DRIVING STANDARDS
IN LUBRICANT TECHNOLOGY

The technical committee of petroleum additive manufacturers in Europe

Particular challenges for creating environmental generic exposure scenarios for mixtures

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Features of the Lubricant Sector

- **Lubricants are complex mixtures**

  Frequently contain up to 20 substances

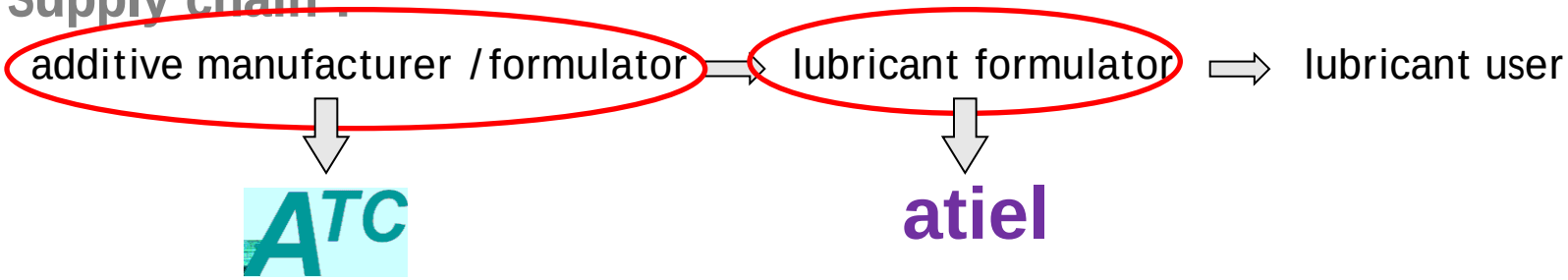
- **Lubricants are marketed for diverse applications:**

  EU volume 5-6 Million tpa

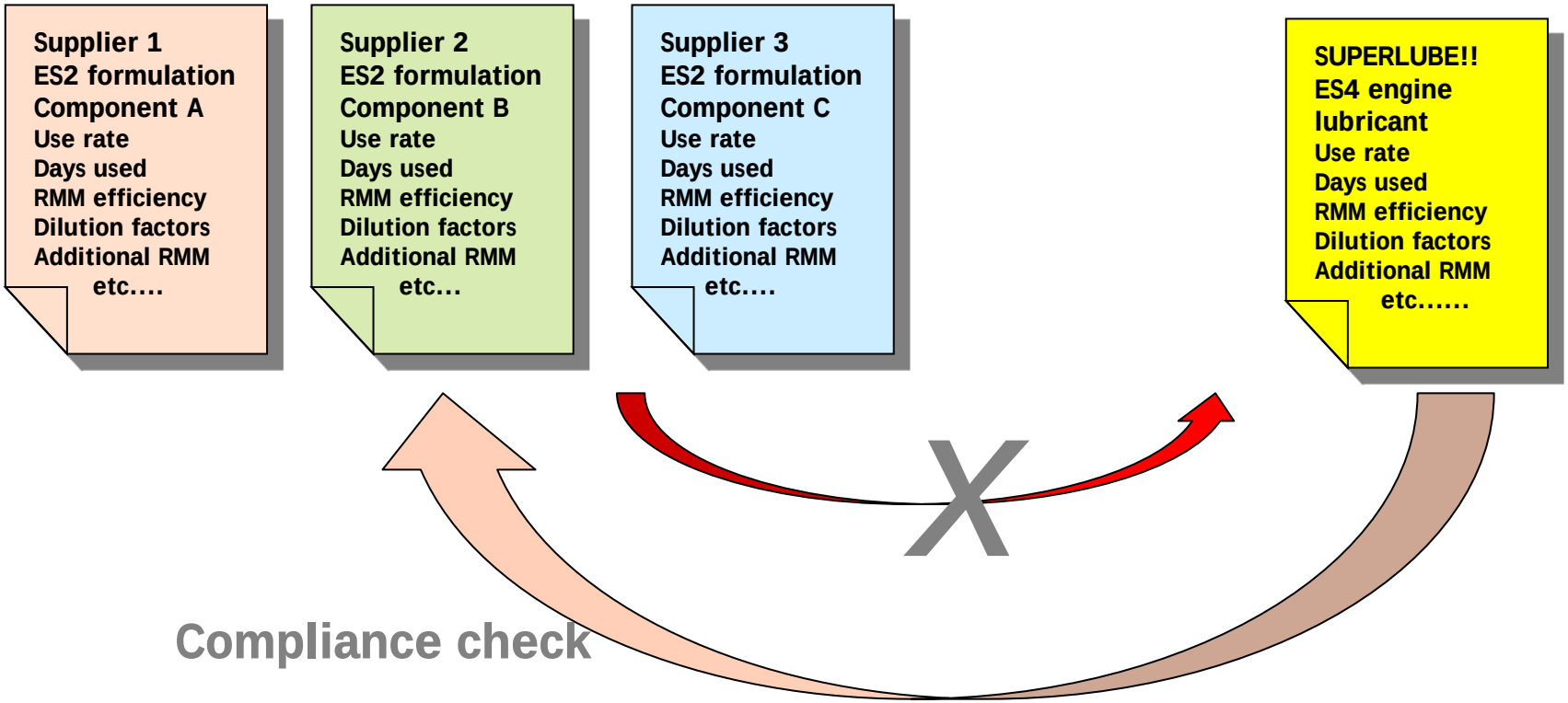
  Industrial (~30%), professional (~65%), and consumer (~5%) use

  Totally closed to total loss; point use to wide dispersive

- **Supply chain :**



Options for communicating safe use information



Advantages of using GES approach

- Delivers clear, concise, consistent advice to DUs now
- Constrains the length of the ext-SDS to a manageable size
- GESs are inherently conservative but not unrealistic

Challenges faced when creating environmental GES for mixtures

- Needed to define conditions of safe use for a large number of components that have a wide range of hazard and physical-chemical properties
- The GES output we produced had to be used by non – (environmentally) technical formulators

Defining conditions of safe use

- Used knowledge of how phys-chem and hazard properties drive fate and effects to define ranges for: Log Kow, vapour pressure (VP), biodegradability, PNEC (fresh water)
- 40 different profiles created, identified by RDS code

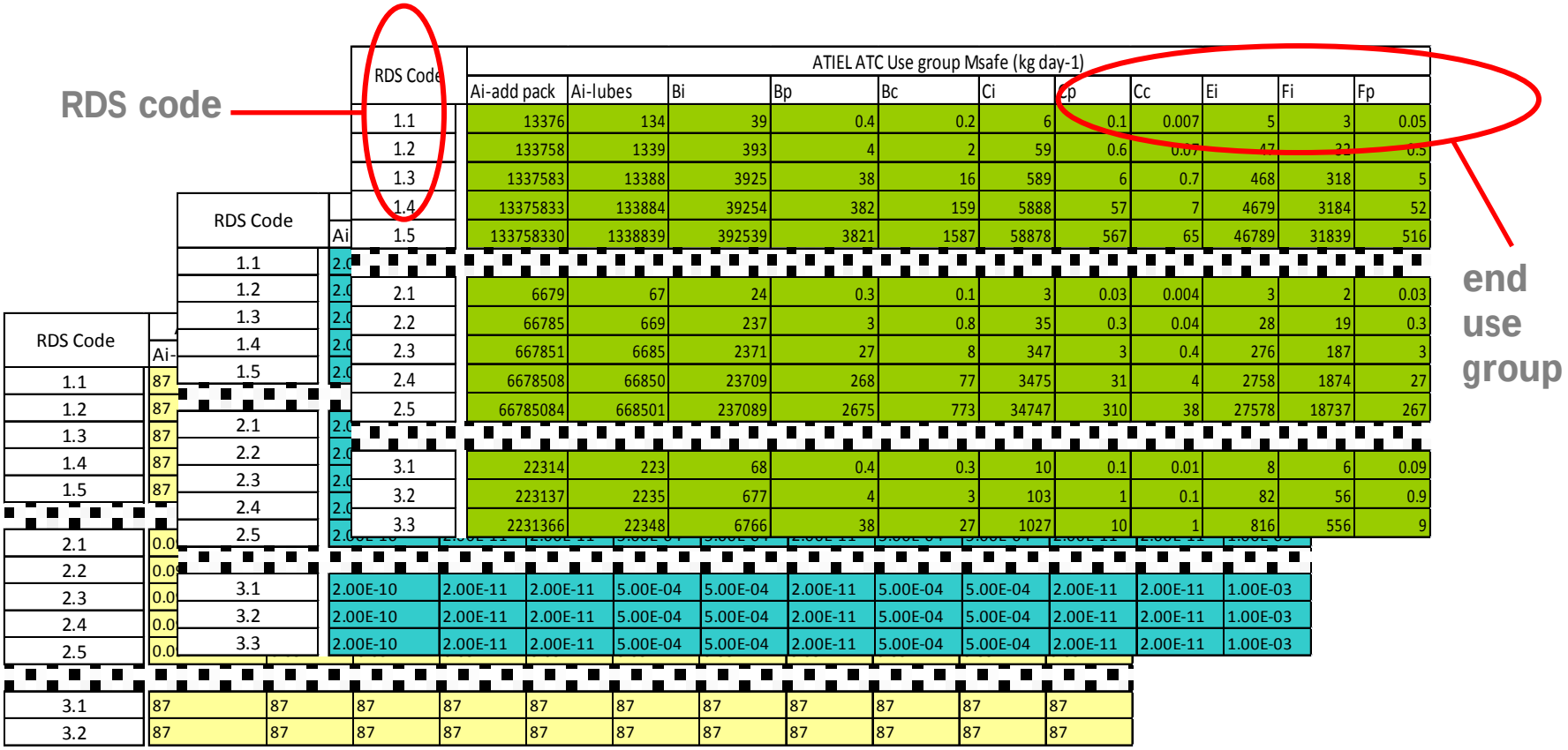
*RDS = Risk Determining Substance

RDS code assigned on basis of four substance characteristics				
Four substance parameters to determine RDS code				RDS Code
log Kow	VP (pa)	Biodegradability	PNEC mg/l	
<5	<1	Readily biodegradable	0.00001 ≤ - <0.0001	1.1
<5	<1	Readily biodegradable	0.0001 ≤ - <0.001	1.2
<5	<1	Readily biodegradable	0.001 ≤ - <0.01	1.3
<5	<1	Readily biodegradable	0.01 ≤ - <0.1	1.4
<5	<1	Readily biodegradable	0.1 ≤ - <1.0	1.5
<5	<1	Not biodegradable	0.00001≤ - <0.0001	2.1
<5	<1	Not biodegradable	0.0001≤ - <0.001	2.2
<5	<1	Not biodegradable	0.001≤ - <0.01	2.3
<5	<1	Not biodegradable	0.01≤ - <0.1	2.4
<5	<1	Not biodegradable	0.1≤ - <1.0	2.5

- ECETOC TRA tool run for each profile using most conservative values within ranges and Atiel ATC specific environmental release fractions. Repeated for all downstream uses

Creating a practicable process

Compiled look up tables from ECETOC TRA inputs and outputs



Compiled GES template

Section 2.2	Control of environmental exposure
Amounts used	
EU tonnage (tonnes per year) [ATE09]	*insert value from Environmental GES values table*
Fraction of EU tonnage used in region [A1]	0.1
Fraction of Regional tonnage used locally [A3]	0.1
Frequency and duration of use	
Emission days (days/year) [FD4]	300
Environmental factors not influenced by risk management	
Local freshwater dilution factor [EF1]	10
Local marine water dilution factor [EF2]	100
Other given operational conditions affecting environmental exposure	
Negligible wastewater emissions as process operates without water contact. [OOC20]	
Release fraction to air from process (after typical onsite RMMs) [ATE11]	5.0 E-05
Release fraction to wastewater from process (after typical onsite RMMs and before (municipal) sewage treatment plant): [ATE12]	*insert value from Environmental GES values table*
Release fraction to soil from process (after typical onsite RMMs): [ATE13]	0
Technical conditions and measures at process level (source) to prevent release	
Common practices vary across sites thus conservative process release estimates used [TCS1]	
Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil	
Treat air emission to provide a typical removal efficiency of (%):	70
Prevent discharge of undissolved substance to or recover from onsite wastewater. [TCR14]	
User sites are assumed to be provided with oil/water separators or equivalent and for waste water to be discharged via public sewer system. [ATE14]	
Organisational measures to prevent/limit release from site	
Do not apply industrial sludge to natural soils [OMS2].	
Sludge should be incinerated, contained or reclaimed [OMS3].	
Conditions and measures related to municipal sewage treatment plant	
Estimated substance removal from wastewater via domestic sewage treatment (%) - F_{STP} [STP3]	*insert value from Environmental GES values table*
Assumed domestic sewage treatment plant flow (m^3/d) [STP5]	2.00E+03
Maximum allowable site quantity (MSafe) based on OCs and RMMs as above (kg/day): [ATE15]	*insert value from Environmental GES values table*
Conditions and measures related to external treatment of waste for disposal	
External treatment and disposal of waste should comply with applicable local and/or national regulations. [ETW3].	
Conditions and measures related to external recovery of waste	
External recovery and recycling of waste should comply with applicable local and/or national regulations. [ERW1]	

Pre-filled fields

Data from look-up tables

Formulator carries out following steps

- ✓ Assigns RDS code to classified components in mixture according to component properties
- ✓ Extracts safe tonnage values from relevant Atiel ATC table
- ✓ Identifies RDS of mixture by taking component with lowest safe tonnage
- ✓ Compiles product ES based on this RDS, accounting for RDS concentration
- ✓ Checks GES values against supplier ES (if available) to ensure that GES communicates conditions that are at least as protective as the supplier ES.
- ➢ Process, tables etc are provided on Atiel website

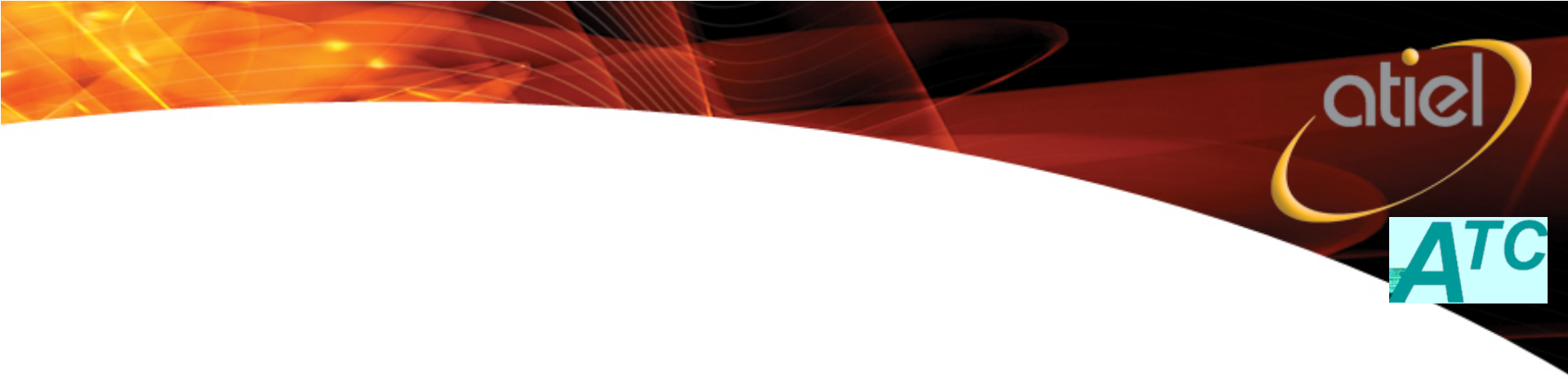
Is this approach suitable for other industry sectors?

Features of the Lubricant Industry Sector that facilitated GES approach

- Short supply chain
- Reasonably well-defined and structured sector
- Limited number of manufacturers and major formulators
- Formulations oriented towards a limited number of specific end uses
- Stable formulations; not a high rate of change; not a trend for more hazardous mixtures over time
- Had a working group that committed a lot of time and effort into generating a GES process!!

Conclusions

- We have created a process for compiling GES for the environment
- Process can accommodate a wide range of components and formulations
- With guidance, the process may be used by non-technical personnel
- The process may be applicable to other sectors of industry



Thank you for your attention !

Backup

Atiel ATC environmentally classified substance table

Substance Name	CAS #	EC #	DSD Classification	GHS classification (optional)	Parameter values as input to RDS code				RDS code
					log Kow	VP (pa)	Biodegradability	PNEC FW aqua mg/l	
1,2,4-trimethylbenzene	95-63-6		R10-20-36/37/38-51/53		3.63	300	readily biodegradable	0.12	3.5
1H-Imidazole-1-ethanol, 2-(8-heptadecenyl)-	95-38-5	202-414-9	R50/53	Chronic 1 M fac	7.5	0.000000026	not biodegradable	0.00003	6.1
2,6-ditert-butyl-p-cresol (R50/53) - (Global)	128-37-0	204-881-4	N; R50/53		5.0 - 5.2	0.39	not biodegradable	0.000199	6.2
2,6-di-tert-butylphenol / butylated phenol	128-39-2	204-884-0	R50/53	Chronic 1	4.48	0.938	not biodegradable	0.00045	2.2
2,6-di-tert-butylphenol / butylated phenol	128-39-2		R50/53		4.48	0.938	not biodegradable	0.011	2.4
2-Ethylhexyl nitrate	27247-96-7		R51/53		5.24	27	not biodegradable	0.0008	8.2
2-ethylhexyl zinc dithiophosphate : see also 7	4259-15-8	224-235-5	R51/53	Chronic 2	3.59	0.00042	not biodegradable	0.004	2.3
7A-Ethyldihydro-1H,3H,5H-oxazolo[3,4-C]oxa	7747-35-5		R50/53; 51/53; 52/53; 50		-0.32	60.6	not biodegradable	0.0513	4.4
Alkaryl amine	68411-46-1	270-128-1	R52/53	Chronic 3	>6	<0.01	readily biodegradable	0.051	5.3
Alkoxylated alkylamine	25307-17-9 or 61	791-44-4	R22-34-50 (M factor 10)		3.4	0.0012	readily biodegradable	0.000214	1.2
Alkyl methacrylate (as impurity)	97-86-9		R10-36/37/38-43-50		2.95	211	readily biodegradable	0.21	3.5
Alkyl phenol (as impurity)	121158-58-5		R38-50/53-62		6.1	0.011	not biodegradable	0.000074	6.1
Alkyl phenol (as impurity)	25154-52-3+84852-15-3		R22-34-50/53-62-63		5.4	10	not biodegradable	0.000614	8.2
Alkyl phenol (R38, R62, R50/53 <0.1mg/l)	74499-35-7 / 121	310-154-3	Repr. Cat. 3; R62 i; R38 ; R5(		7.14	0.01	not biodegradable	0.000074	6.1

Creation of Specific Environmental Release Factors (SpERCs)

- Initial assessments using standard environmental release factors (ERCs) showed that these were too conservative for our industrial uses
- Using combination of information from Emission Scenario Document (ESD) and emission data from members sites
- Result -Atiel /ATC SpERC many orders of magnitude lower than ERC – considered to be more realistic

GES information within Atiel

- http://www.atiel.org/reach/introduction

Options for communicating information on mixtures

• Append supplier ESs to own product SDS	X	*Resulting document cumbersome and complex*
• Consolidate information into own mixture ES	X	*Can be difficult to do. Have to wait for all information*
• Incorporate information into body of SDS	X / √	*Approach used for unclassified products*
• Create GES	√	*Approach used for classified products*