



Safety, Health and Environmental Attributes of Group 3 Fluids

American Association of Drilling Engineers (AADE)

February 21, 2019

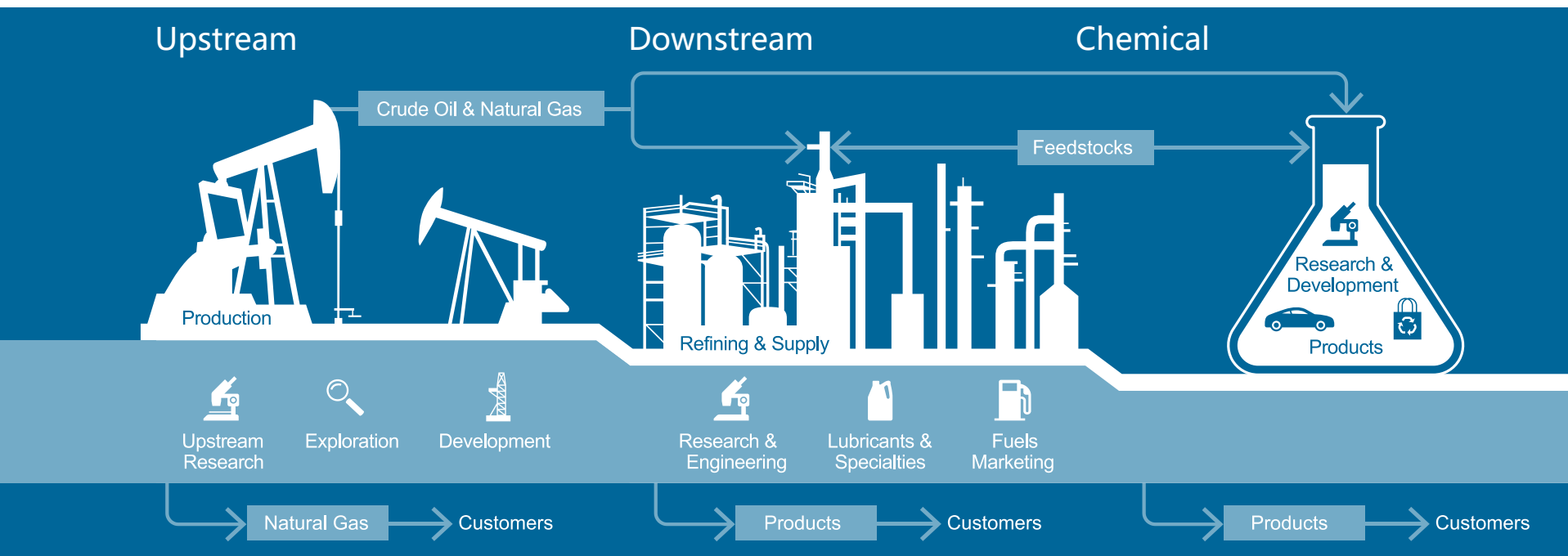
Melanie Bower

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Agenda

- ExxonMobil Introduction
- Summary of Base Fluid and Mud Types (Non-Aqueous and Synthetic)
- Environmental / Human Health Aspects
- Summary / Conclusions

ExxonMobil Integration



ExxonMobil Chemical Company

Polymers

Polyolefins
Specialty
Elastomers
Butyl
Adhesion

Global Operations

Manufacturing
Engineering
Safety
Health
Environment
Security

Basic Chemicals & Intermediates

Fluids
Oxo
Olefins
Aromatics
Synthetics

Application customized fluids

Escaid™ (Drilling)
Escaid™ PathFrac (Fracing)
Exx-Print™ (Reprographics)
Somentor™ (Metal Extraction)



OGP¹ Grouping

- IOGP grouped Non-Aqueous Base Fluids (NABFs) according to aromatic hydrocarbon concentration; a factor that contributes to toxicity²

Less Toxic



Non-Aqueous Fluid	OGP ³ Grouping	% PAH Content ⁴	Aromatic Content
Oil-Based Muds	Group I	3-10 vol%	> 5 wt%
Low Toxicity Mineral Oil-Based Muds	Group II	< 0.35 and > 0.001 wt%	0.5 – 5 wt%
Enhanced Mineral Oil-Based Muds / Synthetic-Based Muds	Group III	< 0.001 wt%	< 0.5 wt%

- Enhanced mineral oils are highly purified and have PAH content of less than 10 ppm, distinguishing them from conventional mineral oils


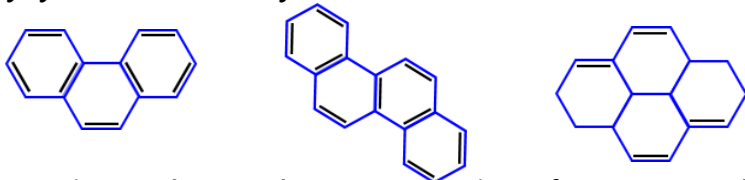
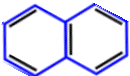

1. OGP: International Oil and Gas Producers Association

2. Environmental fates and effects of ocean discharge of drill cuttings and associated drilling fluids from offshore oil and gas operations Report 543 March 2016

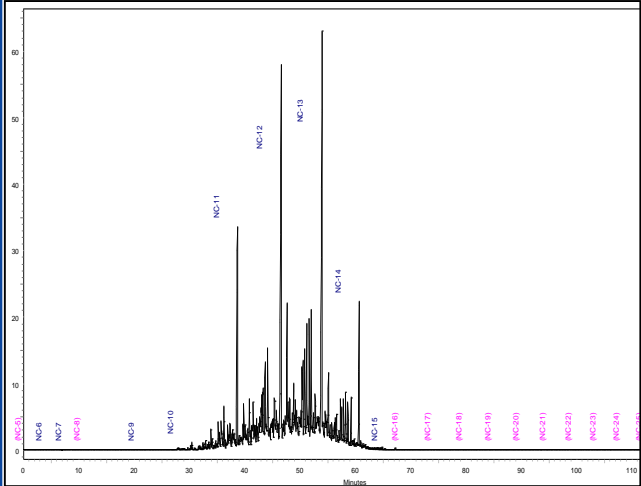
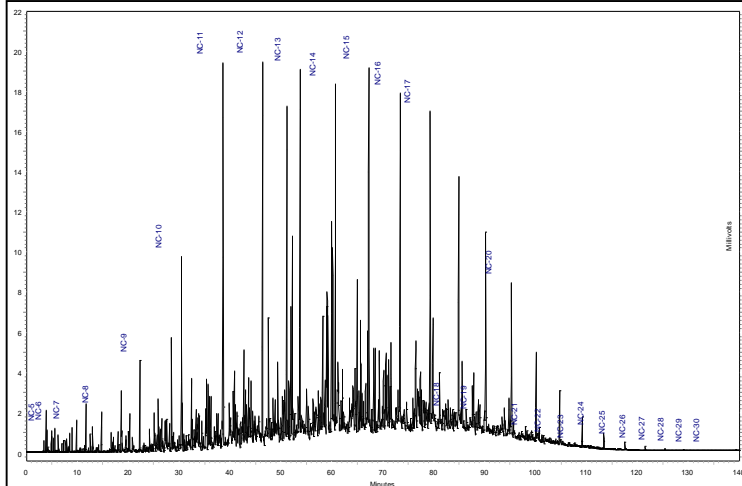
3. IOGP **Environmental aspects of the use and disposal of non aqueous drilling fluids associated with offshore oil & gas operations Report 342 May 2003**

4. PAH content expressed as phenanthrene by US EPA Method 1654A

Polycyclic Aromatic Hydrocarbons (PAH)

- Aromatic hydrocarbons are those which contain one or more benzene rings 
- Polycyclic aromatic hydrocarbons (PAHs) are aromatic hydrocarbons that consist of fused aromatic rings

- Aromatics and PAHs have properties of concern to human health and the environment
 - Aromatics without alkyl side chains (benzene, naphthalene) are metabolized by ring oxidation, leading to uniquely toxic metabolites
 - Naphthalene  can cause eye irritation, headaches, and nausea
 - Benzene  can cause hematotoxicity (severe anemia), cancer, and genotoxic effects
 - PAHs have been associated with skin cancer in humans & are comprised of priority pollutants
 - 4 to 6 ring PAHs are primarily responsible for carcinogenicity
- Clean Air Act (CAA) calls for monitoring and minimizing hazardous air pollutant (HAP) emissions
 - Aromatic components in diesel, such as benzene, toluene, xylenes, are HAPs from drilling operations
 - Aromatics have greater photochemical ozone creation potential (i.e., ability to form smog) than non-aromatics

Fingerprint of Group 1 and 3 Fluids

Type	Group 3	Group 1
Paraffins	53.2	29.3
Cycloparaffins	46.6	30.7
1 Ring Aromatics	0.2	21.3
2 Ring Aromatics	0	15.7
3+ Ring Aromatics	0	3.1
Fingerprint (GC Chromatogram)*		

*Spot Compositions Measured by ASTM D-2786 (Mass Spec) and SFC Analyses

** Group 3 based on Escaid 110™

GHS Classification

Group 3

ExxonMobil

Product Name: ESCAID™ 110 FLUID
Revision Date: 23 Mar 2015
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SAFETY DATA SHEET

SECTION 1 PRODUCT AND COMPANY IDENTIFICATION

PRODUCT
Product Name: ESCAID™ 110 FLUID
Product Description: Deaerated Hydrocarbons
Intended Use: Drilling fluids, oil-based

COMPANY IDENTIFICATION
Supplier: EXXONMOBIL CHEMICAL COMPANY
225 - LOC. 106
22777 Springdale Village Parkway
Spring, TX 77389-1426 USA
(800) 726-2015
(800) 624-6300 or (703) 527-3887 CHEMTREC
(332) 624-8500
(332) 624-8500

SECTION 2 HAZARDS IDENTIFICATION

CLASSIFICATION:
Flammable liquid: Category 4
Aspiration toxicant: Category 1.

LABEL:
Pictogram:



Hazard Statements:
H227: Combustible liquid. H304: May be fatal if swallowed and enters airways.

Precautionary Statements:
P210: Keep away from flames and hot surfaces. - No smoking. P280: Wear protective gloves and eye / face protection. P301 + P310: IF SWALLOWED: Immediately call a POISON CENTER or doctor/physician. P331: Do NOT induce vomiting. P370 + P376: In case of fire: Use water fog, foam, dry chemical or carbon dioxide (CO2) to extinguish. P403 + P235: Store in a well-ventilated place. Keep cool. P405: Store locked up. P501: Dispose of contents and container in accordance with local regulations.

SAFETY DATA SHEET
According to OSHA Hazard Communication Standard, 29 CFR 1910.1200
SARALINE 185V

Version 4.0 Revision Date: 04/26/2018 SDS Number: 800001034201 Print Date: 05/02/2018
Date of last issue: 10/20/2015

SECTION 1. IDENTIFICATION

Product name : SARALINE 185V

Product code : V1903

CAS-No. : 172343-37-2

Manufacturer or supplier's details
Company : Shell Chemical LP
PO Box 576
HOUSTON TX 77001
USA
SDS Request : 1-800-240-6737
Customer Service : 1-855-697-4355

Emergency telephone number
Chemtrec Domestic (24 hr) : 1-800-424-6300
Chemtrec International (24 hr) : 1-703-627-3887

Recommended use of the chemical and restrictions on use
Recommended use : Use as a component in enhanced oil recovery operations.
Restrictions on use : This product must not be used in applications other than the above without first seeking the advice of the supplier.

SECTION 2. HAZARDS IDENTIFICATION

GHS classification in accordance with 29 CFR 1910.1200
Flammable liquids : Category 4
Aspiration hazard : Category 1

GHS label elements
Hazard pictograms : 

Signal word : Danger

CLASSIFICATION:
Flammable liquid: Category 4.
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Human Health Hazards

Group 3: Enhanced Mineral Oil ¹	
Acute Oral	Low LD ₅₀ > 5 g/kg
Acute Inhalation	Low LC ₅₀ > Saturated vapor concentration ²
Skin Irritation	Mild PII = 1.58 ²
Sensory Irritation	Non-Irritant Alarie Assay ²
Genotoxicity	Negative Ames ² , <i>In vitro</i> chromosome aberration, <i>In vivo</i> chromosome aberration ²
Subchronic	Low NOAEL > 1000 mg/kg/day (13-week oral) NOAEC > 10,400 mg/m ³ (12-week inhalation) ²
Carcinogenicity	NOT EXPECTED TO BE CARCINOGENIC Based on negative genetox data and low subchronic toxicity
OEL	No Preventive Controls Required 1200 mg/m ³

- Have low subchronic adverse effects
- Have low order of acute toxicity by the oral, dermal, and inhalation routes of exposure
- Are not labeled as potential carcinogens, and are not expected to be skin sensitizers in humans
- Are not mutagenic using in vitro or in vivo genotoxicity assays
- Have significantly higher Occupational Exposure Limits requiring less preventive controls
- Improve worker safety versus OGP³ Group I or II base fluids due to lower aromatic contents

1. Enhanced Mineral Oil data based on Escaid 110™


2. ExxonMobil Studies

3. International Association of Oil & Gas Producers (OGP), Report No. 342, May-2003

Exposure Scenarios

	Group 3*	Group 1
<p>General measures (Aspiration Hazard)</p> <p>The H304 risk phrase (May be fatal if swallowed and enters airways) relates to potential for aspiration, a non-quantifiable hazard determined by physico-chemical properties (i.e. viscosity) that can occur during ingestion and also if it is vomited following ingestion. A DNEL cannot be derived. Risks from the physicochemical hazards of substances can be controlled by implementing risk management measures. For substances classified as H304, the following measures need to be implemented to control the aspiration hazard.</p> <p>Do not ingest. If swallowed then seek immediate medical attention. Do NOT induce vomiting.</p>	X	X
<p>General measures (Flammable Liquid)</p> <p>Risks from the physicochemical hazards of substances, such as flammability or explosiveness can be controlled by implementing risk management measures at the workplace. It is recommended to follow the recast ATEX Directive 2014/34/EU. Based on the implementation of a selection of handling and storage risk management measures for the identified uses, the risk can be regarded as controlled to an acceptable level.</p> <p>Use in contained systems. Avoid ignition sources – No Smoking. Handle in well ventilated area to prevent formation of explosive atmosphere. Use equipment and protective systems approved for flammable substances. Restrict line velocity during pumping to avoid generation of electrostatic discharge. Ground/bond container and receiving equipment. Use non-sparking tools. Comply with relevant EU/national regulations. Review SDS for additional advice.</p>		X
<p>General measures (skin irritants)</p> <p>Avoid direct skin contact with product. Identify potential areas for indirect skin contact. Wear gloves (tested to EN374) if hand contact with substance likely. Clean up contamination/spills as soon as they occur. wash off any skin contamination immediately. provide basic employee training to prevent / minimize exposures and to report any skin problems that may develop.</p>		X

Environmental Toxicity

		Group 3*	Group 1
FISH	Rainbow trout (<i>Oncorhynchus mykiss</i>)	96- hr LL0 = 10,000 ppm ¹	96-hr LL50 = 6.3 ppm ⁴
	Sheepshead minnow (<i>Cyprinodon variegatus</i>)	96-hr LL0 = 8958 ppm ²	96-hr LL50 = 57 ppm ⁴
INVERTEBRATE	Ampelisca abdida	96-hr LL0 = 10,000 ppm ³ (RA)	10-d LC50 = 879 mg/Kg ⁴
Microbial Toxicity	<i>Vibrio Fischeri</i>	EL50 > 5000 mg/L ⁴	EL50 = 3300 ⁴
GHS Classification		No Classification	Acute 2 / Chronic 2 

Group 3 Fluids demonstrate orders of magnitude lower toxicity as compared to diesel

- Lower aqueous toxicity is driven by extremely low aromatic content
- Microtox assays indicate low hazard to microbes (bacterium)
- Biodegradation in soil was equivalent to two “positive control” substances⁹, demonstrating it will not persist in terrestrial environments

• Group 3 data based on Escaid 110™

1. Seakem Oceanography Ltd. (1986) Study No. B3B 1E4

2. Opus (2011) Assessment of the aquatic-phase toxicity of Escaid 110 to the marine fish *Cyprinodon variegatus*, Report No. 1527-22

3. TNO Institute of Environmental Sciences (1991) The Acute Toxicity to the Crustacean *Chaetogammarus marinus*, Report No. R90/425

4. ExxonMobil Studies

Group 3 Fluids Benefits Summary

Health and safety

- Low human health toxicological hazard
- Fewer risk management measures required versus diesel
- Lower risks for worker exposures, especially inhalation of vapor

Environmental impact

- Readily biodegradable¹; will not persist in terrestrial environments
- Low total aromatics content, low PAH content
- No environmental classifications under GHS

1. ExxonMobil Studies



Thank You

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