

## DECISION SUPPORT SYSTEM FOR SOIL PROTECTION OF INDUSTRIAL SITES

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Keywords: prevention, soil protection, risk assessment, ranking system, industrial sites.

### Background

The recently issued Dutch "Directive for Soil Protection of Industrial Sites" marks the growing interest for soil protection in the soil conservation policy of the Netherlands. As a part of this Directive, the Decision Support System for Soil Protection Strategy of Industrial Sites (acronym: BBB) has been developed. The BBB is a risk based instrument, facilitating the selection of the optimal soil protection strategy, a process in which private companies and the competent authorities both find themselves involved. The BBB can be applied for a complete plant or factory but also for individual facilities.

The BBB consists of a decision scheme which guides the user through the subsequent steps needed to establish the required level of precautionary measures and provisions (scheme below). A categorised methodology is offered, allowing for a quick soil risk estimate using a minimum of input data. The required input data are standardized and can be simply read from tables with relevant data that are included in the BBB. The model does not require complicated calculations.

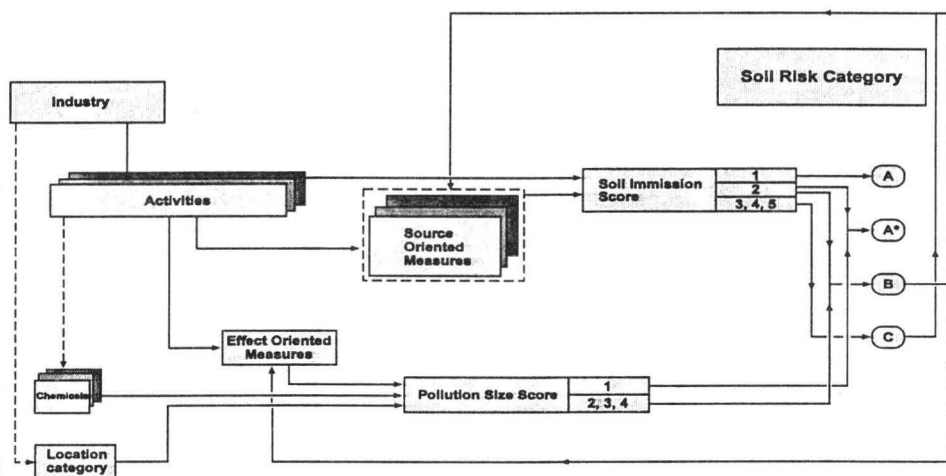


Figure. Scheme, representing the Decision Support System for Soil Protection Strategy of Industrial Sites (acronym: BBB).

### Soil Immission Score

Before actually determining the Soil Immission Score, the plant is subdivided into logical units. Practical experience has shown that the various types of activities in an industrial plant form a practical lead. In the BBB, the following activities are distinguished:

- storage of bulk liquids;
- handling and internal transport of bulk liquids;
- storage and handling of bulk cargo (solids) and packaged goods;
- process installations;
- other (sewer systems, workshops, emergency collection tanks, waste water treatment facilities).

Soil Immission Scores have been established for every activity, indicating the soil hazard. Scores may vary from 1 (very low risk) to 5 (very high risk), and include both the probability and the possible size of soil pollution. The final value of the Soil Immission Score depends on the soil protection level; the user has to select the appropriate package of precautionary measures. Soil protection may be achieved by either source-oriented provisions, aimed at minimizing the frequency of leakages, spills etc., or effect-oriented provisions, i.e. containment facilities to prevent the released materials to actually reach the soil.

### **Pollution Size Score**

Only if the Soil Immission Score has a value of 2 *and* source- or effect-oriented provisions turn out not to be feasible (e.g. for economic reasons), the Pollution Size Score is determined. This score is a measure for the dimensions (i.e. the length) of the underground pollution plume and ranges from 1 (low) to 4 (high); if the value is 1, the activity is assessed a Soil Risk Score A\*. This means that the activity is accepted under the condition that a monitoring programme is implemented. Furthermore, if any soil pollution is observed, soil sanitation is obligatory.

The Pollution Size Score depends on the soil chemical behaviour of the pollutant (mobility), the location typology (ground water flow rate, dimensions of the vadose zone) and the monitoring frequency. The source term (released quantity) is not included in this list. Dispersion calculations demonstrate that, although the source term does contribute to the concentration pattern in the underground, it is not the determining factor for the plume size.

Six location categories have been identified: polder, brook valley, elevated terrain, sandy areas with silt, clay or peat, idem without, and elevated sandy areas. The main features are the type (or absence) of infiltration and the groundwater flow rate. In the latter category, groundwater flow is not applicable, but the dispersion in the unsaturated zone is normative.

### **Soil Risk Assessment**

The output of the BBB is the Soil Risk Category which is determined by combining the Soil Immission Score and the Pollution Size Score, which may be either A (low or negligible risk), A\* (conditionally acceptable risk), B (elevated risk) or C (high risk). The ultimate aim is to achieve a soil protection level A for every individual installation. In case of a higher Soil Risk Score, additional precautionary measures are required.

Determination of the Soil Risk Category not only provides insight into the risks of individual installations, but also is a means for comparison of installations within a specific plant, industry or even a whole branche.

### **Current use of the BBB**

The Decision Support System for Soil Protection has been implemented in the Netherlands and gains increasing support. Currently, several branche-specific systems have been or are being developed, specifying the activities from the different branches which significantly increases the method's user friendliness. Finally, TNO offer a computerised version of the Decision Support System called ASSISTERIX (Assessment of Industrial Site Terrestrial Risks).