

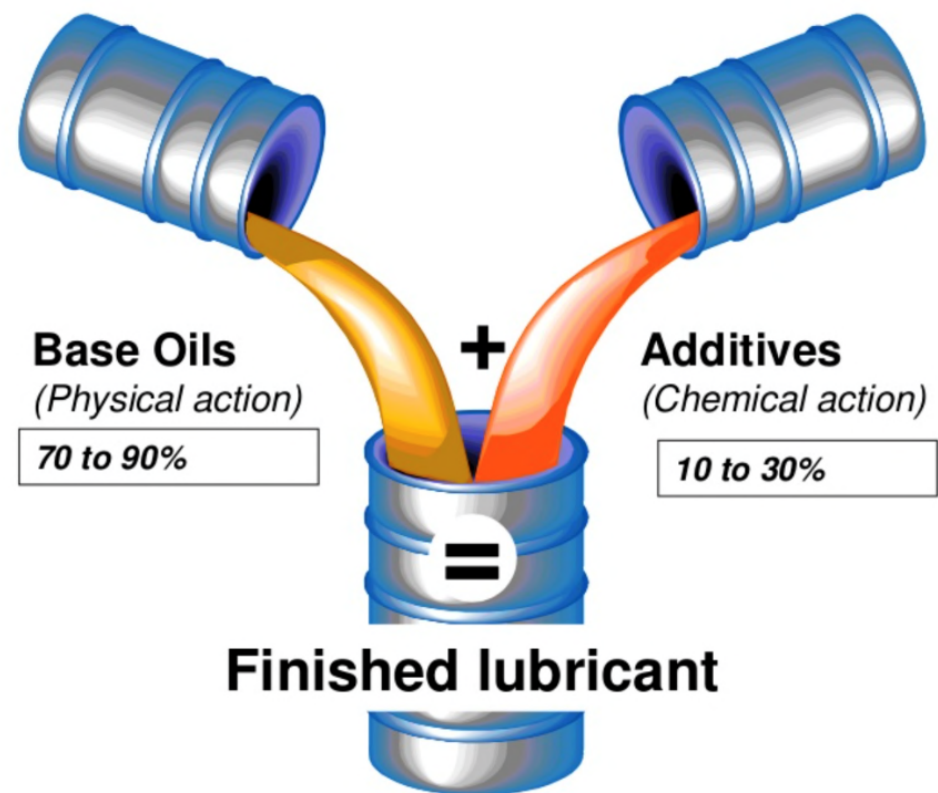


## SFI proposal/idea on Environmentally Acceptable Lubricants



# What is a lubricant?

- Lubricants are complex substances used to minimize friction and wear of moving surfaces in relative motion.
- Lubricants consist of a base oil and various additives.
- Lubricant quality and differentiation is mainly achieved through the additives.
- Mineral oils represent around 90% of the total market due to their world wide availability, high performance, compatibility with OEM and low price.
- Conventional lubricants based on mineral oils need to be replaced by EALs.
- EALs are Environmentally Acceptable Lubricants that are biodegradable, minimally toxic, and not bio-accumulative.



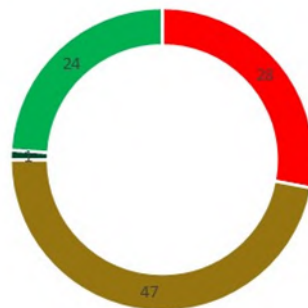
# Toxicity of base oil and various additives

- Base Oil



## The 5 Groups of Base Oils

- **Group 1** These are lubricants with sufficient evidence of carcinogenicity to humans. This group includes base oils that are acid-treated oils, mildly re-treated solvent-refined oils, aromatic oils, and mildly hydro-treated oils.
- **Group 2** These are lubricants with no human data, but strong animal data exist that indicate possible or probable carcinogenicity. There are no bad oils listed in this group.
- **Group 3** These are lubricants not classifiable as to carcinogenic to humans. They include base oils that are white oils and petrolatum.
- **Group 4** These are lubricants that are probably not carcinogenic to humans. This group includes base oils that are white oils and petroleum.
- **Group 5** These are all other oils including vegetable oils and natural esters.



■ Group 1 ■ Group 2 ■ Group 3 ■ Groups 4 and 5

- Additives (some examples)
  - ZnDTP (Zinc dibutyl dithiophosphate)

### Zinc dibutyl dithiophosphate hazard information

GHS classification\*: serious eye damage/eye irritation, category 2A

H319—Causes serious eye irritation



GHS classification†: hazardous to the aquatic environment, long-term hazard, category 2

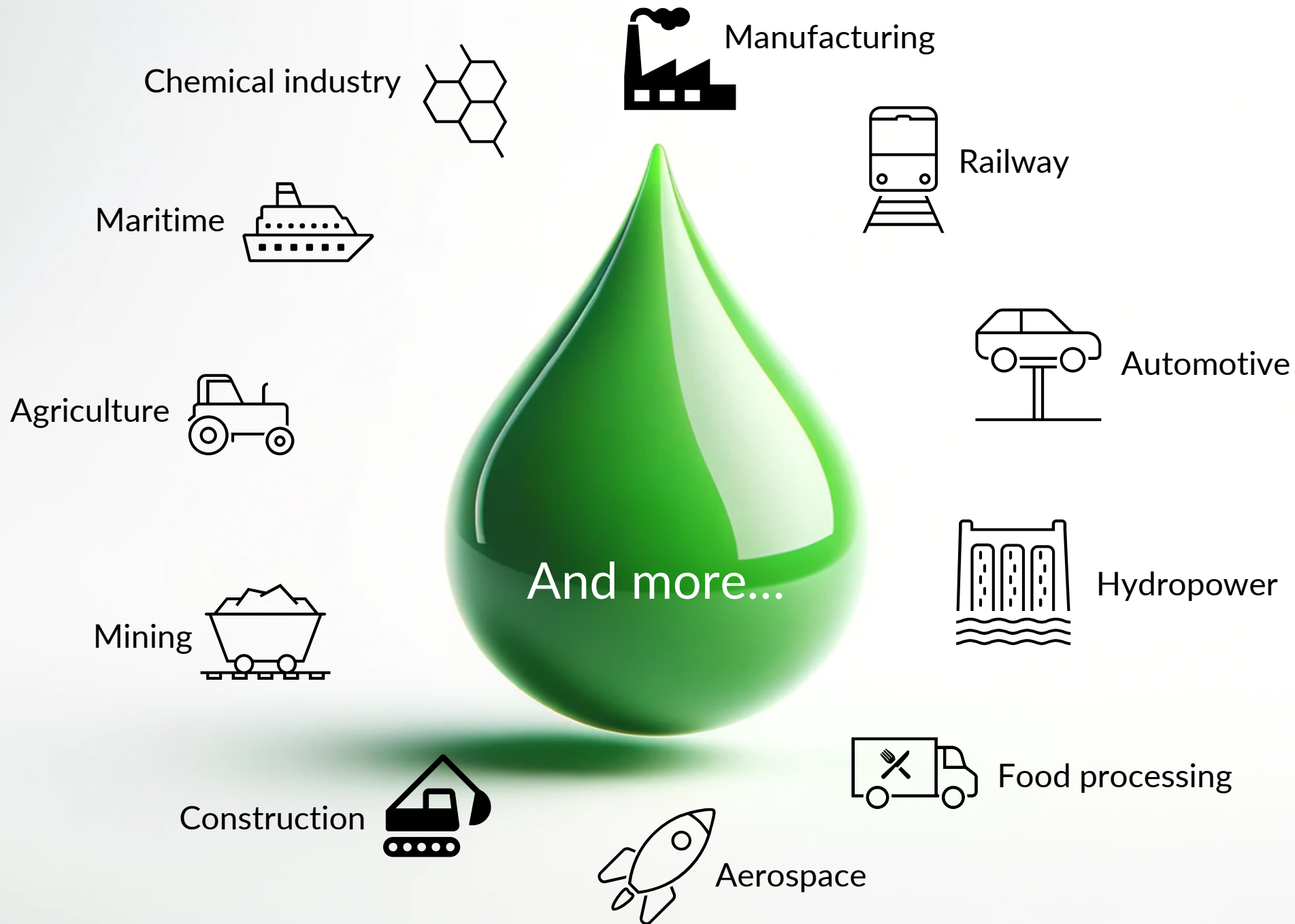
H411—Toxic to aquatic life with long-lasting effects



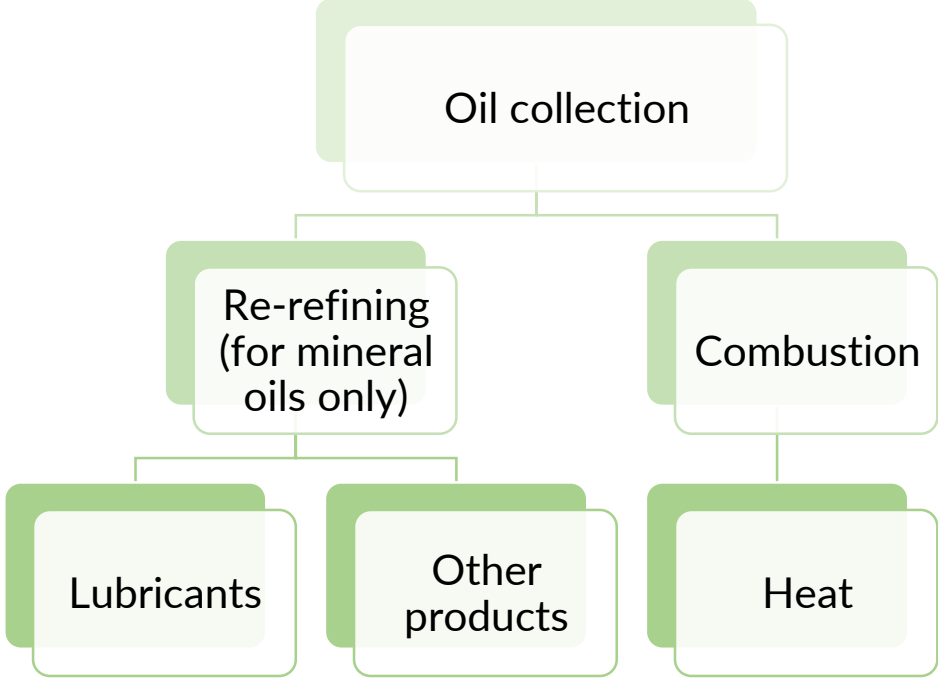
- Chlorinated additives
  - Very good extreme pressure additives.
  - According to EPA: medium-chain (C14 to C17) and long-chain (C18 to C20) chlorinated paraffins present persistent, bioaccumulative and toxic risk to the environment.
- Etc...



# Where do we use lubricants?



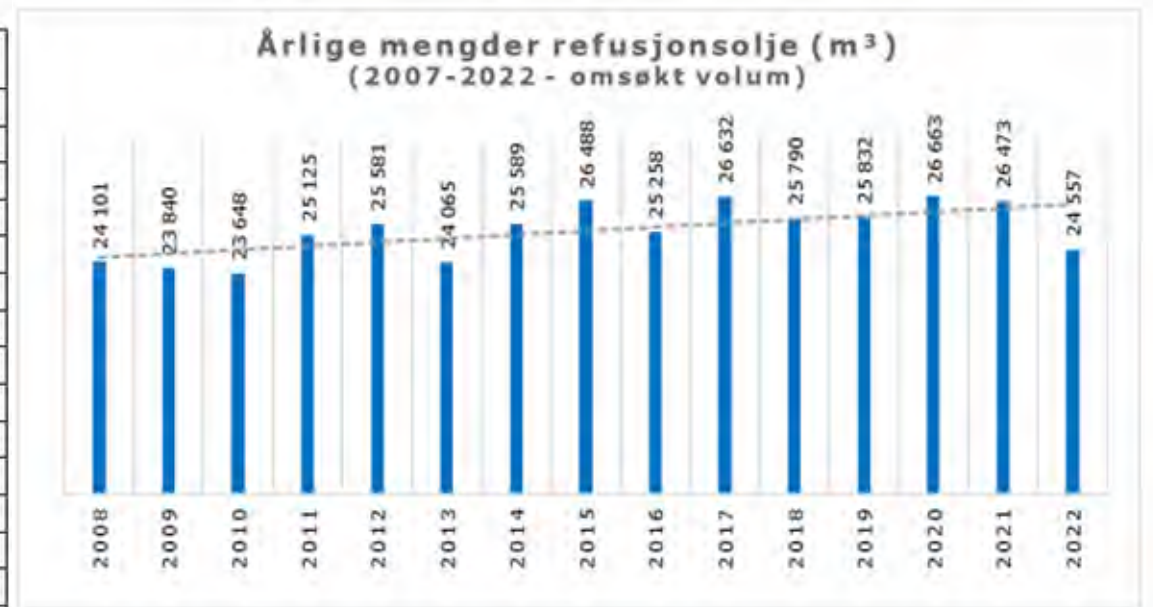
# Example: Automotive oil recycling



# The refund scheme for used oil collection in Norway

Tabell 1. Nøkkeltall for refusjonsordningen for spillolje, 2008-2022.

År	Anmodninger	Deklarasjoner	Refusjonssats	Refusjonsbeløp	Omsøkt	Vann - innhold	Svovel innhold.	Klor innhold
	antall	antall	(NOK/l)	(MNOK)	(m <sup>3</sup> )	(%)	(%)	(ppm.)**
2022	343	16 795	2,70	66,1	24 557	4,81	0,30	107*
2021	372	17 659	2,66	64,4	26 473	5,15	0,30	110*
2020	371	18 245	2,57	67,2	26 663	4,76	0,31	116*
2019	357	17 672	2,53	58,7	25 832	4,33	0,33	68
2018	348	17 464	2,49	71	25 790	3,93	0,34	56
2017	353	17 271	2,46	60,3	26 632	4,52	0,38	58
2016	379	17 053	2,41	58,9	25 258	4,61	0,38	49
2015	383	19 714	2,24	56,7	26 488	5,05	0,39	59
2014	367	18 860	2,20	53,1	25 589	4,83	0,39	71
2013	352	17 671	2,15	48,6	24 065	4,80	0,40	71
2012	381	18 360	2,11	49,3	25 581	4,87	0,41	77
2011	387	17 410	2,06	47,6	25 125	5,08	0,39	79
2010	368	16 377	2,03	44,6	23 648	5,46	0,36	91
2009	373	16 760	1,97	44,4	23 840	5,30	0,36	131
2008	388	17 034	1,94	43,1	24 101	6,14	0,39	136



Figur 1. Årlige mengder refusjonsoljespillolje 2008-2022. Verdiene er basert på omsøkt volum.

Source: MILJØDIREKTORATET M-2526|2023, REFUSJONSORDNINGEN FOR SPILLOLJE ÅRSRAPPORT 2022



# The "Invisible" Problem

Around 50% of the lubricants end up in nature\* → 20,000,000,000 liters per year, 90% of which are based on harmful mineral oil based lubricants

Oil pollution is a more acute problem than microplastics because it has immediate and direct toxic effects\*\*

Maritime transportation releases up to **250 million liters of lubricant** into the oceans every year.

New regulations in the maritime industry (USA-Vessel General Permit 2013) forcing the use of Environmentally Acceptable Lubricants – EALs → Europe is lying behind!

**MARITIME CHALLENGE**

According to EFSA harvesting is one of the sources of MOH (Mineral Oil Hydrocarbons) in food.

**AGRICULTURE CHALLENGE**

100 % of the lubricant used in rails & wheels end up in nature.

The lubricants pollute groundwater

**RAILWAYS-TRAINS CHALLENGE**

\* <https://www.tribonet.org/wiki/environmentally-acceptable-lubricants/>

\*\*<https://www.dw.com/en/exclusive-how-chronic-oil-pollution-at-sea-goes-unpunished/a-6120198>

# Environment

Home > Topics > Waste and recycling > Waste oil

## Waste oil

EU rules aim to ensure that waste oils are correctly managed, to avoid contaminating the environment and to take advantage of its high recovery potential.

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**Overview**

Objectives

Law

Implementation

Timeline

Publications

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## Overview

Many engines and mechanisms need lubricant oils to function. Around half of all purchased lubricant oil will ultimately become waste oil. The rest is lost during use, or through leakage.

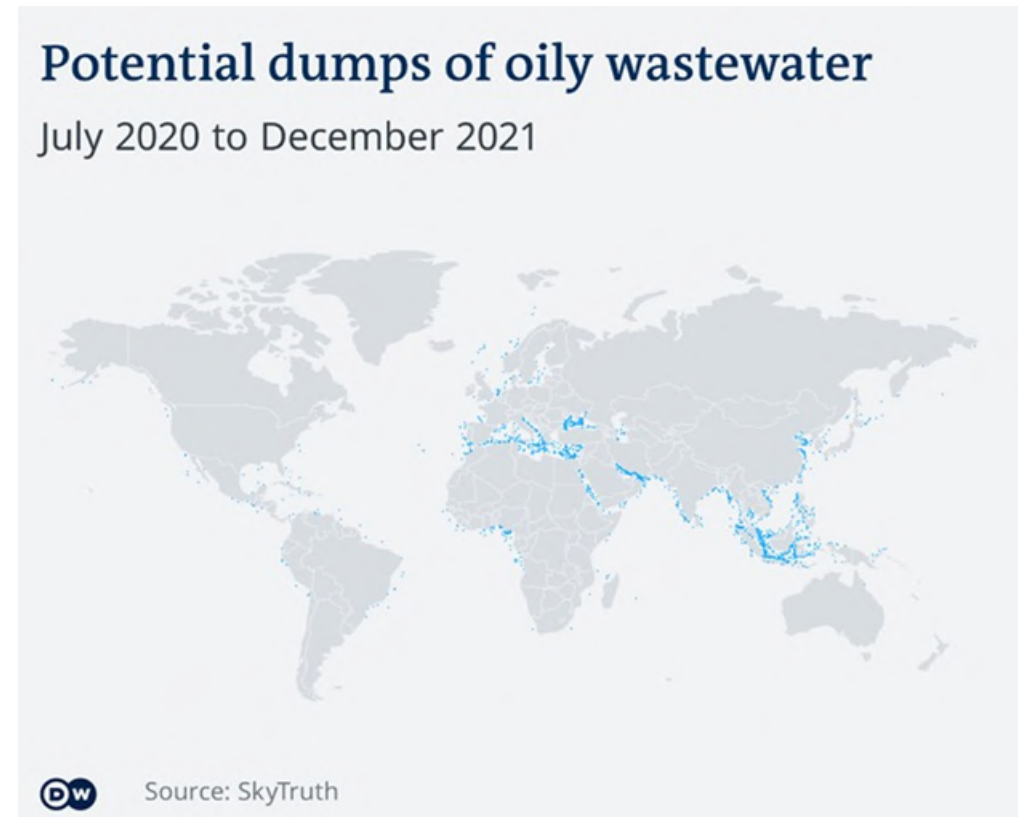
Waste oils are considered hazardous waste and have some dangerous properties. One litre of waste oil can contaminate one million litres of water. Waste oils in rivers, lakes and streams threaten aquatic life. Also, if waste oils are left on the ground, they can severely contaminate soil.

Everyone, including industries, consumers, and garages have an essential role to play in the recovery of waste oil. They must make sure to hand waste oil over to authorised collectors and avoid dumping it at all costs.



# But reality is still worse!!

- According to the Swedish Environmental Research Institute:
  - *Oil pollution is a more acute problem than microplastics because it has immediate and direct toxic effects.* The impact of small oil discharges on marine life remains underinvestigated, but academic research suggests that even small oil spills can have lasting harmful effects on marine life when they happen frequently. And repeated spills create a form of chronic pollution that can have severe effects on the environment.



# Spills in Norway also occur

Norge

## Oljelekkasje i Øygarden

NTB

20. aug. 2023 15:24 – Oppdatert 20. aug. 2023 16:17

Brannvesenet melder om akutt forurensing på CCB-basen på Ågotnes i Øygarden utenfor Bergen søndag ettermiddag. Det er snakk om en del oljesøl.



SEILINGSFORBUD: MS Oslofjord seiler vanligvis mellom Sandefjord og Strømstad. Nå har ferja fått seilingsforbud og ligger til kai inntil feilene er rettet.

FOTO: THEODOR AASLAND VALEN / NRK



Sjøfartsdirektoratet har gitt MS Oslofjord seilingsforbud etter at det ble oppdaget flere feil med skipet.



**Forbudet ble gitt etter at Sjøfartsdirektoratet var på et uanmeldt tilsyn onsdag.**



[Sandefjords Blad](#) meldte saken først.

– Årsaken til seilingsforbudet er at det skal ha blitt funnet feil på 12 brannspjeld på ferja og en lekkasje fra en thruster, skriver Helga Maria Sulen Sund i Sjøfartsdirektoratet til avisen.

Feilen med brannspjeldene skal ha vært at de ikke lot seg stenge. Oljelekkasjen skal være på mellom 40 og 80 liter.



Kystverket dro søndag ut for å kartlegge oljesølet i Drøbaksundet. Blant annet for å passe på at sølet ikke nærmer seg naturreservatet Askholmene.

FOTO: HANS OLAV TORGENSEN

**Leakage from the war ship (second world war) Blücher in Oslofjorden.**  
Source: NRK 6. aug. 2023



# Ulike virkemidler som utløser ulik grad av offentlig/privat samarbeid om forskning

Lavere TRL

Høyere TRL

Forskerprosjekt

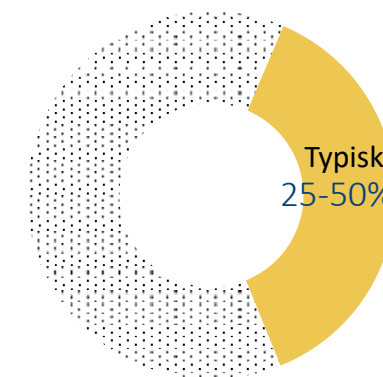
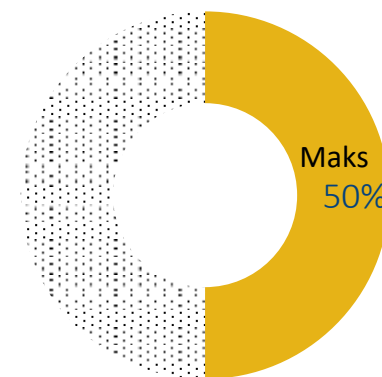
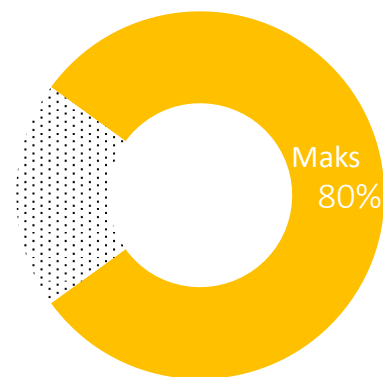
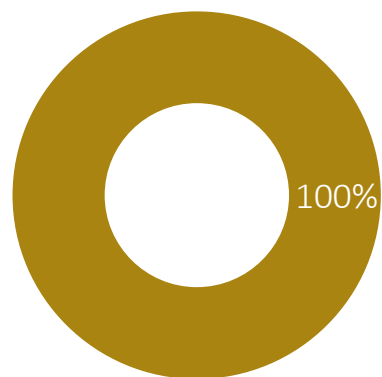
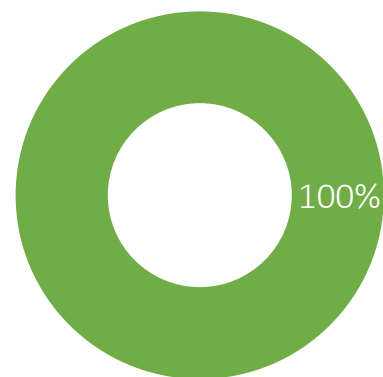
KSP-S\*

KSP-N(KPN)

SFI/FME

IPN

Andel finansiering av NFR



- Ingen krav til samarbeid

- Krav om samarbeid

- Krav om medfinansiering fra partner (minimum 20%)

- Krav om medfinansiering fra partnere (minst 50%)

- Bedriften finansierer prosjekt (typisk 50-75%)



Bidragsforskning  
«ikke-økonomisk aktivitet»

Oppdragsforskning  
«økonomisk aktivitet»

# SFI main pillars

## Environment

- Public bodies (kommuner, direktorater, public companies)
- Regulations

## Recycling and reuse

- Collection by public bodies
- Incentives to companies
- Technology for recycling

## Markets/Applications

- Maritime
- Hydropower
- O&G
- Aluminum
- Transportation
  
- Others



# Additional info

- Two steps process (pre-proposal + main proposal)
- Deadline for pre-proposal: September the 18th
- 8 centres will be funded by the NFR
- Cash or in kind contribution needed
- 8 years project



# Concluding remarks

- **The Problem:** 20,000,000,000 liters of lubricants is ending up in the nature every year.
- **The Opportunity:**
  - New regulations forcing the industry to use EALs (already started in the maritime industry)
  - Social awareness from End Users demanding greener products
  - Bring Trondheim/Norway in the forefront of the green shift.
- **The Solution:** Interdisciplinary approach based on SINTEF know how.
- **The need:** A joint strategy at SINTEF
- **Timing:** The sooner the better

