



## THE GERMAN SOIL PROTECTION LAW AND REGULATIONS FOR THE UTILISATION OF BIOWASTE

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### Abstract

With the introduction of the Federal Soil Protection Act and the corresponding ordinance on Federal Soil Protection and Contaminated Sites in 1998 respectively 1999 the cornerstone for a federal-unique soil protection was laid and benchmarks were set-up for the harmonisation of existing provisions of national and environmental law, to bring soil into focus. The scope of the soil protection law is to maintain soil functions in a sustainable way or to restore them. Thus precaution must be taken to avoid the occurrence of harmful changes to the soil, also concerning the discharge of harmful substances into soil by cultivation activities, especially fertilizing. As a result there is a need to restrict unavoidable input of pollutants to an equilibrium between input and tolerable output or to restrain pollutant concentrations in discharged materials to tolerable loads for soils, which outlines the principles of the below described German “Fertilizer Concept” for the standard valuation of fertilizers with regard to their long-term residues in soils.

### Keywords

Precautionary soil protection, Fertilizer Concept, biowaste, harmful substances

### 1. Origin and Demand for a Federal Soil Protection Act in Germany

For the last three decades German environmental policies have been increasingly stamped by orientation to the precautionary principle. Improved requirements to safeguard the environmental media water, air and soil considerably induced a changeover from waste displacement across waste economy to recycling management [1].

With the resolution to the Federal Soil Protection Act on 17<sup>th</sup> March 1998 [2] and its entry into force on 1<sup>st</sup> March 1999, including the corresponding Federal Soil Protection and Contaminated Sites Ordinance on 12<sup>th</sup> July 1999 [3], in Germany the preconditions for a federal-unique soil protection were created.

Soil protection is a latecomer in German environmental policy. For a long time it was assumed that there was no need for independent regulations in the sense of a soil protection act, but being a part of existing environmental regulations.

In 1985 the German Federal Government had adopted a “Soil Protection Concept”, as an incentive to work out regulations for the protection of soil in particular. Under the aim of practising the protection of soil all important impacts on soil were summarised for the first time [4]. The scope was to balance the diverse utilization requirements, averting damages and maintaining precaution against long-term hazards to soil. It was especially pointed out that 2 natural properties as much as the soil were the subject of protection, regardless of utilization interests. Soil functions became the standard for the assessment of soil conditions and the required level of its protection.

The Soil Conception of 1985 still regarded soil protection as a cross-section task. Soon it was discovered that such partial regulations were not sufficient. Primarily there was a lack of mandatory standards or limit values for the valuation of detrimental effects, regardless of the source of impact, or precautionary or target values for the remediation of soil.

## **2. General Concept of the Federal Soil Protection Act**

The Federal Soil Protection Act and the corresponding Soil Protection and Contaminated Sites Ordinance of 1999 integrates the prevention of harmful changes to the soil, the rehabilitation of the soil and precautions against negative soil impacts. Thus, soils in Germany are now protected as the third environmental media after water and air. At the same time benchmarks for a harmonisation of existing environmental policies were settled with regard to the protection of soils.

The Federal Soil Protection Act consists of 5 main parts:

- 1) General Provisions
- 2) Principles and Obligations
  - a) Obligations to Prevent Hazards
  - b) Unsealing of Sealed Ground
  - c) Application and Introduction of Materials on to or in to the Soil
  - d) Obligation to take Precautions
  - e) Values and Requirements
  - f) Risk Assessment and Orders for Studies (Investigations)
- 3) Supplementary Provisions for Contaminated Sites
- 4) Good Agricultural Practice
- 5) Final Provisions

With the introduction of the Federal Soil Protection Act soil functions became the standard for the assessment of soil conditions and the required level of its protection. This includes the prevention of harmful changes to the soil, rehabilitation of soil and precautions against negative soil impacts. Article 2 of the Soil Protection Act defines three main soil functions i.) natural soil functions (e.g. as a basis for life and a habitat for people, animals, plants and soil organisms; and as a medium for decomposition, balance and restoration as a result of its filtering, buffering and substance-converting properties, and especially groundwater

protection), ii.) functions as an archive of natural and cultural history and iii.) functions useful to man (e.g. land for agricultural and silvicultural use). The Federal Soil Protection Act is based on the German concept of the precautionary principle, which comprises the protection or restoration of soils and their functions on a permanent sustainable basis.

If harmful changes to the soil occur or become likely to occur, measures for averting a danger (Article 4), orders for investigations and risk assessment (Article 9) and obligations for the remediation of the soil (Article 10) are required by law.

Indications for the concern of harmful changes to the soil are given, when

- soil functions are impaired and if
- this could lead to danger, to considerable drawbacks or nuisance for individual persons or for the general public and its goods (including groundwater).

To safeguard the ecological soil functions and the functions linked to human activities, measures against harmful changes to the soil are required, in line with the precautionary principle, which relies on the assessment of predicted incidents for the required level of intervention, based on soil quality targets and the respective subject of protection. Article 7 of the Act specifies the obligations for precautionary measures. Soil impacts shall be avoided or reduced where this is a reasonable requirement also with respect to the purpose of the use of the site. The obligations for precautionary measures in agricultural soil use are specified in Article 17, which refers to the code of good agricultural practice to preserve the soil fertility and productivity as a natural resource on a long term sustainable basis<sup>21</sup>.

### **Essential Criteria for the Precautionary Soil Protection**

1. The natural soil functions e.g. as habitat for plants and soil organisms, as regulatory body in ecosystems (filter, storage, buffer) and the function as the site to be used by agriculture and forestry
2. Abiotic factors e.g. the structures of clay minerals with their significance for natural soil functions (e.g. against soil acidification) as well as the soil structure
3. Integrity of soil as a part of ecosystem
4. Protection of groundwater as an indirect result of soil protection
5. Public health: in particular by direct uptake of soil caused contamination of fodder and foodstuffs including ground- and drinking water
6. The soil as scarce resource, e.g. against destruction and loss by soil abrasion, sealing and denaturation.

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<sup>21</sup> This also includes the soil's yield potential.

In the Federal Soil Protection and Contaminated Sites Ordinance “trigger levels” and “action levels” are provided according to defined heavy metals and organic pollutants derived for the three considered pathways:

- soil - human being
- soil - useful plant
- soil - groundwater;

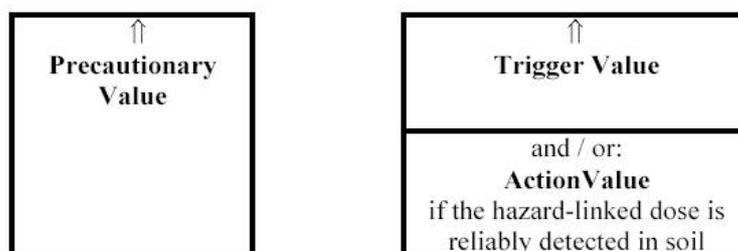
as well as precaution levels and values for admissible additional pollution loads for all pathways [5].

"**Trigger levels**" triggering further investigations to ascertain (verify/falsify) whether the contamination implies a danger;

"**Action levels**" generally indicating a danger which has to be warded off; further investigations to ascertain the danger are usually not necessary;

"**Precaution levels**" indicating a certain chance of future soil problems which need to be addressed in order to avert upcoming damages.

Precaution		Averting a Danger
Impairment is excluded according to practical reason, but possible	Concern that impairment might occur if impacts (e.g. substance inputs) continue	Impairment sufficiently probable
----- Increasing risk to the asset to be protected >----->		
Area of residual risk	← Point where undesirable risk begins	← Point where non-tolerable risk begins
Practically safe, based on an analysis in the light of current knowledge and referring to a single substance and/or including incalculable risks and referring to several substances	e.g., for the soil – human being pathway: extrapolated dose with no adverse effects on sensitive groups of persons	e.g., for the soil – human being pathway: extrapolated dose which is linked to a hazard in an unfavourable exposure scenario



**Figure 1:** Soil specific risk areas and soil protection values/levels [6]

Among other statutory principles and requirements to safeguard soil functions, Article 3 specifies other provisions of national law with regard to soil protection, which are not under the scope of the Federal Soil Protection Act and the corresponding ordinances. These provisions of foregoing national law were established before the Soil Protection Act's entry 5 into force 1999. Thus it is an important task to harmonise these provisions with the Soil Protection Act and to integrate them into corresponding legal regulations.

### **3. Evaluation of harmful substance discharges by cultivation activities - Ordinance on Biowastes and Ordinance on Sewage Sludge**

In line with the Federal Soil Protection Act, precaution must be taken to avert harmful changes to the soil, also with regard to the discharge of harmful substances into soil by cultivation activities [7]. To comply with the precautionary principle by "*following the aims of preventive environmental protection, problematical input of substances into the environmental media soil, water and air (must) be prevented. Regarding both the outstanding importance of agricultural soil for the production of safe food it has to be ensured [...] that there will be no accumulation of contaminants in soil (especially by application of sewage sludge, slurry and other farm manure, artificial fertilizer and compost)*" [8], the Federal Ministry of Consumer Protection, Food and Agriculture and the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety introduced the German Concept for the Assessment of Fertilizers "Gute Qualität und sichere Erträge", during their joint Conference in 2001. According to this resolution all affected policies in Germany are currently under revision to meet the requirements in line with the Federal Soil Protection Act.

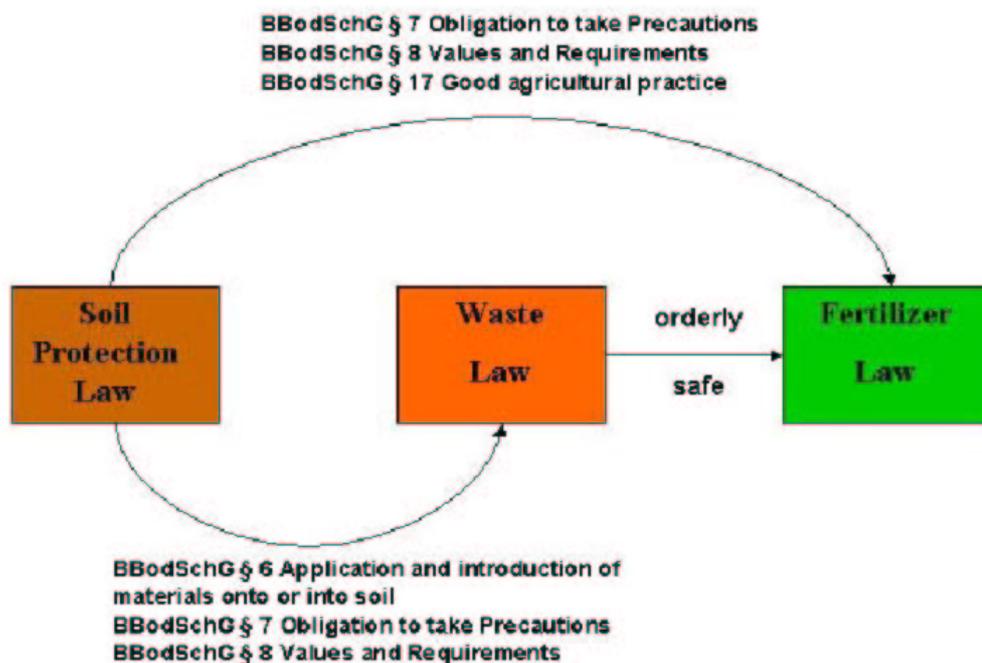
In this regard the relevant principles were already settled by the Federal Recycling Management and Waste Act of 27 September 1994 [9], providing the fundamental definitions in waste management (including biowastes) (§ 5) as for:

- **not detrimental** (no considerable drawbacks for general public wealth, no accumulation of harmful substances in reusable material cycle);
- **in accordance with the rules;**
- **beneficial** (application with the aspect of use not of disposal, at least positive impact on one soil function).

Concerning the application of organic wastes on soil the Sewage Sludge Ordinance of Germany of 1992 [10] and the Biowaste Ordinance of Germany of 1998 [11] are very important, against the background of the precautionary requirements in soil protection. During the drafting of the Biowaste Ordinance the given precautionary values were matched to comply with the respective values outlined in the Federal Soil Protection and Contaminated Sites Ordinance.

The Biowaste Ordinance contains the following focal points:

- 1) Requirements concerning treatment to ensure human, animal and plant health;
- 2) Requirements concerning pollutants and additional parameters;
- 3) Requirements concerning application in agriculture;
- 4) Obligations to provide proof.



**Figure 2:** Interference of different law branches concerning soil protection and waste acts

#### 4. Concept for the reduction of harmful substance discharge in soil by means of fertilizer quality

With concern to the nutrient level sewage sludges and biowastes are regarded as organic fertilizers by German law, hence the German Fertilizer Ordinance regulates questions with regard to their nutrient level. Concerns of harmful substances are regulated in the Sludge Ordinance and the Biowaste Ordinance. These provisions also have to account for the requirements of the Soil Protection Act.

To solve the existing imbalance between the requirements of the German Biowaste and the Sewage Sludge Ordinance, concerning the terms “*not detrimental*”, “*in accordance with the rules*” and “*beneficial utilization*”, the requirements of the fertilizer law and the resulting practice in fertilizer application, these provisions are currently revised, to comply with the German Soil Protection Law. Thus for the first time in Germany a framework of rules and regulations provides a unified assessment for all substantial discharges into soil, in line with the precautionary principle in soil protection. The baseline is marked by the German “Fertilizer Concept”, to restrict unavoidable input of pollutants to an equilibrium between input and tolerable output or to restrain pollutant concentrations in discharged materials to tolerable contents for soils, taking into account the accumulative effects by the decomposition of applied materials.

In line with precautionary soil protection the German National/Federal States Working Group Soil Protection challenged a graduated action concept for the limitation of pollutant discharges that takes into account the type and behaviour of pollutants and provides for some flexibility

various action options to limit pollutant discharges. The aim of this limitation is to protect soil, particularly with regard to its natural soil functions (Article 2). Therefore as a first step, care shall be taken that pollutants do not accumulate beyond a critical level. Based on this, four options were derived.

- 1) Avoidance of discharges of harmful substances
- 2) Limitation of harmful substance discharges to a content level that corresponds to that of cultivation site (“one to one”)
- 3) Limitation of harmful substance discharges to a balance level with tolerable discharge (“input equals output” (no net accumulation))
- 4) Setting up conventions on provisionally tolerable accumulation and harmful substance discharges according to defined ancillary conditions [12]

The options No. 2 (“one to one”) and No. 3 (no net accumulation) safeguard no further discharge of harmful substances into soil. During the creation of these action principles it was overlooked that also a combination of these two options would lead to the same results. This combination of options No. 2 and 3 was then applied by the German Fertilizer Concept of 2002 and adopted by the “Framework Ordinance (Artikelverordnung)” for the unified assessment of fertilizers. The resulting concept implements the new standards in the Sewage Sludge -, Biowaste-, Fertilizer- and Fertilizing Ordinance in line with the soil protection law.

The main aspects of this concept are:

- 1) the long-term residual fraction of materials in the soil (mineral and organic);
- 2) the nutrient contents of organic fertilizers;
- 3) the nutrient demand of plants;
- 4) the withdrawal of heavy metals by plants;
- 5) the analytic variation limit.

Concerning the principle „one to one“ the relevant figure for the aversion of discharges of harmful substances into soil, is the fate of contaminants in fertilizers with regard to their longterm residues in the soil. According to this three groups of fertilizers were created.

**Table 1:** Fertilizer groups according to the long-term residual fraction of materials in soil (mineral and organic)

<b>Fertilizer</b>	<b>For long-term residues in the soil (% of dry matter)</b>	<b>Contents of nutrients (g P<sub>2</sub>O<sub>5</sub>/kg dry matter)</b>
<b>Compost and brewing or distilling waste</b>	up to 70	up to 20
<b>Cattle slurry, cattle manure, poultry manure, brewing or distilling dregs</b>	up to 40	up to 35
<b>Pig slurry, pig manure, sewage sludge</b>	up to 40	up to 50

These limits were derived from the precautionary values of Federal Soil Protection Ordinance according to the average soil substrate loam/silt (60 % of German soils are of this substrate). They mark the upper limit for the heavy metal contents in the the long-term residual fraction of fertilizers in soil. Also the uptake by crops was considered - weighted and averaged for all crops. In addition the inevitable analytic variations of the respective analytic methods were standardised and included [13].

## 5. Perspectives

At present the harmonisation process of other provisions of national law with regard to soil has nearly been completed. Especially with regard to the application of sewage sludge considerable changes are foreseen, since many sludges no longer comply with the soil protection law. Thus those sludges need to be disposed using more environmentally friendly processes such as thermal utilisation, in the future.

The efforts by the German “Quality Assurance Confraternity (Gütegemeinschaft Kompost)” have vastly improved the quality of biowastes, especially composts. These elevated requirements for the quality assurance of biowastes comply with the new standards in soil protection law. Currently research projects are carried out to determine the causes of the local occurrence of high heavy metals contents in different organic fertilizers.

Concerning a European soil protection policy it will be essential to meet the prerequisites of the precautionary principle on the European scale, to safeguard soil functions on a long-term sustainable basis. In Germany this was achieved by the introduction of the soil protection law coequal to existing provisions with regard to water or air.

To comply with the precautionary principle and to safeguard soil functions it is necessary to limit future discharges of harmful or disturbing substances to an equilibrium between input and tolerable output. For this a stronger harmonisation of the requirements for the quality of all fertilizers can be a first step.

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