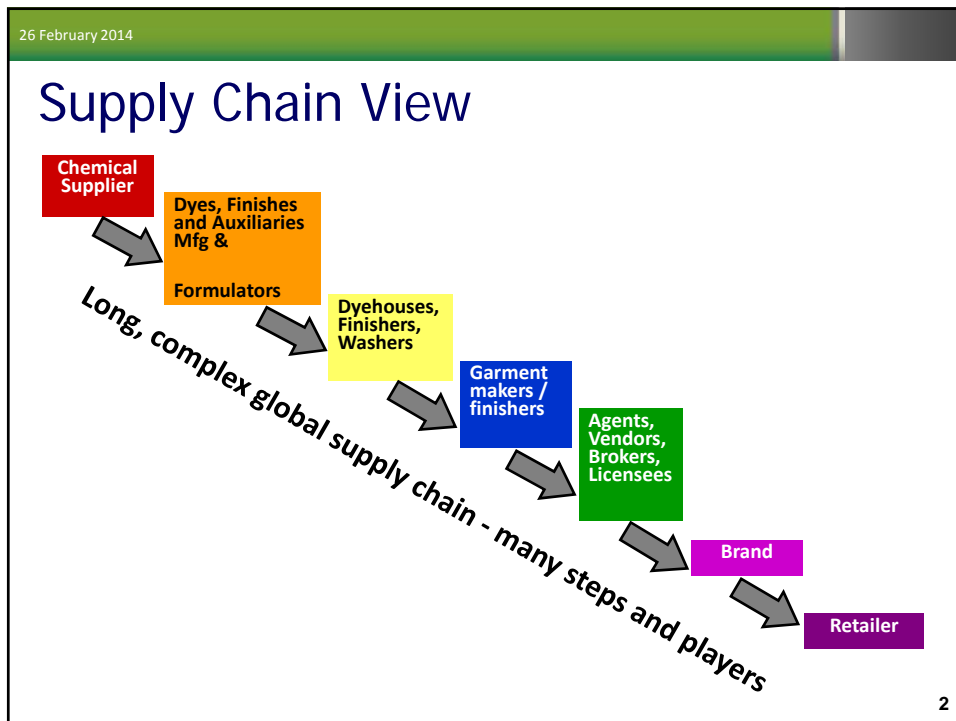


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Durable Water Repellent Technology - Environmental Health and Safety

SUPFES Project Meeting
25 February 2014
Borås, Sweden
Bob Buck - DuPont



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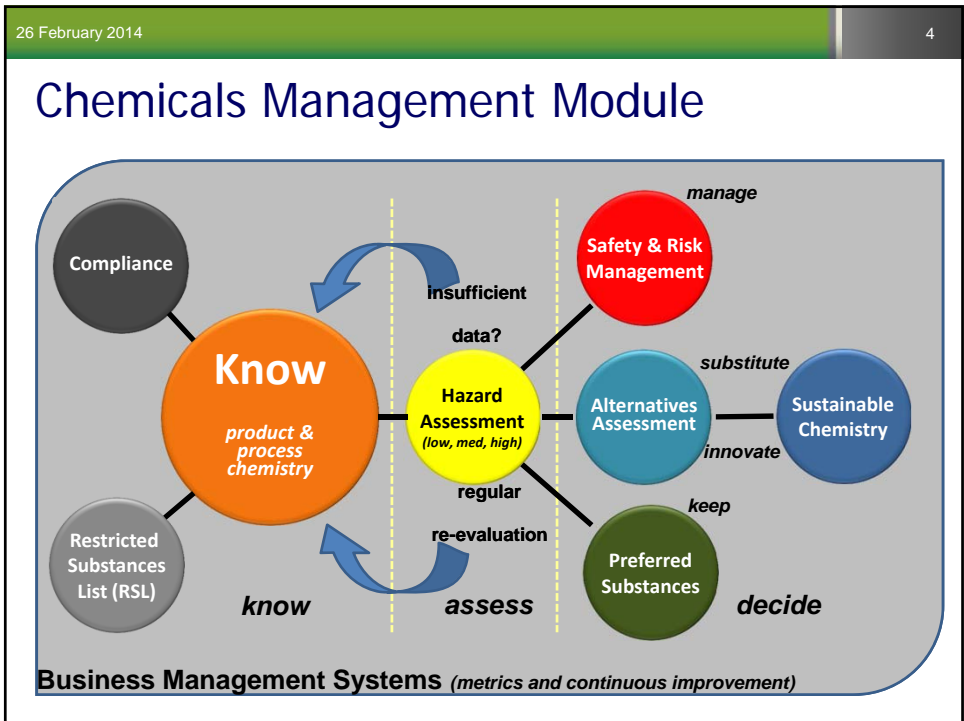
The Global Industry is Taking ACTION

- **DWR Task Force**
 - DWR Research Report
 - Brand Questionnaire
 - DWR Supplier Questionnaire*
 - And more!

Global Supply Chain Collaboration



- **The Higg Index®**
 - <http://www.apparelcoalition.org/higgindex/>
- **Chemicals Management Module (CMM)**
 - <http://www.outdoorindustry.org/responsibility/chemicals/cmpilot.html>



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DWR Supplier Questionnaire

<ul style="list-style-type: none"> • Chemical Supplier • Fluorinated DWR Product Trade Name • Performance Effects Offered • Fabric types, Comments • What is the DWR Product's technology platform? • Is the Product based on long chain or short chain technology (See links for definitions) • If it is long chain, provide a list of short chain alternatives with similar performance • Is the DWR Product compliant with the US EPA 2010/15 stewardship program and the EU marketing and use restrictions for PFOS and related substances? • Is the DWR product registered on: <ol style="list-style-type: none"> 1) the US EPA TSCA inventory by filing of a Pre-Manufacturing Notification (PMN) or 2) the Canadian Domestic Substances List (DSL) or 3)with NICNAS, Australia? 	<ul style="list-style-type: none"> • Do you have mammalian toxicity data for the DWR Product? • Do you have aquatic toxicity, bioaccumulation and environmental fate data for the DWR Product? • Do you have a documented product stewardship process to assess the worker, consumer and environmental impacts of the DWR Product through the entire product life cycle?" • Has the DWR Product been assessed by a third party such as Bluesign® in the BlueTool or in Finished Product such as Oekotex® 100/1000? • If you answered yes to the previous question, please share who it is certified with. <p style="text-align: center; color: red; font-weight: bold;"> KNOW more about your DWR. ASK Your supplier(s)! </p>
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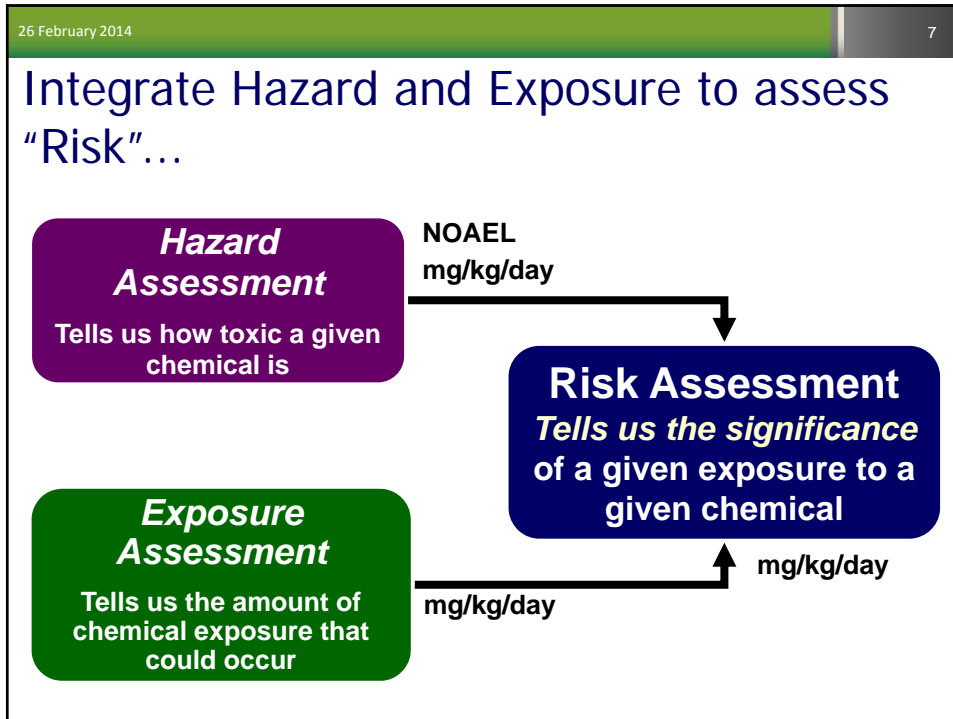
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Life-cycle Product Stewardship

Identification of Sources

The environment,
wildlife and humans

Fate & Transport
Processes



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Hazard Assessment considerations

<u>Mammalian Toxicity</u>	<u>Aquatic Toxicity</u>
<ul style="list-style-type: none">• Acute<ul style="list-style-type: none">▪ Oral, Inhalation▪ Eye, Skin irritation▪ Skin sensitization• Genotoxicity• Repeated-dose<ul style="list-style-type: none">▪ Oral, dermal, inhalation▪ Development▪ Reproduction▪ Cancer▪ Toxicology- and Pharmacokinetics	<ul style="list-style-type: none">• Acute<ul style="list-style-type: none">▪ Fish▪ Daphnia (invertebrate)▪ Algae• Repeated-dose, Chronic<ul style="list-style-type: none">▪ Fish 90d ELS; 21d Daphnia▪ Bioconcentration / Bioaccumulation

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Raw Material 6:2 Fluorotelomer Alcohol*

$C_6F_{13}CH_2CH_2OH$

Acute Mammalian

- Oral LD50 (rat): 1,750 mg/kg
- Eye Irritation (rabbit): mild irritant,
- Skin Irritation (rabbit): non-irritating
- Dermal LD50: 5,000 mg/kg
- Local Lymph Node Assay (LLNA) (mouse) : negative
- Inhalation: 4Hr. ALC > 3.6 mg/L vapor

Genetic Toxicity

- Bacterial Reverse Mutation (Ames), Chromosome Aberrations in Mammalian Cells, both negative

Repeated-Dose Mammalian (rat)

- Oral 90-day sub-chronic: NOAEL 5 mg/kg/day
- Reproduction, One-generation: NOAEL 25 mg/kg/day
- Development: NOAEL 25 mg/kg/day
- Inhalation – 5 day, 28 day: NOAEL 10ppm
- Target: Teeth (F), blood, liver

Pharmacokinetics (rat)

- Single and repeated dose oral and inhalation.
- Rapid bioelimination

Acute Aquatic

- Fish: 96Hr LC50 4.84 mg/L
- Daphnia: 48Hr EC50 7.84 mg/L
- Algae: 72-hour EC50 4.52 mg/L

DuPont Summary

- Not classified for mammalian toxicity. R51/53 for aquatic toxicity.
- Not damaging to DNA, not genotoxic or mutagenic.
- Rapid elimination, not bioaccumulative.
- Repeated-dose toxicology similar to published results for other fluorotelomer alcohols studied.
- Not expected to be harmful to human health or the environment at environmentally relevant concentrations.

Serex et al., *Toxicology*, **2014**, in-press
 O'Connor et al., *Toxicology* **2014** 371:6-16.

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Raw Material 6:2 Fluorotelomer Methacrylate*

$C_6F_{13}CH_2CH_2OC(O)C(CH_3)=CH_2$

Acute Mammalian

- Oral LD50 rats and mice > 5,000 mg/kg
- Eye Irritation non irritating
- Skin Irritation non irritating
- Acute Dermal LD50 > 5,000 mg/kg
- Local Lymph Node Assay not a skin sensitizer

Genetic Toxicity

- In-vitro
 - Bacterial Reverse Mutation Assay Negative
- In-vivo
 - Mouse Lymphoma, Mouse Micronucleus and Chrom. Ab. : Negative

Repeated-dose (rat)

- 14d Oral repeated-dose NOAEL 1000mg/kg/day
- Target: Teeth (F), liver wt.

Acute Aquatic

- Fish: 96Hr LC50 > 14.5 mg/L
- Daphnia: 48Hr EC50 > 120 mg/L
- Algae: 72-hour EC50 > 24.6 mg/L

Summary

- Not classified for mammalian toxicity. R52/53 for aquatic toxicity.
- Not damaging to DNA, not genotoxic or mutagenic.
- **Metabolized rapidly to 6:2 FTOH**
- Repeated-dose toxicology similar to 6:2 FTOH

*Anand et al., *Toxicology* **2012**, 292(1): 42-52.

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Degradation Product – Perfluorohexanoate (NaPFHx)

$C_5F_{11}CO_2Na$

Mammalian

Acute*

- Oral LD50 1750 mg/kg

Genetic Toxicity*

- Bacterial Reverse Mutation (Ames) and Chromosome Aberrations in Mammalian Cells: negative
- Neither genotoxic nor mutagenic

Repeated-Dose Mammalian* (rat)

- Oral 90-day sub-chronic
 - NOAEL 20 mg/kg/day
- Reproduction One-Generation
 - NOAEL 100 mg/kg/day; no effects on reproductive parameters
- Development
 - NOAEL 100 mg/kg/day; no effects on developmental parameters
- Pharmacokinetics §
 - Single and repeated dose studies. Rapid elimination.

Aquatic

Acute*

- Fish: 96Hr LC50 > 100mg/L
- Daphnia: 48Hr EC50 > 100 mg/L
- Algae 72Hr NOEC 50 mg/L

Summary

- Not classified for mammalian or aquatic toxicity.
- Not damaging to DNA, not genotoxic or mutagenic.
- Not a selective developmental or reproductive toxicant. Benchmark dose analysis.

Rapid elimination, not bioaccumulative*.

- Not expected to be harmful to human health or the environment at environmentally relevant concentrations

Reproduction and development NOAELs are for reproduction and developmental endpoints

*Loveless et al., *Toxicology* 2009, 264(1-2): 32-44.
§ Gannon et al., *Toxicology* 2011, 283(1): 55-62
‡ Conder et al., *Environ Sci Technol* 2008, 42(4): 995-1003.

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Degradation Product – Perfluorohexanoic Acid (PFHxA)

$C_5F_{11}CO_2H$

- 2-year chronic (rat)***
 - NOAEL M 15 mg/kg/day; F 30 mg/kg/day
 - No carcinogenic effects observed
- 90 day sub-chronic acid (rat)****
 - NOAEL 50 mg/kg/d M, 200 mg/kg/d F
- Pharmacokinetics § (rat, monkey)**
 - Rapid elimination.
- 90d Early-life stage fish***
 - OECD 210
 - NOEC 10 mg/L

Summary

- Rapid elimination, not bioaccumulative.
- No carcinogenic effects observed.
- Not expected to be harmful to human health or the environment at environmentally relevant concentrations

*Asahi Glass / Daikin study

**Chengelis et al., *Repro Tox*, 2009, 27(3-4), 342-351

§ Chengelis et al. *Repro Tox* 2009, 27(3-4): 400-406.

‡ Daikin Study data.