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Total Quality. Assured.

Sustainable Aviation Fuel Overview

Liam Mills

Sustainable Hydrocarbon Specialist

WE ARE POSITIONED GLOBALLY TO DELIVER SOLUTIONS

46,000+ EMPLOYEES

GLOBAL MARKET
LEADER IN ASSURANCE

12,000+ AUDITORS,
INSPECTORS, TECHNICAL PERSONNEL

340,000+ INSPECTIONS
AND OTHER TECHNICAL VISITS / YEAR

100+ COUNTRIES

GLOBAL MARKET
LEADER IN TIC

1,000+ LABS & OFFICES

80+ LANGUAGES

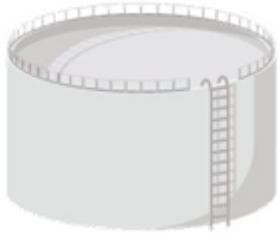
Systemic approach to Quality and Safety

ASSURANCE | TESTING | INSPECTION | intertek CERTIFICATION

Our Sectors

Products | Trade | Resources

Terminology

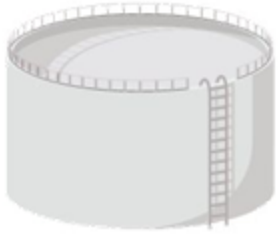


Technical Specifications

SBC

Synthetic Blend Component

As defined by ASTM D7566 Annexes

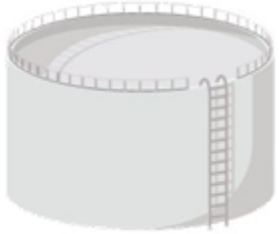


Technical Specifications

Jet Fuel

Fossil Derived Kerosene

As defined by DEFSTAN 91-091 / ASTM D1655



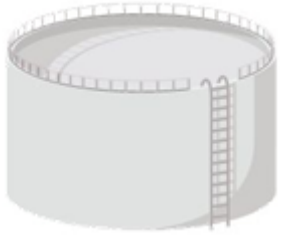
SSJF

Semi-synthetic Jet Fuel

As defined by ASTM D7566 (Table 1) / DEFSTAN 91-091 / ASTM D1655

Terminology

Certification / Regulation

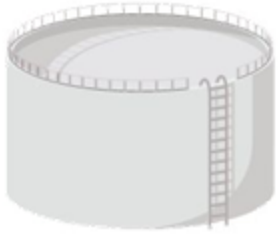


Technical Specifications

SBC

Synthetic Blend Component

As defined by ASTM D7566 Annexes



Technical Specifications

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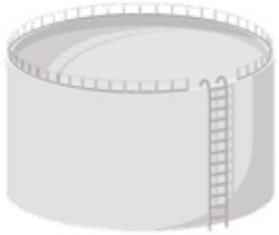


SATF

Sustainable Aviation Turbine Fuel

As defined by:

ASTM D7566 (Table 1) / DEFSTAN 91-091 / ASTM D1655
EU RED II(I) / UK RTFO / ICAO CORSIA

Approved Pathways (D7566)

	Feedstocks from waste produced CO2			Feedstocks derived from waste edible oils, fats and greases					Feedstocks derived from crops or biomass	
Feedstock	Direct Air Capture or Waste CO_2 and renewable power. Waste CO_2 from municipal solid waste or agricultural waste / waste wood			Vegetable and waste oils (fats, oils, greases and used cooking oil)			Already processed HEFA	Botryococcus braunii species of algae	Ethanol, isobutanol and isobutene from sugars and other sources.	C2 – C5 alcohols derived from sugars and other sources.
Common Name	FT-SPK	Co-Processed FT	FT-SPK/A	**HEFA SPK**	**Co-Processed HEFA**	CHJ	Co-Processed Hydroprocessed HEFA	HC-HEFA SPK	ATJ-SPK	ATJ-SKA
ASTM Annex	A1 (D7566)	A1.2.2.2 (D1655)	A4 (D7566)	**A2 (D7566)**	**A1.2.2.1 (D1655)**	A6 (D7566)	A1.2.2.3 (D1655)	A7 (D7566)	A5 (D7566)	A8 (D7566)
Blending Limit (%vol)	50	5 (feed and product)	50	**50**	**5 (feed and product)**	50	24 (feed) 10 (product)	10	50	50

Co-Processing with Hydrotreating	Co-Processing with Hydrocracking
B.4.1.1.1 (DEFSTAN 91-091)	B.4.1.1.2 (DEFSTAN 91-091)
5 (feed and product)	30 (feed) 15 (product)

= Current Predominant Production

NOT ALL SATF IS THE SAME

1st Generation Corn Ethanol vs 2nd Generation Waste-Derived Ethanol

Both pathways will produce an acceptable ATJ SBC based on D7566.

But the EU and UK don't define 1st generation biofuels (those from feed crops) as sustainable due to the food vs fuel argument.

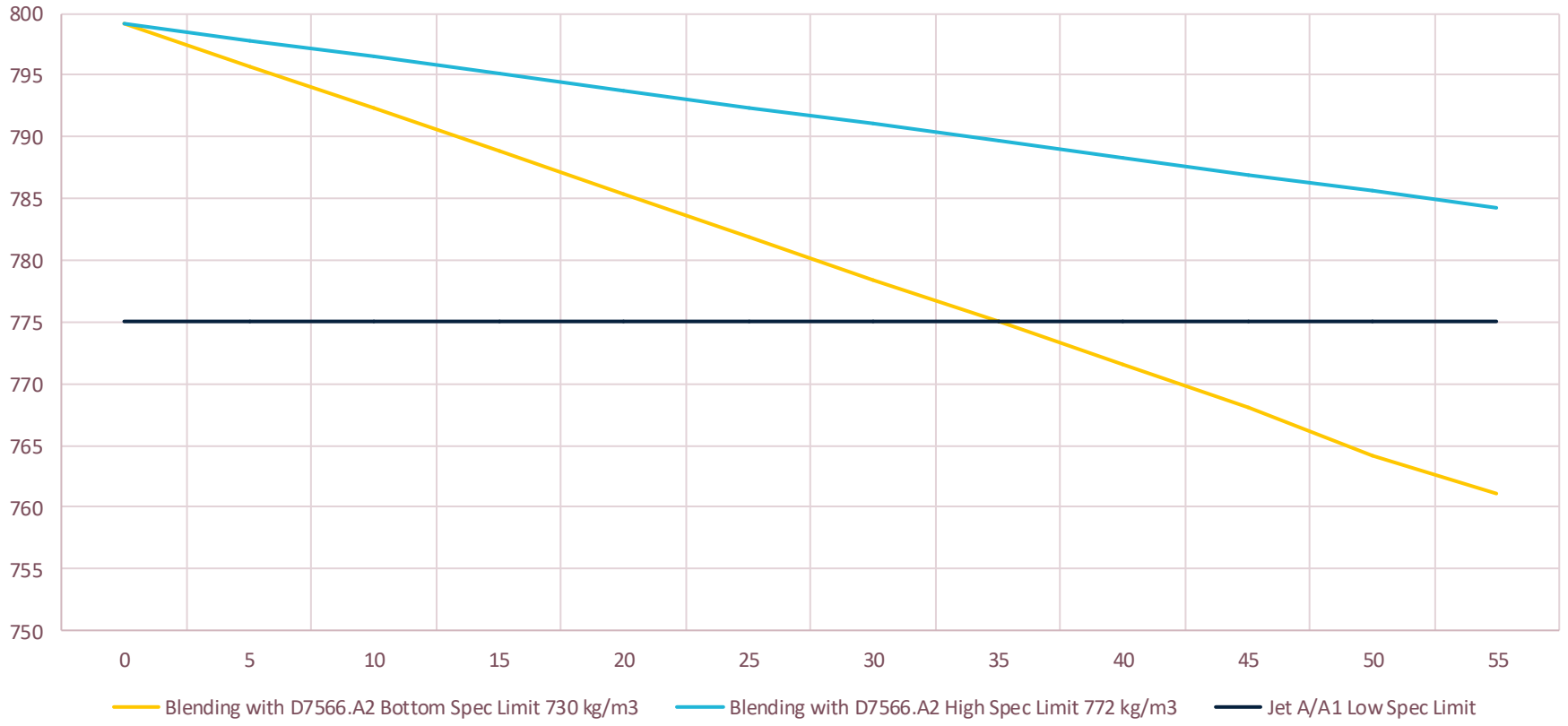
MANDATES

	UK	EU
2025 Volume	2% ✓ (Provisional Data Suggests 2.36%)	2% ✓
2030 Volume	10%	6%
Minimum GHG Saving	40%	65%
Feedstocks	• non-recyclable wastes or residues (e.g. used cooking oil or forestry residues) • recycled carbon fuels (RCFs) (e.g. unrecyclable plastics) • PtL fuels made using low carbon (renewable or nuclear) electricity	All biofuels which qualify for sustainability and greenhouse gas criteria in the RED II (Articles 29 and 30), except for those produced from food and feed crops as defined in the RED II
Certification Scheme (Geographic)	ISCC EU *SAF can be counted as zero emission under RTFO* *Carbon certs can be traded as UK ETS*	ISCC EU *SAF can be counted as zero emission under RED II* *Carbon certs can be traded as EU ETS (or CH ETS for Switzerland)*
Certification Scheme (End User)	ISCC EU or CORSIA Airlines are bound by the ETS and CORSIA regulation to reduce emissions – need CORSIA approved fuels	

D7566 Blending

Potential properties to limit blending:

- Density
- Aromatics
- Distillation
- Viscosity -20°C and -40°C
- Freezing Point



Guide

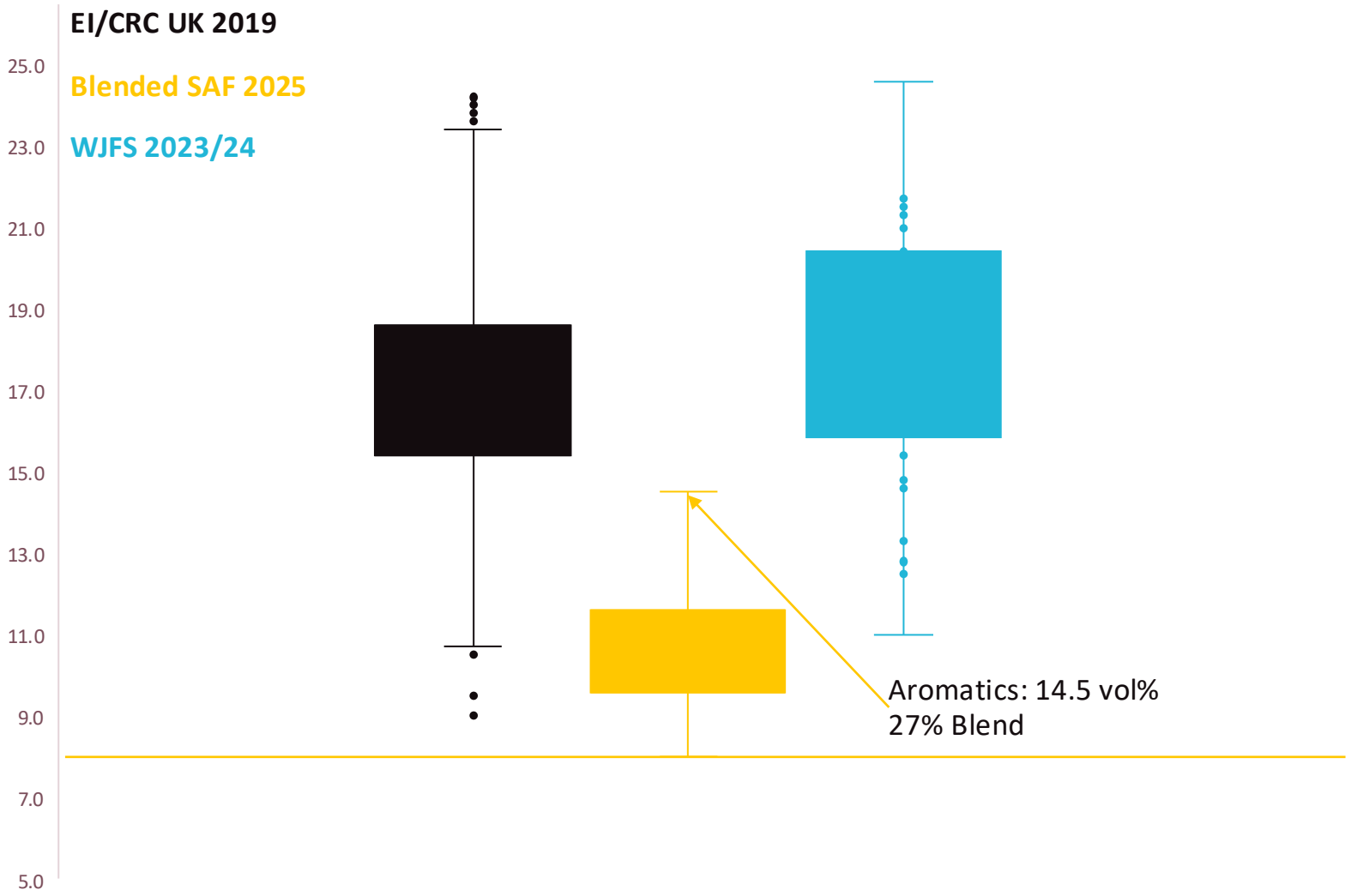
Data presented in **Black** is EI/CRC 2019 Jet A1 Data.

Data presented in **Yellow** is Blended SAF (ASTM D7566 Table 1) from 2025.

- Over 50 batches of Blended SAF from multiple sources across Europe
- Only specification data available.
- D7566 Annex data is not available.
- Conventional Jet Fuel conforms to DEFSTAN 91-091
- Does not include co-processed Jet

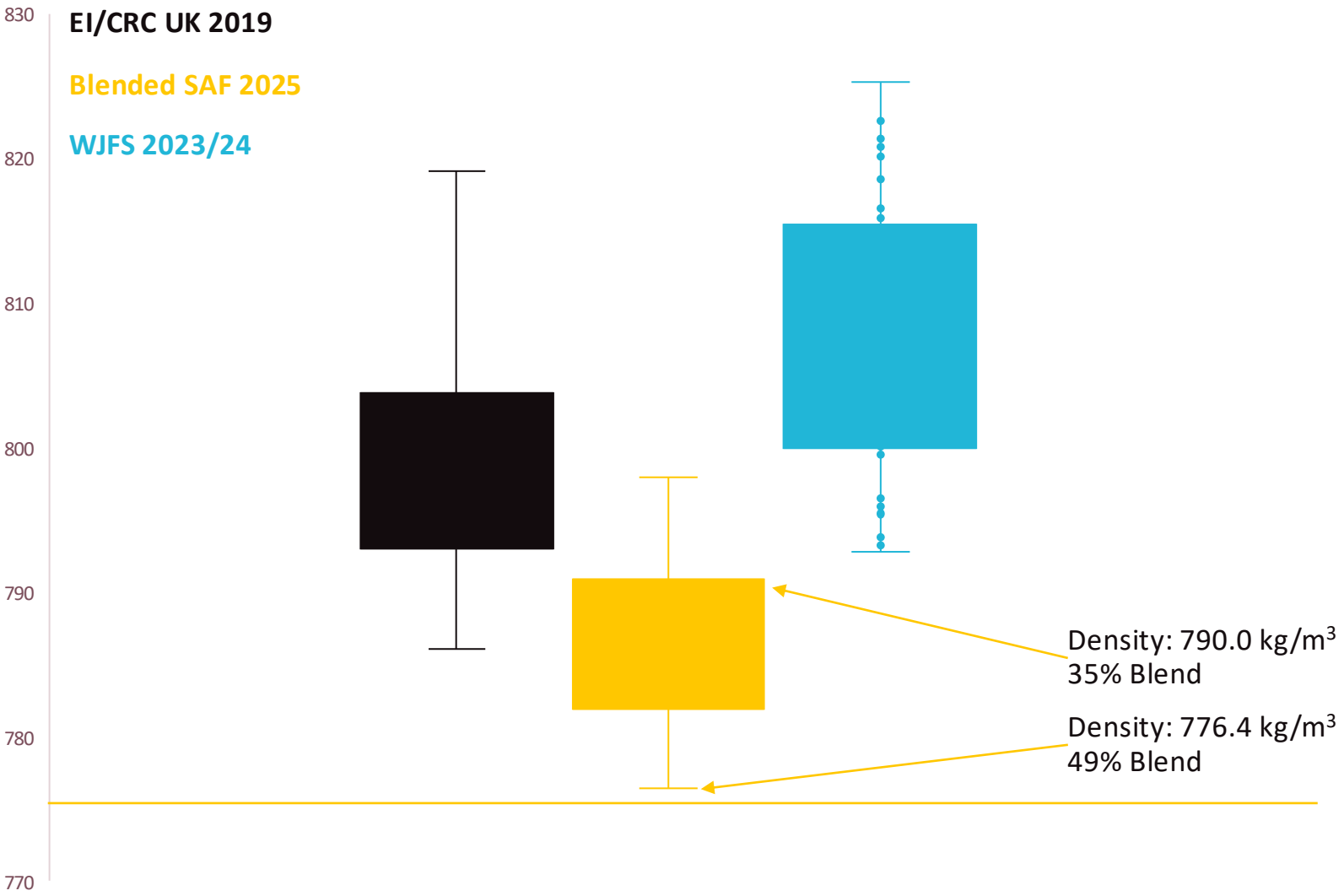
Data presented in **Blue** is WJFS 2023/2024 Data.

Aromatics



	% SAF Blend
Min	25
Average	36
Max	49

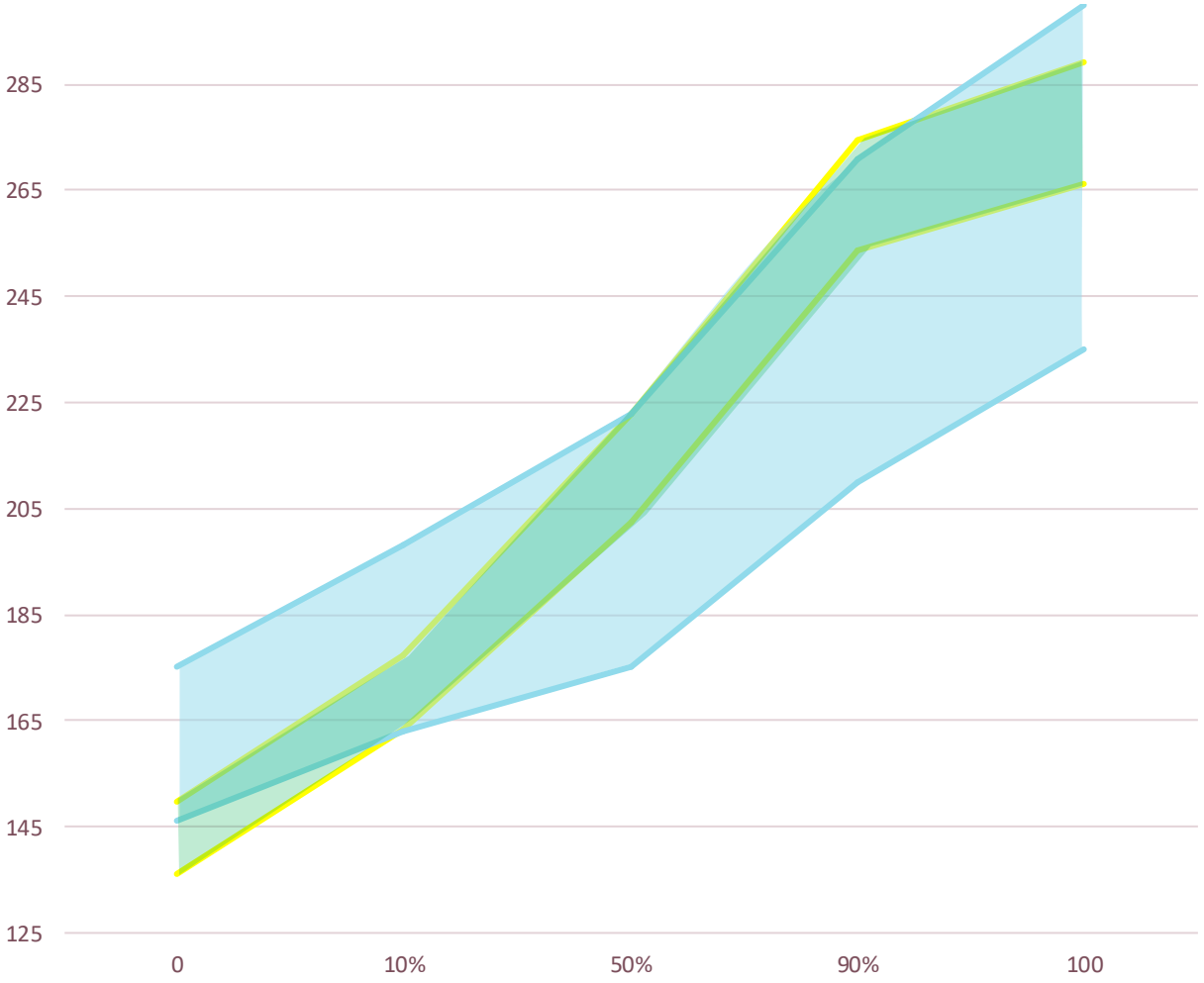
Density



Density is not currently a limiting factor in Blending

	% SAF Blend
Min	25
Average	36
Max	49

Boiling Curve
WJFS 23/24



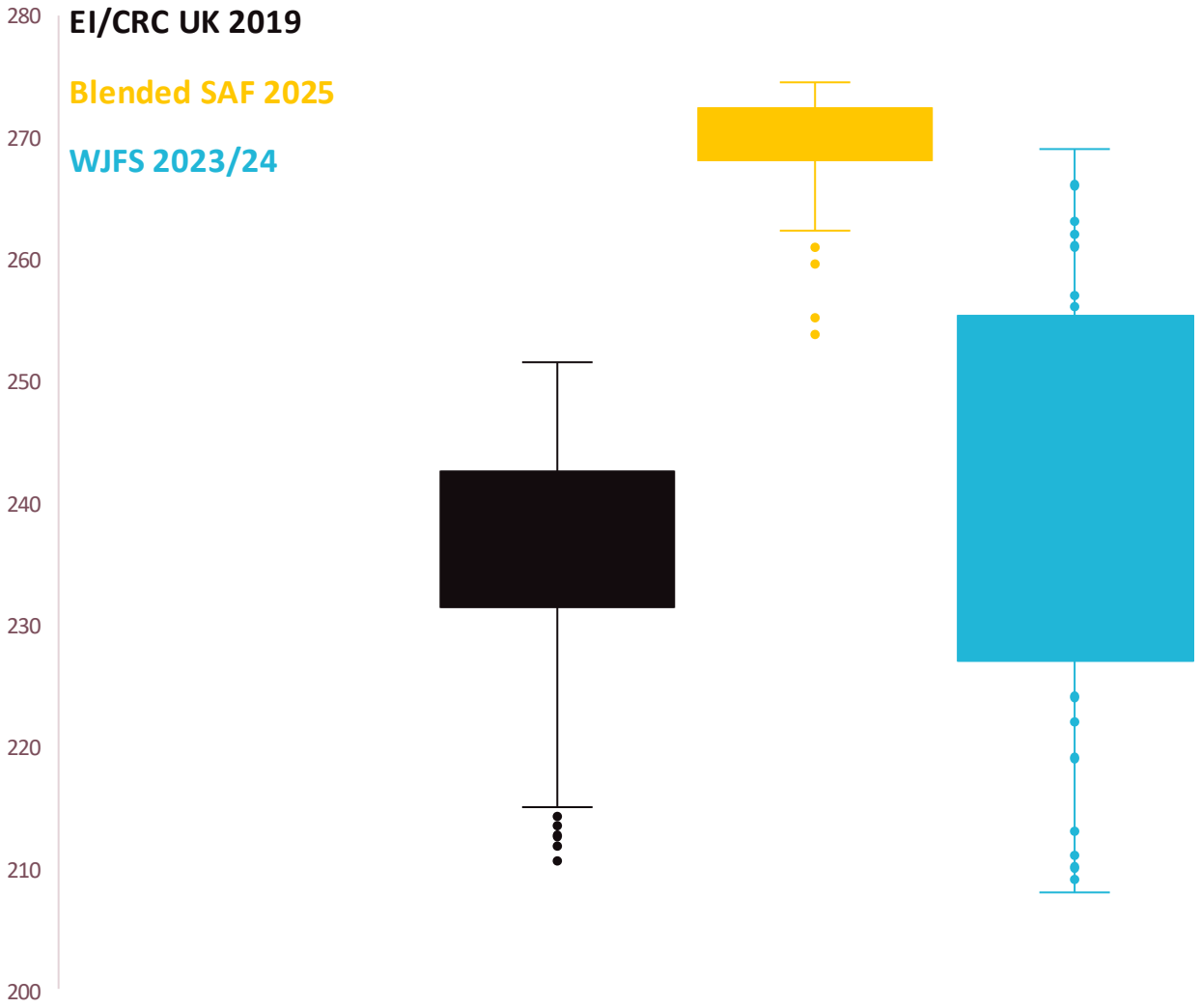
	T50-T10	T90-T10
Average Fossil Jet A1	28	68
Average Blended SAF	44	99

Comparison against World Jet Fuel Survey show closer comparison.

However, T90-T10 still larger in blended SAF.

	% SAF Blend
Min	25
Average	36
Max	49

Boiling Curve
T90



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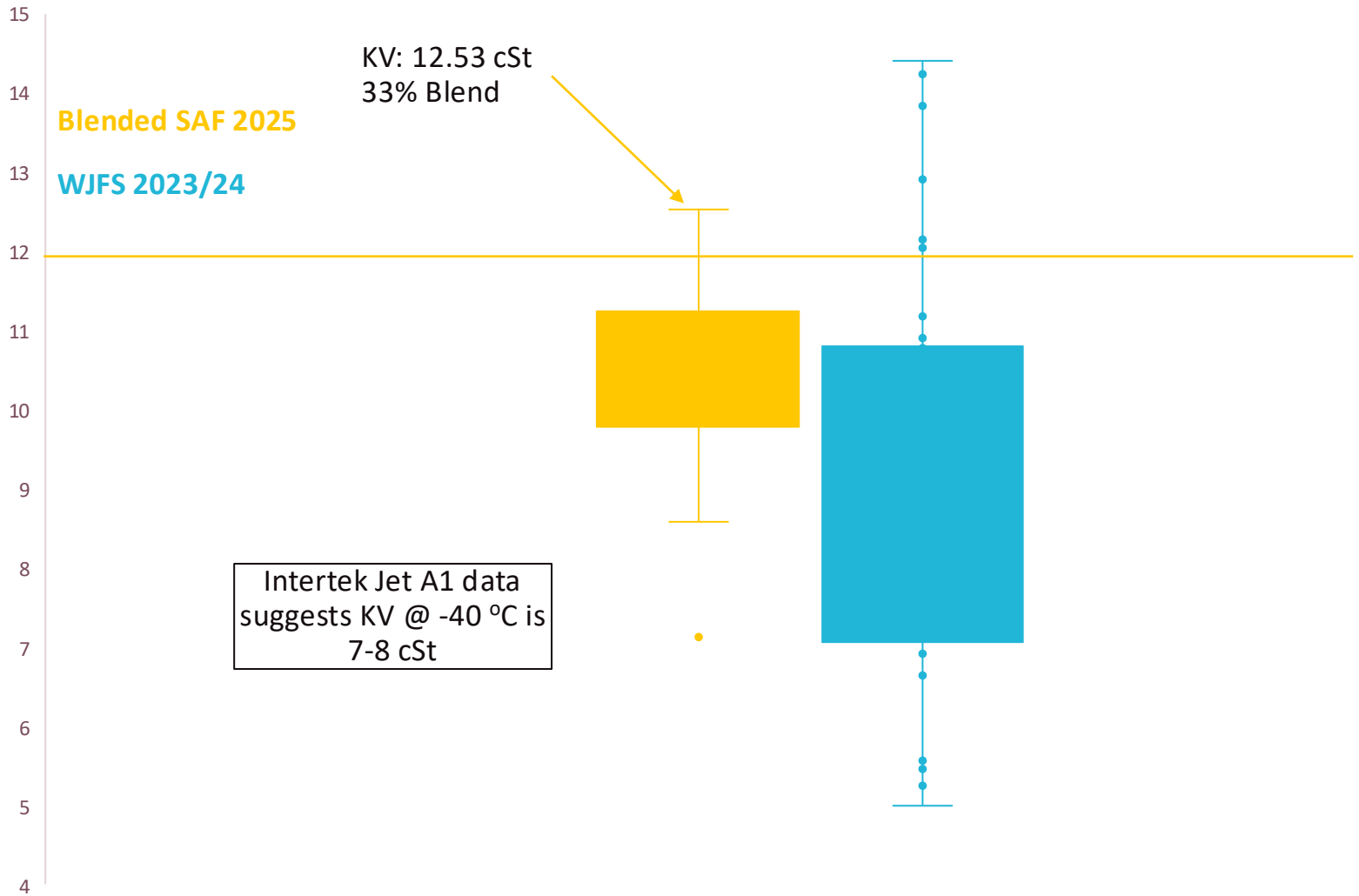
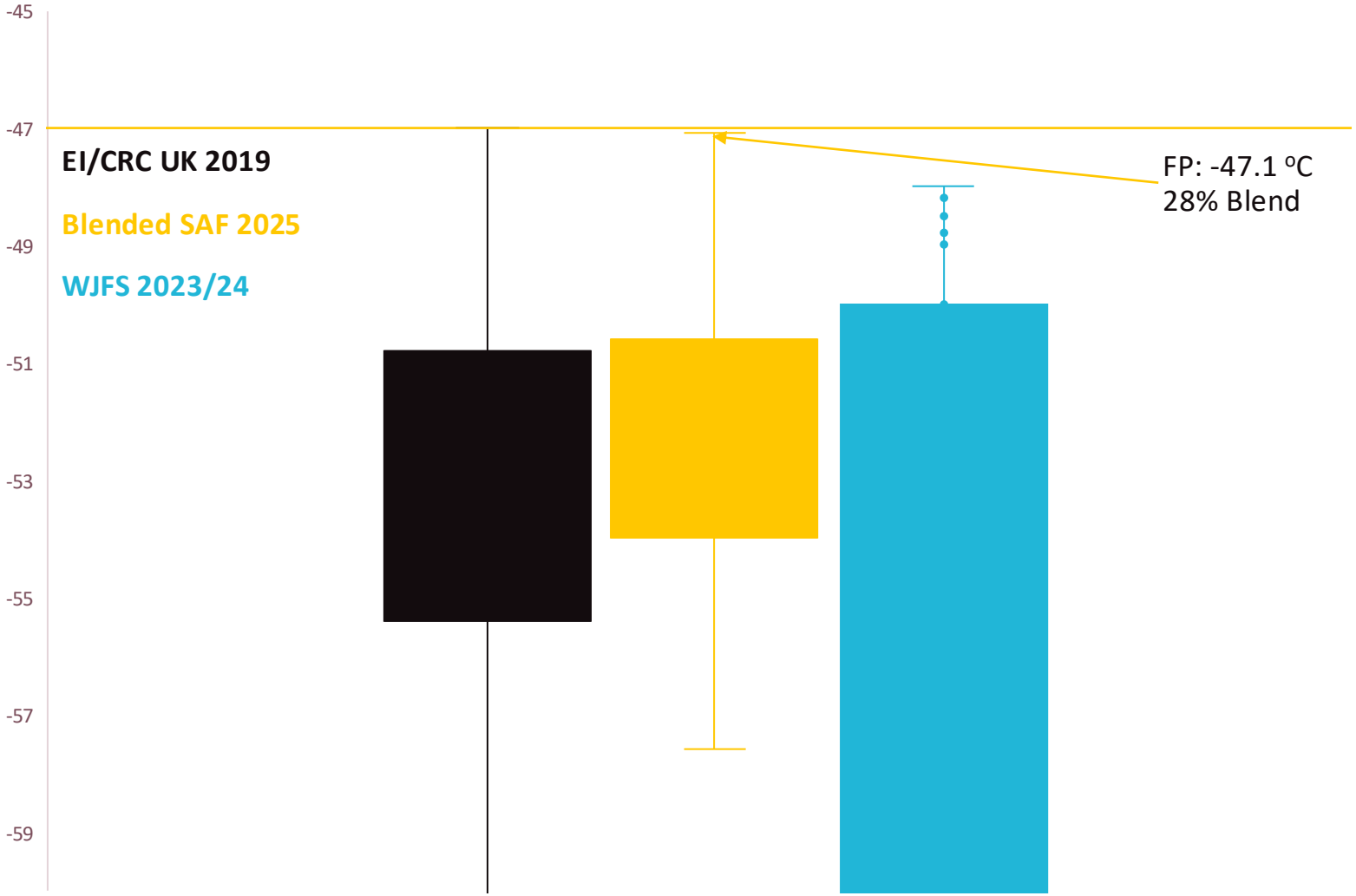
Kinematic Viscosity @ -40°C



	% SAF Blend
Min	26
Average	33
Max	40

Freezing Point

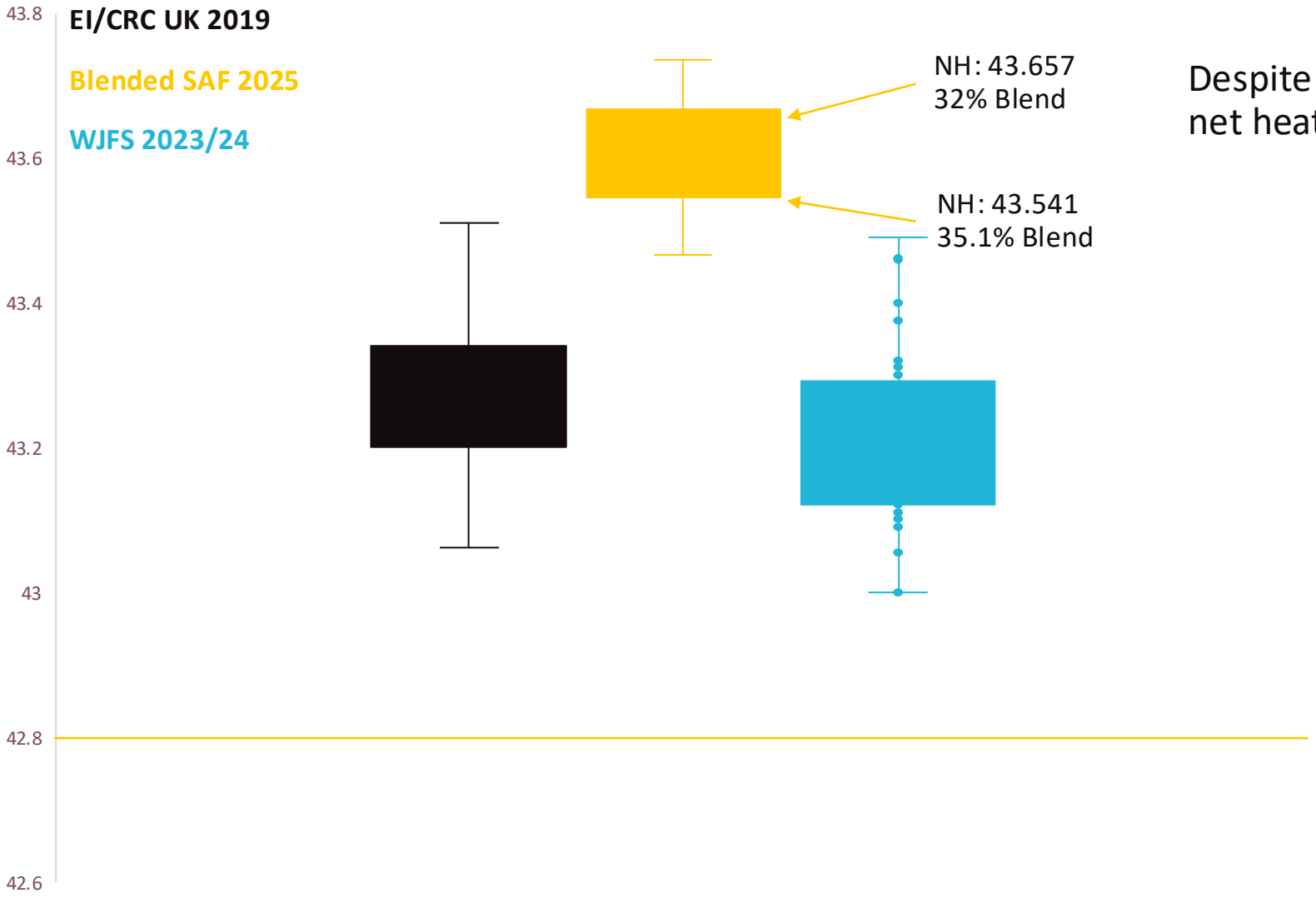


Generally, Freezing point is not a concern for blending

	% SAF Blend
Min	25
Average	36
Max	49

Note WJFS Jet A samples have been removed for comparison purposes

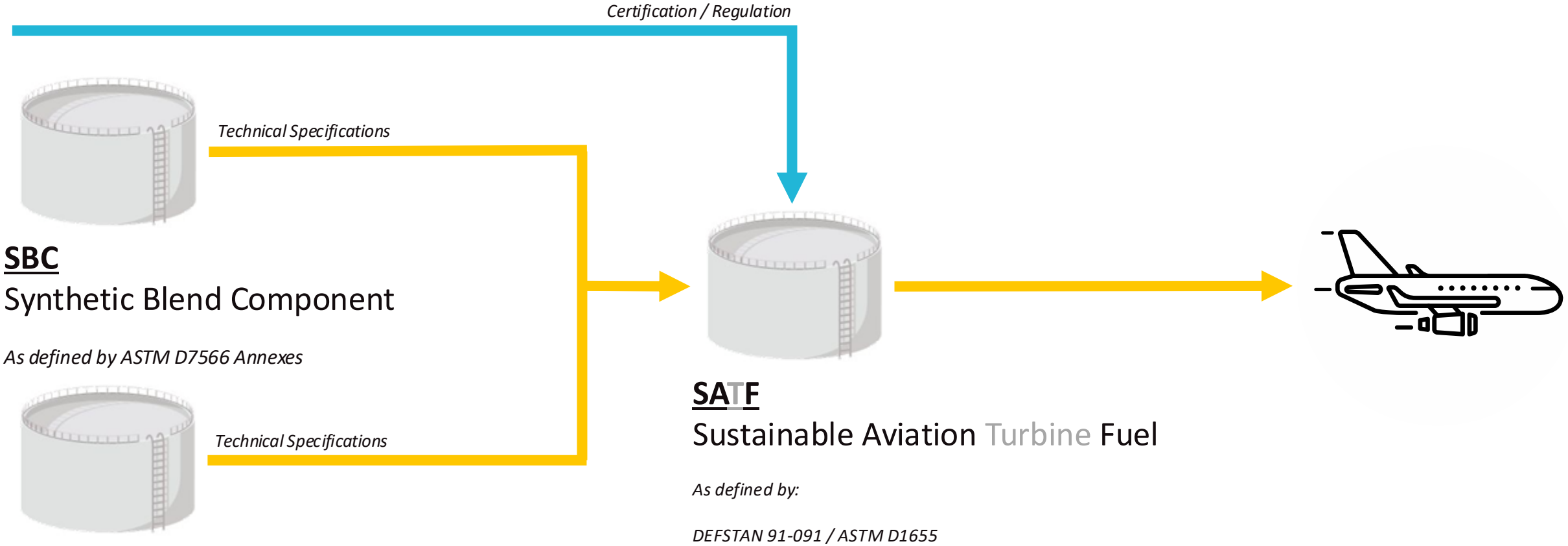
Net Heat of Combustion



Despite being a lighter product in density, the net heat is higher.

	% SAF Blend
Min	25
Average	36
Max	49

Terminology



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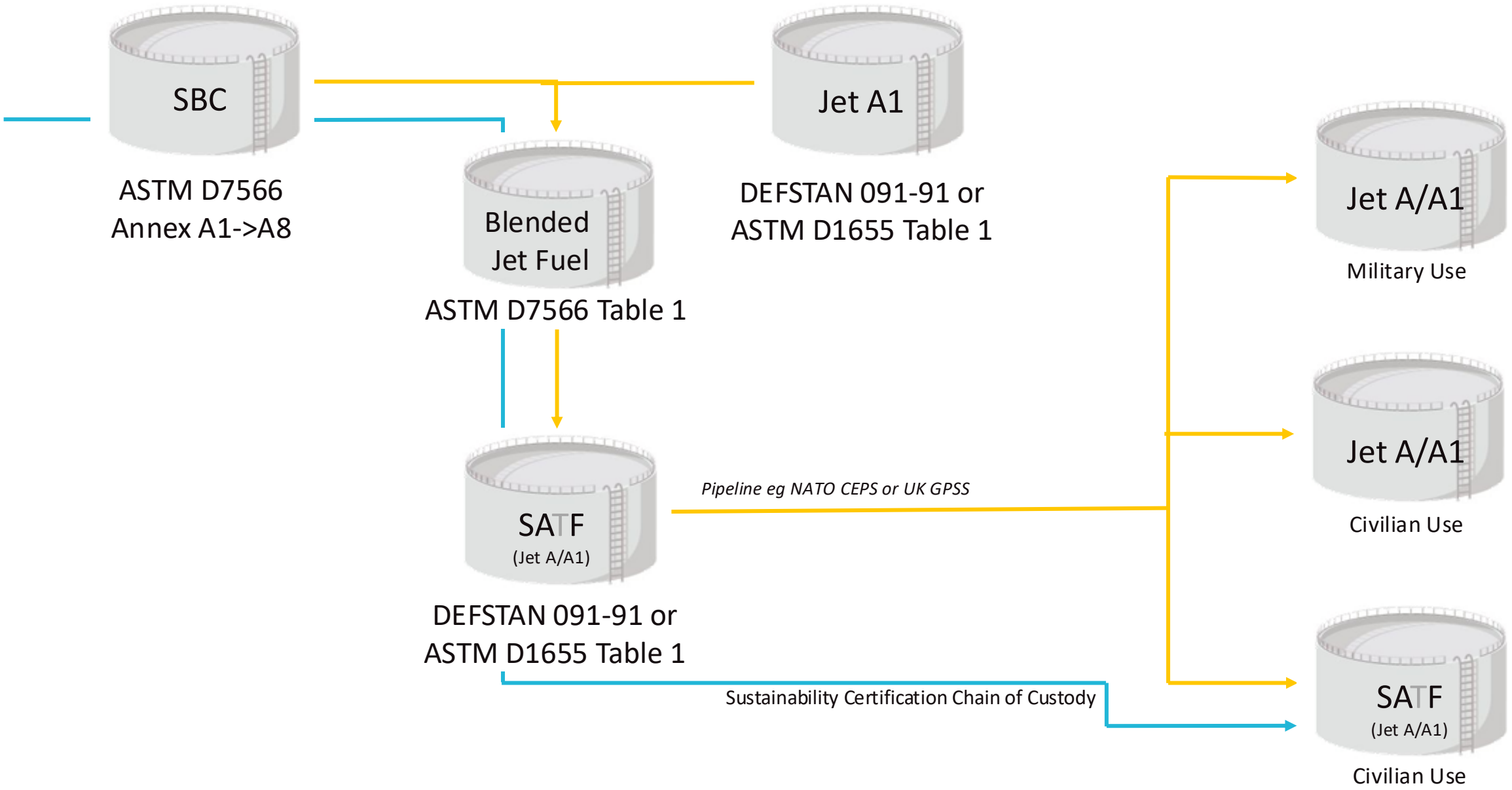
Downstream Handling



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