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NRB 2001

A4 Measures

This chapter describes the measures which contribute to, and/or are necessary for, effective soil protection.

InfoMil Publication, revised edition
June 2003.

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Under the responsability of
Project Group NRB
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project management
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Design
Conefrey/Koedam BNO, Almere

Cover Photograph, Podzol
Photographic Centre SC-DLO

Printed by
PlantijnCasparie, The Hague

Paper and Production
This brochure has been printed on 100% recycled paper, using Computer to Plate production.

How to Order
This publication can solely be ordered in writing or by faxing + 31 70 373 56 00, using the publication number B05 as reference. The costs, € 35,– will be invoiced following delivery. Additions will be sent, free of charge, to all registered NRB owners.

ISBN 90-76323-02-X

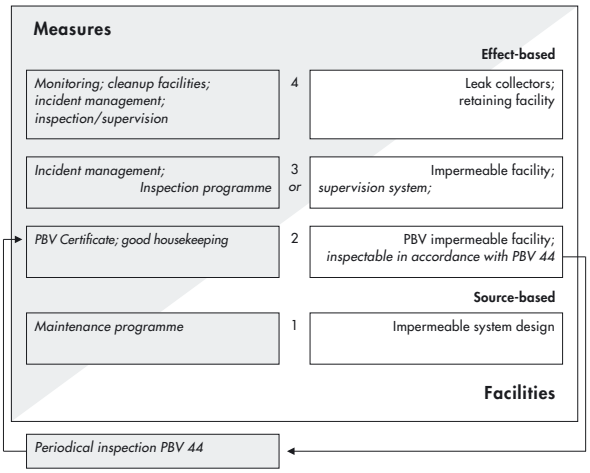
4.1 General measures

Various measures focusing on industrial operations contribute to soil protection, either directly or indirectly, because they make the application of specific measures and facilities more efficient by:

- centralising the activities involving substances which pollute the soil (both in storage and in processes) as much as possible. This opens the way to cost savings on facilities and measures, particularly in new situations;
- storing substances of different kinds and with different properties separately so that soil protection facilities and measures can be adapted to deal with those substances specifically. This avoids the necessity to spread facilities around the establishment in a cost-ineffective way. The separation of substances may also be required on the basis of CPR guidelines.

4.1.1 System design

Extra facilities in or on installations to keep substances which are hazardous to the soil in their casing reduce the soil risk. Leak-proof or impermeable system design – such as flangeless joints and/or double-walled systems with leak detection – is effective as long as a specific maintenance programme (special operational maintenance) is in operation for this purpose.



4.2 Control measures

Measures and facilities should be coordinated. Less effective facilities require more intensive control measures and vice-versa.
Control measures can be broken down into 'repairs and maintenance', 'inspection and supervision' and 'incident management'.

4.2.1 Repairs and maintenance

Preventive maintenance extends the service life of the facility. It is advisable to carry out maintenance in a planned way. A maintenance programme will state:

- which facilities require maintenance;
- maintenance frequency;
- what maintenance consists of;
- who carries out the maintenance;
- what resources are required for that purpose.

4.2.2 Supervision and inspection

A distinction is made between

- the supervision of risk-determining activities during the activities which are conducted in accordance with operating instructions, and
- periodical or automatic inspection/surveillance of equipment and facilities.

A special form of inspection is the 'soil investigation for the purposes of the duty to clean up'. This investigation is not included in the soil risk checklist (see part A3.3) but it must always take place, either in the form of a soil pollution investigation or in the form of monitoring to reduce the risk.

a Supervision

In order to limit the soil risk as much as possible, clear operating instructions and specific supervision of industrial activities are necessary. In addition, staff must be given instructions about how to respond when there are malfunctions and/or spills and how to use resources to prevent the dispersion of released substances or penetration into the soil.
In so far as applicable, facilities must be introduced which make it possible to prevent dispersion and to clear up spilt materials.

Examples of this are:

- absorption material and/or large drums for leaking packaging;
- closable sewers;
- facility for pumping out, within a reasonable time, bassins which have filled up.

b Visual inspection

Process vessels, pipe lines, pumps and soil protection containment facilities require periodical inspection. Generally, there is a maintenance programme for this purpose (see 4.2.1). However, even when installations require little or no preventive maintenance, periodical company inspections for leaks or defects are desirable. General criteria for the determination of efficient inspection intervals cannot be given. All this depends very much on the nature of the substances and actual operations.

An inspection programme or plan should state:
- which facilities should be inspected;
- the inspection frequency (periodical, supervision of specific activities);
- the method of inspection (visual, sampling, measurements etc.);
- which expertise is required for this purpose;
- who is responsible for the inspection;
- what resources are required for that purpose;
- how the results are reported and recorded;
- what action should be taken when irregularities are found.

b.1 Inspection of soil protection facilities

Inspections of simple facilities such as drip pans and floors where the risk of failure is low can be carried out by staff with the appropriate training and adequate experience. As with the supervision of specific process activities, a company can use its own staff. They will usually be well informed about the circumstances and changes in the situation.

For impermeable facilities, open to visual inspection, a valid PBV impermeable facility certificate is required from a Qualified Inspector (see also part A5.2.1).
A precondition for the validity of a certificate of this kind is that the company itself should also conduct frequent visual inspections of facilities of this kind and keep a record of the findings and action taken in a logbook.
The Qualified Inspector also uses the logbook to determine the period of validity of the PBV impermeable facility certificate.

CUR/PBV Recommendation 44 [67] includes a checklist which can be used for visual inspection by the company. Defects found during company inspections may result in further investigation by a Qualified Inspector.

c Automatic monitoring / leak detection

Automatic monitoring may be used as an alternative for the visual inspection of the condition of installations. Examples of this are: leak detection systems in double-walled tanks or pipe lines, under liquid-retaining floors and/or above underground containers. Automatic monitoring systems should be seen as part of an installation (see part A5.1.2) and may not be dissociated from the organisational measures for immediate intervention after a failure has been observed.

Leak detection should not be confused with monitoring to reduce the risk. (cf. 4.2.d3). Leak detection is used to monitor the installation "outside the soil", whereas monitoring as part of risk limiting soil investigations informs management about immissions in the soil.

d Soil investigation for the purposes of the duty to clean up

Even if the risk of soil pollution is negligible as a result of the facilities and measures in place, the possibility of pollution cannot be excluded altogether. A specific soil investigation is needed – after termination of the industrial activity – to determine whether there has been significant soil pollution as a result of that activity (soil pollution investigation).
In situations in which measures and facilities do not keep the soil risk negligible, effective monitoring of soil quality to reduce the risk is required. NRB Part B-1 gives details on how soil quality monitoring should be elaborated within the framework of preventive soil protection.

d.1 Exploratory study

The amount of investigation required for proper decision-making about soil cleanup after pollution has occurred can be established by a thorough exploratory study which looks at:
- the location of the industrial activities;
- data about the stratification of the soil and the geohydrology;
- data about the mobility, solubility and volatility of used or stored substances.

It will be necessary on the basis of this exploratory study, to determine for each activity where substances may have entered the soil and how they may disperse. See, for further information about the required exploratory study, part B1.
It is then possible to determine an investigation strategy indicating where (location, depth) and how the soil quality should be assessed.

d.2 Soil pollution investigation

Prior to the start of, or any change in, a industrial activity, the baseline situation of the soil will be established. After termination of that activity, the final situation will be determined using the same method. A significant difference between the results of the investigations indicates that the relevant industrial activity has resulted in contamination of the soil.
It may also be a good idea to require an interim soil pollution investigation (where appropriate on a periodical basis), particularly if the interval between the baseline and final investigation is unacceptably large. This makes it possible to intervene at an early stage if the company's activities result in contamination. Check part BI.4 for further details on soil pollution investigation.

d.3 Monitoring to reduce the risk

It is only in certain situations that the competent authority can agree that a risk is rendered acceptable by means of specific soil investigation. In that case, monitoring soil quality to reduce the risk must take place in accordance with the 'Guidelines for Monitoring Soil Quality (industrial activities)' (see part BI.5).
Although monitoring to reduce the risk is excluded by the NRB as a measure in all other circumstances, there may be reasons why the competent authority, insurer or the company wants monitoring activities.
A system of monitoring to reduce the risk is not considered to be a soil protection facility. It is a soil protection measure and cannot be dissociated from the duty to clean up (see also part A2.2.1). Monitoring to reduce the risk is a measure for detecting soil pollution at an early stage and for limiting the extent of soil cleanup activities. Therefore, the aim of the required monitoring system is not – by contrast with leak detection – to detect the failure of a facility immediately. Regular checks on the functioning of the sampling network and maintenance are necessary and have to be set out in the monitoring programme. Within the company, it must be clear who is responsible for the control and the planning and who has the authority to make changes.

Monitoring to reduce the risk must be approved by the competent authority. If monitoring to reduce the risk shows that there is soil pollution resulting from the industrial activity, the duty to clean up must be fulfilled as quickly as possible unless it has been agreed otherwise for the relevant source in a Soil cleanup action plan. Temporary control measures could be needed if requested by the competent authority. See also part A2.1.2C.

d.4 Coordination of baseline investigation, final investigation, soil pollution investigation and monitoring soil quality to reduce the risk

The appraisal of the baseline, intermediate and final soil situations has a completely different objective – and therefore structure – than monitoring to reduce the risk with a view to reducing the soil risk to an acceptable level.
If an effective monitoring system has been set up to reduce the risk, the requirement of an interim soil investigation (repeat investigation) would appear to be redundant in the context of the soil pollution investigation for the relevant industrial activity. Monitoring to reduce the risk and interim soil investigations are, however, different in terms of design. Monitoring to reduce the risk specifically follows the development of soil quality at the site of the industrial activity.
An interim appraisal of the soil situation is less frequent and generally less extensive than monitoring to reduce the risk. Repeat soil investigation cannot therefore, in the case of industrial activities in soil risk category B, replace monitoring.
Conversely, monitoring cannot replace baseline, interim or final soil investigations because monitoring is confined to sampling of the vapour and liquid soil phase.

The competent authority can, with respect to the final soil investigation, take the most recent monitoring results for specific industrial activities into account. It should be pointed out here that monitoring soil quality to reduce the risk provides no information, or at best secondary information, about the quality of the solid soil phase. Immobile substances can enter the solid soil phase which are not identified by monitoring to reduce the risk but which can be detected upon the termination of the business.

4.2.3 Incident management

a Good housekeeping

The soil protection measures should be part of the company housekeeping rules and conduct guidelines for safe and orderly working.

No matter how much effort has been put into soil protection, leaks have to be dealt with and spills cleared up. This good housekeeping is the basis of good environmental management.
Especially in the case of retaining facilities (see part A5.2.4), supervision and frequent inspections are important. In that case, clearing up facilities and/or trained staff are required for a fast and effective response to incidents.
Checks on spills and leaks, inspection and maintenance programmes, specific emergency plans etc. can be worked out in an overall 'soil protection and care system' or be integrated in a company environmental protection system.

a.1 Certification of environmental protection systems

Company environmental protection systems can be certificated on the basis of the EMAS or ISO-14001. These quality systems are comparable, except for the

fact that the EMAS requires the environmental report to be checked by an independent party.

Within environmental protection systems, policy statements, procedures, work instructions etc. laid down within documents, as well as the accompanying registrations and reports play a crucial role. An overview of these documents and procedures relevant to incident management is given in NRB Part b3.1.

b Facilities and human resources

Despite the facilities and measures in place, it is possible that as a result of the failure of process equipment and/or human error, substances may be released which can pollute the soil. The objectives of incident management are to:

- identify possible incidents;
- set up arrangements and procedures in such a way that identified incidents are kept to a minimum;
- make arrangements so that, when there are incidents
  - the release of substances will be stopped,
  - released substances will be cleared up,
  - further dispersion or penetration into the soil of substances will be prevented,
  - if there has been soil pollution, the soil will be cleaned up;
- identify the causes of incidents after they have occurred and, where possible, adapt the facilities and measures in order to reduce to a minimum the risk of the incident being repeated.

Although it is impossible to identify all undesirable events, it is advisable to identify foreseeable incidents as much as possible and to set up associated procedures which state what action should be taken and by whom. It is advisable to integrate incident management in an environmental protection system.

b.1 Company emergency plan

A company emergency plan sets out the procedure for preventing soil pollution or limiting the extent of the pollution resulting from incidents such as materials escaping from their casing, leaks and spills.
Examples here are the collection and discharge of fire extinguishing water, and of spilt materials as a result of failures in facilities or operating errors etc.

Emergency plans should at all times cover the following areas:

- notification and registration:
  - who should the incident be reported to,
  - when the competent authority should be informed;
- the prevention of dispersion;
- auxiliary materials;
- clearing up, cleaning and cleanup;
- evaluation.

b.2 Training of staff; instruction cards

Staff should be instructed and trained in the correct use of process equipment, the procedures required for that purpose and the associated protective measures. This also includes training in the use of emergency measures, clearing up released substances and reporting incidents to the people appointed for that purpose.

Specific supervision of the progress of activities by the operating staff reduces the soil risk. It may be a good idea for operating and safety instructions to be prominently present on cards close to the activity.

b.3 Presence of absorption material, etc.

The penetration of spilt substances in the soil and/or further dispersion thereof over the site can sometimes be prevented by absorbing substances and clearing them up.
Suitable and adequate clearing up facilities for this purpose must be present in the vicinity of the activities in question. In addition to absorption materials and drums used for clearing up, there should also be material for stopping leaks.

c Soil polluting incident management

In most occasions an effective combination of measures and facilities will reduce the soil risk to a negligible level (A). Sometimes the essential measures or facilities are not feasible and soil-polluting incidents[1] can not be excluded. Achieving an acceptable soil risk (A*) using risk reducing soil quality monitoring is in some situations no realistic option, facing the preconditions set by chapter B1.5.

For these situations a quality assured management system for soil polluting incidents – meaning more strict measures – could be effective in reducing the soil risk also. Such a system must be based on early warning and full restoration of the baseline soil quality in case of soil pollution.

Incident management focused at soil polluting incidents could – under certain conditions - serve as an alternative to make soil risk acceptable for companies where it is not feasible to realise negligible soil risk. Such an soil polluting incident management system would be an further elaboration of an ordinary incident management system and involves procedures, plans, work instructions, training and instruction of personal, as well as specific means like:

- early warning in case of a soil polluting incidents by means of leak detection, soil quality monitoring and/or using frequent inspection of equipment and supervising activities;
- immediate and effective action to restore baseline soil quality after a soil polluting incident;
- quality insurance procedures aimed at adaptation of work instructions, supervision procedures, replacement of equipment and/or improved maintenance in

[1] Soil polluting incidents are incidents of which is to be reasonably assumed that released compounds would pollute the soil and/or situations where from leak detection, soil monitoring, or otherwise is concluded that soil pollution has occurred.

order to prevent future incidents.

As a matter of principle soil-polluting incident management is feasible within all companies where essential facilities needed to obtain a negligible soil risk are not reasonably achievable. However an environmental care system should be operational within the company, including the elements relevant to soil polluting incidents given above. The company should demonstrate the effectiveness of its incident management system, e.g. by means of certification on the basis of EMAS or ISO-14001 certification.
NRB Part 3.2 gives an example of the aspects to incorporate in the management system for soil polluting incidents. This overview is a supplement to the chapter B3.1 giving the elements relevant to incident management as such.

Proper operation of the soil polluting incident management system is to be checked by the competent authority facing:
- *Presence of proof:*
  Checking whether relevant documents, procedures and records are available and up-to-date.
- *Demonstrable availability of means and skills of the incident team:*
  Checking whether the means needed for cleanup after a soil-polluting incident are available on site and if drills and exercises are scheduled as planned.
- *Compliance with procedures:*
  – Checking whether procedures are in use effectively;
  – Checking whether monitoring / inspection is done according schedule and results are recorded.
- *Proper operation of the care system:*
  Checking whether the overall effect of the warning system and cleanup yields in an acceptable soil risk, using the output of the environmental care system (records of internal audits, changes to policy statements and/or procedures, monitor data, etc.).

Using a soil protection strategy including soil incident management, soil polluting is likely to occur. Although measures will reduce the risk of soil incidents (and so soil pollution), the over all effect will be insufficient to exclude soil pollution, for, if the measures would be sufficient the soil risk would have been negligible.
Soil polluting incident management implies an effective warning system for soil polluting incidents. Occasionally visual inspection / supervision or leak detection would be sufficient. However, in most cases soil risk reducing monitoring will be needed to safeguard the baseline soil quality (see B1.5.1).
In respect to this risk reducing monitoring, results from the baseline soil quality investigation, being part of the soil polluting investigation essential to all activities. The repeat baseline soil investigation (needed in some occasions) will not suffice as early warning instrument within soil polluting incident management.

4.3 Soil cleanup pursuant to the duty to clean up

Having regard to the duty of care provisions in the Environmental Management Act (section 1.1a) and the Soil Protection Act (section 13), companies are obliged to clean up the soil when soil pollution has been found. If necessary, temporary control measures must be taken immediately. The competent authority shall be the judge of whether these measures are necessary.

It is advisable to lay down the duty to clean up the soil in conditions accompanying the environmental permit.
The duty to clean up remains even if the company has reduced the soil risk to the negligible level (A). A return to the baseline situation is the aim of soil cleanup after soil pollution has occurred, using state-of-the-art cleanup techniques (see the Handboek Bodemsaneringstechnieken [Soil Remediation Techniques Handbook], which will be extended to include this area [66]).

There are two different situations in which the duty to clean up applies:
- cleanup of the soil if - despite the introduction of facilities and measures resulting in a negligible soil risk - the final or interim soil investigation irrefutably shows that there has been unforeseen soil pollution as a result of that activity; and
- return to the baseline situation when monitoring or the final soil investigation has shown that there is soil pollution in situations where the combination of measures and facilities does not result in a negligible soil risk.

The consideration of reasonableness plays a role in the fulfilment of the duty to clean up. The principle of proportionality (General Administrative Law Act section 3.4) states that the consequences of the penalty to be imposed (soil cleanup costs) and the interest intended to be served (restoration of the baseline situation) must be in proportion. The competent authority will therefore need to verify whether the severity of the pollution of the soil justifies the consequences of cleaning up the soil as soon as possible.

Facing the NRB, the cleanup duty is aimed at future pollution only. Due to the preventive measures and facilities the scale of future pollution will be rather small. Soil pollution investigation based on NRB Part B-1 minimalises plume lengths and so costs for cleanup.
The environmental target for soil cleanup is restoring the soil quality as determined by the baseline soil quality investigation (see Part B1.4).

Within this framework the Draft Decree on Financial Guarantee [Government Gazette 17 July 2001,134] cleanup costs are estimated to € 22.500,–. This sum gives a rough indication of the State of the Art cleanup technology to be selected. Soil quality restoration should not last more than several years.
If the company has not – yet – achieved a negligible soil risk – in other words has consciously accepted a risk of soil pollution – other starting points apply immediate restoration of the baseline situation should be restored within a shorter timeframe..