ▲ | ▲ | ● | ● | ● | 35 | |
| 10 | redacted | redacted | 5.0 | ▲ | ▲ | ▲ | ● | ● | ● | 10 | |
| 11 | redacted | redacted | 5.0 | ▲ | ▲ | ▲ | ● | ● | ● | 10 | |
| 9 | redacted | redacted | 2.5 | ▲ | ▲ | ▲ | ● | ● | ● | 10 | |
| 12 | redacted | redacted | 40.0 | ▲ | ▲ | ▲ | ● | ● | ● | 50 | |

Nike Formulation Score

SCIVEROLENS rapid screen

Assessment results
Formulation Example

Details Nike

| ROW | CASRN | COMMON NAME | NRSL | RSI | LC | DG | MCR | KPS |
|-----|-------|-------------|------|-----|----|----|-----|-----|
| | | | ▲ | ▲ | ● | ● | ● | 9.8 |
| | | | ▲ | ▲ | ● | ● | ● | 20 |
| | | | ▲ | ▲ | ● | ● | ● | 20 |
| | | | ▲ | ▲ | ● | ● | ● | 20 |
| | | | ▲ | ▲ | ● | ● | ● | 20 |
| | | | ▲ | ▲ | ● | ● | ● | 0 |
| | | | ▲ | ▲ | ● | ● | ● | 0 |
| | | | ▲ | ▲ | ● | ● | ● | 90 |
| | | | ▲ | ▲ | ● | ● | ● | 90 |
| | | | ▲ | ▲ | ● | ● | ● | 88 |
| | | | ▲ | ▲ | ● | ● | ● | 10 |
| | | | ▲ | ▲ | ● | ● | ● | 10 |
| | | | ▲ | ▲ | ● | ● | ● | 10 |
| | | | ▲ | ▲ | ● | ● | ● | 10 |
| | | | ▲ | ▲ | ● | ● | ● | 50 |
| | | | ▲ | ▲ | ● | ● | ● | 50 |

Formulation Example

1 redacted redacted

5 redacted redacted

6 redacted redacted

redacted redacted

redacted redacted

Nike Formula

sciverOLENS
rapid screen

Details Nike

| Row | CASRN | POSITION NAME | Nike | MRSL | RSL | HC | MCR | KPS |
|-----|----------|---------------------|------|------|-----|----|-----|-----|
| | | Formulation Example | ▲ | ▲ | ▲ | ● | ● | 9.8 |
| 1 | redacted | redacted | ▲ | ▲ | ▲ | ● | ● | 20 |
| 5 | redacted | redacted | ▲ | ▲ | ▲ | ● | ● | 20 |
| 6 | redacted | redacted | ▲ | ▲ | ▲ | ● | ● | 20 |
| 7 | redacted | redacted | ▲ | ▲ | ▲ | ● | ● | 0 |
| 8 | redacted | redacted | ▲ | ▲ | ▲ | ● | ● | 0 |
| 9 | redacted | redacted | ▲ | ▲ | ▲ | ● | ● | 90 |
| 4 | redacted | redacted | ▲ | ▲ | ▲ | ● | ● | 90 |
| 2 | redacted | redacted | ▲ | ▲ | ▲ | ● | ● | 88 |
| 10 | redacted | redacted | ▲ | ▲ | ▲ | ● | ● | 10 |
| 11 | redacted | redacted | ▲ | ▲ | ▲ | ● | ● | 10 |
| 9 | redacted | redacted | ▲ | ▲ | ▲ | ● | ● | 10 |
| 12 | redacted | redacted | ▲ | ▲ | ▲ | ● | ● | 50 |

Nike Formulation Score

sciverOLENS
rapid screen

Details Nike

| ROW | CASRN | COMMON NAME | % | Nike |
|-----|----------|----------------------------|-------|------|
| | | Formulation Example | 100.0 | ▲ |
| 1 | redacted | redacted | 20.0 | ▲ |
| 5 | redacted | redacted | 0.5 | ▲ |
| 6 | redacted | redacted | 0.5 | ▲ |
| 7 | redacted | redacted | 0.5 | ▲ |
| 8 | redacted | redacted | 6.0 | ▲ |
| 3 | redacted | redacted | 10.0 | ▲ |
| 4 | redacted | redacted | 5.0 | ▲ |
| 2 | redacted | redacted | 5.0 | ▲ |
| 10 | redacted | redacted | 5.0 | ▲ |
| 11 | redacted | redacted | 5.0 | ▲ |
| 9 | redacted | redacted | 2.5 | ▲ |
| 12 | redacted | redacted | 40.0 | ▲ |

Assessment
Formulation Example

HC

DS

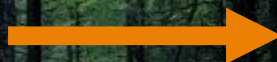
NCR



Innovation and Scoring

Before Formulation Scoring:

- Chemical Supplier provides formulation as part of innovation project
- Nike Chem team reviews
 - Determines formulation does not meet standards
- Supplier alters formulation but doesn't know what is exactly wanted
 - New Formulation is also rejected
- Repeat as needed.



With Formulation Scoring:

- Chemical Supplier able to see score, identify specific ingredient impacts, alter formulations to improve score
- Nike Chem team reviews
 - Approves formulation
- New product moves to market quickly and is a huge success!
- Supplier is happy, Innovation teams are happy, everyone is happy.



Scivera Quantitative Chemistry Index (“QCI”)

1. Calculates a 0-100 score for a chemical
2. Based on comprehensive hazard assessment results
3. Useful for comparing alternative ingredients within qualitative category
4. Valuable for scale, consistency, and dynamic nature of assessments

Scivera Quantitative Chemistry Index (“QCI”)

Assign endpoint score based on hazard condition

Factor score for Core endpoints and limited evidence

Sum endpoint scores and divide by total possible

Group QCI scores by qualitative category

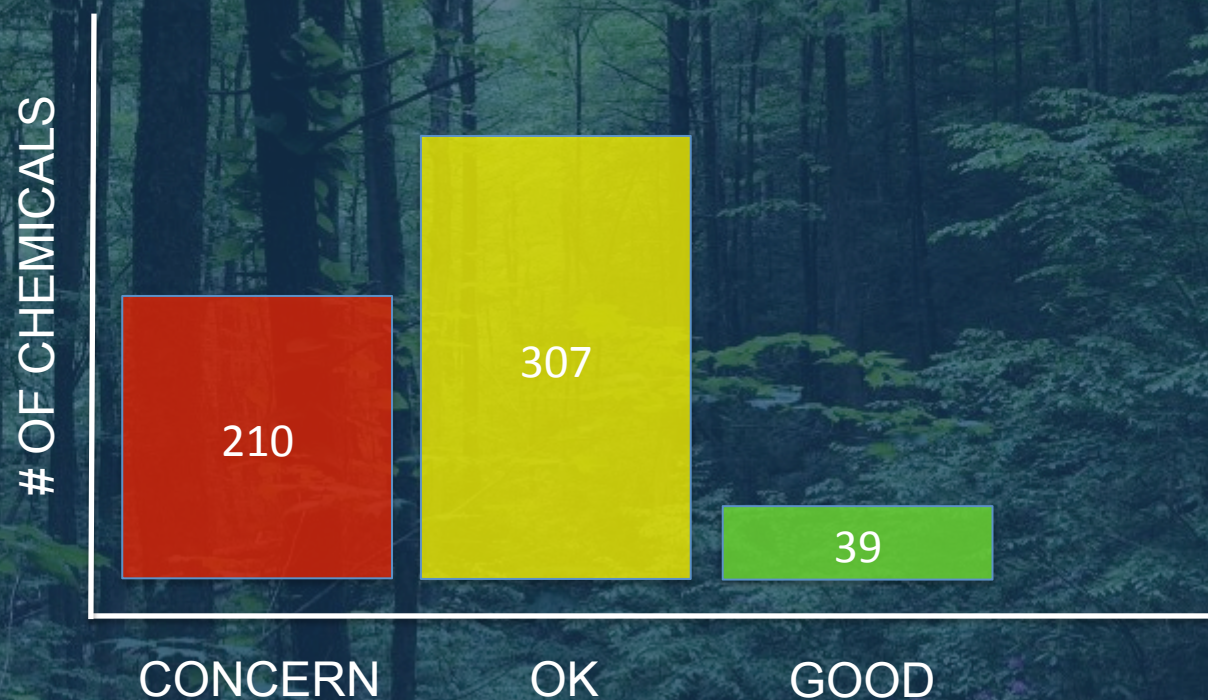
Scivera Quantitative Chemistry Index (“QCI”)

| Hazard Condition | Base Score | Core Endpoint Factor (0.67/1.5) | Limited Evidence Factor (0.75) Base | Limited Evidence Factor (0.75) Core |
|--------------------------|------------|---------------------------------|-------------------------------------|-------------------------------------|
| Low (l) | 11 | 16.5 | 8.25 | 12.375 |
| Moderate (m) | 8 | 12 | 6 | 9 |
| High (h) | 3 | 2 | 2.25 | 1.5 |
| Very high (vh) | 1.5 | 1 | 1.125 | 0.75 |
| Unassessed (u) | 1.125 | 0.75 | - | - |
| Assessed - Data Gap (nd) | 1.5 | 1 | - | - |

NB: Core Endpoints: CMRD/PBT
Limited evidence: Modeled data, etc.

Qualitative screening categorization

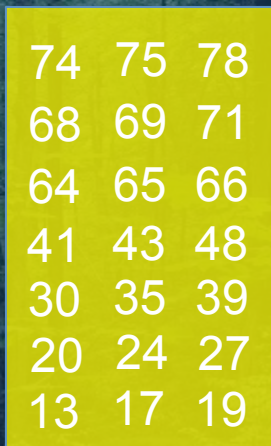
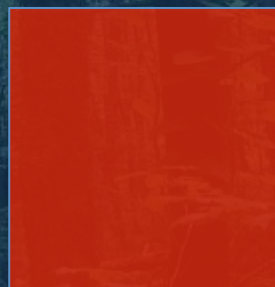
Case Study: Solvent Alternatives [US EPA CP-CAT]



Chemical ranking by QCI

Case Study: Solvent Alternatives [US EPA CP-CAT]


OF CHEMICALS



CONCERN

OK

GOOD



ZDHC in practice:
**Evaluating Safer
Alternatives**

Converging Brand
Screened Chemistry
Programs

*ZDHC Foundation
November 1, 2018*

Some challenges
are too big to be
faced alone

Transforming an industry
requires

- Collaboration
- Transparency
- Commitment



Image: Greenpeace

Signatory Brands:



Value Chain Affiliates:



Associates:





OUR VISION is widespread implementation of sustainable chemistry, driving innovations and best practices in the textile, apparel, leather and footwear industries to protect consumers, workers and the environment.

OUR MISSION is to enable brands, retailers and their supply chain partners in the textile, apparel, leather and footwear industries to **implement sustainable chemical management best practice across the value chain.**

The background of the slide is a microscopic image of plant cells, showing a network of cell walls forming irregular polygons. The left half of the image is dark, while the right half is light, creating a vertical gradient.

**Contact us at
roadmap@zdhc.org**

**Learn more at
www.roadmaptozero.com**

Ø ZDHC

Summary

1. Engaging 100s of suppliers and 1000s chemical companies
2. Establishing objective feedback for safer chemistry achievement
3. Expanding to more brands and categories
4. Reducing cost, protecting IP, expanding safer alternatives



LEVI STRAUSS & CO.

Ø ZDHC

