



Oil Field Chemicals – Global Perspectives

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Presentation Outline

- Background
- Primary players
- Current status
- Consequences of current system – The Big Picture
- Plausible Path forward
- Summary

Background

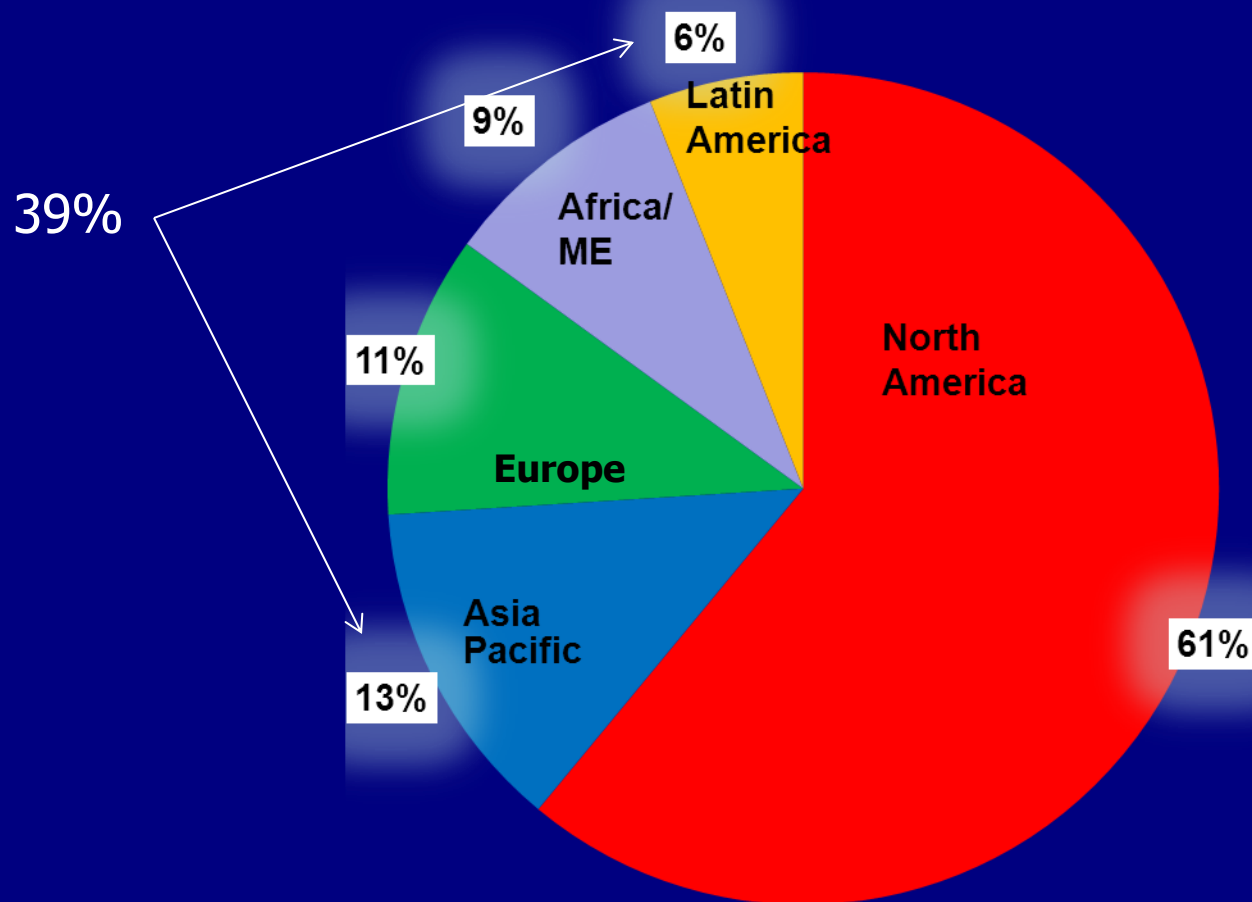
A Global Industry

- In 2010, the global oilfield chemical (OFC) demand - US \$14.5 billion
- Projected global demand by 2015 - US \$31 billion (annual 5.7% growth)

OFC Categories

- Drilling fluids >40%
- Stimulation Chemicals >34%
 - forecast to see largest growth
- Cementing Chemicals >7%
- Production chemicals >12%
- Others 12%

OFC Demand in 2010



IHS Chemical Report, 2011

Industrial sand and gravel (Silica) world production (Source: USGS 2012 Mineral Yearbook



- Australia
- Finland
- France
- Germany
- Italy
- Japan
- Mexico
- Poland
- Saudi Arabia
- South Africa
- Spain
- Turkey
- United Kingdom
- United States
- Others

Players

- **Regulatory bodies**
 - Oil producing countries
 - Intra-governmental agencies
- **Operators**
 - Multinational oil companies
 - National oil companies
- **Suppliers**
 - Service companies
 - Chemical companies

Regulations and Drivers

- **Regulatory agencies set regulations**
 - Pollution prevention
 - Protection of population and ecology
 - Trade relationships
 - Energy needs
 - Revenue
- **Operators implement**
 - Lower cost, performance and compliance with regulations
- **Suppliers comply**
 - Profitability (IP Ownership + Low Cost)
 - Market share and business volumes
 - Operator needs
 - Technology needs
 - Compliance with regulations

What is Wrong with the Current Framework ?



Global Business



but not global regulations

Current Status - Regulatory bodies

- Country specific (100+ countries)
 - regulations
 - environmental tests and HSE requirements
 - product registration requirements
 - importation requirements
 - Transportation requirements
- Trade relationships/barriers

Current Status

- Multiple regulatory agencies within a country
- Same environmental tests, but
 - result interpretations and product approvals are country specific

Test Matrix

- Human Health

- Mammalian Toxicity
- Irritation/Corrosion
- Carcinogenicity
- Genetic toxicity
- Reproductive and developmental toxicity

- Environmental

- Aquatic Toxicity (Fresh and Sea Water)
- Bioaccumulation
- Biodegradation

- Physical Hazards

- Explosive
- Flammability
- Oxidizer
- Corrosive

Example of Required Test Variations

	Europe (HOCNF)	USA (GOM)	Brazil
Aquatic Toxicity (Fresh or Sea water??)	Acartia-tonsa (herbivore)	Sheephead Minnow (Fish)	Mysidopsis juniae (local shrimp)
	Skeletonema costatum (Algae)	Mysidopsis Bahia (Mysid shrimp)	Lytechinus variegatus (Embryos of local urchin)
	Scophthalmus maximus (Fish)		
	Corophium volutator (Sediment Reworker)		

In some countries, environmental testing is needed for disposal or discharge of chemicals rather than for their use₁₂

Cost of Testing and Registration in Europe and Its Impact

REACH - Cost of Testing/Substance

Minimum Dataset	€48,000
10-100t/yr	€300,000
100-1,000t/yr	€950,000
>1,000t/yr	€2,300,000

Who pays the testing cost

- Chemical supplier or the operator ??
- Cost vs Benefit Analysis

*Data based on G. Payne,
OGR, 2005, Issue 2, 34*

Consequences of Current System

- ✓ Increased cost of doing business
- ✓ Discourages new technologies
- ✓ Can impede innovations
- ✓ can become counter productive
(win the battle, lose the war!)

A global business with no global consensus

The Ideal Big Picture – We Are A Global Village

- One globe and one ecology
- Oil business is global
- Ecological effects are global



Example of Global Impact

Butterfly Migratory Paths

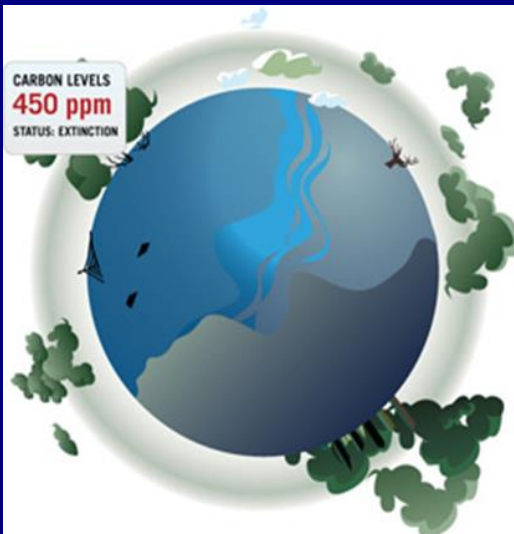


Wyoming Wildlife Refuges



Need to Think “Outside the Border”

- Japan tsunami
- Ebola
- Mt. Helens eruption
- Atmospheric CO2 Levels



The Big Picture – One Globe and One Ecology

- How to juggle *Global HSE* regulations and *stay profitable* ???
- Path forward – Holistic approaches
 - Regulatory bodies
 - chemical developers/suppliers



Way Forward

A Holistic Approach for Regulatory Bodies

- Global consensus
 - Normalize methods, regulations and protocols for OFC
- Global one-stop registration

With the same set of HSE testing
(similar to API/ASTM grading of cements)
- Global lists
 - Unconditionally approved chemicals
 - Ex: PLONOR chemicals
 - HSE tested and approved chemicals
 - Banned chemicals

(**PLONOR** – Pose Little Or No Risk)

Way Forward

A Holistic Approach for Regulatory Bodies

- Natural products and derivatives
 - should be acceptable with only simplified toxicity testing
- Mixture Component Testing
 - at component concentrations in a mixture, plus testing of the mixture
- harsh environments
 - zero- or low toxicity synthetic materials with low or no biodegradability should be acceptable

Way Forward

A Holistic Approach for Product Developers/Suppliers

- Chemists follow “Green Chemistry” Principles
- Suppliers demonstrate HSE commitment
 - self-policing
 - certification such as Responsible Care etc.,
 - ISO certifications etc.,
- Globally uniform chemical classification and labelling system

Product Developers/Suppliers

Green Chemistry

12 Principles

1. Waste Prevention
2. Atom Economy
3. Less Hazardous Chemical Syntheses
4. Designing Safer Chemicals
5. Safer Solvents and Auxiliaries
6. Design for Energy Efficiency
7. Use of Renewable Feed stocks
8. Reduce Derivatives
9. Catalysis
10. Design for Degradation
11. Real-time analysis for Pollution Prevention
12. Inherently Safer Chemistry for Accident Prevention



Product Developers/Suppliers



- A voluntary initiative to
 - a) self-police
 - b) safely handle products from inception, through manufacture and distribution,
 - c) reuse, recycle and disposal,
 - d) involve the public in the decision-making processes.
- Responsible Care has 53 member countries.
- All suppliers commit to guidelines of Responsible care or similar organizations



Product Developers/Suppliers

Classification and Labeling of Chemicals

- Good News
 - Globally Harmonized System (GHS) for material safety data sheets (MSDS) in place
 - Implementation in progress in many countries

 **Science Lab.com**
Chemicals & Laboratory Equipment



Material Safety Data Sheet
Acetone MSDS

Section 1: Chemical Product and Company Identification	
Product Name: Acetone	Contact Information:



Magnitude of the Challenge

- A difficult challenge
- Global regulation normalization requires
 - concept buy-in by OFC suppliers, oil companies and regulating bodies
 - united support/campaign by global organizations
SPE, API, AADE, IADC, ACS, UNEP
 - Awareness Presentations
 - Focused Forum meetings/work shops
- Meanwhile – “Green Chemistry” and “Best Practices”
- Realistic in scope ???
- Time Lines ???

Realistic in Scope??

Example from Drug Industry

- ICH (Intl. Conf. on Harmonization)
- Mission
 - Harmonisation of Technical Requirements for Registration of Pharmaceuticals for Human Use
- Unique in bringing together the regulatory authorities and pharmaceutical industry of Europe, Japan and the US

Realistic in Scope??

Example from Drug Industry

- ICH Guidelines
 - Quality
 - Safety
 - Efficacy (Clinical Trials)
- Members
 - USA
 - Japan
 - European Union

Summary



- Current Status
 - Nation-specific requirements
 - constrain new technology development
 - not realistic in many cases
 - Not cost effective for suppliers
 - Counter-productive
- Needed
 - Recognition of global nature; and thinking “outside the border”
 - “Holistic Global HSE” definitions for Global certifications/approvals/registration of OFC

Summary

- Recommended

- A Campaign to seek

- buy-in by all players for
 - Globally coordinated test protocols and regulations
 - active support from global organizations connected with hydrocarbon production
 - Operators
 - Seek best practices commitment
 - Suppliers
 - Follow green chemistry principles

