Public document

The French approach to contaminated-land management

Revision 1

BRGM/RP-52276-FR
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D. Darmendrail

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RÉPUBLIQUE FRANÇAISE
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1. Organization at the national level

1.1. FRENCH GOVERNMENT AND CONSTITUTION

France, although showing a recent trend towards regionalization, remains a centrally governed country. For the environment, as for other subjects, laws are discussed and voted by parliament, the corresponding regulations being enacted by Government with national validity.

The main distinction with other European countries concerning the implementation of the legal framework on contaminated-land management, is linked to a basic principle of the French approach: i.e., to be effective, implementation must be cooperative between the different participants (stakeholders, site owner, consultants, regulators).

1.2. ADMINISTRATIVE ORGANIZATION FOR ENVIRONMENTAL ISSUES

The administrative organization in France is based on national and regional levels, which show significant variations in the decision-making bodies for contaminated-land management and water management in France.

1.2.1. Contaminated-land management

The Ministry of the Environment

At the central level, the section in charge of contaminated-land management is the *Direction de la Prévention des Pollutions et des Risques* (DPPR) of the Ministry for the Environment (acronym: "**MEED**" – Ministère de l'Ecologie et du Développement Durable) and especially the Service for the Industrial Environment (**SEI**, Service de l'Environnement Industrial). This service is responsible for taking action intended to reduce pollution, nuisances and risk to the environment from the activities related to the classified installations legislation.

The Departments

At the local level, the basic geographical administrative unit is the *département*. In all, there are 100 French departments distributed over 26 regions. Their heads, the representatives of central government, are the so called *préfets de département*, hereafter designated "Prefect". Most individual decisions are taken by the Prefect of the Département, under the authority of the Minister for the Environment. He or She has the responsability of deciding, of checking that rules are followed and taking any further measure that may prove necessary. They are supported by specific divisions of the Prefectures and/or decentralized administrations.

Regional Directories of Industry, Research and Environment

In the specific case of contaminated sites, the Prefect is assisted by Inspectors of Authorized Installations, who control industrial activities and generally are members of the Regional Directorate of Industry, Research and Environment, *les Directions Régionales de l'Industrie, de la Recherche et de l'Environnement* (**DRIRE**). For the Paris area only, assistance is provided by a particular division of the Paris Police Headquarters, the inter-departmental technical service for the inspection of classified installations - STIIC (difference due to the particular status of Paris that is considered both as a city and a department).

Local level

Municipalities have an indirect interest in contaminated-land management. They are in charge of land-use and urban planning and its enforcement.

1.2.2. Water pollution

Different actors are involved in water protection versus contaminated-land management. At the national level, this is the Water Division of the Ministry of National Land Planning and the Environment. Locally, the Prefects are assisted by inspectors of various regional offices (DDAF, DDE).

Six water agencies, covering the hydrogeological basins, have 5 specific missions:

- ensure the equilibrium between water resources and requirements,
- reach the quality objectives set by regulations,
- improve and increase the usable resources within the area,
- protect resources against flooding and pollution,
- coordinate general actions within the basin area, such as:
  . instrumentation and measuring,
  . assistance for water recycling and savings,
  . public information, etc.

These actions are funded by an additional levy on water abstractions and discharges.

At the regional level, a Basin Coordinator Prefect is in charge of the coordination of Water policy.

At local level, the municipalities have the responsibility for drinking-water distribution.

2. Legal framework

2.1. GENERAL LEGAL FRAMEWORK

France has no specific legislation concerning contaminated sites. The only law for managing the remediation of soil polluted by industry is the one dated 19 July 1976 on the classified installations (annulled and replaced since september 2000 by the Environment Act), and its decree of 21 September 1977 - see below.

The first general text regulating installations that are sources of nuisances or risks was the imperial decree of the 15th of October 1810, 'establishing three classes for factories and workshops that give off an unhealthy or offensive smell'. The lax of the 19th of December 1917 concerning dangerous, unhealthy and disruptive establishments revised the regulations by replacing the authorization required for the 3rd class with a declaration system.

The law of the 19th of July 1976 concerning installations classified for the protection of the Environment updated the old law of 1917, notably by extending its application scope to all installations whatever their legal status and strengthening the government's powers of action. It has been very significantly modified by the laws of the 3rd of July 1985 in particular, notably increasing the penal sanctions, of the 22nd of July 1987 on major risks, of the 13th of July 1992 (2 laws, one concerning waste and the other, genetically modified organisms), of the 4th of January 1993 on quarries and of the 2nd of February 1995 concerning the strengthening of the Protection of the Environment. Since the 21st of September 2000, it has been subsumed into the Environment Act.

National policy and measures to be applied are defined in circulars of the Minister of the Environment to the Prefects (Government representatives) of the departments. Two key documents are the circulars from the Minister of the Environment of 3 December 1993 and 10 December 1999, defining major features of a national policy for contaminated sites.

2.1.1. Circulars

Dec. 1993 Minister of the Environment to the Prefects, defining ***the general policy concerning contaminated sites***. Major tasks in this document are:

- Principles of a realistic soil cleaning-up policy;
- Measures and tools to implement this policy - Investigation of polluted soils and sites - Evaluation of risks and vulnerability of those sites – Setting up of a concerted information network at a regional level – Creation of a national inventory of contaminated industrial sites;
- Initial classification of contaminated sites.

April 1996 In two circulars, the Minister of the Environment instructs the Prefects how ***to select priority industrial sites for conducting Preliminary Site Investigations and Simplified Risk Assessments*** (see Table 1).

June 1996 The Minister of the Environment forwards to the Prefects ***definitions of the administrative and legal instructions for the remediation of contaminated sites*** and in particular for that of ***orphan sites***.

September 1997 The Minister of the Environment explains the chain of responsibility between the various actors of soil-remediation management (owner, operator).

December 1999 The Minister of the Environment forwards to the Prefects a ***blueprint for defining remediation objectives***.

2.1.2. Framework laws

Other important regulatory documents that address contaminated sites are:

Law of 15 July 1975 on the Elimination of waste and recovery materials

This law covers all aspects industrial and/or domestic waste, and the obligations of the producer and/or owner of the waste. It defines the necessity of an authorization for all installations serving to eliminate waste.

Law of 19 July 1976, on Environmental permits for classified industrial sites for the protection of environment ("ICPE" law)

The law on environmental permits covers all environmental aspects of industrial activity, including waste management tasks, and requires large-scale facilities to be authorized (currently 68,000 sites) and smaller facilities to be declared (currently 500,000 sites). Furthermore, it covers legal provisions for closing down industrial facilities and the discovery of contamination next to industrial plants.

Articles 1 and 2 of the Act list all the categories of installations that may cause danger or inconvenience to the neighbourhood, health, safety, public health, agriculture, the protection of nature and the environment, the conservation of sites and monuments on condition that they are listed in a nomenclature drawn up by decree by the Council of State. No distinction is made according to the legal status of the installation. This nomenclature is divided in two main parts: the first covers the 'substances and preparations' (headings 1000 and following), the second, the "activities" (headings 2000 and following).

The installations whose impact on the environment is minimal are subject to a simple **declaration procedure**. The operator sends the prefect a declaration file specifying the nature of the activity that he or she wishes to carry out. The prefect check the file and delivers a receipt and the general prescriptions that apply to the category of activities concerned.

Installations that present more serious risks or dangers cannot operate without an **authorisation** from the prefect. The authorisation must include, among other things, an impact study and a study of the dangers, whose contents must be proportional to the predictable effects on the environment. This request must include a non-technical

summary. The petitioner must also specify his or her technical and financial resources. The procedure for handing this request must include a public enquiry and consultations with the technical service, local councils and departmental health and safety council.

The authorisation can only be granted on condition that the technical prescriptions drawn up in accordance with the technical information concerning the activity in question and the use of the areas surrounding the installation and intended to prevent or reduce the danger, pollution and nuisance that installation presents are respected.

Thus, it is possible to force the operator to install a water purification station, to treat gaseous emissions, to limit noise levels, to eliminate waste that present no danger to the environment and to take the necessary measures to prevent risks.

Law of January 1992 on Water resource management and protection (so called "Water law")

This law considers the oneness of water resources. The main principles are that:

- water is part of the national heritage: its protection, exploitation, and sustainable resource development are in the general interest;
- national and balanced management of water resources is required;
- protection against all pollution and reclamation of the quality of water resources (surface water, groundwater, seawater within territorial boundaries) are required for preserving public health and drinking-water supply and for Public safety;
- large-scale planning is required to prevent pollution: the **SDAGE** (*Schéma Directeur d'Aménagement et de Gestion des Eaux* = Water Development and Management Master Plan) are under development at the scale of hydrographic basins (with overlaps at the boundaries of administrative regions).

The main differences (mainly because of historical legal reasons) between the "Water law" and the contaminated-land policy (under ICPE law) are:

- the Water law concerns water management and protection: water resources, in particular groundwater, are considered as potential receptors of pollution. This is mainly due to the intensive use of groundwater for drinking water supplies, ranging from 45% to 98% depending on the region (average use = 65%);
- contaminated-land policy focuses on industrial pollution sources. Water resources are one of the four targets to be studied in the French risk–based approach to contaminated sites (with human health, ecosystems, and buildings). Here, the 'fitness–for–use' concept has to be applied.

In some of the authorized areas (defined at basin level as part of the SDAGE master plans - see above), the differences between the two approaches will be minimal, as the remediation objectives will be the obtaining of acceptable drinking-water quality (maximum tolerable concentrations).

Law of 13 July 1992 on the Management of domestic waste

The main objective of the law is to reduce direct land-filling of domestic waste that cannot be further treated, for instance through thermal valorization by incineration, or composting. The law includes a tax on direct land-filling and regulates the sale of land to facilities that operate under authorization of the IC law (see above). In this case, the vendor is obliged to inform the purchaser about possible soil contamination to avoid the purchase of land in ignorance of existing contamination.

Law of 2 February 1995 on the Funding of orphan sites

The law regulates the funding of orphan sites by applying a levy on the treatment of special hazardous waste, which has been integrated in the General Tax on Polluting Activities (TGAP – see below).

2.2. APPLICATION TO SITES

The ICPE law of 1976 allows the Prefect to issue specific documents called "*Arrêté préfectoral complémentaire*" (Complementary Prefectoral Order) that complete an "*Arrêté préfectoral d'autorisation d'exploiter*" (Prefectoral Order for Operating Authorization) on the specific issues related to soil contamination.

An industrial activity may start when the Prefect signs the Operating Authorization (see above) under the ICPE Law. This first "*arrêté"* specifies various points, including 'normal' discharges into the milieu (maximum admissible concentrations in air, water, etc.). When the Prefect, who also represents the Ministry of the Environment, wants to obtain more information on soil quality, or wishes to ask for site-investigation and risk-assessment studies or remediation work, he uses an "*Arrêté préfectoral complémentaire*" for this purpose.

In case of environmental accidents, the administration has discretionary powers to start studies or remediation work to prevent spreading of the pollution. When the emergency period ends, the Prefect can start proceedings against those that caused the accident.

Under the ICPE law, it is possible to reclaim money needed for investigations and remediation work from the responsible party, when identified.

This is more difficult under the Water law because the only reason to do will be a pollution of water resources (targets already impacted). In many cases, it will be necessary first to identify the polluters, which can involve major investigations, especially when the contamination is due to a ubiquitous substance such as nitrates or solvents.

3. Technical tools

3.1. INTRODUCTION

French policy in the field of polluted sites and soil is based on a limited number of principles that help in tackling the problem in a clear and reasoned manner:

- the active prevention of future pollution;
- an exhaustive knowledge of potential risks that is accessible to all;
- suitable treatment of the site in terms of its effective impact on the milieu and its planned use, based on a thorough risk evaluation.

The basic principles of the French approach are:

The precautionary principle (defined in Law No. 95-101 of 2 February 1995) specifies that the uncertainty inherent in current scientific and technical knowledge should not delay the adoption of measures intended to prevent the risk of serious and irreversible damage to the milieu, at an acceptable cost.
The proportionality principle verifies the consistency between the detail of the study, the extent of the pollution, and the predictable effects of this pollution. This generally leads to implementing an iterative procedure; prior understanding of a site can be extremely useful for optimal design of required studies and work.
The specificity principle states that remediation work should eliminate the appearance or persistence of risks or harm to humans or other identified targets (ecosystems, water resources, etc.). The aim of remediation is thus determined on a case-by-case basis by a specific approach to the sites, based on the assessment of the potential risks and on the intended use of the site by the owner/operator (so-called functional and specific approach).
The transparency principle aims at imposing a rule so that choices (working hypotheses, tools used, degree of detail, understanding, residual uncertainties, etc.) inherent in the risk assessment procedure are presented, explained and discussed, in particular when the interested parties work together.

These principles are based on the observation that the essential problem is that of the risk of transferring pollutants towards identified targets.

Different tools were developed for answering the common questions asked when managing polluted sites and soil, in particular those concerning the **identification of sites presenting the greatest risk,** and their study and, if necessary, remediation.

Over the past years, working groups steered by the French Ministry for the Environment have developed several methodological guidelines for easier management of polluted sites and soils. These guidelines form a toolbox to be used for answering specific questions. Figure 1 hereafter summarizes the way in which most situations encountered in this field can be handled. Such guidelines should be used, all or in part, where they might provide a pertinent answer to the problems raised by a site.

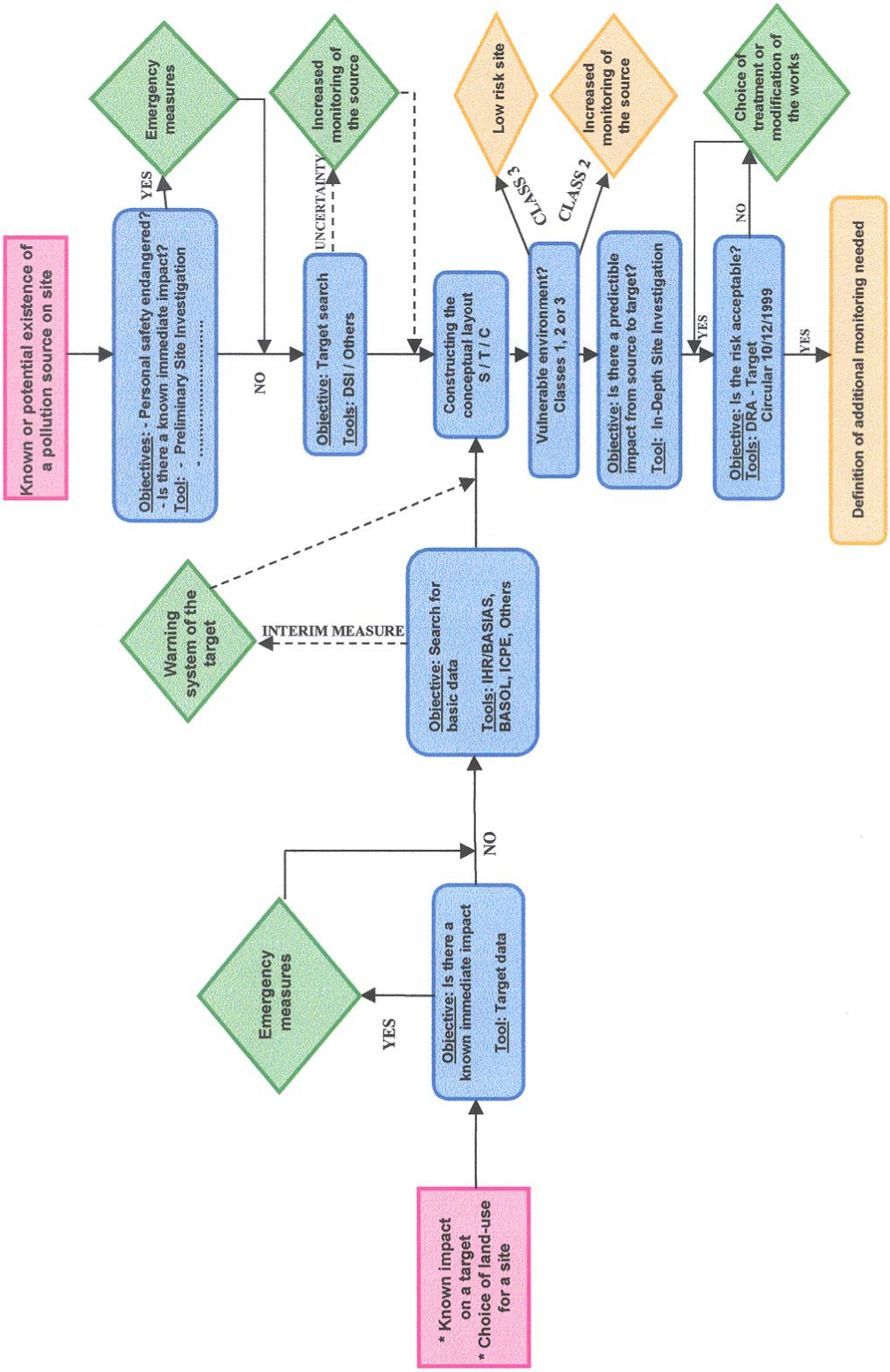

Fig. 1 - Flow chart of the French approach to contaminated land management.

Appendix 3 contains some examples of how to use the "toolbox". These examples, though not exhaustive, correspond to commonly encountered situations:

- an active industrial site;
- cessation of industrial activity on a site;
- accidental spills;
- fortuitous discovery of pollution on a site;
- pollution with a limited surface extension;
- former industrial land being sold;
- land potentially affected by present or past industrial pollution and now assigned to sensitive use (protected perimeter around a drinking-water well, agricultural use, school or other public building, etc.);
- derelict industrial land.

For each of these situations, the questions correspond to specific objectives of the various actors. We propose a systematic approach to answering some of the most commonly asked questions. This should, however, not be seen as prescriptive, as other approaches may well be more efficient for certain types of substance.
In every case, certain simple measures relying on common sense will provide the first answers to questions of how to reduce the risk to Man and the environment, and avoid spreading of the pollution. Such emergency measures include the fencing in of the site, the removal of any barrels stored in the open air, the sampling and analysis of groundwater, and, if necessary, the pumping of such groundwater.

Such actions should never be put off in favour of later, more "in depth", studies, especially as some of these initial observations, in particular measurements in groundwater, will provide a better understanding of the pollution. Such emergency measures must be started as soon as necessary and at any moment of the site-management process.

3.2. REGISTERS AND INVENTORIES

In the 1970s, France was probably one of the first European countries to carry out inventories of polluted sites, but limited attention was paid to the problems of land pollution until the beginning of the 1990s. Apart from the early national surveys on contaminated sites, the recent initiatives taken include the creation of a National Register, an Inventory of Ancient Industrial sites, and an Inventory of Active Industrial Sites.

3.2.1. National register

Since 1993 the Ministry for the Environment runs a National Register, referring to sites that have been reported by the local authorities as being in fact or potentially polluted and needing specific administrative action. These sites are entered into a data base and periodically MATE issues public reports on the current situation. In December 1994, 669 sites were reported to be in the register, but by December 1997 it referred to 896 contaminated sites and 125 sites that had already been restored with or without any limitation in land use.

This database is available on the web at http://www.environnement.gouv.fr., and is regularly updated by the DRIRE. The current situation shows around 3,000 sites (Fig. 2) on which the French administration acts either for risk prevention or for remediation.

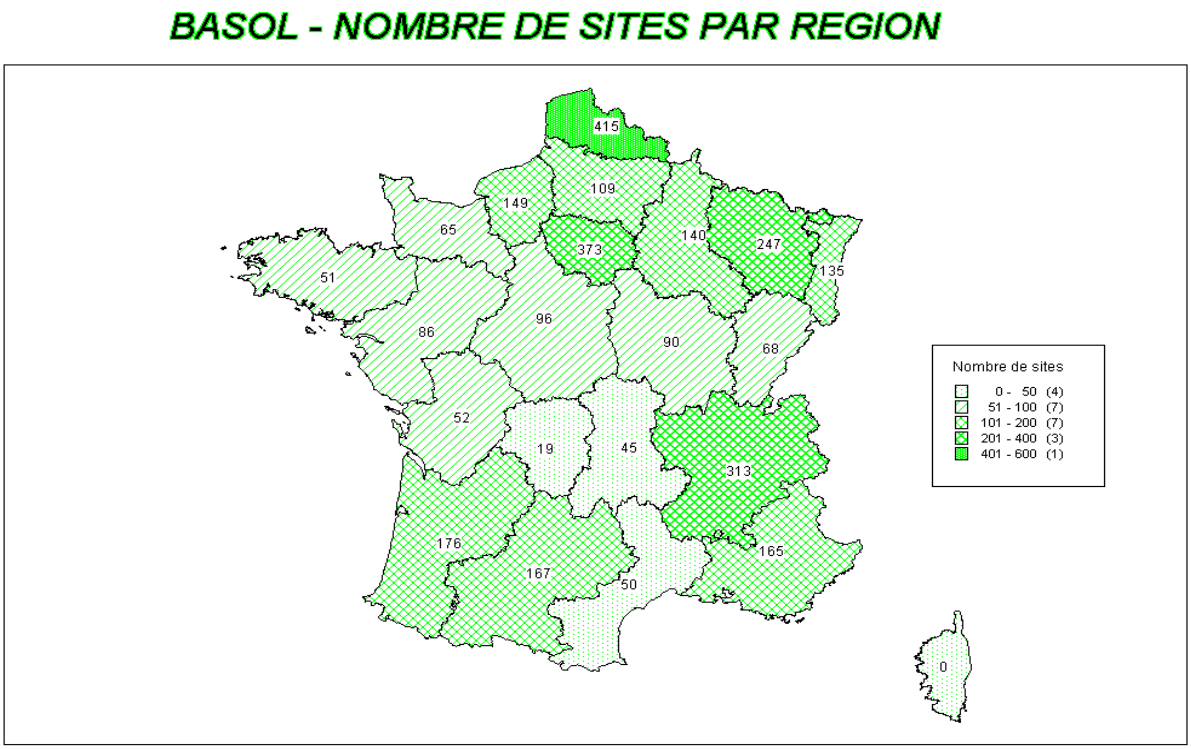

Fig. 2 - Level of progress of the French database on contaminated industrial sites (Ministry of the Environment, 2000).

3.2.2. Inventory of abandoned industrial sites

Apart from the investigation of operating sites, the Ministry conducts a systematic national survey of old and abandoned industrial sites. These inventories are managed on a regional scale. Since 1994, regional historical inventories have been carried out in the Auvergne, Bourgogne, Lorraine, Rhône-Alpes, etc., regions. As an indication, in

the Lorraine region, some 20,000 old sites were identified through research into public and private archives. By late 2000, all but 5 of the 99 departments had initiated such inventories, and 27 had been completed.

From these first results, and taking into account the extent of past industrial activity. It is expected that 300,000 to 400,000 abandoned industrial sites will have been identified at the end of the studies. This inventory is available on the web at http://basias.brgm.fr. The database is updated when the inventory of a Department is considered as achieved by the regional steering committee.

Along with the above activities, 467 abandoned gas works will be investigated that still belong to the national gasworks company Gaz de France. The sites were selected according to a scoring system that was approved by the Ministry. Depending on the results of the Preliminary Site Investigation (see 3.2, hereafter), Gaz de France is committed to further investigations and the needed clean-up measures.

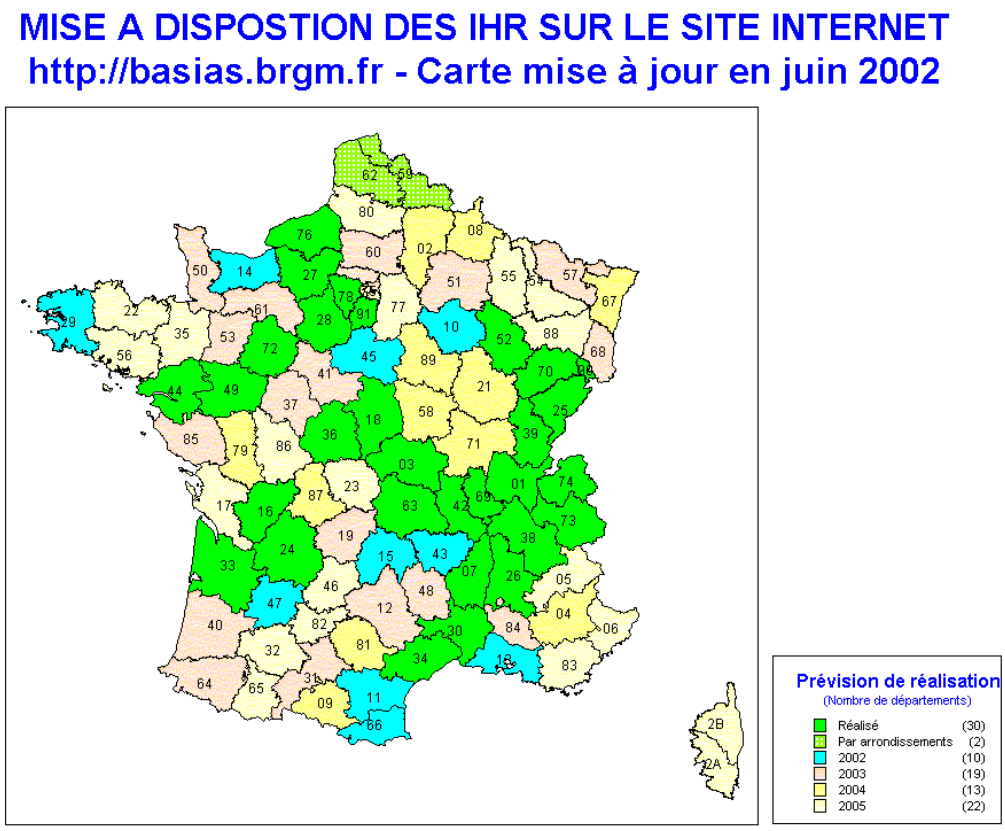

Fig. 3- Progress of the regional inventory of abandoned industrial sites (BRGM, 2000).

3.2.3. Inventory of active industrial sites

In April 1996, the Ministry instructed the Prefects to draw up a list of priority sites for further investigations. A preliminary classification of priorities is given in the annex of the Circular (see Table 1). It was planned that by 2001 soil studies and a simplified risk assessment will have been carried out on some 1,300 priority 1 sites, including, if necessary, the appropriate cleaning-up measures.

3.2.4. Registration of incidents

Contaminated sites discovered by chance and accidents are also registered and treated under the provisions of the ICPE law or Water law. The ARIA database is managed by the Ministry (Bureau Analyses des risques et des pollutions industrielles – BARPI).

3.3. PRELIMINARY INVESTIGATIONS

This step includes the so called Preliminary Site Investigation and the Simplified Risk Assessment (SRA). It aims at identifying potential pollution sources, and at a brief evaluation of their potential impact on human health and the milieu.

Implementation of these two tools, Preliminary Site Investigation and Simplified Risk Assessment, generally requires the help of specialists, whether from inside or outside the companies in charge of the polluted sites, whose knowledge and experience will optimize the quality/cost ratio, thus satisfying the client's requirements.

Table 1 - Priority branches according to the Circular from the Minister of the Environment (3 April 1996).

Priority	Branches
1	Special industrial waste-processing and waste-recycling facilities Production and storage facilities of chemical, petrochemical, carbochemical, pharmaceutical, and pesticide industries, gas works, coke plants, oil refineries. Hydrocarbon tanks and stocks Iron and steel industry, plus non-ferrous metal processing and surface processing Tanning and wood-treatment facilities Crystal- and ceramic-processing industries
2	Thermal power plants Secondary steel industry (blast furnaces), transformation of steel, mechanical industries, including repair and maintenance shops
3	Other industries

Hereafter, we present the methodology developed in July 2000 for **version 2** of these guidelines, setting them in their general context. The guidelines can be applied as part of a voluntary action, in particular for the sale or purchase of a site, but will normally be used in a regulatory context related to the site management of authorized installations, especially those targeted by the Ministerial Circular of 3 April 1996.

Version 2 was developed after testing on about 200 pollution sources in the late 1990s, and based on feedback from version 1 that became available in July 1997.

3.3.1. General presentation of Preliminary Site Investigations and Simplified Risk Assessment *(SRA)*

The present guidelines help in setting a site in its historical and environmental context, and in defining its vulnerability in terms of soil pollution. They are based on a Preliminary Site Investigation consisting of two stages, the first being the collection of all available information on a site and its milieu; the second stage consists in (preliminary) sampling and analyses, as well as further documentary research, if warranted, for completion and/or validation of the collected data.

If necessary, the results of the Preliminary Site Investigation form the basis of a Simplified Risk Assessment (SRA). An SRA is based on about 40 simple parameters that are easily established and, as the name indicates, evaluate the risk presented by the site. At this stage, we are not looking for a detailed evaluation, but the aim is to determine whether further investigations are needed. The SRA ranks sites in three classes:

- ***Class 3****:* so-called ***"Low-risk" sites*** that only require monitoring of the changes in site use and of its milieu;
- ***Class 2****: **Sites to be monitored,*** for which suitable monitoring conditions, such as observation wells (piezometers) and regular analyses, must de designed and set up, and for which it may be necessary to draw up land-use restrictions;
- ***Class 1****: **Sites requiring detailed investigations***.

This ranking obviously is neither definitive, nor absolute, as it reflects the environmental setting of the site at the moment of the SRA, as well as the available information and the state of scientific and technical knowledge at that time. Any change in one of these elements should thus lead to a *new* Simplified Risk Assessment and, possibly, to a modification of the initial ranking.

3.3.2. Basic principles of the SRA

A Simplified Risk Assessment is based on the information collected during the Preliminary Site Investigation. Using voluntarily simple options, the objective of the SRA is to provide the elements for differentiating sites that present no menace to human health and the milieu, from sites that might generate notable and lasting nuisance.

The SRA is a scoring method. It is based on the principle that the existence of a risk implies: the concomitant presence of a dangerous/hazardous source (D), a transfer mode to and from the transfer medium (T), and a target (C). As soon as one of these factors does not exist, e.g. the absence of groundwater, the risk becomes irrelevant and a risk Assessment, for this milieu and its planned use, is not necessary.

For each type of parameter (D, T, C), we then define the technical criteria and parameters for their characterization. Each of the latter is allotted a specific notation in terms of the values it can assume. Each is first evaluated using the data obtained during the Preliminary Site Investigation, after which it is described. The individual descriptions are then combined into synthetic notes, each corresponding to a different exposure pathway, to arrive at a classification of the site.

The simplifying options retained are:

- *The SRA assumes that Man is the primary exposure target*, whether direct (e.g. through contact with the soil) or indirect (e.g. through using groundwater).
- *The SRA and the resulting site classification concern the conditions existing at the time of the study*, in the light of the scientific and technical knowledge of the moment, and of the planned use of the site and its milieu. The SRA must be revised as soon as one of the last two conditions changes.
- *The SRA does not consider immediate risks*, e.g. landslips, collapse, fire, explosions, etc., for which safety measures must be taken as soon as they have been identified (during an initial visit or during the Preliminary Site Investigation). *The SRA*, to be implemented after the taking of safety measures, *only considers the residual risks*.
- *The SRA only considers primary sources*, in other words those that caused the contamination and are still present on site.
- *The SRA has to be done for each pollution source identified on site*. The source will be ranked according to the highest synthesis note obtained for any of the milieu/use couples. In the case of complex sites with several pollution sources, the site classification will be that of the pollution source that led to the highest ranking.

The notes attributed to the parameters and rubrics of the evaluation grid, are then combined for obtaining the overall set of notes for the site, thus enabling its classification. To simplify this general notation, we have adopted the principle of a notation by vector milieu for the transfer of polluting substance from source to target.

This means that seven notation grids are used in version 2 of the Simplified Risk Assessment method:

- three grids for groundwater;
- three grids for surface waters;
- one grid for soil versus direct contact (N.B.: the system for compiling the notes of this soil grid has changed between versions 1 and 2).

For the groundwater and surface-water milieu three situations are distinguished, hence the three grids per milieu:

- The milieu is used for drinking-water supply.
- The milieu is not used for drinking-water supply, but for other water uses such as industry or agriculture, and is not considered as a resource (in the sense of development and water-management master plans) to be preserved for future drinking-water supply.

- The milieu is not used for drinking-water supply, but is considered as a resource to be preserved for future drinking-water supply.

The notation grids for "**Air**" and "**Fire** - **explosion**" of version 1 have been eliminated, as they were hardly ever used for these purposes. In addition, the major technical difficulties of measuring impact on the air milieu, did not allow for an application according to the basic assumptions of a national policy.

Only those milieu/use couples should be considered that are pertinent in terms of the Preliminary Site Investigation, and which have been adopted in the conceptual framework for the site. This means that a certain milieu may not have to be noted, such as the **absence** of:

- groundwater below the site or in its possible zone of influence;
- surface water at less than 5,000 m of the site;
- present or future use of the milieu being considered.

3.3.3. Data required for a Simplified Risk Assessment *(SRA)*

The information required for implementing a Simplified Risk Assessment is collected during the Preliminary Site Investigation phase. In version 2 of the SRA, about 30 parameters, or a maximum of 43 notes, were retained for describing the pollution source(s) found on site, and their potential impact on the milieu.

The parameters fall into four groups:

- potential hazard of the source;
- potential mobilization and transfer of polluting substances, in two parts:
  . potential mobilization of the source toward the milieu, and
  . potential transfer through the milieu toward the target;
- target;
- recorded impact.

It should be understood that the recorded impact at this stage should be attributable to the site being studied. For this, two principles have been retained for evaluating the severity of the impact:

- The measured differences between upstream and downstream must be significant (a difference of at least 50% for the ubiquitous substances); below this, a **suspected impact** can be considered (note 1 accompanied by a "**?**").
- The impact could be major if the measurements made downstream or below the identified targets are higher than the Fixed Impact Value (FIV). Please see the box on the next page for further information on the FIV.

The FIV is, for each exposed milieu, defined in terms of the planned use of the site as recorded in the SRA, using the guidelines laid down in "MANAGEMENT OF (POTENTIALLY) POLLUTED SITES". ***This implies that we attribute a note of '3' in the absence of a***

measurement that justifies the assessment of impact, or if the measuring location of the impact assessment is inappropriate.

Great importance is attached to the quality of the Preliminary Site Investigation and to the assumptions formulated and re-transcribed in the synthesis tools, i.e. the conceptual diagram and the recapitulating table of pollution sources. The French SRA method thus takes account of the reliability of the collected data.

Each parameter and elementary category is given a note from "0" to "3", "3" corresponding to the most unfavourable situation, i.e. maximum risk. Based on how well a site is known, the reliability of the information, and thus of the notation, can vary from one parameter or category to the next. Where the reliability of the information is doubtful, this is expressed in the elementary notation by a "?" in the right-hand box of each parameter note.

The number of these "?" is taken into account during compilation of the notes attributed to each parameter and category, for determining the final note of the source and/or site that finalizes its ranking. If more than 30% of the general note is affected by doubt, the collected information is deemed insufficient for the attribution of a reliable final note. In that case, further data must be sought.

THE FIXED IMPACT VALUE

As part of the development of version 2, several French Fixed Impact Values (FIV) have been set up for hazardous substances. These include arsenic, chromium, mercury, zinc, benzene, vinyl chloride, Cis 1,2-dichloroethylene, tetrachloroethylene, trichloroethylene, benzo(a)pyrene, fluoranthene, naphtalene, arochlor 1016, and arochlor 1254, and cover two types of soil use: sensitive (residential with a vegetable garden) and non-sensitive (industrial or commercial).

The French FIVs were developed by the "Public Health" working group, in the framework of a national approach to the management and remediation of polluted sites and soils. They are based on the methodology for evaluating risk to public health as part of generic studies. The values consider:

- the **chronic risk to public health** related to the use of such sites;
- integrate **several exposure pathways** for the population, such as consumption of fruit and vegetables, and ingestion and skin absorption of soil or dust;
- and are **defined for sensitive or non-sensitive land use**, according to the specific use of the site to be assessed.

Foreign guide values for other substances, e.g. HAP and solvents, are used by default for the moment awaiting the establishment of French FIVs in the near future.

3.3.4. Case of a site with ongoing industrial activity

The points to consider in the case of sites with ongoing industrial activity are:

- Activities that are, or were, not subject to operational prescriptions as part of the environmental-protection regulations for authorized installations.

- Environmental-management practices that are not subject to specific prescriptions, or that visibly do not agree with present-day standards, especially in terms of protecting ground- and surface-water resources.

This mostly concerns historical pollution, and generally does not apply to installations that are operated in conformity with the regulations, and which are subject to appropriate preventive and monitoring measures, such as for:

- the storage of raw materials and finished products;
- installations for the processing and elimination of waste;
- waste-water networks and their associated water-treatment plants;
- the atmospheric discharge from manufacturing units;
- etc.

3.3.5. Consultation and monitoring of the classification

A **Monitoring Committee** should be in charge of the final validation of all actions undertaken on a polluted site, including drawing up of the conceptual diagram and the recapitulating table of pollution sources, identification of the number of pollution sources to be evaluated and of the transfer paths, attribution of elementary notes for each parameter, estimation of the reliability of the information, and classification of the source or the site. This committee should comprise at least the responsible person for the site, the inspector of authorized installation, and the (in-house or external) expert who made the Preliminary Site Investigation on which the SRA was based.

Each of the final classes corresponds to actions to be undertaken on the sites.

- **Class 1 - Sites requiring further investigations and a detailed risk Assessment:** See next chapter.
- **Class 2 - Sites to be monitored** present a limited, but persistent, impact or risk; they require the definition and installation of monitoring equipment that is suitable for the problems encountered, and may require urban-development restrictions. The type of monitoring equipment directly depends upon the situation as assessed and will have to be adapted to any changes in this situation.
- **Class 3 - "Low-risk" sites** are deemed to be suitable for a given use on the basis if the information and technology available at the time the SRA was carried out. They do not need further investigations or specific work, but in certain cases it may be useful to restrict the urban developed of such a site.

3.4. DETAILED INVESTIGATIONS

3.4.1. General presentation of In-Depth Site Investigations and Detailed Risk Assessment (DRA)

The main objectives of the two guidelines described hereafter, are the identification of sites that should be remediated before their planned use, or of those that present a low risk and can be used without any particular action, either "Low Risk" (Class 3) or to be monitored (Class 2).

Table 2 - Differences between SRA and DRA.

	SRA	DRA
Targets considered	• Human health (certain types of exposure) • Water resources (present and future use)	• Human health (all types of exposure) • Water resources (present and future use) • Ecosystems • Material goods
Objectives	• Rank the sites in one of three categories in terms of the actions to be carried out	• Identify hazards presenting unacceptable risk • Determine remediation objectives, if necessary
Types of information needed	• Identify pollution sources • Identify potentially exposed pollution targets • Measure the pollution impact in the main exposure environments	• Define the extension of the pollution • Understand the mechanisms of pollution propagation • Determiner exposure concentrations • Evaluate the relevant exposure scenarios in terms of present and future use of the site.

We present the methodological approach that led to publication of these guidelines in September 2000, placing it in its regulatory context. A test on several industrial pilot sites is in progress, to assess any application difficulties and necessary additions. Feedback will help in updating the guidelines.

The Detailed Risk Assessment with regard to Man and his environment is in fact the first step in a **national policy for a true risk quantification**. This is in contrast to the SRA that is used for classifying sites by using the principles of risk analysis, risk being the result of the concomitant presence of a hazardous source, the possibility of pollution transfer, and the presence of identified targets.

The In-Depth Site Investigation, followed if warranted by a Detailed Risk Assessment (DRA), evaluates the risk level generated by the site, in terms of its planned use and its environment.

An ***In-Depth Site Investigation*** should collect the necessary data for a Detailed Risk Assessment, but should also seek to define the extension of the pollution and to understand the mechanisms of pollution propagation in the various transfer media. Such media can be affected (impact is noted) or can be susceptible to pollution (potential impact). However, in certain cases the taking of simple measures can eliminate a risk without the need for further studies, e.g. the construction of a fence for restricting access to a polluted site, or the cleaning up of a small pollution source.

The ***Detailed Risk Assessment (DRA)*** should lead to:

- identification of the sites that present a major and unacceptable risk to Man and his environment, thus requiring a remediation to limit or eliminate the known risk.
- definition of the remediation objectives, based on available scientific and technical knowledge, and compatible with the planned use of the site and its surroundings. The objectives must be adapted to the target to be protected: Man, water resources, ecosystems, and material goods; they must be based on the principles laid down in the Ministerial Circular of 10 December 1999. If the DRA concludes that the risks are of an unacceptable level, the DRA will lead to the definition of remediation scenarios based on the planned use of the site and its surroundings.

The objectives deriving from the DRA must be adapted to the technical an economic limits of the available treatment methods. The orientation towards a remediation strategy must be adapted to the identified risks; this means that the definition of remediation objectives transposable to a complementary exploitation bylaw, can only be determined after a feasibility study of the different techniques. The decisions taken as a result of a DRA are thus always constrained by the available information on specific technical economic conditions, which in turn means that a DRA should be carried out in iterative fashion, in order to consider all possible changes in the working hypotheses, especially those related to use of the site and its surroundings.

Based on the results of a Detailed Risk Assessment, it may be decided to:

- remediate the site for the planned use on the basis of a tolerable risk level (defined in the Ministerial Circular of 10 December 1999);
- change the planned use to another, compatible with the residual concentrations in the exposed milieus, which should lead to a constraining order to restrict the site use to that for which it has been treated;
- monitor the site so that it will not present risks that are judged unacceptable;
- use the site for a low-risk activity.

3.4.2. Basic principles of the DRA

The Detailed Risk Assessment, one of the elements of a national policy for the management and remediation of polluted sites and soil, has to respect the general principles of this policy, and especially:

- a systematic and organized search for polluted and potentially pollute sites;
- definition of the notion of pollution on a risk-evaluation base, to be used site by site;
- remediation that is adapted to the effective impact of the site on its milieu, and the present and future use to which both are destined;
- ranking of the primary action priorities on the sites with the greatest risks;
- a proportional adaptation of the planned work to the effectively noted impact and of the pollution its possible incidence.

To this, two more general principles must be added:

- a potential recourse to the **precaution principle** (see 3.1, above: the absence of certainty) in view of today's scientific and technical knowledge, should not delay the adoption of economically acceptable measures to prevent the risk of grave and irreversible damage to the milieu (Law n° 95-101, 2 February 1995);
- **dialogue** and **cooperation** among the various partners playing a role in the management of polluted sites and soils (site managers, competent administrative bodies, experts, etc.).

Detailed Risk Assessment of polluted sites aims at evaluating the impact of the polluting chemical substances on the following targets:

- man, considering various direct and/or indirect exposures to pollution sources;
- water resources, both surface and underground;
- the environment (fauna, flora and goods).

The targets taken into consideration are those that were identified on and near the site, and in terms of the actual and future use of the site and its surroundings. The conceptual diagram will serve as the basis for the work.

Remediation objectives thus can be defined through an evaluation of the risk to human health, and/or to water resources, and/or ecosystems, and/or material goods.

Identification of the four different targets corresponds to an operational aim, justified by:

- The differences of competences and tools to be deployed;
- The existence of two priority targets that have to be protected: human health and water resources;
- Different levels of scientific and technical knowledge.

However, for the study of the different targets we can use elements that are common to another target; for example, when carrying out a DRA on human health, a contamination of the water resource or the food chain can be an important element.

3.4.3. Data required for a Detailed Risk Assessment *(DRA)*

In a field where scientific and technical knowledge is incomplete and uncertainty is rife, the evaluation of risk is a structured analytical method where data elements are collected, ordered, and evaluated. The aim is to quantify the risk in a transparent manner, enabling the site manager to react in the most decisive way to the situation facing him. The DRA must be seen as a method that structures knowledge elements, putting them in perspective when compared to the uncertainties.

A risk evaluation, by integrating the data on hazards and exposure, determines the possibility that toxic, noxious, or physical effects will appear on the different targets taken into account and identified in the study area. It comprises three main steps:

- identifying and characterizing the hazards related to the presence of substances identified on the site;
- evaluating the exposure of the various targets related to the use of the site and its surroundings;
- defining the risks to the various targets that must be considered in the specific case of the site being studied (cf. conceptual diagram drawn up during the preceding steps and completed by the data collected during the In-Depth Site Investigation).

For a risk evaluation, the following determinations are needed:

- ***For evaluating hazards related to the pollution source:***

- the hazardous substances (and their transformation products) found on the site, whether related to or derived from activities on the site, or transferred from outside the site (e.g. groundwater pollution), or because of site development work such as the shipping in of construction materials or the spilling of hydrocarbons;

- the physical-chemical characteristics of these hazardous substances, especially in terms of the associated hazards, and the types of effect on the various targets or on the various organs of the potential targets;

The dose-effect relationship for each of the substances retained for a DRA.

• ***For evaluating the exposure potential:***

- the concentrations (in the various environments) to which the different targets can be exposed;
- the modes of transport and transformation mechanisms of the identified substances, which will depend as much on the characteristics of these substances as on the site conditions (type and composition of the soil, water content, pH, etc.);
- the type and number of persons on site, and of their potentially affected means of livelihood and belongings, and this for the present-day situation, for planned development situations, and for staff working on site during the remediation work;
- the most relevant exposure scenarios for each of the identified targets and in each case of use of the site and its surroundings, which will help in defining the exposure concentrations.

Table 3 - Possible exposure pathways of chlorinated solvents pollution.

	Workers on site	**Inhabitants living near the site**	**Distant population using groundwater**
Direct inhalation of gaseous pollutant	**+**	**+**	**-**
Inhalation of pollutant adsorbed on dust	**+**	**+**	**-**
Inhalation of pollutant from contaminated water (e.g. shower)	**-**	**+**	**+**
Direct ingestion of soil or soil dust	**+**	**+**	**-**
Ingestion of contaminated water	**+**	**+**	**+**
Skin absorption of soil and dust	**+**	**+**	**-**
Skin absorption from contaminated water (bath, shower, etc.)	**-**	**+**	**+**
Skin absorption of gaseous pollutant	**+**	**+**	**-**

+ : pathway taken into account for this example **-** : pathway not taken into account for this example

According to the conceptual model, risk-analysis methods have to be established for the evaluation of risk to human health, and/or to water resources, and/or to ecosystems, and/or to property.

In the final phase of evaluating the results of the various approaches, we must consider:

- The different risks, highlighting those that are unacceptable for all targets identified on the site being studied.
- The remediation objectives proposed through the different approaches, but not losing from sight the uncertainties inherent in the work as a whole; at this point, we must propose objective values considered as most certain.
- The possible, easily identifiable, constraints related to implementing the remediation operations for reducing, or eliminating, the risks.

For a site that should be subject to a detailed risk evaluation for a specific short- to medium-term re-qualification project, particular attention must be paid to the adequacy of the investigation work; the latter should be oriented in terms of the planned new installations and not only in terms of past activities on the site.

Any change in the planned use of the site should automatically lead to a new detailed risk evaluation.

3.4.4. Uncertainty analysis

A DRA comprises many uncertainties, caused by the level of knowledge, the number of parameters to consider, and the common difficulty of understanding them in detail. Still, this absence of certainty should not be an obstacle to decision-making; a realistic evaluation of the risk should also evaluate any uncertainties to ensure that a reasonable upper-bounding approach has been followed.

WATER RESOURCES DRA

A Detailed Risk Assessment concerning water resources in contact with polluted sites, has the objective of quantifying the risk to such – surface or sub-surface – resources in terms of the present or planned use.

The targets to be taken into account can be highly diverse, such as:

- water resources that, at the time of the study, have a use that brings them into direct contact with Man, such as for drinking or irrigation water or for swimming;
- water resources tapped for a less sensitive use, such as for process- or cooling water, but which might be adversely affected by a change in quality of the resource, requiring an appropriate treatment for continued use;
- water resources considered as a future source of drinking water, the quality of which must be safeguarded;
- water resources that may be considered for other future uses, such as industrial or irrigation water, for some of which the true production capacity should be ascertained before starting with an estimate of substance concentrations.

The iterative process required for a DRA that is adapted to the specific problems of a given site, generally consists of a first phase based on the use of simplifying, but majorant, hypotheses; these are based on observations and measurements on, or over, the identified targets, or on simple transfer models.

If the result is a risk that is judged unacceptable, more powerful tools can be deployed that lead to a more refined risk evaluation. At this point, it may be necessary to carry out an even more detailed investigation as a second DRA, integrating the main physical, chemical, or biological processes acting upon the behaviour and transport of the pollutants. This can be done via a retarding factor, or through complex mathematical equations.

The main uncertainty factors concern:

• ***For the general assessment:***

- The quality of the data collected during the various investigation phases (initial field visit, Preliminary Site Investigation, In-Depth Site Investigation;
- The possible reliance on bibliographic data or default parameters in certain modelling tools, in place of specific data for the site.

• ***For assessing the risk to health and water resources:***

- evaluation of the toxicity of the substances found on site (identification, definition of the dose-effect relationship, possible interaction between substances, etc.);
- evaluation of the exposure (definition of targets and site uses to be considered, use of the models);
- consideration of the space/time variability of the parameters in question.

Regardless of the type of uncertainty encountered, it should be put into perspective with the results obtained, to contribute the necessary elements for discussion and to highlight the points for which more data, or modelling, might reduce the uncertainty of the final result.

3.4.5. Acceptable risk levels for the definition of remediation objectives

The principles applicable to prescribing remediation work on polluted sites are described in the Ministerial Circular of 10 December 1999 as part of the Law of 19 July 1976 on Authorized Installations for the Protection of the Environment, and concerning the principles of fixing remediation objectives.

The In-Depth Site Investigation and Risk Assessment stages should lead to the evaluation of real or potential risks or nuisances, as well as to a proposal for remediation objectives that will be prescribed by Prefectoral Order as part of a statutory procedure.

The Ministerial Circular defines the acceptable risk levels for:

- ***Human health:***
  - · For toxic substances with a known admissible dose the criterion is the *admissible daily intake;*
  - · For toxic substances without a threshold, the criterion is an individual excess risk of 1.10^{-5}, i.e. a probability of 1 in 100,000 that a cancer will be related to the pollution on the site.
- ***Water resources:***
  - . For groundwater destined to be used as drinking water the maximum admissible concentration values set for the latter are used;
  - . For other water resources, the concentration levels are valid that permit maintaining the resource for its present use.

The Circular also discusses other principles to be applied in this context, such as for:

- setting up **monitoring measures** and **depollution work**, aiming at preventing the appearance or persistence of risks or nuisances for Man and the environment;
- correct **identification of the targets** to be protected;
- **prevention of pollutant transfer** to groundwater and the concomitant spread of the pollution;
- ***information of the public and local communities***, both on the results of In-Depth Site Investigation and DRA work, and on the work carried out by experts, which documents must be available upon simple request from the relevant Government offices;
- if necessary, a **restricted use of the site** compatible with the residual pollutant concentrations.

3.4.6. Consultation

As is the case for the Simplified Risk Assessment, all aspects of the DRA, in particular the simplifying hypotheses adopted for risk quantification (choice of exposure pathways, accuracy of the models used, estimation of the reliability of the data, uncertainty level of the calculations of acceptable concentrations, etc.), must be validated by the Consultation Committee. The last should comprise at least the site manager, the inspector of Authorized Installations, and experts. In certain cases, the Committee can include the site owner and/or the mayor, if warranted.

4. Treatment

Different approaches are used in other countries faced with the same problems. The approach can be multi-functional (as in the Netherlands) or functional (as in Germany), or may be generic (with guide values as a basis) or specific (according to real risks). The principles retained by France are:

- A polluted site is identified by the real risks to mankind and the milieu in the widest sense, i.e. fauna, flora, water resources, natural soil for agriculture or forest, etc., rather than by the concentration of certain substances in the soil.
- Remediation must be done according to the future use defined for the site.
- Actions aiming at reducing or eliminating the primary sources of pollution should be implemented as quickly as possible, in order to limit the impact and thus the global cost of the treatment.

The remediation objectives should be determined on a case-by-case basis, through an approach specific to the sites, and according to the risks incurred and the actual or planned use.

The final stage of the Detailed Risk Assessment should consist of examining possible treatment scenarios for the identified pollution, together with the various potential uses of the site, in order to evaluate the acceptability of the residual impact. Where this impact is judged unacceptable, recommendations, or even limitations of use should be prescribed. Case-by-case decisions should take into account the applicability of the available techniques.The treatment of a site thus depends on its intended use and its impact on Man and his milieu.

In choosing rehabilitation systems, however, French legislation provides no recommendations or contraindications concerning the management and rehabilitation of polluted sites and soils. As the onus for choosing both the solution (or combination of solutions) and the quality of preliminary studies is on the person responsible for the site, it is up to him to put forward the best solution for the situation. This solution will be discussed with the authorities dealing with the case, and then implemented by a further prefectural order.

The selection of rehabilitation systems in France is generally based on the following criteria:

- rehabilitation objectives: traditionally these are specific numerical criteria (by commodity or family of commodities) at a given location, corresponding to acceptable risk levels for the targets under consideration;
- site conditions and how they vary in space and time (including geological consditions, rate of transfer and the physicochemical conditions prevailing in groundwater, characteristics of the pollutants);
- cost of implementing the methods (including establishment and maintenance costs, safety measures costs, elimination of encountered wastes, potential subsidies and

compensations); implementation conditions should not generate more risks and nuisances than those arising from the pollution;

- psycho-sociological criteria (mostly linked to a conception of visual, acoustic and even olfactory comfort) linked to the location and the environment of the studied site;
- other contingencies such as the time available for treatment, which may be limited by a possible sale of the site, or available space for implementing specific techniques.

Whatever method is selected, be it old or modern, the person responsible for the site will need to convince the authorities of his effectiveness in dealing with the conditions prevailing on the site to be rehabilitated, which implies:

- completion of preliminary feasibility studies, so that the conditions for meeting the rehabilitation objectives may be assessed;
- checking implementation conditions on the site;
- checking the effectiveness of rehabilitation on the site in terms of meeting the rehabilitation objectives determined for a specific use by detailed risk assessment within the time allowed.

Although inventories of rehabilitation methods are available (ASTRES databases of the CNRSSP on soil treatment technology, ADEME technical guides and journals – confinement, biological means, etc.), simply implementing these methods is not deemed acceptable in a feasibility study, which has to be site specific. Similarly, two years ago, ADEME established a national research project on the methods most commonly applied to the main types of polluted sites encountered in France, in order to validate by tests their effectiveness under certain conditions. These results will be made available to the general public to facilitate the selection of systems, but without questioning the principle of providing a site-specific feasibility study. These results could be integrated in the feasibility study in order to justify the proposed choices.

The final check, carried out by the manufacturer at the request of the authorities, is used for drawing up an audit report; although this is the only legal document recording a treatment, it is in no way a discharge given by the authorities to the polluter. It should be recalled that the French regulations behind the management and rehabilitation of polluted sites and soils (chiefly the act on classified facilities for environmental protection) do not include this type of provision. In fact the French regulations are based on establishing result-based objectives (the responsibility of the authorities), and not method-based objectives, which are the responsibility of site managers.

Checking the effectiveness of the rehabilitation solution calls for effective on-site measures (measuring residual concentrations in the soil or, in the case of confinement, monitoring the change in pollutant concentrations in transitional and exposed environments), which implies:

- defining the sampling and measuring procedures to be applied in the various environments for checking purposes;
- ensuring that the consultants or laboratories concerned are in fact capable of implementing these procedures.

It should be stated that France only has a relatively comprehensive accreditation system for water. The “soil” system at present focuses solely on parameters associated with the agronomic value of soils. Current efforts do not focus on accrediting consulting firms or laboratories, but rather on developing and publishing standards adapted to the problems encountered. These standards are then used as a base for setting up the control mechanism.

For a number of rehabilitated sites, such as those for which the confinement solution was finally selected, implementation systematically involves monitoring the long-term effectiveness of confinement, especially where vulnerable water resources are concerned. The site monitoring guidelines dealing with groundwater are nearing completion and will be published in the next quarter.

Two mutually exclusive actions are carried out to ensure that site usage will be compatible with its status, or that the required monitoring work will be satisfactorily carried out:

- Implement usage restrictions (or rights) compliant with existing laws and regulations (a guide by the Ministry for the Environment was published in December 2000). These restrictions or rights must be recorded in the land assessor’s office and, if necessary, in city planning documents, so that any purchaser will be aware of the site’s status, and cannot change its intended use without carrying out the required studies and work.
- Publish the largest number of potential risks of the site and keep a record (see section on inventories).

5. Liabilities and funding

5.1. CHAIN OF LIABILITIES

Wherever the polluter is at hand or known, the "**polluter pays**" principle is strictly applied. The current chain of liability is:

- the last industry that is responsible under the law on Environmental Permits for industrial sites;
- by default, the last owner.

This chain of liability covers studies, surveys, remediation work, and even costs associated to the restriction of land use (as a result of plant surveys or residual contamination).

5.2. VOLUNTARY AGREEMENTS BETWEEN INDUSTRY AND THE GOVERNMENT

In 1992, the French industry founded the "French Organization of Enterprises for the Environment", EPE. This organization signed a 5-year agreement with the French Agency for Environment and Energy Control (ADEME) for the clean-up of contaminated sites, for which industry created a fund with an annual budget of about € 2.3 M (FF 15 M). Remediation projects were funded under the control of the ADEME, where the responsible parties were not at hand or were insolvent. The system worked rather efficiently until the end of 1994, when it became obvious that the budget was insufficient to cover the actual needs. As a result, the **Industrial Waste tax** was introduced in February 1995 (see below).

5.3. INDUSTRIAL WASTE TAX

The remediation of orphan sites is funded by a tax introduced in February 1995, concerning hazardous industrial waste. The moneys retrieved from this Industrial Waste tax are allocated to investigations and clean-up work. Initially set at € 3.8 (FF 25) per ton of industrial waste, the tax was increased to € 6.1 (FF 40) from 1998 onwards. In the first year, the income of this new tax amounted to about € 10.5 M (FF 69 M), but it increased to up to € 15.3 M (FF 100 M) in 1998. A National Committee manages this Industrial Waste tax and has agreed to 37 interventions at orphan sites, to a total cost of approximately € 30.5 M (FF 200 M).

Since 1999, this tax is included in the TGAP (General tax on pollutant activities). The remediation is limited to stopping actual or potential risks to the milieu and human safety.

5.4. GRANT AND LOAN SYSTEM

France has six Water Boards (***Agences de l'Eau***), providing grants and/or low-interest loans for site investigations and clean-up work. The Water Agencies intervene in the cases of contaminated industrial sites that have an impact on the aquatic environment and corresponding to a chargeable establishment. The loans are supposed to cover about 50 percent of the total cost, including studies and remediation work. The real amount of grants or loans depends on the Water Board and ranges from 30 to 70% according to the water-resource areas.

Water agencies also provide grant subsidies for investing in and operating equipment contributing to the reduction of water pollution. The funds dedicated to this support result from the collection of charges on consumption and pollution of water.

Recently, the ADEME grants decision – making support on a case-by-case basis for local authorities confronted with the problem of soil pollution.

5.5. PRIVATE–PUBLIC PARTNERSHIP MODELS

On 25 April 1996, the French Ministry of the Environment signed a protocol with Gaz de France (GdF) for rationalizing the management of the 467 old gas works managed by the latter. Today, this is the only concrete French case of a partnership, the protocol calling for:

- a census of the sites of old gas works,
- ranking of the sites according to their potential effects on Man and the environment in order to:
  - · immediately on very sensitive sites (launching of initial environmental audits and, if necessary, remediation operations), or sites liable to be the subject of a land transaction in the short term.
  - · plan environmental audits on less sensitive sites.

In the absence of nationally validated tools at the time the protocol was signed, the ranking used a method devised by GdF, identifying five classes of site according to the measures needed:

- ***Class 1*** – Prompt initial environmental audit; remediation operations identified by the audit and adapted to the local context. Operational conditions subject to agreement by the Inspector of Authorized Installations;
- ***Class 2*** – Initial environmental audit within three years and, based on the results, suitable measures agreed by the Inspector of Authorized Installations;
- ***Class 3*** – Historical study of the site within the next eight years, with localization of any storage tanks or vessels that will be systematically emptied and filled with an inert material;
- ***Classes 4 and 5*** – Same studies as for Class 3, but with a ten-year deadline.

For Classes 3, 4 and 5, if the tank-drainage operations reveal residual pollution, Gaz de France agrees to implement further studies agreed by the Inspector of Authorized

Installations. Similarly, any sale, transfer, or restructuring of sites must be preceded by an initial environmental audit and the remediation conditions, defined in agreement with the authorities, must be adapted to the sensitivity class of the site and its future use.

The implementation of this action protocol is tracked through a national annual report, with specific details for sites requiring the confinement of polluted soils. For the time being, the operations on Class 1 and 2 sites have been carried out on schedule. Operations have also been started on sites in Classes 3 to 5.

A generic study aimed at setting the remediation objectives in predefined scenarios for site use has been prepared by GdF and was validated by the MATE in May 2001.

The only real problems encountered concern the type of operations by GdF when selling a plot of land, and in case of land-use change. However, such cases are governed by civil law, according to the agreements between GdF and the buyer of the site (often a local municipality). Regulatory site-by-site supervision will undoubtedly be necessary.

6. Analysis of current procedures (efficiency, benefits and drawbacks)

The currently used procedures concerning the legal and financial framework of polluted sites and soils, were recently assessed by government task forces, in particular the General Council of Mines and the General Finances Inspection. In addition, the Committee for Prevention and Precaution created by the Minister for Territorial Development and the Environment has formulated recommendations on monitoring the health risks resulting from soil polluted by industrial activity.

The reviews stressed:

- Difficulties in managing soil pollution (legal and technical) and their reasons (accumulation in soil over many years:
  . the large number of potential pollution sources, not all of which have necessarily been examined;
  . the complexity of the phenomena encountered;
  . the relative nature of legal and scientific approaches;
  . the non-linearity of the problems;
  . unsuitable legal frameworks;
  . insufficient financial resources; and
  . a low degree of scientific and technical competence).
- Recent progress from increased research, better understanding of sites, development of methodological tools, and studies of a large number of sites, have all led to heightened awareness of the risks of polluted sites.
- Recommendations to overcome these difficulties concern four points:
  . national regulations,
  . technical resources available to public authorities,
  . programming and evaluating research, and
  . training of the players involved.

6.1. NATIONAL LEGISLATION

There are three categories of proposals:

- **Those requiring no legislative intervention** (entering environmental factors in corporate records; favouring an environmental management approach of large groups; encouraging development and generalization of site and risk assessment; encouraging the administrative participants to cooperate; extending the concept of emergency intervention to the financial possibilities of handling pollution in as early a stage as possible; ensuring the traceability of land-use limitations; etc.).

- **Those requiring modification of existing legislation** (clarifying the responsibility for site remediation; security when there is a change in site operators; legal basis for stipulating specific remediation work; clarification of the status of the environmental history in case of bankruptcy; etc.).
- **Those requiring reinforcement of existing concepts** (compulsory "pollution liability" insurance policy for all installations classified for environmental protection; authorization to create an insurance/savings/pollution system to face obligations or remediation at the end of the lifetime of a site; establish rules of partial discharge; include a contractual procedure in the legal plan, with administrative police power).

6.2. TECHNICAL RESOURCES AVAILABLE TO PUBLIC AUTHORITIES

Technical resources in many cases are incomplete and will need further work.

Recommendations for such work include:

- ***Complement ongoing inventories of all polluted sites***, including those not covered by legislation on authorized installations for environmental protection.
- Continue the ***census of former (abandoned) industrial sites***.
- ***Create a reference on French soil background values***, especially for metals and toxic metalloids.
- ***Create a database on dangerous substances in the environment***, and also make available the data required for Detailed Risk Assessment, e.g. demographic data, data on natural contamination, etc.
- Continue work to ***provide the most suitable public tools*** in this field of activity, especially concerning Detailed Risk Assessments.
- Possibly, ***develop an accreditation system*** that would be relevant for this field of activity, especially for analyses.

6.3. PROGRAMMING AND EVALUATING RESEARCH

France has strongly dispersed research resources for geographic and historical reasons. Recommendations concerning suitable research topics include:

- The provision of means for ***coordinating research programmes*** in various public institutions (BRGM, CEMAGREF, CNRS, INERIS, INSERM, InVS, etc.), to identify and rank scientific subjects or topics that should be included in national research.
- The development of ***research on the toxicology of pollutants*** (acute or chronic toxicity).
- The implementation of ***health studies*** to determine the effect of soil pollution on public health and to monitor populations if necessary.
- The ***inclusion of socio-economic factors*** in ongoing research programmes.
- The ***identification of European and other international partners*** (already partially included in the European CLARINET (Contaminated Land Reclamation Network) research project) ***for a more effective implementation of the proposed research***.

6.4. TRAINING

The desired training would include:

- inspectors of authorized installations for environmental protection, who implement the tools of national policy (more than 450 inspectors trained since 1996);
- other policy partners, such as other administrations (e.g. the Department of Health and Social Action), industry, engineering firms, insurers, etc.;
- other field players who manage sites on a daily basis, in particular municipalities.

7. Contacts

- ***French Ministry of the Environment:***
  Alexandre PAQUOT

Ministère de l'Aménagement du Territoire et de l'Environnement,
Direction de la Prévention des Pollutions et des Risques, Service de l'Environnement Industriel, Bureau de la Pollution des Sols et des Pollutions Radioactives
20, avenue de Ségur, 75302 Paris 07 SP
Tel.: 33.142.19.14.74 – Fax: 33.142.19.14.67
Email: alexandre.paquot@environnement.gouv.fr

- ***French Ministry of the Environment / BARPI :***

Ministère de l'Aménagement du Territoire et de l'Environnement,
BARPI
2 rue Antoine Charial, 69426 Lyon cedex 03
Tel.: 33.437.91.44.89 – Fax: 33.437.91.28.06

- ***ADEME (Agence de l'Environnement et de la Maîtrise de l'Energie):***
  Franck Marot

2, square Lafayette, BP 406, 49004 Angers cedex 01
Tél.: 33.241.91.40.36 – Fax: 33.241.91.40.01
Email: franck.marot@ademe.fr

- ***BRGM:***
  Dominique Darmendrail

Bureau de Recherches Géologiques et Minières, Environment and Process Division
3, avenue Claude Guillemin, 45060 Orléans cedex 2
Tel.: 33.238.64.30.41 – Fax: 33.238.64.39.63
Email: d.darmendrail@brgm.f

- ***INERIS:***
  Hafid Baroudi

Parc technologique ALATA, BP. 2, 60550 Verneuil-en-Halatte
Tel.: 33.344.55.66.77 – Fax: 33.344.55.68.72
Email: hafid.baroudi@ineris.fr

- ***IRSN:***
  André Oudiz

BP. 6, 92265 Fontenay-aux-Roses
Tel.: 33.146.54.82.43 – Fax: 33.146.54.88.29
Email: andre.oudiz@irsn.fr

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APPENDIXES

APPENDIX 1

Circular on principles for determination of Remediation Objectives

(dated 10 December 1999*)*

From the Minister for Territorial Development and the Environment

To the Prefects of France

Subject: Polluted Sites and Soils
Principles for establishing remediation objectives

The objective of the present Circular is to set out the applicable principles for prescribing remediation work on sites where the soil has been polluted by industrial activity authorized by the law of 19 July 1976.

The prescription for such work generally follows from the various steps defined by the Circulars of 3 December 1993 and 31 March 1998:

- urgent work: fencing in, sign posting, and removal of hazardous waste on the surface;
- site monitoring, especially through the installation of observation wells, and a simplified risk assessment on the basis of an initial assessment;
- in-depth audit and detailed risk assessment.

The monitoring and depollution work that you prescribe should aim at preventing the onset or persistence of risks or nuisances to Man and the environment. It also should take account of the land-use envisaged by the site's owner as well as of the available depollution techniques.

The in-depth audit and detailed risk assessment should provide the elements for evaluating the effective or potential existence of risks or nuisances. Based on the results of this evaluation, you should present the remediation objectives according to the principles discussed below.

It should be stressed that these principles apply to the resorption of ***past*** pollution. Any prescription concerning the prevention of ***new*** pollution from operating installations should, in particular, be based on the decree of 2 February 1998, and especially on Articles 10 and 12 concerning retention capacities and confinement basins, on articles 36 to 42 concerning sewage and sludge spreading, on articles 44 to 46 concerning waste management, and on articles 65 and 66 concerning the monitoring of soil and groundwater.

A1.1. RISKS TO HUMAN HEALTH

The detailed risk assessment carried out on site must quantify the doses of harmful substances to which people are or might be exposed. This should be done on the basis of (a) the type of pollutants present and their predicted evolution, (b) the pollutant-transfer possibilities, and (c) the present or foreseeable use of the site. Generally, this starts with identifying the potentially most exposed group of persons; commonly these are persons occupying the site in a (semi) permanent manner, but

they may also be nearby well users, or consumers of agricultural products grown on or near the site. Quantification of exposure doses should be based on exposure scenarios defined in terms of the (planned) site use, and clearly explained in the reports you receive.

Two types of situation must be distinguished for evaluating the tolerable level of calculated doses, depending on whether an acceptable dose has been established for the toxic substance in question, or whether the substance is considered as having no toxic threshold. In the second case, the residual risk is never zero, regardless of how small the ingested dose. Such a residual risk is generally expressed in terms of the probability that a person, during his lifetime, could develop a cancer related to the site pollution.

Various sources are available on the toxicity of products, including those of the WHO, EPA, ATSDR, etc. I have asked INERIS to assist with the inspection of the authorized installations for the use of such databases. In the absence of such data, or in case of uncertainty regarding either the acceptable dose, or the dose/effect relationship, advice should be sought from the DDASS (Departmental Directorate of Health and Social Affairs).

A1.1.1. Toxic substances with a known acceptable dose

The criterion for evaluating a dose to which persons are exposed, is that such a dose, considering all environmental input, must be less than the acceptable dose.

A1.1.2. Substances without threshold

For carcinogenic toxic substances without a threshold, the risk can be described as the probability that a cancer will occur, related to the pollution in question and during the lifetime of the exposed person. For instance, a risk of 10^{-5} means that an exposed person has a probability of 1 in 100,000 to develop a cancer related to the site pollution. At very small doses, this probability is generally considered as proportional to the absorbed dose.

In health terms, this probability can be interpreted as follows:

- As we are dealing with soil pollution, it is generally possible significantly to reduce the risk through measures of restricting land use and the implementation of depollution techniques. In this case, a risk of over 10^{-4} normally is considered as not acceptable.
- The fixing of depollution techniques generally is based on a risk of 10^{-5}, corresponding to the WHO recommendations and already used for establishing drinking-water standards.
- If the available techniques allow reaching a lower level at an economically acceptable cost, this can be legitimately asked.
- If the available techniques do not allow reaching the 10^{-5} level in a realistic manner, a higher level can be adopted, though without exceeding 10^{-4} and on the strength of a detailed technical-economic study. In this case, necessary measures must include that no houses or other facilities are constructed in which children might be received.

Generally, remediation objectives are thus fixed on the definition and comparison of several scenarios in terms of health and cost impacts.

However, risk levels are not only applied to toxic substances without a carcinogenic threshold, but also to substances that are teratogenic, mutagenic, or which affect reproduction.

When several toxic substances without threshold are present on a site, the risk levels described above apply to the sum of the risks caused by each of the substances, except where a synergy between several substances is suspected that might aggravate the risk.

A1.1.3. OPERATING INDUSTRIAL SITES

For evaluating the exposure of workers to substances related to the industrial activity on a site, it suffices to refer to the Labour Law and its official exposure values. However, any soil pollution unrelated to activity on the site is evaluated according to the principles described above.

When the site contamination might contribute to a significant increase in exposure of the workers on or near the site, a specific assessment must be made.

A1.2. RISKS TO GROUNDWATER AND SURFACE WATER

Groundwater pollution is one of the main risks that can be generated by soil pollution. Priority must be given to preventing the transfer of this pollution to the aquifer, and thus its spreading.

For this, piezometers (observation wells) should be almost systematically installed as rapidly as possible. They provide the means of checking the changes in pollutant content of the water as well as its physico-chemical quality, both on site and downstream from it.

A rapid installation of pumps can help in checking the further spread of pollution by drawing down the water table, and thus creating flow toward the pumps.

Where groundwater is used as a drinking-water supply, or has been designed as such according to the SDAGE and SAGE, treatment objectives should be defined so that existing wells are not threatened and new wells will not be compromised. In such situations, when toxic chemical substances might be present that are not taken into consideration by drinking-water standards, a specific risk analysis is carried out in liaison with the departmental authorities of health and social affairs.

Where groundwater is not used for drinking-water supply, but has other uses such as irrigation or private wells, the planned actions should aim at maintaining such uses.

The taking into account of water uses as described in the two preceding paragraphs, must be independent of any measures of preventive closure, or of water treatment, that might have been taken by the well operators.

The impact of pollution on surface waters should be compatible with quality objectives or thresholds and with fish-breeding use of such surface waters, as well as with the SDAGE and SAGE regulations where existing.

A1.3. EVALUATION OF DEPOLLUTION OBJECTIVES IN TERMS OF RISK ASSESSMENT

The practice of soil studies and risk assessments is of relatively recent date in France. This means that the reliability of risk studies rarely can be guaranteed.

This in turn means that, when possible, it should be recommended to use effective environmental (vegetation, air, etc.) measurements, if possible systematically based on transfer or exposure models. Such measurements can include: water quality in piezometers and neighbouring wells, analyses of drill cores, and measurements on dust that has settled around the site. In the case of heavy pollution, you should seek the opinion of DDASS on whether medical analyses on exposed persons have to be carried out, which step then should be part of the enquiry protocol as well.

All risks studies you receive should be critically examined, distinguishing validated data based on effective measurements from –generally more uncertain – predictions. For the latter, you have to distinguish between situations where a monitoring programme will help in the medium-term verification of the predictions resulting from the studies, and situations where such measurements will not be possible. In the second case, the remediation objectives will necessarily be fixed in a more critical manner.

For instance, if a hydrogeological study concludes that soil pollution will probably not generate an impact through transfer by groundwater, you can accept this result, if necessary after expert validation. However, it is still recommended to prescribe a programme of regular checks of groundwater quality on site, or downstream from it.

On the contrary, it is generally difficult to measure the exposure of persons in contact with polluted soil. In this type of situation, you must regard the available estimates with prudence and the necessary precaution.

As laid down in decree 77/1133 of 21 September 1977, I draw your attention to the requirement of consulting the DDASS on the detailed assessment of risks and, when a health risk is suspected, to involve it in defining the remediation objectives.

A1.4. PUBLIC AND COMMUNITY INFORMATION

Article 8-1 of the law of 19 July 1976 (modified) provides for the obligation of information between vendor and buyer of a piece of land, in case an authorized installation has been operated on this land.

Article 34-1-III of the decree of 21 September 1977 provides for an enquiry by the mayor of the community concerning the ways of restoring an authorized installation that has been closed for good.

In the same vein, all information on soil pollution should be easily accessible, in particular when a development programme is planned. This is why you should

systematically inform the mayors of all conclusions of studies, in-depth audits, and risk and expert assessments on polluted sites in their communities. All these documents are considered as public, and should be available for consultation and communicated upon a simple request.

For your orders concerning the long-term remediation of a site, you should ask not only the opinion of the site operator, but also those of the site owner and the mayor.

In fact, you can organize an initial public meeting to present the planned remediation work, especially when such work precedes the construction of a housing subdivision, or of a development that will receive the public.

A1.5. RESTRICTIONS ON SITE USE

When a site has been depolluted with a given use in mind, care should be taken that the site is not given another destination that is incompatible with the residual pollution of the site, and without carrying out the necessary further work.

The procedure of an easement of public service, planned for in article 7-5 of the law of 19 July 1976, is the legal instrument for handling this type of situation.

This procedure should be used when possible, as it allows for compensation of the concerned landowners by the person(s) responsible for the pollution.

However, the landowner, following an agreement with the person(s) responsible for the pollution, can opt not to ask for compensation. In this case, it may be sufficient to include a contractual restriction of use - concluded between the site owner and the State - in the mortgage documents, and to transmit this to the municipality for inclusion in their land-use regulations; this should avoid a re-use of the site that would be incompatible with the residual risk. This procedure is adapted in the case where a landowner has also caused the site pollution.

Other types of use restriction can be envisaged as long as they are mentioned on the mortgage documents.

A1.6. OTHER RISKS OR NUISANCES

The other risks or nuisances that might be generated by a polluted site, such as impact on fauna and flora, risks to buildings, or bad smells, should be the subject of specific studies as and when necessary.

Here, it should be understood that for certain substances, such as volatile organic compounds, the reduction of olfactory nuisance can lead to much more severe prescriptions than the mere consideration of health risks.

The remediation objectives should keep in mind that the site, once depolluted, is indeed suitable for the planned use.

For instance the residual presence of bad smells could be tolerated in a place visited by few people, but is unacceptable for sites destined for or near dwellings.

Another example is a soil pollution that disturbs plant growth: this can be tolerated for a site destined for industrial or strictly urban (high-rise building or parking lot) use, but requires further treatment if the site is to become a garden or cultivated plot.

Finally, if the site will be used for grazing, the impact of the soil pollution on animal health must be examined.

The risks or nuisances connected to the planned remediation work itself should be evaluated beforehand as well. This in particular where the treatment process will take place on the site, or near dwellings.

When the polluted soil is removed from the site of an authorized installation, the operator must be able to justify the destination of such soil. It might then be dumped or re-used, but the operator should ensure that it will not create a nuisance in terms of article 1 of the law of 19 July 1976.

APPENDIX 2

Glossary used for contaminated-land management

A2.1. PREFACE

The definitions found in this appendix are proposed for the most common terms, in order to arrive at a consistent use of the different tools involved in implementing the national policy on the "Management and Treatment of Polluted Sites and Soils".

There are currently three of these tools:

- guidelines for Preliminary Site Investigations,
- simplified Risk Assessment method,
- guidelines for an impact study – In Depth Site Investigations and Detailed Risk Assessment (in preparation).

After discussions within the various working groups for the "Management and treatment of polluted sites and soils", it was decided to use definitions that could be understood by the public, rather than prescribed, technical or scientific definitions.

Comments on this document, version 2, should be sent to:

D. Darmendrail,
BRGM, Service Environnement et Procédés
3, Avenue Claude Guillemin, 45060 Orléans cedex
Fax: 00.33.2.38.64.39.63
Email: d.darmendrail@brgm.fr

A2.2. LIST OF DEFINED TERMS

Absorbed dose
Absorption
Acceptable daily intake (ADI)
Acquisition audit
Acute exposure
Admissible daily intake
Analysis
Aquifer - see also groundwater
Archival search
Authorized installation (for protection of the environment) - see Hazardous facility
Authorization (to operate a class 'a' hazardous facility)
Background level
Best available technology (BAT)
Bioaccumulation
Bioavailability
Biocenosis
Bioconcentration
Biodegradability
Biodegradation
Bioindicator
Biological treatment - see Bioremediation
Biomagnification
Bioremediation
Biota

Biotope
Blank
Body barrier
Calibration
Cancer potency factor
Carcinogen, carcinogenic
Chemical oxygen demand
Chronic exposure
Chronic risk
Clay
Claystone
Client
Climate
Commodity
Compartment
Composite sample
Compound
Conditioning - see Packaging
Confidence level
Container
Containment
Contamination - see also Pollution
Contractor
Corrosive
Criterion
Damage
Danger - see hazard
Declared safe (site)
Decontamination
Depollution - see Decontamination
Deposit
Derelict land
Dermal exposure
Desk study
Detailed assessment
Detailed investigation
Detection limit (of method)
Determination (of pollution)
Development toxicity
Diagnosis see environment audit
Distillation
Domestic water
Dose
Due diligence - see Acquisition audit
Easement (on real estate)
Easily flammable
Ecosystem
Ecotoxicity
Ecotoxicology
Effluent
Emission
Encumbrance – see Easement
End residue
Environment
Environmental audit
Environmental impact study
Epidemiological study

Equipment blank
Evapotranspiration
Explosive
Exposure
Exposure area
Exposure assessment
Exposure compartment
Exposure daily intake
Exposure pathway
Exposure scenario
Extremely flammable
Field blank
Final residue
Fixed impact value
Flammable
Frame of reference
Gauging
Generic
Geochemical background
Geophysics
Good laboratory practices (GLP)
Grainsize distribution
Gross sample
Groundwater
Groundwater vulnerability
Guideline
Guide value
Half-life
Halogenated organic solvent
Harmful
Hazard
Hazard assessment
Hazard category
Hazard class
Hazard ranking
Hazard ratio
Hazardous facility
Historical investigation (of a site)
Historical review - see Historical investigation
Historical search
Hydraulic conductivity
Hydraulic head
Immission
Impact
Impact study
Indicator
Individual excess risk
Industrial water
Inflammable
Ingestion
Inhalation
In situ
Installation - see also Process unit
Intake
Internal dose
Irritant
Koc

Kow
Kp (or kd)
Landfill
Leaching
Lethal concentration (LCN)
Lethal dose (LDN)
Limit of detection - see Method detection limit
Limit of quantification
List of authorized installations
Literature search
Lithology
LOAEL (lowest observed adverse effect level)
Loam
LOEC (lowest observed effect concentration)
Long-term exposure
Low-risk site
Manufacturing process
Maximum allowable concentration (MAC)
Maximum contaminant level (MCL)
Medium
Method detection limit
Mobility
Model
Multimedia (exposure model)
Mutagen, mutagenic
NOAEL (no observed adverse effect level)
NOEC (no observed effect concentration)
Nomenclature of hazardous facilities
Nuisance
Objective
Observation well - see Piezometer
Octanol-water partition coefficient
Operator
Organic solvent
Organic-carbon adsorption coefficient
Oxidant
Oxidizer
Owner
Packaging
Parameter
Particle size (distribution) - see Granulometry
Permeability
Persistence
Piezometer
Piezometric level
Plant permission - see Authorization
Pollutant
Pollution
Pollution assessment
Pollution index
Pollution indicator
Pollution control - see Decontamination
Pollution pathway - see Pollution vector
Pollution vector
Porosity
Potentiometric level
Precaution principle

Preliminary Site Investigation - see Preliminary investigation
Preliminary investigation
Preparation - see Product
Pretreatment
Procedure
Process (manufacturing)
Process unit
Product
Project manager
Quality assurance - see Quality control
Quality control
Quality index
Quality objective
Ranking (of Polluted sites)
Receptor - see Target
Reclamation
Records review - see Historical investigation
Refuse - see Waste
Rehabilitation - see Remediation
Remediation
Remediation objective
Reproductive toxicity
Resorption
Risk
Risk assessment
Route of exposure
Runoff – see Surface runoff
Safety report
Sample
Sample constitution
Sampling
Sampling area
Screening
Selective sample
Sensitivity
Sensitivity analysis
Short-term exposure
Side effect
Silt - see Loam
Site
Skin exposure (see Dermal exposure)
Soil
Soil-moisture balance
Soil /water distribution coefficient
Sorption
Sorted gross sample
Source (of pollution)
Source/soil definition value
Speciation
Spot sample
Standard
Steam cracking
Subchronic exposure
Substance - see Product
Surface runoff
Surface water
Systemic effect

Target
Teratogenic
Test portion
Test sample
Threshold
Threshold limit value/short term exposure limit (TLV/STEL)
Threshold limit value/time-weighted average (TLV/TWA)
Tolerable daily intake (TDI)
Tolerance
Topography
Toxicity
Toxicity scale
Toxicology
Transfer
Unacceptable risk
Use (of a site)
Vector
Volatile organic compound
Volatility
Vulnerability
Waste
Waste disposal assessment
Waste list
Waste study
Waste water
Water use
Watertightness
Xenobiotic

A2.3. GLOSSARY OF POLLUTED SITES AND SOILS
PROPOSED DEFINITIONS

ACCEPTABLE DAILY INTAKE (ADI): Quantity of a chemical substance that can be ingested daily by a human or animal throughout its life with no appreciable risk for its health. Values established for food additives and pesticide residues whose presence in the food results from technical needs, or which are required for the protection of plants (WHO).

***French:* DOSE JOURNALIÈRE ADMISSIBLE (DJA)**

ACQUISITION AUDIT: Assessment, conducted by or for an enterprise desiring to acquire a terrain or a factory, of parameters related to the prior and current management of the said site (including technical capacities, hygiene-safety, environmental limitations and damage, etc.).

***French:* AUDIT D'ACQUISITION DE SITE**

AQUIFER: Groundwater-bearing terrain that is sufficiently permeable to allow significant flow of groundwater and the tapping of significant water quantities.

***French:* AQUIFÈRE**

AUTHORIZED INSTALLATION (FOR PROTECTION OF THE ENVIRONMENT):

See HAZARDOUS FACILITY

French: INSTALLATION CLASSÉE (POUR LA PROTECTION DE L'ENVIRONNEMENT)

AUTHORIZATION (TO OPERATE A CLASS 'A' HAZARDOUS FACILITY: Part of a written decision according the right to operate all or a part of an installation, under stipulations imposed for protection of the environment and public health.

French: AUTORISATION (INSTALLATION CLASSÉE SOUMISE A)

BACKGROUND LEVEL: Representative ambient concentration of an element, a compound or a substance in a given milieu. It takes into account natural concentrations (geochemical background) and those that may arise from man-made sources other than those of the site examined (e.g. pollution diffused by fertilizers, pesticides, etc.).

French: BRUIT DE FOND

BEST AVAILABLE TECHNOLOGY (BAT): Most recent stage of development of activities, processes and their mode of operation that can be used on a site at industrial scale, under economically viable conditions, and at the same time generate a high general level of protection of the entire environment.

French: MEILLEURE TECHNIQUE DISPONIBLE (MTD)

BIOACCUMULATION: The accumulation of a substance in all or part of a living organism, via the food chain or an ecosystem. The exchange process between a living being and its milieu, giving rise to higher concentrations within the organism than in its environment or food.

French: BIOACCUMULATION

BIOCENOSIS: Association of animals, plants and microorganisms living in a given biological milieu (biotope) and interacting directly or indirectly between each other.

French: BIOCÉNOSE

BIODEGRADABILITY: Potential capacity of an organic substance to be biodegraded, generally by microorganisms.

French: BIODÉGRADABILITÉ

BIODEGRADATION: Decomposition of certain substances, e.g. organic matter, into simpler molecules, resulting from complex actions of living organisms, aerobic or anaerobic. Degradation may be incomplete (modification of the initial structure of the molecule) or complete (transformation into inorganic substances such as CO_2, CH_4, etc.).

French: BIODÉGRADATION

BIOINDICATOR: Organism or species (animal or plant, individual or populations) that indicates particular environmental factors (temperature, cold, drought, etc.), or that can indicate the presence or impact on one of the milieus (air, water, soil) of a xenobiotic by its capacities to accumulate it.

***French:* BIOINDICATEUR**

BIOLOGICAL TREATMENT: see BIOREMEDIATION

BIOREMEDIATION: Biological treatment methods utilizing the natural enzymatic activities of microorganisms to transform, degrade, fix, or immobilize pollutants encountered in different milieus (water, soils, waste, etc.).

***French:* BIOTRAITEMENT**

BIOTA: All living organisms (fauna, flora and microorganisms) in a given biotope.

***French:* BIOTE**

BIOTOPE: Localized space that is the support for biocenosis, where all the physical and chemical factors (climatic, pedologic, geologic, hydrogeologic, etc.) of the environment remain more or less constant.

***French:* BIOTYPE**

BLANK: Artificial sample used to control the introduction of artifacts in a process, method, etc.

***French:* BLANC**

There are many types of blanks:

Equipment blank: Used to verify the cleanliness of field sampling equipment.

***French:* BLANC D'ÉQUIPEMENT**

Field blank: Material used in the field, during and at the site of sample removal and constitution, to determine if one of the pollutants present on the site could have affected the integrity of the samples taken.

***French:* BLANC DE TERRAIN**

Laboratory blanks (Rinsate blanks): Materials used to test the laboratory method, instrumentation and reagents in terms of interference or pollution.

***French:* BLANCS DE LABORATOIRE**

These blanks differ from other samples that are an integral part of quality control (estimation of bias, precision, etc.).

CARCINOGEN, CARCINOGENIC: Any chemical, physical or biological factor that may cause or promote the appearance of a cancer.

***French:* CANCÉROGÈNE**

CLAY: Term designating either a particle-size fraction (smaller than 2 µm), a mineral (family of silicates forming flakes or layers whose crystals can be larger than 2 µm and that have very particular properties, in particular concerning the binding and exchange of ions), or a very fine unconsolidated sediment (or residual deposit) with at least 50% clay minerals.

***French:* ARGILE**

CLAYSTONE: Very fine-grained sedimentary or residual rock containing at least 50% clay minerals.

***French:* ARGILE**

CLIMATE: Fluctuating set of atmospheric conditions characterized by the weather and its changes in a determined spatial domain.

***French:* CLIMAT**

CONDITIONING: see PACKAGING

CONFIDENCE LEVEL: Probability that the true value is contained within a calculated interval of confidence. A confidence interval that is 95% of the mean values "x" of a concentration calculated for a sample for which there are "n" results, means that there are 95 chances out of 100 that the interval contains the true value X.

***French:* NIVEAU DE CONFIANCE**

CONTAINER: Generic term designating any structure or recipient, regardless of its form, size, nature, or whether open or closed, containing products/waste. Containers can be made of paper, cardboard, wood, plastic, metal, concrete, or other composite materials (cardboard-metal, textile-tar, etc.). They include:

- cisterns, tanks, reservoirs, ...
- cans, ...
- drums, casks, ...
- bottles, carboys, demijohns, ...
- crates, packages, boxes.

The capacity of a container to prevent or limit the propagation or extension of dangerous/hazardous substances into the environment depends on its physical state, and the compatibility between the products/waste and the material(s) composing the container.

***French:* CONTENEUR**

CONTAINMENT: Any natural or exogenous material, any physical process or any chemical treatment whose aim is to limit or prevent exchanges between a system, an individual, a geographic space and its environment.

***French:* CONFINEMENT**

CONTAMINATION: Abnormal presence of a substance or microorganism(s) in a milieu, an object, or a living organism. Initially, the concept of contamination was first applied to microorganisms and then to radioactive substances.

***French:* CONTAMINATION**

CRITERION: Generic term for numerical values or narrative statements used as a guide or orientation for the protection, preservation, and improvement of specific uses of milieus.

***French:* CRITÈRE**

DAMAGE: Loss, damage, prejudice, whether material, bodily or intangible, whether immediate or delayed, undergone by an individual or legal entity, by the natural milieu or by personal property or real estate.

***French:* DOMMAGE**

DANGER: **see HAZARD**

DECLARED SAFE (SITE): Option for a given site, in view of the data available and the state of knowledge at the moment of the simplified risk assessment, to be used for one or several purposes (residential, agricultural, commercial, industrial, etc.) with no further investigation or special work.

French:* BANALISATION *(du site)

DECONTAMINATION: Operation involving the partial or total treatment of a polluted milieu (soil, water, air) so as to eliminate or strongly attenuate the pollutant character in order to restore the milieu's functions and render it fit for use.

***French:* DÉPOLLUTION**

DEPOLLUTION: see DECONTAMINATION

DEPOSIT: Accumulation of diverse products (raw materials, finished products, waste, etc.) stored in the same place, in bulk or in containers.

***French:* DÉPÔT**

DERELICT LAND: Space that has been temporarily or definitively abandoned following the cessation of an activity (agricultural, port, industrial, service, processing, military, storage, or transport).

***French:* FRICHE**

DERMAL EXPOSURE: Direct communication between a substance and the skin.

***French:* CONTACT DERMIQUE**

DETERMINATION (OF POLLUTION): appraisal of a state of pollution that can be:

1) *Qualitative* (e.g. strong odour, visual sign), and/or
2) *Comparative,* related to a frame of reference (e.g. reference values).

***French:* CONSTAT DE POLLUTION**

DOSE: Quantity of substance absorbed by an exposed organism.

***French:* DOSE**

Dose - Response: relationship between the absorbed dose and the effect and severity of the effects.

DUE DILIGENCE: see ACQUISITION AUDIT

EASEMENT: Subjection or constraint on the use of property, a site, an installation. Public Service easements may be imposed by a legal administrative process after a public hearing in order to assure:

- the protection of common property (groundwater resources, natural park, sites of special scientific interest, etc.),
- the protection of users, e.g. by limiting access to or operation of a polluted site.

French: SERVITUDE

ECOSYSTEM: Basic ecological unit composed of the biotope and the organisms living in it (animals, humans, microorganisms, plants).

French: ÉCOSYSTÈME

ECOTOXICITY: Capacity of a substance, owing to its toxicity, to produce harmful or unpleasant effects for microorganisms, animals, plants or humans via the environment.

French: ÉCOTOXICITÉ

ECOTOXICOLOGY: Science that studies the impact of chemical substances on the ecosystem. It considers the fate of the substances in the environment (phenomena of biotic and abiotic degradation), and also the toxic or ecotoxic effects of the substances and mechanisms by which the biosphere is polluted.

French: ÉCOTOXICOLOGIE

EFFLUENT: Treated or untreated liquid from urban and individual (septic tanks) installations and industrial or agricultural activity, and which is discharged into the environment

French: EFFLUENT

EMISSION: Discharge, from a source into a milieu, of solid, liquid or gaseous substances, of radiation, or of diverse forms of energy.

French: ÉMISSION

END RESIDUE: Waste that may or may not result from the processing of another waste and which cannot be processed under existing technical and economic conditions, in particular by extracting the part that can be reclaimed or by reducing its polluting or hazardous character.

French: RÉSIDU ULTIME

ENVIRONMENTAL AUDIT: Action aimed at determining the existing state (assessment of damage to the environment) and proposing objectives. The audit covers the totality of the following steps:

- Collection of data on the past and present context,
- Determination of the effects (values of different relevant criteria),
- Analysis of phenomena (endogenous, exogenous) in relation to their effects,
- Analysis of the risks at stake (critical level of damage),
- Recommendations for improvement, treatment, emergency, or prevention measures.

French: DIAGNOSTIC ENVIRONNEMENTAL

EPIDEMIOLOGIC STUDY: Study of the distribution and contributing factors (exposure, other factors) of health incidents in human populations.

French:* *ÉTUDE ÉPIDÉMIOLOGIQUE

EVAPOTRANSPIRATION: Loss of water from a surface covered by vegetation; it includes the water taken up by the vegetation and then eliminated through evaporation, water eliminated by evaporation from the dry surface of leaves (transpiration), and evaporation from the soil.

French:* *ÉVAPOTRANSPIRATION

EXPOSURE: Contact with a chemical or physical agent for a certain period of time.

French:* *EXPOSITION

Exposure assessment: Determination of emissions, transfer paths and displacement velocities of a substance and of its transformation or degradation, in order to determine the concentrations or doses to which human populations or environmental components are or may be exposed.

French:* *ÉVALUATION DE L'EXPOSITION

FRAME OF REFERENCE: Set of ordered and dated methods constituting a reference state for a physical (air, water, soil) or biological (fauna and flora) milieu.

French:* *RÉFÉRENTIEL

GEOCHEMICAL BACKGROUND: Natural concentration of an element, a compound, or a substance in a given milieu in the absence of any specific external supply such as human activity.

French:* *FOND GÉOCHIMIQUE NATUREL

GEOPHYSICS: Set of study techniques used to characterize the subsurface based on the measurement of physical parameters (resistivity, density, magnetic susceptibility, etc.) from the surface or from boreholes.

French:* *GÉOPHYSIQUE

GOOD LABORATORY PRACTICES (GLP): Methods and systems required in laboratories to guarantee the high quality of the studies. The main fields covered by GLP are:

* laboratory equipment and specialized personnel,
* the quality control program,
* installations,
* instrumentation, material and reagents,
* test systems,
* reference substances,
* standard operating procedures,
* conducting the study,
* writing up the study results,
* archiving and storage of dossiers and studies.

French:* *BONNES PRATIQUES DE LABORATOIRE (BPL)

GRAINSIZE DISTRIBUTION: Distribution of minerals by size category (diameter).

***French:* GRANULOMÉTRIE**

GROUNDWATER: Underground water that completely fills the pores of a permeable terrain (aquifer) such that there is constant communication between pores via the water; groundwater is in opposition to the overlying unsaturated zone; groundwater can be described by several adjectives depending on its origin (alluvial, etc.), its hydrodynamic conditions (confined or free, artesian, etc.), or the characteristics of the water (salty, thermal, etc.).

French:* NAPPE *(d'eau souterraine)

GUIDELINE: Reference value for a parameter (concentration of a given element) destined for thought or decision making. Generally a value recommended by an authority without being legally binding, used (with professional judgement) in the assessment of a polluted site.

HALF-LIFE: Time required for a mass, a concentration, the activity of a chemical or physical agent to be reduced by half.

French:* DEMI-VIE *(temps ou période de)

HAZARD: Possibility of a situation, or for a substance as a result of its intrinsic properties or characteristics, to cause damage to persons, property or the environment in determined conditions of exposure.

***French:* DANGER, ALÉA**

HAZARD ASSESSMENT: Evaluation of the characteristics giving rise to undesirable effects that a situation or substance is intrinsically capable of causing.

***French:* ÉVALUATION DES DANGERS**

HAZARD CATEGORY: Code (from 0 to 3) defining the type of hazard and its severity, based on risk phrases as defined in the Ministerial Decree of 20 April 1994, in which six types of hazard are included: human toxicity by inhalation, by dermal exposure, by ingestion, carcino- / muta- / teratogenic effects, ecotoxicity (including all routes of exposure), and dangers of explosion and inflammation.

***French:* CATÉGORIE DE DANGERS**

HAZARDOUS FACILITY: Factories, shops, warehouses, construction sites, quarries, as well as any fixed installation operated or possessed by an individual or a legal entity, public or private, that may be sources of nuisance for health, safety, cleanliness of the surroundings, as well as for agriculture, protection of the environment and natureand conservation of the patrimony. Such facilities are formally defined by a nomenclature determining those depending upon authorization or declaration procedures as a function of on the severity of the dangers they present (law No. 76.663 of 19 July 1976 and decree No. 77.1133 of 21 September 1977).

***French:* INSTALLATION CLASSÉE**

HISTORICAL INVESTIGATION (OF A SITE): Collection and technical examination of existing and available information in order to identify the likely presence of dangerous products on a site under conditions indicating an existing or past discharge, or the threat of discharge into structures or the environment (soil, groundwater, surface water, air). The information to look for involves the site activities (installations, processes, products, etc.), environmental management practices (discharges, waste, etc.), and accidents or incidents (fire, explosion, loading/unloading, etc.). Reconstruction of the site's history must take into account changes over time in the use and activities of the site and its surroundings, in property boundaries, etc.).

French:* *ANALYSE HISTORIQUE DE SITE

HISTORICAL REVIEW: **see HISTORICAL INVESTIGATION**

HISTORICAL SEARCH: First step in the policy of management and treatment of polluted sites and soils, attempting to identify and inventory geographic sectors in which activities were practised in the past that could cause pollution of the environment. In France these historical searches are generally conducted at the scale of a Region, based on a critical analysis of local archives (administrations, departmental and municipal archives, National Institute of Geography, chambers of Commerce and Industry, regional cultural affairs administrations, etc.).

French:* *RECHERCHE HISTORIQUE

HYDRAULIC CONDUCTIVITY: Capacity of a natural conduit or set of conduits in a discontinuous water-bearing milieu (fractures, channels, etc.) to allow the movement of water, under the effect of a given hydraulic head gradient, whose direction generally differs from that of flow.

French:* *CONDUCTIVITÉ HYDRAULIQUE

HYDRAULIC HEAD: Altitude of a water level with respect to a reference plane (example: + 20 m NGF [French datum]).

French:* *CHARGE HYDRAULIQUE

IMMISSION: Transfer of pollutants from the atmosphere to a receiver (German term).

French:* *IMMISSION

IMPACT: Effect of an action, development, mining, etc., on a natural milieu, organisms, an ecosystem, landscapes, etc.

French:* *IMPACT

IMPACT STUDY: Methodological study of the consequences of an industrial or agricultural project on landscapes, natural milieus, the soil, air and water, flora and fauna, as well as on neighbouring populations. The impact study is defined in several regulatory texts:

- Ministerial Circular of 14 October 1980 concerning hazardous facilities and impact studies;
- Law No. 76-629 of 10 July 1976 concerning the protection of nature;
- Law No. 76-663 of 19 July 1976 concerning authorized installations for the protection of the environment;

- Decree No. 77-1133 of 21 September, 1977, modified by decree of 9 June 1994, for the application of the law of 19 July 1976;
- Decree No. 77-1141 of 12 October 1977, for the application of the Law of 19 July 1976;
- Ministerial Circular No. 4094/DPP/SEI/CET/AR of 14 October 1984 concerning hazardous facilities - impact studies;
- Decree No. 85-453 of 23 April 1985 for the application of Law No. 83-630 of July 12, 1983 concerning the democratization of public hearings and the protection of the environment;
- Ministerial Circular No. 2164/DPP/SEI of 30 April 1985 concerning hazardous facilities - manipulations of toxic and hazardous substances caused by the operation of a hazardous facilities;
- Directive 85/337/EEC of 27 June 1985 concerning the evaluation of the effects of certain public and private industrial projects on the environment,
- Decree No. 93-245 of 25 February 1993 concerning impact studies and the field of application of public hearings, and modifying decree No. 77-1141 of 12 October 1977;
- Ministerial Circular of 23 September 1993, used for the application of decree No. 93 - 245 of February 25, 1993;
- Decree No. 93 - 1412 of 29 December 1993 modifying the nomenclature of hazardous facilities.

***French:** ÉTUDE D'IMPACT*

INDICATOR: Parameter or value calculated from quantities providing indications on (or describing) the status of a phenomenon, the environment or a geographic zone and whose implications are greater than information directly related to the value of the parameter (OECD), e.g. BOD5, COD, etc. An indicator must fulfill four functions: (1) *validity* (reliable and concise translation of the initial preoccupation), (2) *measurability* (facility of access to the information, taking cost and time into account), (3) *legibility* (simple and unambiguous interpretation), (4) *consistency* (in time and in space, and between diverse elements of the population). It must also be characterized by seven attributes: name, definition, calculation method, measurement unit, revision frequency, original source, validity grid.

***French:** INDICATEUR*

Pollution indicator: Chemical, physical or biological (plant or animal) variable which, above a certain concentration, reflects the realty or extent of a pollution of the milieu.

Pollution index: Arbitrary function of the concentration of one or several pollutants that measures the potential harm of the pollution.

INGESTION: Exposure via the mouth.

***French:** INGESTION*

INHALATION: Exposure via the respiratory tract and the lungs.

***French:** INHALATION*

IN SITU: Measurement or treatment on site, in the natural environment (Latin term).

***French:** IN SITU*

INSTALLATION: Technical unit in which one or more activities or processes are exerted.

***French:* INSTALLATION**

Koc: (Partition coefficient with organic carbon): Ratio between the adsorbed quantity of a compound per unit weight of organic carbon in soil or sediment and the concentration of the same compound in aqueous solution at equilibrium. The tendency of a compound to adsorb to soil depends on its physicochemical properties and the level of organic carbon in the soil or sediment. **Koc** can be used to determine the distribution of a compound between water and solids.

Kow: (Octanol/water partition coefficient): Ratio between the concentration of a chemical substance at equilibrium in octanol and the concentration of the same substance in water. It is used for an indirect estimation of the sorption of an organic substance in soil or the bioconcentration factor.

Kp (or Kd): (Water/solid partition coefficient): Ratio between the concentration of an adsorbed element and its concentration at equilibrium in the dissolved state. It is generally used to quantify sorption in soil, sediments or suspended particles. The intensity of this sorption depends on the properties of the element studied and those of the soil.

LANDFILL: Deposit, accumulation of waste; currently this term is applied to three types of situation:

- deposits of inert waste (class III);
- deposits of harmless urban and industrial waste (class II), regardless of their administrative situation (uncontrolled landfill, untreated, authorized);
- deposits of collective or private industrial waste related to a determined industrial site (class I, collective or internal).

***French:* DÉCHARGE**

LEACHING: Dissolution and removal of substances from a complex solid or from fine particles under the action of a solvent, such as water, through different soil horizons.

***French:* LESSIVAGE, LIXIVIATION**

LETHAL CONCENTRATION (LCn): Concentration of a toxic product that causes death of a percentage "n" in a given population, within a given time period, in a given experiment.

***French:* CONCENTRATION LÉTHALE**

LC 0: Maximum concentration tested that causes no mortality in a population of organisms studied during a given time after a single administration.

LC 50: Concentration causing 50% mortality in a population of organisms studied during a given time after a single administration.

LETHAL DOSE (LDn): Dose of a toxic product that causes death of a percentage "n" in a given population within a given time period, in a given experiment.

French: DOSE LÉTHALE (DLn)

LD 0: Maximum dose tested that causes no mortality in a population of organisms studied during a given time after a single administration.

LD 50: Dose causing 50% mortality in a population of organisms studied during a given time after a single administration.

LIMIT OF DETECTION: **see METHOD DETECTION LIMIT**

LIMIT OF QUANTIFICATION: Concentration in a defined matrix, above which a quantitative measurement can be performed with a given method and with a specified level of confidence.

French: LIMITE DE QUANTIFICATION

LITHOLOGY: Description of the composition of sediment or rock, including physical and chemical characteristics such as colour, mineralogical composition, hardness, and grain size.

French: LITHOLOGIE

LOAEL (Lowest Observed Adverse Effect Level): Lowest level (dose) in an experiment producing an observed adverse effect

French: DMEIO: DOSE MINIMALE AYANT UN EFFET INDÉSIRABLE OBSERVÉ

LOAM: Term designating either a particle-size fraction (basic particles between 2 and 50 µm), or unconsolidated deposits whose size is between that of sand and clay, whose origin may be fluviatile, lagoonal, or wind-borne (generally called loess).

French: LIMONS

LOEC (Lowest Observed Effect Concentration): Smallest concentration in an experiment that causes an observed effect.

French: CONCENTRATION MINIMALE OBSERVÉE (CMO)

MAXIMUM ALLOWABLE CONCENTRATION (MAC): Maximum authorized concentration of a pollutant in a milieu (air, water, soil), a food, or a beverage.

French: CONCENTRATION MAXIMALE ADMISSIBLE (CMA)

MAXIMUM CONTAMINANT LEVEL (MCL): Numerical value (concentration, flux, etc.) that is imposed by legislation. In general, a limit value is defined for a substance, a given milieu, and a specified use (see maximum admissible concentration for drinking water).

French: VALEUR LIMITE

METHOD DETECTION LIMIT: Lowest concentration of an element or a substance that can be detected by a given method for a given matrix.

French: LIMITE DE DÉTECTION (méthode)

MOBILITY: Capacity of substance or particles to migrate under the action of gravity or under the influence of local forces.

French: MOBILITÉ

MUTAGEN, MUTAGENIC: Applied to any physical or chemical factor that can cause genetic changes in living organisms.

French: MUTAGÈNE

NOAEL (No Observed Adverse Effect Level): Highest level (dose) in an experiment that produces no observed adverse effect

French: DSEIO: DOSE SANS EFFET INDÉSIRABLE OBSERVÉ

NOEC (No Observed Effect Concentration): Concentration in an experiment that produces no observed effect.

NOMENCLATURE OF HAZARDOUS FACILITIES: Regulatory document used to classify hazardous facilities (decree of 20 May 1953 and its modifications, law No. 76.663 of 19 July 1976 and decree No. 77.1133 of 21 September 1977).

French: NOMENCLATURE DES INSTALLATIONS CLASSÉES

NUISANCE: Any permanent, continuous, or discontinuous factor that constitutes a hindrance, an immediate or delayed hazard, an impediment, an immediate or delayed adverse effect on the health of a organism, the environment or the functioning of a system (olfactory, visual, auditory nuisance, size, closeness, etc.), and which makes life unhealthy or difficult.

French: NUISANCE

OBJECTIVE: For a given site, search for a result (expressed as a numerical value or a narrative statement) to save, protect or utilize a natural milieu, as a function of the use to which it is destined by taking specific site conditions into account.

French: OBJECTIF

OBSERVATION WELL: see PIEZOMETER

OPERATOR: Any individual or legal entity that operates an installation (holder of the authorization decree), as well as the party who holds or who has received a determining economic power over the installation (law No. 76.663 of 19 July 1976, decree No. 77.1133 of 21 September 1977).

French: EXPLOITANT

PACKAGING: Outer covering of contents, of presentation, and/or of the sale of a substance, a product, or any merchandise in the broad sense.

French: CONDITIONNEMENT

PARAMETER: Measured or observed property.

French: PARAMÈTRE

PARTICLE SIZE (DISTRIBUTION): see GRAINSIZE DISTRIBUTION

PERMEABILITY: Capacity of a milieu to be traversed by a fluid under the action of a hydraulic gradient (difference in hydraulic head between two points of an aquifer per unit of distance along a given direction). The permeability is reflected by an infiltration rate or a coefficient of permeability to water, which depends to a large extent on the level of water saturation of the milieu. Permeability is expressed as volume of water per unit time and per unit surface, but also usually by unit of velocity.

French: PERMÉABILITÉ

PERSISTENCE: Property of a xenobiotic to remain in the environment. It can be measured by the time required to obtain complete or partial degradation (see half-life).

French: PERSISTANCE

PIEZOMETER: Specially equipped observation well used for measuring the water head at a given point in the aquifer, indicating the pressure at that point. It is used to observe or record the level of groundwater or a pressure.

French: PIÉZOMÈTRE

PIEZOMETRIC LEVEL: Ideal potentiometric surface representing the distribution of hydraulic groundwater heads with two-dimensional flow, or pressure heads over a given surface. It is represented by contours of equidistant heads.

French: PIÉZOMÉTRIE (ou surface piézométrique)

PLANT PERMITTING: see AUTHORIZATION

POLLUTANT: Product, substance or chemical compound responsible for a pollution. A distinction is made between primary pollutants, discharged directly into the natural environment, and secondary pollutants that arise from reactions between the former.

French: POLLUANT

POLLUTION: Direct or indirect introduction, via human activity, of substances, preparations, heat? or noise into the environment, that may contribute to or cause:

- a hazard for human health,
- deterioration of biological resources, ecosystems or property,
- an obstacle to the legitimate use of the environment.

French: POLLUTION

POLLUTION CONTROL: see DECONTAMINATION

POLLUTION PATHWAY: see POLLUTION VECTOR

POLLUTION VECTOR: Medium, organism, or physical carrier (liquid, solid or gaseous, inorganic or organic) that may transmit a polluting or infectious element from a source of pollution towards a target by identified transport processes.

French: VECTEUR (de pollution)

POROSITY: Set of voids inside a body or a solid milieu, potentially occupied by fluids. It is expressed with reference to the volume of voids (occupied by fluid) over the total volume of the solid.

***French:* POROSITÉ**

POTENTIOMETRIC LEVEL: see PIEZOMETRIC LEVEL

PRECAUTION PRINCIPLE: (1) One of the principles stated in law No. 95.101 of 2 February 1995 concerning the reinforced protection of the environment,

(2) Principle of the Simplified Risk Assessment method according to which, in the absence of reliable information on a parameter or a magnitude that is to be evaluated during scoring, the maximum score (3 in this case) is applied.

***French:* PRINCIPE DE PRÉCAUTION**

PRELIMINARY SITE INVESTIGATION: see PRELIMINARY INVESTIGATION

PRELIMINARY INVESTIGATION: Preliminary soil study of a (potentially) polluted site aiming to:

1) Identify the potential pollution(s), and possibly determine the impact on human health and the environment, of past or present activities practised on that site;

2) Gather the essential information for implementing a Simplified Risk Assessment and the classification of sites for the ranking intervention priorities.

Refer to the flow diagram explaining the national policy of management and remediation of polluted sites and soil.

Do not confuse with pedology, which is the study of soil.

***French:* ÉTUDE DES SOLS**

PREPARATION: see PRODUCT.

PROCEDURE: Written rule of organization describing the responsibilities and the succession of tasks or activities necessary for the implementation of a service.

***French:* PROCÉDURE**

PROCESS (MANUFACTURING): The means and related activities that transform input elements (raw materials) into output elements (intermediate products, finished products, etc.).

***French:* PROCÉDÉ (de fabrication)**

PROCESS UNIT: Unit containing the equipment necessary to implement a process or a part of a process.

***French:* UNITÉ DE FABRICATION**

PRODUCT: Two types of product are distinguished: ***substances*** and ***preparations***.

French: PRODUIT

Substances: Chemical elements or compounds that are found naturally, or that are produced by industry for sale (decree of 10 October 1983, concerning the list and labelling and packaging conditions for hazardous substances).

Preparations: Mixtures or solutions composed of two or more substances (decree of 10 October 1983, concerning the list and labelling and packaging conditions for hazardous substances).

QUALITY ASSURANCE: see QUALITY CONTROL

QUALITY CONTROL: Set of technical and operational rules and procedures that ensure the compliance of actions undertaken at different stages of an operation so as to guarantee the results. It is managed by a Quality Assurance System.

French: CONTRÔLE QUALITÉ

QUALITY INDEX: Index based on biomarkers, biotests, biocenotic and ecological indicators, enabling the status of aquatic systems to be determined. Special interpretation grids are used for these indices. The most widely used biological quality indices in France today are: the Biotic Index of Verneaux and Tuffery, the Overall Biological Quality Index, and the Standardized Overall Biological Index (AFNOR Standard T90-350).

French: INDICE DE QUALITÉ

QUALITY OBJECTIVE: Search for a result with a quality level that a decision-maker wishes to reach or preserve for the use of a milieu, surface water, groundwater, soil, air, etc.

French: OBJECTIF DE QUALITÉ

RANKING (POLLUTED SITES): Action aiming to organize, classify, or order a defined set of sites according to previously defined rules.

French: HIÉRARCHISATION (des sites pollués)

RECEPTOR: see TARGET

RECORDS REVIEW: see HISTORICAL INVESTIGATION

REFUSE: see WASTE

REHABILITATION: see REMEDIATION

REMEDIATION: The operations (redevelopment, depollution, resorption, institutional controls, etc.) conducted to render a site suitable for a given use.

French: RÉHABILITATION

RESORPTION: Operation of eliminating waste present on a polluted site.

French: RÉSORPTION

RISK: Probability that an adverse effect will occur under given conditions of exposure.

French:* *RISQUE

RISK ASSESSMENT: Following the identification of the hazard, and if applicable the dose (concentration)-response (effect) effect, evaluation of the exposure and characterization of the risks (estimation of level and gravity of the adverse effects that may occur towards a human population or a component of the environment as a result of the real or predictable exposure to a substance).

French:* *ÉVALUATION DES RISQUES

RUNOFF: see SURFACE RUNOFF

SAFETY REPORT: Detailed study of the consequences of operating an installation, extant or planned, on the environment, persons and property, in terms of accidents, natural or man-made hazards, and damage. It is required when depositing an application file for authorization to operate a hazardous installation (decree No. 94.484 of 9 June 1994).

French:* *ÉTUDE DE DANGER

SAMPLE: Quantity of material on which observations may provide data on the entity from which the sample was taken.

French:* *ÉCHANTILLON

Composite sample: Intermittent or continuous mixing of at least two samples or parts of samples in suitable proportions, and from which the mean value of the desired characteristic can be obtained. Sample proportions are generally calculated from measures of time or flow-rate (AFNOR X 31-150).

Spot (localized) sample: Discrete sample taken randomly (as regards moment and/or location) - (AFNOR T 90-502).

SAMPLE CONSTITUTION: Recovery of a portion representative of a milieu for analysis and tests.

SAMPLING: Action involving the taking of a part, considered as representative, of a milieu in order to examine various defined characteristics.

French:* *ÉCHANTILLONNAGE, PRÉLÈVEMENT

SENSITIVITY: Slope of the calibration curve, i.e. the differential of the measurement as a function of the observed concentration.

French:* *SENSIBILITÉ

SIDE EFFECT: Any effect, beneficial or harmful, immediate or delayed, that is in addition to the desired effects obtained by using a product.

French:* *EFFET SECONDAIRE

SILT: see LOAM

SITE: Geographic area of limited extent, in which environmental pollution may be present as a result of former activities practiced there.

French: SITE

Industrial site: Geographic area containing an industrial activity and bounded by property limits.

Polluted site: Site presenting a real or potential long-lasting risk for human health or the environment as a result of the pollution of a given milieu, resulting from former or current human activity.

Orphan Site: (Potentially) polluted site whose owner or operator is unknown or insolvent (in particular because of the cost of work to be done for reducing or suppressing the determined risks). A site is designated 'Orphan' by decision of the Ministry of the Environment, who addresses the committee mentioned in article 22.3 of law No. 75.633 of 15 July 1975. After the decision of the committee to release funds for this site, the Prefect is authorized to demand ADEME (Agency for the environment and energy control) to conduct any studies, treatments and actions necessary for controlling the pollution in terms of its impact on human health and the environment.

SOIL: "*Upper layer of the earth's crust composed of inorganic particles, organic matter, water, air and organisms*" (International draft standard ISO/TC 190 on soil quality).

This draft standard also mentions that "*in the context of protection of the soil, attention must be paid to the superficial soil, subsoil and deeper layers, and to mineral deposits associated with groundwater. Attention must also be paid to man-made materials introduced in or on the soil, such as household or industrial waste, sludge, mud from cleaning watercourses and mining residues. These are important since they may affect certain functions of the soil and constitute a source of hazardous substances for the soil and affect natural neighbouring soils. Pedologic processes may participate spatially and temporally in these man-made materials in the same way as in natural parent rock and surface deposits*".

Pedological sense: Soil is a part of natural surface formations subjected to pedologic processes and undergoing variably important changes in its chemical composition and mineral constitution. The type of soil that will progressively form depends on: (1) the nature of the parent rock (lithological conditions), (2) the nature of attacking reagents (physicochemical conditions), (3) the value of the parameters controlling thermodynamic equilibrium (thermohydric conditions).

Hydrogeological sense: Soil is a part of the pedological and lithological formations included between the surface and the water-table (unsaturated zone), whose functions or utilization may be adversely affected as a result of the input of hazardous substances or pollutants.

French: SOL

SORPTION: Generic term including absorption, adsorption, desorption and ion exchange. Sorption is the major subsurface process affecting the fate and transport of pollutants in the environment.

French: SORPTION

SOURCE (OF POLLUTION): Generic term designating an entity (spatially delimited, focus) or a set of entities whose characteristics or effects enable them to be considered as the origin of nuisances or hazards. They are generally zones in which hazardous substances or waste have been deposited, stored or eliminated.

French: SOURCE (de pollution)

SPECIATION: Definition of the chemical form or bearer phase in which an element is present (ionic form, molecular structure, physical association, inorganic or organic support).

French: SPÉCIATION

STANDARD: Technical specification, approved by a recognized standards organization, for repeated or continuous rational application on the basis of operational techniques of the moment, but whose observation is not obligatory.

French: NORME

SUBSTANCE: see PRODUCT

SURFACE RUNOFF: Part of atmospheric precipitation (rain, snow) that flows over the surface of the ground and on slopes.

French: RUISSELLEMENT

TARGET: Physical or environmental receptor or living being (humans, fauna, flora, water, buildings, etc.) exposed to the direct or indirect effects of a hazard or subjected to a risk.

French: CIBLE

TERATOGEN: An agent likely to cause malformation during embryonic development.

French: TÉRATOGÈNE

TEST SAMPLE: Discrete part of a sample submitted for analysis.

French: PRISE D'ESSAI

THRESHOLD: Level above which a physical, chemical or biological phenomenon can cause a given effect.

French: VALEUR SEUIL

THRESHOLD LIMIT VALUE / SHORT-TERM EXPOSURE LIMIT (TLV/STEL):
Concentrations, expressed in cm^3/m^3 (ppm) and mg^3/m^3, used to protect workers from acute effects or from the effects of a momentary exposure that may ultimately be harmful (maximum exposure 15 minutes). These values are used in France to ensure the health and safety of workers against the risks of exposure to chemical agents in the workplace.

French: VALEUR LIMITE D'EXPOSITION À COURT TERME (VLE)

THRESHOLD LIMIT VALUE / TIME-WEIGHTED AVERAGE (TLV/TWA):
Concentrations, expressed in cm^3/m^3 (ppm) and mg^3/m^3, used to protect workers from a prolonged exposure (during an 8-hour shift). These values are used in France to ensure the health and safety of workers against the risks of exposure to chemical agents in the workplace.

French:* VALEUR LIMITE DE MOYENNE EXPOSITION *(VME)

TOLERABLE DAILY INTAKE (TDI): Estimation of the quantity of a substance present in food or drinking water, expressed as a function of bodyweight (mg/kg or µg/kg bodyweight), that can be ingested daily throughout one's life with no appreciable risk to health. Preferable expression from the standpoint of the WHO, since it is a permitted dose, rather than an acceptable one.

French:* DOSE JOURNALIÈRE TOLÉRABLE *(DJT)

TOLERANCE: Capacity of an organism to support (up to a certain threshold) a change in the conditions of its biotope

***French:* TOLÉRANCE**

TOPOGRAPHY: Depiction of terrain morphology on a map, i.e. a planar representation of terrestrial relief.

***French:* TOPOGRAPHIE**

TOXICITY: Property of a chemical substance introduced into an organism to cause temporary or permanent disorders of certain functions. Toxicity may result from varied phenomena:

- Cumulation of doses related to stable and remnant compounds (heavy metals, chlorinated, fluorinated pesticides, etc.);
- Combination of effects resulting from products metabolized by the organism;
- Immunoallergic toxicity resulting from the subject's own sensitivity, without any dose-effect relationship.

Toxicity is divided into *acute* (causing death or substantial physiological disorders immediately or shortly after exposure), *subacute* (effects produced on target organs due to lower doses occurring over the short term, sometimes reversible), or *chronic* (causing irreversible long-term effects by the continuous absorption of low doses of pollutants, or cumulative effects).

***French:* TOXICITÉ**

TOXICITY SCALE: Classification of the effects related to an acute toxicity via the oral, pulmonary and cutaneous routes (European Directive 67/548 of 18 September 1979).

***French:* ÉCHELLE DE TOXICITÉ**

*LD 50 oral - rat (in mg/kg): very toxic if less than or equal to 25, toxic between 25 and 200, harmful between 200 and 2000,

* LD 50 cutaneous - rat or rabbit (in mg/kg): very toxic if less than or equal to 50, toxic between 50 and 400, harmful between 400 and 2000

* LC 50 inhalation - rat (in mg/l/4 hours): very toxic if less than or equal to 0.5, toxic between 0.5 and 2, harmful between 2 and 20.

TOXICOLOGY: Science that identifies and studies substances that may be injurious to living organisms.

French: TOXICOLOGIE

USE (OF A SITE): Utilization of property, real estate or a milieu to satisfy a need, function or service.

French: USAGE (d'un site)

VECTOR: see POLLUTION VECTOR

VOLATILITY: Capacity of a substance to evaporate, generally measured by its vapour pressure.

French: VOLATILITÉ

VULNERABILITY: Capacity of a milieu, property or person to be damaged by a natural or man-made event.

French: VULNÉRABILITÉ

Groundwater vulnerability: The characteristics of an aquifer that determine the ease of access of substances considered undesirable to this reservoir and their propagation within it.

WASTE: Any residue derived from production, processing or utilization; any substance, material, product or more generally any structure that is abandoned, or which the owner wishes to abandon; any substance or object with which the owner must legally part (Law No. 75.633 of 15 July 1975). French legislation distinguishes between **inert** waste, **harmless** waste (domestic and comparable waste), and **special industrial** waste.

French: DÉCHET

WASTE LIST: Regulatory document for classifying wastes with an alphanumeric code according to their origin and category; code C followed by three digits indicates the category of the waste, while code A followed by three digits refers to the activity having generated it (Recommendation of 16 May 1985 concerning waste nomenclature).

French: NOMENCLATURE DES DÉCHETS

WASTE STUDY: Study, fixed and imposed by legislation (circular of 28 December 1990), of about 2,000 existing hazardous installations or for any new authorization request. It comprises three parts:

1) Description of the existing situation in the installation or the company (production, management and elimination of waste);
2) Technico-economic study of alternative solutions to reduce the flow and residual noxiousness of the waste;
3) Presentation and justification of the choices adopted.

French: ÉTUDE DE DÉCHETS

XENOBIOTIC: Substance with toxic properties, even when present in the milieu at very low concentrations.

French: XÉNOBIOTIQUE

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APPENDIX 3

Examples of application

A3.1. ACTIVE INDUSTRIAL SITE

Examples of objectives

For an active industrial site, the State or the operator can start a preventive evaluation from the viewpoint of protecting the environment, or the health and safety of the persons employed there. For instance:

- Ensure that the environment is not affected or that no pollution migrates beyond the site.
- Evaluate the pertinence of monitoring installations, to ensure that any past pollution does not cause risks to Man (e.g. workers not protected by the Labour Law against dangerous substances related to possible ancient contamination) and the environment, and that an alarm device be installed for the sufficiently early detection of a possible impact.
- Definition of future work to be avoided on the site, related to possible remobilization of pollutants.

Available tools

The **Preliminary Site Investigation** and **Simplified Risk Assessment guides.** Document studies should lead to the probable location of pollution sources and to the identification of the parameters to be measured. Environmental analysis should help in locating the measuring points in the transfer and exposure milieus, in particular for groundwater.

In the case of sensitive land use, e.g. agriculture, around the site, it will be necessary to evaluate the possible contamination of such neighbouring areas. Such contamination may have occurred through the settling of dust from the site, or through migration in groundwater and surface waters.

If an impact is noted, a more **In-Depth Site Investigation** and, if warranted, a **Detailed Risk Assessment** will have to be carried out. The guide describing the **Ways and Means of Site Monitoring** (being prepared) will be another useful tool.

Other possible objectives

The site operator as part of a site analysis may express other types of preoccupation, for instance financial. This may require specific studies, such as:

- respecting contractual clauses with the landowner;
- provisioning the cost of environmental liabilities;
- etc.

A3.2. CESSATION OF INDUSTRIAL ACTIVITY ON A SITE

Examples of objectives

Respect the legal obligations concerning authorized installations. When an authorized installation is closed permanently, its operator must restore the site to such a state that none of the hazards or inconveniences remains as mentioned in article 1 of the law of 19 July 1976 (article 34.1-I of the decree of 21 September 1977). The operator must write a report on the condition of the site.

Available tools

Before anything else, a ***good preliminary site investigation must be made of the site***. In the light of this evaluation and of the planned use of the site, it will be decided if ***more detailed assessment work*** will be needed.

Most of the available tools can be used, depending upon the level of residual pollution at the site as well as upon the ultimate use of this site. The tools include:

- ***guidelines for Preliminary Site Investigation and the Simplified Risk Assessment***, to determine whether or not pollution is present and, in the affirmative, to define the further studies or work;
- ***guidelines for In-Depth Site Investigation and Detailed Risk Assessment***, the various chapters of which can be used according to the choices made in terms of remediation scenarios based on the later use of the site. The applicable principles are precisely laid down in the circular of 10 December 1999, describing the principles of fixing remediation objectives;
- possibly, the setting up of ***official land-use constraints*** and of ***site-monitoring systems***, the specific guidelines for which are being finalized;
- if necessary, the inclusion or updating of the site in the Inventories.

Obviously, the use of a site should be adapted to its real situation. In some cases, simple works will lead to the elimination of further risk, without any detailed work being necessary. In other cases, the level of risk may be high because of the large size of the site or because of the type of past activities; in view of the fact that most cessation of activity is followed by either a sale of the land, or another activity, it is strongly recommended to carry out In-Depth Site Investigation work in this case. If nothing else, this provides reliable information for the future buyer or operator.

A3.3. ACCIDENTAL SPILLS
(Recent pollution)

Examples of objectives

Generally, any pollution caused by an accident (transport, process) affects a relatively limited surface. It is necessary to act quickly so that the situation will not become worse. To this end, several rapid treatments are available.

Available tools

It is essential ***rapidly to confine the polluted area*** in order to, if needed, to excavate the polluted soil and to assess the possible impact on groundwater. Available tools include:

- ***Implementation of representative measurements*** in the soil, for defining the area to be excavated. The zones where measured values are notable higher than the background values bound this area.
- ***Assessment of the hydrogeological environment*** of the site, in order to evaluate a possible contamination of the groundwater and to set up suitable counter measures (surveillance/pumping). The ***guide for Preliminary Site Investigation work*** can serve for this task.

The methodological guides already published or in preparation (see Bibliography), such as those for ***Soil Analysis*** or ***Groundwater Sampling Standards***, can be of some help in this work.

Other objectives

As soon as a pollution has become significant, it may be necessary to carry out a ***more detailed investigation***. The principles to be followed in this case are the same that apply to a Cessation of Activities, however with a ***need for speed*** to avoid a worsening of the situation.

A3.4. FORTUITOUS DISCOVERY OF POLLUTION ON A SITE (Old pollution)

Examples of objectives

Eliminate the immediate risk to the environment and the safety of people.

Available tools

Urgent measures that apply to the management of either pollution sources, or the transfer mechanisms, or the targets in question, include:

- Management of pollution sources:
  . eliminate any toxic waste present on surface, especially explosive or flammable waste;
  . excavate the soil;
  . etc.
- Management of transfer pathways:
  . monitoring and, if necessary, pumping of groundwater;
  . etc.
- Management of targets:
  . Installation of a fence and restricting access to the site;

. Evacuation of a site;

. Stopping the supply of drinking water from the site;

. Demolition of superstructures;

. etc.

This work is carried out, if necessary, through Government intervention at the expense of the responsible party when the latter has not fulfilled his legal obligations and after having instigated suitable administrative procedures against him.

The Preliminary Site Investigation guide can be a useful help in understanding the various aspects of a newly discovered site.

Other objectives

Once the urgent questions have been settled, the same prescriptions apply as for the other cases.

A3.5. POLLUTION WITH A LIMITED SURFACE EXTENSION

Examples of objectives

The problem is the same as for pollution with a larger surface extension. However, economic considerations may dictate simple remediation works, rather than long and costly studies.

Available tools

The ***Preliminary Site Investigation*** and ***Simplified Risk Assessment guides*** help in asking the correct questions for a site. In the case of a limited surface extension of the pollution, excavation of the earth (or any other technique for eliminating the pollution source or its transfer paths) is a likely technique. The Preliminary Site Investigation should help in defining the type and location of any complementary observation needed for circumscribing the area to be treated. In addition, it should help in defining the type of risk for groundwater.

The soil measurements should help in defining the area of pollution, in order to be able to set up treatment scenarios for rendering the site suitable for use. In general, this implies excavation of the soil down to a level where the measured pollutant levels are close to background level, or to a semi-generic level established for this type of pollutant in this type of milieu).

A3.6. FORMER INDUSTRIAL LAND BEING SOLD

Examples of objectives

One should make certain that the economic players dispose over all useful information at the time of the land being sold. This is necessary for them to have complete knowledge of the existence and extent of residual pollution on site, of the residual limits

that thus are linked to its use, and of any complementary studies and works to be carried out if it is decided to change the land use. The sales conditions will include all these parameters, thus ensuring the legal protection of all parties.

Available tools

All tools must be used that can help in obtaining the necessary information, as well as preserving this information for posterity and ensuring the use of the site. They include:

- the creation of regional historic inventories;
- the obligation of information under the terms of article 8.1 of the Law of 19 July 1976;
- the dissemination to all concerned parties of all past assessment results;
- any constraints upon land use;
- etc.

The economic participants have the possibility at any moment before, during, and after the sales transaction, to carry out a more precise assessment of the site.

In certain cases it is desirable that the studies or works implemented for modifying the land-use of the site be supported by a Prefectoral Order, especially when such work might create a renewed environmental impact and in particular as a legal protection of the parties involved.

A3.7. LAND POTENTIALLY AFFECTED BY POLLUTION AND ASSIGNED TO A SENSTITIVE USE

(Protected perimeter around a drinking-water w ell, agricultural use, school or other public building, etc.).

Examples of objectives

The initiative for investigations may emanate from the State, e.g. in case of agricultural use near an active industrial site, or for protecting a drinking-water well, or from other parties.

In that case, for answering the problems posed by such sensitive use one must be able to identify the tools to be used by the parties that share a responsibility related to this use:

- the vulnerability of a drinking-water-well protection perimeter in terms of historic pollution;
- the risks to children in a school constructed on a former industrial site;
- the contamination of vegetables grown in a potentially polluted area;
- etc.

Available tools

In the case of past industrial activity, the ***regional historic inventories*** help in defining the importance of the problem: type and period of the former industrial activity on the

site, and if warranted the type of the polluting substances used or discharged. The data obtained from such historic inventories will guide the type of ***Preliminary*** or ***In-Depth SiteInvestigation*** work and of the ***Detailed Risk Assessments*** to be carried out. In all cases, it is best to make the measurements at the point of exposure.

In the case of active industry, the data for the ***In-Depth Site Investigation*** must be collected by means of a ***Preliminary Site Investigation***:

- Where the interest lies in assessing the vulnerability of drinking water to a pollution source, a detailed risk evaluation of the milieu will involve measuring such pollutant levels in groundwater.
- Where the interest lies in assessing the contamination of vegetables grown on a certain soil, the historical study will help in identifying the pollutants to be measured in the crops for a Detailed Risk Assessment of human health in the case of selling this produce.
- Where the interest lies in assessing the risks run by children attending a school, it is necessary to dispose over all data needed for making a Detailed Risk Assessment for human health in the area.

These are but some examples of the need for a thorough investigation in the face of a pollution problem.

A3.8. DERELICT INDUSTRIAL LAND (Large size plots)

Several cases are possible:

The land may be sold and a direct mutation to the user is planned.

The land may be part of an urban recycling operation, i.e. an urbanization project involving several players, such as industry, landowners, developers, promoters, and municipalities.

The industrialist wishes to keep his land, but modify its use.

Examples of objectives

Develop while respecting the environment: here, optimal choices must be made concerning the destination of the site, and the techniques for managing and treating the pollution. This concerns in particular the preservation of the environment and public health, as well as public desiderata and the cost of the various scenarios. The economic impact of the final choice of site management can be substantial because of the fact that such sites often are quite large. The land use of any plots into which the site might be subdivided, can also be steered towards maximum cost effectiveness in terms of cleaning-up work versus problems encountered. Such optimization thus might result in use restrictions for certain plots.

Available tools

The tools for guiding the land use of such sites are the same that are used for the ***Preliminary Site Investigation*** and the ***Simplified Risk Assessment***. These guides in particular introduce notions such as "**Fixed Impact Value**" and "**Source/Soil Definition Value**" (see Appendix 2), which help in mapping the site thus facilitating its future management. In the case of past industrial activity, the ***regional historic inventories*** help in defining the importance of the problem presented, as they indicate the type and period of these past activities and, if warranted, the type of polluting substances that were used or discharged.

As a second step, iterative technical-economic studies are necessary for defining the optimal remediation and development scenario. At this stage, use is made of the guides for ***In-Depth Site Investigation*** and ***Detailed Risk Assessment***. The principles that apply to the setting of remediation objectives are described in the Circular of 10 December 1999. After drawing up a development scenario, the work consists of defining the possible **land-use constraints** to be set up in specific parts of the site, and of defining the treatment operations to be carried out in other parts. In view of the actual feasibility and cost of these measures, the initial scenario might have to be amended (for instance through modifying the construction plans), confirmed, or abandoned.

In the specific case of urban recycling, the project must be drawn up together with the other partners involved in it. The prerequisite for a successful changeover is that the partners should agree to equitably sharing the costs and benefits induced by this change in land use. If this is not the case, the project may well fail.

APPENDIX 4

Guideline values used for contaminated land management

A4.1. THE USE OF GUIDE VALUES FOR WATER AND SOIL POLLUTION

The values shown hereafter are the guide values adopted for the methodological guide "**Simplified Risk Assessment and Classification of Sites**". They are thus only valid for Preliminary Site Investigation and Simplified Risk Assessment work, and specifically do not represent threshold values for remediation or depollution work.

The values are given for both soil and water, and for sensitive or non-sensitive land use.

ATTENTION

It should be remembered that the guide values for both environments are only valid in the context of the abovementioned guide; this is true for the definition of soil as a pollution source and for noting the assessed impact in the correct box according to the notation principles defined for this grid. For details on the notation and use of these values, please see parts 3 and 5 of the guide.

These values can never be used for remediation objectives; for these, the values are defined through a Detailed Risk Assessment that, generally, is specific for each site and each case examined (Ministerial Circular of 10 December 1999).

A4.2. CONDUCT IN CASE NO GUIDE VALUES ARE AVAILABLE

ATTENTION

In case no guide values are available, the missing parameter must be specifically assessed, or, if thi
In case no guide values s is impossible, a conservative approach must be adopted. The specific assessment should be communicated to the Ministry of the Environment - office in charge of soil pollution - to ensure it is taken into account when monitoring the application of the method and for later updates.

In case a substance is missing from the tables in this Appendix, Fixed Impact values (FIVs) could be proposed on the basis of existing values in other countries, or they could be established from toxicological data or by chemical analogy.

The reference document for determination of the value and its field of application must be mentioned.

A4.3. GUIDE VALUES FOR WATER

Fixed Impact values for the “Water” environment are applicable to both surface waters and groundwater.

A4.3.1. Principle of establishing FIV sensitive use

Fixed Impact values (FIV $_{\text{sensitive use}}$) for water are determined from Appendix 1.1 of the Decree of 3 January 1989, concerning water destined for human consumption with the exception of natural mineral waters. When no value is mentioned in this Appendix 1.1, Appendix 1.3 of the same document is used.

The guide values for substances not mentioned on these lists were found in Directive EC 98/83 (part B, Chemical Parameters), and in the World Health Organization monograph of 1994, updated 1998, “Quality Directives for Drinking Water” – Appendix 2.

All these values are shown in the tables of Chapter 6 hereafter. Generally, they are expressed in µg/l except in specific case where they are expressed in mg/l.

Finally, if necessary, the FIVs of any not mentioned substances can be established as indicated above in Chapter 2.

A4.3.2. Principle of establishing FIV non-sensitive use

FIV $_{\text{non-sensitive use}}$ are derived from the above by multiplying by 2 for the major elements, or by 5 for trace elements. If the resulting values are less than the values in Appendix 3 of the Decree of 3 January 1989, modified (Quality limits for raw water used for the production of human drinking water), the values in Appendix 3 are chosen.

A4.4. GUIDE VALUES FOR SOIL

Two types of value are used for the soil environment:

1. Source/Soil Definition values (SSDV) help in defining the pollution source formed by a soil. Here, a value must be defined for each substance that defines the pollution source, regardless of the transfer and exposure environments adopted for the conceptual scheme of the studied site or pollution source.
2. In case the soil is an exposure environment (see Part 3, § 9.3), the Fixed Impact values (FIV) helps in assessing the impact of the pollution on this same soil environment in terms of the sensitivity of its planned use.

The values shown in the tables of Chapter 6 are expressed in mg/kg of dry matter.

A4.4.1. Fixed Impact values (FIV)

Where soil is the exposure environment, the FIV serve to assess the importance of the impact on the soil environment for a given land use (see Section 4 of Appendix 4 “Simplified Risk Assessment grids” of this report – Appendix 14 of the complete document).

For a given substance, the **FIV $_{\text{sensitive use}}$** is determined as being equal to the maximum difference between the FIV $_{\text{sensitive use}}$ for soil and the quantification limit of the corresponding analytical method.

The **FIV $_{\text{sensitive use}}$** is chosen, in order of decreasing priority, as one of the following values:

- French criteria (where they exist),
- German values for residential application,
- Dutch intervention values of May 1994 or 1998.

The **FIV $_{\text{non-sensitive use}}$** correspond to values:

- Calculated from specific scenarios, like the French and German values;
- Derived, by default, from the Dutch intervention values, multiplied by 2 for the major elements and by 5 for trace elements.

Calculation of the FIV $_{\text{non-sensitive use}}$ from specific scenarios as under 1 above can lead to unrealistic results, such as more than several per cent. In that case, the mention "**nvl**" (no value limit) is shown in the tables of Chapter 6.

For substances without FIVs, the steps in Chapter 2, above, must be taken.

The choice of FIVs must be valid so as to retain those that correspond to a situation that is closest to that of the site being studied, especially its land use.

If no FIVs are available, a conservative attitude must be adopted for the notation.

A4.4.2. Establishing French FIVs

The ***French Fixed Impact values****,* developed by the "Public Health" working group as part of the national approach to the management and remediation of polluted sites and soils, are based on studies of the toxicity of substances to human health, and of the exposure of people to such substances as part of generic scenarios. These values consider the chronic risks to public health related to the actual use of the sites. They integrate three ways of exposing the population (ingestion of home-grown fruit and vegetables, ingestion of soil or dust, and skin absorption of soil or dust), selected by the "Simplified Risk Assessment" working group, and they are defined for two types of land use:

- residential, with a vegetable garden (***sensitive use***),
- industrial (or commercial), with open-air activities, such as construction work, for half of the exposure, and industrial with office activities for the other half of exposure time (***non-sensitive use***).

A4.4.3. Use of soil FIVs

The (planned) land use of the site must be taken into account, in order to determine the most appropriate exposure scenario and, thus, the relevant FIV value to be used. Each value is associated to a specific type of use and to a specific location of the

pollution in the soil, which are the parameters that condition the exposure modes and their importance.

In view of the method retained for establishing the French Fixed Impact Values, (see general document on calculating the values), the values adopted as FIV must be compared to the average concentrations of substances in the **entire** exposure zone, and not only to a spot concentration that may be of relatively restricted influence.

FIVs should thus be only compared to the average concentrations in the area with this land use, as the exposure risks are mainly related to this land use.

A4.4.4. Source/Soil Definition Values (SSDV)

SSDVs help in defining if a soil is a a pollution source (see Part 3, 2.2.2a of the SRA grids).

For a given substance, the Source/soil Definition Value in the table of Chapter 6 is determined as being equal to half the FIV $_{\text{sensitive use}}$ value for soil. All SSDVs must, however, be higher than "x" times the local geochemical background values, if known, "x" being equal to 2 for ubiquitous substances and to 5 for the other substances, and they also should exceed the quantification limits of the suitable analytical methods.

In the absence of an SSDV for a substance, one should start by establishing the $FIV_{\text{sensitive use}}$ using the criteria of Chapter 2.

A4.5. ANALYSIS METHODS

The reference methods for analysing surface waters or groundwater are in principle those that were defined by the Ministerial Decree of 20 February 1990, concerning the reference methods for analyzing water destined for human consumption (French Hansard of 28 February 1990). If necessary, other AFNOR standards, or relevant ISO or foreign standards, can be used in order of decreasing priority.

The reference methods for soil analyses are, in order of decreasing priority, those set by AFNOR, then the ISO standards, and finally relevant foreign methods.

Analytical methods should be adapted to the magnitudes to be measured. For certain substances, the guide values are taken as equal to the **quantification** limit of the analytical method (QL). In this case, the most powerful analytical method should be considered.

A4.6. FIV AND SSDV TABLES

A MODIFIER

	SSDV	FIV soil		FIV waters	
	mg/kg MS	Sensitive use	Non-sensitive use	Sensitive use	Non-sensitive use
METALS					
Aluminium total, Al	(6)	(6)	(6)	200 (17)	1 mg/l
Antimony, Sb	50	100 (3)	250 (3)	10 (17)	50
Silver, Ag	(6)	(6)	(6)	10 (17)	50
Arsenic, As	19 (8)	37 (1) (8)	120 (1) (8)	50 (17)	250
Barium, Ba	312	625 (4)	3125	100(21)	1 mg/l(22)
Beryllium, Be	250	500 (3)	500 (3)	(6)	(6)
Cadmium, Cd	10	20 (2)	60 (2)	5 (17)	25
Chrome total, Cr	65	130 (1)	7000 (1)	50 (17)	250
Cobalt, Co	120	240 (4)	1200	(6)	(6)
Copper, Cu	95	190 (4)	950	1 mg/l (17)	2 mg/l
Manganese, Mn	(6)	(6)	(6)	50 (17)	250
Mercury, Hg	3.5	7 (1)	600 (1)	1 (17)	5
Molybdenum, Mo	100	200 (4)	1000	70 (18)	350
Nickel, Ni	70	140 (2)	900 (2)	50 (17)	250
Lead, Pb	200	400 (2)	2000 (2)	50 (17)	250
Selenium, Se	(6)	(6)	(6)	10 (17)	50
Thallium, Th	5	10 (3)	pvl (3)	(6)	(6)
Vanadium, V	280	560 (3)	pvl (3)	(6)	(6)
Zinc, Zn	4500	9000 (1)	pvl (1)	5 mg/l (17)	10 mg/l
OTHER INORGANICS					
Ammonium, NH4	(6)	(6)	(6)	500 (17)	4 mg/l(22)
Chlorides, Cl	(6)	(6)	(6)	200 mg/l (17)	400 mg/l
Cyanides (free), CN	25	50 (2)	100 (2)	50 (17)	250
Fluorides, F	(6)	(6)	(6)	1.5 mg/l (17)	3 mg/l
Nitrates, NO3	(6)	(6)	(6)	50 mg/l (17)	100 mg/l
Nitrites, NO2	(6)	(6)	(6)	100 (17)	500
Sulphates, SO4	(6)	(6)	(6)	250 mg/l (17)	500 mg/l
AROMATIC HYDROCARBONS					
Benzene	1	2.5 (1)	pvl (1)	1(20)	5
Ethylbenzene	25	50 (4)	250	300 (18)	1.5 mg/l
Styrene	50	100 (4)	500	20 (18)	100
Toluene	5	10 (3)	120 (3)	700 (18)	3.5 mg/l
Xylenes (total)	5	10 (3)	100 (3)	500 (18)	2.5 mg/l
POLYCYCLIC AROMATIC HYDROCARBONS					
HAP totaL (7)	(9)	(9)	(9)	0.2 (17)(23)	1(23)
Anthracene		pvl (1)	pvl (1)	(6)	(6)
Benzo(a)anthracene	7	13.9 (1)	252 (1)	(6)	(6)
Benzo(k)fluoranthene	450	900 (1)	2520 (1)	(6)	(6)
Chrysene	5175	10350 (1)	25200 (1)	(6)	(6)
Benzo(a)pyrene	3.5	7 (1)	25 (1)	0.01 (17)	0.05
Fluoranthene	3050	6100 (1)	pvl (1)	(6)	(6)
Indeno(1,2,3-c,d)pyrene	8	16.1 (1)	252 (1)	(6)	(6)
Naphtalene	23	46 (1)	pvl (1)	(6)	(6)
HALOGENIC AROMATIC HYDROCARBONS					
Monochlorobenzene	8	15 (3)	170 (3)	300 (18)	1.5 mg/l
1,2-Dichlorobenzene	25	50 (3)	pvl (3)	1 mg/l (18)	5 mg/l
1,3-Dichlorobenzene	25	50 (3)	pvl (3)	(6)	(6)
1,4-Dichlorobenzene	25	50 (3)	pvl (3)	300 (18)	1.5 mg/l
1,2,4-Trichlorobenzene	12	25 (3)	300 (3)	20 (18)(24)	100(24)
Hexachlorobenzene	4	8 (2)	200 (2)	1 (18)	5

The concentration units are expressed in µg/l for waters, except where mentioned otherwise (mg/l), and in mg/kg of dry matter for soils.

	SSDV	FIV soil		FIV waters	
	mg/kg MS	Sensitive use	Non-sensitive use	Sensitive use	Non-sensitive use
HALOGENATED POLYCYCLIC HYDROCARBONS					
Chloronaphtalene	5 (4)	10 (4)	50	(6)	(6)
PCDD / PCDF	500 ngTE/kg	1000 ngTE/kg (2)	10000 ngTE/kg (2)	(6)	(6)
PCB	(6) (10)	(6) (10)	(6) (10)	0.1 (17)(25)	0.5(25)
Arochlor 1016	0.05	0.1 (1)	60 (1)	(6)	(6)
Arochlor 1254	0.05	0.1 (1)	17 (1)	(6)	(6)
HALOGENATED ALIPHATIC HYDROCARBONS					
Bromoform	(6)	(6)	(6)	100(20) (29)	500 (29)
Chloroform	LQ	0.1 (3)	0.5 (3)	100(20) (29)	500 (29)
Vinyl chloride	LQ (11)	0.02 (1)	30 (1)	0.5(20)	2.5
1,2-Dichloroethane	2	4 (4)	20	3(20)	15
1,1-Dichloroethylene	(6)	(6)	(6)	30 (18)	150
1,2-Dichloroethylene (cis)	3 (1)	6 (1)	pvl (1)	50 (18)	250
Dichloromethane	LQ	0.1 (3)	2 (3)	20 (18)	100
1,2-Dichloropropane	0.5	1 (3)	5 (3)	40(19)	200
1,3-Dichloropropene	(6)	(6)	(6)	20 (18)	100
Hexachlorobutadiene	(6)	(6)	(6)	0.6 (18)	3
Tetrachloroethylene	3	6 (1)	5300 (1)	10(20)(26)	50(26)
Tetrachloromethane	0.5	1 (4)	5	2 (18)	10
1,1,1-Trichloroethane	7.5	15 (3)	180 (3)	2 mg/l (18)	10 mg/l
Trichloroethylene	0.1	0.2 (1)	3020 (1)	10(20)(26)	50(26)
PHENOLS and CHLOROPHENOLS					
Catechol	10	20 (4)	100	(6)	(6)
Chlorophenols total	5 (12)	10 (4) (12)	50	(6)	(6)
Cresols total	2	5 (4)	25	(6)	(6)
Hydroquinone	5	10 (4)	50	(6)	(6)
Pentachlorophenol	50	100 (2)	250 (2)	9 (18)	45
Phenol	25	50 (3)	pvl (3)	(6)	(6)
Resorcinol	5	10 (4)	50	(6)	(6)
2,4,6-Trichlorophenol	(6)	(6)	(6)	200 (18)	1 mg/l
Phenol index	(6)	(6)	(6)	0.5 (17)	100(22)
PESTICIDES					
Aldrine	2	4 (2)	pvl (2)	0.03 (17)	0.15
Atrazine	3	6 (4)	30	0.1 (17)	0.5
Carbaryl	2	5 (4)	25	0.1 (17)	0.5
Carbofurane	1	2 (4)	10	0.1 (17)	0.5
DDD,DDE,DDT total	2	4 (4)	20	0.1 (17)	0.5
Dieldrine	(6)	(6)	(6)	0.03 (17)	0.15
"Drines" total	2	4 (4)	20	0.1 (17)	0.5
HCH total	5	10 (2) (15)	400 (2) (15)	0.1 (17)	0.5
Heptachlore and epoxyde of heptachlore	(6)	(6)	(6)	0.03 (17)	0.15
Lindane	(6)	(6)	(6)	0.1 (17)	0.5
Manebe	17	35 (4)	175	0.1 (17)	0.5
Other pesticides, by substance	(6)	(6)	(6)	0.1 (17)	0.5
Total pesticides	(6)	(6)	(6)	0.5 (17)	2.5

The concentration units are expressed in µg/l for waters, except where mentioned otherwise (mg/l), and in mg/kg of dry matter for soils.

	DV	FIV soil		FIV waters	
	mg/kg MS	Sensitive use	Non-sensitive use	Sensitive use	Non-sensitive use
PHTHALATES					
Phthalates total	30 (13)	60 (4) (13)	300	(6)	(6)
Di(2-ethylhexyl)phtalate	(6)	(6)	(6)	8 (18)	40
ORGANIC NITROGEN COMPOUNDS					
Acrylamide	(6)	(6)	(6)	0.1(20)	0.5
Kjeldahl nitrogen	(6)	(6)	(6)	1 mg/l (17)(27)	2 mg/l
VARIOUS					
Hydrocarbons	2500 (14)	5000 (4) (14)	25000	10 (17)(28)	1 mg/l(22)(28)

The concentration units are expressed in µg/l for waters, except where mentioned otherwise (mg/l), and in mg/kg of dry matter for soils.

(1) Official French values;

(2) Official German values;

(3) Planned German values in: "*Berechnung zur Prüfwerten zur Bewertung von Altlasten*", Bundesanzeiger Nr. 161a, 28 August 1999;

(4) Dutch values 1994;

(5) Dutch values 1998;

(6) Value to be determined if the substance is present in soil or in water;

(7) Concerns the water environment;

(8) Values for pH > 7 or Eh > -250 mV;

(9) For soil, use the values by substance;

(10) Analyses to be compared as a reference to Arochlor (1016 or 1254) of a composition as close as possible to that to be defined:

Substances	France Arochlor 1016	France Arochlor 1254
MonoCB	x	
DiCB	x	
2,4,4'-TriCB	x	x
2,2',5,5'-TetraCB	x	x
2,2',4,5,5'-PentaCB	x	x
2,3',4,4',5-PentaCB		x
2,2',3,4,4',5'- HexaCB		x
2,2',3,4,4',5-HexaCB		x
2,2',4,4',5,5'-HexaCB		x
2,2',3,4,4',5,5'-HeptaCB		x

(11) QL= quantification limit

(12) If the contamination is due to a single compound of the chlorophenol group, this value is used

(13) Value applicable to the sum of phthalates present

(14) When contamination is caused by mixtures (petrol, diesel, etc.), it will also be necessary to determine the aromatic hydrocarbons and PAH contents

(15) German value applicable to the sum of □,□,□ isomers;

(16) Dutch value applicable to the sum of □,□,□,□ isomers;

(17) Decree of 3 January 1989, Appendix 1 –1;

(18) WHO guide values, Appendix 2 (1994);;

(19) WHO guide values, Appendix 2 (1998);

(20) Directive EC 98/83 (part B, Chemical parameters);

(21) Decree of 3 January 1989, Appendix 1 - 3;

(22) Decree of 3 January 1989, Appendix 3;

(23) Value for the sum of six substances: benzo(3,4)fluoranthene, benzo(11,12)fluoranthene, benzo(1,12)perylene, benzo(3,4)pyrene, fluoranthene, indeno(1,2,3-cd)pyrene (Decree of3 January 1989, Appendixes 1-1 and 1-3);

(24) Sum of trichlorobenzenes, according to (18);

(25) For each substance, according to (17);

(26) Sum of the concentrations in trichloroethylene and tetrachloroethylene, according to (20);

(27) Kjeldahl nitrogen, expressed in nitrogen (except for N of NO_3 and NO_2), according to (17);

(28) Dissolved or emulsified hydrocarbons after carbon-tetrachloride extraction, according to (17);

(29) Value applicable to the sum of trihalomethanes according to (20).

A4.7. BIBLIOGRAPHY

- French Government Decree of 3 January 1989 concerning Drinking Water for Human Consumption, except natural mineral waters.
- Directive of the European Commission N° 98/83/CE of 3 November 1998, concerning the quality of water destined for human consumption.
- WHO Quality Directives for Drinking Water – 1994 – Volume 1 (Appendix 2), Recommendations.
- WHO Quality Directives for Drinking Water – 1998 – Additions to volume 1 (Appendix 2), Recommendations.
- German Bundes Bodenschutz und Altlasten Verordnung, 12 July 1999.
- German Berechnung von Prüfwerten zur Bewertung von Altlasten – Erich Schmidt Verlag, 1999.
- Dutch Reference Guide Values of the Netherlands Ministry of Housing, Spatial Planning and Environment - Circular on intervention values for soil remediation - 9 May 1994, ref. DBO/07/49.40.13. "Intervention values" (I) and "Target values" (T) for a standard soil (10% organic matter, 25% clays).
- Dutch Circular "*Aanpassing interventiewaarden bodemsanering*", 2 July 1998

APPENDIX 5

The simplified risk assessment method

Simplified risk assessment

SITE IDENTIFICATION

Region:.....

Department: ….....……..

Site number: .....……

Site name:…….....…….

Address: .....……....

Owner/Operator:. .....……...

Situation of the site: active ❑ abandoned ❑ transformed ❑

ASSESSMENT

Assessor's name:
.....……
Organization: .....…
Assessment date:
.....…….

Stage of study:

Preliminary investigation - Phase A	❑
Preliminary investigation- Phases A-B	❑
Detailed environmental audit	❑
Other (define)	❑**:**

Number of sources identified on the site:
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1......……
2......….
3......……
4......…..
5......……
6......….
7......……
8......……

Number of the source scored: ....…….

Scored Source Typology	
Storage or deposit of	
❑ Waste	❑ Products
Type of Storage or Deposit	
❑ buried (underground)	❑ on ground
Type of source: ❑ polluted soil as a primary source ❑ polluted soil as a secondary source ❑ substance in aquifer	

DOCUMENTS CONSULTED FOR THE ASSESSMENT

1......

2......

3......

4......

5......

6......

7......

8......

MEDIA AND RISKS CHOSEN FOR SIMPLIFIED ASSESSMENT OF THE SOURCE
(check the box if the response is positive)
ENCLOSE THE CONCEPTUAL DIAGRAM OF THE SOURCE AND/OR THE SITE, AND THE SUMMARY TABLE OF POLLUTION SOURCES.

1. "GROUNDWATER" medium ❑ **Use(s) to be defined: .....**
2. "SURFACE WATER" medium ❑ **Use(s) to be defined: .....**
3. "SOIL" medium ❑

Observations/comments on the definition of the source and Media/Risks selected for the simplified assessment of the source:

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1. Potential hazard of the source

1.1. POTENTIAL HAZARD OF SUBSTANCES PRESENT IN THE PRODUCTS OR WASTE CONSTITUTING THE SOURCE (hazard scores per selected milieu or risk)

Goal of paramater scoring:

It turns out to evaluate the gravity of a potential pollution in terms of the combination o the type of pollutant and of its potential effects on health.

The hazard presented by a substance depends on both the risk level and the exposure medium.

Scoring the potential hazard of a substance is based on the risk phrases as defined in Schedule III of the Decree of 20 April 1994 concerning the declaration, classification, packaging, and labelling of substances.

Appendix 16 (French version) lists the substances subjected to these regulations with their risk phrases resulting from the application of the above-mentioned decree.

The table on p. 118 and 119 (french version), also found in Appendix 14, explains the modalities of scoring the potential hazard of a substance using its risk phrases.

Appendix 15 explains the evaluation principles that have led to the establishment of these scores, principles that assessors can implement for substances not on the list.

General principles of scoring the potential hazard of substances:

- Substance listed in Appendix 16 (french version) with risk phrases: use the table on p.118/119 to attribute corresponding hazard scores for each medium or risk included in the simplified risk assessment.

- Substance not listed in Appendix 16(french version), but subject to "labelling" regulations. The procedure is detailed in Appendix 15 (french version -see section 1.5) and summarized below. Several solutions are possible and are left open to the manager of the site to be assessed:
    1) in priority, search for risk phrases in the safety data sheets or, secondarily, in product catalogues, and then refer to the following table,
    2) search for the characteristics of the substance and the refer to sections 1.5.1 to 1.5.4 of Appendix 15 (french version) to attribute hazard scores,
    3) search for one or more analogues, i.e. substances whose structure is close to that of substances listed and such that it may be assumed that their characteristics are similar, and refer then to p. 118/119 of Appendix 15 (french version) to attribute hazard scores,
    4) as a last resort, attribute the maximum hazard score of "3", with a "?".

- Products not listed and not subjected to "labelling" regulations, thus presumed not to be hazardous: score should be "1" with an accompanying "?" (see § 3.2.3.). Nevertheless a score of 0 can be attributed if there is justification.

- Source composed of waste containing several unidentified substances (see below: Principles of scoring a source composed of a mixture of substances); in this case, the basis used may be the draft classification of waste.

Principle of scoring the potential hazard of a source:

To score the hazard potential of a source, medium by medium, two cases should be distinguished:

- the source is a substance (e.g. buried drums of styrene) or a series of substances (e.g. buried drums of styrene and of phenol),
- the source is a mixture of substances (waste, polluted soil, etc.).

- *The source is a substance or a series of substances*

If the source is a substance, it is simple to score its potential hazard for each medium. It is directly the hazard score as in table p118/119 for each medium.

If the source is a series of substances, the simplified risk assessment is conducted for each of the substances composing the source to score (see § 3.4.2); the hazard score by milieu for each substance is determined as defined above. The score of the source will be composed of the highest scores per milieu.

- ***The source is a mixture of substances:***

In this situation (polluted soil, waste, etc.), the score of potential hazard by milieu must take into account both the substances present in the mixture and the concentration of each substance in the mixture.

First select a maximum of five (5) substances present in the mixture to conduct the simplified assessment of the source. The mixture may in fact contain several different polluting substances, and so the procedure should be limited to the most intrinsically hazardous substances present in the highest concentration in the source.

A simplified risk assessment for this type of source will be done for each of the substances selected and it is the highest overall score, milieu by milieu, that will be the overall score of the source being assessed.

Taking the concentration of a substance in a mixture into consideration will result in maintaining or attenuating, for each milieu the hazard score of the "pure" substance as a function of its concentration in the source being assessed.

The table below provides the modalities for "correcting" the hazard score of the "pure" substance to account for the fact that it is at only a certain concentration in a mixture. These modalities arose from the decision of the Council dated December 22, 1994, with options to simplify or render more severe, establishing a list of hazardous waste in application of Article 1, Section 4 of Directive 91/689/EEC concerning hazardous waste.

In the case of waste without identified substances, the following scoring principles are proposed:
Inert waste = 0, domestic and similar waste = 2, hazardous waste = 3

Hazard score of the substance by milieu	Concentration of the substance in the mixture*	Hazard score to use for the substance in the mixture
3	- concentration >0.1% - concentration <0.1%	3 1.5
2	- concentration >1% - concentration <1%	2 1
1	- concentration >10% - concentration <10%	1 0.5

* The concentrations referred to are m/m.

=> *Scores attributed:*	Pure substance	Mixture	"?"if doubt
1.1.1. Groundwater	❑	❑	❑
1.1.2. Surface water	❑	❑	❑
1.1.3. Soil	❑	❑	❑

Observations/comments on the scores attributed:

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Attribution of hazard scores by media/risk based on risk phrases

CORRESPONDENCE TABLE

PHRASE CODE	PHRASE DESCRIPTION	GROUND-WATER	SURFACE WATER	SOIL
R1 (1)	Explosive when dry			
R2 (1)	Risk of explosion from shock, friction, fire or other sources of ignition			
R3 (1)	High risk of explosion from shock, friction, fire or other sources of ignition			
R4 (1)	Form of very sensitive explosive metallic compounds			
R5 (1)	Danger of explosion from the action of heat			
R6 (1)	Danger of explosion with or without contact with air			
R7 (1)	May cause a fire			
R8 (1)	Favours the inflammation of combustible materials			
R9 (1)	May explode in mixture with combustible materials			
R10 (1)	Flammable			
R11 (1)	Very flammable			
R12 (1)	Extremely flammable			
R13 (1)	Extremely flammable liquefied gas			
R14 (1)	Reacts violently in contact with water			
R15 (1)	Releases highly flammable gases in contact with water			
R16 (1)	May explode when mixed with combustible materials			
R17 (1)	Spontaneously flammable in air			
R18 (1)	Possible formation of a flammable/explosive vapour/air mixture during use			
R19 (1)	May form explosive peroxides			
R20 (2)	Harmful through inhalation	1	1	
R21 (2)	Harmful through contact with the skin	1	1	1
R22 (2)	Harmful through ingestion	1	1	1
R23 (2)	Toxic through inhalation	2	2	
R24 (2)	Toxic through contact with the skin	2	2	2
R25 (2)	Toxic through ingestion	2	2	2
R26 (2)	Very toxic through inhalation	3	3	
R27 (2)	Very toxic through contact with the skin	3	3	3
R28 (2)	Very toxic through ingestion	3	3	3
R29 (1)	Releases toxic gases in contact with water			
R30(1)	Can become flammable during use			
R31 (1)	Releases a toxic gas in contact with acids			
R32 (1)	Releases a very toxic gas in contact with acids			
R33 (1)	Hazard of cumulated effects	2	2	2
R34 (1)	Causes burns			2
R35 (1)	Causes severe burns			3
R36 (2)	Irritant for the eyes	1	1	1
R37 (2)	Irritant for the respiratory tract	1	1	
R38 (2)	Irritant for the skin	1	1	1

PHRASE CODE	PHRASE DESCRIPTION	GROUND-WATER	SURFACE WATER	SOIL
R39 (2)	Danger of very serious irreversible effects	3	3	3
R40 (2)	Possibility of irreversible effects	2	2	2
R41 (2)	Risks of serious eye lesions	2	2	2
R42 (2)	May cause sensitization by inhalation	2	2	
R43 (2)	May cause sensitization by contact with the skin	2	2	2
R44	Risk of explosion if heated in a confined space			
R45 (2)	May cause cancer	3	3	3
R46 (2)	May cause hereditary genetic alterations	3	3	3
R47	May cause congenital malformations *(Suppressed)*			
R48 (2,3)	Risks of serious effects on health in case of prolonged exposure	2/3	2/3	2/3
R49	May cause cancer by inhalation			
R50 (4)	Very toxic for aquatic organisms			
R51 (4)	Toxic for aquatic organisms			
R52 (4)	Harmful for aquatic organisms			
R53 (4)	May cause long-term harmful effects for the aquatic milieu			
R54 (4)	Toxic for flora			
R55 (4)	Toxic for fauna			
R56 (4)	Toxic for soil organisms			
R57 (4)	Toxic for bees			
R58 (4)	May cause long-term harmful effects for the milieu			
R59 (4)	Hazardous for the ozone layer			
R60 (2)	May adversely affect fertility	3	3	3
R61 (2)	Risk of harm to the baby during pregnancy	3	3	3
R62 (2)	Risk of adversely affecting fertility	2	2	2
R63 (2)	Possible risk of harm to the baby during pregnancy	2	2	2
R64 (2)	Possible risk for babies being breast fed	2	2	2
R65	May cause lung damage in case of ingestion			
R66 (2)	Repeated exposure can cause dry and chapped skin			
R67	Vapour inhalation can cause sleepiness and vertigo			

(1) Phrase codes related to fire and explosion are not taken into account at this stage of the evaluation (Simplified Risk Assessment).

(2) The score must be attributed for suitable Media and exposure modes, chosen in the conceptual diagram of the site, provided the substance is present or that it is reasonable to suspect its presence in the milieu(s) chosen.

(3) Is never mentioned alone on labels. When risk phrase R48 is combined with phrases R20, R21, R22, the score should be 2.
When it is combined with R23, R24, R25, the score should be 3.

(4) Phrases concerning only the milieu (fauna and flora) and not considered in the simplified risk assessment.

1.2. ESTIMATED QUANTITY OF THE SOURCE

Objective of parameter scoring:

This takes into account the quantitative importance of the source.

A simplifying option has been selected: the estimated total quantity of the source is scored once whatever media are considered or retained.

Scoring modalities are based on quantifiable parameter that appears to be the most relevant, depending on the type of source: source composed of one or several substances (e.g. deposit of buried drums) or a source composed of a mixture of substances, (e.g. waste deposit, polluted soil).

When it is a mixture (waste, diverse products, polluted soil, etc.), the mixture composing the source is quantified, but not the substances of the mixture, that were selected for assessing potential hazard of the source.

In the case of polluted soil, the area involved by the pollution will be quantify and assess the amount of source.

=> *Scoring modalities*

1) if the source is a substance

Volume in m^3	Weight in tons	Score
<10	<10	1
10 to 100	10 to 100	2
>100	>100	3

2) if the source is a mixture of substances (waste, diverse products, polluted soil, etc.)

Volume in m^3	Weight in tons	Area in hectares	Score
<10,000	<10,000	<1	1
10,000 to 100,000	10,000 to 100,000	1 to 10	2
>100,000	>100,000	>10	3

=> Scores attributed *"?" if doubt*

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Observations/comments on the score attributed:

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2. Mobilization and transfer potential of the polluting substances

2.1. MOBILIZATION POTENTIAL FROM SOURCE TO MILIEU

The mobilization potential of substances is expressed both by the characteristics of the products or source (volatility, solubility, powderiness and physical state of the source), and by the existence and intensity of mobilization vectors (rainfall and floods).

2.1.1. Mobility of polluting substances present in the source

Objective of parameter scoring:

The potential for emission of polluting substances towards a medium can be represented in a simplified manner by : the solubility or dissolution potential in water, regardless of its original physical state

Appendix 15 (french version) sets out the evaluation principles that have led to the establishment of these scores. Assessors may apply the same principles to substances not in lists. The information in Appendix 15 (french version) is used to attribute mobility scores.

If the mobility characteristics of a substance are poorly known, a search for "analogue(s)" with similar structure is recommended. As a last resort, the maximum mobility score of "3" is applied (accompanied by a "?") as a principle of precaution.

When the source is composed of different substances or of a mixture de substances, the mobility score (volatility or solubility) of the source is that of the substance selected for scoring the potential hazard of the source (parameter 1.1).

⇨ *Modalities of scoring the solubility:*

Solubility in water (mg/l)	Score
<0.01: not or poorly soluble	0
0.001 to 1: poorly soluble	1
1 to 1,000: soluble	2
≥1,000: very soluble	3

=> Scores attributed "?" if doubt

2.1.1. Solubility (Water media) ❑ ❑

Observations/comments on the score attributed:

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2.1.2. Physical state of the source

Objective of parameter scoring:

The physical state of the source is an important factor in the mobilization potential: if a solid product is soluble, it can migrate into the soil and towards the aquifer only with the assistance of a transfer vector (rainfall or flooding), while a liquid product can migrate without a transfer vector.

Scoring of the physical state is highly simplified:
- This is the physical state of the source that is scored, not the physical state of the substances present in the source,
- it is assumed that a solid source presents less risks of mobilization (score 1) than a sludge source (score 2), or, in particular a liquid source (score 3).

A source composed of polluted soil is considered as in the solid state, and is scored as such.

=> Scoring modalities

Physical state	Score
Solid	1
Sludge	2
Liquid	3

=> Scores attributed ❑ *"?" if doubt* ❑

Observations/comments on the score attributed:

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2.1.3. Annual precipitation

Objective of parameter scoring:

Precipitation is a transfer vector for soluble products to soil, surface water and groundwater, and a dispersion vector for insoluble products (fine solid particles). It is thus important to take this factor into account.

Adopting the principle of simplicity, precipitation is considered only as an annual amount (rainfall in mm/year). These data are readily accessible from the national meteorology service.

If possible, the mean over a decade or even three decades should be used, rather than the uncorrected annual rainfall from the year preceding the simplified risk assessment.

=> *Scoring modalities*

Precipitation in mm/year	Score
≤1,000	1
1,001 to 1,600	2
≥1,601	3

=> Scores attributed ❑ *"?" if doubt* ❑

Observations/comments on the score attributed:

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2.1.4. Flooding potential

Objective of parameter scoring:

As with rainfall, flooding from the overflow of watercourses is a transfer vector ofsoluble products and a dispersion vector of more or less insoluble products (fine solid particles). Flooding from a phreatic high is not considered here, as it is accounted for determining the thickness of the unsaturated zone.

The scoring of this item is based on whether or not the site is in a floodable area (if possible using the known flooding frequency), the reference being maps published by the Ministry of the Environment (natural risk maps), supplemented by data obtained locally from the DIREN and other State Services responsible for surface water.

If data on the flooding frequency is unavailable, the principle of precaution is applied.

=> *Scoring modalities: the references are maps published by the Ministry of the Environment (natural risk maps) and locally available information:*

Observed flooding frequency	Score
Annual	3
Decennial	2
Centennial	1
Non-floodable area	0

=> Scores attributed ❑ *"?" if doubt* ❑

Observations/comments on the score attributed:

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2.1.5. Packaging of the pollutants (with respect to the media)

Objective of parameter scoring:

The isolation of the source, in particular its packaging, delays, limits, or even prevents the possibility of pollutant mobilization and thus of transfer to the Media (air, soil, water).

The risk for different Media will be much higher for a source composed of a deposit of mixed bulk substances, than for a source composed of substances packaged in drums in good condition, even buried.

=> Scoring modalities

Packaging	Score
Bulk products, polluted soil, or containers in poor condition (obvious leaks, non-existent or damaged lids or covers, etc.)	3
Containers in a doubtful condition (advanced corrosion, oozing, etc.)	2
Containers in good condition, but unprotected against shocks or any other external aggression	1
Containers in good condition and protected against shocks or any other external aggression	0

=> Scores attributed *"?" if doubt*

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Observations/comments on the score attributed:

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2.1.6. Containment of the source or deposit (with respect to the media)

Objective of parameter scoring:

The containment of a source is any artificial barrier or structure, such as a building, retention basin, watertight surface, hydraulic trap at or near the source, etc., erected at the level of the source in order to reduce or prevente the penetration of pollutants into the soil, groundwater, or surface water.

This protection may be good, with or without monitoring of its effectiveness, or poor or doubtful, explaining the four scoring levels as a function of the "quality" of the containment constituted by the barrier.

The same containment does not automatically have the same "braking" or "delaying" effects on the transfer of pollutants for all Media, explaining why the containment system is scored according to the different Media studied.

The effect of a containment structure for a source is thus assessed medium by medium. Special attention should be paid to the correct evaluation of surface containments that can also limit infiltrations of rainwater and thus limit leaching.

=> Scoring modalities:

Confinement	Score
Good protection with provisions or devices for monitoring its behaviour and efficacy over time	0
Good or moderate protection with monitoring of efficacy	1
Moderate protection	2
Poor protection	3

Physicochemical containment by coating or insolubilization of the substances composing the source, is comparable to "Good protection" and is scored 0 or 1 depending on whether or not there are provisions or devices for monitoring.

	=> Scores attributed	*"?" if doubt*
2.1.6.1. Groundwater	❑	❑
2.1.6.2. Surface water	❑	❑
2.1.6.3. Soil	❑	❑

Observations/comments on the score attributed:

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2.1.7. Runoff potential

Objective of parameter scoring:

This item is taken into account for the assessment of the "surface water" medium only.

Transfer of pollutants from the source towards surface water can be characterized in a simplified manner from runoff and potential distance from the source to the surface water.

Runoff is assessed globally from the slope and existence of preferential flow pathways (sewage or drainage systems, ditches, conduits, etc.) direct related to surface water. The possible impermeabilization of the area between the source and the identified surface water should be considered as an aggravating factor (if surface sources are considered).

In the case where the connection between aquifer and river is the only migration pathway for pollutants to surface waters (no runoff), this connection will be considered as a preferential flow path.

=> *Scoring modalities*

Runoff criterion	Score for Surface source *	Score for Buried source
Preferential flow pathways (system, ditch, etc.) close to the source or connection between aquifer and river	3	1
Steep slope (>5%)	2	1
Moderate slope (1 to 5%)	1	0
Shallow slope (<1%) or flat ground	0	0

* Do not forget the possible impermeabilization of the surface (for surface sources, increase the proposed score by one point, with a maximum score of 3)

=> Scores attributed *"?" if doubt*

❑ ❑

Observations/comments on the score attributed:

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2.2. TRANSFER POTENTIAL WITHIN THE MILIEU TOWARDS THE TARGET

2.2.1. Proximity of the groundwater or thickness of the unsaturated zone (at phreatic highs)

Objective of parameter scoring:

For sources at the surface or considered as sources at the surface (e.g. polluted soil), the thickness of the unsaturated zone corresponds to the vertical distance that the polluting substances of the source must travel before reaching groundwater.

For sources composed of waste landfills or diverse buried products, the proximity to groundwater is defined as the distance between the low point of the deposit and the water table.

Proximity of groundwater is determined with reference to its "phreatic high" (highest water level recorded since the groundwater was monitored under identical general hydraulic conditions as the study sector). This parameter should be calculated for the different aquifers considered to exist under the site.

If, in the conceptual design, it is determined that there is no groundwater under the site used for drinking water supplies or for other uses, there will be no scoring.

If there are two superposed aquifers under the site and they communicate, proximity of groundwater is taken with respect to the first aquifer considered. In the case of confined groundwater, the depth considered will be that of the top of the aquifer formation.

=> Scoring modalities

The first aquifers used for drinking water supplies or for other uses are the ones taken for scoring and not the first aquifer physically encountered under the site.

Groundwater proximity or thickness of the unsaturated zone	Score
>10 m	1
4 to 10 m	2
≤4 m	3

=> Scores attributed "?" if doubt

2.2.1.1. Groundwater used for drinking water supply ❑ ❑

2.2.1.2. Groundwater used for purposes other than drinking water ❑ ❑

2.2.1.3. Groundwater considered by SAGE as future water resource ❑ ❑

Observations/comments on the score attributed:

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2.2.2. Permeability of the unsaturated zone

Objective of parameter scoring:

This item involves scoring the potential for vertical migration (or vertical transfer rate) of pollutants from the source towards the groundwater considered for the different existing uses. The distinction among uses may enable different superimposed aquifers to be scored separately.

Two precision levels for scoring are possible, depending on the available information. The proposed order of relevance is the decreasing order of precision (permeability, lithology), lithology being the least precise but most easily accessible information. In the case of deep aquifers, attention should be paid to defining the permeability of the cover, in particular via the concept of equivalent permeability ($H/K = h_1/k_1 + h_2/k_2 + ... + h_n/k_n$).

=> Scoring modalities: the principle is scoring the vertical migration potential of pollutants towards the tapped groundwater.

The order of relevance of information used for scoring is: permeability of the unsaturated zone then, if this information is unavailable, lithology.

Score	Permeability of the unsaturated zone m/s	Lithology
3	$>10^{-4}$	Karst, Pebbles, gravel, coarse and medium sand
2	10^{-4} to 10^{-8}	Fine to silty sand, silt, sand and clay (non karstified)
1	$< 10^{-8}$	Loam, clayey silt, and clay

=> Scores attributed "?" if doubt

2.2.2.1. For groundwater used for drinking water supply ❑ ❑

2.2.2.2. For groundwater used for purposes other than drinking water ❑ ❑

2.2.2.3. For groundwater considered by SAGE as future water resource ❑ ❑

Observations/comments on the score attributed:

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2.2.3. Permeability of the aquifer or transfer rate

Objective of parameter scoring:

This item involves scoring the potential for horizontal migration (or horizontal transfer rate) of pollutants in the groundwater considered (supposing that the pollutants have reached the groundwater).

Three precision levels for scoring are possible depending on the available information. The proposed order of relevance is the decreasing order of precision, lithology being the least precise but most easily accessible information.

=> Scoring modalities: the principle is scoring the horizontal migration potential of pollutants within the tapped groundwater.

The order of relevance of information used for scoring is: horizontal transfer rate, permeability of the saturated zone followed, if the above two pieces of information are unavailable, by lithology.

Score	Permeability of the aquifer m/s	Transfer rate	Lithology
3	> 10^{-4}	> 5 m/d	Karst, Fissured milieu (chalk, granite, etc.) coarse alluvium, pebbles, coarse and medium gravel
2	10^{-4} to 10^{-7}	1 to 5 m/d	Coarse sand and gravel
1	$<10^{-7}$	< 1 m/d	Fine and very fine sand, clayey sand, non-fissured limestone

=> Scores attributed *"?" if doubt*

2.2.3.1. For groundwater used for drinking water supply ❑ ❑

2.2.3.2. For groundwater used for purposes other than drinking water ❑ ❑

2.2.3.3. For groundwater considered by SAGE as future water resource ❑ ❑

Observations/comments on the score attributed:

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3. Target

3.1. ACCESS TO THE SOURCE

Objective of scoring the parameter:

Ingestion or contact with the polluting substances presupposes an access to the source of pollution. This access in turn depends on the access conditions to the site and the conditions of access to the source itself (packaging, containment, special enclosures) already mentioned elsewhere.

Enclosure and surveillance are the two parameters characterizing access that have been selected for scoring. In general, access to the site will be scored. When a site is neither enclosed nor monitored, access to the source can be considered in particular if the source is surrounded by a special enclosure.

Similarly, in the case of an enclosed and monitored site, it should be verified that the source is similarly protected.

=> Scoring modalities

The principle is to score accessibility to the site and not accessibility to the source(s), which is scored elsewhere (packaging and containment) except, for example, if the site is not enclosed, but the source(s) (waste deposits, zone of polluted soil, etc.) is(are) equipped with a special enclosure.

Site accessibility	Score
Site/Source enclosed and monitored	0
Site/Source not enclosed or enclosure in poor state, but monitored	1
Site/Source enclosed, not monitored	2
Site/Source not enclosed or enclosure in poor state and not monitored	3

=> Scores attributed *"?" if doubt*

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Observations/comments on the score attributed:

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3.2. PRESENCE OF A POPULATION ON THE SITE/ON THE SOURCE

Object of parameter scoring:

When a site is occupied, target sensitivity should be determined in terms of the number of individuals who may be regularly or occasionally present on the site.

Occupation of a site must be taken as meaning (and be taken into account) as resulting from a normal situation in the legal sense of the term. Illegal intrusion of individuals on the site is not considered as a normal situation.

In the case of active sites (subjected to monitoring), presence on the considered source of pollution should be taken into account.

=> Scoring modalities

Presence	Score
No individual	0
Occasional or regular presence of fewer than 50 individuals	1
Occasional or regular presence of fewer than 250 individuals	2
Occasional or regular presence of more than 250 individuals	3

=> Scores attributed ❑ *"?" if doubt* ❑

Observations/comments on the score attributed:

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3.3. TYPE OF POPULATION PRESENT ON THE SITE/ON THE SOURCE

Object of parameter scoring:

The object of this parameter is to consider the type of population, regularly or occasionally present on the site in terms of sensitivity towards the risk of exposure to a pollution.
On a site still in activity, exposed population may be regarded as informed if source hazard results from normal activity of the site. In other case, this population should be considered as non informed.

=>Scoring modalities

Type of presence	Score
Informed workers	1
Adult, uninformed population	2
Sensitive populations (children, the elderly, etc.)	3

=> Scores attributed ❑ *"?" if doubt* ❑

Observations/comments on the score attributed:

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3.4. PROXIMITY OF THE CLOSEST GROUNDWATER/DRINKING-WATER CATCHWORK

Object of parameter scoring:

If there is groundwater used for drinking-water supply under the site, or in its zone of probable or possible impact (see preliminary investigation – study of potential targets), the distance considered is that from the site to the closest catchworks.

Two situations are distinguished according to the position of the catchworks with reference to the direction of aquifer flow (general direction of flow, or local if more precise information exists):
- catchwork is downstream from the site,
- catchwork is upstream (or lateral) from the site.

There will thus be simultaneous scoring of the closest catchwork downstream from the site, and that upstream (or lateral) from the site: the score attributed to the item will be the higher of the two thus obtained.

Scoring modalities:

the distance taken into account is that to the closest upstream or lateral catchwork from the site and that to the closest downstream catchwork: the higher of the two scores is used.

Distance	Score for upstream or lateral catchwork	Score for downstream catchwork
≤300 m	1.5	3
301 to 1,000 m	1	2
1,001 to 5,000 m	0.5	1
>5,000 m	0	0

=> Scores attributed ❑ *"?" if doubt* ❑

Observations/comments on the score attributed:

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3.5. DISTANCE TO CLOSEST SURFACE WATER (used for drinking-water supply or considered by SAGE as a future drinking-water resource)

Object of parameter scoring:

This involves scoring the distance from the source on the site to the closest watercourse if, downstream from the site, it has a drinking water supply catchwork, or if the surface water is considered as a future drinking-water resource in the context of SAGE.

If there is communication between the groundwater under the site and the surface water used as a drinking-water supply, the parameter to score may be the distance between the source and the surface water supply along the direction of groundwater flow. In this case, basic scoring is accompanied by a "?".

Scoring modalities:

The only factor used for scoring is the closest surface water with a drinking-water supply catchwork downstream from the site or if it is considered as future drinking-water resource.

Distance	Score
≤50 m	3
51 to 300 m	2
301 to 1,000 m	1
>1,000 m	0

=> Scores attributed "?" if doubt

3.5.1. For surface water used as a drinking water supply ❑ ❑

3.5.2. For surface water considered by SAGE as future water resource ❑ ❑

Observations/comments on the score attributed:

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3.6. DRINKING-WATER SUPPLY - POPULATION CONCERNED

Objective of parameter scoring:

If surface water downstream from the site or groundwater are used as a drinking-water supply, the size of the population concerned by this supply should be determined. This is the object of this item.

The population thresholds set for this scoring have been adopted somewhat arbitrarily and may be changed as experience accumulates,

The parameter will be scored with reference to the drinking water supply catchworks previously considered as relevant targets.

=> Scoring modalities

Number of individuals	Score
≤1,000	1
1,001 to 30,000	2
>30,001	3

	=> Scores attributed	*"?" if doubt*
3.6.1. Supply from groundwater	❑	❑
3.6.2. Supply from surface water	❑	❑

Observations/comments on the score attributed:

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3.7. OTHER USES OF WATER

Objective of parameter scoring:

The objective is to consider the possible uses of ground- and surface water other than as a drinking-water supply (see preliminary investigation - study of potential targets). Certain uses, such as recreation or use in agribusiness can be considered as "direct exposures" of the principal privileged target of the simplified risk assessment, i.e. humans.

The parameters scored under this item are:
- the distance from the site to the catchwork or usage, according to the same modalities as item 3.6,
- the type of water use.

It should be remembered that groundwater is considered only if there is a risk of pollution of these waters by the source(s) of the site in question, i.e. if the tapped groundwater is in the zone of probable or possible impact of the site.

If there are several uses for a milieu, the scores corresponding to the most sensitive use will be used.

In the case of a connection between the aquifer below the site and surface water from which water is abstracted for uses other than drinking water, the parameter to be considered could be the distance between source and surface water, following the flow direction in the aquifer, **if the connection between river and aquifer is the only possible transfer path for pollutants between these two milieus** (no runoff or overflow).

=> *Scoring modalities*

a) Proximity to usage or catchwork

Distance	Score for upstream or lateral catchwork	Score for downstream catchwork
≤300 m	1.5	3
301 to 1,000 m	1	2
1,001 to 5,000 m	0.5	1
>5,000 m	0	0

b) Water use

Use	Score
Recreational activities	3
Husbandry, irrigation, agribusiness	3
Industry	1
Other	0

=> Scores attributed "?" if doubt

3.7.1. From groundwater

a) Proximity of use or catchwork ❑ ❑

3.7.2. From surface water

a) Proximity of use or catchwork downstream from the site ❑ ❑

b) Water use ❑ ❑

Observations/comments on the score attributed:

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Score of the impact

Objective of parameter scoring:

At this stage the impact on- or off-site is scored on the basis of objective data, i.e. primarily the results of analyses and measurements.

Impact is determined with respect to three media: groundwater, surface water and soil.

In most cases, it is considered that an impact has been determined when:

- the concentrations of substances measured downstream and at the site are higher than the concentrations measured upstream from the site (beyond the influence of the site),
- and the upstream-downstream or upstream-on site difference is significant (at least +50%), without the concentration downstream or on-site obligatorily being higher than the impact determination values defined in appendix 5 (french version) or appendix 4 (this document).
- and the observed difference is clearly imputable to the site.

One of the difficulties that may arise when assessing a complex site is scoring, source by source, the impact that may be determined. The determined impact of a complex site on a media is not always imputable to a well-identifiable source on the site, in particular when polluting substances are common to several sources of the same site.

In practice, if an impact is determined and is unambiguously attributable to an identified source of a complex site, only the assessment of this source will consider the determined impact. In the opposite case, i.e. determination of an impact for a multisource site, without being able to attribute the impact to one source rather than another, each source susceptible to be "responsible" will be assessed, with the determined impact as if it were the "only" source responsible for this impact.

The degree of impact will be determined in relation to the impact determination values defined in the following table.

Media	Sensitive use	Non sensitive use
Groundwater	Concentrations in the decree of January 3, 1989 (Appendix 1.1) or WHO recommendations	2 or 5 times these concentrations, depending on the substances
Surface water	Concentrations in the decree of January 3, 1989 (Appendix 1.3)	2 or 5 times these concentrations depending on the substances
Soil	Residential scenario criteria (with or without vegetable garden)	Industrial scenario criteria (offices or exterior) depending on the case

See Appendix 5 (french version) or Appendix 4 (this document) for detailed source of information.

=> Scoring modalities for water media:

Site of impact measurement	Significant impact, but lower than criteria adopted	Significant impact and higher than criteria adopted
Off-site, downstream	2	3
On-site, downstream	1	2
Not suspected and not detected	0	0

=> Scoring modalities for Soil media:

Site of impact measurement	Significant impact, but lower than criteria adopted	Significant impact and higher than criteria adopted
Detected	1	3
Not Detected	0	0

=> Scores attributed "?" if doubt

4.1. GROUNDWATER:

4.1.1. Drinking water supply ❑ ❑
4.1.2. Uses other than drinking water supply ❑ ❑
4.1.3. Future drinking water resource (SAGE) ❑ ❑

4.2. SURFACE WATER:

4.2.1. Drinking water supply ❑ ❑
4.2.2. Uses other than drinking water supply ❑ ❑
4.2.3. Future drinking water resource (SAGE) ❑ ❑

4.3. SOIL ❑ ❑

Observations/comments on the score attributed:

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Simplified risk assessment

Synthesis scores for classification

1. Groundwater

1.1. USED FOR DRINKING WATER SUPPLY

Parameters chosen for the calculation (assessment grid references)	Score attributed to each parameter	
		"?" if doubt
1.1.1. Potential hazard - groundwater	❑	❑
1.2. Estimated quantity of substances	❑	❑
2.1.1. Mobility of substances - solubility	❑	❑
2.1.2. Physical state of the source	❑	❑
2.1.3. Annual precipitation	❑	❑
2.1.4. Flooding potential	❑	❑
2.1.5. Packaging of the pollutants	❑	❑
2.1.6.1. Source containment - Groundwater	❑	❑
2.2.1.1. Proximity of the groundwater	❑	❑
2.2.2.1. Permeability of the unsaturated zone	❑	❑
2.2.3.1. Permeability of the aquifer	❑	❑
3.4. Proximity of the closest catchwork	❑	❑
3.6.1. Population concerned	❑	❑
4.1.1. Determined impact - groundwater (drinking-water supply)	❑	❑

Calculation of the synthesis score:

3 x (1.1.1) x (1.2)
+ (2.1.1) x (2.1.2)
+ (2.1.3) + (2.1.4) + (2.1.5) + (2.1.6.1)
+ 2 x (2.2.1.1) x (2.2.2.1)
+ (2.2.3.1) x (3.4)
+ 6 x (3.6.1)
+ 6 x (4.1.1)

= > Score:_____
(Max.: 111)

1. Groundwater

1.2. USES OTHER THAN DRINKING-WATER SUPPLY

Parameters chosen for the calculation (assessment grid references)		Score attributed to each parameter	
			"?" if doubt
1.1.1.	Potential hazard - groundwater	❑	❑
1.2.	Estimated quantity of substances	❑	❑
2.1.1.	Mobility of substances - solubility	❑	❑
2.1.2.	Physical state of the source	❑	❑
2.1.3.	Annual precipitation	❑	❑
2.1.4.	Flooding potential	❑	❑
2.1.5.	Packaging of the pollutants	❑	❑
2.1.6.1.	Source containment - groundwater	❑	❑
2.2.1.2.	Proximity of the groundwater	❑	❑
2.2.2.2.	Permeability of the unsaturated zone	❑	❑
2.2.3.2.	Permeability of the aquifer	❑	❑
3.7.1.a.	Proximity of use or catchwork	❑	❑
3.7.1.b.	Water use	❑	❑
4.1.2.	Determined impact - groundwater (other uses)	❑	❑

Calculation of the synthesis score:

3 x (1.1.1) x (1.2)
+ (2.1.1) x (2.1.2)
+ (2.1.3) + (2.1.4) + (2.1.5) + (2.1.6.2)
+ 2 x (2.2.1.2) x (2.2.2.2)
+ (2.2.3.2) x (3.7.1.a.)
+ 6 x (3.7.1.b)
+ 6 x (4.1.2)

=> Score:_____
(Max. = 111)

1. Groundwater

1.3. NOT USED FOR DRINKING WATER, BUT RESERVED FOR THIS USE (SAGE, SDAGE, etc.)

Parameters chosen for the calculation (assessment grid references)		Score attributed to each parameter	
			"?" if doubt
1.1.1.	Potential hazard - groundwater	❑	❑
1.2.	Estimated quantity of substances	❑	❑
2.1.1.	Mobility of substances - solubility	❑	❑
2.1.2.	Physical state of the source	❑	❑
2.1.3.	Annual precipitation	❑	❑
2.1.4.	Flooding potential	❑	❑
2.1.5.	Packaging of the pollutants	❑	❑
2.1.6.1.	Source containment - groundwater	❑	❑
2.2.1.3.	Proximity of the groundwater	❑	❑
2.2.2.3.	Permeability of the unsaturated zone	❑	❑
2.2.3.3.	Permeability of the aquifer	❑	❑
4.1.3.	Determined impact - groundwater (SAGE)	❑	❑

Calculation of the synthesis score:

3 x (1.1.1) x (1.2)
+ (2.1.1) x (2.1.2)
+ (2.1.3) + (2.1.4) + (2.1.5) + (2.1.6.1)
+ (2.2.1.3) x (2.2.2.3) x (2.2.3.3)
+ 9 x (4.1.3)

= > Score:_____
(Max.: 102)

2. Surface water

2.1. USED FOR DRINKING-WATER SUPPLY

Parameters chosen for the calculation (assessment grid references)		Score attributed to each parameter	
			"?" if doubt
1.1.2.	Potential hazard - surface water	❑	❑
1.2.	Estimated quantity of substances	❑	❑
2.1.1.	Mobility of substances - solubility	❑	❑
2.1.2.	Physical state of the source	❑	❑
2.1.3.	Annual precipitation	❑	❑
2.1.4.	Flooding potential	❑	❑
2.1.5.	Packaging of the pollutants	❑	❑
2.1.6.2.	Source containment - Surface water	❑	❑
2.1.7.	Runoff potential	❑	❑
3.5.1.	Distance to the closest surface water	❑	❑
3.6.2.	Population concerned	❑	❑
4.2.1.	Determined impact - surface water (drinking-water supply)	❑	❑

Calculation of the synthesis score:

3 x (1.1.2) x (1.2)
+ (2.1.1) x (2.1.2)
+ (2.1.3) + (2.1.4) + (2.1.5) + (2.1.6.2)
+ 2 x (2.1.7) x (3.5.1)
+ 6 x (3.6.2)
+ 6 x (4.2.1)

= > Score:_____
(Max. = 102)

2. Surface water

2.2. USES OTHER THAN DRINKING-WATER SUPPLY

Parameters chosen for the calculation (assessment grid references)		Score attributed to each parameter	
			"?" if doubt
1.1.2.	Potential hazard - surface water	❑	❑
1.2.	Estimated quantity of substances	❑	❑
2.1.1.	Mobility of substances - solubility	❑	❑
2.1.2.	Physical state of the source	❑	❑
2.1.3.	Annual precipitation	❑	❑
2.1.4.	Flooding potential	❑	❑
2.1.5.	Packaging of the pollutants	❑	❑
2.1.6.2.	Source containment - Surface water	❑	❑
2.1.7.	Runoff potential	❑	❑
3.7.2.a.	Proximity to use or catchwork	❑	❑
3.7.2.b.	Water use	❑	❑
4.2.2.	Determined impact - surface water (other uses)	❑	❑

Calculation of the synthesis score:

3 x (1.1.2) x (1.2)
+ (2.1.1) x (2.1.2)
+ (2.1.3) + (2.1.4) + (2.1.5) + (2.1.6.2)
+ 2 x (2.1.7) x (3.7.2.a)
+ 6 x (3.7.2.b)
+ 6 x (4.2.2)

= > Score:_____
(Max. = 102)

2. Surface water

2.3. NOT USED AS DRINKING-WATER SUPPLY, BUT TO BE PRESERVED FOR THIS USE (SAGE, SDAGE,..)

Parameters chosen for the calculation (assessment grid references)		Score attributed to each parameter	
			"?" if doubt
1.1.2.	Potential hazard - surface water	❑	❑
1.2.	Estimated quantity of substances	❑	❑
2.1.1.	Mobility of substances - solubility	❑	❑
2.1.2.	Physical state of the source	❑	❑
2.1.3.	Annual precipitation	❑	❑
2.1.4.	Flooding potential	❑	❑
2.1.5.	Packaging of the pollutants	❑	❑
2.1.6.2.	Source containment - Surface water	❑	❑
2.1.7.	Runoff potential	❑	❑
3.5.2.	Distance to surface water (future resource)	❑	❑
4.2.3.	Determined impact - surface water	❑	❑

Calculation of the synthesis score:

3 x (1.1.2) x (1.2)
+ (2.1.1) x (2.1.2)
+ (2.1.3) + (2.1.4) + (2.1.5) + (2.1.6.2)
+ 2 x (2.1.7) x (3.5.2)
+ 10 x (4.2.3)

= > Score:_____
(Max. = 96)

3. Soil

Parameters chosen for the calculation (assessment grid references)		Score attributed to each parameter	
			"?" if doubt
1.1.3.	Potential hazard - Soil	❑	❑
1.2.	Estimated quantity of substances	❑	❑
4.3.	Determined impact - soil	❑	❑
2.1.5.	Packaging of the pollutants	❑	❑
2.1.6.3.	Source Containment - soil	❑	❑
3.1.	Access to the site (to the source)	❑	❑
3.2.	Presence of a population on the site/on the source	❑	❑
3.3.	Type of population present	❑	❑

Calculation of the synthesis score:

[(4.3) + (1.1.3) + (1.2)]
x
[(2.1.5) + (2.1.6.3) + (3.1) + (3.2) + (3.3)]

= >

Score:_____
(Max. = 135)

Calculating the uncertainty on the notes obtained on the calculation sheet, is done by discounting the notes affected with a “?” in the formula, and by affecting the same constants and calculating modes to the breakdown as to the notes themselves.

An example of this calculation is given for the “Groundwater” and “Soil” notation sheets.

Modalities of source classification

Synthesis scores	Class 1	Class 2	Class 3
1. Groundwater			
1.1. Drinking-water supply	>55	>27 and <55	<27
1.2. Other uses of water	>60	>37 and <60	<37
1.3. Non-drinking water supply, but to preserve for this use	>56	>38 and <56	< 38
2. Surface water			
2.1. Drinking-water supply	>55	>29 and <55	<29
2.2. Other uses of water	>59	>39 and <59	<39
2.3. Non drinking-water supply, but to preserve for this use	>62	>32 and <62	<32
3. Soil	>55	>30 and <55	<30

NOTE

The definition of threshold values for the site classification is a *provisional one*, established on the basis of estimations and results of testing the present methodological guide on about 200 sites. This definition will be re-examined and perhaps modified with "feedback" from the application of this guide to a larger number and greater diversity of sites.

The class limits described above were defined by purposely choosing conservative conditions that can be re-examined after applying the national method to a larger number of sites.

The absence of clearly defined limits (absence of = sign) favours:

1 The critical analysis of the information used for scoring, in particular the number of "?" characterizing the reliability of the data,

2 The dialogue between the different participants of the Simplified Risk Assessment (in particular site managers, administrators responsible for the dossiers, and consultants conducting the assessment). This dialogue must involve the entire simplified assessment procedure (from the definition of the conceptual image to the attribution of scores).

Simplified risk assessment

Final classification of the source

SITE IDENTIFICATION

Region: .....

Department:.....

Site number: .....

Site name: .....

Designation of the assessed source: .....

ASSESSMENT

Assessor (name):.....

Organization:.....

Assessment date: .....

Stage of study: **Preliminary investigation- Phase A** ❑

Preliminary investigation- Phases A-B ❑

Detailed environmental audit ❑

Other ❑

Classification	Media/risks concerned	Number of?	Weight of uncertainty
1	.....	.....	.....
2	.....	.....	.....
3	.....	.....	.....

APPENDIX 6

List of existing technical guidance documents

For more details, see the website http://fasp.brgm.fr

*** For sites contaminated by radionucleides:**

Gestion des sites industriels potentiellement contaminés par des substances radioactives – Version 0, may 2001, Editions IRSN.

*** For sites contaminated by chemical substances:**

Technical documents:
Mode d'emploi des outils méthodologiques applicables aux sites et sols pollués,

Classeur "Gestion des sites (potentiellement) pollués" – Guides relatifs à la visite de terrain, au diagnostic initial et à l'évaluation simplifiée des risques – Version 2, mars 2000, Editions du BRGM.

Classeur "Gestion des sites pollués" – Guides relatifs au diagnostic approfondi et aux évaluations détaillées des risques – Version 0, septembre 2000, Editions du BRGM.

Guide méthodologique pour l'analyse des sols pollués. Editions du BRGM.

Méthode de calcul des valeurs de constat d'impact . INERIS Editions.

Fond géochimique naturel – Etat des connaissances à l'échelle nationale. Rapport BRGM.

Guide sur le comportement des polluants dans les sols et les nappes. Editions du BRGM.

Guide méthodologique pour la mise en place et l'utilisation d'un réseau de forages au droit d'un site pollué.

For site management:
Scénarii de référence "sous-sol" pour la France Métropolitaine.

Guide pour la mise en œuvre des servitudes. Ministère de l'Aménagement du Territoire et de l'Environnement.

Guide pour la résorption des décharges brutes d'ordures ménagères. ADEME Editions.

For site reclamation:
Guide pour la "protection des travailleurs sur les chantiers de dépollution de sites pollués". ADEME Editions.

La pollution des sols liée aux activités de préservation du bois. ADEME Editions.

Techniques de traitement par voie biologique des sites pollués. ADEME Editions.

Procédés de confinement appliqués aux sites pollués. ADEME Editions.

La désorption thermique des sols pollués – Etat des techniques en 1009. ADEME Editions.

Centre scientifique et technique
Service environnement industriel et procédés innovants
3, avenue Claude-Guillemin
BP 6009 – 45060 Orléans Cedex 2 – France – Tél. : 02 38 64 34 34