TDE-P01 | Soil Characterisation

INORGANIC PARAMETERS · PRELIMINARY CRITERIA · 7 NOVEMBER 2026

Technical document for the TrustyFood Lands of Excellence project. It sets out the criteria adopted to select and assess metals in agricultural soils. TDE thresholds are voluntary and remain subject to validation; they do not replace statutory requirements.

1. Analytical panel and thresholds

Parameter	CSC, Ministerial Decree 46/2019	TDE	Rule / note
Arsenic (As)	30	10	Acceptance up to 10
Cadmium (Cd)	5	2.5	Acceptance up to 2.5
Total chromium (Cr)	150	150	Consider geogenic background
Hexavalent chromium (Cr VI)	2	< LOQ	Not quantifiable; method to be specified
Mercury (Hg)	1	1	Acceptance up to 1
Nickel (Ni)	120	120	120–180: conditional assessment
Lead (Pb)	100	100	Acceptance up to 100
Copper (Cu)	200	100	100–150: conditional assessment
Soil pH	—	Mandatory	Initiates Ni/Cu assessment where pH > 7

Units: mg/kg dry matter for metals. pH is dimensionless. The “< LOQ” result for Cr(VI) requires an appropriate quantification limit, declared and verified by the laboratory.

2. Special rule for Ni and Cu

Total concentration alone does not necessarily represent the fraction available to plants. An additional assessment using an official method is therefore envisaged for non-acid soils, provided the measured pH is greater than 7.

• Nickel: ≤ 120 mg/kg — criterion met; > 120 and ≤ 180 mg/kg at pH > 7 — decision suspended pending analysis of extractable Ni; > 180 mg/kg — TDE criterion not met.

• Copper: ≤ 100 mg/kg — criterion met; > 100 and ≤ 150 mg/kg at pH > 7 — decision suspended pending analysis of extractable Cu; > 150 mg/kg — TDE criterion not met.

• Where pH ≤ 7, the higher concentration band is not applicable under the TDE criterion.

• Acceptance within the suspended band will require limits for extractable Ni and Cu, still to be defined in consultation with a soil geochemistry specialist. No automatic acceptance is envisaged without that assessment.

3. Official method for extractable fractions

Ministerial Decree of 13 September 1999 (“Official methods for chemical analysis of soil”), Section XII: Method XII.1, availability index for Cd, Ni, Pb, Cu and Zn in non-acid soils. Extraction with DTPA / $CaCl_2$ / triethanolamine buffered to pH 7.3 (Lindsay and Norvell method). Method XII.2 is provided for acid soils but is not used in the proposed pH > 7 exception.

Interpretative note: the extractable fraction is an operational index of availability, not a direct or universal measure of concentrations in grain or other crops. A pH greater than 7 does not, by itself, establish a geogenic origin of the metal.

4. Scientific rationale and scope

Ministerial Decree 46/2019 provides a reference for managing contaminated agricultural soils; its contamination threshold concentrations (CSCs) are not a scale of agronomic or food excellence. TDE must distinguish natural concentrations linked to lithology (e.g., Ni and Cr in ophiolitic materials), potential anthropogenic inputs and metal availability. Emilia-Romagna regional maps and background datasets may support this interpretation. Exceedance of any applicable statutory threshold must in all cases be assessed separately under legal obligations.

Antimony (Sb) is excluded from the routine panel, together with Be, Co, Se, Tl, V, Zn and free cyanides. Their exclusion does not prevent targeted analyses where a plausible source or a specific legal requirement exists. Cr(VI) remains in the panel with a < LOQ criterion; the Bartlett & James procedure is a reference under consideration, but the operating method and LOQ must be specified in the SOP.

5. Outstanding issues

• Define acceptable maxima for extractable Ni and Cu with the designated specialist.

• Formalise the analytical procedure and required LOQ for Cr(VI).

• Specify confirmation procedures, measurement uncertainty and treatment of near-threshold results.

• Validate the protocol in the pilot area before declaring it a definitive, replicable standard.

Key references

• Ministerial Decree of 1 March 2019, No. 46, Annex 2: CSCs for agricultural soils. https://www.reteambiente.it/normativa/34835/

• Ministerial Decree of 13 September 1999, Official methods for chemical analysis of soil, Section XII (Methods XII.1 and XII.2). https://www.gazzettaufficiale.it/eli/gu/1999/10/21/248/so/185/sg/pdf