



Calculation of the Damage Caused to Soils as an Object of Environmental Protection Due to the Use of Livestock By-Products

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Calculation methodology

To determine the monetary value of the damage caused to soils, the "Methodology for Calculating the Damage Caused to Soils as an Object of Environmental Protection," approved by Order No. 238 of the Ministry of Natural Resources of Russia dated July 8, 2010, is used.

Knowing how to perform calculations using this methodology will allow you to:

- Understand the extent of soil damage in monetary terms (assess the scale of the problem)
- Evaluate the accuracy of calculations made by control and supervisory authorities to develop a strategy for addressing potential issues



Calculation of the total amount of damage

$$\text{DMG} = \text{DMGcont} + \text{DMGwaste} + \text{DMGcover} + \text{DMGremov} + \text{DMGdestr},$$

where: **DMG** – total amount of damage caused to soils (rubles);

DMGcont – amount of damage resulting from soil contamination;

DMGwaste – amount of damage due to soil deterioration from littering, caused by the storage of production and consumption waste on the soil surface or within the soil layer;

DMGcover – amount of damage from soil deterioration when its surface is covered with artificial materials and/or objects (including linear objects and sites of unauthorized production and consumption waste disposal);

DMGremov – amount of damage from soil deterioration due to the removal and/or relocation of the fertile soil layer;

DMGdestr – amount of damage from the destruction (complete loss) of the fertile soil layer.

Calculation of the amount of damage resulting from soil contamination



$$\text{DMGcont} = \text{CD} * \text{S} * \text{Kd} * \text{Kuse} * \text{Tx} * \text{Kfst},$$

where: **DMGcont** – amount of damage (rubles);

CD – contamination degree;

S – area of the contaminated site (sq. m.);

Kd – factor accounting for the depth of soil contamination;

Kuse – factor accounting for the land category and type of permitted land use;

Tx – rate for calculating the amount of damage caused to soils as an object of environmental protection due to soil contamination;

Kfst – factor accounting for the fertile soil layer thickness.



Determination of the degree of contamination

The degree of contamination depends on the ratio of the actual content of the i^{th} contaminant in the soil to the environmental quality standard for soils.

The ratio (C) of the actual content of the i^{th} contaminant in the soil to the environmental quality standard for soils is determined by the formula:

$$C = \sum_{i=1}^n X_i / X_s$$

Where:

X_i – actual content of the i^{th} contaminant in the soil (mg/kg);

X_s – environmental quality standard for soils (mg/kg).



Determination of the degree of contamination

$$\text{DMGcont} = \text{CD} * S * Kd * Kuse * Tx * Kfst,$$

In the absence of an established environmental quality standard for soils (for a specific contaminant), the concentration value of this contaminant in an adjacent area with a similar intended purpose and type of use, which is not negatively affected by this type of violation, is used as the value of X_s .

If C is less than 5, CD=**1.5**;

If C is from 5 to 10, CD=**2.0**;

If C is from 10 to 20, CD=**3.0**;

If C is from 20 to 30, CD=**4.0**;

If C is from 30 to 50, CD=**5.0**;

If C is from 50 to 70, CD=**6.0**;

If C is from 70 to 100, CD=**7.0**;

If C is from 100 to 150, CD=**9.0**;

If C is from 150 to 250, CD=**12.0**;

If C is over 250, CD=**15.0** (up to 2021, the maximum CD was 6.0).



Indicator considering the depth of soil contamination (Kd)

$$\text{DMGcont} = \text{CD} * \text{S} * \text{Kd} * \text{Kuse} * \text{Tx} * \text{Kfst},$$

The value of the indicator considering the depth of soil contamination (Kd) is determined according to the maximum actual depth of soil contamination, which must not exceed the soil thickness values based on the location of the land plot within forest zones and land plots situated north of the tundra forest and sparse taiga zones, as established in the Methodology.

At a depth of soil contamination:

up to 5 cm, Kd=1;

up to 20 cm, Kd=1.3;

up to 50 cm, Kd=1.5;

up to 100 cm, Kd=1.7;

up to 150 cm, Kd=2.0;

up to 200 cm, Kd=2.5;

more than 200 cm, Kd=3.

Soil thickness depending on the confinement of the land plot to forest zones and land plots located north of the tundra forest and sparse taiga zones



Confinement of the land plot to forest zones and land plots located north of the tundra forest and sparse taiga zones	Thickness, cm
Land plots located north of the tundra forest and sparse taiga zones	150
Zone of tundra forests and sparse taiga	150
Taiga zone	200
Coniferous-broad-leaved forest zone	150
Forest-steppe zone	200
Steppe zone	250
Semi-desert and desert zone	170
Mountainous North Caucasus and mountainous Crimea zone	150
South Siberian mountain zone	200

Value of the factor accounting for the land category and type of permitted land use (Kuse)



$$\text{DMGcont} = \text{CD} * \text{S} * \text{Kd} * \text{Kuse} * \text{Tx} * \text{Kfst},$$

- for lands of specially protected natural areas, lands designated for nature protection purposes, and especially valuable lands containing natural objects and cultural heritage sites of special scientific, historical, and cultural significance — **2**;
- for agricultural lands in the Far North, which are moss-lichen reindeer pastures within agricultural lands — **1.9**;
- for water protection zones within lands of all categories — **1.8**;
- for other agricultural lands within the agricultural land category — **1.6**;
- for lands of the forest fund and lands of other categories where forests are located — **1.5**;
- for lands of residential settlements, except for plots designated as industrial zones, zones of engineering and transportation infrastructure, special-purpose zones, and military facility zones — **1.3**;
- for lands of other categories and types of permitted use, as well as for land plots whose state ownership is not delimited — **1.0**.

Rate for calculating the amount of damage caused to soils as an object of environmental protection in case of contamination



$$DMG_{cont} = CD * S * Kd * Kuse * Tx * Kfst,$$

Confinement of the area of distribution of soils, which have been harmed, to forest zones and land plots located north of the tundra forest and sparse taiga zones.	Rates (RUB/m)
Land plots located north of the tundra forest and sparse taiga zones	1000
Zone of tundra forests and sparse taiga	900
Taiga zone	500
Coniferous-broad-leaved forest zone	400
Forest-steppe zone	500
Steppe zone	600
Semi-desert and desert zone	550
Mountainous North Caucasus and mountainous Crimea zone	700
South Siberian mountain zone	700



The factor accounting for the fertile soil layer thickness (Kfst)

$$\text{DMGcont} = \text{CD} * \text{S} * \text{Kd} * \text{Kuse} * \text{Tx} * \text{Kfst},$$

The Kfst factor is applied if there is a fertile soil layer.

At the fertile soil layer thickness:

up to 0.5 cm, Kfst=**8**;

up to 5 cm, Kfst=**6**;

up to 15 cm, Kfst=**5**;

up to 20 cm, Kfst=**4**;

up to 30 cm, Kfst=**3**;

up to 40 cm, Kfst=**2.5**;

up to 50 cm, Kfst=**2**;

up to 60 cm, Kfst=**1.5**;

over 60 cm, Kfst=**1**.

In the absence of a fertile soil layer (or if its presence cannot be proven), the Kfst factor is set to 1.



Thank you!