Matters Risk?
The Allocation of Government Subsidies for Remediation of Contaminated Sites under the Local Investment Programme

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Sammanfattning

Det övergripande syftet med Sveriges miljöpolitik är att till nästa generation lämna över ett samhälle där de stora miljöproblemen i Sverige är lösta. För att uppnå detta har Riksdagen beslutat om 16 miljömål med tillhörande delmål. Bland dessa miljömål anses *Giftfri miljö* vara ett av de mål som kommer att bli svårast att uppnå. Ett av målets delmål avser efterbehandling, d v s åtgärder för att minska miljö- och hälsorisker från områden som genom industriell aktivitet förorenats med oljerester, tungmetaller, kemikalier och andra föroreningar. I delmålet ges högsta prioritet till de områden som medför de största riskerna för människors hälsa och för miljön.

I Sverige finns uppskattningsvis 50 000 förorenade områden av varierande riskkaraktär. Hittills uppgår statens kostnader för efterbehandling till 2,5 miljarder kronor. Att sanera de mest riskfyllda områdena beräknas kosta ytterligare 45 miljarder kronor. För att kunna uppnå miljömålet inom rimlig tid och till en rimlig kostnad är det därför viktigt att statliga medel för efterbehandling fördelas till rätt objekt.

Statligt stöd för efterbehandling har hittills i huvudsak fördelats genom Lokala Investeringsprogram (LIP) och genom Naturvårdsverkets sakanslag. LIP hade två huvudsyften: att påskynda omställningen till ett hållbart samhälle, samt att skapa arbetstillfällen. För att framhålla det lokala perspektivet samt ta vara på kunskap om lokala miljöproblem var det främst kommuner som fick söka bidrag för LIP. Istället för att dela ut bidrag till separata åtgärder inom enskilda sektorer var strategin att satsa på hela åtgärdsprogram. De beviljade LIP åtgärderna har i efterhand delats in i elva projektområden, varav projekt för efterbehandling av förorenade områden utgör en. Under programperioden, 1998-2002, avsattes närmare 400 miljoner kronor till efterbehandlingsåtgärder.

I den här rapporten utvärderas LIP stödet till efterbehandling. Analysen baseras på data över både avslagna och beviljade efterbehandlingsprojekt. I utvärderingen analyseras dels vad som påverkat sannolikheten att beviljas LIP bidrag och dels vad som påverkat bidragsstorleken för de beviljade projekten. Då LIP har lyfts fram som ett viktigt bidrag i arbetet för att nå miljömålen är det intressant att analysera i vilken utsträckning LIP bidragen fördelats enligt principen ”farligast först”, d v s utifrån de riktlinjer som statuerats i delmålet.

Av utvärderingen framgår att sannolikheten för att beviljas LIP bidrag för efterbehandlingsåtgärder var högre ju lägre miljö- och hälsorisk ett område hade. Med tanke på att de flesta åtgärdsprojekt som sökt bidrag avsåg områden med höga miljö- och hälsorisker, tycks prioritering i enlighet med miljömålet ha gjorts på lokal nivå, medan beslutsansvariga instanser gjort andra överväganden. Särskilt besynnerligt är detta då bidragssystemet utformades på ett sätt som skulle ta till vara på den lokala kunskap och expertis som fanns i kommunerna. En bidragande förklaring till varför ansvariga instanser prioriterat annorlunda skulle kunna vara det faktum att LIP utöver hållbarhetsmålet även syftade till att stimulera sysselsättningen i en tid med hög arbetslöshet. Resultaten i den studie som presenterats här stödjer hypotesen att sysselsättningen påverkade både sannolikheten att få ett bidrag och storleken på bidraget. Givet att projektet hade beviljats bidrag visar resultaten däremot

att ju högre ett områdes miljö- och hälsorisk var desto större bidrag fick projektet.

Sammanfattningsvis är svaret på frågan i uppsatsens titel (Matters Risk?) inte entydigt. Sett till vad som påverkade bidragsstorleken är svaret ja. Av LIP bidragen till förorenade områden avsåg hela 75 procent (300 miljoner) åtgärder på de farligaste områdena. Trots att 100 miljoner kronor kunde ha fördelats bättre så gick huvuddelen av LIP-bidraget till de mest prioriterade områdena. Sett till fördelningsbeslutet å andra sidan, d v s om ett sökande projekt beviljades bidrag eller inte, så påverkade risken men åt fel håll, då sannolikheten att beviljas bidrag ökade ju lägre risk området hade. Även om resultaten inte motsäger påståendet att LIP varit ett viktigt bidrag i miljömålsarbetet, visar analysen att en tydligare prioritering av högriskområden kunnat leda till bättre måluppfyllelse av delmålet för förorenade områden.

En rimlig förklaring till att ansvariga instanser inte lyckades följa principen om ”farligast först” kan ha varit brist på relevant information om olika områdens miljö- och hälsorisker. Vidare kan LIP: s avvikande från den, i policysammanhang, vedertagna styrmedelsnormen ”ett mål - ett medel” ytterligare ha försvårat för ansvariga instanser att prioritera i enlighet med delmålet för förorenade områden. Själva programdesignen syftade ju trots allt till att med ett medel uppfylla såväl ekologisk hållbarhet som ökad sysselsättning och, som vår utvärdering visar, i viss mån även teknikutveckling. Programutformningen kräver mycket av både bidragsgivare och utvärderare, vars arbete väsentligen skulle ha underlättats av information om projektens förväntade kvantitativa miljöeffekter. För efterbehandlingsåtgärder skulle det ha skett genom information om det förorenade områdets riskklass (bedömda risk) samt om projektets förväntade riskminskning i ansökningsblanketterna. Då efterbehandlingsverksamheten även fortsättningsvis kommer att vara kostsam, torde prioriteringar med avseende på miljö- och hälsorisker vara väsentliga i framtiden.

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Johanna Forslund[•], Eva Samakovlis[•], Maria Vredin Johansson[*]

Abstract

In this paper we evaluate how the environmental and health risks posed by a contaminated site affected the probability that it would receive funding for remedial action under a Swedish subsidization scheme, the Local Investment Programme (LIP). The LIP, effective between 1998 and 2002, had a twofold purpose: to step up the pace at which Sweden becomes an ecologically sustainable society and to reduce unemployment. Under the LIP, almost € 43 million (SEK 400 million) were granted to various municipal projects aimed at remediation of contaminated sites. In analyzing data on both subsidized and non-subsidized remediation projects, we unexpectedly find that the more hazardous a site, the less the probability of its receiving funding. Thus, contrary to the "worst things first" strategy officially adopted by the Swedish Parliament for remediation of contaminated sites, our results reveal a risk-avoiding allocation of government subsidies. Furthermore, the number of employment opportunities generated by remediation projects positively affects the probability of receiving a LIP subsidy. Although more faithful observance of the official strategy would have been desirable, the most highly contaminated sites at least received the most money. Based on our findings, we believe that extensive information about the hazards posed by contaminated sites is necessary to ensure better decisions on remediation funding and more efficient use of public resources in the future.

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1. Introduction

Swedish environmental policy is based on 16 environmental quality objectives (Gov. Bill 2000/01:130 and Gov. Bill 2004/05:150).[1] Among these, the 'non-toxic environment' is viewed as one of the most challenging. Several interim targets have been promulgated to operationalize this objective. In the present paper, we focus on the interim target for remediation[2] of contaminated sites, i.e. landfills or areas of soil, groundwater or sediment contaminated by anthropogenic activities.[3] Altogether, there are more than 50 000 contaminated sites in Sweden, which are hazardous to a varying degree (Swedish Environmental Protection Agency, SEPA, 2005a). Before 2006, the interim target was that all contaminated sites should be identified, that cleanup should have begun at 100 sites and that 50 of the highest-priority sites should be remedied by 2005. This target was not fulfilled. Instead, a new interim target has been set, stipulating that all contaminated sites involving *acute risks* should be remediated by 2010 and that the problem of contaminated waste sites should be completely solved by 2050 (Gov. Bill 2004/05:150). Thus, both the previous and the new version of the interim target give highest priority to contaminated sites posing the highest risks to human health and the environment; in other words, a "worst things first" principle is to be followed in the choice of sites to remediate. In order to reach the interim target within a reasonable time and at a reasonable cost, it is therefore important that government funding is channelled to the sites with highest priority.

Thus far, the remediation has cost the Government around SEK 2.5 billion.[4,5] It is estimated that an additional SEK 45 billion is needed to clean up the highest-priority sites. Historically, government funding has primarily taken two forms in Sweden: *sakanslag* (directed grants) and *Lokala investeringsprogram* (Local Investment Programmes, or LIP).[6] From the introduction of directed grants in 1999 through 2004, SEK 1.3 billion had been allocated in that form (Forslund, 2005). The LIP, in effect between 1998 and 2002, was an investment subsidy programme with a dual purpose: to speed up Sweden's transformation into an ecologically sustainable society and to reduce unemployment. The SEPA and the Swedish Institute for Ecological Sustainability (IEH) claim that the LIP programme played a central role in the efforts to achieve the environmental quality objectives (SEPA and IEH, 2004).

The purpose of this paper is to investigate the extent to which allocation of LIP subsidies has focused on the most hazardous sites or, in other words, to analyze how

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[1] The environmental quality objectives are: Reduced Climate Impact; Clean Air; Natural Acidification Only; A Non-Toxic Environment; A Protective Ozone Layer; A Safe Radiation Environment; Zero Eutrophication; Flourishing Lakes and Streams; Good-Quality Groundwater; A Balanced Marine Environment, Flourishing Coastal Areas and Archipelagos; Thriving Wetlands; Sustainable Forests; A Varied Agricultural Landscape; A Magnificent Mountain Landscape; A Good Built Environment and A Rich Diversity of Plant and Animal Life (Environmental Objectives Portal, 2005)

[2] *Remediation* refers to measures that permanently eliminate or reduce the present or future effect on health and environment of contamination in soil, groundwater or sediments. This process involves identification and registration of potentially contaminated sites as well as cleanup procedures.

[3] Common contaminated sites are mines, iron and steel mills, metalworks, ferroalloy works, sites of wood impregnation, pulp and paper mills, gasworks and tanneries. Serious contaminants include mercury, cadmium, arsenic, lead, chrome and copper, persistent halogen-organic compounds, chlorinated solvents, non-biodegradable biocides, polycyclic aromatic hydrocarbons, creosote and BTEX (SEPA, 2005b).

[4] On average 1 Euro=SEK 9.28 and 1 USD=SEK 7.48 in 2005.

[5] Until now, measures for remediation have been financed predominantly by government funding. In addition, voluntary cleanups are conducted by an association of oil companies, SPIMFAB.

[6] Additional governmental costs arise from remediation projects finaced through SEPA, Swedish Armed Forces, Geological Survey of Sweden and Banverket (SEPA, 2005a; Gov. Communication 2003/04:141).

the environmental and health risks posed by a site has affected the probability of its receiving a LIP subsidy for remediation. Our hypothesis is that the more hazardous the waste site, the greater the probability of its receiving a LIP subsidy for remediation. By using data on projects for which remediation subsidies were sought under the LIP (both accepted and rejected projects), we test this hypothesis, controlling for variables that have previously proved important in decisions on remediation (such as political representation on the municipal council, municipal wealth and unemployment). We also study how the site risk and the number of employment opportunities involved in the project affected the allocating agency's decision at the continuous margin of the allocation decision, i.e. the decision about the size of the subsidy.

Somewhat surprisingly, we find that the probability of receiving a subsidy for remediation increases the lower the health and environmental risk posed by the site. Thus, the "worst things first" principle has not been followed. However, sites with high risks received larger subsidies. The number of employment opportunities involved in a project affected both the probability of receiving a subsidy and the size of the subsidy positively.

Most previous analyses of contaminated sites investigate the US Environmental Protection Agency's (EPA's) programme known as 'Superfund'. Gupta et al. (1996) analyzed EPA's cleanup decisions at Superfund sites. Their results reveal a cost aversion that is unaffected by socioeconomic characteristics of the communities surrounding the sites. Sigman (2001) analyzed the length of time required for sites on the Superfundlist of priorities to complete the three stages from listing to cleanup. Her results show that sites were not prioritized according to the severity of hazards posed. Instead, private interests, such as legally liable parties and local communities, played important roles. Hamilton and Viscusi (1999a) found that more stringent cleanup standards were set for sites where residents are more politically active, and that regulators select cleanup remedies differently depending on the nature of the community exposed. Hamilton and Viscusi (1999b) showed that EPA Superfund remediations fail a partial cost-benefit test. In addition, studies have analyzed the role of liability, regulation and economic incentives, as well as risk-assessment issues and valuation issues related to contaminated sites.[7]

Our paper contributes to the existing literature in at least two ways. First, the data are unique for examining how environmental policy decisions are carried out at the agency level. Second, no economic analysis so far has evaluated the allocation of government funding for remediation in Sweden. Since most analyses of contaminated sites have concerned the US, our analysis contributes a European perspective.

The paper is organized as follows. In the next section, the environmental problem of contaminated sites in Sweden is described, as is the LIP. Section 3 specifies the model, and Section 4 describes the data. Estimation results are presented in Section 5. The findings are discussed in the concluding section.

[7] For liability issues see Alberini et al., 2005; Alberini and Austin, 1999; Bluffstone and Panayotou, 2000; Chang and Sigman, 2000; Dinan and Johnson, 1990. For risk assessment issues see Viscusi et al., 1997; Hamilton and Viscusi, 1999a. For valuations using hedonic pricing, see Mc Cluskey and Rausser, 2003, Gayer, Hamilton and Viscusi, 2000; Gayer and Viscusi, 2002; Greenberg and Hughes, 1992; Ketkar, 1992; Kiel, 1995; Kiel and Zabel, 2001; Ihlanfeldt and Taylor, 2004; Michaels and Smith, 1990.

2. Contaminated sites and the LIP

2.1 Contaminated sites in Sweden

In 1990, the SEPA was assigned the task of planning for remediation. Between 1992 and 1994 a nation-wide inventory of industries was carried out to identify the sites in greatest need of remediation (SEPA, 1995a). The sites were classified by category of risk ranging from 'very high risk' (Risk Class 1) to 'low risk' (Risk Class 4), according to their historical and on-going industrial activities.[8,9] The inventory was based on available information and did not involve field investigations. Examples of industries in the highest risk category are paper and pulp, wood preservation, mining, metalworking, and the entire chemical industry.

To supplement the inventory by industry, a more uniform method for risk assessment, designated the method for inventory of contaminated sites (MIFO), was introduced in 1996.[10] The MIFO method consists of two phases. The first phase is a preliminary survey involving identification, data collection, inspection and interviews. The second is a site investigation including inspection and sampling (SEPA, 2002).[11] As with the inventory by industry, MIFO phases 1 and 2 both conclude with an overall evaluation of risk on a scale ranging between 1 and 4, where Risk Class 1 refers to conditions posing a 'very high risk' to human health and the environment. Since risk classification in MIFO phase 2 is generally more reliable than risk classification in phase 1, the risk class assigned in phase 1 may be subsequently revised. The risk class resulting from the MIFO method (both phases) consists of an overall evaluation of the site's/contaminants' hazard level, contamination level, migration potential, sensitivity and protection value (see Appendix 1). The sensitivity value is assessed at the individual level, i.e. regardless of the number of human beings exposed. The protection value is assessed for the species and/or ecosystem exposed to contaminants at the site and, thus, pays regard to e.g. the population density at the site. The range of risk facilitates SEPA's scheme of setting priorities.[12] In our application, however, the risk classification has one drawback: it may appear counterintuitive when the results are interpreted (i.e. the lower the risk class, the more hazardous the site).

Of the more than 50 000 contaminated sites in Sweden, approximately 96 percent have presently been identified (SEPA, 2006a). Around 24 000 sites have been risk-assessed according to industrial activity, and 8 443 according to MIFO. Table 1 shows

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[8] The inventory involved about 60 industries which were ultimately given a general "industry classification" (i.e. a risk class according to the type of industrial activity) based on factors such as production processes, raw materials used, products and waste treatment, health and environmental effects of branch specific contaminants, and amounts of contaminants involved (SEPA, 2002).

[9] In addition, other risk classification methods have been developed and applied for municipal landfills, mining wastes and military shooting ranges. For an overview see SEPA (2002). For more information on previous classification models, see SEPA (1990a; 1990b;1995b).

[10] The MIFO method was tested in a trial inventory in 1995. In 1999 the first MIFO manual was published (SEPA, 1999). Collected data and samplings are registered and stored in a national database commonly referred to as the "MIFO database".

[11] For an overview of the risk assessment process, see Appendix 1.

[12] Based on information from the county administrative boards, an annual listing of the 30 highest-priority sites in each county is presented by SEPA. The first 10 sites are ranked according to risk, regardless of risk assessment method (i.e. industrial inventory, MIFO method or other earlier methods for classification).

that more than 3 000 sites are in need of full government funding for remediation. The sites that require no funding or only partial funding will be remediated either voluntarily or by a legally liable party.[13]

Table 1 Estimated numbers of sites in risk categories 1 to 4

Risk class	Estimated Number of sites	Sites in need of government funding		
		Entirely	Partially	Not at all
1	1 501	499	394	608
2	10 007	2 585	2 088	5 284
3	16 490	0	0	0
4	24 652	0	0	0
Total	52 650	3 084	2 482	5 892

Source: SEPA, 2004a

2.2 The LIP

During the period when the LIP was in effect (1998-2002), SEK 6.2 billion was allocated to more than 1 800 different projects in 161 municipalities.[14] This investment is the Sweden's largest in ecological sustainability to date (SEPA and IEH, 2004). Twenty-four of the projects were aimed at remediation of contaminated sites. These projects received six percent, almost SEK 400 million, of the total LIP subsidies.

A guiding principle for the LIP was to emphasize the local perspective, since much of the knowledge and expertise on local environmental problems and conditions for sustainable development can be found at the municipal level. Only municipalities could apply for subsidies. Support from the LIP was regulated by the "Ordinance on Support for Local Investment Programmes Aimed at Enhancing Ecological Sustainability in the Community" (SFS 1998:23)[15], which required that the subsidies be allocated to the projects that best promoted ecologically sustainable development and increased employment in relation to the subsidy applied for. In reality, many of the LIP projects involved measures to promote efficient use of energy, electricity and water, as well as measures to recover, recycle and compost waste. Altogether, the projects were categorized into eleven different project groups. [16]

Despite the principal goals of the programme, other variables may have affected decisions on which projects to subsidize. During the first four years of the

[13] The enactment of the Swedish environmental legislation (Gov. Bill 1969:387) in 1969 was a policy landmark; thereafter, it was possible to have remediation financed by parties found legally liable *ex post*. Under this legislation, parties responsible for activites causing permanent harm are legally liable for remediation. In 1999 previous legislation was superseded by the Swedish Environmental Code (Gov. Bill 1998:808). Chapter 10 provides that parties responsible for contaminating ground, water or buildings are liable for remediation. However, no legal liability can be imposed for harm arising before 1969.

[14] Representing 55 percent of the total number of municipalities in Sweden.

[15] For a summary of this ordinance, see Appendix 2.

[16] Total LIP grants were allocated as follows: 11 percent to waste projects, 4 percent to building projects, 6 percent to site remediation, 9 percent to energy efficiency and energy saving, 26 percent to renewable-energy projects, 12 percent to multi-dimensional projects, 1 percent to industrial projects, 6 percent to nature conservation, 5 percent to administration and public education, 10 percent to traffic projects and 10 percent to water and sewerage projects (SEPA and IEH, 2004).

programme, the Government allocated LIP subsidies after preparation by the Ministry of the Environment (MoE). In 2002, the allocation function was transferred to the SEPA. The allocation of subsidies by the MoE has been critizised for the sovereign decision making power given to the central government (Kågeson and Lidmark, 1998; Riksrevisionsverket, 1999; Riksdagens Revisorer, 1999). Furthermore, in 1998, when a majority of the subsidies were allocated, these decisions were made five to six months before the general election in Sweden. In an analysis covering the first year of the LIP, Dahlberg and Johansson (2002) found support for the hypothesis that the Government had used the LIP subsidies to "buy" votes. Furthermore, Berglund and Hanberger (2003) found that good support from the MoE and the county boards, as well as a large number of Green Party representatives in the municipal council, were important for receiving a LIP subsidy. A major drawback of previous analyses, however, is that they do not control for the anticipated beneficial environmental outcomes of the projects.[17]

3. Model specification

In this section we specify a model for the allocating agency's decision on LIP subsidies for remediation. Because the guidelines for the LIP (Regeringskansliet, 2000) state that applications for the LIP subsidy should be assessed according to the anticipated outcome of the project, we formulate a subsidy function (Equation 1) where the magnitude of the LIP subsidy for a project depends on the anticipated variables for beneficial environmental effects and employment, i.e.

$$S^*_{ijt} = f(\Delta R_{ijt}, L_{ijt}, \mathbf{x}_{it}, \mathbf{m}_{jt}). \tag{1}$$

Thus, we assume that the LIP subsidy for project *i*, in municipality *j*, at time *t*, S^*_{ijt}, is a function of the expected benefits, i.e. the reduced risk to health and the environment ΔR_{ijt} and the employment opportunities created, L_{ijt}. In order to control for heterogeneity, we also include the variable vectors $\mathbf{x}_{it}$, for project- and programme-specific variables, and $\mathbf{m}_{jt}$, for municipality-specific variables.

Because S^*_{ijt} is censored at zero, the complete distribution of S^*_{ijt} cannot be observed. Formalized,

$$S_{ijt} = \begin{cases} S^*_{ijt} \text{ if } S^*_{ijt} > \bar{S} \\ 0 \text{ otherwise.} \end{cases}$$

In other words, if the subsidy function exceeds some threshold value (here set at $\bar{S}$), the project is accepted and subsidy S_{ijt} is observed. If the value of S^*_{ijt} falls below the threshold value, the project is rejected and the subsidy is thus equal to zero.

[17] Two other analyses evaluating LIP projects for reducing air pollutants included environmental effects but focused only on the projects that received subsidies: Vredin Johansson (2006) evaluated allocation rationality and ex ante cost effectiveness and found that the LIP was a low-cost, cost-effective environmental policy for reducing carbon dioxide; SEPA (2004b) claims that the state cost of environmental improvement measures in the LIP has been low compared to other policies.

Considering the characteristic of the subsidy variable[18], Tobit analysis might be the obvious choice for analysing how risk reduction, employment opportunities and other variables affect the subsidy granted. However, Tobit models are very restrictive. For instance, in a Tobit model a variable that increases the probability of a positive observation also increases the conditional mean value of the dependent variable. In some cases the effects are in fact more likely to be the opposite.[19] Thus, there may be two different processes generating zero and non-zero observations. Considering the limitations and the fragility of the Tobit model[20], a less restrictive model is desirable. Such a model can be found in the family of "hurdle" models (Cameron and Trivedi, 2005), where it is possible for one process to determine the granting decision (frequently referred to as the "participation" decision) and another to determine the size of the subsidy granted. [21]

A hurdle model is a two-part model given by two equations. Here the first equation represents the allocation decision at the discrete margin, and the second equation, the allocation decision at the continuous margin.

The first equation is

$$\Pr\left(y_{ijt}=1\middle|\Delta R, L, \mathbf{x}, \mathbf{m}\right)=\Phi\left(\alpha_0+\alpha_1\Delta R_{ijt}+\alpha_2 L_{ijt}+\alpha_3^{'}\mathbf{x}_{it}+\alpha_4^{'}\mathbf{m}_{jt}\right), \qquad (2)$$

where $y_{ijt}=\begin{cases}1 \text{ if } S_{ijt}^{*}>\bar{S}\\ 0 \text{ otherwise.}\end{cases}$

Φ denotes the cumulative normal distribution, $\mathbf{x}_{it}$ is a vector of project- and programme-specific variables (excluding ΔR and L), and $\mathbf{m}_{jt}$ is a vector of municipality-specific variables. α_0, α_1, α_2, α_3, and α_4 are parameters and parameter vectors to be estimated.

The second equation,

$$E\left(S_{ijt}\middle|y_{ijt}=1\right)=\gamma_0+\gamma_1\Delta R_{ijt}+\gamma_2 L_{ijt}+\theta_{ijt}, \qquad (3)$$

models how risk reduction/classification affect the size of the subsidy – provided one was granted. The intercept and "weight" parameters, γ_0, γ_1 and γ_2, indicate the marginal value of a unit of each explanatory variable and θ_{ijt} is the error term.

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[18] The subsidy variable, S_{ijt}, is censored, i.e. zero, for rejected projects, and equal to the subsidy for accepted projects, whereas the explanatory variables are observable for both rejected and accepted projects.

[19] For example, the probability that a building will catch fire and the consequential loss due to the fire both depend on the age of the building, but most likely in contrary directions (Lin and Schmidt, 1984).

[20] Maximum likelihood estimation of the Tobit model produces inconsistent parameter estimates if the error term is either heteroscedastic or non-normal (Cameron and Trivedi, 2005).

[21] A formal test of the appropriateness of the Tobit specification against a two-part specification was first performed (Lin and Schmidt, 1984). The test strongly rejected the Tobit model (χ^2 (9)=118.02).

4. Data

Data on the accepted projects were available from the LIP database at the SEPA. Data on rejected projects could only be found in the LIP applications, filed at the MoE or, from 2002 on, at the SEPA. Thus, to find all rejected applications, we searched these archives.

In 1998 the application procedure was not strictly formalized. In 1999 an application form was introduced, but the completeness of the forms submitted varies considerably. To avoid losing too many observations, additional project information was sought and obtained through telephone and email contacts with the applying municipalities. In addition, the data were supplemented by municipality-specific information like the municipal unemployment rate and the municipal tax base.
In the first stage, analyzing the allocation decision at the discrete margin (i.e. whether a subsidy is granted or not), the dependent variable equals one if the project received a subsidy and zero otherwise. In the second stage, analyzing the allocation decision at the continuous margin (i.e. the decision on the amount of the subsidy), the dependent variable equals the size of the subsidy. In Appendix 3 descriptive statistics for the accepted projects are given. Approximately 91 percent of the subsidies were allocated to land-based projects. Another 8 percent of the subsidies were allocated to water-based projects such as those involving remediation of bottom sediments in lakes, rivers and streams. Most of the subsidies for remediation of contaminated sites (i.e. 66 percent) were allocated in 1998. One reasonable explanation for the subsequent decrease is the announcement of forthcoming directed grants; another is a general decrease in the amount of LIP subsidies. As shown in Appendix 3, the degree of subsidization, i.e. the ratio between the subsidy and the investment cost, varies between 15 and 100 percent. According to the LIP ordinance (SFS 1998:23), the maximum degree of subsidization was 30 percent. Non-profitable activities could, however, be subsidized to a higher degree.
The most important project-specific explanatory variable is the anticipated reduction in risk to human health and the environment. Ideally a measure of the risk reduction to be achieved by the LIP project should be included. Unfortunately, neither the risk class of the site nor the risk reduction provided by the project was included in the application form.[22] Still, we assume that the risk class of a site at least implicitly was known to the decision-makers. This assumption is valid given that the remediation projects for which funding was sought commonly required expert opinions from appropriate SEPA officials. Thus, we use the risk class of the contaminated site, R, as a proxy for the risk reduction possible to achieve, ΔR. If LIP subsidies are allocated to the most hazardous sites the risk parameter will be negative in the estimation of Equation 2.

[22] For determining the anticipated environmental effects of a project, the LIP application form included six categories of environmental indicators: reduction of environmental pressure, enhanced efficiency in use of energy and natural resources, favourability to utilization of renewable raw materials, increased reuse and/or recycling, preserved biodiversity and/or cultural-heritage, and improved circulation of plant nutrients. These indicators are only rough approximations of the anticipated environmental effects and do not capture the different health and environmental risks associated with these sites or the contribution of a project to reducing these risks. From an evaluation point of view, information on quantitative environmental effects is crucial. Although quantitative information about the anticipated environmental effects of the project was required in the application, the information supplied by applicants was scanty.

The risk classification of the sites was derived from the MIFO database (see section 2.1) and from information provided by officials at the municipalities and county administrative boards. In total, 92 of the sites were MIFO classified (either phase 1 or 2), and 10 sites were categorized according to the standard industry classification. An additional 17 sites were categorized by historical classification, preceding both the standard industry classification and the MIFO. Six of the projects could not be categorized by risk class. Four of these projects were not linked to any specific contaminated site, but involved development of remediation techniques.[23] The two remaining projects with no risk class were not identified by municipal officials as contaminated sites, and subsequently no risk class has been assigned to them.[24] To include 'non-contaminated sites' and technique projects in the analysis, an additional risk category, Risk Class 5, has been adopted. Moreover, six waste deposits were identified as contaminated sites but never classified according to risk. They were therefore excluded from the estimation. Thus, our sample consists of 125 observations; in 24 of these cases, subsidies were granted.

In total 14 out of 24 accepted projects were lower-priority sites. Of the SEK 400 million allocated to remediation projects, 75 percent went to Risk Class 1 projects (the most hazardous sites), 22 percent to Risk Class 2 projects, 0.3 percent to Risk Class 4 projects and 2 percent to Risk Class 5 projects. Thus, about SEK 100 million were allocated to lower-priority sites under the LIP. Given the prevalent allocation, around 60 percent of the rejected Risk Class 1 projects (starting with the rejected project applying for the smallest subsidy, then taking the next smallest subsidy and so on) could have been subsidized if these SEK 100 million had been used *exclusively* to subsidize Risk Class 1 projects. Table 2 shows the respective numbers of projects for which subsidies were granted and rejected, stratified by risk class.

Table 2 Number of accepted and rejected projects according to risk class

Risk	Accepted (y=1)	Rejected (y=0)	Percent accepted	Mean subsidy (SEK 1 000)		Mean employment opportunities(#)	
				Accepted	Rejected	Accepted	Rejected
1	10	65	13	30 022	14 615[25]	33	15
2	8	28	22	10 966	7 001	17	6
3	0	5	0	0	28 203[26]	0	7
4	1	2	33	1 000	430	3	1
5	5	1	83	1 757	3 035	6	0
Total	24	101	19	16 572	12 565[27]	21	10

Most applications concerned Risk Class 1 sites i.e. the most hazardous sites. Even if the number of accepted projects was greatest in Risk Class 1, Table 2 also shows that

[23] For instance, in 2001, the municipality of Kristianstad was granted SEK 180 000 to assess a method for remediation of oil-contaminated soil by the application of pine bark.

[24] The 'site remediation project' in Landskrona in 1999 was not aimed at decontaminating a site but at getting rid of hydrogen sulphide stench. Through removal of sediment, the odor was eliminated and better water quality was achieved, yet in terms of risk the site was never considered hazardous either to humans or to the environment. The same argument has been raised about the remediation project in Aneby in 2002, which entailed more 'exterior cosmetics' than reduction of risk.

[25] Three rejected projects did not specify the subsidy applied for. The mean is therefore based on 62 observations.

[26] One rejected project did not specify the subsidy applied for. The mean is therefore based on four observations.

[27] Based on 97 observations.

the "percent accepted", i.e. the number of subsidized projects in relation to the number of projects for which subsidies were sought, is lower for Risk Classes 1 and 2 than for Risk Classes 4 and 5. A question arising from Table 2 is why were not more Risk Class 1 projects accepted when the rejected Risk Class 1 projects were not much more expensive than the accepted Risk Class 2 projects? Could the higher amount of employment opportunities in the Risk Class 2 projects be the decisive reason behind acceptance?

Furthermore, as previously mentioned, the LIP was also aimed at creating employment opportunities. To control for the employment opportunities of a project, the variable *L*, measuring the estimated employment directly resulting from the project investment (as assessed by the applying municipalities and expressed as the number of annual full-time employment opportunities), was included in the estimation. Table 2 shows that the largest number of employment opportunities was found in Risk Class 1 projects, presumably because these projects were cumbersome and labour-intensive.

It is plausible that the introduction of the directed grant significantly reduced the probability that a municipality would receive a subsidy. To control for this possibility in the estimations, an indicator variable, *G,* equal to 0 for 1998 and 1 for 1999-2002, is added to the model.

The LIP programme was launched during a period with relatively high unemployment rates in Sweden.[28] From the 24 approved remediation projects, 502 employment opportunities were anticipated. Because increased employment was claimed to be the primary goal by the initiators of the LIP (SEPA, 2004b) it is interesting to analyze whether the probability of receiving a LIP subsidy was greater for municipalities with high unemployment rates and thus a more acute need for employment opportunities. To control for the municipality's need for employment opportunities, the municipal unemployment rate (*U*) was included in the analysis.

Furthermore, although regulatory impact analyses are standard practice in many areas of political decision-making, political decisions rarely depend only on the social net benefits of the alternatives considered. Because external influences like lobbying and log rolling are political realities, decisions are not always optimal from a social point of view. To control for political and interest-group pressures, variables representing the political composition of the municipal council were included in the analysis. The share of votes for both Social Democrats (*SD*) and the Green Party (*GP*) in the local government election were included, the Social Democrats because they were (and are) the incumbent Government in Parliament, and the Green Party members to control for special environmental interests.

Moreover, we control for the municipality's previous environmental efforts by including a variable that measures the municipality's environmental ranking the year before it received the LIP subsidy. The higher this variable, the better the municipality's performance in regard to the environment. The municipality's environmental ranking (*ER*) is based on a questionnaire to all Swedish municipalities

[28] The Swedish unemployment rate averaged 6.5 percent in 1998 (Statistics Sweden, 2006).

in an annual survey by the magazine "Miljö Eko" (Miljö Eko 1997:5; 1998:5; 2000:1; 2001:1 and Miljö Eko 2002:1).[29]

For analysis of environmental equity aspects, the municipality's tax base per capita *(T)* was included.

Table 3 provides descriptive statistics comparing the explanatory variables between accepted and rejected projects, and Appendix 4 provides means, standard deviations, definitions and sources for all the variables.

Table 3 Comparison between rejected and accepted projects

	Means and (standard errors)		t-tests for equality between means
	Rejected projects	Accepted projects	
Subsidy, (S^*)	12 565 232 (2 114 920)	16 572 250 (5 161 921)	-0.81
Risk class, (*R*)	1.48 (0.08)	2.29 (0.32)	**-3.70
Employment opportunities, (*L*)	9.75 (1.67)	20.93 (9.16)	**-2.00
Social Democrats, (*SD*)	0.42 (0.01)	0.42 (0.02)	-0.25
Green Party members, (*GP*)	0.04 (0.00)	0.05 (0.00)	**-2.60
Environmental ranking, (*ER*)	58.89 (1.88)	60.32 (3.39)	-0.10
Unemployment rate, (*U*)	0.05 (0.00)	0.05 (0.00)	-0.37
Tax base per capita, (*T*)	99 455 (1 442)	98 717 (2 069)	0.23

**: significant at 5 percent

As is evident, the risk class is significantly higher, i.e. less hazardous to the environment and to health, for the subsidized projects, implying that the "worst things first" principle was *not* followed. In addition, the employment variable is significantly different between subsidized and non-subsidized projects. Subsidized projects involved significantly more employment opportunities. The proportion of Green Party members in the municipal councils is also significantly larger in subsidized municipalities than in non-subsidized municipalities.

5. Results

Table 4 shows the estimation results from the discrete margin of the allocation decision. Both a full model with all explanatory variables and a more parsimonious model including only the risk and employment variables are estimated. Based on a likelihood ratio test between the two model specifications, the more parsimonious model cannot be rejected.[30]

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[29] Miljö-Eko is a politically independent magazine established in 1993. The use of a lagged (*t*-1) *ER* variable is reasonable but mainly for practical purposes: Miljö Eko's environmental rankings ceased in 2001. It is noteworthy that the environmental ranking variable is endogenous in 1998, the reason being that the 1998 survey included the question whether the municipality had applied or intended to apply for LIP subsidies. If the answer was affirmative, the environmental ranking was higher. Because the maximum attainable score varied over the years, we employ standardized rankings.
[30] The test statistic is χ^2 (6)= 12.12 (the critical value at the five-percent level is 12.59).

The results from the estimation of the discrete margin of the allocation decision (Equation 2) indicate that the probability of receiving a subsidy increases the *lower* the risk of the site to health and the environment.[31] This finding is remarkable in that the interim target for contaminated sites focuses on sites with the highest risk. This result is however primarily attributable to the six remediation projects in Risk Class 5.[32]
As can be seen in Table 2, most LIP applications concerned high-risk sites. Thus, the municipalities were aware of the risks posed by the sites and eager to remediate them. In total, Risk Class 1 sites received 75 percent of the LIP subsidies aimed at remediation of contaminated sites, which implies that SEK 100 million could have been allocated better. Considering the high cost of remediation, it is unfortunate that government funding was not directed towards the most hazardous sites.

Table 4 Probit model estimation results

Variable/Parameter	Estimate	Robust std err	z	Estimate	Robust std err	z
Risk class, (*R*)	**0.398	0.134	2.97	**0.435	0.118	3.70
Employment opport., (*L*)	**0.012	0.005	2.56	**0.012	0.004	2.90
Unemployment rate, (*U*)	7.317	11.324	0.65	-	-	-
Directed grant, (*G*)	**-0.974	0.344	-2.83	-	-	-
Social Democrats, (*SD*)	-1.439	2.263	-0.64	-	-	-
Green Party, (*GP*)	10.779	17.075	0.63	-	-	-
Environmental rank, (*ER*)	-0.005	0.008	-0.62	-	-	-
Tax base per capita, (*T*)	-1.24e-05	9.72e-06	-1.27	-	-	-
Constant	0.212	1.702	0.12	**-1.800	0.284	-6.34
Pseudo R^2	0.23			0.13		
Number of observations	125			125		
logL	-47.08			-53.14		

*: significant at 10 percent, **: significant at 5 percent

Furthermore, Table 4 shows that the number of employment opportunities (*L*) created in the project increases the probability of receiving a subsidy (at the five-percent level).[33] The results also show that the existence of alternative financing for remediation of contaminated sites -- the directed grant introduced in 1999 -- significantly lowers the probability of receiving a LIP subsidy for remediation. However, because the introduction of the directed grant coincided with smaller overall LIP budgets for the years 1999-2002, the effect of the directed grant may be confounded with the effect of a smaller budget.

[31] Contrary to our results are those of Cropper et al. (1992); in a similar analysis of EPA decisions whether to prohibit or permit continued use of cancer-causing pesticides, the authors found that the risk to human health and the environment increased the likelihood that the EPA would ban a particular pesticide.

[32] These sites were granted two percent (SEK 9 million) of the total LIP. If they are excluded from the estimation, the risk variable becomes insignificant. If dummy variables are used for risk classes 2 to 5 (risk class 1 being the reference), estimation gives that the probability of receiving a subsidy is significantly higher for risk class 5 projects (p value 0.001) compared to the other risk classes.

[33] This result, however, is not very robust. If the project with the greatest number of employment opportunities is excluded (L=205), the *L* variable is only significant at 11 percent.

Contrary to Dahlberg and Johansson's (2002) analysis covering the first year of the LIP program, we found no significance for the political and interest group variables, *SD* and *GP*, or for the environmental ranking variable, *ER*.[34] Moreover, the tax base, *T*, and the unemployment rate, *U*, turned out to be insignificant, implying that equity and the municipal need for employment opportunities were unimportant to the allocation decision.

To investigate the risk and employment opportunity variables relative impacts on the probability of receiving a subsidy, we calculate marginal effects. More specifically, we calculate the change in probability of being granted a subsidy caused by a standard deviation's change in the relevant variable. The marginal effect for the risk variable is 0.09, while the marginal effect for the employment opportunity variable is 0.07. Thus, a standard deviation's increase in the risk variable has a larger impact on the probability of being granted a subsidy than a standard deviation's change in the employment opportunity variable. Furthermore, we calculate the elasticities for these variables. A one percent increase in the risk variable results in a 0.79 percent increase in the probability of being granted a subsidy, while a one percent increase in the employment opportunity variable results in a 0.17 percent increase in the probability of being granted a subsidy. Altogether, risk appears to matter more than employment, although it must be remembered that the risk variable has an unexpected sign.

In the estimation of the continuous margin of the allocation decision (Equation 3), the number of observations (i.e. the number of subsidized projects) is very small (n=24). To have at least some degrees of freedom in the estimation, we need to restrict the number of parameters in the model. We therefore employ only the two variables of principal interest for the analysis, i.e. the risk and the employment opportunity variables. Because the number of employment opportunities (*L*) is right-skewed with an extreme upper-tail distribution[35], the probability of observations with high leverage, i.e. a strong influence on the regression estimates, is large. Giving full weight to influential observations means that a minority of observations can determine the results obtained. To down-weight the potential effect of influential data points, we use, in addition to the ordinary least squares (OLS) estimator, a robust regression estimator based on iteratively reweighted least absolute residuals (Stata Corp, 2001).

Table 5 Results from OLS and robust regressions

	OLS			Robust		
Variable/Parameter	**Estimate**	**Robust Std err**	**t**	**Estimate**	**Std err**	**t**
Risk class, (*R*)	**-3 898 408	1 496 074	-2.61	**-1 790 173	750 892	-2.38
Employment opport.,(*L*)	**430 780	52 815	8.16	**1 065 691	53 202	20.03
Constant	**1.65e+07	6 286 540	2.62	*4 290 534	2 306 242	1.86
R^2	0.73			-		
Number of observations	24			23		

*: significant at 10 percent, **: significant at 5 percent

[34] Dahlberg and Johansson (2002) found in their study that the more swing voters there are in a municipality, the higher the probability that it will receive money from the central government. An attempt was therefore made to include the *distance between the political-party blocs* in the national election. This variable was very strongly correlated (0.90) with the share of the votes received by the Social Democrats and was not significant. It was therefore excluded from the estimations.

[35] Eighty-eight percent of the projects have 27 or fewer employment opportunities while the four projects with the largest number of employment opportunities have 64, 90, 100 and 205 employment opportunities.

In Table 5, we present the results of both regressions. In the robust regression one observation is dropped because of its undue influence on the estimation results. Table 5 shows that the parameter estimates are heavily dependent on the estimator used and that the confidence intervals of the parameters do not even overlap.

Additionally, Table 5 shows that the more hazardous the contaminated site (the lower the risk class), the larger the subsidy that it receives. The number of employment opportunities (*L*) created by a project also has a significant effect on the subsidy granted. Depending on the estimator used, the parameter estimates vary between SEK 430 000 and SEK 1 065 000 per employment opportunity. Compared to previous studies evaluating all projects in the LIP (Vredin Johansson, 2006; SEPA, 2004b), the employment opportunities created in the remediation projects appear very expensive. An estimation of government costs for an average annual employment opportunity created in a general labour market programme amounts to approximately SEK 132 000 (Hallvig, 2006).[36] It is reasonable to expect that employment opportunities created in ecological programs will not be more expensive than those in general labour market programs when controlling for the program's environmental effects. On the harsh assumption that the *L* parameter estimate is representative of the average cost of employment opportunities, we calculate that the excessive cost of employment opportunities created by LIP remediation projects represents a misallocation of SEK 150 million.[37]

6. Conclusions

The Swedish Parliament has enacted 16 environmental quality objectives to guide Sweden toward becoming a sustainable society. Among these, the 'non-toxic environment' objective is regarded as one of the most challenging. One of the interim targets for this objective is remediation of contaminated sites, i.e. landfills or areas of soil, groundwater or sediment contaminated by anthropogenic activities. According to the interim target, highest priority should be given to sites posing the greatest risk to human health and the environment. Thus, a "worst things first" principle has officially been declared the strategy for remediation of contaminated sites. In other words, to reach the interim target within a reasonable time and at an acceptable cost, it is important that government funding is allocated to the most hazardous sites.

In this paper we analyze how the health and environmental risk posed by a contaminated site affected the probability of receiving funding for its remediation under a Swedish subsidization scheme, the Local Investment Programme (LIP). The LIP, effective between 1998 and 2002, had a twofold purpose: to step up the pace at which Sweden becomes an ecologically sustainable society and to reduce unemployment. In the LIP, the municipalities had to compete for subsidies with projects of highly varied character. During the period when the programme was in

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[36] This estimation is based on an average monthly disbursement of the Swedish activity support calculated as (11 000*12)=132 000. Participants in labour market programmes (i.e. employment training, occupational rehabilitation, practical job experience, computer centre work, business start up or development guarantee) may be entitled activity support (Swedish Social Insurance Agency, 2006). The activity support is taxable and based on a participants daily allowance from its unemployment insurance fund.

[37] Calculated as (430 000 – 132 000)*502=149 596 000 where 502 is the number of employment opportunities created in LIP remediation projects.

effect, almost € 44 million (SEK 400 million) were granted to various projects aimed at remediation of contaminated sites. The data used to analyze how the hazard created at a site affected *i*) the probability of its receiving a subsidy and *ii*) the size of the subsidy granted were obtained from the application forms for both approved and rejected municipal remediation projects.

Contrary to the "worst things first" principle of the interim target, we find that the probability of receiving a subsidy for remediation increased the lower the risk to environment and health of the site. This result is remarkable considering that most of the applications involved high-risk sites, an indication that the applicants (i.e. municipalities) were aware of the risks posed by the sites and eager to remediate them. The allocating agency thus appears to have overlooked one of the guiding principles of the LIP, which emphasized the knowledge and expertise at the local level. Furthermore, the number of employment opportunities generated by a project positively affected both the discrete and the continuous margins of the allocation decision. Compared to previous studies evaluating LIP, the employment opportunities created in remediation projects appear to have been expensive. Moreover, until the introduction of the directed grant in 1999, the LIP subsidies were the primary form of government funding for remediation. We find that the introduction of the directed grant significantly reduced the probability that a municipality would receive a subsidy under the LIP. It is therefore tempting to conclude that growing awareness of the upcoming directed grant influenced the allocating agency in favour of less expensive projects to the detriment of those involving the more hazardous sites.

In sum, did risk matter? The answer is not clear-cut. Focusing on the continuous margin of the allocation decision, i.e. the size of the granted subsidies, the answer is yes. Seventy-five percent of the LIP subsidies (SEK 300 million) were granted to high-risk sites (Risk Class 1 sites) and, although SEK 100 million could have been spent wiser, the majority of the LIP subsidies went to prioritized sites. However, focusing on the discrete margin of the allocation decision, i.e. whether an applying project was accepted or rejected, the results showed that the risk matters but in contrary direction to what would be expected. We, therefore, believe that a better allocation of the LIP subsidies, giving priority to high-risk sites, would have improved the progress toward the interim target for contaminated sites. One possible explanation for the paradoxical result for the risk variable is that the allocating agency, at the time of its decisions, lacked the requisite information about the hazardous nature of the site. Even though a risk classification based on the previous industrial activities at the site (classification by type of industry) had been completed years before the LIP programme took effect, a more uniform inventory method, the MIFO method, had just been introduced at the time of the LIP. Departing from the "one goal, one measure" principle, decision-makers in the LIP must have found it difficult to allocate remediation subsidies according to the "worst things first" criterion. Probably, the design of the LIP application further complicated the allocation decision. Although applications required quantitative information about anticipated environmental effects of the project, they were very sparsely filled out. Both allocation decisions and subsequent evaluations would have been facilitated by information about the risk of the site and the risk reduction anticipated from the project. We therefore emphasize the importance of including these two kinds of information as factors in future decisions about remediation of contaminated sites.

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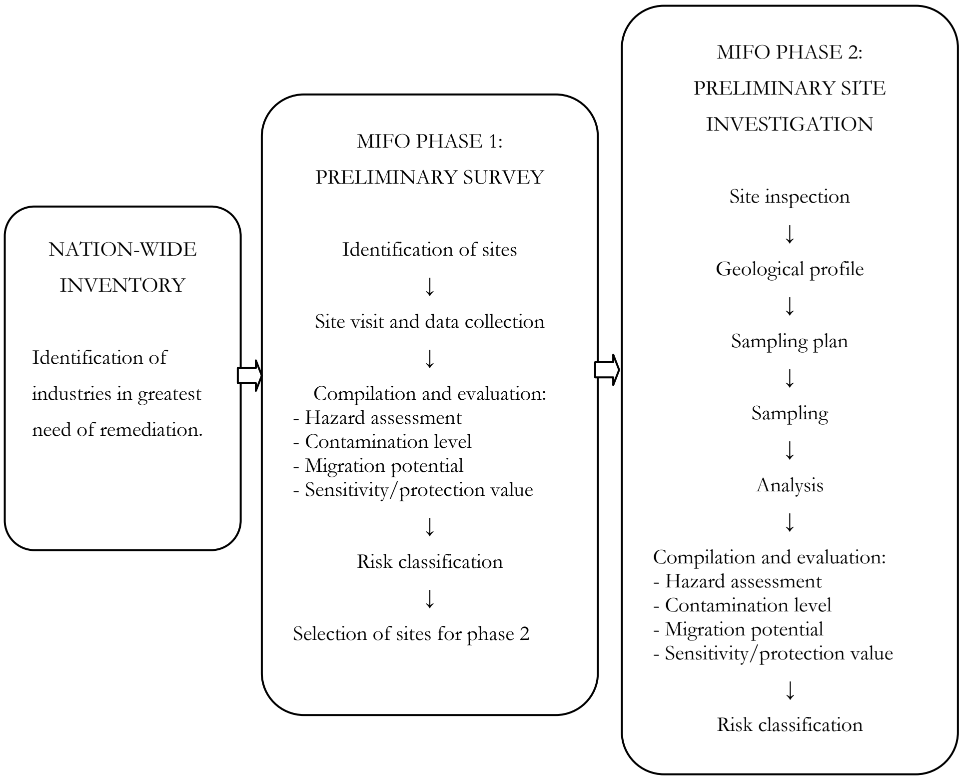
Appendix 1

Comprehensive assessment and risk classification



Source: SEPA (2002)

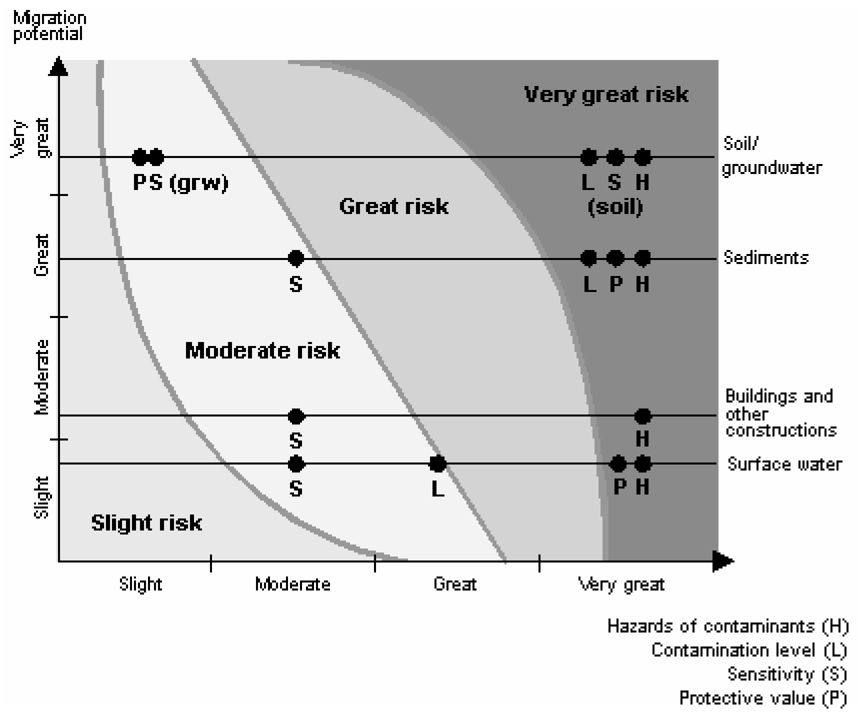
Hazard assessment: Contaminants are classified according to four categories ranging from slightly hazardous (e.g. calcium and magnesium) to extremely hazardous (e.g. arsenic and mercury). Sites with multiple contaminants are generally classified as a greater hazard than sites with single-type contaminants.

Contamination level: Risk assessment related to *i)* the severity of the effects potentially caused by the contaminant concentrations observed, *ii)* the number of contaminants *iii)* the presence and effect of point sources *iv)* and the total volume of contaminated material. Generally, sites with large volumes of multiple contaminants in high concentrations are found to have high contamination levels. The contamination level at "hot-spots" ultimately depends on the number of contaminants at the site.

Migration potential: Risk assessment associated with the estimated or calculated potential for migration. Given high contaminant concentrations, rapid migration generally implies greater risk than slower migration. The combination of soil types and slopes affects the migration potential.

Sensitivity/protection value: The level of risk related to the sensitivity of exposed humans, and to the value of protecting the exposed environment. The two aspects are risk-assessed separately. Sensitivity is assessed at the individual level, i.e. regardless of the number of human beings exposed. The protection value is assessed for the species and/or ecosystem exposed to contaminants at the site.

As shown by the schematic diagram below, the *hazard assessment (H)*, *contamination level (L)*, *sensitivity value (S), protection value (P),* and *potential for migration* are ultimately weighted together in a comprehensive assessment. The final risk class (i.e. 1 to 4) is determined in a plotting scheme shown by the graph below. The location of the dots on the horizontal lines is determined by the risk assessment presented above. If all the dots on every line fall within the range for the same class, the site is assigned that particular risk class. In cases where the dots are distributed among two or more risk classes, the class best describing the site condition is to be selected. In this regard, factors such as the impressions of the assessors, the size of the site and the number of different contaminants involved will be decisive. Larger amounts of contaminants generally pose greater health and environmental risks than more limited amounts.



Source: SEPA (2006b)

Based on the comprehensive assessment, the site is assigned one of the following risk classes:

Risk Class 1 – *Very high* health and environmental risk.
Risk Class 2 – *High* health and environmental risk.
Risk Class 3– *Moderate* health and environmental risk.
Risk Class 4 – *Slight* health and environmental risk.

Appendix 2

Summary of the Government bill on LIP including a description of the information required in an application (SEPA, 2005c)

Grant applications must be accompanied by an account of the local authority's current efforts to promote ecologically sustainable development. In this regard, a holistic perspective is very important. Measures for which a local authority has sought a grant must contribute to improved ecological sustainability through a reduction in environmental impact, more efficient use of energy and other natural resources, increased use of renewable raw materials, extended re-use and recycling of waste material, activities to preserve and strengthen biological diversity, or projects aimed at improving the passage of plant nutrients through an eco-cycle.

Local authorities are required to show evidence of cooperation with the public, the business community and voluntary associations. They must also submit a detailed account of the measures planned to inform and educate the public in connection with the investment programme, and of the cost and financing of the programme. In addition, the local authority should present an assessment of the anticipated impact of the measures planned on employment, along with an account of the effects in relation to gender equality and the architectural character of the areas involved. The municipality should have a well-conceived strategy for follow-up.

Grants are to be distributed to those local authorities judged to have submitted the best proposals for local projects aimed at promoting ecologically sustainable development. Programmes should be assessed primarily on the basis of the results and effects anticipated by the local authority regarding ecological sustainability and increased employment, in relation to the amount of the grant.

Appendix 3

Subsidies granted for remediation projects under the LIP

Year	Municipality	County	Type	Subsidy (SEK 1 000)	Degree of subsidization	Risk class
1998	Nykvarn	Stockholm	water	28 400	0.67	1
1998	Mönsterås	Kalmar	land	61 000	1.00	1
1998	Alingsås	Västra Götaland	water	1250	0.42	2
1998	Kungälv	Västra Götaland	land	500	0.50	1
1998	Hedemora	Dalarna	land	18 200	0.31	2
1998	Ljungby	Kronoberg	land	350	0.70	2
1998	Ljungby	Kronoberg	land	2 220	0.70	2
1998	Fagersta	Västmanland	water	350	0.50	1
1998	Malmö	Skåne	land	49 000	0.33	2
1998	Falkenberg	Halland	land	6 504	0.80	2
1998	Karlstad	Värmland	land	2 200	0.30	2
1998	Kävlinge	Skåne	other	1 000	0.50	4
1998	Stockholm	Stockholm	land	90 000	0.44	1
1998	Stockholm	Stockholm	land	3 300	0.30	5
1999	Landskrona	Skåne	other	3 000	0.50	5
1999	Jönköping	Jönköping	land	8 000	0.87	1
1999	Jönköping	Jönköping	land	7 600	0.95	1
1999	Västervik	Kalmar	land	68 875	0.95	1
1999	Hagfors	Värmland	land	5 500	0.91	1
2000	Eskilstuna	Södermanland	land	8 000	0.67	2
2000	Göteborg	Västra Götaland	land	2 235	0.30	5
2001	Kristianstad	Skåne	other	180	0.15	5
2001	Kumla	Örebro	land	30 000	0.95	1
2002	Aneby	Jönköping	land	70	0.32	5
Total				398 000	0.56	

Source: SEPA's LIP database

Appendix 4

Variables: means, standard deviations, definitions and sources (n=125)

Variable	**Mean (st dev)**	**Definition and data source**
Risk class, (*R*)	1.63 (1.02)	The risk class of the site according to type of industry, MIFO phase 1 or 2, or other method of classification. The risk classes are based on information from agency officials, primarily of county and municipal administrative boards.
Employment opportunities, (*L*)	11.90 (24.89)	The number of annual full-time employment opportunities created by the project. From the LIP database at the SEPA and the project applications.
Unemployment rate, (*U*)	0.05 (0.02)	The annual unemployment rate of the municipality for 1998-2002. Source: AMV/ Statistics Sweden.
Directed grant, (*G*)	0.72 (0.45)	Dummy variable indicating the introduction of the directed grant in 1999 (=0 in 1998, and =1 in 1999-2002).
Social Democrats, (*SD*)	0.42 (0.09)	The share of votes for Social Democrats in the local government elections of 1994 and 1998. Source: Statistics Sweden.
Green Party members, (*GP*)	0.04 (0.01)	The share of votes for the Green Party in the local government elections of 1994 and 1998. Source: Statistics Sweden.
Environmental ranking, (*ER*)	59.97 (18.41)	The environmental ranking of the municipality from 1997 to 2001. Source: the magazine Miljö Eko.
Tax base, (*T*)	99 313 (13 726)	The tax base of the municipality in SEK per capita in year 1998. Source: Statistics Sweden.

References

Alberini, A. and D. Austin (1999) 'On and off the liability bandwagon: Explaining state adoptions of strict liability in hazardous waste programs', Journal of regulatory Economics 15(1), 41-63.

Alberini, A., A. Longo, S. Tonin, F. Trombetta, M. Turvani (2005) 'The role of liability, regulation and economic incentives in brownfield remediation and redevelopment: Evidence from surveys of developers', Regional Science and Urban Economics 35(4), 327-351.

Berglund, E. and A. Hanberger (2003) 'Evaluation of a national investment program for local sustainable development with a focus on environmental work' (in Swedish), Evaluation Reports No 12, Umeå Centre for Evaluation Research.

Bluffstone, R. A. and T. Panayotou (2000) 'Environmental liability and privatization in central and eastern Europe: Towards an optimal policy', Environmental and Resource Economics 17(4), 335-352.

Cameron A. C. and P. K. Trivedi (2005) 'Microeconometrics. Methods and Applications'. Cambridge University Press.

Chang, H. F. and H. Sigman (2000) 'Incentives to settle under joint and several liability: An empirical analysis of superfund litigation', Journal of Legal Studies 29(1), 205-236.

Mc Cluskey, J. J. and G. C. Rausser (2003) 'Hazardous Waste Sites and Housing Appreciation Rates', Journal of Environmental Economics and Management, 45(2), 166-176.

Cropper, M. L., W. N. Evans, S. J. Berardi, M. M. Ducla-Soares, and P. R. Portney (1992) 'The Determinants of Pesticide Regulation: A Statistical Analysis of EPA Decision Making', The Journal of Political Economy, Vol. 100, No. 1, 175-197.

Dahlberg, M. and E. Johansson (2002) 'On the Vote-Purchasing Behaviour of Incumbent Governments', American Political Science Review, 96 (1), 27-40.

Dinan, T. and F. R. Johnson (1990) 'Effects of hazardous waste risks on property transfers: Legal liability vs. direct regulation', Natural Resources Journal 30, 521-536.

Environmental Objectives Portal (2005) http://www.miljomal.nu/english/objectives.php. Accessed 2005-09-27.

Forslund, J. (2005) 'Insamling och bearbetning av data till projektet Utvärdering av svensk miljöpolitik: Sanering av förorenade områden' (in Swedish), Memo 2005: 17, National Institute of Economic Research.

Gayer, T., J. T. Hamilton and W. K. Viscusi (2000) 'Private Values of Risk Tradeoffs at Superfund Sites: Housing Market Evidence on Learning about Risk', Review of Economics and Statistics, 82(3), 439-451.

Gayer, T. and W. K. Viscusi (2002) 'Housing Prices Responses to Newspaper Publicity of Hazardous Waste Sites', Resource and Energy Economics, 24(1-2), 33-51.

Gov. Bill 1969:387: Miljöskyddslagen (in Swedish)

Gov. Bill 1998:808: Miljöbalken (in Swedish)

Gov. Bill 2000/01:130: Svenska miljömål – delmål och åtgärdsstrategier (in Swedish).

Gov. Bill 2004/05:150: Svenska miljömål – ett gemensamt uppdrag (in Swedish).

Gov. Communication 2003/04:141: Sanering och återställning av förorenade områden – resultatredovisning (in Swedish).

Greenberg, M. and J. Hughes (1992) 'The impact of hazardous waste Superfund sites on the value of houses sold in New Jersey', Annals of Regional Science 26(2), 147-153.

Gupta, S., G. Van Houtven, and M. Cropper (1996) 'Paying for permanence: an economic analysis of EPA's cleanup decisions at Superfund sites', Rand Journal of Economics, Vol. 27, No. 3, 563-582.

Hallvig, G. (2006) Swedish National Labour Market (AMS). Personal communication 2006-04-07.

Hamilton, J. T. and W. K. Viscusi (1999a) 'Calculating Risks? The Spatial and Political Dimensions of Hazardous Waste Policy'. The MIT Press.

Hamilton, J. T. and W. K. Viscusi (1999b) 'How Costly is 'Clean'? An Analysis of the Benefits and Costs of Superfund Site Remediations', Journal of Policy Analysis and Management, Vol. 18, No. 1, 2-27.

Ihlanfeldt, K. R. and L. O. Taylor (2004) 'Externality effects of small-scale hazardous waste sites: evidence from urban commercial property markets', Journal of Environmental Economics and Management, 47, 117-139.

Ketkar, K. (1992) 'Hazardous waste sites and property values in the state of New Jersey', Applied Economics 24(6), 647-659.

Kiel, K. A. (1995) 'Measuring the impact of the discovery and cleaning of identified hazardous waste sites on house values', Land Economics 71, 428-435.

Kiel, K. and J. Zabel (2001) 'Estimating the economic benefits of cleaning up Superfund sites: The case of Woburn, Massachusetts', Journal of Real Estate Finance and Economics, 22(2-3), 163-184.

Kågeson, P. and A. M. Lidmark (1998) 'Konsten att använda 5.4 miljarder. En kritisk granskning av stödet till de lokala investeringsprogrammen för hållbar utveckling' (in Swedish), Svenska Naturskyddsföreningen, Rapport 9423/98.

Lin, T. F. and P. Schmidt (1984) 'A test of Tobit specification against an alternative suggested by Cragg', Review of Economics and Statistics, 66, 174-178

Michaels, G. R. and K. V. Smith (1990) 'Market segmentation and valuing amenities with hedonic models: the case of hazardous waste sites', Journal of Urban Economics 28(2), 223-242.

Miljö-Eko (2005) 'Miljö-ekos kommunranking 2001' (in Swedish), http://www.miljo-eko.nu/. Accessed 2005-11-08.

Ordinance 1998:23, Ordinance on Support for Local Investment Programmes Aimed at Enhancing Ecological Sustainability in the Community.

Regeringskansliet (2000) Att ansöka om stöd till Lokala investeringsprogram (in Swedish).

Riksdagens Revisorer (1999) 'Statligt stöd till lokala investeringsprogram för en ekologiskt hållbar utveckling' (in Swedish), Rapport 1998/99:8.

Riksrevisionsverket (1999) 'De lokala investeringsprogrammen i praktiken. En uppföljning av kommunernas arbete' (in Swedish) Effektivitetsrevisionen RRV 1999:37.

SEPA (1990a) 'Inventering och riskklassning av äldre avfallsupplag: Växjöprojektet' (in Swedish), Rapport 3858, 1990.

SEPA (1990b) 'Översiktlig undersökning av avfallsupplag: Metodutveckling och tillämpning med exempel från Östergötland 1990' (in Swedish), Rapport 3859.

SEPA (1995a) 'Branschkartläggningen' (in Swedish), Rapport 4393.

SEPA (1995b) 'Inventering och riskklassificering av äldre gruvavfallsupplag' (in Swedish), Rapport 4396.

SEPA (1999) 'Metodik för inventering av förorenade områden. Bedömningsgrunder för miljökvalitet. Vägleding för insamling av underlagsdata'(in Swedish), Rapport 4918. Fälth & Hässler, Värnamo.

SEPA (2002): 'Methods for inventories of contaminated sites. Environmental quality criteria. Guidance for data collection', Report 5053. Fälth & Hässler, Värnamo.

SEPA and IEH (2004) 'Local Investment Programmes – The way to a sustainable society'.
SEPA (2004a) 'Summering av länsstyrelsernas nyckeltal för efterbehandling år 2004' (in Swedish).
SEPA (2004b) 'The Swedish Local Investment Programs from a socio-economic perspective' (in Swedish), Report 5453.
SEPA (2005a) 'Introduktion till efterbehandling' (in Swedish) http://www.naturvardsverket.se/dokument/teknik/sanering/sanerdok/intro.htm. Accessed 2005-11-14.
SEPA (2005b), 'Efterbehandling och sanering av förorenade områden' (in Swedish) http://www.naturvardsverket.se/dokument/teknik/sanering/sanering.htm Accessed 2006-01-30.
SEPA (2005c), 'Applications' http://www.internat.environ.se/documents/issues/inveprog/lip/lip_docs/applicat.htm. Accessed 2006-01-30.
SEPA (2006a) 'Efterbehandling och sanering av förorenade områden' (in Swedish), http://www.naturvardsverket.se/dokument/teknik/sanering/sanering.htm. Accessed 2006-03-16.
SEPA (2006b) 'Environmental Quality Criteria for Contaminated sites' http://www.internat.environ.se/index.php3?main=/documents/legal/assess/assedoc/cont.htm. Accessed 2006-02-24.
Sigman, H. (2001), 'The pace of progress at Superfund sites: Policy goals and interest group influence', Journal of Law and Economics Vol XLIV, 315-344.
Stata Corp (2001), 'Stata Statistical Software, Release 7.0', College Station, TX, Stata Corporation.
Statistics Sweden (2006) www.scb.se. Accessed 2006-01-11.
Swedish Social Insurance Agency (2006), 'Activity Support', http://www.fk.se/sprak/eng/arbsok/. Accessed 2006-02-24.
Viscusi, W. K., J. T. Hamilton, P. C. Dockins (1997) 'Conservative versus mean risk assessments: Implications for Superfund policies', Journal of Environmental Economics and Management 34(3), 187-206.
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