European Oilfield Speciality Chemical Association

- 42 Members – chemical suppliers and service companies
- Members represent >85% by number and quantity of products used in North Sea
- Operating for more than 25 years
- Collaborate with regulators and stakeholders to develop test, tools and guidance

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Potential pathways for releases to the environment

- Drilling (& Completion/Workover)
  - No intended release
- Production
  - Potential release via Produced Water
- Pipelines
  - No intended release

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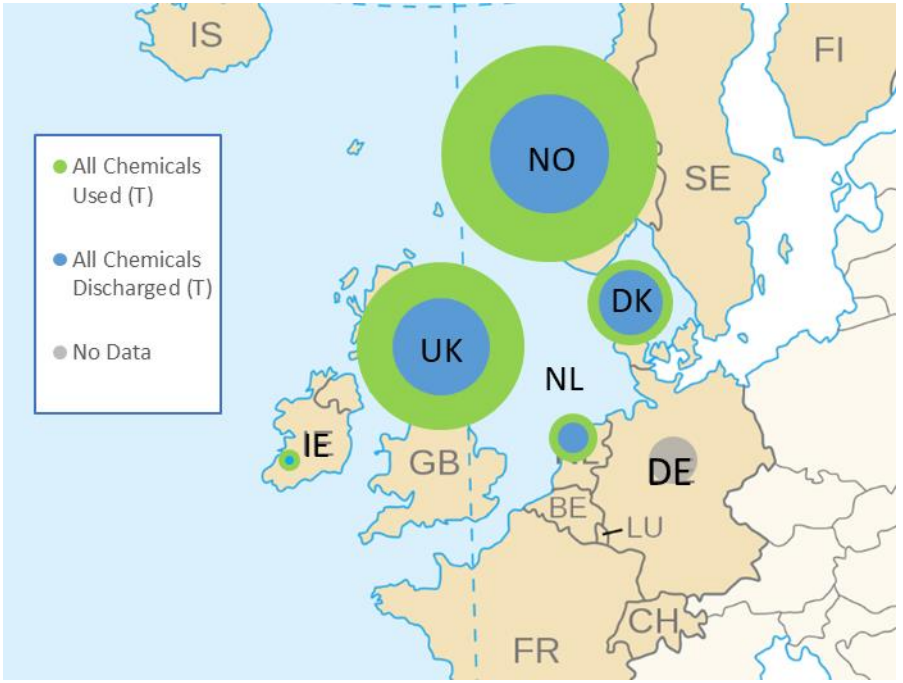
OSPAR Contracting Parties with offshore industries

- Norway and UK have the greatest number of fields in the OSPAR area
- Consequently they have larger chemical usage figures

Installations with PW discharges (2016)	
Denmark	16
Germany	1
Ireland	1
Netherlands	78
Norway	46
UK	96

(OSPAR OIC, 2018)



24% of PW reinjected in UK & NO, 56% in NL & 33% in DK
(OSPAR OIC, 2018)

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Potential for environmental releases

OSPAR data is a reasonable estimate of total EU discharges, accounting for > 90% of all EU offshore oilfield industry discharges.

- 3252 products used & 2439 discharged
- 71% of discharges classified by OSPAR as PLONOR
  (substances that Pose Little or No Risk to the Environment, OSPAR OIC, 2018)

Number of products containing microplastics:

- 115 products were used containing “microplastics” = 3.5%
- 82 products were discharged containing “microplastics” = 2.5%

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Data for 2016 OSPAR contracting parties

Potential for environmental releases

Total chemical products used = 910,670T

Total “microplastics” used = 1,948T (0.2%)

Products where no MP data provided = 29,740T (3.3%)

Total reported chemicals discharged = 310,359T

Total reported “microplastics” discharged = 487T*

Total “microplastics” discharged excluding demulsifiers = 102T

“microplastics” discharged = 0.05% chemicals used

“microplastics” discharged = 0.16% total discharges

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* See Demulsifiers slide for comment on over estimation

Data for 2016 OSPAR contracting parties

Where are chemicals used in oilfields?

The following diagrams and P&ID schematic shows where chemicals are applied and which process streams they enter.

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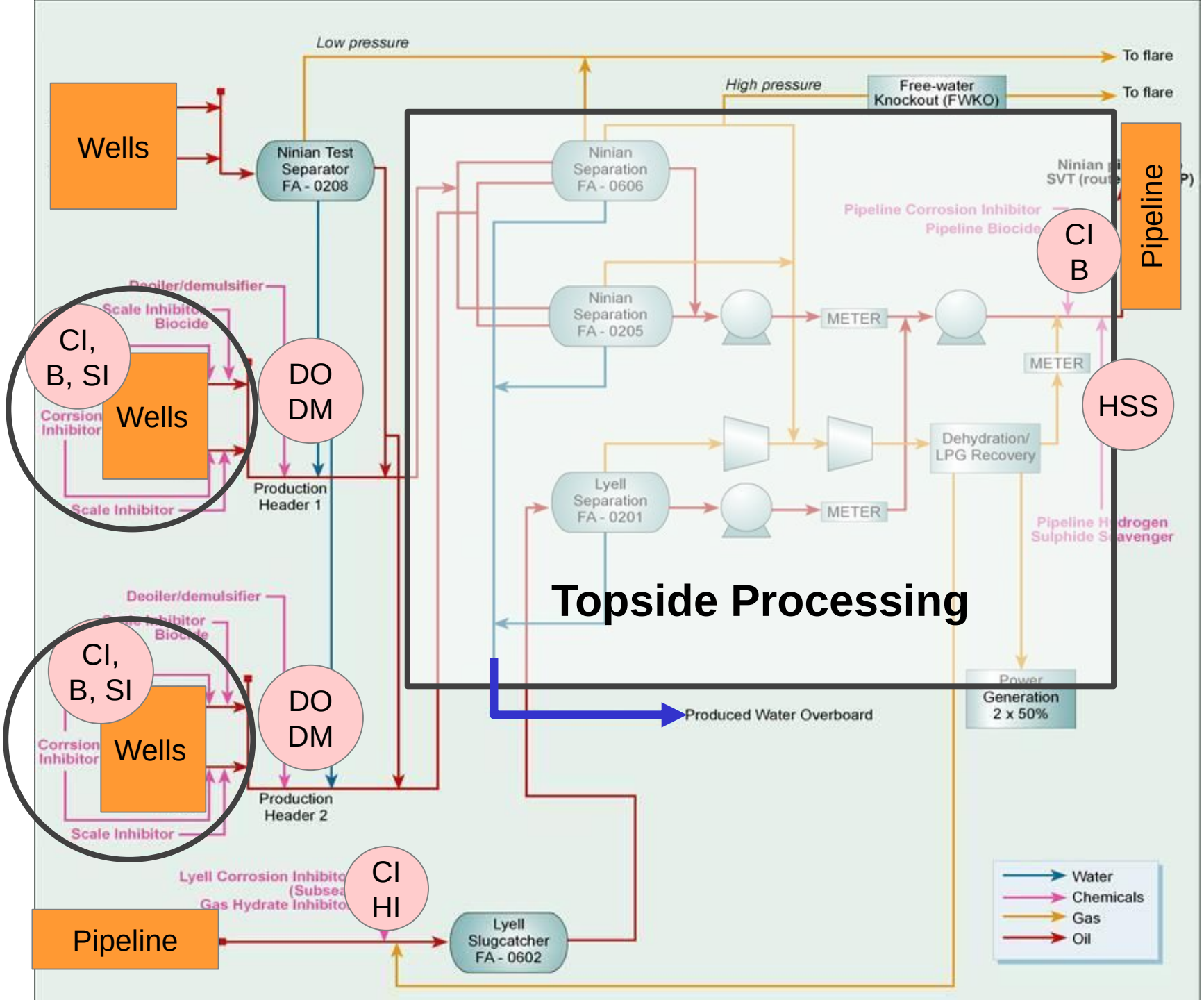

An offshore process

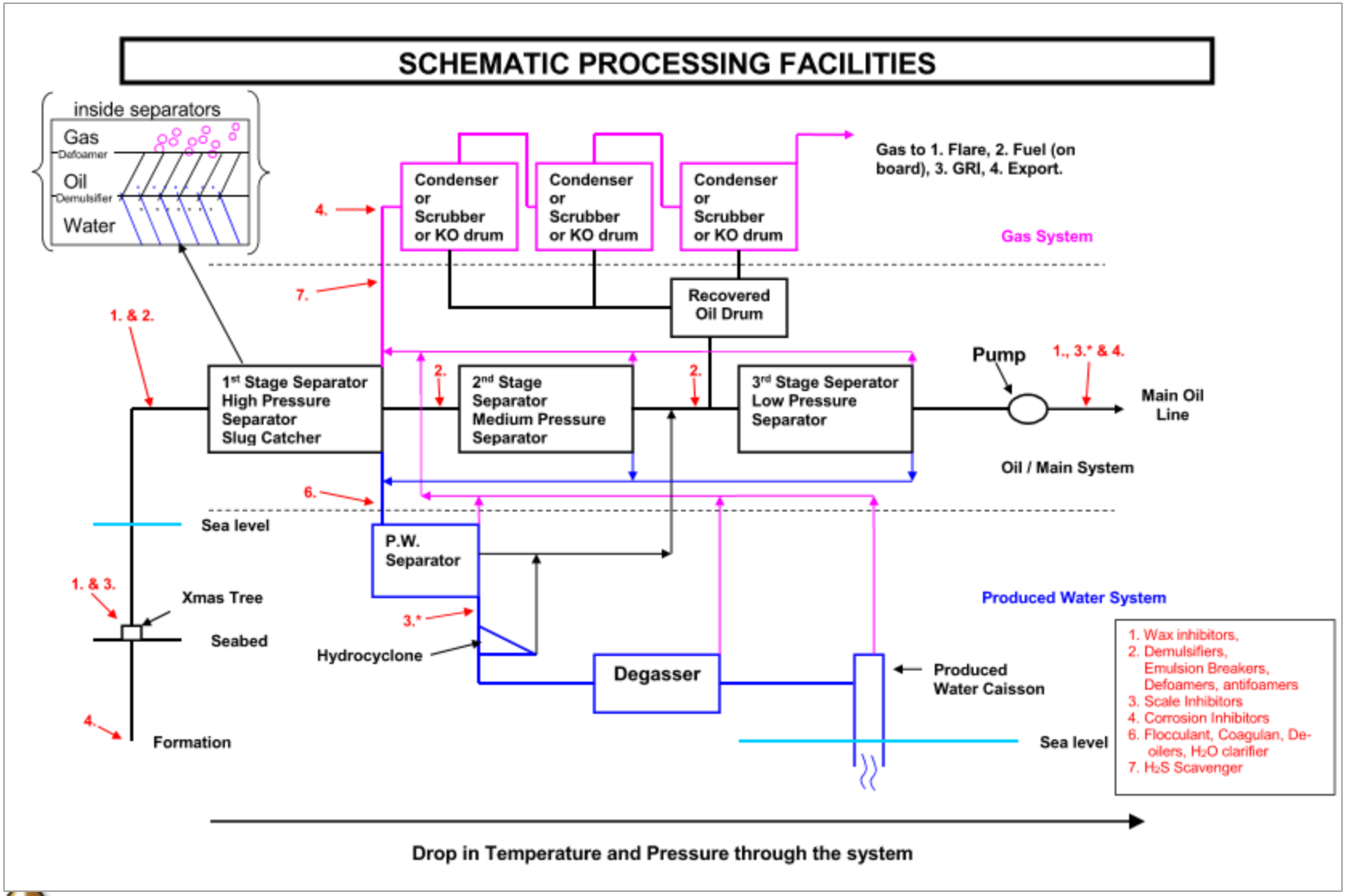

Image source & copyright: BMT Group

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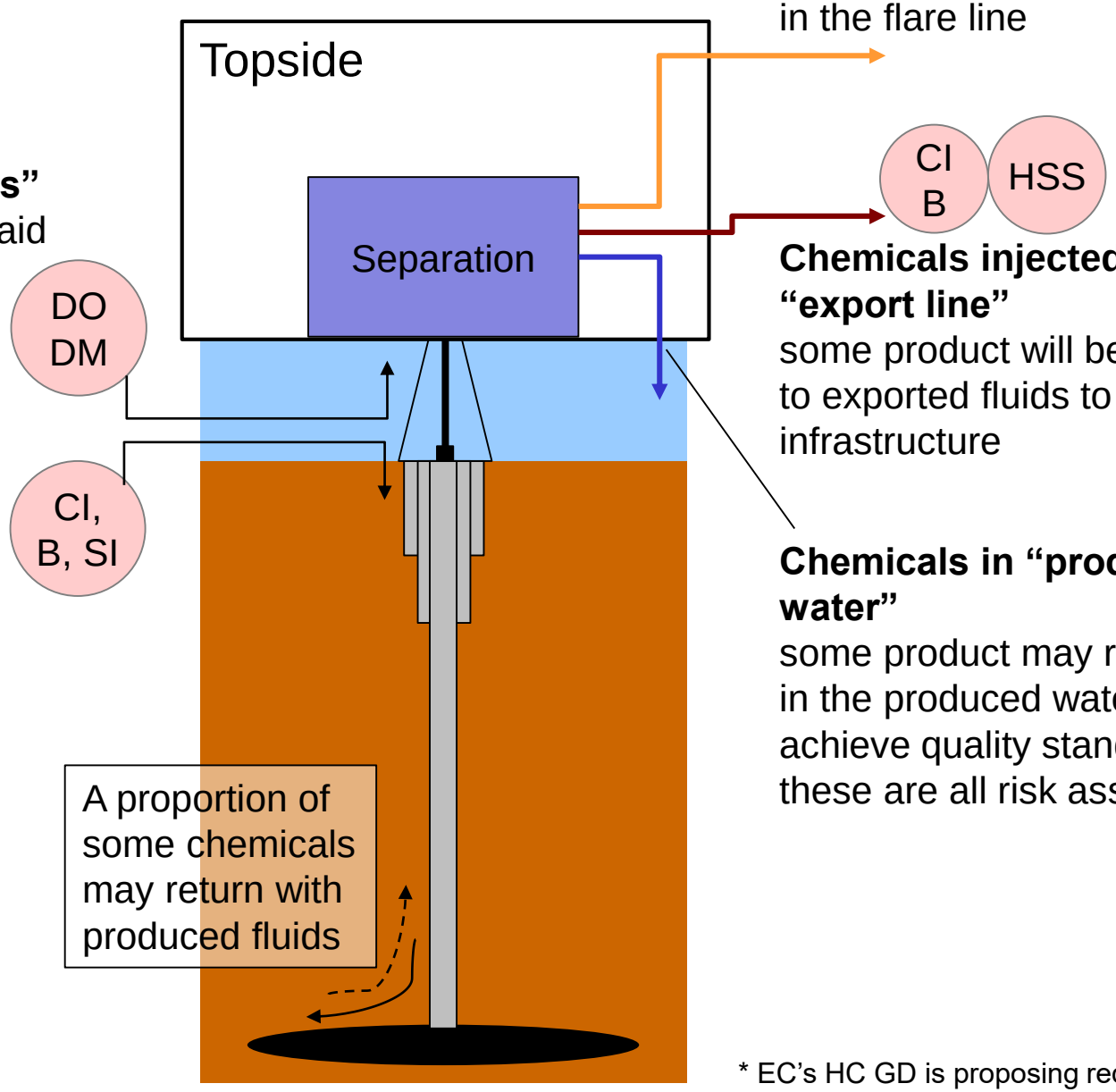
An offshore process

Chemicals to "flare"
a few product may end up in the flare line

Chemicals injected into "produced fluids"
Products intended to aid management and processing of the produced fluids



Chemicals injected into "export line"
some product will be added to exported fluids to protect infrastructure

Chemicals injected "downhole"
most if not all of the product will be consumed whilst performing intended function

Chemicals in "produced water"
some product may remain in the produced water, to achieve quality standards these are all risk assessed.*

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* EC's HC GD is proposing reducing OIW limit which would increase chemical use

Function of the microplastics

- Drilling & CWO – e.g. Lost circulation material:
  - Substances added to drilling fluids when drilling fluids are being lost to fissures in rock formations or porous rock strata. The particles will fill the fissures and pores - No intended discharge
- Production – e.g. Demulsifiers:
  - Substances added to the produced fluids during the separation processes to break emulsions, often by neutralising electorstatic charges. Where “microplastics” polymers used they are dissolved in organic solvent – No/minimal release
- Pipeline – e.g. Friction reducers (other):
  - Polymers added to exported oil to reduce operating pressure, which makes system safer, reduces corrosion rates and reduces energy requirements and CO_2 emissions - No intended discharge

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Function of Oilfield Chemicals

OSPAR defines 59 functions, EOSCA's review of 2016 data found 14 functions where some products contained microplastics:

- Antifoam (Hydrocarbons)
- Asphaltene Inhibitor
- Cement or Cement Additive
- Corrosion Inhibitor
- Defoamer (Drilling)
- Demulsifier
- Drilling Lubricant
- Filtrate Reducer
- Fluid Loss Control Chemical
- Gelling Chemical
- Lost Circulation Material
- Viscosifier
- Wax Inhibitor
- Other (Friction/Drag Reducing Agent)

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Functions from OSPAR Agreement 2012/05, Updated 2015

Function of products with microplastics

The datasets were reviewed by OSPAR function *(NO & UK only)*

Greatest contribution reported as Demulsifiers, however investigations showed:

- Dimulsifiers usually polymers dissolved in organic solvent which will partition to hydrocarbon phase ∴ will not be discharged
- How operators calculate reported discharge volumes differs, leading to over estimates of discharges
- Need to provide better guidance on calculating discharge factors

OSPAR Function	MP Used (T)	MP Disch. (T)
Demulsifier	1085.6	384.8
Wax inhibitor	160.0	20.9
Other chemicals	122.1	2.0
Corrosion inhibitors	94.5	30.5
Antifoam (Hydrocarbons)	67.3	42.4
Lost Circulation Material	70.4	0.1
Drilling lubricants	45.8	0.1
Defoamer	36.5	2.3
Fluid Loss Control Chemical	30.2	0.0
Ashphaltene Inhibitor	25.0	0.1
Friction Reducing Agent	17.4	2.5
Viscosifier	14.6	0.0
Cement/Cement Additive	12.4	0.9

Functions from OSPAR Agreement 2012/05, Updated 2015

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Digging into the Demulsifiers

	Country	Function	Used (kg)	Disch. (kg)	% MP	MP Used (kg)	MP Disch. (kg)	% Disch.	Re-calc (kg)
Product A	UK	DEMULSIFIER	199.7	199.7	38.7	77.2	77.2	100%	50.2
	NO	DEMULSIFIER	3308	2150	38.7	1278.8	831.2	65%	
	NL	DEMULSIFIER	7484	111	38.7	2893.2	42.9	1.5%	
Product B	UK	DEMULSIFIER	15265.9	15265.9	22.3	3399.8	3399.8	100%	136.0
	NO	DEMULSIFIER	14114.9	559.3	22.3	3143.5	124.6	4%	
	NL	DEMULSIFIER	700	0	22.3	155.9	0	0%	

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Microplastics used & function

- Different types of microplastics used e.g. polypropylene (thermoplastic), rubber, polylactic resin etc.

- Used for specific/critical function:
  - Polymers dissolved in organic solvents that are used as inhibitors (wax/corrosion), or as emulsion breakers – all oil soluble
  - Microplastic used to protect long-term integrity of an oil-well by imparting flexibility to set cement
  - Sealing micro-sized gaps in rock formations cement when the cement ensuring long-term oil-well integrity

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Alternatives

The OSPAR HMCS drives substitution of hazardous components, however this takes substantial time & investment

Examples

Friction reducers: previously gel products were used –
75% less effective, pose greater safety risk due to highly flammability and higher environmental impact as more toxic.

Other applications: often no current alternatives offering same properties or effectiveness, having been carefully selected after extensive trials. Previous chemistries may be less efficient or more toxic.

Many products already represent best available technology

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Transitioning to alternatives

Development of an emulsion breaker (25th Int. Oil Field Chem. Symp. 2014)

- Formulation and trial of a new demulsifier for North Sea Heavy Oilfield
  - Laboratory based bottle testing
  - Field optimization and trial
  - Test separator trial
  - Full plant trial with injection
  - Formulated product field trial
- Process took 4-years and this trial ran smoothly
- Cost of time, resource and potential operating field impacts were considerable!

Other Impacts

- Regulatory Critical use
  e.g. deoilers & demulsifiers are used to separate produced fluid phases and achieve Oil-in-Water environmental quality standard

- Safety Critical use
  e.g. Corrosion/Wax Inhibitors used to maintain asset integrity which have direct human health/environmental impacts

  e.g. Friction reducer, polymer based products far safer than previous gel products

- Unintended consequences of substitution
  Chemical treatment packages are field specific and complex. Substitution can impact the efficacy of other treatment chemicals

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Current Legislative Controls

- OSPAR HMCS requires all products to be notified using HOCNF format data – hazard & generic risk assessment
- Substitution labelling and programmes for the reduction of discharge of hazardous products
- All products must be site specifically risk assessed prior to use offshore
- Risk Based Approach produced water discharge modelling and Whole Effluent Toxicity testing on a rolling programme
- Move towards zero discharge of hazardous substances, and greater use of PLONOR chemicals (71% of discharges)

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Conclusions

- EOSCA would like to support effective review and control of microplastics
- Potential substitution chemicals would need to be identified, and are likely to be required in greater quantities and many are likely to be more toxic
- Substitution of microplastics is therefore likely to be difficult, costly and very time consuming (years)
- The offshore oil and gas industry is already highly regulated and the use and discharge of chemicals is well controlled
- Potential proposals to take to OSPAR:
  - Harmonisation of microplastics definition
  - Continue to monitor and report on use & discharge
  - Risk based review, move towards zero hazardous substance discharge

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