Complying with New EPA Lubricant, Cleaner Requirements for Marine Transportation Industries

RSC Bio Solutions

EnviroLogic® SafeCare®

Speaker Introduction

Bernard C. Roell, Jr. Ph.D. is the Vice President of Technology for RSC Bio Solutions since 2013.

Dr. Roell's lubricant experience and expertise includes seven years with Houghton International where he was VP of Technology and Director of Operational Excellence and a combined 15 years with Ciba Specialty Chemicals and The Lubrizol Corporation in product development and business management of Industrial Products and Automotive Transmission Fluids segments.

Dr. Roell has a Ph.D. in Organic Chemistry from Ohio University and a B.S in Chemistry and B.A in Mathematics from Lock Haven University.

Dr. Bernie Roell
Vice President of Technology
RSC Bio Solutions

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Who Is RSC Bio Solutions?

RSC Chemical Solutions

Radiator Specialty Company

- Diversified, family-owned private enterprise
- Deeply experienced formulator, manufacturer and distributor of cleaners, lubricants and functional fluids
- Family of trusted brands

Liquid Wrench · GUNK · Motor Medic · TITESEAL

RSC Bio Solutions

A separate, connected platform

- Full array of innovative lubricating and cleaning products & services that delivers superior performance and systems savings without sacrificing environmental safety
- Leverages the strength and reach of RSC, investing in emerging and advanced technology and creating new-to-the-world solutions

Partners and Investments

EnviroLogic®

Terresolve Technologies

- Founded in 1996
- Acquired in 2012
- Leader in readily biodegradable, high performance industrial lubricants

SafeCare®

Gemtek Products

- Exclusive technology license
- Proprietary biobased surfactant blends and solvents

GreenSorb®

Sorbent Green

- Exclusive distribution rights
- High performance and safe absorbent technology

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Introduction to RSC Bio Solutions

Key Markets Served

Offshore Oil & Gas

Marine Transportation

Marine Construction

Utility Fleets

Wind Power

Waste

Turf

Applications which demand high levels of performance and benefit from risk reduction RSC BIO Solutions offer.

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Marine Industry Challenges

- **Unauthorized Fluid Discharges**
  - Leaks far outpace catastrophic events
  - Have to be reported, cleaned up
  - Difficult to prevent

- **Consequences of Spills**
  - Lost productivity
  - Costly fines, remediation
  - Damage to environment
  - Negative public relations

2013 VGP changes are designed to address this issue.

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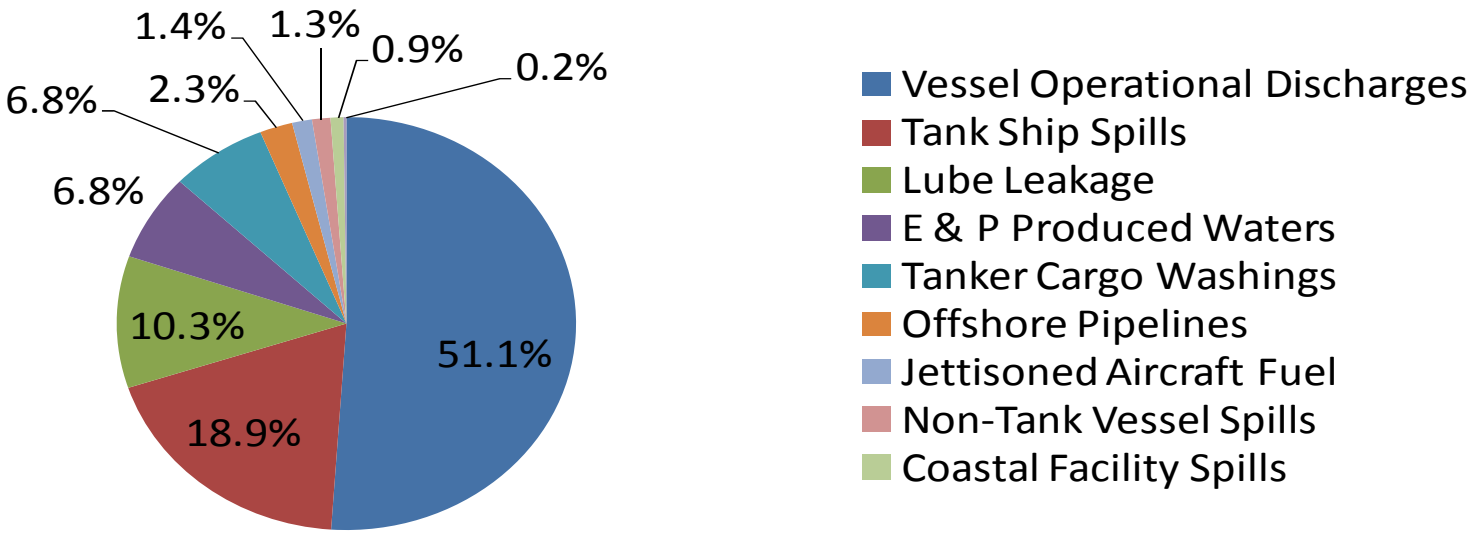
Lubricant Discharges in the Marine Environment



9.7 – 16 million gallons per year

Annual response and damage costs: Worldwide $322 Million and U.S. $31 Million.*

Routine, unauthorized vessel operational discharges (predominantly stern tube leakages) equate to 1.5X size of Exxon Valdez spill annually.*

*Sources: Etkins, 2010, Worldwide Analysis of In-Port Vessel Operational Lubricant Discharges and Leakage, 33rd Proc. Arctic & Marine Oil Spill Program Technical Seminar; EPA EAL 800-R-11-002 November 2011

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U.S. EPA Vessel General Permit 2013

Applicable to:

- All commercial vessels > 79 ft
  - New builds: at time of construction
  - Existing assets: at next dry dock
- Recommended, not yet mandated, for vessels < 79 ft
- Operating within three nautical miles of
  - U.S. Coastline
  - Great Lakes
  - Inland Waterways

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U.S. EPA Vessel General Permit 2013

Requires all vessels to use:

- Environmentally acceptable lubricants (EALs) in all oil-to-sea interfaces unless technically infeasible
- Cleaners and detergents for deck washdowns are required to be phosphate free (permit p. 112) and non toxic
- VGP maintains regulations on “sheen” originating from EPA Oil Pollution Act (OPA 90 – 1990)

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U.S. EPA Vessel General Permit 2013

Oil to Sea interfaces include:

- Oil-lubricated stern tubes
- On-deck, underwater or submerged machinery
  - rudder bearings
  - CP propellers
  - thrusters
  - fin stabilizers
  - dredgers
  - grabs
  - propulsion pods
  - wire ropes

Any component with potential to leak lubricants is included.

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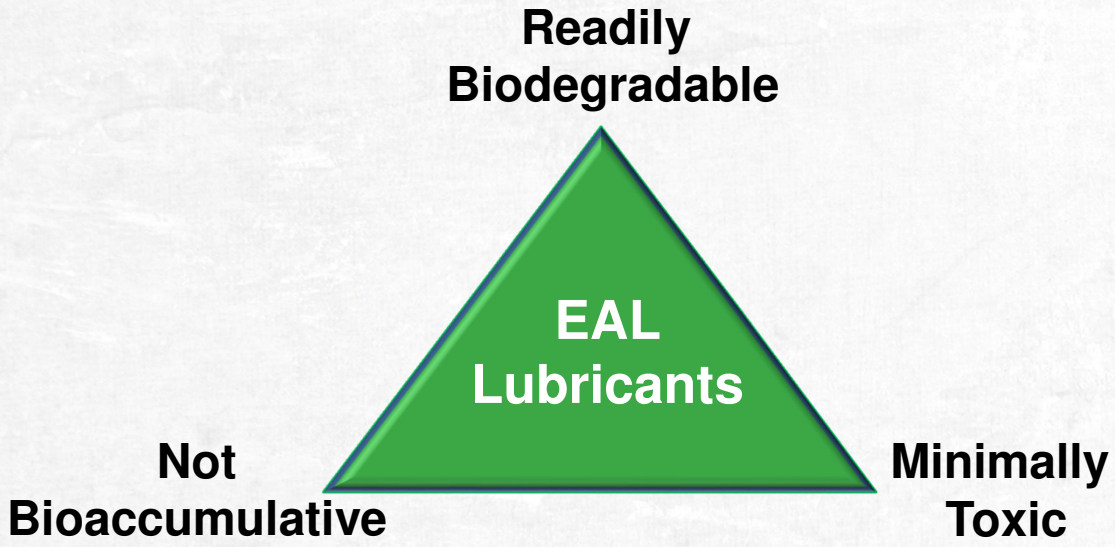
U.S. EPA Vessel General Permit 2013

EPA defines EALs as those proving minimized negative impact on aquatic environment



Independent testing certification or 5 EU labeling programs are accepted by EPA. PDS, MSDS should clearly state.

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U.S. EPA Vessel General Permit 2013

What does technical infeasibility mean?

- No OEM approved EALs for a specific use
- No available alternatives manufactured with EALs (wire ropes)
- EALs not available in ports in which vessels call
- Next dry dock has not yet occurred

Approved EALs are available in almost all cases.

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U.S. EPA Vessel General Permit 2013

What are reporting requirements?

- Vessel owner/operators are to report any *noncompliance* which may endanger health or the environment orally within 24 hours from the time you become aware of the circumstances to the US EPA Regional Office.
- A written follow-up is required within five days of the time you became aware of the circumstances.
- Part 4.2 of VGP requires documentation of *compliance or noncompliance* in vessel annual report and log effective Feb 2015.

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Viable Alternatives Can Reduce Cost

Environmentally acceptable lubricants (EALs)

- Don't
  - Eliminate the spill occurrence
  - Eliminate the need to report
  - Eliminate the need to clean up
- Do
  - Perform equal to or better than petroleum based lubricants
  - Mitigate the discharge's impact
    - Environmental
    - Regulatory

Improved Productivity = Improved Profitability

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While Not All Fluids Are the Same, Enviro-fluid Technology Is Much Improved

- Improved formulations
  - Specifically designed for marine equipment
  - Extensive testing, use
- Improved compatibility
  - Components
  - Contamination
- Improved application
  - The right product for the right application
- OEM approved
  - Years of field proven performance

There is little risk with the right fluids.

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Common EAL Misperceptions Persist

1. “All EALs are the same”
2. “HEPR type fluids are not biodegradable”
3. “All EALs are technically infeasible”
4. “EALs are not compatible with seals and other lubricants”

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Common EAL Misperceptions Persist

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Truth: There Are Four Classifications of EALs Recognized By VGP and ISO

ISO 6743/4 – Hydraulic Environmental:

- Triglycerides (HETG)
- Polyalkylene Glycols (HEPG)
- Synthetic Esters (HEES)
- PAO (polyalphaolefins) and related products (HEPR)

Application performance requirements affect EAL selection.

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Triglycerides (HETG)

- Conventional vegetable oil based fluids
- Good frictional characteristics and viscosity index
  - Shorter oil life expectancy than time between dry docks
- Oxidative stability
  - Under high temperature application more susceptible to oxidation
- Hydrolytic stability
  - More prone to hydrolysis in the presence of water (typically > 1%)

While we offer HETG fluids for land applications, we more often recommend HEPR for marine applications.

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Polyalkylene Glycols (HEPG or PAG)

- Synthetic, not vegetable or biobased
- Fire resistant
- Incompatible with conventional seals or filters
- Incompatible with petroleum, vegetable, ester based oils
- Absorbs water creating rust and acid

Best to consider in new designs where hydraulic systems can be engineered for compatibility with PAGs.

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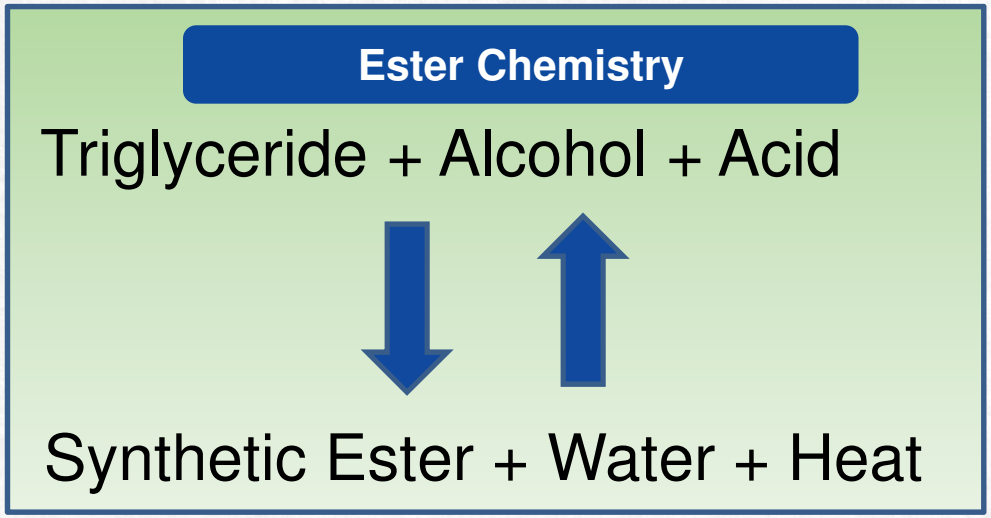
Synthetic Esters (HEES)

- Synthetic or biobased



- Hydrolytically instable
- System deterioration, wear

Best to use where water ingress is unlikely.

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Polyalphaolefins (PAO) and Related Products (HEPR)

- Synthetic, readily biodegradable
- Durable
- Low cost/long fluid life
- Separates from water
- Excellent seal compatibility
- Broad temperature range

Many EnviroLogic marine EAL offerings are HEPR type.

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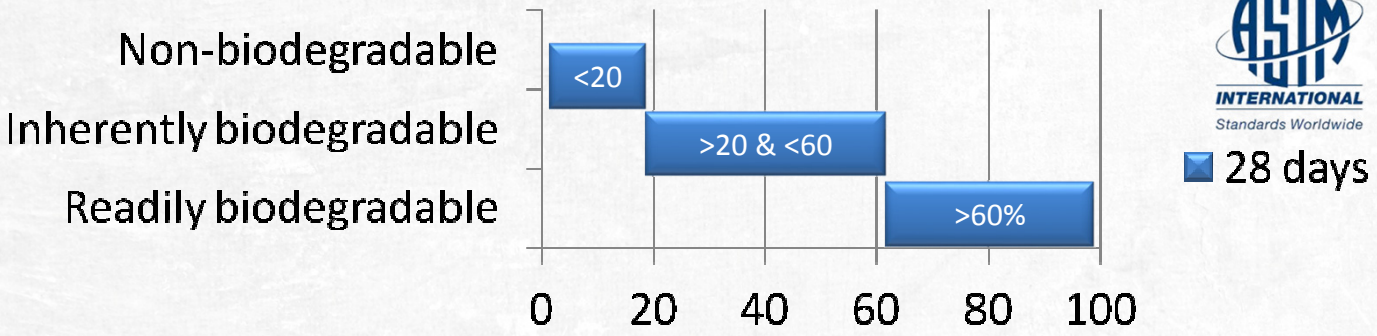
Biodegradability

- **VGP Compliant EALs must degrade 60%+ ≤28 days**
  - Biodegradation according to ASTM definition



Beware of unsupported claims!

"Environmentally Safe"

"Environmentally Friendly"

"Non-sheening" *"Biodegradable"*

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Truth: HEPR Lubricants Can Be Readily Biodegradable

EnviroLogic Product Grade	Bio-Preferred*	ASTM D-7373	OECD 301B	Readily Biodegradable**
EnviroLogic® 115	No	✓		Yes
EnviroLogic® 122	Yes	✓		Yes
EnviroLogic® 132	Yes	✓		Yes
EnviroLogic® 146	Yes	✓		Yes
EnviroLogic® 168	Yes	✓	✓	Yes
EnviroLogic® 3015	No	✓		Yes
EnviroLogic® 3022	No	✓		Yes
EnviroLogic® 3032	No	✓		Yes
EnviroLogic® 3046	No	✓	✓	Yes
EnviroLogic® 3068	No	✓		Yes
EnviroLogic® 3100	No	✓		Yes
EnviroLogic® 200	No	✓		Yes
EnviroLogic® 210	No	✓		Yes
EnviroLogic® 215	No	✓	✓	Yes
EnviroLogic® 222	No	✓		Yes

* Minimum Biobased content of 44% for Hydraulic Fluids

** > 60% biodegradation with 28 days

Synthetic and biobased products can be VGP compliant.

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Truth: EALs are Technically Feasible

- **Stern Tubes** (Blohm+Voss/Simplex, Wartsila, JMT, Aegir Marine, Kobelco)
- **Thrusters** (Rolls-Royce, ABB, Wartsila, Schottle, Berg, Thrustmaster)
- **Stabilizers** (Blohm + Voss)
- **Water-tight Doors**
- **Lifeboat Davits**
- **Stern Ramps** (TTS, MacGregor, Cargotec)
- **Deck Equipment** (Rolls-Royce, Hatlapa)
- **Cargo Deck Fans/Mushrooms**
- **Hydraulic Cranes**

OEM approvals are complex. It's a good idea to ask for supporting letters of approval.

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Truth: EALs Are Compatible With Many Seals

Hydraulic Fluids and Seal Material Compatability Table					
	Rubbers				Thermoplastics and Elastomers
	NBR, HNBR		FKM		PA, PF, PM, PEEK, PTFE
	Normal Temperature ≤60°C (≤140°F)	High Temperature ≤100°C (≤212°F)	Normal Temperature ≤60°C (≤140°F)	High Temperature ≤100°C (≤212°F)	All Temperatures
Hydraulic Fluid Type					
HETG (Triglycerides, rapeseed oil)	A/B	A/B	A	A	A
HEES (synthetic esters)	A/B	A/B	A	A	A
HEPG (Polyalkylene glycols)	A	A/B	A/B	C/D	A
HEPR (Polyalphaolefins)	A/B	A/B	A	A	A

Key
Excellent
Good
Limited
Not recommended

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SKF Group 2012, PUB SE/P1 12393/1 EN · April 2013 ASTM D471 (Volume Change) and ASTM D2240 (Durometer Hardness)

EnviroLogic® Product Performance

- Compliant with 2013 EPA VGP
- Manufactured from mix of synthetic bio-polyolefin, renewable and synthetic esters and additives providing strong AW/EP properties
- Extensive service life
- Outstanding viscometrics (VI > 210); wide range of operating temperatures (from -40 to 120 °C)

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EnviroLogic® Product Performance

- Gear oils offer enhanced wear (FZG failure load stage 14 pass) and highest levels of micro pitting protection
- Hydraulic fluids offer enhanced wear (FZG failure load stage 12 pass)
- Non-emulsifying formula facilitates water removal in event of leak

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VGP Compliant Product Portfolio

Hydraulic Fluids	EnviroLogic® 100 - Readily Biodegradable,* Minimally Toxic Hydraulic Fluids EnviroLogic® 3000 - Ultra-High Performance, Readily Biodegradable Hydraulic Fluids
Gear Oils	EnviroLogic® 200 - Readily Biodegradable, Industrial Gear Oil EnviroLogic® 200EP - Extreme Pressure Synthetic Gear/Thruster Oils
Rope & Chain Oil	EnviroLogic® 268 - Readily Biodegradable Oil
Grease	EnviroLogic® 802 - Biodegradable Grease
System Flush	EnviroLogic® BioFlush - Readily Biodegradable, Non-toxic Flush Oil
Cleaners	SAFECARE® SC-1000 Aqueous Cleaner Concentrate
Degreasers	SAFECARE® SuperSolv SAFECARE® CSR-3000
Absorbent	GreenSorb® Absorbent

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SAFECARE®

GREENSORB®

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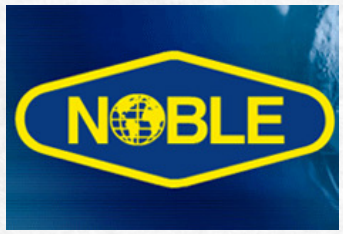
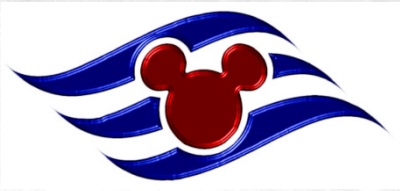
A Sampling of EnviroLogic Users





Thanks and Questions?

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for problems you don't.™

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