TDE-P01 | Soil Criterion

Dioxins, furans and dioxin-like PCBs — rationale and decision rules · Technical protocol · Version 0.1 · 7 November 2026

1. TDE criterion

The Lands of Excellence (TDE) project uses an internal criterion for selecting agricultural areas: the total toxic-equivalent concentration in soil of polychlorinated dibenzo-p-dioxins (PCDD), polychlorinated dibenzofurans (PCDF) and dioxin-like PCBs (DL-PCBs). This criterion does not, by itself, certify the entire area: it governs only the assessment of this contaminant group in soil.

TDE indicator: Σ(PCDD + PCDF + DL-PCBs), calculated with WHO-TEF 2005 factors and expressed in pg WHO-TEQ/g dry matter (numerically equivalent to ng WHO-TEQ/kg dry matter).

Soil value	TDE decision	Next step
< 3.00 pg WHO-TEQ/g	CRITERION MET	Proceed with the remaining TDE requirements.
3.00–6.00 pg WHO-TEQ/g (inclusive)	ASSESSMENT SUSPENDED	Results from biological matrices, assessed against their own limits, determine the outcome.
> 6.00 pg WHO-TEQ/g	CRITERION NOT MET	Area excluded from TDE under the internal rule; regulatory requirements apply separately.

A particularly low concentration (e.g. 0.50 pg WHO-TEQ/g) may be highlighted as favourable in the report, but does not automatically confer TDE status.

2. Rule for the intermediate band (3–6)

Where soil is between 3 and 6 pg WHO-TEQ/g, the decision remains suspended until results for the same contaminant groups are available from suitable biological matrices (for example earthworms, mosses, sentinel plant leaves or other relevant bioindicators, according to the investigation plan).

• If all biological matrices specified by the protocol meet their respective TDE limits, the soil criterion is considered met.

• If a decisive biological matrix exceeds its own confirmed TDE limit, the criterion is not met; discretionary offsetting by other favourable results is not permitted.

• If biological data are unavailable, unrepresentative or analytically unsuitable, the assessment remains suspended: qualification is not granted without sufficient evidence.

Illustrative example: soil = 5; earthworms = 0.4; leaves = 0.1 pg/g. These numbers are NOT directly comparable between matrices and do not establish suitability until specific thresholds, expression bases, methods and exposure periods are defined. The example illustrates decision logic only.

3. Origin of the 3 pg/g threshold

The internal threshold of 3.00 pg WHO-TEQ/g was set at half the agricultural CSC specified by Ministerial Decree of 1 March 2019, No. 46, Annex 2: 6 ng WHO-TEQ/kg dry matter for PCDD + PCDF + DL-PCBs. The legislation provides an official reference and a precise definition of the sum; it does not classify soils as “excellent” or require halving the threshold. The 50% reduction is a voluntary precautionary choice by TrustyFood.

The criterion is also informed by regional observations showing that TEQ concentrations on the order of picograms per gram may occur in agricultural or natural soils without known point sources. These data help avoid an arbitrarily low threshold, but do not measure exactly the same indicator as TDE.

4. Territorial evidence: Emilia-Romagna and Piedmont

Source / population	Measured PCDD/F	Interpretation
Emilia-Romagna, 2026 report; 162 samples from 81 stations, 8 rural areas, 2 seasons	Median 0.60 pg I-TEQ/g dry matter (reported in conclusions of the shared report)	Empirical regional agricultural background reference, not a health threshold; predominantly rural plains and foothill sites.
Piedmont, 2008 State of Environment report, surface horizon; 19 agricultural sites	Mean 1.4; median 1.3 pg I-TEQ/g dry matter	Diffuse concentrations, higher than the Emilia-Romagna median.
Piedmont, 2008 report, surface horizon; 24 natural sites	Mean 3.0; median 1.7 pg I-TEQ/g dry matter	The mean at natural sites may exceed that at agricultural sites; the mean alone does not describe the distribution.

In the Piedmont dataset, the higher mean in natural soils does not prove stronger local anthropogenic pressure: atmospheric deposition, greater organic matter, accumulation in litter and different sampling depths can affect results. “Pollution” must not be inferred solely from a value of 3 pg/g.

Essential comparability note: Emilia-Romagna/Piedmont data refer to PCDD/F expressed as I-TEQ; the TDE criterion and the CSC in Ministerial Decree 46/2019 refer to PCDD/F + DL-PCBs in WHO-TEQ 2005. They provide useful orders of magnitude but are NOT directly interchangeable. Rigorous quantitative comparison requires congener-level data and consistent recalculation.

5. Scientific rationale and scope of validity

• Dioxins and furans are persistent and may accumulate in soil following historical and widespread atmospheric deposition; low concentrations do not prove an active local source.

• For many crops, root transfer of PCDD/F into edible parts is limited; direct deposition, dust and crop-specific pathways remain possible.

• TDE designation is a voluntary environmental-quality selection and does not replace analytical testing of food products, checks on other matrices, or legal obligations.

• Soil below 3 does not demonstrate “zero contamination”; soil between 3 and 6 is not automatically contaminated; soil above 6 is not necessarily evidence of a criminal offence. These conclusions must remain distinct.

6. Parameters to establish before official implementation

• Confirm with the laboratory the list of 17 PCDD/F and 12 DL-PCB congeners, WHO-TEF 2005 factors and dry-matter basis.

• Predefine treatment of < LOQ values (lower-, middle- or upper-bound), LOQs per congener and calculation of the TEQ sum.

• Define a metrological rule for results near 3.00 and 6.00 (uncertainty, possible resampling and non-discretionary decisions).

• Define and validate separate thresholds for each biological matrix; soil limits cannot be applied to mosses, earthworms or bees.

• Verify legal requirements and responsibilities if the CSC is exceeded, independently of the voluntary TDE decision.

• Reassess the internal threshold following the pilot, without retroactive changes to favour a particular area.

7. Summary and rationale for the criterion

“The TDE threshold of 3 pg WHO-TEQ/g is not intended as a universal toxicological limit. It is a voluntary, predetermined and reproducible criterion: it uses the Italian agricultural CSC of 6 pg WHO-TEQ/g for PCDD/F + DL-PCBs as its formal reference and reduces that value by 50%. Regional studies show that agricultural and natural soils may have diffuse picogram-level concentrations even in the absence of local industrial pressure. Consequently, the Emilia-Romagna agricultural median of 0.60 alone is not used as a universal exclusion threshold; instead, a 3–6 intermediate band is resolved through biomonitoring of independent matrices with their own thresholds. Regulatory compliance, environmental pressure and actual food-product quality remain distinct.”

8. Sources and documentary checks

• Ministerial Decree of 1 March 2019, No. 46, Annex 2, item 37 and note **: https://www.reteambiente.it/normativa/34835/dm-ambiente-1-marzo-2019-n-46/

• Emilia-Romagna Region, “Organic micropollutants in the agricultural soils of Emilia-Romagna”, 30 June 2026: https://ambiente.regione.emilia-romagna.it/it/geologia/notizie/notizie-2026/microinquinanti-organici-nei-suoli-agricoli-dellemilia-romagna

• Emilia-Romagna Region, 2026 Report, §7.7 “General conclusions”: median 0.60 pg I-TEQ/g from the complete report; the summary webpage does not directly report the median.

• ARPA Piemonte, State of the Environment Report 2008, Ch. 16, Table 16.3 (agricultural and natural soil mean and median): https://relazione.ambiente.piemonte.it/2024/sites/default/files/doc/RSA2008/cap_16.pdf

• ARPA Piemonte, diffuse organic soil contaminants, Environment Report 2022: https://relazione.ambiente.piemonte.it/2022/it/territorio/stato/suolo-contaminazione

Document status: voluntary TDE criterion, not yet validated for metrological requirements or biological thresholds. It is neither a statutory certification nor a legal limit.