The Employment Potential of Site Remediation Policies: A Micro-Economic Simulation

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Brief title: Employment and Site Remediation

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This paper deals with the impact on employment of a particular environmental protection policy: contaminated site remediation. We provide quantitative results on the employment level and also on qualifications in the case of France, by making different assumptions regarding the number of sites to be cleaned up and the decontamination level. We use a composite methodology: the engineering estimation method to get costs and direct jobs and a reversed input-output matrix to assess indirect employment, i.e., jobs incurred by the production of inputs**.** Given the high diversity of contaminated sites, we have selected two case studies, the first gathering gasworks and coke ovens and the other dealing with petrol filling stations. As regards the level of decontamination for each site, labour intensity follows a 'bell curve' with the highest labour intensity for intermediate levels of decontamination. By contrast, an increase in the number of sites to be treated has an important positive net effect on employment. Hence, a programme of site remediation of a large number of sites, preferably with an intermediate level of decontamination, would lead to a significant increase in employment, even when we take into account the jobs destroyed elsewhere in the economy by the funding of the clean-up.

Keywords: Employment, Contaminated site, Labour intensity

INTRODUCTION[1]

Site remediation in Europe: standing at the crossroads

The purpose of this paper is to assess whether a more stringent site remediation policy would increase the level of employment. In comparison with other environmental policies, site decontamination presents three main distinctive features[2]. First, it is rather new on the political agenda. With the exception of the U.S. and the Netherlands which have dealt with the problem since the early 80's, most countries are only beginning to design a policy. It is very likely that this will become a major policy issue in the coming years.

Second, past experience of the most advanced countries demonstrates the financial burden it may be: in the Netherlands, it is estimated that the clean-up of the 110,000 contaminated sites will cost between 22 and 44 billion ECU. A lot of countries have made an inventory of contaminated sites, and in every case the number of sites (and thus the clean-up costs) turned out to be much higher than anticipated.

Third, several decontamination techniques are available. They can be based on chemical, thermal, mechanical or microbiological treatment. The choice of a particular technique depends on the features of the site to be cleaned up (nature of the soil, type of pollutants, geological features...), but also on the level of decontamination to be reached. Thus, by choosing the latter, the public policy will affect the technical options and ultimately employment.

To sum up, the novelty of the site remediation issue, as well as the diversity of available techniques, open a window for public intervention aimed at favouring employment. Furthermore, given the financial burden at stake, the employment consequences of the choices made in this field is unlikely to be negligible.

A micro-economic study

This article belongs to a growing literature, which deals on the existence of a “double dividend”, i.e., on the possibility of simultaneously increasing the level of employment and the quality of the environment. Until now, in Europe, the question of the double dividend has been mainly addressed with macro-economic modelling. In fact, this is the only kind of study that takes into account the main economic retrofits in a consistent way. Furthermore, they allow different assumptions to be made about financing schemes, the timing of environmental policies, and so on.

However, the macro-economic approach has some limitations that justify an complementary, micro-economic approach. Indeed, the aggregation of macro-economic

[1] This paper is based on the results of the 'Jobs, Environment and Policy' research project, led by CERNA in 1994-95 and funded by the European Commission (DG XII, SEER programme), the French environmental agency (Ademe) and Labour ministry. A previous version of this text has been presented at the 51st International Conference of Applied Econometric Association, “Econometrics of the Environment and Transdisciplinarity”. Thanks to Peter Borkey and Matthieu Glachant (CERNA) for their help during this research.

[2] Quirion and Glachant (1995) provide more information on public policies in European countries and on available technologies.

models - they rarely distinguish more than ten sectors - prevents them from apprehending well fine sector-related policies. Concerning site clean-up policies, a micro-economic approach is justified by the fact that site remediation is a very specific and emergent activity.

A lot of micro-economic studies have been led in North America since the end of the 70's, in order to assess the employment impact of environmental policies in energy conservation, renewable energies, transport, construction and so on. Renner (1991) provides a good survey of these studies. Even if such studies are much less widespread in Europe, some of them have also been carried out in recent years, in particular by ECOTEC (1994), Cottica and Kaulard (1995), and Whiston (1995).

1. METHODOLOGY

Engineering estimation and input-output accounting

In order to provide quantitative results, we have developed a composite methodology. Indeed, we have used engineering estimation to get costs and direct jobs and a reversed input-output matrix to assess indirect employment**.** The basic idea of engineering estimation is to get engineers to design a representative site and remediation scenario, and estimate its cost and its employment content on paper from performance data of the equipment installed. Here are the successive steps:

(i) Definition of standard cases. We get engineers to define a few 'standard-cases' that gather the features of the most widespread sites: type of pollutants, concentration, quantity of polluted soil, type of soil... For example, a filling station with 450 m3 of polluted sandy soil, a polluted ground water, etc.

(ii) Choice of technical remediation options. For each polluted item present in the standard cases, we list every available technique.

(iii) Definition of remediation scenarios. For each standard case, we elaborate several treatment scenarios *via* a combination of the techniques used to treat each polluted item. These scenarios are ranked according to their environmental efficiency, i.e., the level of decontamination they reach.

(iv) Calculation of direct employment for each scenario. For each standard case and each scenario, engineers assess total cost, *direct* employment and inputs. Here, by direct employment, we mean (i) jobs that take place on the site, (ii) jobs in off site treatment plants (landfills, thermal treatment plants) and (iii) jobs in analysis laboratories.

(v) Calculation of indirect employment for each scenario. In order to have a complete view of the employment potential of site decontamination policies, it is necessary to estimate *indirect* employment, i.e., employment incurred by the production of inputs used in decontamination. For this purpose, the French DEFI model has been used[1]. It computes, for each class of inputs, the number of domestic jobs per unit of final demand. This figure is multiplied by the amount of this class of inputs in each operation in order to estimate indirect employment in France.

[1] The basic principle of the DEFI model is to reverse an input-output matrix. Results used in this study were computed for the French economy in 1992 and converted by us into ECU 1994. For a description of DEFI, see Péronnet and Rocherieux (1983).

Taking into account the diversity of site remediation: selection of case studies

Two types of site have been chosen as case studies: gasworks / coke ovens and petrol filling stations. In fact, they gather a significant number of sites[1] and avoid too large a heterogeneity, even though the latter cannot be completely suppressed. Furthermore, they are contrasted as regards complexity: the former is a complex site whereas the latter is a rather simple one. Annex 1 and 2 present the standard cases and treatment scenarios, with respect to gas works / coke ovens and petrol filling stations.

The first case study gathers two kinds of plants: gasworks and coke ovens. The former produced gas from coal during the XIXth and XXth century in a number of towns. These plants closed when the consumption of natural gas increased. The latter are still used in the steel industry to produce coke from coal. These plants are generally bigger than gasworks, but the production process and thus the pollutants are very similar.

Apart from gas and coke, both types of works produced a lot of by-products: tar, ammoniac, sulfuretted compounds... After the closure of these factories, the stocks of by-products were generally left on the site, and have often contaminated the soil. Among these by-products are mainly tar and scrubbing residuals. Coal tar contains several toxic compounds: light aromatic hydrocarbons (benzene, toluene, ethylbenzene, xylene), phenols and especially polycyclic aromatic hydrocarbons (PAH). Scrubbing residuals contain mainly sulfuretted and cyanide compounds. Some of these pollutants are carcinogenic, others cause nervous or digestive problems.

The second case study deals with petroleum hydrocarbons, that are an important cause of soil and ground water contamination. Pollution comes either from refineries, transportation accidents or petrol filling stations. We shall concentrate on the latter, which is very widespread because of the number of sites - about 50,000 in France. A cleaning up of all filling stations, either closed or in activity, has been decided on in the Netherlands, following an agreement made in 1991 between the Government and the two petroleum branch organisations. Before 1999, every filling station will have been cleaned up. Available treatments differ widely regarding hydro-geological features, i.e., the type of soil and the existence of polluted ground water, which led us to define four standard cases.

Obviously, we cannot make quantitative extrapolations for the other kinds of polluted sites. Nevertheless, we can assume that the qualitative trends we discovered are roughly valid in the other cases. Indeed, the techniques we have studied cover a large majority of those actually used. On the basis of a rough computation[2], they represent more than 66 % of those used in the U.S. and in the Netherlands.

[1] Assessing the share of our case studies in the whole problem is difficult. In the French inventory (France, ministère de l'Environnement, 1994), the petroleum and natural gas industry (including filling stations) accounts for 10.6 % of the number of sites whereas gasworks and coke ovens account for 9.6 %. Both figures are to be taken as a maximum because (i) the former includes sites other than petrol filling stations, and (ii) gasworks are better known than other sites thanks to the centralisation of information by the public company Gaz de France.

[2] Based on figures from Kovalic (1994) for the U.S. and NATO/CCMS (1993) for the Netherlands.

Shortcomings of our methodological tools

As explained by Cottica and Kaulard (1995), the main theoretical problem of engineering estimation is that the assumption of zero X-inefficiency tends to underestimate costs. This problem may create a bias when comparing site remediation with other activities.

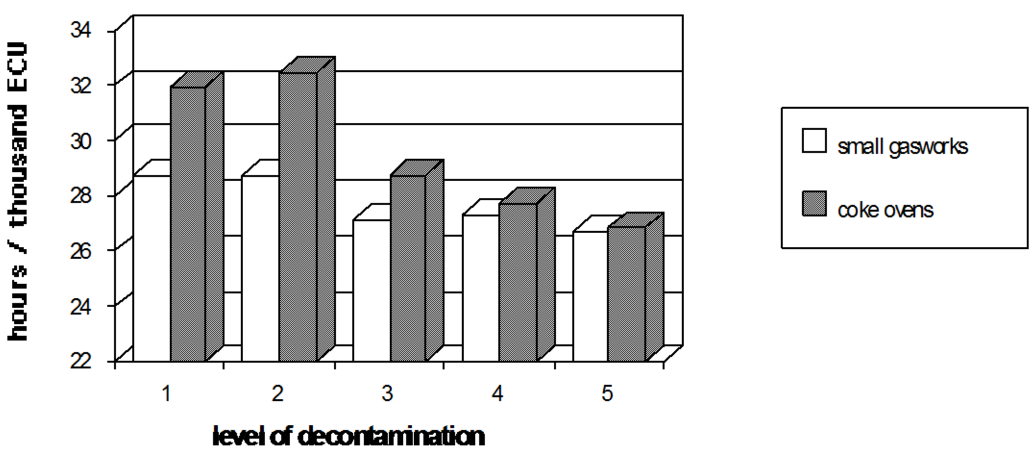
Turning to indirect jobs, the use of a reversed input-output matrix has two main limitations[1]. The first is due to the inevitably limited number of classes of inputs. Indeed in each class, an assumption of homogeneity is made as regards employment intensity. However, the number of classes in the DEFI model (90) seems sufficient to reduce the severity of this first problem. The second limitation results from the static nature of such a matrix. Indeed, the employment content of a *marginal* spending, that we want to estimate, may differ from the employment content of an average spending, which is computed by the model.

2. THE MICRO-ECONOMIC BASIS: EMPLOYMENT IMPACT FOR ONE SITE

Employment intensity and decontamination level: a bell curve

Does a tougher environmental ambition for each site boost employment? In order to address this question, the charts below present for each type of site and for each remediation scenario, the employment intensity, i.e., the number of hours (direct and indirect) generated for each ECU spent. For gasworks and coke ovens, the employment intensity increases slightly from scenario 1 to 2, but then decreases sharply until the most ambitious scenario. This result is not surprising, given that options used in the two first scenarios, i.e., mainly on site containment and microbiology, are close to public works and thus very labour-intensive. On the contrary, on site washing, landfilling and thermal treatments that are used in the other scenarios are more capital intensive options.

Figure 1. Employment intensity for gasworks and coke ovens



Turning to filling stations, results follow the same trend. Employment intensity increases greatly when shifting from the first scenario to the second, and then decreases. The low labour intensity of hydrological containment, which is used in scenario 1, is due to its

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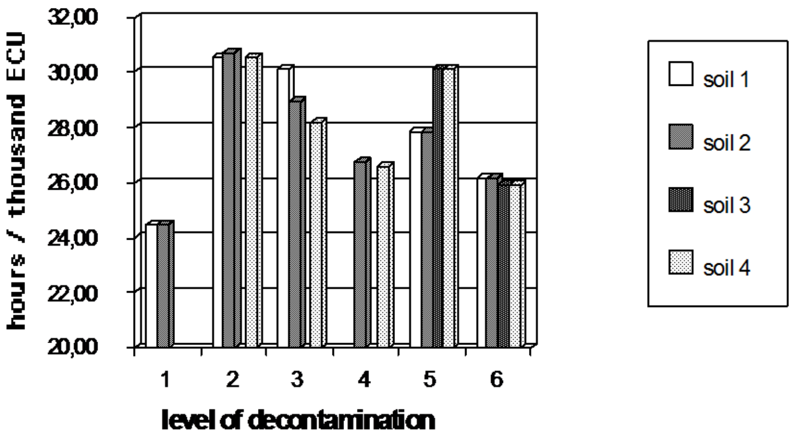
[1] See in particular Freyssinet *et al.* (1976) and Husson (1994).

high electricity consumption (40 % of the cost). Indeed, electricity supply is very capital intensive. On the contrary, options used in the second scenario (on site bioremediation, venting and stripping without air treatment) are generally rather cheap and labour-intensive. Scenarios 3 to 5, compared to scenario 2, mainly differ in including air treatment and a longer treatment duration. The resulting purchase of active coal and electricity decreases the labour intensity. Finally, scenario 6 uses thermal treatment, which is more capital intensive.

Figure 2. Employment intensity for filling stations



To sum up, in the two case studies, a similar pattern emerges. Indeed, the employment content follows a 'bell curve' with respect to the level of decontamination for one site: it first increases and then decreases. This parallelism is interesting given that the techniques differ between gasworks and filling stations.

Which jobs will be created: the qualification issue?

For a few years now, some economists have claimed that a part of actual European unemployment comes from a 'skill mismatch': the demand for low-skilled workers has been reduced by technical changes and/or competition from newly industrialising countries, leading to structural unemployment in Europe[1]. As is generally admitted by the authors, proof of this explanation is very indirect, and it is obviously outside the scope of this paper to discuss this point. However, for those who believe in this theory, it is of the prime importance to know what kind of jobs would be created by a sector-related policy, such as a site remediation policy.

With this aim, we have computed the impact of different levels of environmental ambition on employment qualifications. Two levels of qualification have been defined: low qualifications (under A-level, mainly workers) and high qualifications (starting from A-level, including technicians and engineers). The two graphs below give the share of high qualifications, but we have to stress that these figures only concern on site jobs.

[1] See for example Drèze and Malinvaud (1994).

Figure 3. Gasworks and coke ovens: share of high qualifications

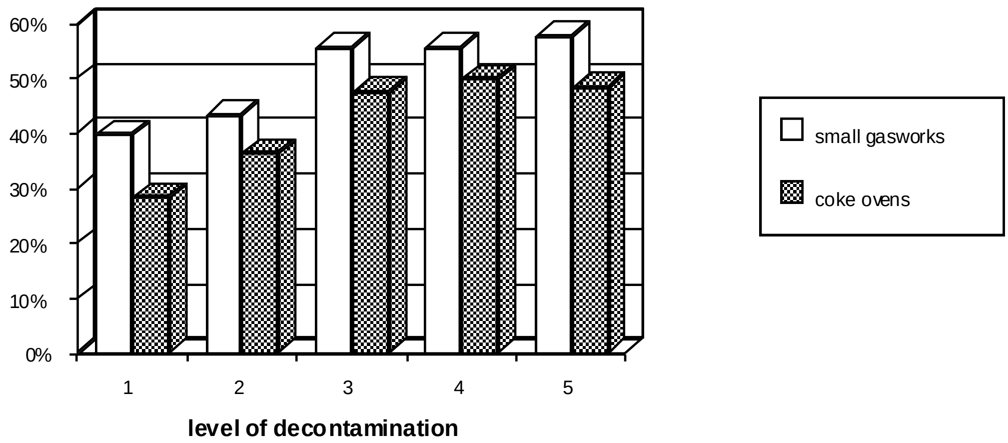
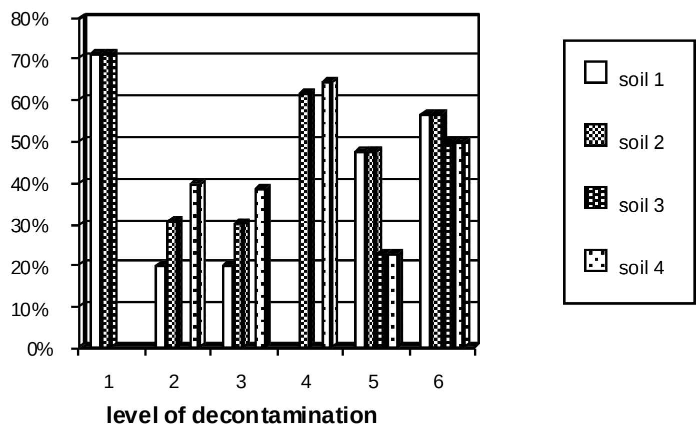


Figure 4. Filling stations: share of high qualifications



Two main features arise. Firstly, comparing site remediation with other economic activities, the share of high qualifications is generally bigger. Indeed, in most cases it is over 35 %, whereas among the French working population, professions that fit our 'high qualifications' account for 34 % of the population. In construction-public works or in waste recovery, this ratio is only 23 % (INSEE, 1993). Furthermore, we can guess that workers employed in site remediation are more skilled than those employed in public works. In fact, because of the danger they are exposed to on some sites, special training is sometimes required.

Secondly, the share of the skilled workforce increases with the decontamination intensity, and with the capital intensity. This finding is not surprising, since it is generally said since Griliches (1969) that skilled labour is more complementary to capital than low-skilled labour.

For gasworks and coke ovens, the percentage of high qualifications increases with the environmental ambition for two reasons. First, on site treatments become more complex as the ambition rises: for instance containment, then microbiology, then soil washing. Second, as more off site treatments are used in the last scenarios, most remaining on site jobs are due to investigation and project management - and thus highly skilled.

For filling stations, the high figures for scenarios 1 and 4 are due to the long duration of the treatment, involving a lot of maintenance, which is done by technicians. On the contrary, short term on site treatments (three months venting and stripping, six months on site bioremediation) require a higher share of civil engineering, hence more low skilled workforce. The first, fourth and sixth scenarios, that require the biggest percentage of high qualifications, have at the same time the lowest employment content.

3. FIVE POLICY OPTIONS: A GLOBAL ASSESSMENT

Defining contrasted public policy options

We can build contrasted policy options combining the decontamination intensity and the percentage of sites to be cleaned up. Concerning the latter, the number of gasworks and coke ovens in France is about 800, of which 750 are similar to our 'small gasworks' standard case, the other 50 being similar to our 'coke ovens' standard case. About 50,000 filling stations exist in France, 30,000 of which have closed and 20,000 are still in service. On the basis of the Dutch experience, we make the assumption that 75 % of them are polluted, i.e., above the Dutch intervention criteria. Hence, we assume that the maximum number of sites to be cleaned up is 37,500. Among these, each of our standard cases is assumed to account for one quarter of the total. The table 1 below presents the five options we have selected.

Table 1. Public policy options

	Percentage of polluted sites which are treated		
Decontamination level	5 %	33 %	100 %
Scenario 1: containment		'insurance' policy	
Scenario 2: moderate clean-up		'half way' policy	'double dividend' policy
Scenario 6: radical clean-up	'show off' policy		'maximalist' policy

The 'show off' policy option is based on a radical clean-up of a few polluted sites. Its rationale is to attain a green image, however superficial, at a relatively low cost. On the contrary, the maximalist policy exhibits the highest environmental awareness. The 'insurance' policy, which is based on a combination of a containment strategy and an intermediate number of concerned sites, basically aims at avoiding major health problems in the most polluted sites. The 'half way' policy is a median option.

Finally, we have added a 'double dividend' policy, which maximises the number of jobs created. The rationale for this label is that this option combines a significant increase in the environmental quality with respect to the present situation in most European countries, with a substantial increase in employment.

A rough estimation of induced effects

As explained in the first part, our micro-economic method is able to assess direct and indirect (upstream) effects. But the overall effect of an environmental policy also depends on the so-called 'induced' effects, that include the recycling of the revenues generated - or destroyed - by the environmental policy, and more generally all the retrofits between macro-economic variables. For instance, on the one hand, an increase in direct and indirect jobs in site decontamination activities increases wages and hence consumption which leads to the creation of new jobs. But on the other hand, site decontamination negatively affects agents which are legally in charge of the financing (the polluting firms for instance). This phenomenon can lead to a decrease in consumption and hence in employment, that will differ according to the origin of the funding, thus on liability rules. Whereas direct and indirect effects can be studied by micro-economic methods, induced effects are typically addressed by macro-economic modelling. Macro-economic modelling is outside the scope of our study, nevertheless we provide a rough quantification of the induced effects, by assessing the jobs destroyed elsewhere in the economy by the funding of site clean-up. We have used the following definition: induced effects = cost x average labour intensity of household consumption.

We have to stress that this definition lies on a particular assumption: this spending is supposed to lead to a decrease in household consumption without changing the structure of the latter. It is clear that, in reality, this assumption would not be enforced, which modifies the employment impact. First, from a Keynesian point of view, if a part of the spending is financed through either the public deficit, a decrease in profits or household savings, employment will further increase. Second, if a strict liability rule is adopted, clean-up costs will be incurred by polluting firms, which are likely to produce or sell capital intensive goods. This assumption is checked for our case studies. The employment intensity of the polluting sectors, i.e., petroleum, electricity and gas production and distribution, is much lower than average, according to the DEFI model. Thus, if the price-elasticity of these goods is not nil, then the net employment effect will be more positive than in our computations.

Global results

The three tables below give the cost, the employment rough creation and the employment net variation for both case studies. The employment 'net' variation rests on the assumption discussed before: one ECU spent in site remediation will replace one ECU of household consumption, without modifying the structure of the latter. This figure is thus positive when the hours/ECU ratio is higher than the average ratio for household consumption (25.0), and negative if not.

Table 2. Consequences of public policy options

	public policy	cost (million ECU)	employment rough increase (man-year)	employment net variation (man-year)
gasworks and coke ovens (1)	show off	25	417	27
	insurance	88	1,620	244
	half way	102	1,886	289
	maximalist	537	8,977	587
	double div.	305	5,633	862
filling stations (2)	show off	313	5,146	263
	insurance	355	5,422	-127
	half way	575	10,979	1,987
	maximalist	6,247	102,867	5,258
	double div.	1,726	32,936	5,962
global	show off	337	5,563	290

(1)+(2)	**insurance**	443	7,042	117
	half way	678	12,865	2,277
	maximalist	6,784	111,845	5,845
	double div.	2,032	38,568	6,824

First, the global incidence of the two case-studies on employment is far from being negligible. If we consider the half-way option, about 13,000 man-years are needed. Assuming that these sites will be cleaned up within 10 years, it provides 1,300 jobs. Given that our case studies cover only a small part (less than 10 %) of the whole problem, the global figure would be much higher. Admittedly, the related cost would be high (678 million ECU for both case-studies), but with the assumptions concerning funding already mentioned, the net effect on employment would remain positive: 2,300 man-years.

Second, the effects on employment will be dramatically different according to the public policy chosen. As regards rough effects, the number of man-years required goes from 5,600 (insurance policy) up to 112,000 (maximalist policy). The high cost of the latter leads to a much lower net effect: 5,900 man-years. On the contrary, the 'double dividend' option provides much less rough employment (39,000) but more net man-years: 6,800. Finally, if we compare the three cheaper options, i.e., show off, insurance and half-way, the employment potential is very different: 290, 117 and 2,300 net man-years respectively. This point is especially noteworthy given that the difference in costs is small: 337, 443 and 677 million ECU respectively.

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Annex 1. Standard cases and remediation scenarios for gasworks - coke ovens

For this case study, we defined two standard cases. The biggest gasworks and the coke ovens are similar to the first standard case, called 'coke oven'. The majority of gasworks are similar to the other standard case, called 'small gasworks'.

Table 3. Coke oven: site description

area: 20 hectares
no buried tank because surface tanks were used on the site
soil density: 1.7
contaminated soil: 10 000 m3 of which:
• 2000 m3 (3400 tons) of rubble covered with tar • 3000 m3 (5100 tons) of clayey soil slightly contaminated with tar (< 5 % HC) • 3000 m3 (5100 tons) of sandy soil slightly contaminated with tar (< 5 % HC) • 1000 m3 (1700 tons) heavily contaminated with tar (> 5 % HC) • 1000 m3 (1700 tons) slightly contaminated with scrubbing residuals no pollution of the ground water

After an investigation of the site, several methods can in general be used for the containment or the remediation of each polluted item. We have thus drawn five 'treatment scenarios', which define the treatment that will be used for the polluted items. These scenarios are ranked by increasing environmental ambition. The table below gives the technical option used for each polluted item and for each scenario.

Table 4. Coke oven: treatment scenarios

	scenario				
polluted item	**1**	**2**	**3**	**4**	**5**
rubble polluted / tar	washing with water	washing with water	washing with water	washing with water	thermal treatment
clayey soil slightly polluted / tar	on site containment	on site microbiology (2 years)	on site microbiology (2 years)	thermal treatment	thermal treatment
sandy soil slightly polluted / tar	on site containment	on site microbiology (2 years)	washing with solvents	washing with solvents	thermal treatment
soil heavily polluted / tar	thermal treatment	thermal treatment	thermal treatment	thermal treatment	thermal treatment
soil polluted / scrubbing residuals	on site containment	on site containment	hazardous waste landfill	thermal treatment	thermal treatment

Scenario 1 uses mainly containment, which is not a real 'treatment' since the pollutants remain in the soil - they are just prevented from spreading out. On the contrary, scenario 5 consists in a thermal treatment for each polluted item, thus allowing the complete destruction of the pollutants. Scenarios 2 to 4 include microbiology, washing and/or landfilling, all of which are intermediary as regards their cost and environmental efficiency.

Table 5. Small gasworks: site description

area: one hectare
one filled buried tank: 500 m3 (500 tons) of tar
soil density: 1.7
contaminated soil: 1000 m3 (1700 tons) of which:
• 200 m3 (340 tons) of rubble • 300 m3 (510 tons) of clayey soil slightly contaminated with tar (< 5 % HC) • 300 m3 (510 tons) of sandy soil slightly contaminated with tar (< 5 % HC) • 100 m3 (170 tons) heavily contaminated with tar (> 5% HC) • 100 m3 (170 tons) slightly contaminated with scrubbing residuals no pollution of the ground water

As regards treatment scenarios, the difference with the coke oven comes from economies of scale. Indeed, in scenario 2, the quantity of clayey soil slightly polluted with tar is too small to allow specific on site treatment, i.e., containment, at a reasonable cost. Thus, this item is landfilled. Furthermore, in scenario 3, the quantity of clayey soil slightly polluted with tar is too small to justify a microbiological treatment. As a consequence, clayey soil slightly contaminated with tar is thermally treated in this scenario.

Table 6. Small gasworks: treatment scenarios

	scenario				
polluted item	**1**	**2**	**3**	**4**	**5**
tar from the tank	incineration	incineration	incineration	incineration	incineration
rubble polluted with tar	washing with water	washing with water	washing with water	washing with water	thermal treatment
clayey soil slightly polluted / tar	on site containment	on site microbiology (2 years)	thermal treatment	thermal treatment	thermal treatment
sandy soil slightly polluted / tar	on site containment	on site microbiology (2 years)	washing with solvents	washing with solvents	thermal treatment
soil heavily polluted / tar	thermal treatment	thermal treatment	thermal treatment	thermal treatment	thermal treatment
soil polluted with scrubbing residuals	on site containment	hazardous waste landfill	hazardous waste landfill	thermal treatment	thermal treatment

Annex 2. Standard cases and treatment scenarios for petrol filling stations

In this case study, four standard cases are defined, by combining two criteria: the type of soil, i.e., clayey or sandy, and the ground water, i.e., polluted or not. Apart from this, other site features are common.

Table 7. Petrol filling station: differences between the four standard cases

	ground water polluted	ground water not polluted
sandy soil	standard case 1	standard case 3
clayey soil	standard case 2	standard case 4

Table 8. Petrol filling station: common features of the four standard cases

pollutants: mixture of diesel oil and gasoline contaminated soil: 450 m3
• depth: 5 m • area: 90 m2 • density: 1.7 (750 tons) ground water (when polluted):
• top: 5 meters deep • bottom: 10 meters deep

For each case, a various number of options (from 2 to 6) is available to treat the soil and, if polluted, the ground water. These options are combined in six scenarios, ranked by increasing environmental efficiency.

Table 9. Petrol filling station: treatment scenarios

		scenario					
std. case		**1**	**2**	**3**	**4**	**5**	**6**
1	**soil**	no action	on site bio (6 months)	on site bio (6 months)		on site bio (6 months)	thermal treatment
	ground water	hydrological containment (10 years)	stripping (3 months)	stripping a.t. (3 months)		stripping a.t. (2 years)	stripping a.t. (2 years)
2	**soil**	no action	venting (3 months)	venting a.t. (3 months)	bioventing a.t. (2 years)	on site bio (6 months)	thermal treatment
	ground water	hydrological containment (10 years)	stripping (3 months)	stripping a.t. (3 months)	stripping a.t. (2 years)	stripping with a.t. (2 years)	stripping with a.t. (2 years)
3	**soil**	no action				on site bio (6 months)	thermal treatment
4	**soil**	no action	venting (3 months)	venting a.t. (3 months)	bioventing a.t. (2 years)	on site bio (6 months)	thermal treatment

a.t.: with air treatment on active coal.

In standard cases 1 and 3, the clayey soil prevents the use of *in situ* treatments, hence reducing the number of scenarios.