

Puget Sound Clean Cars Stormwater Partnership Working Group Meeting

Ken Zarker, Washington State Department of Ecology
Tom Lewandowski, Gradient
Keith Wilson, SAE International

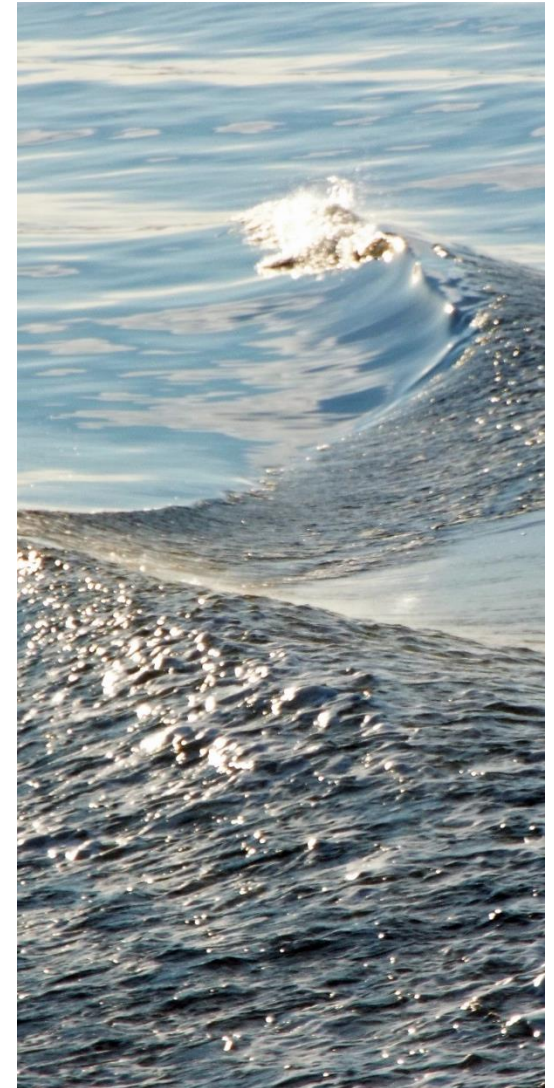
Wednesday April 18, 2018

Working Group Organization Chart

Area of Expertise	Contact Name	Affiliation
Academic/Research	Ed Kolodziej	University of Washington - Tacoma
	Michael Smith	Clover Park Technical College
	Sagi Hemi	Advanced Test Concepts
	Jen McIntyre	Washington State University
Automotive design, manufacturing, maintenance and repair	Sheila Andrews/Tom Tucker	Auto Care Association
	Marcel Halberstadt	Independent consultant; SAE
	Laurie Holmes	Motor & Equipment Manufacturers Association (MEMA)
	Dan Selke	Mercedes-Benz USA, LLC
Government	Ken Zarker	Dept. of Ecology
	Bill Malatinsky	Seattle Public Utilities
	Elsa Pond	WS DOT
NGO	Andy Gregory	Puget Soundkeeper
	Tere Carral	Bridge Latino
Operations Team	Tom Lewandowski	Gradient
	Keith Wilson	SAE

Web Meeting Agenda

- Draft Report Sections
- Next Steps and Project Schedule
- Progress Update – web site, project materials



Draft Report: Updates

1. Draft report text distributed to Working Group members for review April 2018
 - Draft sections 1-4 this week, sections 5-8 following thereafter
2. WG members encouraged to comment on/contribute to specific sections related to their areas of expertise
3. Gradient still gathering feedback/input for WG members on initial draft

Report Section 1.

Introduction

- Project overview and background
- Vehicle leak data
 - Puget Sound Toxics Loading Analysis (PSTLA) identified and prioritized chemicals detected in Puget Sound
 - CoCs of highest priority: copper, PAHs, DEHP, petroleum
 - similar findings reported in Swedish study (Markiewicz et al. 2017)
 - oil and grease from vehicle sources identified as the most abundant CoCs (present at highest concentrations)
- Potential environmental and human health impacts of vehicle fluid leaks
 - spawner mortality syndrome in Coho salmon (Spromberg et al. 2017)
 - used oil may be more toxic than unused oil
 - mutagenic in Ames assays (Kamal et al. 2011), and carcinogenic in dermally exposed mice (ATSDR 1994)
 - unused oils were negative for carcinogenicity – effects may be attributable to PAHs accumulated over time (ATSDR 1994)

Report Section 2

Current Automotive Design and Maintenance Practices Related to Leaks

- Design features to prevent fluid leaks
 - Voluntary standards for vehicle design to measure durability, performance for seals and related parts
 - vehicle fuel leak test methodologies (SAE J2973-21402 2014)
 - leak test methods for elastomeric hoses (SAE J1638-201504 2015)
 - tightening torque of hold down bolts and proper gasket **sealing** performance (Kandreegula et al. 2015)
- Design features to provide leak warnings
 - Functional Failure Modes and Effects Analysis (FMEA) helps identify appropriate diagnostic method for each failure mode at vehicle design stage (Chamarthi et al. 2017)
 - leak sensors/warning lights (typically only for significant volume loss)

Report Section 2

Current Automotive Design and Maintenance Practices Related to Leaks

- Repair Facilities Best Practices
 - leak detection methods for handling brake fluids by service maintenance personnel (SAE J1707_201609 2016)
 - handling and dispensing brake fluid
 - procedures for filling brake fluid reservoirs, bleeding brake system
 - general maintenance and service recommendations for brake system
 - Pacific Northwest Pollution Prevention Resource Center (PNPPRC) "Floor Cleanup Best Management Practices" (2015)
 - Spill response plan and protocol
 - Sealing floor drains connected to wastewater
 - Pressurized overhead fluid delivery systems reduce spills associated with oil changes

Report Section 3

Approaches to Reduce Vehicle Leaks

- Innovative technologies and onboard diagnostics
 - R&D stage
 - experimental single cylinder engine for diesel vehicles (Dharan et al. 2017)
 - optimized vacuum detection system for detecting very small leaks from fuel tanks (Tseng et al. 2017)
 - Commercially available
 - moisture-cure polyacrylate gaskets perform under extreme temperature conditions (Ryba 2016)
- Methods to reduce impacts of vehicle fluid leaks
 - waste oil recycling and re-refining (Madanhire and Mbohwa 2016)
 - stormwater management systems
 - catch basin inserts(Kostaerlos et al. 2011)
 - bioretention cells (Li and Davis 2009)
 - filtration systems (Mrowiec 2016; Reddy et al. 2014; Fuerhacker et al. 2011)

Report Section 4

Vehicle Fluid Composition & Safer Chemical Alternatives

- Vehicle Fluid Composition
 - Motor oil; radiator fluid (aka coolant); brake fluid; power steering fluid; windshield wiper fluid; fuel (gasoline, diesel); transmission fluid
 - Safety Data Sheet (SDS) Review
 - Review SDSs vehicle fluids commercially available within the past 3-5 yrs
 - Automotive trade association members requested SDS from auto companies and suppliers
 - Company and product names removed and shared with Gradient as a set
 - identify chemicals most commonly used across vehicle fluids, and chemicals used at highest percentage (%w/v)

Report Section 4

Chemicals Appearing Most Often Across SDS

Chemical Name	CAS	Use Category for Each Product Whose SDS Includes This Chemical
Distillates (petroleum), hydrotreated heavy paraffinic	64742-54-7	Engine oil (3 SDSs) Automatic transmission fluid Transmission fluid (3)
Sodium hydroxide	1310-73-2	Use in engine coolant and antifreeze Brake fluid (2 SDSs) Radiator conditioner and cleaner
Distillates (petroleum), hydrotreated light	64742-47-8	Transmission fluid Fuel injector cleaner (2 SDSs) Power steering fluid
Toluene	108-88-3	Transmission fluid Power steering fluid Automotive fuel
Diethylene glycol monobutyl ether	112-34-5	Brake fluid. Use only as hydraulic fluid in vehicle brake and clutch systems. (2) Power steering fluid
Triethylene glycol monobutyl ether	143-22-6	Brake fluid (3 SDSs)
Distillates (petroleum), hydrotreated heavy naphthenic	64742-52-5	Transmission fluid Engine stop leak Power steering fluid
Distillates (petroleum), hydrotreated light paraffinic	64742-55-8	Transmission fluid (3)
Methanol	67-56-1	Windshield washer fluid (2) Alcohol-based cleaner

Report Section 4

GADSL Review

- Global Automotive Declarable Substance List (GADSL)
 - List of chemicals of concern for the automotive supply chain, must be declared if present
 - >3200 chemical substances (including different metal salts and categories of chemicals)
- GADSL lists only example applications for each chemical, few automotive fluids indicated
- Used USEPA CPCat database to query chemicals on GADSL for reported use in automotive fluids
 - <https://www.epa.gov/chemical-research/chemical-and-product-categories-cpcat>
 - Used category terms such as lubricant, hydraulic fluid, brake fluid, wiper fluid
 - Identified 155 chemicals on GADSL as possible fluid components

Report Section 4

Vehicle Fluids Detected in Stormwater

- Reviewed research articles and WG member database (Ed Kolodziej) identifying chemicals of concern from collected stormwater runoff samples
 - Gradient reviewed recent publications from the Kolodziej group, and other relevant articles (citation searches)
 - Tabulated chemicals identified in stormwater runoff samples

Report Section 4

Stormwater Chemicals on SDS or GADSL

- Cross referenced the chemicals identified via the SDS search and the GADSL review against the stormwater chemical list to look for overlap
- Only 4 chemicals found in SDS review were also reported as being present in stormwater runoff
 - Propylene glycol
 - 4,4-isopropylidenephenol
 - Naphthalene
 - Poloxalene (polyethylene-polypropylene glycol)
 - Several limitations may explain the low number (fluid degradation, analysis methods used)
- 15 chemicals found in GADSL that were possible fluid components were also reported as being present in stormwater runoff, examples:
 - Polycyclic aromatic hydrocarbons (including naphthalene)
 - 4,4-isopropylidenephenol
 - Di-isodecyl phthalate
 - Several flame retardants (e.g., triphenylphosphate)
 - These may be present in automotive fluids, extent or concentration is unknown

Report Section 4

Safer Chemical Alternatives

- Initial search to see what information on alternatives is readily available; wide net, not an evaluation of alternatives
- Motor oil alternatives
 - synthetic base oils, polyalkylene glycols, vegetable oils, mahua oils (Madanhire and Mbowha 2016, Sharma et al. 2014)
 - unclear whether alternative base oils will have similar weathering effects (increased levels of breakdown products or metal contaminants) – may confer no hazard advantage
 - performance and compatibility of alternatives are obstacles to widespread adoption of alternatives
- Radiator fluid alternatives
 - propylene glycol, glycerol, propane-1,3-diol safer alternative to traditional ethylene glycol (PPRC 2015)

Report Section 4

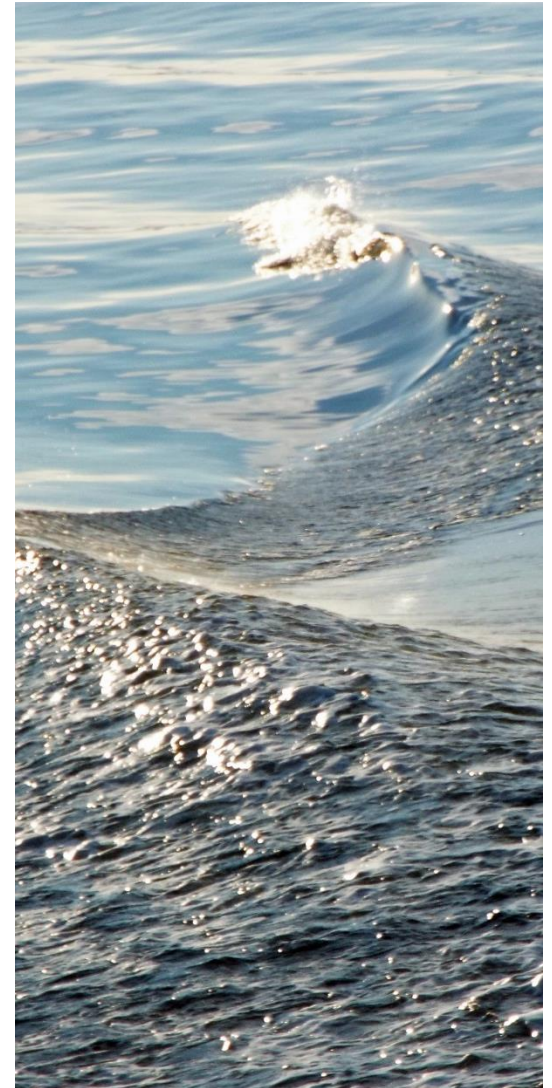
Safer Chemical Alternatives

- Wiper fluid alternatives
 - State regulations (CA, TX) limit amount of allowable methanol content (CARB 2013, TCEQ 2018)
 - similar regulations in Europe (EC 2017)
 - formulations with reduced levels of methanol currently available
- Transmission Fluid alternatives
 - bio-based oils (e.g. high oleic vegetable oils) offer biodegradable alternatives (Schaeffer Manufacturing Company 2012)
- Available alternatives would need to be evaluated according to alternative assessment criteria (e.g. cost, performance, hazard, availability)

Draft Report: Next Steps

1. Report sections distributed to WG members for review
2. WG members review their assigned sections
 - check text for accuracy and comprehensiveness
 - consider additional resources/references worth seeking out
 - evaluate report section and conclusions
3. Timeline:
 - 1st Quarter 2018 – draft report sections to WG (January - March), WG reviews returned to Gradient (January - April), 5th web meeting for report discussion (April), data gaps, etc.
 - 2nd Quarter 2018 – full draft revision completed submitted to Ecology for preliminary review (May), circulated to WG for review (mid-May), WG reviews returned (mid-June), 6th web meeting for report discussion, address any outstanding issues
 - 3rd Quarter 2018 – WG completed (July), finalize report with Ecology and make available (September)

Questions or Comments?



Progress Update: Project Materials

- Project materials available for download from Ecology's website: <https://fixcarleaks.org/clean-cars-partnership/>
 - Working group meeting minutes, slides, and video
 - Newsletters #1, #2, #3 and #4
 - Project organization chart
- Newsletter #5 issued April 2018
 - Will be posted to Ecology's website
- Poll for next (and last) web meeting (~June 2018) coming soon