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Selecting the right diluent

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Dr. Lim Wen Pei

ExxonMobil Chemical Asia Pacific

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Abstract

Diluent is a key component in the solvent extraction process. In selecting the optimal diluent for a mining operation it is important to consider the **technical performance** as well as the potential **safety** (health, flammability) and **environmental risks** associated with the diluent. A good understanding of the chemistry and physical properties of the diluent enables a good control of fire hazards and a safe environment while potentially reducing diluent consumption.

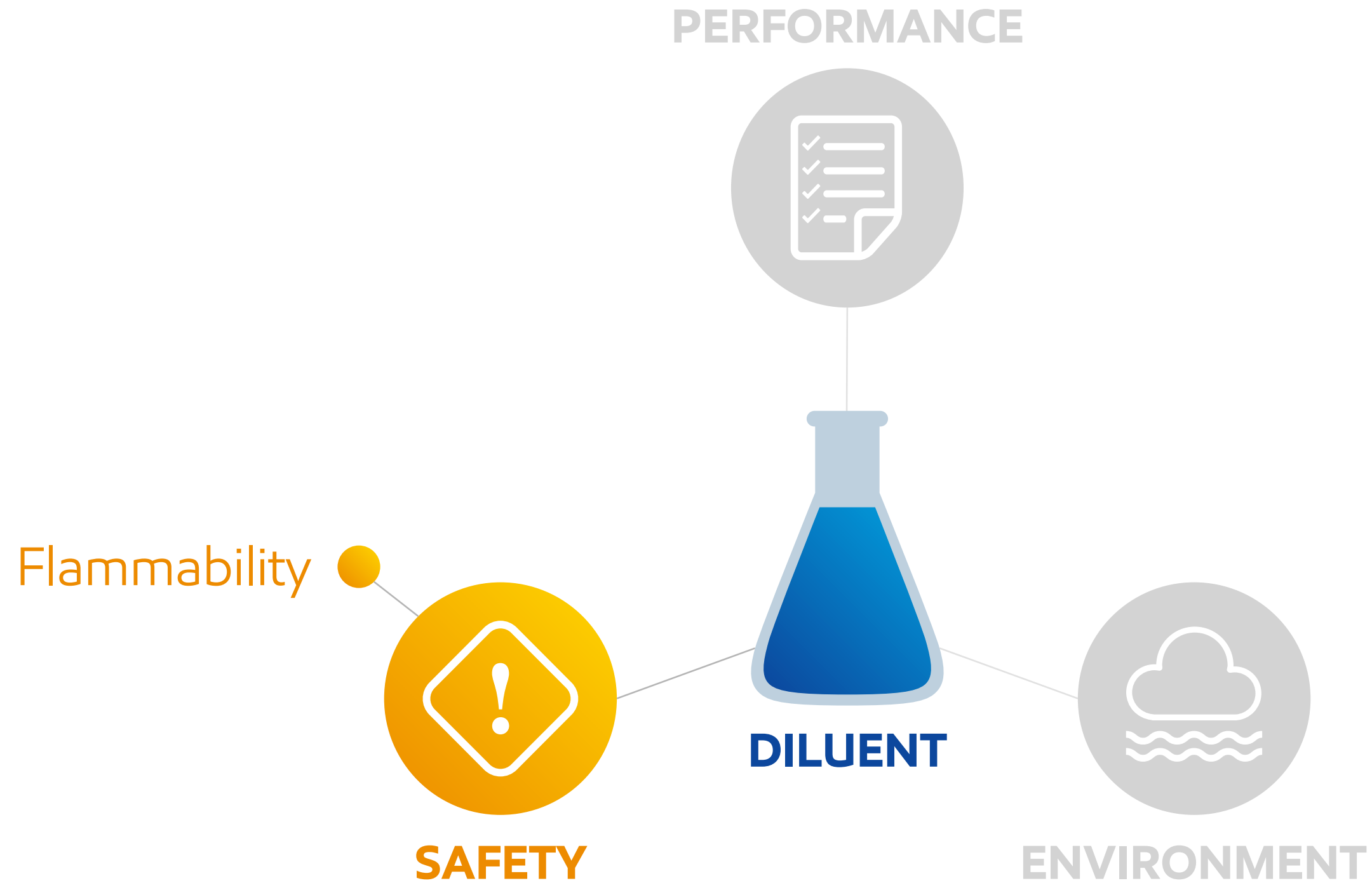
The presentation is intended to give insights on the different ways to measure flammability and workers exposure, and will demonstrate how, by means of appropriate diluent selection, the concerns about diluents can be addressed **without the need to compromise its performance.**

Keywords: Solvent extraction, diluent, flammability, workers' exposure, safety, environment, sustainability

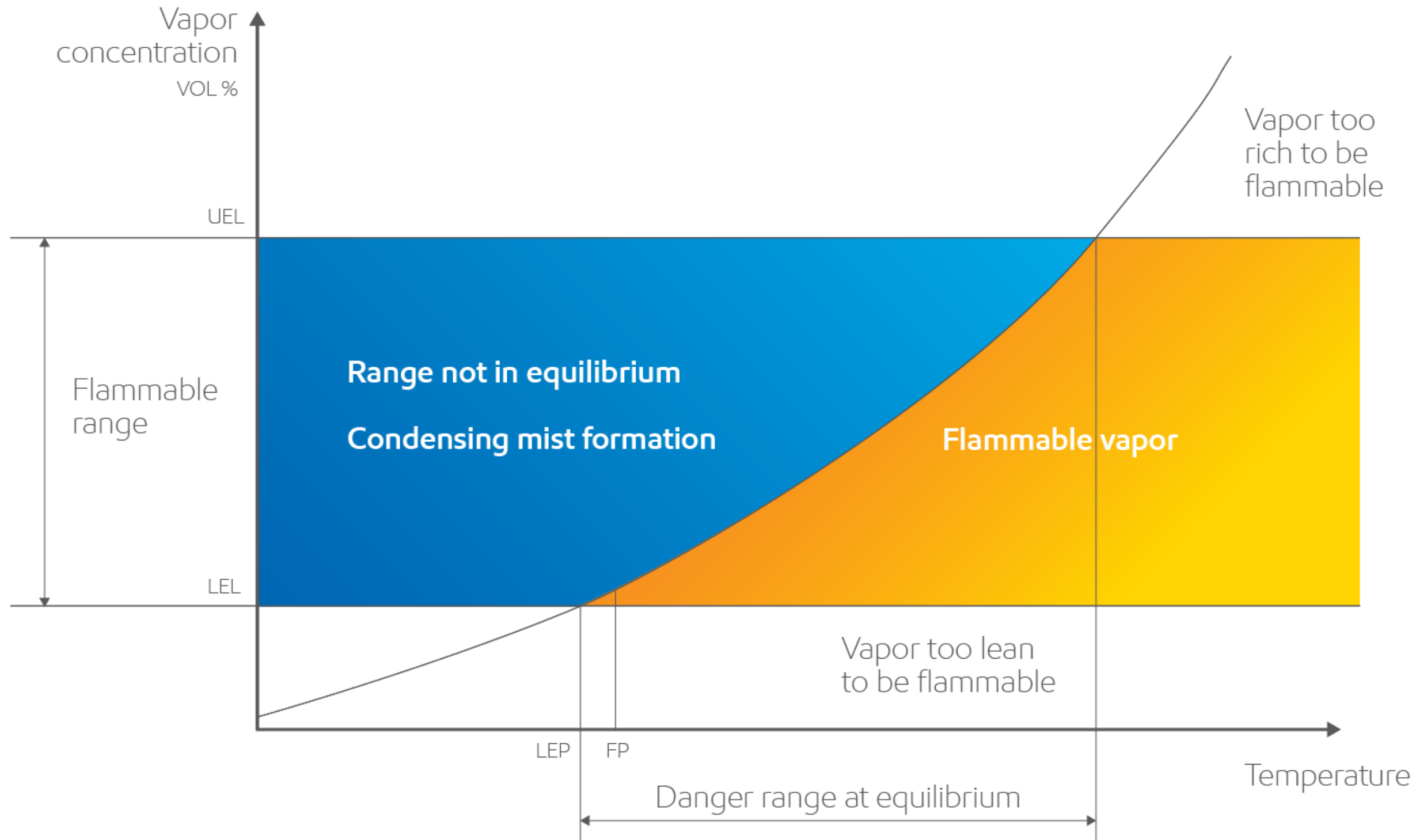
Is my diluent selection optimized?



Improved worker safety – flammability

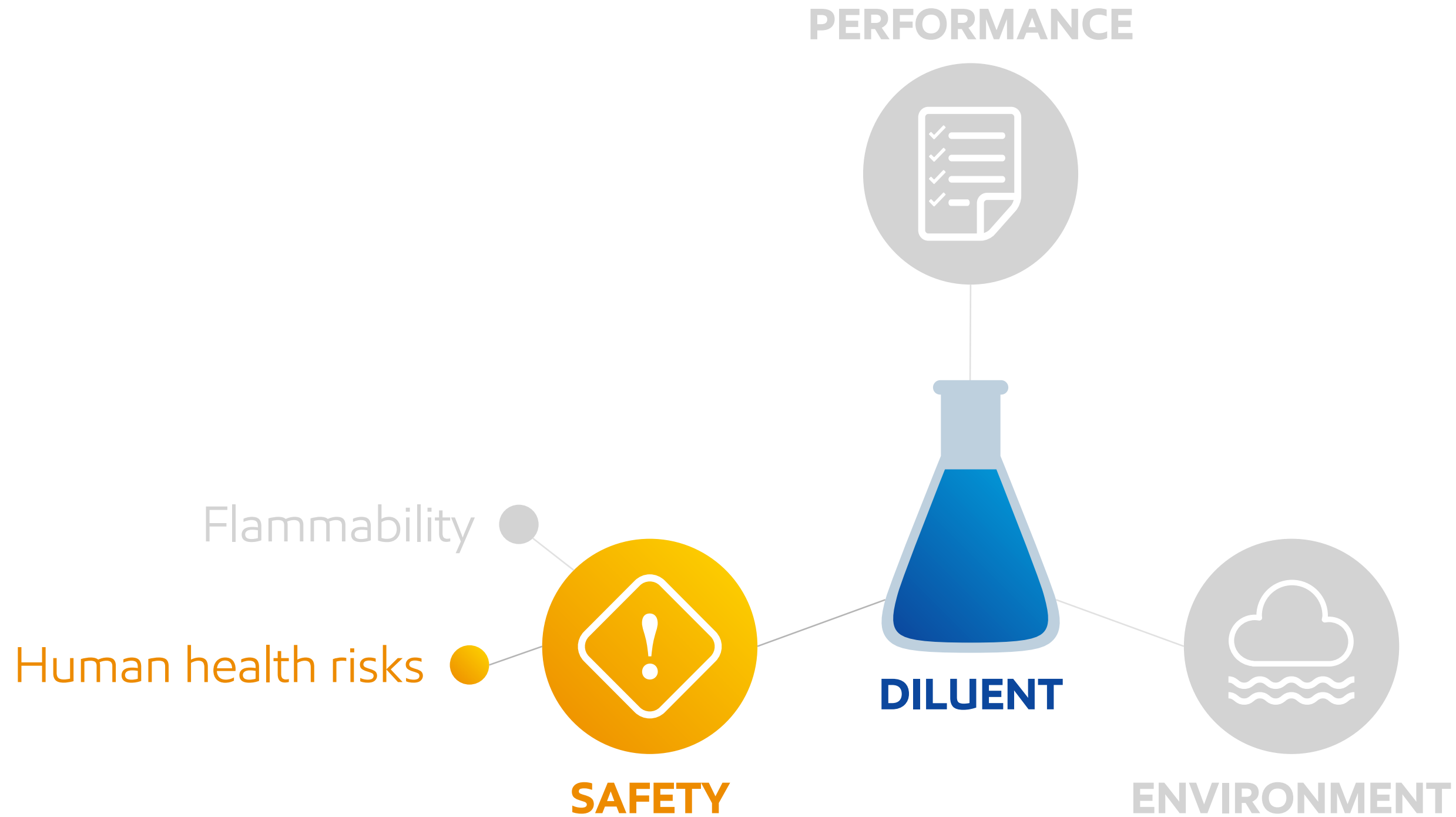


Reduced fire risk



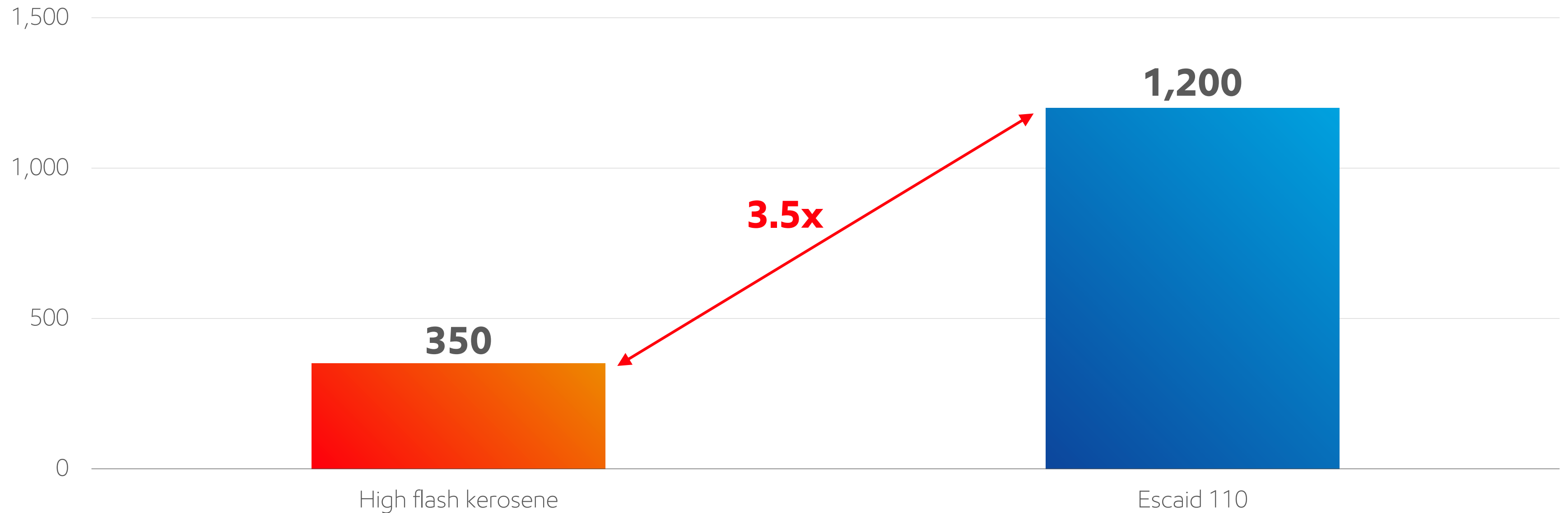
Product	Flash point (°C) [ASTM D93]	Distillation range (°C) [ASTM D86]
Escaid 110	81	206 – 238
Escaid 115	96	225 – 256
Escaid 120	103	236 – 265
Escaid 120 ULA	103	236 - 264

Improved worker safety – exposure



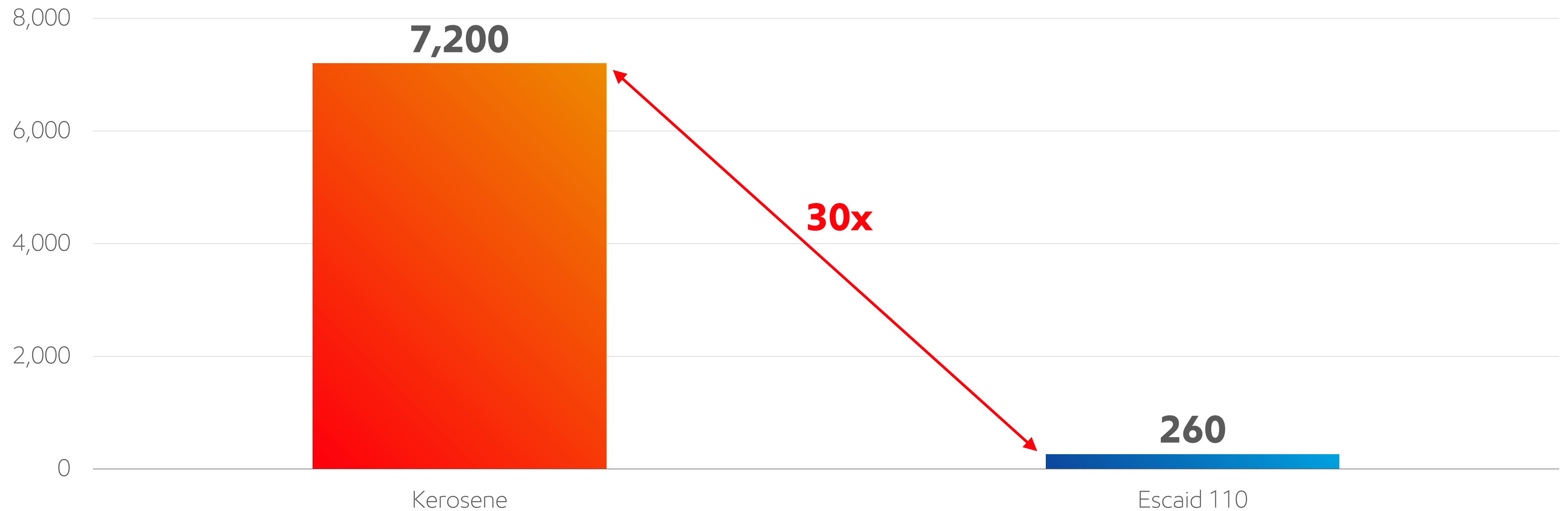
Lower risk of worker overexposure

Occupational Exposure Limits (OEL) (mg/m³)



Increased worker comfort

Relative odor detection limits (ED50)



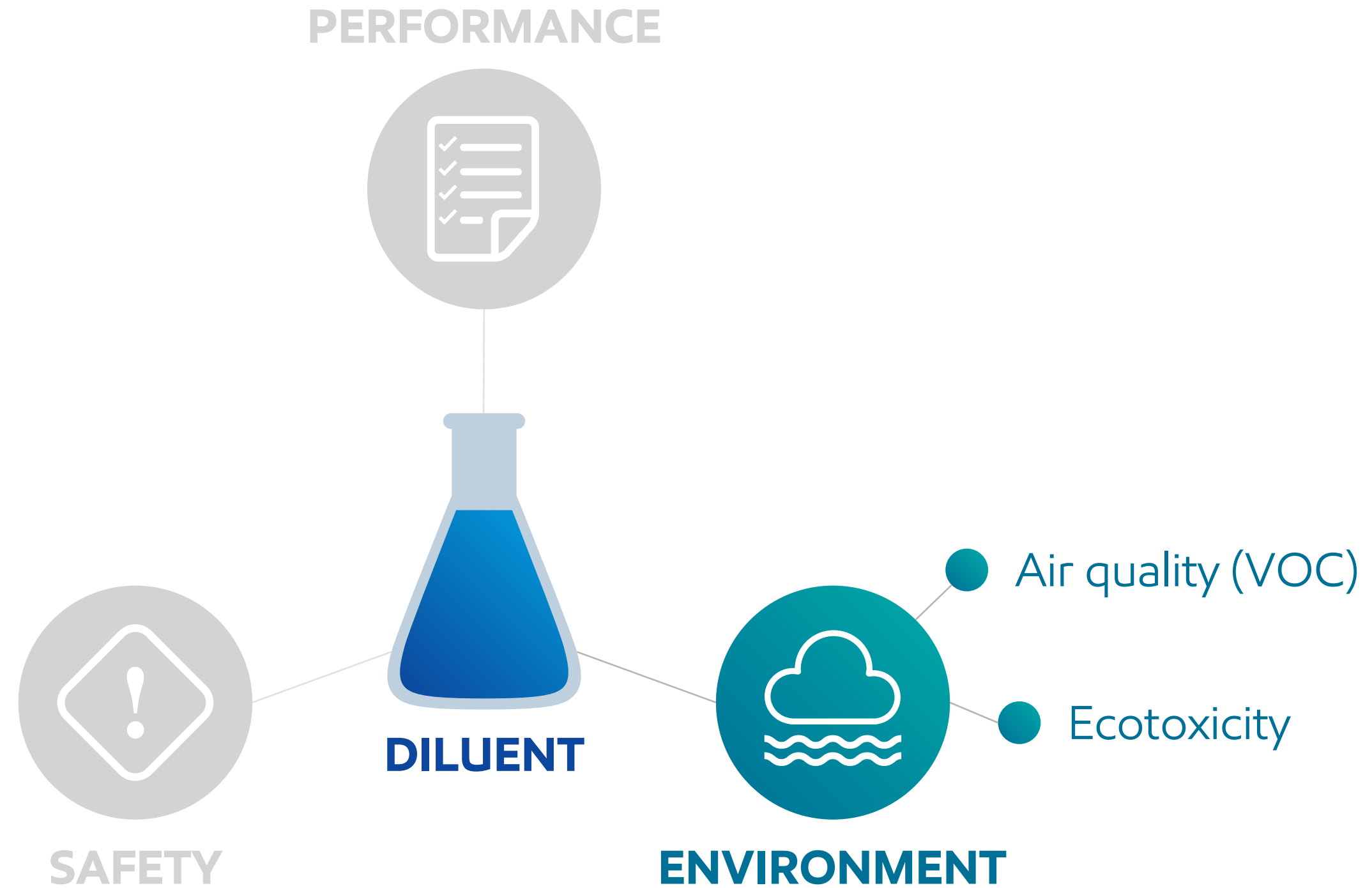
Central Research Institute in Oslo

Lower worker health risk

Property	Escaid™ 110 (typical)	High flash kerosene (typical)
GHS hazard categories (health)	Aspiration Tox 1	Carcinogen 2* Aspiration Tox 1
Naphthalene content [GC]	< 1 ppm	< 10 %

* Suspected of causing cancer.

Lower environmental impact

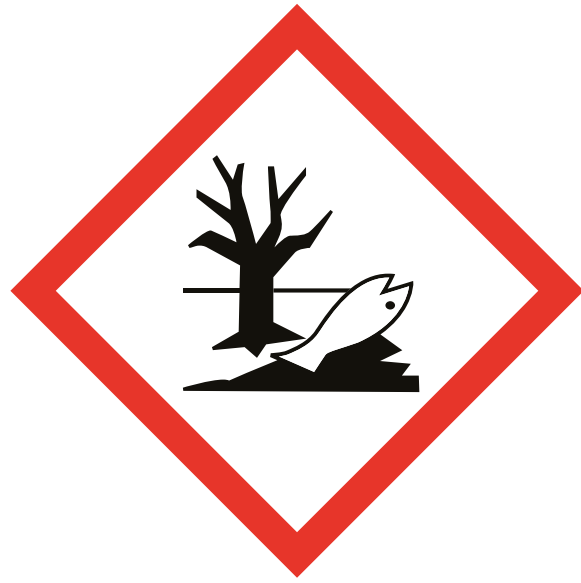


Lower ecotoxicity

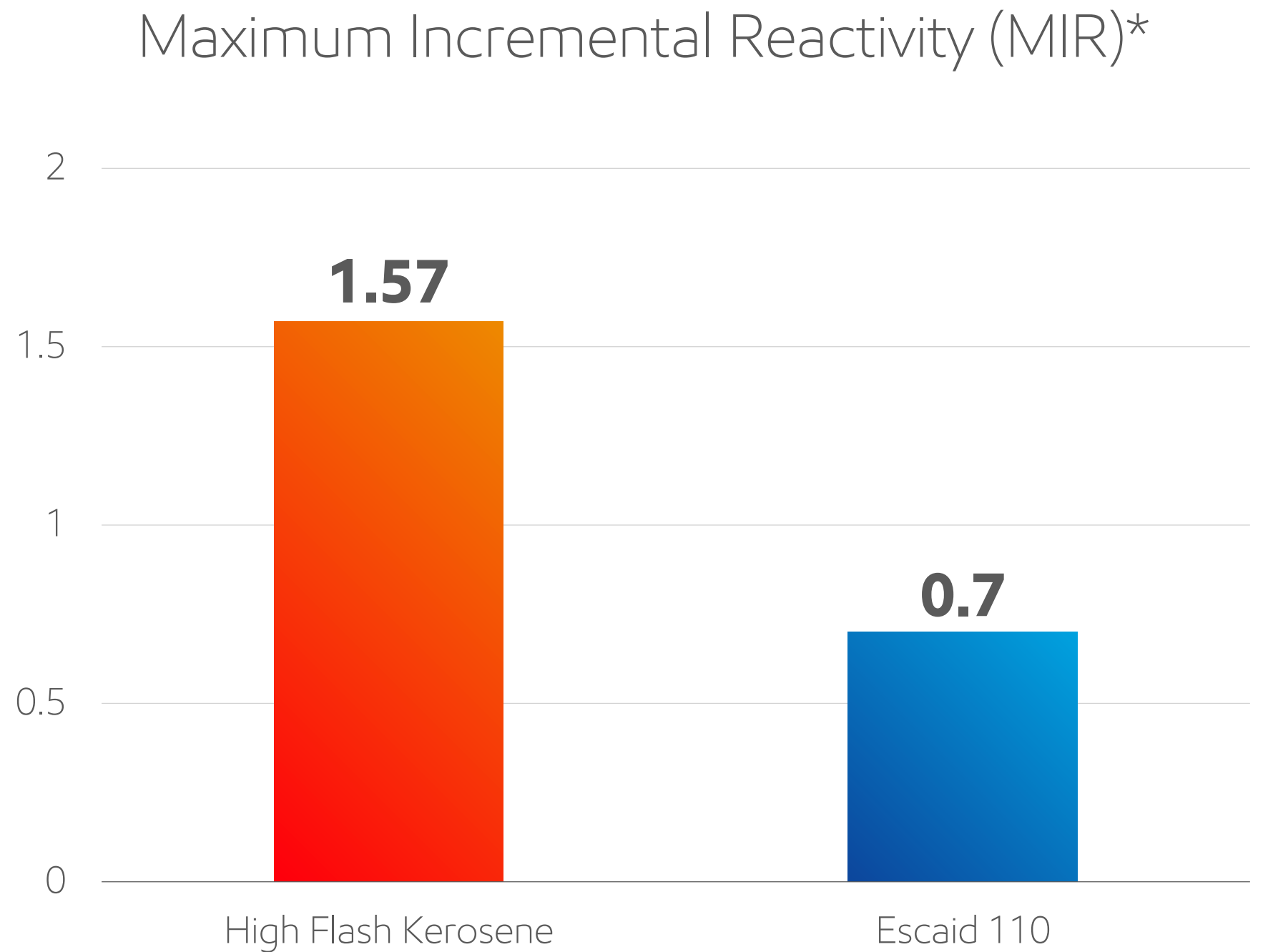


- Escaid not classified for environment (GHS); kerosene GHS classified aquatic chronic 3

Lower ecotoxicity, lower ozone creation

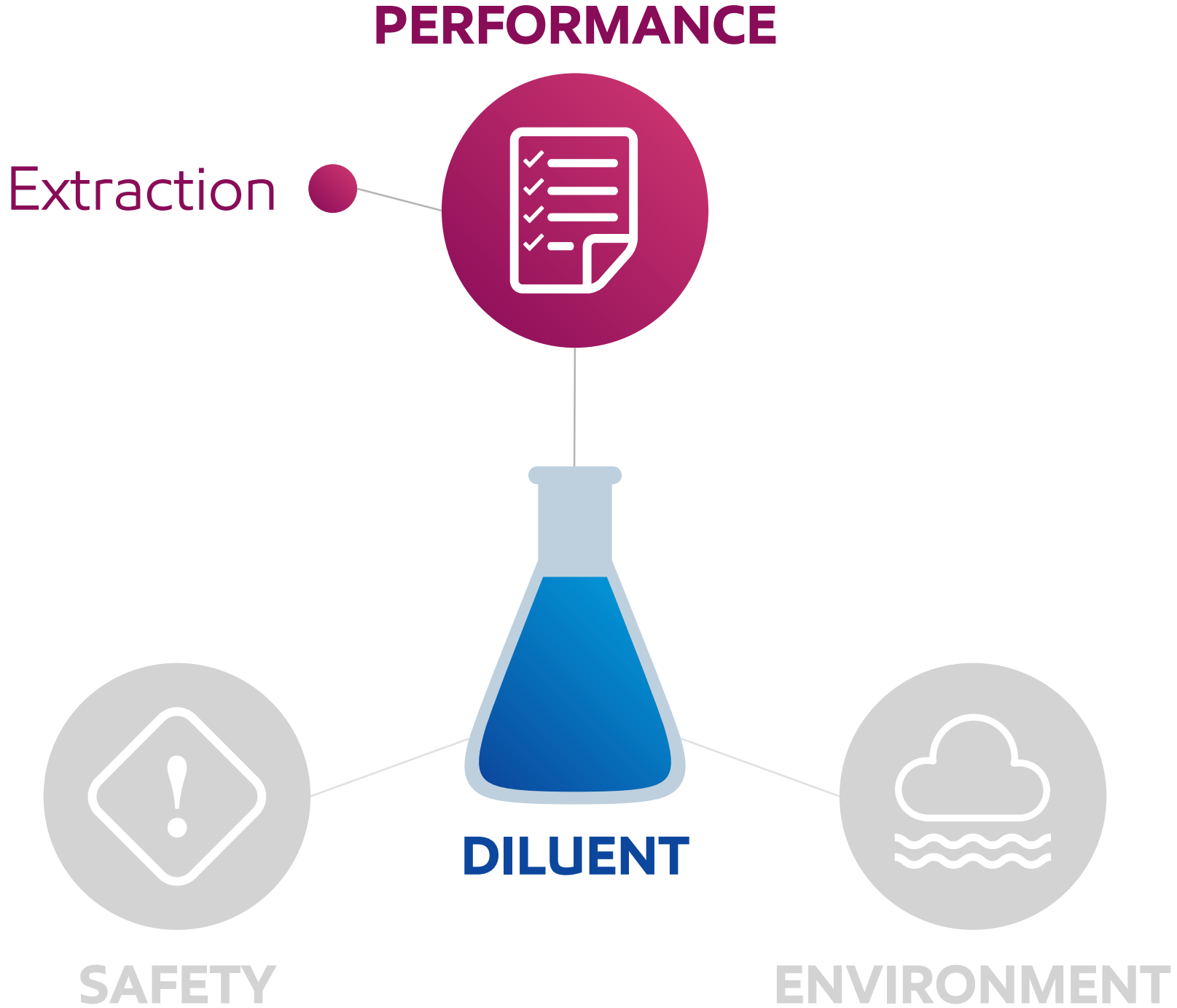


- Escaid not classified for environment (GHS); kerosene GHS classified aquatic chronic 3
- Lower ozone creation potential



*Grams of ozone formed/gram of VOC emitted (California Air Resources Board)

Optimizing performance

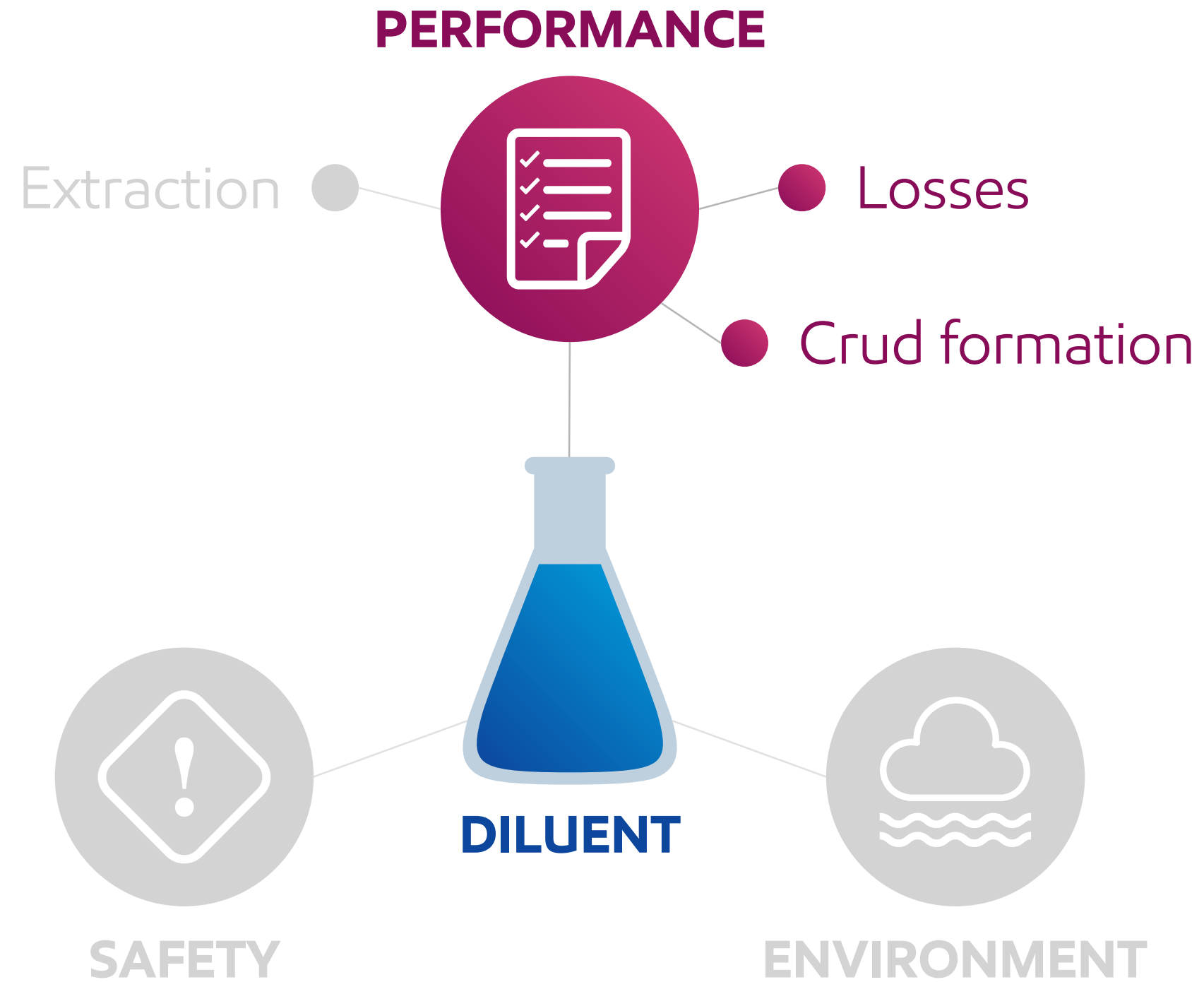


High extraction performance

Extraction kinetics ¹	Escaid™ 110	High Flash Kerosene
Average phase separation time (s) aqueous continuous / organic continuous	26 sec. / 26 sec.	25 sec. / 30 sec.
Average extraction efficiency (%) 15 s / 30 s	93% / 97%	92% / 96%
Cu maximum loading (g/L)	13.76 g/L	13.59 g/L

¹Lab tests conducted at Saybolt Laboratories with 50/50 aqueous/organic phase ratios on: PLS 1 | 27 wt% Acorga™M5774, PLS 2 | 22 wt% Acorga™M5774, PLS 3 | 10 wt% Acorga™M5774, PLS 4 : 20 wt% LIX™84 I

Optimizing performance



Lower losses, lower costs

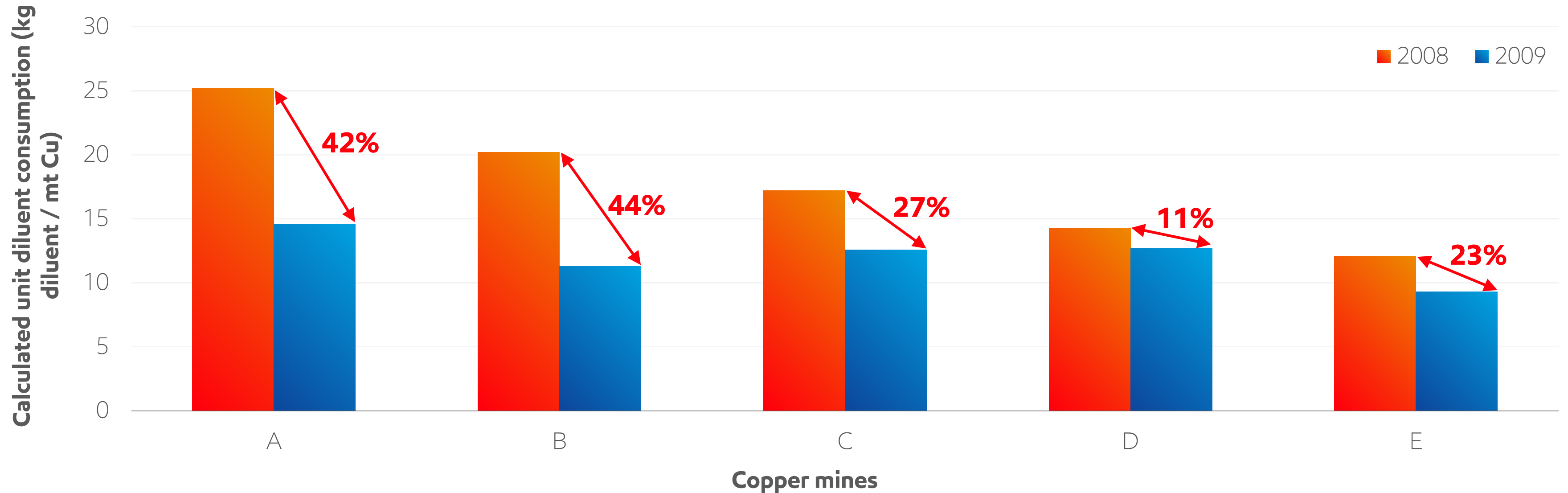
Property	Escaid™ 110 (typical / single test*)	High flash kero (typical / single test*)
Distillation range (°C) [ASTM D86]	206 – 238	204 – 240
Aromatics (wt%) [UV]	0.01	25
Density at 15°C (kg/dm ³) [ASTM D4052]	0.794	0.818
Kinematic viscosity @ 25°C (cSt) [ASTM D445]	2.1	2.1
Entrainment loss ¹ – concentration of organic phase in aqueous phase (mg/l)	31*	43*
Crud formation – Ratio of total volume sludge / total volume organic	0.040*	0.085*

¹Trace organic fluid (15% LIX 984 N PLS 5 with pH=1.83) in aqueous phase measured via molecular absorption spectrophotometry following contact with the organic phase (O/A=1) and subsequent extraction with cyclohexane
²By solvent evaporation weight test. Escaid 110 diluent exhibit lower weight loss % compared to high flash kerosene

Lower diluent consumption with Escaid 110


Mines A and B upgraded from high flash kerosene (25% aromatics) to Escaid 110 diluent

Mines C, D and E upgraded from high flash kerosene (13% aromatics) to Escaid 110 diluent



Regional presence



-  Key Fluids Site
-  Manufacturing Site

Reliable global supply



Escaid in world's largest mining/SX operations



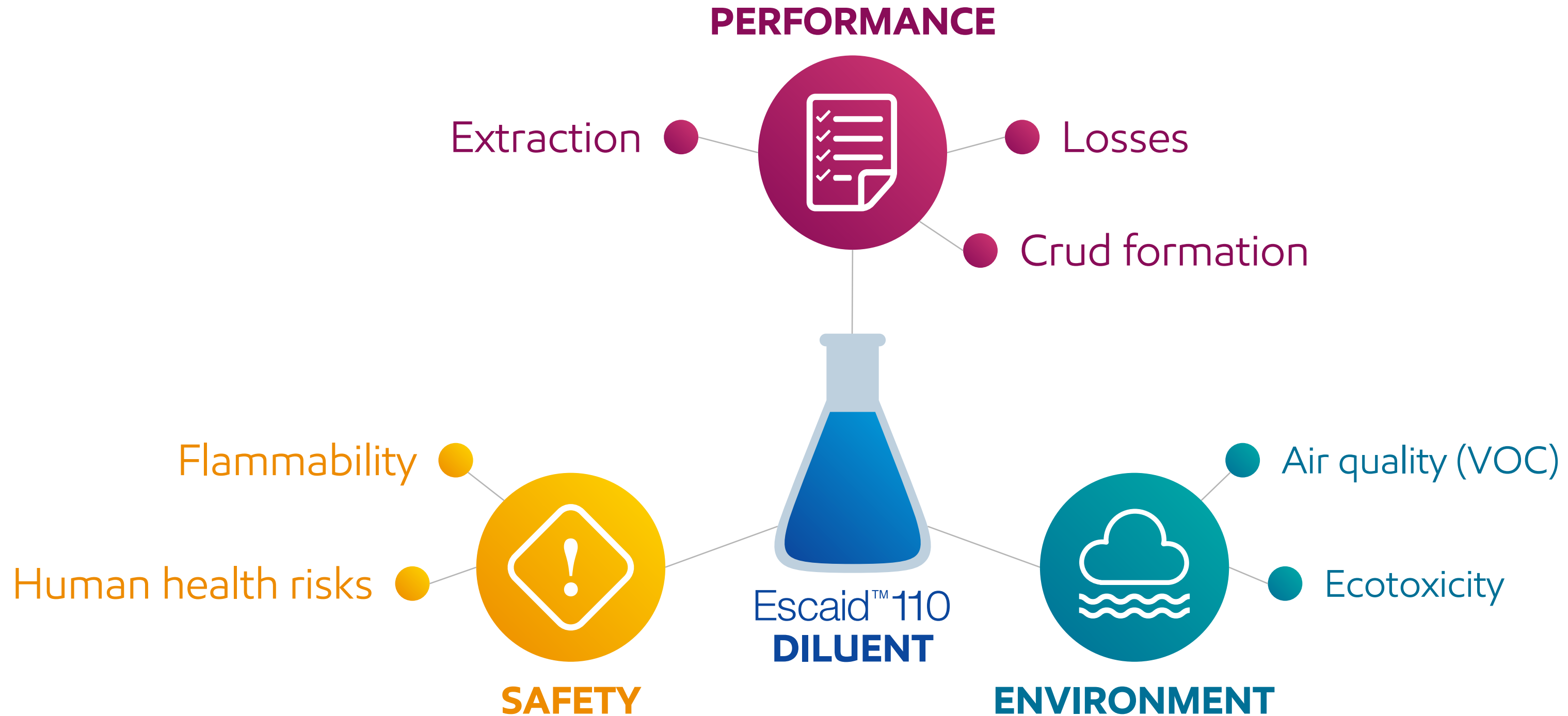
Escaid 110 diluent: Meeting evolving needs



Escaid 110 diluent: Meeting evolving needs



Escaid 110 diluent: Meeting evolving needs



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