

# Threshold Values in the Context of European Soil Protection Policies

**Report**

to

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as co-ordinators of the 1<sup>st</sup> European Soil Forum, to be held in  
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## 1 Scope of the Report

During the Preparatory Meeting on 18 and 19 May 1999 in Berlin in preparation of the First European Soil Forum, the use of **threshold values** was -among other scientific and policy topics - identified as an issue of major interest in the strengthening of soil protection policies. As a lead person, *Dr. Günther Bachmann* has prepared a background paper on 'Threshold values'. This paper contains proposals for the further proceedings of the ESF.

In preparation of this report, a questionnaire was send to all Member States, Applicant Countries and Non-EU States, which are involved in the ESF. Almost all of the states responded to the questionnaire, some even going into detail by attaching documents for further explanation. We recieved the questionnaire from the following states: Austria, Bulgaria, Belgium, Denmark, Estonia, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Netherlands, Poland, Romania, Slovak Republic, Slovenia, Spain, Switzerland, United Kingdom.

The statements given in the questionnaires must be clearly understood as the personal views of those who answered, not necessarily as the official point of view of their countries.

## 2 Recommendations to the Co-ordinators of the 1<sup>st</sup> ESF

The agenda is twofold: There are policy issues on the one side and scientific or technical issues on the other side. The agenda of issues in relation to threshold values is wide open.

The way threshold values are established and used presents a clear cut view on policy choices and policy needs, respectively. Like a mirror, the state-of-the-art of setting threshold values shows what kind of policies - if existent - are currently being implemented. Threshold values are a (the?) core element of any soil policy.

A distinction is to be made between

- The prevention policies considering the need to **control and reduce** the amount of **future additional input** pollutants into soil, and
- The management of **existing contamination** in order to deal with damages, hazards and threads to public health and the environment.

In both cases, threshold values are needed to sustain any policy approach. However, the use of these values and the way they are derived is different. So are the recommendations of this report.

## 2.1 Recommendation 1:

### **Action on EU - Level: Soil Threshold Values for Preventing Soil From Being Polluted**

On the EU - level, soil threshold values are already a very important element of prevention policies. In the field of waste management, the land application of sewage sludge is based on soil threshold values throughout Europe.

⇒ It is suggested that the state-of-the-art of EU - soil prevention values should be checked. There is a need to enlarge the scope of these values and to include soil-related products such as soil improvers or soil as building material. Other mineral and organic waste should be included as well, as long as there is a relevant land application of these materials.

The need for an European approach to soil prevention policy is backed up by the fact that soil material and soil-related products are part of the common market. There is the notion that in the process of selling and marketing these products, a formal assurance should be given as security that a minimum set of environmental requirements will be fulfilled. In addition to that, soil criteria in relation to product qualities should be set in an uniform way so that they will not to interfere with market compatibility.

Furthermore, the ESF member states are paying increased attention to the development of soil prevention values and of strategies for their implementation and enforcement. By doing so, they introduce of a broad agenda of issues to be covered by threshold values, covering organic compounds and other soil properties such as fertility and salinity. The amendment of existing values is understood as a first step towards establishing a comprehensive (synonym: holistic) approach to soil quality management.

Given the fact that setting threshold values is strongly related to policy choices, I recommend that the

#### **ESF discusses**

- ⇒ **how to work out a systematic and structured comparison of soil prevention issues and thresholds, including policy approaches on the EU-level and on the level of ESF member states;**
- ⇒ **the need to develop a strategy for the translation of scientific and technical issues of threshold values into policy-relevant information for prevention strategies, e.g. how to cope with high natural contents of heavy metals and how to translate soil quality into concept of immission control and reduction.**

## 2.2 Recommendation 2:

### Action on ESF - Level: Threshold Values for Evaluating Damages and Hazards

Threshold values play a major role in the frame of managing contaminated land. It should be noted that there are two opposing expectations suggested by ESF Member States. On the one side, there is the expectation that ESF and/or EU DG XI will go into the business of setting standards and will, finally, establish a uniform set of intervention values. On the other side, presumably the majority of countries, states that there is virtually no inclination to establish intervention values on the European level. As there is no legal basis for any European instrument on managing contaminated sites, there is consequently also no technical basis for European intervention standards. Instead, priority should be given to the

**⇒ exchange of information and to the networking of national approaches in order to make them more transparent and easier to compare and to work with.**

This point of view is in line with the concept and work of the concerted action CARACAS and CLARINET.

Finally, one topic for consideration should be the feasibility of an easily accessible documentation of existing approaches to threshold values for evaluating damages and hazards.

## 2.3 Recommendation 3: Threshold Values as Related to Risk Assessment

Both types of threshold values, the one framing prevention issues and the one evaluating damages and hazards, are based on risk. The extent to which risks for public health and the environment are signalled by threshold values is different.

Threshold values for evaluating damages and hazards facilitate and streamline the process of risk assessment. They can not replace an in-depth risk-analysis to evaluate a case of contaminated land. Assessing site-specific risks definitely needs site-specific procedures.

**⇒ Methods and procedures for risk assessment, understood as part of site-specific evaluation, should therefore not be considered an ESF issue at that time. For the future, once the concerted action on risk assessment of contaminated land will be finished there sure is an option to integrate risk assessment work items into the ESF-scope.**

### 3 State of the Art 1: Threshold Values in Existing Instruments of EU Environmental Policy

Threshold values are soil quality criteria which are preventive and which serve to describe and realise the policy objectives. Thus there is a close relation between the definition of threshold values and soil policy formulation. In other words, soil quality criteria build the link between scientific information and environmental objectives. On the other hand, soil quality criteria fit in or complement political strategies and concepts. As integrating soil requirements into other policies is one of the principles established in the EC Treaty, the definition of threshold values is a suitable means to harmonise regulations and political strategies of different sectors. Threshold values address two different policy objectives: the prevention of soil degradation on the one hand and the remediation of contaminated sites on the other.

Threshold values for the receiving media, e.g. soil, may be used as reference levels which, if exceeded, indicate the need for further action, e.g. assessment, monitoring or measures. The general principle behind avoiding soil degradation is to ensure that the concentration of certain elements, e.g. heavy metals, is not exceeded.

**Soil threshold values are established in a few regulations on the European level** and there is a particular need for harmonising them. On the other hand, threshold values are not indicated at all in relevant regulations, e.g. the Directive on Hazardous Waste (91/689/EEC). So far, categories and generic types of hazardous wastes are listed according to their nature, the activity which generates them, or the constituents which render waste hazardous. The Directive on Integrated Pollution Prevention and Control (96/61/EC) aims at preventing or minimising emissions to the goods under protection, namely soil, water and air (Preamble, Article 1). All installations listed in Annex I of the Directive have to be authorised through permits. Furthermore, each permit must contain emission limit values which take into account that the risk of hazardous substances can be transferred from one medium to another. According to the Directive, the emission values have to be based on the best available practise.

**Limit ranges for concentrations of heavy metals in the receiving media soil** are set out in Annex I A of the Sewage Sludge Directive (86/278/EC), which calls for sludge to be used in a manner that does not affect the quality of soil (Article 8). Thus, the further use of sludge must be regulated to ensure that heavy metal accumulations in the soil do not exceed these limits. Another example is the Commission Decision on Soil Improvers (94/923/EC), which refers to the Ordinance 880/92/EC on a Community eco-label award scheme. The values included in this regulation describe the concentration of heavy metals in soil improvers. Both regulations do not refer to the origin of these values. There is no other regulation containing threshold values for the receiving media soil.

## 4 State of the Art 2: Threshold Values in the Soil Protection Policies of ESF-Member States: Results of the Questionnaire

### 4.1 Threshold Values as an Instrument in Soil Protection Policies

As a point of departure, one may define threshold values as soil quality standards, given as mg/kg soil or µg/l soil eluate, regardless whether they are called screening, trigger or guideline levels, or any other name. Almost all countries make some use of threshold values for the purpose of soil protection.

Thus, it is confirmed that threshold values play an important role within the policy making process and that they are a core element of any policy decision process regarding soil.

In some of the responses to the questionnaire it was stated that those values have not yet been set by rigorous scientific criteria. The questionnaire did not ask for an evaluation of the scientific background of those values. Nevertheless, it appears reasonable to check what this statement would mean in detail, e.g. it raises the question of what exactly "rigorous scientific criteria" means and what seems to be a reasonable and defensible level of scientific analysis and data evaluation for the purpose of setting threshold levels.

### 4.2 Purposes and Policies

All but four of the countries involved use threshold values for the purpose of risk assessment for contaminated soils.

Threshold values are also used within prevention policies. Following the EU-Directive on Sewage Sludge (86/278/EC), the countries often mention threshold values in the context of limiting pollutant emissions due to the application of sewage sludge on land. However, a majority of the countries base their efforts to limit the input of airborne substances on some kind of threshold values for soils.

There are other environmental instruments for which threshold values play an important role, such as

- environmental impact assessment;
- control of remediation goals and other monitoring activities;
- formal risk assessment procedures, in which threshold values function as a pre-requisites;
- management of soil as a product<sup>1</sup>;
- criteria for the fertility of soil (in the sense of agriculture and the use of organic soil quality as a resource for agricultural use of soils);
- management of salinity and acidity.

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<sup>1</sup> in the context of excavated soil being reused/recycled, one may see this soil as a "product" and not as "waste"

Threshold values may also be used as guiding criteria for land use.

### 4.3 Legal or Other Regulatory Bases for the Use of Threshold Values

There are two types of regulatory bases used for the introduction of threshold values, legal instruments and informal instruments or guiding documents (handbook a.s.o.).

For the regulation of the application of sewage sludge, threshold values are introduced by legally binding instruments, laid down through ordinances or other legal instruments - obviously following the EU waste management regime.

Concerning risk assessment for contaminated sites, the majority of the countries introduces threshold values in some kind of guiding documents. Thus, these values are not legally binding.

There are two exemptions from this position: Switzerland and Germany have adopted legally binding values (or rather a differentiated set of values) for the prevention as well as for the management of contaminated sites.

The countries which were asked whether there is a need for future changes pointed out the following:

#### Some change expected:

- Concerning risk assessment of contaminated sites, some additional effect based on site-specific values need to be adopted. (Slovak Republic)
- A draft regulation (law) is currently being negotiated. (H)
- The necessity to define and adopt a legal frame is generally accepted. The justifications are mainly economical and ecological (to avoid the use of "new" soil, to enforce the reuse of brown fields, to attract potential foreign investors who could otherwise preferably be tempted by other countries where the legislation is more transparent and reliable). (B)
- Prevention: It is likely that there will be a need to extend the catalogue of materials to which legal limits apply. (UK)

#### No change expected:

- CH clearly stated that there will be no change, given the situation that CH has already adopted legally binding values for both of the following purposes, the management of contaminated sites and the prevention policies.
- Poland refers to the problem of geochemical anomalies (higher contents of heavy metals due to geogen and/or pedogen factors). Enforcement of legally binding values may cause confusion in these areas. Therefore, Poland tends not to introduce binding values. (P)



### Not yet determined:

- As the introduction of legally binding values needs long and complicated parliamentary procedures, the changing or introduction of a non-legally binding value is much easier. This makes it possible either to use these values in particular legally binding instruments or to incorporate these values into legally binding cleanup/management decisions for particular sites. However, things may change in the future as the issue is still under political discussion.. (NL)  
In the Netherlands, the values are part of the
  - Management of contaminates sites (n. b.: not legally binding)
  - Building Materials Decree: excavated soil is considered as building material (that means: as a product, not as waste).
  - Harbour dredging material: soil values are used to decide where the dredged material can be put.
- As far as contaminated sites are concerned, the issue is still under discussion. It seems likely that values will be introduced as guidelines within recommendations for the management of contaminated sites by regional authorities. (E)

#### **4.4 Land-use Based Values vs. General Values**

About half of the countries use values based on land use. Land-use based and general values are understood as follows:

- Land-use based: For one pollutant there are a number of values, each of which applies for a specific land use or a specific geographic region.
- General: For a particular pollutant there is one value applying to all land uses and to all regions.

Those countries considering land-use based values mainly differentiate between urban vs. agricultural land use. A minority differentiates values according to soil types. Switzerland and Germany have the most differentiated systems. Germany has introduced values according to the following land uses: play grounds, residential areas, park and leisure areas, industrial and commercial areas, arable land and gardening ground, grassland. In addition to land-use based values for the management of contaminated sites, both countries, Switzerland and Germany, have introduced threshold values for prevention purposes which they clearly do not differentiate according to land use. Instead, the prevention values consider different types of soil quality.

#### **4.5 Reference Levels for Natural Contents of Soils**

Reference levels for natural contents of heavy metals in soils are commonly used. Determining these levels is an essential instrument for judging the quality of soils. Only four countries have not yet established a reference level for heavy metals and some persistent organic substances for natural soils. It is clearly understood that these levels have not been determined on a risk related basis.

The questionnaire did not further enquire into the technical procedure used for determining these levels. However, some countries reported that statistically based sampling studies and other surveys, e.g. on forest soils, have been used. Others highlight that for determining reference levels, depending on the substance, geochemical factors and thus geographic areas are more relevant than any other single factor. Particularly for PAH and Pb, the urban (meaning residential and industrial) vs. rural distinction is reported as the most evident. In conclusion, it seems appropriate to determine a range of levels instead of one distinct value for a particular substance.

There were other issues mentioned in the answers, each of which is of great importance for the determination of reference levels:

- Are these levels given as mean or 90/95 percentile values ?
- How should the distinction be made between rural and urban soils ?
- How should the levels for urban soils be determined and how far can these natural levels be judged?
- How can the spatial representativeness of levels be determined?
- How can a reference level be related to a risk based level?

Again, the questionnaire did not go into detail on this point.

#### **4.6 Reference Methods of Analysis**

For determining a threshold value, it is implicit that the reference method of analysis has to be determined as well. There is no sound approach to threshold values without having a distinct method to analyse the substance concentration in the soil. This is why the questionnaire chose the example of cadmium and asked which method of analysis is currently being used.

Both the analysis of total contents and the analysis of aqua regia contents are widely used. This is demonstrated by the fact that each received half of the positive answers. Only a minority of countries reported that, additionally, they introduced the analysis of bio-available contents (e.g. CaCl, NaNO<sub>3</sub>, NH<sub>4</sub>NO<sub>3</sub>) (CH and G).

This result shows that there are still remarkable differences in the methods of analysis which on a first glance seems to be a technical detail of minor importance. However, together with the answers given to the question of reference levels, these technical details have a crucial significance. They focus on basic difference in the "philosophical" understanding of threshold values and soil quality as well.

#### **4.7 Targets of "Thresholds"**

For the determination of threshold values, any of the following targets is used within the risk assessment process: human health, groundwater, crop plants, soil organisms, 'multi-functionality'. According to the site situation and corresponding with certain land use categories (see above), there might be a certain hierarchy of targets. Thus, the target of human health plays the most important role for the trigger or cleanup values (decisions), whereas values focussing on prevention take all targets into account.

In addition to the targets already mentioned, 'grazing animals' and 'soil percolation water' have been named.

#### **4.8 Follow -up Requirements in the Case of Threshold Values Being Exceeded**

Independent of whether follow up requirements are legally enforced, part of the administrative procedures or part of more informal recommendations, the answers show a more or less uniform understanding of what should be done in the case of a threshold value being exceeded by a soil content. The requirements have been described as follows:

- Site specific risk assessment according to the use of the site and to the potential hazards;
- Reducing contact between contaminated soil and the targets to be protected;
- Remediation, checking appropriate measures;
- Registration;
- Expertise on land use restrictions;
- Agricultural management advice;
- Limits of application of mineral and organic fertilisers, land application of sewage sludge, compost and dredging material;
- Limits for deposition of airborne substances taking soil accumulation into account, and
- Regulatory limits and / or recommendations for the application of excavated soil material.

#### **4.9 General Frame for the Derivation of Threshold Values?**

Asked whether there is a need for establishing a general frame for the derivation of threshold values in the respective country, the answers very clearly confirm the need to set some basic principles on how to derive threshold values. It is also stated that there will not be such a general approach for legally enforceable values assessing risks of contaminated sites.

A general frame is expected to improve guideline (precaution) values which will facilitate a better identification of sites where management practices or controls may be needed in order to safeguard the ecological soil quality (UK, G). This is what others express through target values for soil protection, critical loads and quality criteria for soil as a product, including soil as dredging material (NL).

An overall approach is also expected to analyse the scientific background in order to determine the mobile fraction of a given substance and thus the actual hazard.

A uniformed approach is also seen as essential to achieve a legal transparency of those measures that interfere with property rights of land owners. The majority of countries expect a general approach to harmonise existing procedures and concepts.

Improved guideline (precaution) levels might also be translated into future legislation to ensure that currently clean soils will not be contaminated in future by human activities (UK). In this respect, it is obvious that for agricultural soils, specific soil values have to ensure that the spatial variability of soils and hence the bio-availability of contaminants are properly taken into account when soil values are to give a soil based reference to the food levels of the 'codex alimentarius'.

Some answers added a statement on the feasibility of a general approach. Although the approach is desirable, they highlight technical and scientific difficulties in getting values that have 'credibility' and reliability. This view is backed up by the huge variety of soil effect concentrations reported in literature, e.g. on Pb in soil.

#### **4.10 Issues Suggested for the Presentations at the ESF**

According to the viewpoint of several countries, any soil protection policy should be aware of the difference between existing contaminations resulting from historic activities and ongoing deposition of pollutants on soils from land application of waste, soil related products or by atmospheric deposition.

The state-of-the-art of risk assessment is another issue mentioned as being of general relevance for the development of soil protection policies:

- Scientific problems related to the predicting of the effects of contamination through soil examination; how can this prediction be improved?
- Is risk assessment a credible procedure? A firm foundation of risk assessment is needed when threshold values are to be based on risk assessment. Is there an alternative system for deriving threshold values?
- How should the concept of bio-availability be implemented? How does bio-availability relate to land use?
- How are soil contamination and food quality related?
- What is the relationship between soil pollution and ecotoxicological responses?
- How can a general methodology for the derivation of threshold values and the assessment of impacts be described?
- Standardisation of extraction methods;
- Determination of thresholds for various contaminants, specific soils and soil functions;
- Development of a database regarding the scientific issues of determining thresholds;
- Sustainability and sensitivity levels of specific soils, and
- Research requirements regarding the mobility of substances.

An important issue underlined by several contributions is the issue of information exchange and harmonisation of concepts and criteria. There is a need to give an overview on the use of threshold values within soil protection policies of ESF-member states. The political and technical implications of implementing threshold values are also of great interest. Some of those contributions mentioning harmonisation pointed out that national approaches will be needed in the future. In this sense, harmonisation is understood as a technical harmonisation, not as harmonisation of policies.

The issue of setting threshold values and their socio-economic implications is another issue of explicit political relevance. In this respect, one contributor also asked: How can strategies and sectors (limits) for the application of threshold values be developed?

In addition, there are some crucial issues underlining that setting threshold values is strongly linked with the general political approach to soil protection: Is the approach to the prevention of "new" pollution backed up by the ALARA-requirement (as low as reasonably achievable) and "stand still"-strategies or is it focussed in a more immission-based sense on precautionary soil levels?

Others expressed a particular uncertainty as to whether or not an European approach to harmonisation seems feasible and reasonable?

#### 4.11 Expectations for the ESF

- Platform for discussing the background of policies on the national and EU level, in order to improve national activities;
- Discussion on the policy frame;
- Establishment of a network, workshops, and a research agenda;
- Definition of a frame for national activities, speeding up of national activities by setting an European agenda;
- Introduction of a holistic approach to soil policy by establishing threshold values;
- Establishment of the project of an European handbook on soil standards/thresholds;
- Identification of research requirements;
- Setting a frame / exchange of experience regarding questions such as
  - How to cope with high natural contents of pollutants?
  - How to differ between natural and anthropogenic contents (how to define reference values for urban vs. rural areas)?