TARGET VALUES AND BACKGROUND LEVELS IN THE NETHERLANDS: HOW TO DEFINE GOOD SOIL QUALITY

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FORMULATION OF THE PROBLEM

The target values in the Netherlands are based on (natural) background levels and on negligible risk concentrations [1]. The relation with the background levels is variable for the individual compounds. For the heavy metals the relation is relatively well known, while only little information is available on background levels for organic compounds. The target levels for the heavy metals are high percentiles of natural occurring concentrations, varying between 83 and 94% [2, 3]. Thus there is a 6 to 17% probability that the target level for a heavy metal is exceeded in a natural soil. As the evaluation of "good" soil quality is based on each individual compound analysed, the probability of exceeding a target value, and therefore exceeding "good" soil quality, will rise significantly when analysing for instance 8 heavy metals. This could be solved by simply raising the target values. However, due to the relation with negligible risk, for most compounds this is not acceptable. Furthermore, the original data were measured 15 years ago and should preferably be updated.

INVESTIGATION OF THE BACKGROUND LEVELS

More recently, several of the Dutch provinces installed a soil quality monitoring network. The data from these networks were studied in order to define the background levels for both organic and inorganic compounds [4].

Obtaining a correct data set from these networks was a problem because the monitoring networks are partly based on different principles. As a result, part of the information was incomparable. A selection of the data had to be made, rejecting data that appeared to deviate significantly due to its origin (scale, soil use, depth, etc.). The resulting set of data was used to study the background concentrations.

For the heavy metals, the results are approximately comparable to the results of the study in 1983 [2]. For the organic compounds, including PAH, PCB's and several specific pesticides, a large part of the measurements appeared to be below the detection limits. This interfered the statistical analysis of the data, specially in those cases where the target values are close to, or even below, the detection limits. Additionally only a limited number of results was available for the organic compounds. Table 1 provides statistical characteristics for some of the compounds.

It was concluded that, when comparing analytical results with target values, the relation of these target values with the background levels should be taken into account. As the quantification of the background levels depends on a large number of factors (scale, soil use, depth, etc.), these same factors should apply to the analytical results that are evaluated. In relation to the now available information on background levels, soil quality must be evaluated using mixed samples from a soil volume of approximately 1250 m^3.

Table 1: Background levels for a limited number of compounds in mg/kg on the scale of the whole Netherlands (TV = target value)

compound	mean	standard deviation	median	90-percentile	% > TV	target value[2)]
PAH	0,57	1,13	0,27	1,06	15	1
As	n.v.t.[1)]	n.v.t.[1)]	<	14,0	<1	29
Hg	n.v.t.[1)]	n.v.t.[1)]	<	0,20	5	0,3
Cd	0,44	5,0	0,20	0,50	5	0,8
Cr	13,6	11,2	9,0	29,3	<1	100
Cu	13,2	13,1	11,0	22,0	6	36
Ni	n.v.t.[1)]	n.v.t.[1)]	2,0	18,0	<1	35
Pb	27,2	38,4	20,0	46,0	2	85
Zn	46,5	108	32,9	81,8	5	140

< below or equal to detection limit

1) More than 30% of analytical results below detection limit

2) Target values for a soil with 25% clay and 10% organic matter

ALTERNATIVE EVALUATION OF GOOD SOIL QUALITY

The mentioned soil volume that should be tested based on a mixed sample does already implicate that, due to the mixing of samples, fewer samples will exceed the target values. Nevertheless, the testing of more than one compound would still result in a larger probability of exceeding a target value. Therefore, different methods for evaluating soil quality were investigated, using the data from the provincial networks [5].

It was assumed that the percentage of soils exceeding the reference values should be constant, no matter how much compounds would be involved in the evaluation. To fulfil this condition, for each compound a correction factor was introduced, defined as the quotient of the 90 percentile of the of background concentrations and the target value. When the 90 percentile is larger than the target value, the correction factor is used in the evaluation. For those compounds at least 90 percent of the evaluated background soils would satisfy when evaluating the soil on one compound.

To keep a constant percentage of "good" soil when the evaluation is based on more than one compound, it was proposed to evaluate groups of compounds, for instance the evaluation of all of the heavy metals. In this method, a small exceeding for one compound can be compensated with the low concentration of another compound.

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