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A3 Determining soil protection strategy

Chapter 3 describes the procedure for the determination of whether soil protection is required and, if so, what form it should take.
It aims to support the decision-making procedure for the best possible soil protection strategy.

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3.1 Soil protection, where?

Whether or not there is a situation which is hazardous for the soil depends on the nature of the activities and substances involved. The industrial activities referred to below are considered to represent a hazard to the soil. For these activities, an appraisal of the baseline and final condition of the soil is required, as well as an assessment based on the NRB.

3.1.1 Industrial activities

1	**Bulk liquid storage**
1.1	Storage in underground tank or tank covered with soil
1.2	Storage in above-ground tank directly placed on the ground
1.3	Storage in raised above-ground tank (horizontal/vertical)
1.4	Storage in pits and basins
2	**Transshipment and internal transport of bulk liquids**
2.1	Loading and unloading activities
2.2	Pipeline transportation
2.3	Pump transfer
2.4	Transport on company premises in open drums etc.
3	**Storage and transfer of bulk and packed goods**
3.1	Storage of bulk goods
3.2	Transfer of bulk goods
3.3	Storage and transfer of solid materials (including viscous liquids) in packaging (drums, containers etc.)
3.4	Storage and transfer of liquids in packaging (drums, containers etc.)
4	**Processing plants**
4.1	Enclosed process or treatment
4.2	Open or semi-open process or treatment
5	**Other activities**
5.1	Waste water drainage to company sewage system
5.2	Emergency containment
5.3	Activities in workshop
5.4	Waste water treatment

3.1.2 Substances

A firm answer cannot always be given beforehand to the question of whether certain substances, groups of substances or preparations can be considered to be contaminants. List of substances has been given below which can be used as a tool for determining whether a substance may be a contaminant.
The list is derived from the Soil Remediation on exisiting industrial sites list (BSB) and lists of substances from other policy contexts. The BSB list was developed in the context of voluntary soil remediation on existing company premises[9].

This list serves as an indication for substances which may be contaminants. Substances which are not on the list can also contaminate the soil. In general, substances present in a designated industrial activity are considered to contaminate the soil unless the contrary can be demonstrated convincingly.

The NRB method for the determination of soil risk makes no distinction between the amount and/or storage temperature of a substance. The aim of the NRB is to prevent all soil pollution which may require soil cleanup.
In cases of doubt, there will need to be consultations between the company and the competent authority to determine whether there is in fact a situation which is hazardous to the soil.

a Examples of substances which pollute the soil

- **Organic liquids and watery solutions or emulsions thereof**
  - alcohol(s);
  - ethers;
  - esters;
  - organic acids;
  - aromatics;
  - phenols;
  - polyaromatic hydrocarbons (PAHs);
  - chlorinated carbons and chlorinated fluorocarbons;
  - pesticides (see Pesticides Decree), as well as the active ingredients in pesticides
  - solvents, degreasers, paint strippers and cleansers, metal treatment liquids;
  - varnishes, paints and inks;
  - oils (e.g. drilling oil and cutting oil, rolling oil, grinding oil, lubricating oil, thermic oil, hydraulic oil, edible oil);
  - wood preservation agents, creosote oil, carbolineum, naphthalene;
  - liquid fuels.

- **Inorganic compounds, minerals and ores**
  - salts and watery solutions containing:
    - chromium, cobalt, nickel, copper, arsenic, molybdenum, cadmium, tin, barium, mercury, lead,
    - inorganic acids,
    - ammonia, fluoride, cyanide, sulphide, bromide, phosphate, nitrate;
  - plating baths, pickling baths;
  - inorganic wood preservation agents and watery solutions thereof;
  - road salt;
  - sulphur;
  - iron ore, bauxite, ilmenite, jarosite, phosphate ore, Chile nitrate, etc.;
  - solid fuels (coal).

- **Liquid and solid hazardous substances and preparations which have to be designated as such pursuant to the Chemical Substances Act (Wms), as well as watery solutions thereof.**

- **Processed and unprocessed agricultural products in liquid and paste form**
  - animal fertilisers, other organic fertilisers and artificial fertilisers;
  - silage.

- **Hazardous waste as referred to in the Hazardous Waste Designation Decree (BAGA).**

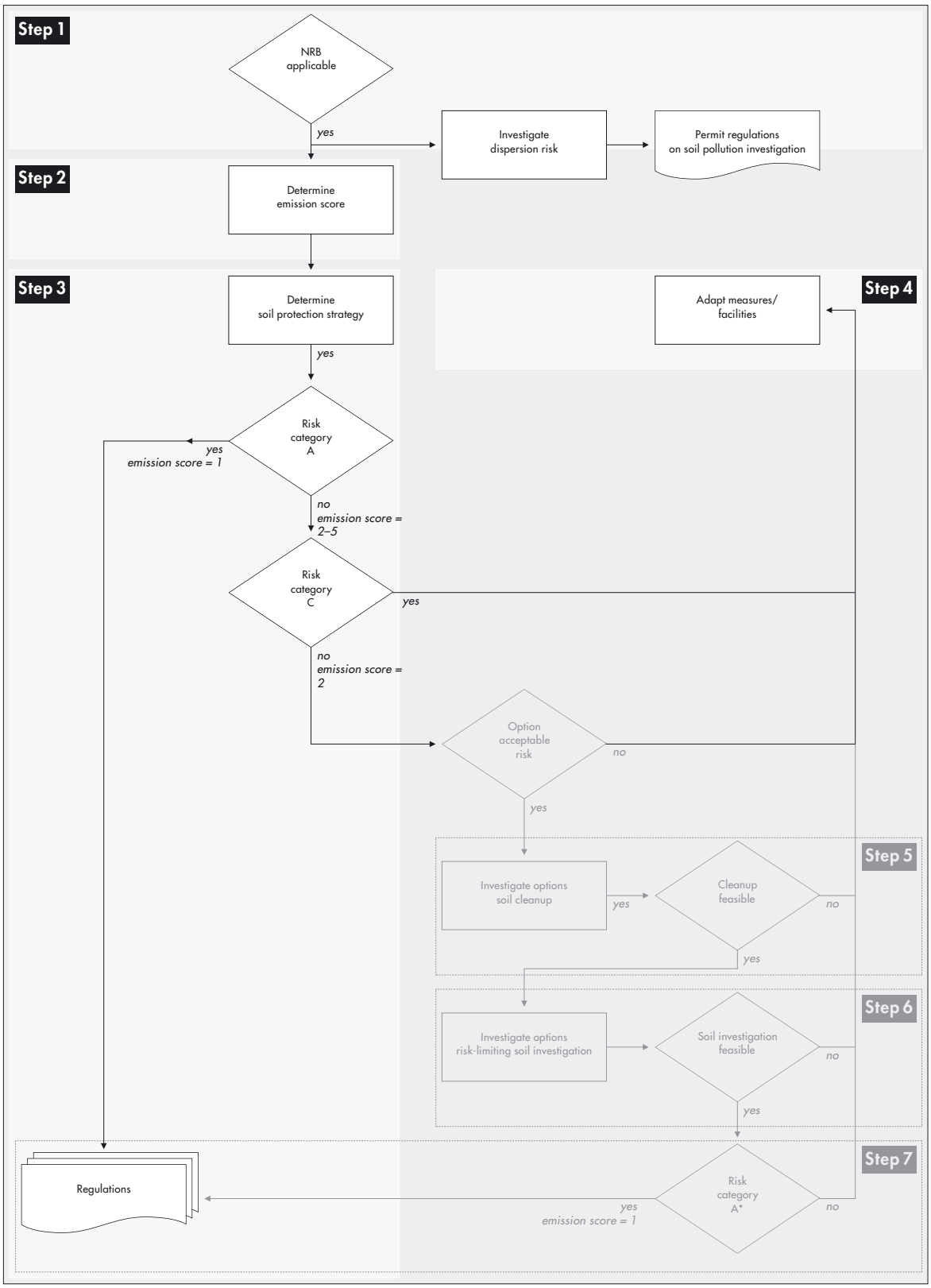
- **The substances listed explicitly below**
  - resins and artificial resins;
  - sewage sludge;
  - animal or slaughter waste;
  - pulp waste from the agricultural products, food, drinks and tobacco industries;
  - bio-waste;
  - mixed solid domestic waste;
  - mixed construction and demolition waste;
  - discarded vehicles, scrap vehicles and unsorted parts thereof;
  - shredder waste;
  - fly ash;
  - contaminated blasting grit;
  - drilling sludge and bore waste;
  - enamel sludge.

3.2 Soil protection, how? Negligible soil risk procedure

The method for establishing an efficient soil protection strategy for an activity can be summarised in a few steps. These steps are elaborated in the tables below.

Steps 1 to 4 focus on the most common situations in which a negligible soil risk can be achieved with measures and facilities.
The steps which result in the establishment of an acceptable soil risk are only required in exceptional circumstances and are not discussed here. They are examined in NRB, part B1.3.

Negligible soil risk procedure



3.2.1 Step 1 Determine whether the NRB applies to the industrial activity(ies)

	Action	Notes	Comments
1.1	**Determine whether the establishment or industrial activity is covered by the Environmental Management Act and/or Soil Protection Act.**	If an activity is covered by a general administrative order, soil protection must be provided in accordance with that order in council.	If a general administrative order does not set out a clear definition of the concept 'impermeable' or the monitoring of its implementation, the NRB can be used as a guideline. The general administrative orders pursuant to section 8.40 of the Environmental Management Act (those issued as of mid-2000) state that soil protection may be subject to more detailed requirements on the basis of the NRB.
1.2	**Check whether industrial activities are located in an environment protection area.**	If a industrial activity is located in a environment protection area, a 'special protection level' applies. The soil protection must then meet the requirements of the provincial environmental ordinance (PMV).	Provincial authorities may decide to declare the NRB applicable to environment protection areas. However, this can vary depending on the situation and the provincial authority.
1.3	**Split the company up into separate activities:**		In consultation between the company and the competent authority, agreement will have to be reached about the approach and, where necessary, the prioritisation of soil protection measures and facilities.
1.3a	Determine for each industrial activity whether it is hazardous to the soil *(see A3.1.1)*.	§ 3.1.1 provides an overview of activities and sub-activities which are hazardous to the soil; this table constitutes an approach to the overview of measures in the soil risk checklists.	The activity overview is not limitative. There may be parts of a industrial which cannot be classified simply under an activity or sub-activity but which may, in the opinion of the competent authority, be hazardous to the soil.
1.3.b	List for each activity the materials in storage and/or use *(see A3.1.2)*.	The NRB substance lists are intended as an example and to provide an indication of which substances pollute the soil! Substances not on the list can also pollute the soil. Common sense is required here.	The nature and amount of a substance are of secondary importance in the NRB method: the soil risk checklist does not take the amount, temperature or storage conditions of the substances into account specifically. If only very small amounts of substances are present or if specific properties of those substances make penetration into the soil impossible, the competent authority may decide not to apply the NRB.
1.4	**Initiate soil pollution investigation.**	A specific soil investigation is required – after termination of the industrial activity – to determine whether there has been significant pollution of the soil as a result of those activities as compared to the baseline situation (soil pollution investigation; *see A4.2.2d*).	The soil pollution investigation starts with an assessment of the soil quality in the baseline situation. The elaboration and implementation of this soil investigation should be done by a qualified organisation. In order to determine the appropriate sampling locations and method, the actual investigation should be preceded by a determination of the risk of dispersion. (*See part B1.4*).

3.2.2 Step 2 Determine for each activity the emission score or (final) emission score

	Action	Notes	Comments
2.1	**Look up the correct activity table in the soil risk checklist *(see § A3.1.1).***	Determine the soil risk category separately for each activity or subactivity. Industrial activities cannot always be classified straightforwardly into the activities or subactivities in the soil risk checklists. Chapter 3.3 includes, for each activity or subactivity, a more detailed description of the activities and notes explaining the packages of measures.	In the context of the industry user group policy, specific soil risk checklists have been drawn up for some branches of industry. They provide clearer profiling of the activities which are usual in the particular branches. These lists state emission scores or a direct listing of the soil risk category.
2.2	**Take the basic emission score from the left-hand column of the relevant soil risk checklist. *(see § A3.3).***	The basic emission score is a measure of the soil risk of the activity, regardless of the facilities or measures which have been put into place or which are being put into place for that activity. The basic emission score ranges – depending on the activity – between 5 and 2.	The basic emission score is based on the risk of soil contamination given average industrial activity. A package with measures and facilities which reduces the risk of contamination results in a lowering of the score.
2.3	**Determine what package of measures/facilities in the relevant soil risk checklist applies to the industrial activity.**	It is necessary to look up the actual or intended combination in the relevant soil risk checklist. The soil risk checklist tables include, under the heading 'package of facilities and measures for soil protection', the usual combinations of soil protection facilities and measures for the industrial activity.	The soil risk checklists make a distinction between impermeable containment facilities and liquid-retaining containment facilities. These are structures which collect 100% of all leaks. They need not always be 'containers'. For example, in the case of relatively small spills in workshops, the floor can be thought of as a containment facility. The actual condition of a facility determines whether it is impermeable or liquid-retaining. An impermeable containment facility which can be visually inspected (*see A5.2.1*) must be provided with a valid 'PBV impermeable facility certificate'.
2.4	**For this package of measures/facilities, take the final emission score from the far right-hand column of the soil risk checklist table.**	The final emission score takes into account the soil protection provided by the package of soil protection facilities and measures, deducting it from the basic emission score. If none of the packages of measures correspond to the actual or intended situation, the final emission score will be identical to the basic emission score.	The soil risk checklists describe an 'average' situation. The final emission score should therefore not be seen as a hard number. The application of common sense can result in a change to the final emission score calculated previously (upwards or downwards). Companies may, in consultation with the competent authority, include the nature and design of the facilities and the nature, amount and physical condition of the substances in their calculations. Reasons must be given for departures from the soil risk checklist.

3.2.3 Step 3 determine the soil protection strategy: negligible soil risk

	Action	Notes	Comments
3	**The NRB distinguishes between four soil risk categories.**	The soil risk category determines the soil protection strategy for the relevant activity.	The Decision-making model for Soil Protection on Company Premises (BBB) describes how to determine the soil risk category. In the BBB, the soil risk category is determined primarily by the emission score (*see part A2.3.2*).
	Derive soil risk category from final emission score. Determine action on the basis of the soil risk category.	The soil risk category follows directly from the final emission score: Final emission score / Soil risk category 1 – A *step 3.1* 3–5 – C *step 3.2* 2 – B *step 3.3*	The NRB distinguishes between four soil risk categories. A = negligible soil risk A* = acceptable soil risk B = increased soil risk C = high soil risk
3.1	**Soil risk category A:** Industrial activity meets state-of-the-art requirements for soil protection; During authorisation procedures, bear the following in mind: • the measures, particularly of an organisational nature, associated with the facility • baseline, repeat and final situation for soil investigation • periodical leak-proof checks of facilities in question.	A final emission score of 1 means that the measure / facility combination is 'state of the art'. Here, the soil risk is negligible (soil risk category A). The relevant activity can be authorised or need not – in existing plants – be included explicitly in an application for a renewed permit. Where the risk is negligible, a survey of the baseline and final soil situation remains necessary for the industrial activities described in the NRB (*see part A2.2*).	If visually-inpectable impermeable facilities are required, those facilities must be tested periodically on the basis of CUR/PBV Recommendation 44 to ensure they are impermeable[67]. The inspection (and where possible the associated approval period) must be set separately for each facility (in permit conditions). Recommendation 44 also includes a checklist which can be used for the monitoring and enforcement inspections required in this area (*see part A4.2.2*).
3.2	**Soil risk category C.**	Supplementary measures are required for soil risk category C. Changes to the facilities must result in a final emission score of 1. Continue with step 4.	In exceptional cases, it will not be possible to reduce the final emission score to 1. The changes should then result in a reduction to no more than final emission score 2 (*see also step 3.3*).
3.3	**Soil risk category B.**	Soil risk category B means that the activity involves an increase in the soil risk. In new situations, measures or facilities should result in an emission score of 1 (cp. step 3.2). In existing situations, it is also preferable if measures and facilities reduce the emission score to 1. However, a risk-limiting soil investigation can be used to reduce the risk to an acceptable level (soil risk category A*). Here, it will be necessary to take the possibility of soil cleanup into account if immission into the soil as a result of the activities is observed. (*See also NRB part B1.5*)	N.B. Leak detection systems under tanks are not, in the terms of the NRB, considered to be instruments for risk-limiting soil investigations. Facilities of this kind are plant components (*see part A5.1*). There are situations in which it will not be possible to fulfil the requirements of soil risk category A using measures and facilities. In these cases, an acceptable level of risk (soil risk category A*) could still be achieved through monitoring soil quality to reduce the risk. However, an acceptable soil risk is only possible if soil cleanup is reasonably feasible.

3.2.4 Step 4 Determine supplementary measures and facilities

	Action	Notes	Comments
4	**Select measures and/or facilities.**	Measures and facilities which reduce the emission score of an activity can be derived from the soil risk checklist. It is often possible – assuming that facilities are in place – to settle for improvement of (organisational) measures.	The NRB states that source-based measures are preferable to effect-based measures. Source-based measures are process-specific and are not described in the NRB. The reader is referred in this respect to publications based on the emission prevention policy. The possibilities of using other raw materials and auxiliary products or other production processes should be reviewed at all times. However,not all of them can be realised in practice.
4.1a	Choosing a soil protection facility.	If a new soil protection facility has to be put into place, it will be necessary to take into account the strain (falling objects, vibrations, traffic) and of course (liquid) substances. Depending on the nature of those burdens, certain types of facility may or may not qualify. Is a suitable type of facility is found, a suitable design (material and structure) will have to be selected.	The NIBV/PBV Table 'Which facility for soil protection' can be used to determine whether the desired facility can be introduced in the light of the given conditions. *(See NRB, part B2.4).*
4.1b	Design, construction and maintenance of the containment equipment • CPRs • CUR/PBV design and detailing manual [17] • CUR/PBV Recommendation 65 [63] • CUR/PBV Recommendation 64 [41]	During the construction (and appraisal) of facilities, the correct choice of material is not the sole factor of importance. Construction must also be carried out by accredited bodies. Impermeable facilities should be built and repaired in accordance with the applicable Guidelines and/or CUR/PBV Recommendations. For the design of impermeable facilities, the Handboek Ontwerp en Detailering Bodembeschermende Voorzieningen [Design and Detailing Manual for Soil Protection Facilities]' has been drawn up under the auspices of the PBV. An impermeable facility is only approved if, after construction, it has received a 'PBV impermeable facility certificate'.	Certification is advisable. When constructing an impermeable facility, it is not only the certification of the material used which is important (product certification). Certification of the construction is also of primary importance (process certification). The certification of products or the construction of facilities (processes) takes place on the basis of Assessment Guidelines (BRLs). Assessment guidelines of this kind are not suitable for elaboration in permit regulations.
	CUR/PBV Recommendation 44 [67] (*see part A5.2.1*)	Inspection and completion testing of soil protection facilities should be carried out in accordance with CUR/PBV Recommendation 44 by an independent Qualified Inspector. The inspection of drip pans/containers, storage cabinets based on CPR guidelines, prefab facilities etc. are not subject to compulsory inspections based on CUR/PBV Recommendation 44. Here, impermeable checks can generally be carried out by the organisation itself quite simply (*see also part A 5.2.4*).	For the issue of a 'PBV impermeable facility certificate', it must be possible to inspect the relevant facility visually. The Qualified Inspector or the company for which this inspector is working must be accredited to inspect the relevant facility. (*See also chapters A5.2.1 and B2.3.1*). When designing or selecting facilities of this kind, it is necessary to take into account the amount and nature of the substances in question.
4.2a	Design, construction and maintenance of company sewage systems.	CUR/PBV Recommendation 51 has been drawn up for the design of company sewage systems [52]. CUR/PBV Report 2001-3 [NN] deals with the management and maintenance of company sewage systems. Different impermeable categories for sewers are listed.	CUR/PBV Recommendation 44 is being amended for the inspection of company sewage systems [67]. The soil risk checklist for sewers (*see § 3.3.5*) indicates that emission scores of less than 2 cannot be achieved for underground sewers. Underground sewers with an emission score of 2 have been exempted for the time being from the obligation to carry out risk-limiting soil investigations (*see chapter A5.2.2*).
4.2b	Design, construction and maintenance of large-scale above-ground tank storage (atmospheric).	Against the background of the NRB, the Bobo guideline has been drawn up for large, atmospheric storage tanks (*see also chapter A5.1.3c*)	This guideline has been included in part B3. Vertical tanks with membranes have already been included in the soil risk checklist (*see A3.3.1*).
4.3	**Return to step 3.**		

3.3 Soil protection, what? Soil risk checklist

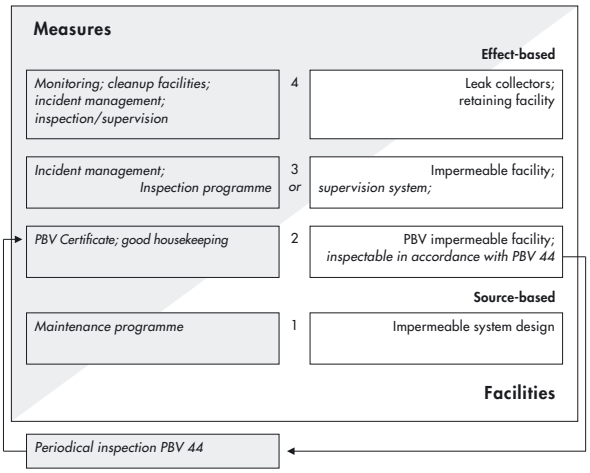
Soil contamination can be caused by events of various kinds. The nature of the event will be determined by, on the one hand, the amount released and, on the other hand, the frequency of the event (or the chance of the event happening). Large incidents are not very frequent; small incidents occur relativelyoften. For example, spills (the release of a small amount) will generally be more frequent than a broken pipe or the complete failure of a storage tank or installation. The main objective of the NRB is to minimise the risk of soil pollution by, on the one hand, keeping the risk of leaks, spills and so on as small as possible. In addition, the aim is to optimise containment facilities so that substances which may be released pollute the soil as little as possible.

During the development of the soil risk checklist (BRCL), the starting point was that the soil protection facilities would primarily focus on reducing the consequences of 'spills' and 'incidents'.
Spills are small, undesired events with a relative high frequency (several times a year) which result in small emissions. Examples of spills are spill losses during filling or transfer activities and small leaks which are noticed quickly.
Large incidents can be attributed to the failure of installation components or to operational mistakes. The consequences are confined to the company premises. They include, among others, long-lasting leaks, the failure of an overfill device, a leak in a tank or failure to close a shut-down valve.

Structure of the soil risk checklist

On the basis of the soil risk checklist, a basic emission score is allocated to each separate industrial activity. Soil protection measures and facilities result in a reduction of the basic emission score. The nature and quantity of the substances in question are less important in terms of assessing the soil risk. The soil risk can only be considered to be negligible beforehand if it can be demonstrated categorically that released substances will not penetrate into the soil or that the amount or composition of the substances cannot cause any perceptible change in soil quality.

Measures (software) and facilities (hardware) must be coordinated in order to achieve an actual reduction in the score. Less effective facilities require more intensive control measures and vice-versa.



The soil risk checklist looks at the effectiveness of the usual packages of soil protection measures and facilities for each activity. The description of the packages distinguishes between system design (part A5.1), containment facilities (part A5.2) and associated control measures (part A4.2). Where useful, indications are given of the links between the relevant activity and other activities.

Impermeable containment facilities with a PBV impermeable facility certificate (PBV-VVV) must be inspected periodically in accordance with CUR/PBV Recommendation 44 [67]. This is indicated in the soil risk checklist by the mention 'CUR/PBV 44'.

Control measures also include incident management. Here, action focuses specifically on cleaning equipment and the workfloor (good housekeeping) and/or the necessary presence of clearing up facilities and trained staff (facilities and human resources) so that effective intervention can take place when there are incidents.

3.3.1 Bulk liquid storage

1.1 Storage in underground tank or tank covered with soil

		System design		Control measures				
	Basic emission score	Construction / design	Emphasis on	Special operational maintenance	Inspection	Supervision	Incident management	Final emission score
Tank in impermeable container	4	underground impermeable container with leak detection	filling point and filling lines; venting (CPR)		leak detection	see 2.1		1
Double-walled tank with internal leak detection		double-walled with leak detection	filling point and filling lines; venting (CPR)		leak detection	see 2.1		1
Cathodic protection system		cathodic protection system	filling point and filling lines; venting (CPR)		periodical for cathodic protection	see 2.1		2

In a number of cases, underground or covered storage tanks are located in concrete containers which are then filled up and covered over. When tanks are located in concrete containers, the risk of soil pollution is reduced to a minimum.
This facility, in combination with a warning system under the tank but inside the container, provides maximum soil protection when the entire contents of the tank can be accommodated by the container (100% capacity).
The warning system is important because it is not possible to determine visually whether the container is impermeable. A system of this kind usually consists of monitoring wells from which samples are taken with a certain regularity. Sometimes, the quality of soil air can also be determined. Alternatively, the quality of the drained rainwater can be measured.

The soil risk of tanks with cathodic protection features and leak detection is also considered to be negligible. For this, certain quality requirements have to be met, for example the presence of a quality management system, design in accordance with the applicable assessment guideline (BRLs) etc.

Cathodic protection is only effective if there is periodical inspection of the system. When a single-walled tank leaks (despite the cathodic protection system), the liquid will pollute the soil immediately.
In the case of leakage from an inner tank, the liquid will be stopped by the outer tank. According to this thinking, a double-walled tank is therefore a better facility than a single-walled tank. However, the difference in soil risk does not justify a difference in score reduction.

Cathodic protection or another, equivalent form of corrosion protection is only necessary when the soil is corrosive (depending on the soil characteristics). For optimal soil protection, this facility should be supplemented by an appropriate inspection programme and (in the case of single-walled tanks) by monitoring (in accordance with the Storage in Underground Tanks Decree (BOOT).
The soil risk checklist assumes that double-walled underground storage tanks are always equipped with leak detection features. Is this not the case, the tank should be treated as if it were single-walled. In the case of double-walled tanks, an inspection programme is not essential for the level of protection because leaks will be registered immediately by the leak detection system.

CPR 9 [18, 19, 20] recommends both leak detection and cathodic protection for double-walled tanks. The combination of a double-walled tank with leak detection and cathodic protection provides maximum soil protection because it not only gives the greatest chance of discovering any leak but also because measures were taken to minimise damage to the outer tank wall.

Spills which occur when filling and/or venting tanks determine to a large extent the soil risk of tank storage. Particularly in the case of tanks which are not provided with a concrete underground container, an overfill device is a necessary soil protection facility alongside operating instructions for filling the tank. Otherwise overfills will result in the liquid going straight into the soil.
Installation of an impermeable containment facility below and around the filling point and vent can reduce this risk (see A3.3.3.2, under 2.1). It should be noted that such measures are compulsory pursuant to the Storage in Underground Tanks Decree (BOOT).

1.2 Storage in above-ground tank placed directly on the ground

	System design		Control measures				
Basic emission score	**Construction / design**	**Emphasis on**	**Special operational maintenance**	**Inspection**	**Supervision**	**Incident management**	**Final emission score**
3	retaining facility; leak detection			leak detection		good housekeeping	2
3	retaining facility	filling point and filling lines; venting (CPR)			see 2.1	good housekeeping	2
3	retaining facility; leak detection	filling point and filling lines; venting (CPR)		leak detection	see 2.1	good housekeeping	2
3	retaining facility; leak detection	filling point and filling lines; venting (CPR)		leak detection	see 2.1	facilities and human resources	1
3	retaining facility; (leak detection)	filling point and filling lines; venting (CPR)	tank management	leak detection	see 2.1	facilities and human resources	1
3	impermeable containment facility (+ PBV-VVV)	rainwater; filling point and filling lines; venting (CPR)		CUR/PBV-44	see 2.1	good housekeeping	1

Tanks placed directly on the ground consist effectively of a membrane on the ground onto which the vertical walls are welded. Since the membrane is not visible, any defects cannot be identified visually. In this type of tank, the main purpose of a warning system is to detect leaks in the membrane. Inspections focus on the condition of the tank (particularly the walls) and of the underlying surface and on the condition of the filling point, overflow drainage etc. 'Controlled overflow drainage' means that the liquid (which comes out of the tank through the overflow) is led to an appropriate containment facility through a product-proof, impermeable drainage system.

Above-ground tanks are generally built with corrosion protection (cathodic protection system, coating etc.). The presence of corrosion protection does not result in a score reduction.

A specific guideline has been drawn up (the Bobo guideline) for soil protection with large storage tanks (with diameters larger than 8 m). See part A5.1.3c. For the overfill device and filling instructions, the reader is referred to subactivity 2.1, loading and unloading locations; filling and drain points (A3.3.2).

1.3 Storage in above-ground tank, raised

	System design		Control measures				
Basic emission score	**Construction / design**	**Emphasis on**	**Special operational maintenance**	**Inspection**	**Supervision**	**Incident management**	**Final emission score**
2	retaining facility	filling point and filling lines; venting (CPR)		visual	see 2.1	facilities and human resources	1
2	impermeable containment facility (+ PBV-VVV)	rainwater; filling point and filling lines; venting (CPR)		CUR/PBV-44	seee 2.1	good housekeeping	1

When there is an impermeable containment facility (see part A5.2.1) under the tank, it is assumed that the liquid enters that containment facility when there is an overflow or overfill.
With a retaining containment facility, a controlled overflow drainage feature or an overfill device is required in order to achieve the maximum level of protection. An overfill device is expected to be accompanied by filling instructions.

In the case of double-walled above-ground tanks, the soil risk compared to single-walled tanks is not so much lower that a lower emission score can be justified.

1.4 Storage in pit/ basin

	System design		Control measures				
Basic emission score	**Construction / design**	**Emphasis on**	**Special operational maintenance**	**Inspection**	**Supervision**	**Incident management**	**Final emission score**
4	retaining facility				visual	facilities and human resources	3
4	retaining facility; leak detection			leak detection	visual	facilities and human resources	1
4	impermeable containment facility (+ PBV-VVV)	rainwater		CUR/PBV-44			2
4	impermeable containment facility (+ PBV-VVV)	rainwater		CUR/PBV-44	visual	good housekeeping	1

Pits and basins are open storage facilities for larger amounts of liquids or solid materials. Baths etc. are included under subactivity 4.1: open and semi-open processing plants (A3.3.4).
Linkage to a drainage system is covered under subactivity 5.1: sewage (A3.3.5).

Emergency containment tanks are found in the form of underground containment tanks and/or above-ground bassins or tanks.

3.3.2 Transshipment and internal transport of bulk liquids

2.1 Loading and unloading activities

		System design		Control measures				
	Basic emission score	Construction / design	Emphasis on	Special operational maintenance	Inspection	Supervision	Incident management	Final emission score
Loading and unloading platforms	4	retaining facility	autostop with detection in hose; immobiliser, position filling hose			filling instructions; detection device in filling hose		3
	4	retaining facility	autostop with detection in tank			filling instructions; detection in tank		3
	4	retaining facility				filling instructions; filling capacity		3
	4	retaining facility	immobiliser, autostop			filling instructions; detection in tank	facilities and human resources	2
	4	retaining facility	immobiliser			filling instructions; filling capacity	facilities and human resources	2
	4	retaining facility; drip pans	double-independent overfill device			filling instructions; detection in tank	facilities and human resources	1
	4	impermeable containment facility (+ PBV-VVV)	rainwater; length/position filling hose		CUR/PBV-44	filling instructions	good housekeeping	1
Draw-off points	4	drip pan	rainwater			visual	facilities and human resources	1
Filling and venting points	4	drip pan	rainwater			visual	facilities and human resources	(1)
	4	drip pan	rainwater			controlled overflow drainage	facilities and human resources	1
	4	impermeable containment facility (+ PBV-VVV)	rainwater		CUR/PBV-44	visual	good housekeeping	1

Loading and unloading platforms should be designed as containment facilities (see part A5.2).
In order to prevent incidents, clear filling and drawing off instructions should be observed and facilities and/or measures are necessary to prevent overfills and to make it impossible to drive away with the hose still attached to the vehicle.
Furthermore, the filling hoses should be short or positioned so that they cannot reach outside the containment facility.
There should be drip pans at filling and draw-off points.
The containment facilities at filling and venting points in storage tanks need only be considered separately if the point in question is not located within a tank pit.

2.2 Pipeline transportation

		System design		Control measures				
	Basic emission score	Construction / design	Emphasis on	Special operational maintenance	Inspection	Supervision	Incident management	Final emission score
Underground incl. mountings	4			maintenance programme	line inspection		facilities and human resources	3
	4	impermeable design		maintenance programme	line inspection			1
Corrosion-proof or equipped with cathodic incl. mountings	4	corrosion-proof / cathodic protection		maintenance programme	periodical for cathodic protection			3
	4	corrosievast / cathodic protection		maintenance programme	line inspection periodical for kathodische cathodic protection		facilities and human resources	(2)
Double-walled incl. mountings	4	double-walled with leak detection			leak detection		facilities and human resources	1
Above-ground incl. mountings	2		mountings	maintenance programme	line inspection	visual	facilities and human resources	1

Pipes located entirely above ground can be given a basic emission score of 1 if they are inspected frequently for leaks. Leaks in above-ground pipes can be subjected to direct visual inspection; those in underground lines cannot.

There is a range of design possibilities for the prevention of leaks in underground pipes.

By analogy with the approach for underground tanks, the maximum reduction in the score is given for double-walled systems furnished with leak detection and corrosion protection features.
Sewage systems and process pipes are comparable in terms of function. See, for a more detailed description of company sewage systems, subactivity 5.1 (A3.3.5).

2.3 Pump transfer

		System design		Control measures				
	Basic emission score	Construction / design	Emphasis on	Special operational maintenance	Inspection	Supervision	Incident management	Final emission score
Double rotating axle seal with flushing system	5			maintenance programme	pump inspection		good housekeeping	3
see pumps, general	5	retaining facility					good housekeeping	3
	5	retaining facility		maintenance programme	pump inspection		good housekeeping	2
Pump with no stuffing box	5	no stuffing box				visual	good housekeeping	1
Pumps, general	5			maintenance programme	pump inspection		good housekeeping	4
	5	retaining facility					good housekeeping	3
	5	drip pan	rainwater	maintenance programme	pump inspection	visual	facilities and human resources	1
	5	impermeable containment facility (+ PBV-VVV)	rainwater		CUR/PBV-44	visual	good housekeeping	1

Pump locations should be looked at separately when they have not been dealt with previously (for example, in activity 3: bulk-liquid transfer). The 100% container capacity required by § 1.3 and § 1.4 for category 1 and 2 containment facilities does not apply here because pumps can be linked to very large storage installations or processing plants. It is more realistic to suppose that the complete failure of the pomp will be noticed by an operator and that a valve in the supply pipe will be closed so that only a limited amount of liquid can escape.

2.4 Transport on premises in open drums etc.

	System design		Control measures				
Basic emission score	**Construction / design**	**Emphasis on**	**Special operational maintenance**	**Inspection**	**Supervision**	**Incident management**	**Final emission score**
5	retaining facility (premises)					good housekeeping	4
5	retaining facility (premises)				visual	facilities and and human resources	3
5	impermeable containment facility (premises)	rainwater		(CUR/PBV-44)		good housekeeping	2
5	impermeable containment facility (premises)	rainwater		(CUR/PBV-44)	visual	facilities and and human resources	1

The soil risk checklist does not include the activity 'transport on company premises in tanker etc.'. This is because this type of transportation mainly involves vehicles which can also be used on public roads. Given the fact that the entire Dutch road network is not yet impermeable, a requirement for this type of facility for company premises for transportation activities could result in inequality before the law.

For the carriage of dangerous substances by road, there are special regulations (ADR) which considerably reduce the risk of accidents and soil pollution. For those situations in which tankers are used on company premises which do not meet the ADR Guidelines, it is advisable to take a critical look at the soil risk.
Sites which are only partly impermeable are considered to be 'liquid-retaining' in this context.

The soil risk is only negligible if a site is completely impermeable (see part A5.2.1/2) and equipped with a checked, impermeable drain with the appropriate facilities such as an oil/water separator and valves for incidents.
The delimitation of the site to which the risk relates should take place in consultation between the company and the competent authority on the basis of a realistic review of the various arguments.

3.3.3 Storage and transfer of bulk and packed goods

3.1 Storage of bulk goods

	System design		Control measures				
Basic emission score	**Construction / design**	**Emphasis on**	**Special operational maintenance**	**Inspection**	**Supervision**	**Incident management**	**Final emission score**
4		roof/covering					3
4	retaining facility	roof/covering			visual	facilities and human resources	1
4	impermeable containment facility (+ PBV-VVV)	rainwater		CUR/PBV-44			2
4	impermeable containment facility (+ PBV-VVV)	rainwater; roof/covering		CUR/PBV-44		good housekeeping	1

The basic score is established for a storage facility without any roof and without additional facilities directly in contact with the soil.
The introduction of a roof limits the soil risk when:

- the roof is large enough to prevent rainwater reaching the bulk goods;
- facilities are in place to prevent liquid and/or rainwater from the vicinity of the storage facility from flowing freely over the ground beneath the roof and causing soil pollution in this way as a result of leaching of the bulk goods.

If the storage facility has raised edges or if storage takes place within a building with permanent (impenetrable) walls, this requirement will generally have been met. In addition, walls and roofs also prevent material from being blown away.

If rainwater can penetrate into the storage facility or if pollutant liquids can be released from the bulk goods, controlled drainage will be necessary using an adequate company sewage system. An impermeable underlying surface and controlled drainage of water and rainwater alone are not adequate to render the soil risk negligible. If there is a roof (in the case of 'dry' bulk goods), a retaining underlying surface will be adequate.

3.2 Transshipment of bulk goods

		System design		Control measures				
	Basic emission score	**Construction / design**	**Emphasis on**	**Special operational maintenance**	**Inspection**	**Supervision**	**Incident management**	**Final emission score**
	4					visual	facilities and human resources	3
	4	retaining facility				visual	good housekeeping	3
	4	retaining facility				visual	facilities and human resources	2
	4	retaining facility				visual	facilities and human resources	1
	4	impermeable containment facility (+ PBV-VVV)	scrubbing water and rainwater		CUR/PBV-44	visual	good housekeeping	1
Enclosed system	4	enclosed system	connections	maintenance programme		visual	good housekeeping	1

An 'enclosed system' is a system with facilities on all sides which are adequate to cope with wind dispersal and spills as a result of overloading (for example, pneumatic elevators, screw and chain conveyors or covered belt conveyors).
The transfer of bulk goods in an 'open system' (for example, with grabbing cranes, open conveyor belts, or direct dumping from a truck) is generally accompanied by relatively large spills so that specific monitoring and clearing up facilities are required to limit the soil risk. The soil risk is considerably reduced in an enclosed system.

Other forms of transfer (movement of containers etc.) are generally included under packed goods transfer.

3.3 Storage in packaging solid and viscous substances

	System design		Control measures				
Basic emission score	**Construction / design**	**Emphasis on**	**Special operational maintenance**	**Inspection**	**Supervision**	**Incident management**	**Final emission score**
3		special packaging			visual	facilities and human resources	2
3	retaining facility/ container					good housekeeping	2
3	retaining facility/ container	special packaging			visual	facilities and human resources	1
3	impermeable containment facility (+ PBV-VVV)	scrubbing water and rainwater		CUR/PBV-44	visual	good housekeeping	1

Solid materials and viscous liquids in packaging cause soil pollution when the packaging is so damaged that large quantities are released and remain lying around for long periods of time since these are substances with a relatively low dispersion rate. The basic score is therefore lower than for packed liquids.

When the substances are packed in special packaging (metal packaging, UN-approved packaging), the risk of damage to the packaging is limited. This will generally be the case with dangerous substances which have to meet the requirements of the ADR (road and rail transport), the IMO (shipping) or the IATA (aviation).

When special packaging is used, a negligible soil risk can be achieved with a retaining underlying surface, frequent monitoring and adequate procedures to deal with leaks.

3.4 Storage in packaging liquids

	System design		Control measures				
Basic emission score	**Construction / design**	**Emphasis on**	**Special operational maintenance**	**Inspection**	**Supervision**	**Incident management**	**Final emission score**
4		special packaging			visual	facilities and human resources	3
4	retaining facility/ drip pan					good housekeeping	3
4	retaining facility/ drip pan	special packaging				good housekeeping	2
4	retaining facility/ drip pan				visual	facilities and human resources	2
4	retaining facility/ drip pan	special packaging			visual	facilities and human resources	1
4	impermeable containment facility (+ PBV-VVV)	scrubbing water and rainwater		CUR/PBV-44	visual	facilities and human resources	1

For further explanation, see subactivity 3.3: storage and transfer in packaging (drums, containers etc.) with solid materials or viscous liquids.

3.3.4 Processing plants

4.1 Enclosed process or treatment

		System design		Control measures				
	Basic emission score	Construction / design	Emphasis on	Special operational maintenance	Inspection	Supervision	Incident management	Final emission score
	3	retaining facility					good housekeeping	2
	3	retaining facility				visual	facilities and human resources	1
	3	impermeable containment facility (+ PBV-VVV)	scrubbing water and rainwater		CUR/PBV-44		good housekeeping	1
Enclosed system design	3	enclosed system	pumps; mountings; sampling points etc.	maintenance programme	system inspection		good housekeeping	1

This subactivity includes plants which are not open during normal operations: enclosed reactors, columns etc. which are filled and emptied using pipes which are part of the plant.

An enclosed system design involves process equipment designed and constructed is such a way that no process or auxiliary substances can depart the process covering under normal conditions, like (double-walled) process vessels having no draw-off and/or inspection holes etc. and welded piping with no flanges.

4.2 Open or semi-open process or treatment

	System design		Control measures				
Basic emission score	Construction / design	Emphasis on	Special operational maintenance	Inspection	Supervision	Incident management	Final emission score
4	retaining facility					good housekeeping	3
4	retaining facility				visual	facilities and human resources	2
4	impermeable containment facility (+ PBV-VVV)	scrubbing water and rainwater		CUR/PBV-44			2
4	impermeable containment facility (+ PBV-VVV)	scrubbing water and rainwater		CUR/PBV-44	visual	facilities and human resources	1

'Semi-open processes and treatment' include plants or parts which have to be opened in order to be filled or emptied. This includes activities such as filtration, extrusion, die-casting, drying, muffling, heating, cooling, automatic filling, dosage and weighing.

The 'open processes and treatment' category includes activities which do not take place in a limited area or activities such as spraying and blasting in which it is only possible to prevent the dispersion of substances into the environment by means of very specific facilities and measures. These include procedures located directly on the uncovered ground, the movement and temporary storage of wet materials, car washes, etc.

An impermeable containment facility under the entire activity is necessary in order to render the soil risk of open and semi-open processes negligible. This collection capacity can be achieved using a floor with raised edges and/or an impermeable drain.
Furthermore, the presence of clearing up facilities is essential so that it is possible to respond adequately when there are incidents.

3.3.5 Other activities

5.1 Waste water drainage to company sewage system

		System design		Control measures				
	Basic emission score	Construction / design	Emphasis on	Special operational maintenance	Inspection	Supervision	Incident management	Final emission score
Underground sewers	4				sewer inspection		facilities and human resources	2
		CUR/PBV-Recommendation 51	pits, sludge collectors, oil separators, joints	CUR/PBV-Report 2001-3	CUR/PBV-44*		facilities and human resources	1
Above-ground sewage	4		mountings	maintenance programme	line inspection		facilities and human resources	1

* third revides version [67]

When a processing water sewage system is located above ground, it can be considered to be a chemical pipeline. The scores are therefore identical to those in subactivity 2.2 (A3.3.2).
The presence of an inspection programme and emergency plan results in a score reduction of 2 points.
With existing underground sewers, it is not possible to achieve a negligible soil risk and risk-limiting soil investigation is therefore required to render the soil risk acceptable. For the time being, this is not considered to be reasonable.

New underground sewers developed in accordance with CUR/PBV recommendation 51 [52], with operational maintenance in accordance with CUR/PBV Report 2001-3 [64], can be inspected visually on the basis of CUR/PBV Recommendation 44 [67]. A new underground sewer with a valid PBV impermeable facility certificate results in a negligible soil risk.

5.2 Emergency containment

		System design		Control measures				
	Basic emission score	Construction / design	Emphasis on	Special operational maintenance	Inspection	Supervision	Incident management	Final emission score
Underground	3		(CPR) filling point and filling lines			see 2.1	facilities and human resources	2
	3	corrosion-proof / cathodic protection			periodical for cathodic protection	see 2.1	facilities and human resources	2
	3	corrosion-proof / cathodic protection	(CPR) filling point and filling lines		periodical for cathodic protection	see 2.1	good housekeeping	2
	3	corrosion-proof / cathodic protection	(CPR) filling point and filling lines		periodical for cathodic protection bescherming	see 2.1	facilities and human resources	1
Underground prefab	3	impermeable design			internal visual inspection	see 2.1	facilities and human resources	1
Above-ground	3	above-ground	(CPR) filling point and filling lines		visual inspection	see 2.1	good housekeeping	1

Emergency containment tanks are only used in an emergency. This means that this activity is different from storage in tanks or basins.
The most common type is the underground containment tank, but there are also above-ground basins or tanks. Emergency ponds for the containment of contaminated fire extinguishing water are not discussed here.
Because underground tanks are only filled in exceptional circumstances and do not therefore contain liquids on a permanent basis, the basic score for emergency containment tanks is 3.

Emergency tanks must be impermeable as long as the discharged substance is kept in them (generally not much more than 3 to 4 days). Corrosion protection is necessary: because the tank is empty for most of the time, the material will corrode faster (mainly on the inside). The inside will therefore have to be coated. In areas where the soil properties justify this, external cathodic protection is also desirable.
Leaks from above-ground emergency containers can be identified immediately if there is effective supervision during filling. It is assumed that filling and drawing off activities will then be suspended immediately so that the soil risk will be negligible.

5.3 Activities in workshops

		System design		Control measures				
	Basic emission score	Construction / design	Emphasis on	Special operational maintenance	Inspection	Supervision	Incident management	Final emission score
Without storage	4	retaining facility					good housekeeping	3
	4	retaining facility				visual	facilities and human resources	1
With storage	4	retaining facility/ drip pans	storage			visual	good housekeeping	3
	4	retaining facility/ drip pans	equipment			visual	good housekeeping	3
	4	retaining facility/ drip pans	storage and equipment			visual	good housekeeping	2
	4	retaining facility/ drip pans	storage and equipment			visual	facilities and human resources	1
	4	impermeable containment facility (+ PBV-VVV)	scrubbing water drainage		CUR/PBV-44		good housekeeping	1

Both storage and processing activities can take place in a workshop. The materials stored may be waste, chemical waste, fuel, and working stocks of cleaning agents or hydraulic or other oil.

This subactivity primarily involves construction and repair workshops, for example for metalworking and woodworking, or equipment construction.
The basic score which has been assigned to workshops is 4. The following considerations played a role here:

- the frequency of spills will be relatively high because of the intensity of activity, so a high basic score is realistic;
- it has been assumed that workshop floors are always paved and that they can be considered to be retaining. In addition, spills will generally be smaller in workshops and usually take place during the work so that they will be noticed quickly. This justifies a reduction of the basic score.

If equipment (lathes, hydraulically-driven machines etc.) and any stores are located above drip pans, a retaining workfloor is adequate for a negligible soil risk, on condition that there is regular monitoring and spills and leaks are cleaned up efficiently.

For storage in tanks, the reader is referred to subactivity 1.3: above-ground storage (A3.3.1). Processing activities are included under subactivity 4.2: open or semi-open process or treatment (A3.3.4).

5.4 Waste water treatment

When a company has a waste water treatment system, this is generally a clearly delimited, separate unit (activity). A waste water treatment system can be considered to be a collection of pipes/sewers and basins.

Given the fact that the separate parts of a waste water treatment system do not have any specific features which distinguish them from ordinary pipes or basins, it is enough to refer the reader here to subactivities 1.4: pits and basins (A3.3.1) and 2.2: lines (A3.3.2).