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Risk assessment for the 2025 In-Service Verification (ISV) of CO_2 emissions of Heavy-Duty Vehicles

Risk Assessment ISV 2025 according to Commission Implementing Regulation (EU) 2025/35

Pavlovic, J., Broekaert, S., Passier, G., Ktistakis, M., Komnos, D., Bitsanis, E., Deschle, N., Steininger, N., Fontaras, G.

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Joint Research Centre

EUR 40412

Contact information
Name: Georgios Fontaras
Address: Via Enrico Fermi 2749
Email: georgios.fontaras@ec.europa.eu
Tel.: +39 033278-6425

EU Science Hub
https://joint-research-centre.ec.europa.eu

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Contents

Abstract

Article 13 of Regulation (EU) 2019/1242 requires Granting Approval Authorities (GAA) to verify, based on appropriate and representative vehicle samples, that the CO_2 emission and fuel consumption values recorded in the customer information files of heavy vehicles match those actually occurring in-service. Commission Delegated Regulation (EU) 2024/1127 sets out the guiding principles and criteria for defining the procedures for these verifications, while Commission Implementing Regulation (EU) 2025/35 determines the verification procedures. In-Service Verification (ISV) testing includes several types of tests: the Verification Testing Procedure (VTP) tests, air drag tests, tyre Rolling Resistance Coefficient (RRC) tests, mass tests, and dedicated tests to verify the presence of Artificial Strategies (AS).

Article 3 of (EU) 2025/35 requires the Commission to set out a risk assessment methodology and each year to publish a report containing a list of VTP families, air drag families, Computational Fluid Dynamics (CFD) families, and tyre families with the highest risk of a deviation in the CO_2 emission values. The Joint Research Centre's (JRC) task is to perform the risk assessment analysis on behalf of the Commission. When assessing the risk, at least the elements mentioned in Article 3(2) of the Implementing Regulation need to be considered, when available. The GAAs must use the Commission's risk assessment as a basis for selecting the families for their in-service verification.

This is the first annual report describing the methodology used for the risk assessment, and the main findings. The risk assessment methodology described is based on a Composite Risk Index (CRI), which combines the probability and severity of a specific occurrence. Probability levels are determined based on the total number of new vehicles, or tyres, that have been placed on the European Union market. Severity levels are determined based on the data collected pursuant to Reg. (EU) 2019/1242 and Article 22 (2) of Reg. (EU) 2017/2400.

This report presents the outcome of the ISV risk assessment for the VTP, air drag, and tyre families, identifying those with the highest risk of including vehicles with deviations in CO_2 emissions values. Based on the assessment, **35 tyre families**, **17 air drag families**, **13 engine VTP families**, and **4 transmission VTP families** have been classified as high risk. No specific families have been identified for mass and AS tests, as there were no relevant indicators to consider in the risk assessment for these parameters. Nevertheless, these tests are still required within the scope of the HDV ISV. Vehicles selected for air drag and VTP testing can be used for the mass tests as well, while AS tests should be performed on vehicles selected for VTP testing. In addition, CFD family selection remains out of scope for the 2025 ISV, as this certification pathway is not yet in force.

To support the GAAs in the planning and selection of vehicles, components, and tyres for the 2025 ISV campaign, each identified ISV family is accompanied by its certification number and key technical specifications, that can assist authorities in sourcing the relevant vehicles, components, and tyres.

Acknowledgements

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Authors

Pavlovic, J., Broekaert, S., Passier, G., Ktistakis, M. A., Komnos, D., Bitsanis, E., Deschle, N., Steininger, N., and Fontaras, G.

Executive summary

Policy context

To ensure that the CO_2 emission and fuel consumption values recorded in customer information files correspond to those of heavy-duty vehicles in service, Article 13 of Regulation (EU) 2019/1242 requires Granting Approval Authorities (GAA) to carry out In-Service Verifications (ISV) based on appropriate and representative vehicle samples. Building on the guiding principles and criteria set out in Commission Delegated Regulation (EU) 2024/1127, the procedures for the In-Service Verification of Heavy-Duty Vehicles CO2 emissions by GAAs, are set out in Commission Implementing Regulation (EU) 2025/35. The Implementing Regulation sets the family definitions, the type and number of ISV tests, the pass/fail criteria, the vehicle and test conditions, the reporting format and, in case of failure, the procedure for correcting the average specific emissions of CO_2 of a manufacturer. In this context, the Commission has to develop a risk assessment methodology for the ISV family selection and annually publish a list of ISV families with the highest risk of having vehicles with a deviation in the CO_2 values. The JRC has taken up this task.

Methodology

To support the risk assessment and the selection of ISV families, the elements listed in Article 3(2) of the Implementing Regulation (EU) 2023/2866 were considered, where available. The datasets used for this purpose included:

1. data reported pursuant to Regulation (EU) 2019/1242 on each individual new vehicle from the Verification Testing Procedure (VTP) family, air drag family, and ISV tyre family placed on the Union market during the 2021–2023 reporting period; and
2. results from tyre conformity of production (CoP) tests conducted in accordance with Section 4 of Annex X to Regulation (EU) 2017/2400.

Other elements referenced in Article 3(2) of Implementing Regulation (EU) 2023/2866 could not be considered in this assessment. Specifically, previous ISV results were unavailable as this is the first implementation of the ISV procedure. In addition, no evidence of a deviation in CO_2 emissions values was reported by another approval authority, market surveillance authority, or third party. Lastly, real-world data were excluded from the assessment due to their current unavailability. Moreover, data collected under Delegated Regulation (EU) 2021/1430 via the DICE platform were not used in this year's risk assessment, given the lack of VTP test data, air drag CoP results, and air drag certificates for many vehicles. These data will be considered in next year's risk assessment.

The risk assessment methodology described in this report is based on a Composite Risk Index (CRI) that combines the probability and severity of a specific occurrence. Probability levels are determined based on the number of vehicles or tyres from the same ISV family registered in the EU between 2021 and 2023, categorized into low (1), medium (2), or high (3). Severity levels are determined based on family/test-specific outlier detection and Conformity of Production (CoP) performance. For tyres, severity was assessed by identifying outliers in rolling resistance coefficients within the same tyre dimension and fuel efficiency class. In addition, the analysis included the evaluation of CoP test results, with particular focus to the ratio between the measured and declared Rolling Resistance Coefficient (RRC) values. For air drag families, severity was assessed by identifying outliers in air drag coefficients (CdA) within the same vehicle subgroups. For VTP families, severity was evaluated separately for engine and transmission performance. Severity is also categorized into three levels: low (1),

medium (2), and high (3). The final CRI score is calculated as the product of the probability and severity levels, resulting in one of six possible values: 1, 2, 3, 4, 6, or 9. Based on the CRI score, the final risk level for each family is classified as Low (CRI = 1 or 2), Medium (CRI = 3 or 4) or High (CRI = 6 or 9).

Main findings

The risk assessment identified 35 tyre ISV families, 17 air drag ISV families, 13 engine VTP families, and 4 transmission VTP families as those with the highest risk of leading to potential discrepancies in CO_2 emissions and fuel consumption values. For each selected family, the list provides key technical information about the associated vehicles and tyres to further support GAAs in preparation for the 2025 ISV testing.

1 Introduction

1.1 Scope of the report

This report is intended to support the implementation of Regulation (EU) 2025/35 ([1]) on the In-Service Verification (ISV) of CO_2 emissions and fuel consumption of heavy-duty vehicles. The report addresses the requirement of Article 3(3) of the Regulation, which stipulates that:

> "***Each year, by 30 June**, the **Commission** shall **publish a report** containing **a list of VTP families, ISV air drag families, CFD families and ISV tyre families with the highest risk of a deviation in the CO_2 emission values**. The report shall also describe the **methodology used** for the assessment referred to in paragraph 1, first subparagraph, undertaken in the reporting period the report concerns, and **the main findings** of that assessment.*"

This report provides the first annual risk assessment for the in-service verification of CO_2 emissions for heavy-duty vehicles and guides the Member States' Granting Approval Authorities (GAA) in selecting the ISV families that should undergo the ISV 2025 testing.

1.2 Regulatory background

Under Article 13 of Regulation (EU) 2019/1242 ([2]), granting approval authorities which granted manufacturers a licence to operate a simulation tool (VECTO) under Regulation (EC) No 595/2009 ([3]) and Regulation (EU) 2017/2400 ([4]) must verify, for those manufacturers, that the CO_2 emission and fuel consumption values recorded in the customer information files of heavy-duty vehicles match those occurring in-service, based on appropriate and representative vehicle samples.

They must also verify whether any strategies are present on board or related to the sampled vehicles that artificially enhance vehicle performance during testing or in the calculations used for CO_2 emission and fuel consumption certification.

Commission Delegated Regulation (EU) 2024/1127 ([5]) sets out the guiding principles and criteria for defining the procedures for performing the in-service verification, while implementing regulation (EU) 2025/35 sets out detailed procedures for the ISV, in line with those guiding principles and criteria. Implementing Regulation (EU) 2023/2866 sets the family definitions, the type and number of ISV tests, the pass and fail criteria, the vehicle and tyre test conditions, the reporting format and, in case of failure, how the average specific emissions of CO_2 of a manufacturer should be corrected.

The HDV in-service verification of CO_2 emissions and fuel consumption values recorded in the customer information files will be carried out using the following test types: VTP tests, air drag tests, tyre RRC tests, mass tests, and dedicated tests aimed at detecting the presence of artificial strategies.

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1 EC. 2025. Regulation (EU) No 2025/35. Off. J. Eur. Union OJ L (IMPLEMENTING)
2 EC. 2019. Regulation (EU) No 2019/1242. Off. J. Eur. Union OJ L 198, 202-240.
3 EC. 2009. Regulation (EU) No 595/2009. Off. J. Eur. Union OJ L 198, 1-13.
4 EC. 2017. Regulation (EU) No 2017/2400. Off. J. Eur. Union OJ L 349, 1-247.
5 EC. 2024. Regulation (EU) No 2024/1127. Off. J. Eur. Union OJ L (DELEGATED).

The GAA shall select families for ISV on the basis of a risk assessment performed by the Commission. Those families include vehicles, components, or tyres that present the highest risk for a potential deviation in in-service CO_2 emission and fuel consumption values compared to the specific values recorded in the customer information file.

In this regard, the Commission must publish every year, by 30 June, a report describing the methodology used for the risk assessment, and the main findings of its assessment undertaken in that year. The report also needs to contain a list of VTP, air drag, and tyre ISV families with the highest risk of including vehicles with a potential deviation in fuel/energy consumption and CO_2 emissions.

1.3 Structure of the report

The report is structured as follows:

Chapter 1 introduces the scope of the report, and the regulatory background. In addition, this chapter outlines the most important objectives of the risk assessment and the report's structure.

Chapter 2 describes the sources of data used in the risk assessment.

Chapter 3 provides a comprehensive overview of the risk assessment methodology, including the definitions of probability and severity, the approaches used to determine their levels, and the calculation of the composite risk index.

Chapter 4 presents the main findings of the risk assessment analysis.

Chapter 5 presents the results and the list of families with the highest testing priority in the 2025 in-service verification.

Chapter 6 summarizes the conclusions of this report.

2 Sources of data

To support the risk assessment, in line with the elements listed in Article 3(2) of Implementing Regulation (EU) 2025/35 the Commission shall take into account at least the following elements, when available:

a) the total number of new vehicles from the VTP family, ISV air drag family and ISV tyre family that have been placed on the Union market, hereafter referred to as the **EEA dataset**, used to calculate the total number of new vehicles registered in the Union in the period from 2021-2023 for each ISV family. Since 2019, the European Environment Agency (EEA), on behalf of the European Commission, has been collecting data on heavy-duty vehicles registered in each Member State;

b) the data collected pursuant to Article 1 of Commission Delegated Regulation (EU) 2021/1430, hereafter referred to as **DICE dataset**;

c) the **evidence of a deviation in the CO_2 emission values** obtained by the Commission, or received from another approval authority, a market surveillance authority, or a third party complying with the requirements of Commission Implementing Regulation (EU) 2022/163(8); however, **no such data has been received to date**;

d) the results of **previous in-service verifications**, and in particular the findings related to the presence of artificial strategies**: these are not available yet** as this is the first year of ISV;

e) relevant information from conformity of production tests performed pursuant to Section 4 of Annex X to Regulation (EU) 2017/2400, hereafter referred to as **Tyre CoP dataset;**

f) **real-world fuel consumption** data: these are **not available yet**.

The risk assessment presented in this report builds on several of the elements listed above. However, this year's assessment could not yet consider points (d) and (f), as no ISV tests have been conducted to date and real-world fuel consumption data are not yet available. Furthermore, due to the limited availability of data collected pursuant to Regulation (EU) 2021/1430, findings from those tests were also not included. To address these data gaps and support this year's assessment, the data collected pursuant to Art. 13(a) and 13(b) of Regulation (EU) 2019/1242 was used, which contains detailed technical characteristics of the EU heavy-duty vehicle fleet (**VECTO dataset**).

Specifics regarding each dataset can be found in the subsequent sections.

2.1 EEA dataset

Regulation (EU) 2019/1242 requires EU Member States (MSs) and manufacturers (OEMs) to report data related to heavy-duty vehicles. MSs report information on trucks, buses, and trailers registered in their territory, while OEMs report data of vehicles subject to certification requirements. For the risk assessment, **only matched entries**, those present in both the MS and OEM reports, have been included in the analysis. Reporting follows an annual cycle, covering the period from 1 July to 30 June of the following year. To date, **five reporting periods have been submitted to the EEA, covering the timeframe from 01/07/2019 to 30/06/2024** (reporting periods 2019–2023). All five periods have been considered in the severity analysis to ensure a larger sample size, whereas only the three most recent periods (2021–2023) have been used for the probability assessment to focus the selection on vehicles produced more recently.

The number of vehicles in each heavy-duty vehicle category subject to certification requirements, excluding pure electric vehicles[6], registered in the EU is presented in **Table 1**. It concerns vehicles of categories N3, N2, M3, and trailers of categories O4, and O3.

The **EEA dataset** provides valuable information on the total number of new vehicles and trailers registered in the EU and enables the calculation of the number of VTP, air drag, and tyre RRC in-service verification tests for each granting approval authority, as detailed in Article 4 of Implementing Regulation (EU) 2025/35. In addition, the dataset is used to determine the probability level of VTP, air drag, and tyre families in the risk assessment, as described in section 3.1, and for tyre families, also the severity level as described in section 3.2.

Table 1. Distribution of registration numbers in 5-year (2019-2023) and 3-year (2021-2023) periods used in the study.

PERIOD	VEHICLE CATEGORIES				
	N3	N2	M3	O4	O3
2019-2023	1,104,486	55,745	460	933,358	27,378
2021-2023	725,367	39,200	460	583,336	18,446

Source: JRC, 2025.

2.2 DICE dataset

For each air drag certificate granted, extended, refused, or withdrawn, as well as for each air drag conformity of production (CoP) test and VTP test performed, the competent authorities of the Member States shall report the data to the Commission (JRC). Since 2021, these data have been collected pursuant to Delegated Regulation (EU) 2021/1430 via the **DICE** platform.

As of 24 March 2025, a limited number of VTP and air drag CoP tests have been reported to the **DICE** platform, only about 15% of the total expected number of tests estimated by the JRC. In addition, a detailed analysis of the air drag certificates reported to **DICE** (194 as of the same date) and those missing (but identified in the **EEA dataset**) revealed that at least 161 certificates are still unreported. To avoid bias in the risk assessment and ensure equal treatment of all granting approval authorities, regardless of whether they reported data to DICE, it was decided not to use the DICE dataset in this year's risk assessment.

2.3 Tyre CoP dataset

Tyre conformity of production (CoP) tests conducted pursuant to Section 4 of Annex X to Regulation (EU) 2017/2400 shall be made available to the Commission upon request. A total of 1,453 Tyre CoP

[6] Pure electric vehicles do not fall within the scope of the in-service verification obligations, as they have zero tailpipe emissions.

tests were received, for the CoP testing period 2022-2024, covering more than 99% of the EU market, and distributed across fuel efficiency (FE) classes as follows:

- FE Class A: 129 tests
- FE Class B: 287 tests
- FE Class C: 550 tests
- FE Class D: 389 tests
- FE Class E: 98 tests

One of the methodologies for the severity analysis of tyre families has been developed based on this **Tyre CoP dataset,** as described in section 3.2.1.

2.4 VECTO dataset

The VECTO simulation summary files (vsum files), submitted for vehicles registered between 2021 and 2023, were used to conduct the severity analysis of VTP families. After applying data cleaning and validation procedures, including resolving duplicates across years, addressing inconsistencies in vehicle entries, retaining only reference mass tests and excluding vehicle groups with limited number of data, the final **VECTO dataset** comprised 683,845 vehicles. These vehicles were distributed across various vehicle groups, as presented in **Table 2**. It should be noted that these numbers do not reflect actual registrations, and that certain categories were introduced in VECTO later in time than others so not all numbers cover the same time period.

Table 2. Allocation of vehicles per different vehicle groups and different mission profiles.

Cycle	NUMBER OF VEHICLES IN VEHICLE GROUPS										
	1	**10**	**11**	**12**	**16**	**1s**	**2**	**3**	**4**	**5**	**9**
Construc-tion	0	0	0	0	14,852	0	0	0	0	0	0
Long Haul	0	27,912	0	0	0	0	0	0	47,109	417,291	98,862
Regional delivery	7,721	27,912	8,616	5,626	0	2,525	27,135	26,196	47,109	417,291	98,862
Urban delivery	7,721	0	0	0	0	2,525	27,135	26,196	0	0	0

Source: JRC, 2025.

3 Risk assessment methodology

The risk assessment methodology employed in this report is based on the concept of Composite Risk Index (**CRI**). This index combines the **probability** and **severity** of a specific occurrence. In the context of this report, severity is a measure of the impact of a risk, particularly concerning CO_2 emissions. Probability, on the other hand, indicates the frequency with which the harm associated with a risk may occur, specifically in terms of the number of vehicles in the Union market affected by the risk. Further details regarding severity, probability, and the determination of overall risk levels can be found in the subsequent sections.

3.1 Probability

Probability levels are determined based on the number of new vehicles registered in the Union over a 3-year period under review (from 01/07/2021 to 30/06/2024) that belong to the same VTP, air drag, or tyre family.

For all test types, when determining probability levels (1, 2, or 3), it has been established that the median size of family will serve as the threshold for medium probability (probability level 2), and the 75th percentile will act as the threshold for high probability (probability level 3). In practical terms, this means that if the ISV family size for the analysed 3-year period is:

- Below median value, the probability level for that family is low (level 1);
- Equal or higher to the median value and below 75th percentile, the probability level for that family is medium (level 2);
- Equal or higher to the 75th percentile, the probability level for that family is high (level 3).

With this approach, 50% of ISV families will have a low probability, 25% will have a medium probability, and the remaining 25% will have a high probability.

The advantage of this dynamic probability assessment, compared to using fixed pre-set values, is that the threshold values are adjusted annually to reflect the current market conditions. This is particularly important as the size of ISV families may change with the increased registration of pure electric HDVs and reduced sales of CO_2 emitting HDVs. This ensures that the probability levels remain relevant and adaptable to evolving trends.

To reduce dataset errors, primarily due to typos in ISV family identifiers reported to the EEA, the risk assessment has been limited to ISV families with at least 100 registered vehicles or tyres over the 3-year period. Additionally, ISV families with fewer than 100 vehicles or tyres are unlikely to be available for testing and would inherently have low probability levels.

3.1.1 Probability tyre families

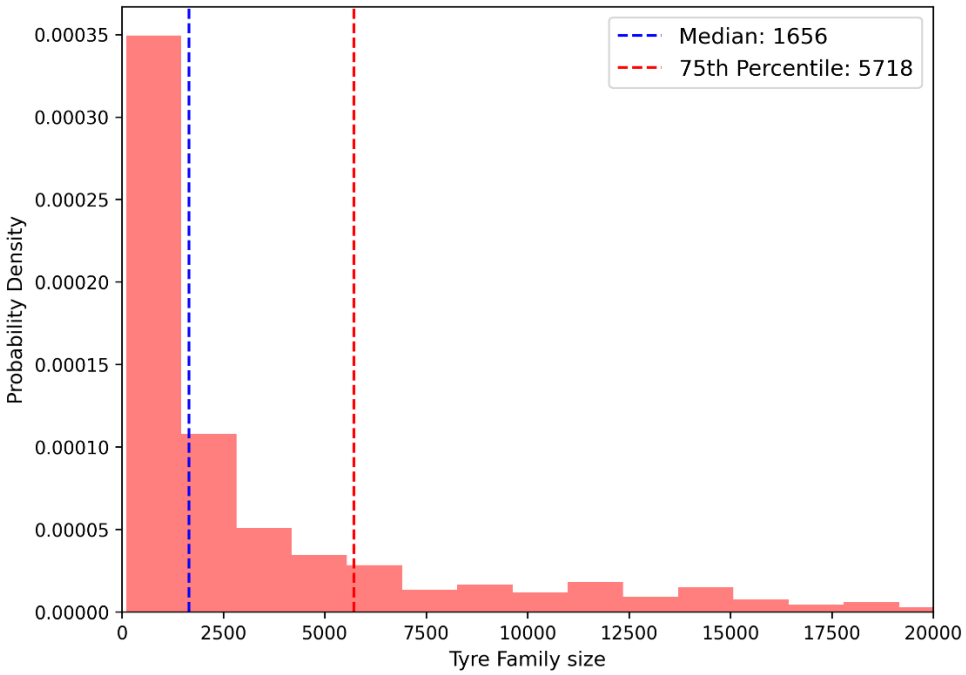
In accordance with Article 2 of Implementing Regulation (EU) 2025/35, an **ISV tyre family** means a **group of tyres** consisting, for the purpose of ISV, of all tyres **belonging to a type of tyre**, as defined in Section 2, point 3, of Annex X to Regulation (EU) 2017/2400, **from the same manufacturer and from the same fuel efficiency class**, as defined in Regulation (EU) 2020/740.

For the purposes of the risk assessment, tyre families were identified based on unique combinations of tyre certificate numbers, tyre dimensions, and declared rolling resistance coefficients for tyres mounted on all vehicle axles, as reported in the **EEA dataset** for the reporting years 2021, 2022, and 2023.

Figure 1 illustrates the frequency distribution of tyre family sizes over the three-year reporting period. A total of 757 tyre families have been identified during the same period. After excluding tyre families with fewer than 100 tyres sold (267 of them), 490 tyre families were kept for the analysis. **The median and 75th percentile values** of tyre family sizes during this period **were 1,656 and 5,718 tyres**, respectively.

Probability levels for tyre families were assigned based on their sales volumes. Tyre families with fewer than 1,656 tyres sold were assigned a low probability level (1); those with sales between 1,656 and 5,718 tyres were assigned a medium probability level (2); and those with more than 5,718 tyres sold were assigned a high probability level (3).

Figure 1. Histograms of the size of tyre family in period 2021-2023 along with probability level thresholds.



Source: JRC, 2025.

3.1.2 Probability air drag families

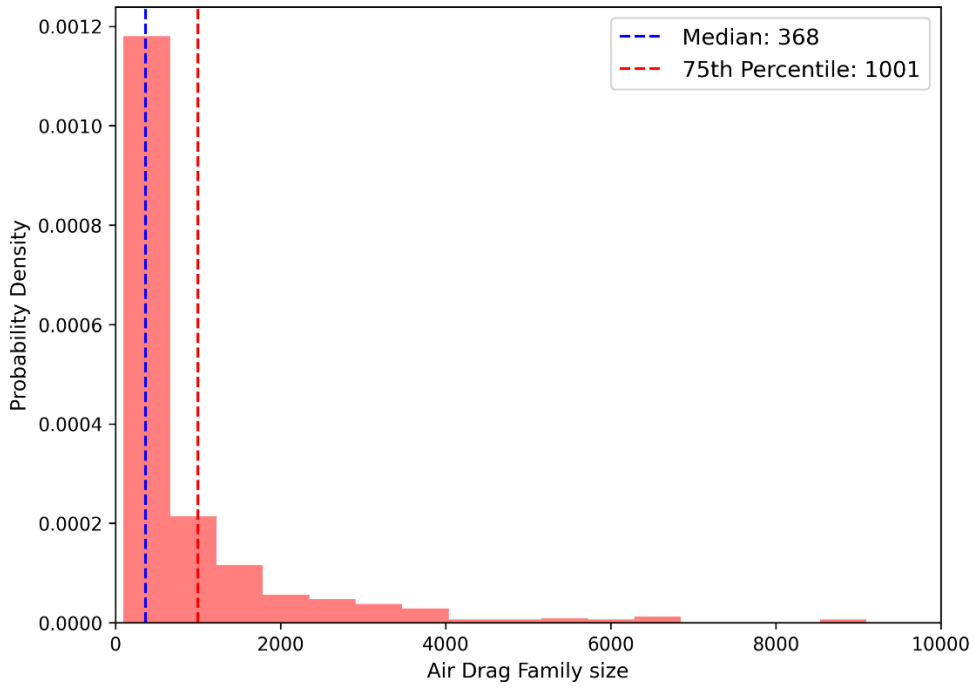
In accordance with Article 2 of Implementing Regulation (EU) 2025/35, an **ISV air drag family** means a **group of vehicles**, that have a **lower or equal declared air drag value than the parent vehicle** of the air drag family which has been selected for performing an air drag test, and that are permitted to be with this parent vehicle within the same air drag family as set out in Appendix 5 of Annex VIII to Regulation (EU) 2017/2400.

For the purposes of the risk assessment, air drag families were identified using unique combinations of the air drag model identifier and the declared air drag value (CdA), as reported in the **EEA dataset** for the years 2021, 2022, and 2023. The analysis included only vehicles for which measured air drag values were used, excluding those using standard values. A total of 1,653 air drag families have been identified during the same period. Air drag families with fewer than 100 vehicles sold were excluded from the analysis and 565 air drag families were kept for probability analysis.

Figure 2 illustrates the frequency distribution of air drag family sizes over the three-year reporting period. **The median and 75th percentile values** of air drag family size during this period **were 368 and 1,001**, respectively.

Probability levels for air drag families were assigned based on their sales volumes. Families with fewer than 368 vehicles sold were assigned a low probability level (1); those with sales between 368 and 1,001 vehicles were assigned a medium probability level (2); and those with more than 1,001 vehicles sold were assigned a high probability level (3).

Figure 2. Histograms of the size of air drag family during 2021-2023 along with probability level thresholds.



Source: JRC, 2025.

3.1.3 Probability VTP families

In line with Article 2 of Implementing Regulation (EU) 2025/35, an **ISV VTP family** refers to a **group of vehicles that share one or more components, separate technical units, or systems** as listed in Article 12(1), points (a) to (f), (h), and (j) of Regulation (EU) 2017/2400.

For the purpose of the risk assessment, probability levels for VTP families were calculated separately for engine and transmission families.

VTP engine families were defined based on unique combinations of the engine certification number and the engine displacement, using data reported in the **EEA dataset** for the years 2021, 2022, and 2023. Only families with at least 100 vehicles sold during this period were included in the analysis.

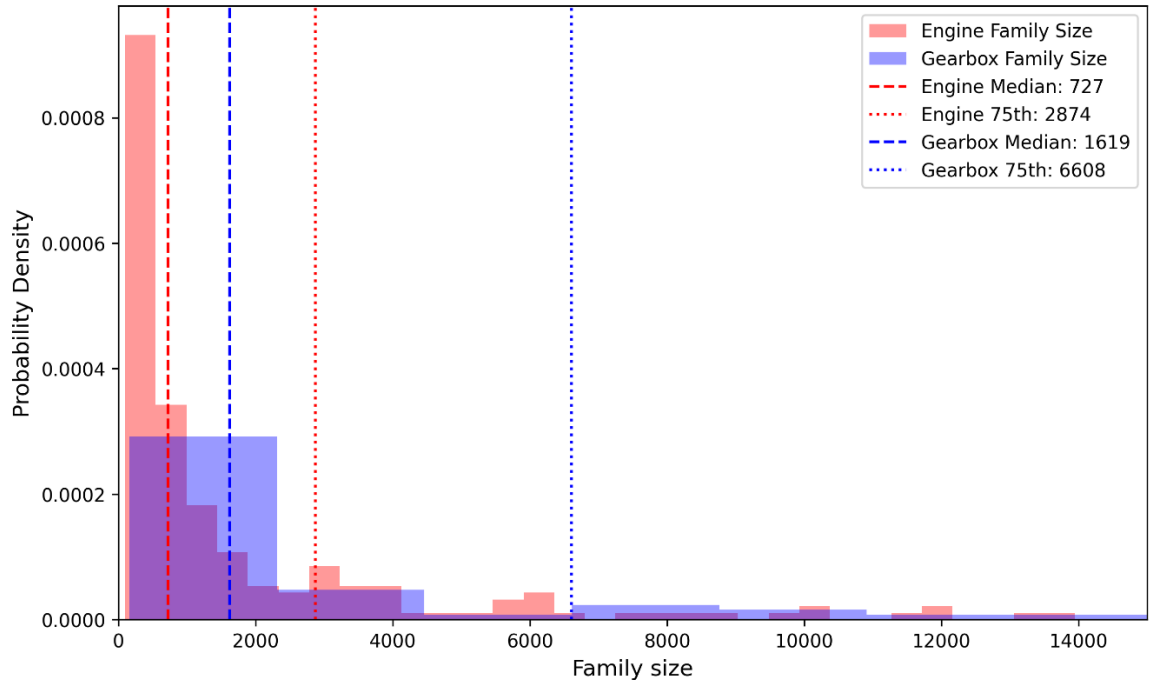
Similarly, **VTP transmission families** were identified using unique combinations of the transmission certification number and transmission type, considering only entries with measured values (standard values were excluded) and with at least 100 vehicles sold over the same period.

A total of 209 VTP engine families and 59 VTP transmission families were identified. As shown in **Figure 3**, for the **engine families**, the **median number of vehicles sold was 727, and the 75th**

percentile was 2,874. For the **transmission families**, the **corresponding values were 1,619 and 6,608**, respectively.

Based on these thresholds, probability levels were assigned according to the following logic. VTP engine families with fewer than 727 vehicles were assigned a low probability level (level 1), those with between 727 and 2,874 vehicles a medium probability level (level 2), and those with more than 2,874 vehicles a high probability level (level 3). For transmission families, a low probability level (level 1) was assigned to families with fewer than 1,619 vehicles, a medium level (level 2) to those with between 1,619 and 6,608 vehicles, and a high probability level (level 3) to those exceeding 6,608 vehicles sold during the three-year reporting period.

Figure 3. Histograms of the size of VTP families (engine and transmission) in period 2021-2023 along with probability level thresholds.



Source: JRC, 2025.

3.2 Severity

The study has employed two distinct methodologies for establishing severity levels: one involves **setting thresholds** for deviations, while the other focuses on **detecting outliers**. The choice between these approaches depends on the type of ISV family (tyre, air drag, VTP) and the specific type of analysis performed, as outlined in **Table 3**.

In the context of analysing the **Tyre CoP dataset**, specific **thresholds** are set to distinguish between different severity levels. The **outlier detection** method was employed in the analysis of outliers in the rolling resistance coefficient (RRC), CdA value, or outliers in the engine and/or transmission efficiency. It is crucial to note that, in this context, outliers are not indicative of measurement errors but are instead considered statistical outliers. These outliers represent families that significantly deviate from the broader population with similar characteristics.

This study adopts Tukey's approach ([7]) to identify outliers, in this case families substantially different from others with similar characteristics, and to evaluate the severity of these deviations. Families were grouped with others sharing similar characteristics, depending on the variable under analysis.

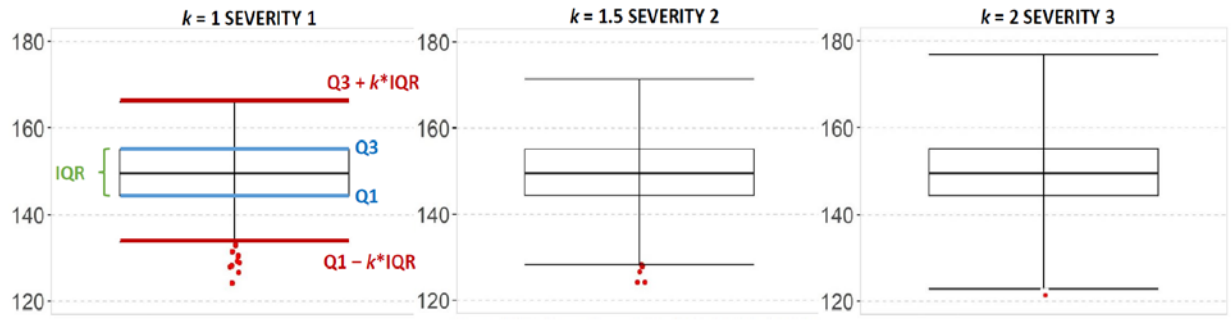
Table 3. Severity methodologies used in the risk assessment for tyre, air drag, and VTP families.

ISV FAMILY	TYPE OF ANALYSIS	SEVERITY LEVELS		
		S=1	S=2	S=3
TYRE FAMILY	ANALYSIS OF OUTLIERS	k=0.25	k=0.50	k=0.75
	CoP TESTS	0.99-1.01 ratio	1.01-1.03 ratio	> 1.03 ratio
AIR DRAG FAMILY	ANALYSIS OF OUTLIERS	k=0.25	k=0.50	k=0.75
VTP FAMILY	ANALYSIS OF OUTLIERS	k=0.50	k=1.00	k=1.50

Source: JRC, 2025.

The interquartile range (IQR), calculated as the difference between the third quartile (Q3) and the first quartile (Q1) of a dataset (IQR = Q3 – Q1), is fundamental to this method. Outliers are identified using Tukey's 'k * IQR rule' where data points below Q1 - k * IQR or above Q3 + k * IQR are flagged as potential outliers. Notably, the 'k' factor is pivotal in determining severity; a higher 'k' results in fewer but more severe outliers. **Figure 4** visually illustrates this process, highlighting how Tukey's method and increase of 'k' factors effectively identify outliers.

Figure 4. Illustration of the IQR outlier detection for definition of severity



Source: JRC, 2025.

[7] Tukey, JW. Exploratory data analysis. Addison-Wesley, 1977

The choice of 'k' factor can vary based on specific analysis requirements and data characteristics. Additionally, depending on the issue analysed, solely the lower side (below the threshold of Q1 - k * IQR) or the higher side (above Q3 + k * IQR) outliers might be selected in a risk assessment. In the example shown in **Figure 3**, k-factors of 1, 1.5, and 2 have been used, and only outliers on the lower side are selected. In practical terms, the example depicted in Figure 3 can be interpreted as follows:

- All data points below Q1 - 2 * IQR are marked with the highest severity: 3;
- All data points below Q1 – 1.5 * IQR, and not identified in the previous step, are marked with medium severity: 2;
- All data points below Q1 – 1 * IQR, and not identified in the previous two steps, are marked with low severity: 1.

In the next sections more in-depth discussions and details are given about practical implementation of these two methodologies (thresholds and outliers) for various types of families.

3.2.1 Severity tyre families

For this analysis, two datasets were used: the **EEA dataset** collected pursuant to Regulation (EU) 2019/1242 and the **Tyre CoP dataset**. The **outlier analysis (Method 1)** was conducted on the **EEA dataset**. In the first step, tyres were grouped by their fuel efficiency (FE) class (A, B, C, D, E) and dimensions, resulting in 71 unique combinations. Of these, 20 combinations with a sample size of at least 10 tyre families (see **Table 4**) were directly included in the outlier analysis.

The remaining 51 combinations, with fewer than 10 tyre families in each, were analysed separately. These were split into two categories, Low and High, based on tyre width, and further grouped by their FE class.

Outliers were identified using the IQR-based method, on both sides of the distribution, defined as values below Q1 − k × IQR or above Q3 + k × IQR, with the following three k factors:

- k = 0.75 for high severity (severity level 3),
- k = 0.50 for medium severity (severity level 2),
- k = 0.25 for low severity (severity level 1).

In **Method 2**, severity **thresholds** were defined using the **Tyre CoP dataset**, which included 1,453 CoP test results. For each test, the ratio between the measured RRC and the declared RRC was calculated as $\mathbf{RRC_{MEAS}/\ RRC_{DECL}}$. **Figure 5** illustrates that the median $\mathbf{RRC_{MEAS}/\ RRC_{DECL}}$ ratio across all reported CoP tests is 0.96, while the 75th percentile $\mathbf{RRC_{MEAS}/\ RRC_{DECL}}$ ratio reaches 1.00.

Within this dataset, 354 tyre certificates were tested once, while 309 certificates were tested multiple times. For tyres tested more than once, the final $\mathbf{RRC_{MEAS}/\ RRC_{DECL}}$ ratio was determined by averaging the individual ratios for each tyre.

Severity levels were then assigned based on that averaged ratio:

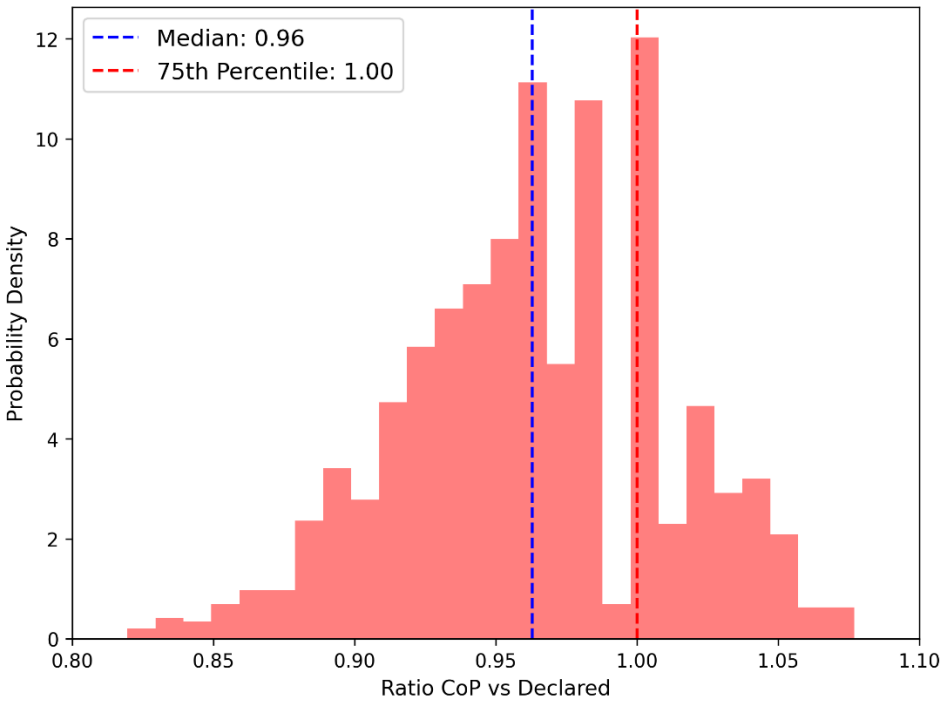
- Severity 3: ratio > 1.03
- Severity 2: ratio between 1.01 and 1.03
- Severity 1: ratio between 0.99 and 1.01.

Table 4. Combinations of fuel efficiency (FE) class and tyre dimensions, of groups with at least 10 families, along with their corresponding counts, used in the outlier analysis (Method 1)

FE	Tyre dimension		Count of combi-
D	315/80	R22.5	44
C	315/80	R22.5	41
C	315/70	R22.5	38
C	385/65	R22.5	36
D	315/70	R22.5	29
B	315/70	R22.5	27
C	315/60	R22.5	24
D	295/80	R22.5	24
B	385/65	R22.5	21
B	315/80	R22.5	18
C	385/55	R22.5	16
B	385/55	R22.5	15
C	295/80	R22.5	15
A	315/70	R22.5	13
D	285/70	R19.5	13
C	295/60	R22.5	13
E	315/80	R22.5	11
D	315/60	R22.5	10
D	245/70	R17.5	10
B	315/60	R22.5	10

Source: JRC, 2025.

Figure 5. Distribution of RRC measured over declared RRC ratio (RRC_{MEAS}/RRC_{DECL}) from CoP tests.



Source: JRC, 2025.

3.2.2 Severity air drag families

For this analysis, the **EEA dataset** collected pursuant to Regulation (EU) 2019/1242 was used, covering all vehicles registered from 2019 to 2023. In the initial step, air drag families were grouped by their air drag model identifier, declared CdA, and vehicle sub-group. The final severity analysis considered only vehicles with measured air drag values, excluding those using standard values. Furthermore, air drag families with fewer than 100 vehicles sold, during the 2019–2023 period, were excluded from the analysis, resulting in 759 unique combinations.

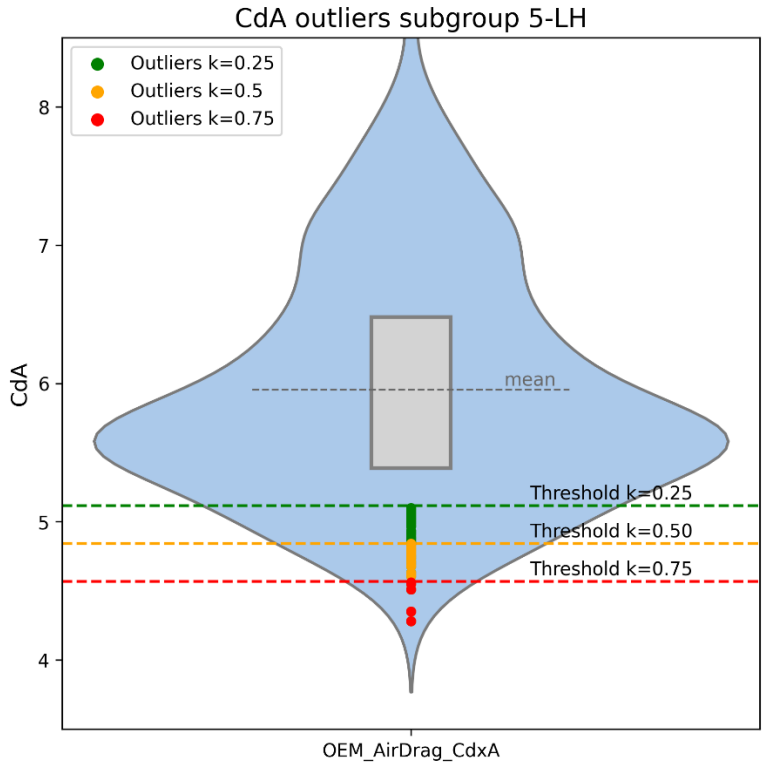
The highest number of air drag families belong to vehicle sub-group 5-LH (238), followed by 9-LH (118), 4-RD (84), 10-LH (69), 9-RD (51), 4-LH (43), group 2 (36), and group 3 (29). Air drag families from other vehicle sub-groups showed low probability in the analysed period and were therefore not included in the outlier analysis.

Within the same vehicle sub-groups outliers in CdA values were identified using an IQR-based method, on the lower side of the distribution, defined as values below Q1 − k × IQR, using three k factors:

- k = 0.75 for high severity (severity level 3),
- k = 0.50 for medium severity (level 2),
- k = 0.25 for low severity (level 1).

Figure 6 illustrates the severity analysis for air drag families within the 5-LH sub-group, which represents the largest share.

Figure 6. Severity analysis with different k factors within vehicle sub-group 5-LH.



Source: JRC, 2025.

3.2.3 Severity VTP families

For this analysis, the **VECTO dataset** described in Section 2.4 was used. Outliers in efficiency were identified separately for the engine and the transmission. To detect engine outliers, vehicles were grouped by fuel type, vehicle sub-group, and mission profile. For transmission, the grouping was based on transmission type, vehicle sub-group, and mission profile.

Outliers in engine and transmission efficiencies were identified using three severity levels, determined by the following k factors:

- k = 1.5 for high severity (Severity Level 3),
- k = 1.0 for medium severity (Level 2),
- k = 0.5 for low severity (Level 1).

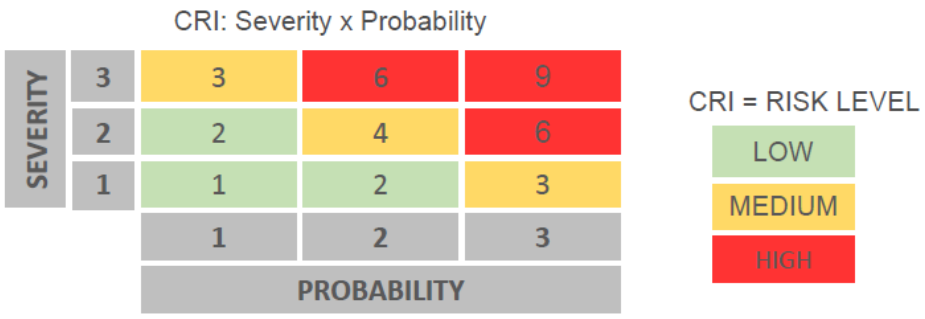
In cases where a vehicle was assessed under multiple mission profiles (**Table 2**) and assigned different severity levels, only the highest severity level was retained. Severity rates for engine and transmission groups, defined by certification number and, respectively, fuel type or transmission type, were calculated as the proportion of vehicles within each group identified with severity level 2 or 3. These rates range from 0 (no issues detected) to 1 (all vehicles in the group flagged with severity level 2 or 3). All engine and transmission groups with severity rates exceeding 0.1 were combined with probability values for the final calculation of the CRI.

3.3 Composite Risk Index (CRI)

The CRI is used in this risk assessment to evaluate and quantify the overall risk level of each family by combining probability and severity levels defined as described in sections 3.1 and 3.2. The CRI considers both, the number of vehicles and tyres registered in the last three years in the EU and the impact on CO_2 emissions.

The CRI is calculated by multiplying the probability and severity scores, both being either 1, 2 or 3. The combination of these 2 components is used for defining the final risk level of a family as illustrated in **Figure 7**.

Figure 7. Calculation of CRI and the final risk levels.



Source: JRC, 2025.

As shown in Figure 7, the CRI can yield results with values of 1, 2, 3, 4, 6, and 9. Depending on the outcome the final risk level a family can be labelled as:

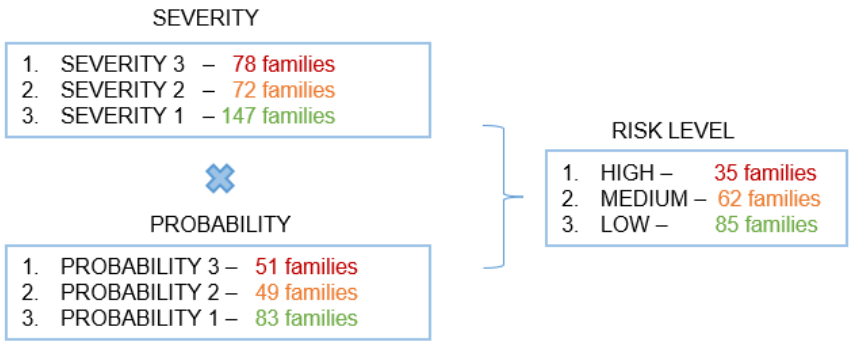
1. **Low Risk (CRI 1 or 2)**
    a. CRI 1: Occurs when both probability and severity are low (both equal to 1).
    b. CRI 2: Occurs when either probability or severity is medium (equal to 2), and the other is low (equal to 1).
2. **Medium Risk (CRI 3 or 4)**
    c. CRI 3: When either probability or severity is high (equal to 3), and the other is low (equal to 1).
    d. CRI 4: Occurs when both probability and severity are medium (equal to 2)
3. **High Risk (CRI 6 or 9)**
    e. CRI 6: Occurs when either probability or severity is high (equal to 3), and the other is medium (equal to 2).
    f. CRI 9: Occurs when both probability and severity are high (both equal to 3).

4 Main findings ISV 2025

4.1 Tyre families results

This section presents the outcomes of the severity and risk assessments carried out on tyre families based on the methodologies described in section 3.2.1. Among all families analysed for severity using Method 1 and Method 2; 147 were classified as severity level 1, 72 as severity level 2, and 78 as severity level 3. Following the procedure outlined in Section 3.3, probability levels were combined with severity levels to calculate the CRI and determine the final risk levels. This process led to the identification of **35 high risk families**, 62 medium risk families, and 84 families classified with low risk, as shown in **Figure 8**.

Figure 8. Probability, severity and final risk levels for tyre families



Source: JRC, 2025.

4.2 Air drag families results

This section presents the results of the severity and risk assessment of air drag families, based on the methodology described in Section 3.2.2. Following the procedure outlined in Section 3.3, severity levels were combined with probability levels to calculate the CRI and determine the final risk levels. As shown in **Table 5**, this process led to the identification of **19 high risk** families, **23 medium risk** families, and **40 low risk** families. The majority of high risk families were found in the 5-LH subgroup (10 families), which also has the highest number of vehicles and air drag families.

The risk assessment identified air drag families with a high risk of deviation for certain vehicle manufacturers. In cases where multiple high risk families were identified for the same OEM, the final selection was based on the air drag family with the highest number of vehicle registrations in the EU market over the past three years (2021–2023).

For manufacturers not flagged by the risk assessment, the final air drag selection was carried out as described in Section 4.4. The resulting selection includes **17 air drag ISV families** from **8 unique World Manufacturer Identifiers (WMIs).**

Table 5. Number of air drag families selected in risk assessment with Risk Level = High, Medium, or Low for different vehicle sub-groups.

VEHICLE SUB-GROUP	RISK LEVEL		
	LOW	MEDIUM	HIGH
5-LH	5	5	10
9-LH	8	4	3
9-RD	6	2	0
4-RD	4	4	2
3	2	1	0
2	3	3	0
10-LH	6	0	2
4-LH	6	4	2
TOTAL	**40**	**23**	**19**

Source: JRC, 2025.

4.3 VTP families results

This section presents the results of the severity and risk assessment of VTP families, based on the methodology described in Section 3.2.3. The outlier analysis resulted in the identification of **36 engine families** and **13 transmission families**, each with at least 100 vehicles sold during the period 2021–2023 and associated with severity levels 2 or 3.

After combining with probability levels, the risk assessment identified **13 VTP engine families with high risk**, originating from **eight vehicle manufacturers (WMIs)**. For manufacturers associated with more than one high-risk VTP engine family, the final selection was based on the highest number of vehicle registrations in the EU market during the 2021–2023 period.

Similarly, the risk assessment identified **four VTP transmission** families with high risk. These transmissions are found in vehicles produced by **five different manufacturers**.

4.4 Ensuring at least one ISV family per manufacturer

To comply with the ISV testing requirements explicitly stated in Article 4 of Implementing Regulation (EU) 2025/35:

> *"Each reporting period, the granting approval authority shall perform,* ***for each manufacturer to which it has granted a licence to operate the simulation tool, at least for the number of VTP families, ISV air drag families and ISV tyre families*** *selected in accordance with Article 3 and set out in Table 1 of Annex I, the corresponding in-service verification tests on the individual vehicles and tyres selected in accordance with Article 5."*

ISV families must therefore be selected per granting approval authority (GAA) for each manufacturer, to which it has granted a VECTO licence to operate the simulation tool. Furthermore, as defined in Table 1 of Annex I of (EU) 2025/35, a minimum of one ISV test is required for each manufacturer for whom the total number of vehicles reported under Article 9 of Regulation (EU) 2017/2400 exceeds 5,000 annually.

As described in Section 4.2, the selection of air drag families has been based on the high risk families identified through the risk assessment. To ensure that at least one ISV family can be selected for each manufacturer, additional air drag families have also been included beyond those identified as high risk.

These additional families were selected according to the following prioritised approach:

1. Medium-risk families from the risk assessment were selected, where available.
2. Additional families were identified through an **internal outlier analysis** of each OEM's fleet of registered vehicles. Selection in this step was made from the high or medium risk lists, if available. This assessment used specific k-factors to determine severity levels:
    - k = 0.6 for severity level 3
    - k = 0.4 for severity level 2
    - k = 0.2 for severity level 1
3. If no suitable families were found using steps 1 or 2, families with the highest registration volumes in the EU market over the past three years (2021–2023) were selected.

5 Testing priorities for ISV 2025

The families identified through the risk assessment with the highest risk and testing priority for ISV 2025 include:

- Tyre ISV families: summarised in **Annex 1;**
- Air drag ISV families: summarised in **Annex 2;** and
- VTP families: summarised **in Annex 3a** and **Annex 3b**.

The **35 tyre ISV families** presented in the table in **Annex 1** have been ordered by their registration count identified in 2023. The list contains information about each tyre, such as the tyre certificate number, tyre dimension, and fuel efficiency class. In the case of tyres, as an ISV tyre family can be used by multiple vehicle manufacturers, it is appropriate to limit the testing of tyres from an ISV tyre family to one GAA within each ISV reporting period, in order to simplify the process and reduce the administrative burden.

The final selection includes **17 air drag ISV families**, as presented in the table in **Annex 2**. These families correspond to combinations of WMI and VECTO license under which more than 5,000 vehicles were sold annually in the EU over the past three years. Based on the minimum testing requirements estimated by JRC, **at least 9 ISV air drag families will need to be tested in 2025**, from 8 unique WMIs. To ensure broader coverage, at least one additional family has been selected for each WMI and VECTO license combination, resulting in the 16 ISV families proposed in **Annex 2**. The list provides key information for each air drag family, including the air drag model, certification number, vehicle sub-group, and the associated VECTO license.

The final **13 engine VTP ISV families** are presented in the table in **Annex 3** and have been grouped according to the approval authorities that granted a VECTO licence to operate the simulation tool. Within the same vehicle manufacturer, engine families have been ordered by the vehicle registration count in the period 2021-2023. Based on the minimum testing requirements estimated by the JRC, **at least 9 ISV VTP families will need to be tested in 2025**, from 8 unique WMIs. The list in **Annex 3** provides key information for each engine VTP family, including the engine certification number, engine displacement, the associated (anonymised) vehicle manufacturer, and the count of vehicles in that engine family registered in the period 2021-2023.

The table in **Annex 3** also lists **four transmission VTP ISV families** identified as high risk, along with their certification numbers, transmission types, and associated vehicle manufacturers. For one granting approval authority and vehicle manufacturer, vehicles have been identified that feature a specific combination of engine and transmission listed in **Annex 3**. In such cases, priority shall be given to selecting vehicles that belong to one of the listed engine–transmission combinations.

Other GAAs and vehicle manufacturers shall proceed with the selection of vehicles featuring the engine specifications identified in **Annex 3**. For one manufacturer, **Annex 3** includes a single transmission family and if additional VTP tests are required, these may be carried out on vehicles from that transmission family.

In line with Article 3(1) of Regulation (EU) 2025/35, the granting approval authority shall ensure that vehicles from a VTP family, or tyres from an ISV tyre family, are not tested by another granting approval authority within the same ISV reporting period. The JRC can assist in coordinating this process.

No specific families were identified as high risk for **mass** or **AS** tests, however, these tests are still required within the scope of the HDV ISV. Mass tests may be conducted on any vehicle within the ISV families selected for air drag and VTP testing, while AS tests should be performed on vehicles selected for VTP testing.

6 Conclusions

This report summarises the first annual risk assessment for the selection of ISV families under Commission Implementing Regulation (EU) 2025/35, supporting the implementation of the in-service verification procedure for heavy-duty vehicles. It establishes a methodology for identifying those vehicle and tyre families that present the highest risk of deviation in certified CO_2 emissions and fuel consumption values. It is also offering a guidance to Member States' Granting Approval Authorities in selecting the ISV families that should undergo the in-service verification testing planned for 2025.

Despite limitations due to the unavailability of certain data, this year's risk assessment incorporated multiple sources, including:

- Data reported under Regulation (EU) 2019/1242;
- Tyre CoP test results under Regulation (EU) 2017/2400; and

The methodology builds upon the guiding principles and criteria set out in Delegated Regulation (EU) 2024/1127 and applies a Composite Risk Index based on the probability and severity of potential deviations in CO_2 values. Probability reflects the volume of vehicles or tyres per ISV family placed on the market over the reporting years 2021, 2022, and 2023. Severity assessments were adapted to the specific characteristics of each family type, rolling resistance for tyres, aerodynamic drag for air drag families, and engine and transmission configuration for VTP families. Based on this methodology, the assessment identifies:

- **35 ISV tyre families**,
- **17 ISV air drag families**,
- **13 VTP engine families**, and
- **4 VTP transmission families**

with the highest calculated risk of deviation from certified CO_2 emissions and fuel consumption values. Each listed family is accompanied by key technical and certification data to support GAAs in planning and executing their in-service verification activities.

References

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List of abbreviations and definitions

AS	Artificial Strategies tests
CoC	Certificate of Conformity
CRI	Composite Risk Index
DICE	Database for In-Service verification of CO_2 Emissions
EEA	European Environment Agency
EU	European Union
GAA	Granting Approval Authority
ISC	In-Service Conformity
ISV	In-Service Verification
IQR	Interquartile Range
JRC	Joint Research Centre
HDV	Heavy-Duty Vehicles
WMI	World Manufacturer Identifier
VTP	Verification Testing Procedure
CFD	Computational Fluid Dynamics
RRC	Rolling Resistance Coefficient
CoP	Conformity of Production
MS	Member State
OEM	Original Equipment Manufacturer
FE	Fuel Efficiency
AMT	Automated Manual Transmission
APT-S	Automatic Powertrain Type Simplified

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Annex 1. Tyre families with high risk in the year 2025

	Tyre Certification Number	FE Class	Tyre Dimension
1	e4*2017/2400*2017/2400*T*0442	A	315/70 R 22.5
2	e13*2017/2400*2019/318*T*0252	B	315/70 R22.5
3	e4*2017/2400*2019/0318*T*0631	C	315/70 R22.5
4	e4*2017/2400*2019/318*T*0885	C	385/65 R22.5
5	e13*2017/2400*2017/2400*T*0169	A	315/70 R22.5
6	e4*2017/2400*2019/318*T*0932	A	315/70 R 22.5
7	e4*2017/2400*2019/318*T*0730	B	385/65 R22.5
8	e4*2017/2400*2017/2400*T*0462	A	315/80 R 22.5
9	e13*2017/2400*2019/318*T*0261	B	385/65 R22.5
10	e4*2017/2400*2019/318*T*0732	B	385/65 R22.5
11	e13*2017/2400*2019/318*T*0263	B	315/80 R22.5
12	e4*2017/2400*2017/2400*T*0457	B	315/80 R22.5
13	e4*2017/2400*2019/0318*T*0423	B	315/70 R22.5
14	e4*2017/2400*2019/318*T*0795	C	315/80 R22.5
15	e13*2017/2400*2017/2400*T*0059	E	315/70 R22.5
16	e4*2017/2400*2017/2400*T*0268	D	315/70 R22.5
17	e4*2017/2400*2019/318*T*0584	B	385/65 R22.5
18	e13*2017/2400*2019/318*T*0256	B	315/80 R22.5
19	e4*2017/2400*2019/318*T*0753	A	315/70 R22.5
20	e4*2017/2400*2022/1379*T*01149	A	315/70 R22.5
21	e13*2017/2400*2019/318*T*0245	D	295/60 R22.5
22	e2*2017/2400*2019/318*T*5002	C	355/50 R22.5
23	e4*2017/2400*2019/318*T*0580	B	385/65 R22.5
24	e2*2400/2017*2400/2017*T*8805	B	295/60 R22.5

25	e4*2017/2400*2019/0318*T*0569	B	315/60 R22.5
26	e13*2017/2400*2017/2400*T*0051	C	355/50 R22.5
27	e4*2017/2400*2017/2400*T*0119	B	315/70 R22.5
28	e4*2017/2400*2019/318*T*0697	B	315/70 R22.5
29	e4*2017/2400*2017/2400*T*0272	D	295/60 R22.5
30	e4*2017/2400*2017/2400*T*0554	C	285/70 R19.5
31	e4*2017/2400*2017/2400*T*0553	C	285/70 19.5
32	e4*2017/2400*2017/2400*T*0545	E	315/70 R22.5
33	e13*2017/2400*2017/2400*T*0192	B	315/80 R22.5
34	e13*2017/2400*2017/2400*T*0161	B	315/70 R22.5
35	e4*2017/2400*2017/2400*T*0349	D	315/80R 22.5

Source: JRC, 2025.

Annex 2. Air drag families with high risk in the year 2025

	Air Drag Certification Number	Air Drag Model	VECTO license	Vehicle sub-group
1	e4*2017/2400*2017/2400*P*0057*00	CONFIDENTIAL	RDWH-CEV-01, RDWH-CEV-02	5-LH
2	e4*2017/2400*2017/2400*P*0055*01		RDWH-CEV-01, RDWH-CEV-02	11, 9-LH
3	e4*2017/2400*2019/318*P*0921*00		RDWH-CD0-01	5-LH
4	e4*2017/2400*2019/318*P*0920*00		RDWH-CD0-01	5-LH
5	e1*2017/2400*2017/2400*P*0050*01, e1*2017/2400*2017/2400*P*0050*02		RDWH-CD9-01, RDWH-CD9-02, RDWH02-CD9-00	10-RD, 11, 9-LH, 9-RD
6	e1*2017/2400*2017/2400*P*0053*02		RDWH-CD9-01	10-LH, 11, 9-LH
7	e5*2017/2400*2019/318*P*0018*02		e5*2017/2400*2017/2400*0001*01	5-LH
8	e5*2017/2400*2019/318*P*0018*02		e5*2017/2400*2017/2400*0001*01	5-LH
9	e3*2017/2400*2019/318*P*1031*00		e3*2017/2400*2019/318*0001*01	9-LH
10	e3*2017/2400*2022/1379*P*1004*01		e3*2017/2400*2019/318*0001*01	5-LH
11	e3*2017/2400*2019/318*P*1023*00		e3*2017/2400*2019/318*0002*01, e3*2017/2400*2022/1379*0002*02, e3*2017/2400*2022/1379*0002*03	3
12	e3*2017/2400*2019/318*P*1015*00		e3*2017/2400*2019/318*0002*01, e3*2017/2400*2022/1379*0002*02, e3*2017/2400*2022/1379*0002*03	2
13	e1*2017/2400*2019/318*P*0165*00, e1*2017/2400*2019/318*P*0165*01		e1*2017/2400*2017/2400*LICENCE*0001*00, e1*2017/2400*2019/318*LICENCE*0001*01, e1*2017/2400*2022/1379*LICENCE*0001*02	1, 1s
14	e1*2017/2400*2019/318*P*0161*00, e1*2017/2400*2019/318*P*0161*01		e1*2017/2400*2017/2400*LICENCE*0001*00, e1*2017/2400*2019/318*LICENCE*0001*01, e1*2017/2400*2022/1379*LICENCE*0001*02	1, 2
15	e1*2017/2400*2019/318*P*0169*00, e1*2017/2400*2019/318*P*0169*01		e1*2017/2400*2017/2400*LICENCE*0001*00, e1*2017/2400*2019/318*LICENCE*0001*01, e1*2017/2400*2022/1379*LICENCE*0001*02	2, 3
16	e2*2017/2400*2019/318*P*8053		e2*2017/2400*2019/318*8057*01, e2*2017/2400*2019/318*8057*02	2, 3
17	e2*2017/2400*2019/318*P*8053		e2*2017/2400*2019/318*8057*01, e2*2017/2400*2019/318*8057*02	2

Source: JRC, 2025.

Annex 3. VTP engine and transmission families with high risk in the year 2025

NR	Engine certification number	Engine (L)	Gearbox certification number	Transmission type	Vehicle count 2021-2023	GAA	OEM
1	e1*2017/2400*2019/318*E*00404	12.8			29,313	e1	OEM 1
2	e1*2017/2400*2019/318*E*00390	12.8			11,822		
3			e1*2017/2400*2019/318*G*0178	AMT	10,589		
4	e5*2017/2400*2019/318*E*00232	12.8			37,075	e5	OEM 2
5	e5*2017/2400*2019/318*E*00214	12.8			6,078		
6	e4*2017/2400*2022/1379*E*00991	12.4			21,808	e4	OEM 3
7	e4*2017/2400*2022/1379*E*0829	6.9			4,792		
8	e4*2017/2400*2019/318*E*0854	12.7			31,037		OEM 4
9	e4*2017/2400*2019/318*E*0011	12.7			2,741		
10	e4*2017/2400*2019/318*E*0866	12.9			44,786		OEM 5
11	e2*2017/2400*2020/1181*E*0007	5.1	e1*2017/2400*2019/318*G*0311	APT-S	1,864	e2	OEM 6
12			e1*2017/2400*2017/2400*G*0193	AMT	1,241		
13			e1*2017/2400*2017/2400*G*0192	AMT	871		
14	e5*2017/2400*2019/318*E*00213	12.8			21,776		
15	e3*2017/2400*2019/318*E*1039	5.9			924	e3	OEM 7
16	e3*2017/2400*2019/318*E*1035	12.9			2,918		OEM 8

Source: JRC, 2025.

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