Public Policies for Contaminated Site Cleanup: The Opinions of the Italian Public

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Summary

Cleaning up contaminated sites is one of the most important environmental policy priorities in many countries. Remediation of contaminated sites is attractive because it reduces risks to human health and ecological systems, and brings a host of potential social and economic benefits. Even when the burden of paying for cleanup is imposed on the parties that are responsible for the contaminated sites, in many countries government programs are established for enforcement purposes, to set cleanup standards, and to address contamination at those sites where the responsible parties are no longer in existence or do not have the means to pay for cleanup ("orphan" sites). This paper presents the results of a survey of the Italian public where we ask citizens to report their opinions about possible goals for such government programs and for cleanup. Our survey respondents are generally in favor of broad-based programs that protect the health of a diverse population—without restricting attention to cleanup beneficiaries in specific age groups or to specific exposure pathways. They also in favor of permanent remedies, even if they cost more, and of cleaning up sites even when the health risk reduction are experienced in the future, as is usually the case with carcinogenic contaminants.

Keywords: Public Policy, Contaminated Sites, Permanent Remedies, Protection of Health and Ecosystems at Contaminated Sites

JEL Classification: I18, J18, K32, Q53

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1. Introduction

Recent public opinion surveys in the United States and Europe suggest that cleaning up contaminated sites is considered an important priority for environmental policy in many countries. As recently as March 2006, polls indicated that the American public worries about contamination of soil and water by toxic waste to a greater degree than other environmental problems.[1] Likewise, 70% of the European citizens surveyed as part of the European Commission's Thematic Strategy on soil protection identified polluting industrial installations as the most important contributors to soil degradation, and two-thirds mentioned contamination as the most important threat to soil.[2]

Remedial action at contaminated sites mitigates the risks to human health and the environment by interrupting exposure pathways and reducing the amount, mobility and toxicity of uncontrolled hazardous wastes in the environment. Even if remediation is undertaken now, the risk reduction—and hence of the health benefits of cleanup—takes place in the future, especially when cancer risks are concerned. This has two important implications: First, an individual currently exposed to contaminants may experience the risk reduction later in life. Second, the likely beneficiaries of the risk reduction may be today's children and teenagers (Hersch and Viscusi, 2005).

[1] Specifically, 52% of the public worries "a great deal" about toxic waste contamination, 29% worries "a fair amount" about it, and only 19% worries only a little or not at all about it (statistics from a Gallup poll reported in the New York Times, 23 April 2006).
[2] See http://ec.europa.eu/environment/soil/pdf/results_citizens.pdf

Assuming that people's perceptions are in line with true risks (see Hadden, 1991; Slovic et al., 2004; Hakes and Viscusi, 2003), does the public understand the time dimension involved in cleanup decisions and policies? Which goals should be pursued when setting policies for remediating contaminated sites?

In May 2005, we surveyed residents in four Italian cities selected to ensure a geographical coverage of the country and because they have serious contaminated site problems—Venice, Milan, Naples and Bari—to find out how familiar people are with contaminated sites, what human health effects they link with contaminated site exposures, and how concerned they are about such health effects.

After eliciting their baseline knowledge, the questionnaire provided information about contaminated sites in Italy and remediation techniques, including their cost, the type of contamination best addressed by each of them, and the time needed for their completion. We then asked respondents to read a list of statements describing possible objectives of government remediation programs and to tell us how strongly they agreed or disagreed with them. Examples of these statements include, among others, priority for permanent cleanups (even if more expensive), protection of ecosystems, restricting cleanups to sites that pose a threat to human health, and avoiding spending money on cleanups that would save human lives only in 30 years from now.

In this paper, we report on the main results from this study, focusing on three main research questions. First, how well acquainted are people with contaminated sites, and where do they seek information about them? Second, which do people believe should be the goals of public remediation programs? Third, are the priorities people assign to contaminated site programs systematically related to their individual and socio-economic

characteristics, and to their degree of civic and environmental activism? Do they depend on how much people know about contaminated sites in their area, how much they know about remediation, and whether they approve of government cleanup activities in general?

Briefly, we found that people report being aware of contaminated sites, at least in the four cities of our survey. They also know that it is possible to address the risk of contamination through remedial action and are generally supportive of remediation programs with broad and far-reaching goals. Most people are in favor of permanent remedial actions even if they are more expensive and even if benefits will be incurred in the future. The responses to our survey also indicated that most people believe that public remediation programs should have a broad focus and should not be targeted to specific population groups or to specific contamination pathways. We found little evidence of a systematic association between priorities and individual characteristics of the respondents.

The remainder of this paper is organized as follows. In Section 2 we present background information on hazardous waste site policies in the US and in Italy. In Section 3 we describe our survey and its administration in the four Italian cities. Section 4 discusses the results of the survey. Concluding remarks are provided in Section 5.

2. Legal Background

In the U.S., remediation of contaminated sites is addressed by the federal Superfund program (established by law in 1980) and a host of state enforcement- and incentive-based programs. Since 1986, when the Superfund statute was amended and re-

authorized, the selection of remedies at the most egregious contaminated sites in the U.S.—those placed on the so-called National Priorities List—is supposed to give preference to permanent remediation, such as treatment of the uncontrolled hazardous wastes, as opposed to simple barriers or restrictions to access. Incentive-based programs, such as Voluntary Cleanup Programs and Brownfield programs, were subsequently established in hopes of encouraging private cleanups and productive reuse of the properties (Meyer and Van Landingham, 2000; Bartsch and Dorfman, 2000).[3] A survey of the US General Accounting Office (1997), however, suggests that impermanent remedies have been common at cleanups covered by these programs.

In Italy, until April 2006, a number of laws addressed contaminated sites. Legislative Decree 22/1997 (also known as Ronchi Decree or Waste Act) first imposed private and public liabilities with respect to remediation, established standards for contaminant concentrations in various environmental media as a function of land use, and provided guidelines for environmental assessment, investigation and remedial action. The Ronchi Decree is consistent with the Directive of the European Union on environmental liability (Directive 2004/35/CE) and with the Communication on Thematic Strategy on Soil (COM2006/231 final).[4]

Ministerial Decree 471/99 defines as contaminated sites those sites with levels of contamination or chemical, physical or biological alteration of soils, subsoils, surface or

[3] See Alberini et al. (2005) for a stated-preference study of the responsiveness of real estate developers to incentives, and Trombetta and Turvani (2006) and Wallace-Jones (2003) for a discussion of the role of voluntary cleanup agreements between parties. Alberini (forthcoming) studies the determinants and the effects on properties prices of participation in voluntary cleanup programs.

[4] The Directive on Environmental Liability states that remediation of contaminated sites should take place in an effective manner ensuring that the cleaning up objectives are achieved. Regarding contamination problems, Communication 2006/321 recommends that Member States identify the contaminated sites on their territory and establish a national remediation strategy that "should be based on sound and transparent prioritarization of the sites to be remediated, aiming at reducing soil contamination and the risk caused by it and including a mechanism to fund the remediation of orphan sites".

ground water that pose a danger to public health or the natural or built environment. A site is considered contaminated if even only one of the contaminants exceeds the maximum contamination level set by the law.

Cleanup must bring contamination below specific concentration limits established by the law, which vary with the land use at the site. However, the limits are very stringent and are usually interpreted to imply a preference for permanence remediation.

The law further dictates that the most egregious contaminated sites be placed on the National Priorities List (NPL), and spells out criteria that must be met for a site to be included in the NPL. Only sites on the NPL qualify for funding for cleanup and oversight from the national government. Regarding financing, the Decree provides that cleanup be partly financed by public funds up to 50% of the total cleanup costs. Public intervention is granted in the presence of higher public interests related to the protection of human health, as well as environmental and employment needs.

At this time the NPL is comprised of 53 sites. Figure 1 shows the location of the Italian NPL sites along with cleanup cost information for the NPL sites in the four cities where we conducted our survey. This figure demonstrates that the NPL sites are distributed over the entire national territory, and in this sense the Italian contaminated site program is truly a national program.

In addition, there are at least 13,000 potentially contaminated sites in Italy, and about 5,100 of these non-NPL sites are included in the Registry of Contaminated Sites maintained by each Italian Region[5] following the guidelines established by the national

[5] In Italy, a Region is a jurisdiction roughly comparable to the State in the U.S. Regions have law-making authority and run their own environmental programs and agencies.

Environmental Protection Agency (APAT) (APAT, 2004). About 420 of the sites on this registry (about 8% of the total) have been already cleaned up (APAT, 2004).

In 2006 Legislative Decree 152/2006 changed the approach to addressing contaminated sites. Its main novelty is the endorsement of risk assessment as the approach for quantifying the degree of contamination in a specific area. The concentration limits previously established by Ministerial Decree 471/99 are now used as "Contamination Threshold Concentrations (CTCs)." If the concentrations of contaminants at a particular sites are higher than the CTCs, the responsible party must prepare a site characterization plan and conduct a risk assessment study to determine the site's Risk Threshold Concentrations (RTCs) and within six months, a remedial action plan must be presented by the responsible party to the Regional Authority. At orphan sites, the municipal government must prepare the remediation plan and present it to the Regional Authority.

The implications of this approach on the permanence of remedies are unclear. In addition, our conversations with representatives of local waste management and cleanup agencies suggest that there is much uncertainty about whether this recent law is expected to remain in place or be repealed.

3. The Survey

There are numerous contaminated sites in Italy, as a result of its extensive manufacturing base and oil refining plants on the coastline. The transition to a service economy and urban regeneration needs have resulted in changing land uses and raised awareness about contamination, abandoned facilities and the possible reuse of the land.

It is thus important to find out how well acquainted are people with contaminated sites, and if and where do they look for information about them. We also wish to find out which goals people want for public remediation programs. Are these priorities systematically related to individual and socio-economic characteristics, and to the respondent's degree of civic and environmental activism? Do they depend on how much direct knowledge people have about contaminated sites in their area and/or remediation?

To answer these questions we developed a survey questionnaire, which we administered in May 2005 to a sample of residents of four Italian cities—Venice, Milan, Bari and Naples—chosen to be representative of Italy's geography and because all of these four cities have one or more sites on the NPL. The Marghera industrial and chemical complex, near Venice, is notorious for the complexity of its contamination problem and because this is the NPL site with the most expensive cleanup (€753 million). Cleanup costs are relatively modest for Bari's Fibronit site (a former asbestos processing plant), where they are estimated to be €7.7 million (Law 468/2006).

The questionnaire was self-administered by the respondents using the computer, and resulted in 804 completed questionnaires (about 200 per city). Our respondents were recruited among the residents aged 25-65 of the four cities and asked to go to a centralized facility to take the survey. The sample is comprised of a roughly equal number of men and women, and is stratified by age using three broad age groups (25-44, 45-54, 55-65), with an equal number of respondents for each of them.

The questionnaire begins by asking people whether they are acquainted with contaminated sites, and, if so, how. Did they learn about contaminated sites from the newspapers or television news, by attending civic association meetings, or in other ways?

Since a respondent's notion of contaminated site may be different from our own, we subsequently provide the following definition: "A contaminated site is a parcel or an area with hazardous substances that pose risks to human health or the environment, now or in the future. These hazardous substances are the result of human activities. Electromagnetic fields/pollution and air pollution are not considered contaminated sites in this questionnaire." Respondents are then encouraged to think about possible contaminated sites that might exist in their neighborhood or near their workplace.

Respondents were offered summary information about the extent of the contaminated site problem in Italy, the NPL, and the population affected by these sites. The questionnaire then informed them about the ways in which individuals are exposed to toxics migrating from contaminated sites (for example, by drinking contaminated groundwater or through dermal exposure) and the health consequences potentially linked to these exposures. How concerned is the respondent, we inquire, about these adverse health effects? Respondents are then offered stylized information about remediation and are shown three commonly used remediation techniques—pump-and-treat, soil excavation and removal, and bioremediation—along with the typical duration, cost, and the contaminants for which these techniques are best suited.

Once respondents had been educated about the technological aspects of addressing contaminated sites and their feasibility, it was then possible to pose questions about people's opinions about goals and priorities of remediation programs. Specifically, we first asked people to rate the usefulness of government-led remediation of orphan sites, and then asked to tell us how strongly they agreed or disagreed with a number of possible priorities for contaminated site programs.

Figure 2 shows the screen with these questions. As shown in Figure 2, we asked whether the respondent agrees with (i) giving priority to permanent and effective remediation plans, even if they cost more, (ii) implementing remediation plans which ensure protection of the ecosystem, (iii) implementing remediation plans only if the site poses threat to human health, (iv) avoiding spending resources for remediation plans which save lives no earlier than 30 years from now, (v) giving priority to sites where the groundwater is contaminated, (vi) intervening only at sites where the contamination has entered in the food chain, (vii) investing more resources at sites where the elderly are the most highly exposed category of people, and (viii) investing more resources at sites where children are the most highly exposed group. Respondents were asked to express their agreement or disagreement with each of statement (i)-(viii) on a scale from 1 to 5, where 1 denotes complete disagreement and 5 denotes complete agreement.

It should be noted that by the time people were queried about program priorities, they had been given information about the institutional, technological and economic aspects of contaminated site programs. In addition, the respondents had previously engaged in tradeoffs between alternative hypothetical cleanup programs that differed for the mortality risk reduction afforded by the program, the size of the population affected, the delay until the beginning of the risk reduction, the duration of these mortality risk reductions and, of course, cost. The responses to these questions and their implications on the monetized benefits of cleanup programs are presented in Alberini et al. (2006).

The last section of the questionnaire asks respondents to report standard socio-demographic information, such as age, gender, marital status, educational attainment, income and occupation.

4. Results

A. Characteristics of the respondents

Descriptive statistics of the respondents are reported in Table 1. Our sample is evenly split between men and women and the average age is 47 years, which is slightly more than the average age in the Italian population (42.3 years), but it is consistent with our sampling plan.

Forty-nine percent of the sample has a high school degree and 13% a university degree or post graduate education. For comparison, in the Italian population in the same age range (18-65), these percentages are 32% and 11%. The average household income is €26,784 per year. This figure is comparable to the average household income in Italy, which is about €29,483 per year (Banca d'Italia, 2006).

About 73% of the respondents are married or cohabitating with their partners, while 19.4% are single and 7.21% are divorced, separated or widowed. The average household size in our sample is 3.25. This is slightly higher than the average in Italy (2.69 people per household). Thirty percent of the respondents have children up to 15 years old.

B. Information about Contaminated Sites

Are our respondents acquainted with the contaminated site problem? The data show that 90% of our respondents have previously heard of contaminated sites. This seems reasonable, given the population from which we sampled our respondents. Further examination of the data reveals that there is variation across the cities in the degree of awareness about contaminated sites: In Bari, 81.50% of the respondents have heard of

contaminated sites prior to the survey, while in Milan, Venice and Naples the corresponding figures are 96.52%, 91.63% and 90.50%. The respondents in the Bari subsample are less educated than the others which prompts us to examine the correlation between education and prior knowledge of contaminated sites.

Knowledge does appear to be related to the respondent's educational attainment: 92.49% of the most highly educated respondents (those with a high school diploma or college degree) reported having heard of contaminated sites before, against 85.91% of the less educated respondents. The difference between the two groups is statistically significant at the 1% level.

Roughly 77% of the "informed" group obtained their information by reading newspapers and watching television, 18% by attending conferences and neighborhood meetings, and 11% at school or at the university. The propensity to acquire information by attending events such as neighborhood meetings and conferences increases with education and is higher among those respondents living in proximity of disposal sites and abandoned factories. We find that highly educated respondents (persons with a high school diploma or a college degree) said that they had attended these events, against 16.78% of the others—the difference being statistically significant at the 1% level. In addition, 36.4% of the respondents living near disposal sites and 26% of those living near abandoned factories participated in such meetings or conferences, against 18.98% and 20% for all others.[6] We do not know whether those respondents who live near waste disposal sites went to meetings and conferences to seek further information about these

[6] The differences are statistically significant at the 5% level for abandoned factories and at the 1% level for disposal sites.

sites (which they already knew to be contaminated), or rather learned that these sites are contaminated *because* they attended these meetings.

Finally, 43% of our respondents are aware of the existence of contaminated sites near their homes or workplaces. These respondents generally are more concerned with health risks associated to contamination and, even before reading the questionnaire's information about possible health risks, they are more likely to link exposure to toxicants at contaminated sites with a number of adverse health effects, including allergies, respiratory problems, damage to liver and other organs, and cancer. Overall, almost 90% of the respondents subscribe to the statement that it is "very important" to reduce such adverse health effects.

C. The Role of the government and cleanup priorities

Most of our respondents are in favor of active involvement on the part of the government at contaminated sites: 83.6% believe that government-led remediation at orphan sites is "very useful" (response category 5 on a scale from 1 to 5), 6.72% find them "useful" (response category 4), 4.73% "somewhat useful" (response category 3), and only 2.26% opts for response category 1 ("not useful") or 2.

We now turn to people's opinions on the general goals of programs addressing hazardous waste sites. The questionnaire offers respondents a set of statements defining possible goals of the remediation programs, and respondents must indicate how strongly they agree or disagree with them on a Likert scale where 1 means complete disagreement and 5 means complete agreement. The frequencies of the responses are displayed in Table 2.

As shown in Table 2, people do care about permanent remediation (variable PERMANENT): 79% of the respondents fully agree with giving priority to permanent cleanup and effective remediation plans, even if they cost more. While human health is probably their strongest concern, our respondents also care about the consequences of pollution on ecological system: 85% of the sample completely agree that remedies should be chosen to protect the ecosystem (see item 2 in Table 2) .

Although people appear to be concerned about health risks due to contamination at sites, the distribution of the responses to the statement that "remedial actions should be carried out only if contamination is a threat to human health" (THREAT in Table 2) is bimodal. About 41% of the respondent is in complete agreement and 21% is in complete disagreement with this statement, suggesting that people favor broader goals for public interventions and not merely the protection of human health.

We explore the issue of futurity of the health benefits again with the statement that we should "avoid spending resources for remediation actions that save lives no earlier than 30 years from now" (AVOID-item 4 in Table 2). Forty one percent of the sample is in complete disagreement with it, while 24% is in complete agreement.

Yet, the AVOID responses are broadly consistent with those exhibited for the PERMANENT statement: Out of the 623 people that fully agree with the statement that preference should be given to permanent remediation even if more costly (PERMANENT), 346 (about 56%) fully or almost fully disagree with the AVOID statement that remediation should be avoided if it brings health benefits in the distant future (more than 30 years from now).

It is of interest to examine if people show a preference for programs that would target sites with specific exposures pathways, perhaps those judged to be most common and dangerous. We explore people's opinions about remediation of sites associated with certain exposure pathways in statements 5 and 6: people are asked to agree or disagree with giving priority to cleaning up sites where the groundwater is contaminated (GROUDWATER) or whether contamination has entered in the food chain (FOODCHAIN). The responses show that people agree that remediation of contaminated groundwater deserves high priority (77% of the sample is in complete agreement with this statement). By contrast cleaning up sites where toxicants have entered in the food chain garners less support: 49% are in agreement with this statement, and the remainder is spread evenly over the other response categories.

Finally, it is conceivable that the beneficiaries of public interventions might be specific age groups in the population, raising the question whether the respondents are sensitive to the age of the beneficiaries issue. The three-quarters of the respondents is in full agreement with devoting more resources to cleaning up sites where children are the most highly exposed group, but only 39% of the sample would agree to devote more resources to cleaning sites where the elderly are the most highly exposed category of people. However, it should be noted that 306 of the 313 respondents supporting programs for the elderly also support protecting children. This suggests that a sizable fraction of our sample favors broad programs without specifically focusing on the age of the beneficiaries.

C. Determinants of opinions about cleanup priorities

Are the responses to the Likert scale questions about cleanup priorities systematically associated with individual characteristics of the respondents and their place of residence? To look for answers to these questions we turn to pairwise correlations, which we report in table 3.A-D.

Table 3.A suggests that preferences for cleanup priorities are generally not significantly associated with the individual characteristics of the respondents. The only exception is that respondents with children (or more children) are willing to devote more resources to cleaning up sites where children are the most highly exposed group and to be less in favor of focusing exclusively on sites where human health is at risk. Older respondents tend to agree that sites where pollutants have entered the food chain should be given high priority.

Regarding socioeconomic status, which we measure using education and income, perusal of the bottom panel of Table 3.A suggests that more highly educated people tend to disagree with programs that imply a narrow focus on very specific pathways, age group and human health effects of pollution. We interpret the negative association between income and the agreement scores for such types of programs in an analogous way.

The responses of people that already knew about contaminated sites or remediation before participating in the survey are not systematically different from those of the other respondents (Table 3.B). Being concerned about the health risks due to pollution exposures tends to result in being more favorable to cleanup even where the benefits would be incurred in the distant future (as is typically the case with carcinogens) and to programs that target sites where children are the most highly exposed category.

The same applies for respondents approving of active government involvement with orphan sites cleanups.

Respondents volunteering their time to social causes show less support for narrowly focused cleanup priorities, and, as expected, people who participate in environmental organizations are more concerned with protecting the ecosystem—but these effects are small and statistically significant only at the 10% level (see table 3.C).

Finally, table 3.D examines priority patterns by city. The only notable effect here is that respondents in the Naples sample tend to be in full agreement with most of the suggested priorities (except for cleanup exclusively at sites where human health is at risk).

D. Ordered probit models

Tables 4.A-4.C report the results of ordered probit equations that relate the Likert scale scores to *all* of the variables (individual characteristics, socioeconomics, knowledge of sites, attitudes and city of residents) previously examined. For each dependent variable the strength of agreement or disagreement with specified priorities of publicly funded cleanups we fit two specifications—one with and one without city dummies. The general finding is that few of the regressors are significantly associated with the agreement/disagreement scores.

Support for permanent remediation is fairly uniform throughout the sample, but somewhat stronger among those who are very concerned about the health risks linked to exposures to the contamination. Support for remediation that protects ecosystem, in addition to human health risks, is stronger among those respondents who volunteer time

to environmental organizations and causes. *Exclusive* focus on reducing human health threats is somewhat less likely among respondents with children and with higher education.

What kind of respondents are more "patient" with the benefits of cleanup, so that they would insist on remediation even if cleanups result in benefits 30 years or more from now? Table 4.B shows that more highly educated respondents, persons which higher income, with previous knowledge of the problem of contaminated sites, and who are more concerned about the health effects of pollution are more "patient" (variable AVOID).

Concern for specific pathways (GROUNDWATER and FOODCHAIN) is more pronounced among those who worry about the health effects of pollution and less pronounced among the more highly educated and wealthier respondents. Surprisingly, once all other regressors are included, neither the age of the respondents nor having children are significantly associated with giving priorities to specific age-groups of beneficiaries. Better educated people, however, tend to be less supportive of programs targeting the elderly.

5. Conclusions

Most environmental protection agencies and city officials agree that remediation of contaminated sites is attractive because it reduces risks to human health and ecological systems, and brings a host of potential social and economic benefits. The legislation adopted in the US and Europe is generally based on the *"polluter pays"* principle, i.e. on assigning responsibility for the cost of cleanup on those parties who have contributed to

creating the contaminated site in the first place. Enforcement and the need to address "orphan sites" have, however, placed considerable burden on government's agencies.

At the same time, little is known about the public's opinions about various priorities for hazardous waste site programs. We have surveyed residents of four Italian cities (Venice, Milan, Bari and Naples) with serious contaminated site problems to investigate their awareness of the contaminated site problem and to elicit their preferences for public programs for the remediation of contaminated sites, probing them extensively on specific priorities for such programs.

Briefly, we find that the majority of people in Italy are informed about the existence of contaminated sites, and that a large proportion of the sample (around 43%) have direct personal knowledge of one such site in their neighborhood or near their workplace. People are in favor of permanent remediation, even if more expensive, and of remedial actions that produce risk reduction benefits in the distant future. They also care for the health of ecological systems and support broad-based cleanup programs, regardless of the contamination exposure pathway. The most highly educated respondents do not discriminate for or against beneficiaries in specific age groups. This suggests that our respondents' tastes for cleanup goals are generally consistent with environmental and social sustainability goals.

We find relatively little evidence of an association between preferences for cleanup programs and the individual characteristics of the respondents, or prior knowledge of the contaminated site problem. Generally speaking, however, more highly educated people seem to prefer broader goals for programs that address hazardous waste sites. These findings would seem consistent with a Bayesian updating mechanism (e.g.,

Viscusi and O'Connor, 1984; Gayer et al., 2000), whereby the final attitudes towards the goals of cleanup programs incorporate the respondents' pre-existing attitudes as well as the information about contaminated sites, current legislation, cleanup technologies and feasibility that was provided in the questionnaire. The relative weight placed on the prior beliefs and the newly provided information may well depend on respondent education. We leave explicit Bayesian updating mechanisms explaining how individuals form or update their preferences in response to exposure to information about contaminated sites to future research.

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Figure 1. Sites on the Italian NPL.

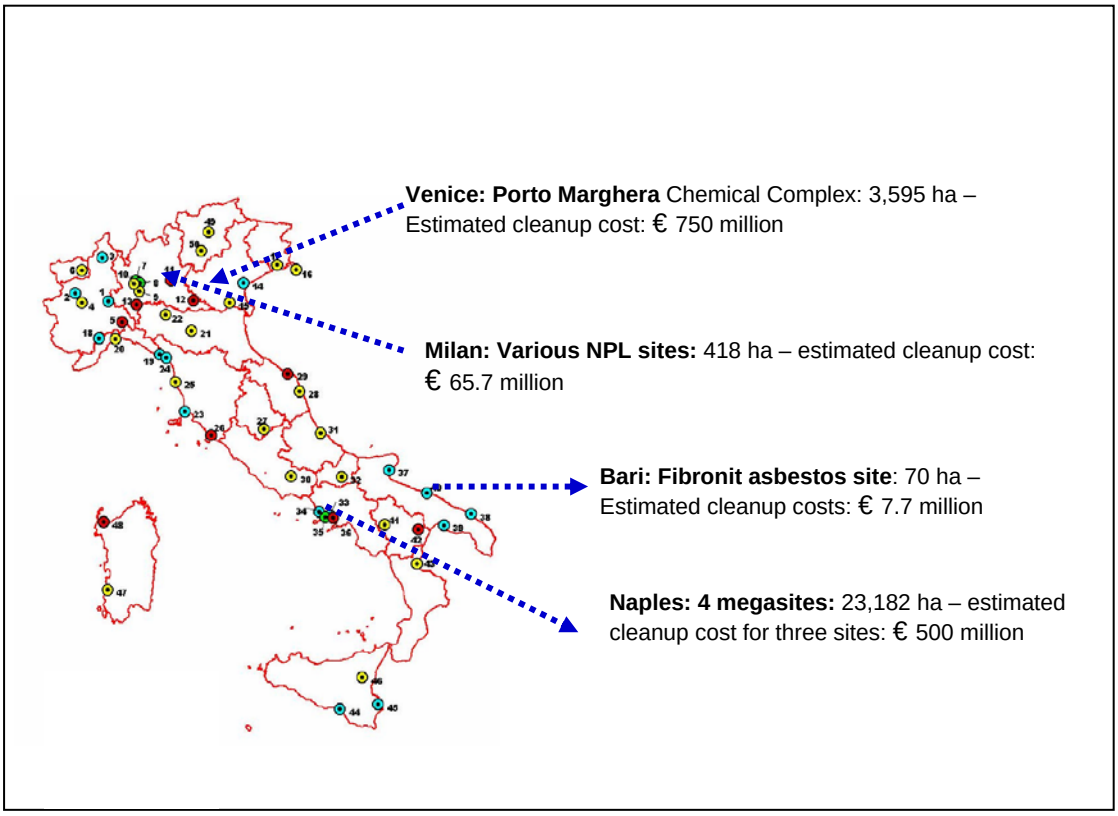

Figure 2. Priorities for cleanup policies in the survey questionnaire.

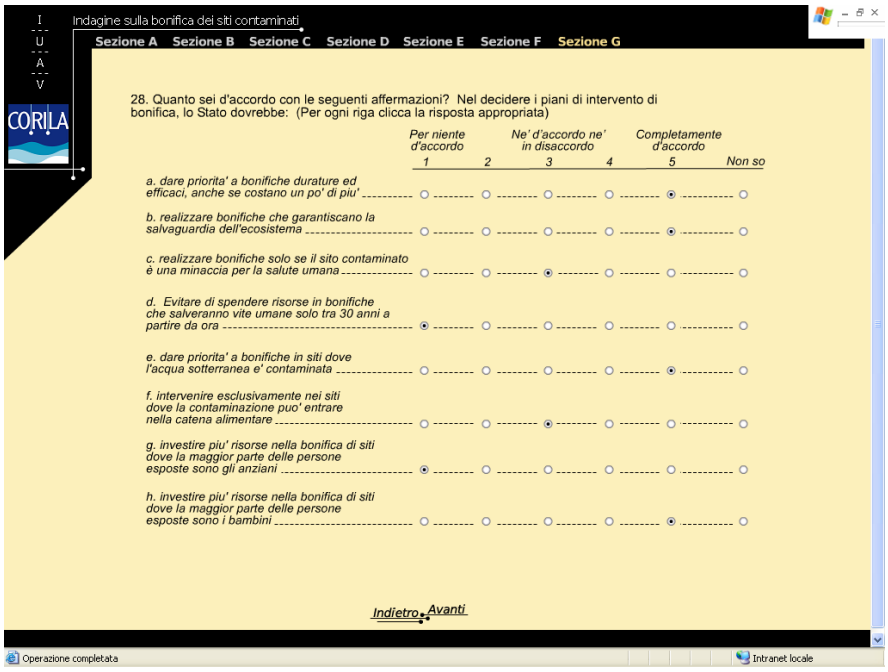

Table 1. Socio-demographic characteristics of the respondents.

Variable	Mean	Stand. Devn.	Min	Max
Male (dummy)	0.5075	0.50	1	2
Age (years)	47.02	11.25	25	65
Married/living together (dummy)	0.73	0.44	0	1
CHILDREN 0-15 (dummy)	0.308	0.46	0	1
High school degree (dummy)	0.49	0.50	0	1
University degree (dummy)	0.13	0.32	0	1
Household size	3.25	1.17	1	8
Household income (euro/yr)	26,784	19,248	5,000	150,000

Table 2. "Do you agree with the following statements? When deciding about remediation plans, the Government should:…"

Goals and priorities of remediation programs	1 Completely disagree	2	3 Neither disagree nor agree	4	5 Completely agree	Don't know
1. Give priority to permanent and effective remediation plans, even if they cost more **[PERMANENT]**	0.62%	0.75%	5.85%	12.31%	79.60%	0.87%
2. Implement remediation plans which ensure protection of the ecosystem **[ECOSYSTEM]**	0.50%	0.50%	2.99%	10.07%	85.07%	0.87%
3. Implement remediation plans only if the contamination is a threat to human health **[THREAT]**	21.02%	8.83%	14.55%	12.56%	41.42%	1.62%
4. Avoid spending resources for remediation plans which save lives no earlier than 30 years from now **[AVOID]**	40.55%	10.07%	14.43%	7.46%	23.76%	3.73%
5. Give priority to the cleanup of those sites where groundwater is contaminated **[GROUNDWATER]**	2.49%	1.62%	4.98%	12.56%	76.87%	1.49%
6. Intervene exclusively when contamination could enter in the food chain **[FOODCHAIN]**	14.80%	9.20%	13.81%	11.82%	49.00%	1.37%
7. Invest more resources to clean up those sites where the elderly are the most highly exposed category **[ELDERLY]**	10.70%	10.07%	22.76%	15.80%	39.05%	1.62%
8. Invest more resources to clean up those sites where children are the most highly exposed category **[CHILD]**	4.35%	1.99%	5.60%	12.60%	75.25%	0.75%

Table 3.A. Pairwise correlations between Likert scores and demographic and socioeconomic status of the respondents.

First number in each cell: pairwise correlation coefficient. Second number: P-value. Third number: number of valid responses (Don't know responses were excluded).

	permanent	ecosystem	threat	avoid	groundwater	foodchain	elderly	child
demographics								
Eta	0.1177	0.0607	0.1197	-0.0126	0.1316	0.1409	0.1986	0.0579
	0.0009	0.0868	0.0007	0.7264	0.0002	0.0001	0	0.1022
	797	797	791	774	792	793	791	798
Male	-0.0324	0.0126	-0.056	-0.0069	-0.0080	-0.0199	-0.013	-0.003
	0.3603	0.7233	0.1153	0.8489	0.8217	0.5763	0.716	0.9321
	797	797	791	774	792	793	791	798
Figli	-0.0232	0.016	-0.1149	-0.021	-0.0209	0	-0.044	0.0623
	0.5126	0.6527	0.0012	0.5598	0.5563	0.1636	0.2161	0.0787
	797	797	791	774	792	793	791	798
hhsize65	-0.0126	0.0389	-0.0127	0.0224	0.0472	0	0.0193	0.035
	0.7276	0.2825	0.727	0.5415	0.1934	0.5464	0.5943	0.3331
	766	766	760	743	761	762	760	767
socioeconomic status								
diploma	-0.0046	-0.0262	-0.1148	-0.0926	-0.0246	-0.1397	-0.0961	0.0478
	0.8966	0.4606	0.0012	0.01	0.4888	0.0001	0.0068	0.1774
	797	797	791	774	792	793	791	798
Laurea	0.0056	0.0348	-0.0929	-0.0951	-0.0853	-0.0828	-0.1402	-0.1198
	0.8748	0.3265	0.009	0.0081	0.0163	0.0198	0.0001	0.0007
	797	797	791	774	792	793	791	798
Incpuntuale	-0.0088	-0.0093	-0.0129	-0.0902	-0.1336	-0.0582	-0.0397	-0.0643
	0.8036	0.7923	0.7181	0.0121	0.0002	0.1012	0.265	0.0694
	797	797	791	774	792	793	791	798

Eta=age
Figli=number of children 0-15
Hhsize65=number of adults older than 65 in the household
Diploma=high school diploma
Laurea=college degree
Incpuntuale=household income

Table 3.B. Pairwise correlations between Likert scores and **knowledge of/concern about contaminated sites and remediation.**

First number in each cell: pairwise correlation coefficient. Second number: P-value. Third number: number of valid responses (Don't know responses were excluded).

	permanent	ecosystem	threat	avoid	groundwater	foodchain	elderly	child
knowledge of and concern about contaminated sites and remediation								
knowsite	0.076	0.05	-0.0501	-0.0726	0.0491	0.0392	0.0533	0.0594
	0.032	0.1589	0.1594	0.0434	0.1675	0.2696	0.1341	0.0935
	797	797	791	774	792	793	791	798
hearboni	0.0512	0.0528	-0.0795	-0.0464	-0.0202	-0.069	-0.0892	-0.002
	0.1489	0.1367	0.0254	0.1969	0.5709	0.052	0.012	0.954
	797	797	791	774	792	793	791	798
impexpos5	0.2432	0.1921	-0.0383	-0.1165	0.1178	0.0097	0.0207	0.0783
	0	0	0.2815	0.0012	0.0009	0.7843	0.5618	0.027
	797	797	791	774	792	793	791	798
approval of government involvement with contaminated sites								
bonifica5	0.2215	0.2182	-0.012	-0.0746	0.1319	0.0043	0.0471	0.0992
	0	0	0.7355	0.038	0.0002	0.9045	0.1862	0.005
	797	797	791	774	792	793	791	798

Table 3.C. Pairwise correlations between Likert scores and **civic and environmental participation.**

First number in each cell: pairwise correlation coefficient. Second number: P-value. Third number: number of valid responses (Don't know responses were excluded).

	permanent	ecosystem	threat	avoid	groundwater	foodchain	elderly	child
civic and environmental concern								
social	0.0136	0.0378	-0.016	-0.0147	-0.0596	-0.01	-0.0896	-0.0608
	0.7013	0.2859	0.6535	0.684	0.0937	0.7781	0.0117	0.0859
	797	797	791	774	792	793	791	798
civico	-0.0597	-0.0344	0.0258	0.0353	-0.078	0.0057	-0.0284	0.0053
	0.092	0.3319	0.468	0.3267	0.0282	0.8728	0.4258	0.8807
	797	797	791	774	792	793	791	798
ambiente	0.0317	0.0608	0.0302	0.0326	0.0118	0.047	0.022	0.037
	0.3716	0.0865	0.3955	0.3647	0.7395	0.1865	0.5373	0.2959
	797	797	791	774	792	793	791	798

Knowsite=is aware of contaminated site near home or workplace
Hearboni=has heard of remediation
Imposexp5=highest concern about the health effects of contaminated sites
Bonifica5=the government should undertake remediation of orphan sites
Social= social issues and organizations volunteer
civic= civic issues and organizations volunteer
ambiente=member of or volunteer for environmental organizations

Table 3.D. Pairwise correlations between Likert scores and **city of residence**.

First number in each cell: pairwise correlation coefficient. Second number: P-value. Third number: number of valid responses (Don't know responses were excluded).

	permanent	ecosystem	threat	avoid	groundwater	foodchain	elderly	child
cities								
venezia	0.0085	0.0353	-0.0236	-0.0539	-0.036	-0.1411	-0.1492	-0.1239
	0.8097	0.3202	0.5078	0.134	0.3117	0.0001	0	0.0005
	797	797	791	774	792	793	791	798
milano	-0.0436	-0.0668	0.0408	0.0451	-0.0543	-0.0377	-0.0325	-0.0778
	0.2193	0.0595	0.2513	0.2097	0.1267	0.2885	0.3618	0.028
	797	797	791	774	792	793	791	798
napoli	0.0693	0.0542	-0.0567	0.0584	0.0815	0.1284	0.1448	0.1197
	0.0504	0.1266	0.1113	0.1045	0.0218	0.0003	0	0.0007
	797	797	791	774	792	793	791	798
bari	-0.0345	-0.023	0.04	-0.0495	0.0089	0.0505	0.0369	0.0822
	0.3309	0.5164	0.2615	0.1691	0.8022	0.1553	0.3002	0.0201
	797	797	791	774	792	793	791	798

Table 4.A. Ordinal probit models.

	dep. Var.: permanent				dep. Var.: ecosystem				dep. Var.: threat			
	Coeff.	t stat	Coeff.	t stat	Coeff.	t stat	Coeff.	t stat	Coeff.	t stat	Coeff.	t stat
eta	-0.0668	-1.73	-0.0640	-1.64	-0.0128	-0.32	-0.0086	-0.21	0.0099	0.35	0.0064	0.23
eta2	0.0009	2.13	0.0009	2.05	0.0002	0.52	0.0002	0.43	0.0000	-0.12	1.00E-06	0
male	0.0059	0.05	-0.0041	-0.04	0.0767	0.65	0.0642	0.53	-0.0798	-0.94	-0.0798	-0.94
figli	-0.0009	-0.01	-0.0596	-0.47	0.0047	0.03	-0.0666	-0.48	-0.1970	-2.04	-0.1776	-1.81
hhsize65	-0.1240	-1.05	-0.1397	-1.16	0.1521	1.01	0.1117	0.73	-0.0430	-0.45	-0.0266	-0.28
diploma	0.1529	1.26	0.1827	1.47	0.0588	0.45	0.1044	0.78	-0.3485	-3.63	-0.3647	-3.76
laurea	0.2519	1.4	0.2763	1.5	0.2566	1.28	0.2816	1.36	-0.4787	-3.4	-0.4752	-3.31
incpuntuale	0.0000	-0.1	0.0000	0.18	0.0000	-0.88	0.0000	-0.38	0.0000	-0.06	0.0000	-1.60E-01
knowsite	0.1627	1.47	0.1031	0.91	0.0413	0.35	-0.0105	-0.09	-0.1030	-1.19	-0.0780	-0.88
hearboni	0.0958	0.72	0.0758	0.56	0.1082	0.75	0.0850	0.58	-0.0760	-0.68	-0.0619	-0.55
impexpos5	0.8234	5.91	0.8535	6.1	0.7471	4.99	0.7820	5.2	-0.1042	-0.81	-0.1165	-0.9
social	0.0097	0.08	-0.0001	0	0.1319	0.91	0.1430	0.97	-0.0034	-0.03	-0.0020	-0.02
civico	-0.2669	-1.53	-0.2684	-1.54	-0.2783	-1.44	-0.3115	-1.61	0.1593	1.09	0.1591	1.09
ambiente	0.1081	0.73	0.0989	0.67	0.3826	2.13	0.3950	2.16	0.0592	0.52	0.0569	0.5
venezia			0.0882	0.62			0.2368	1.51			-0.0944	-0.81
napoli			0.3946	2.45			0.4868	2.78			-0.1718	-1.41
bari			-0.0285	-0.19			0.0761	0.47			0.0591	0.47
_cut1	-2.7046	-3.20	-2.5376	-2.96	-1.8489	-2.08	-1.5465	1.35	-0.9829	-1.57	-1.1129	-1.84
_cut2	-2.3923	-2.87	-2.2265	-2.62	-1.5957	-1.81	-1.2903	1.40	-0.6924	-1.11	-0.8204	-1.39
_cut3	-1.5835	-1.92	-1.4167	-1.69	-0.9944	-1.14	-0.6918	1.65	-0.2775	-0.44	-0.4038	-0.73
_cut4	-0.9229	-1.12	-0.7486	-0.89	-0.2718	-0.31	0.0361	-8.65	0.0644	0.10	-0.0615	-0.19

Table 4.B. Ordinal probit models.

	dep. Var.: avoid				dep. Var.: groundwater				dep.var.: foodchain			
	Coeff.	t stat	Coeff.	t stat	Coeff.	t stat	Coeff.	t stat	Coeff.	t stat	Coeff.	t stat
eta	-0.0421	-1.46	-0.0443	-1.53	0.0582	1.74	0.0611	1.81	0.0143	0.5	0.0105	1.81
eta2	0.0004	1.29	0.0004	1.38	-0.0005	-1.34	-0.0005	-1.41	-0.0001	-0.22	0.0000	-1.41
male	0.0081	0.09	0.0025	0.03	0.1194	1.14	0.1079	1.03	0.0151	0.18	0.0046	1.03
figli	0.0660	0.67	0.0772	0.77	-0.1046	-0.89	-0.1492	-1.24	-0.0454	-0.46	-0.1205	-1.24
hhsize65	0.0275	0.27	0.0544	0.53	0.1873	1.42	0.1847	1.38	0.0365	0.37	0.0658	1.38
diploma	-0.3847	-3.96	-0.3857	-3.93	-0.0750	-0.62	-0.0480	-0.39	-0.4003	-4.07	-0.3551	-0.39
laurea	-0.6031	-4.17	-0.5587	-3.79	-0.2683	-1.61	-0.2415	-1.42	-0.4630	-3.23	-0.3414	-1.42
incpuntuale	0.0000	-1.55	0.0000	-1.94	0.0000	-3.19	0.0000	-2.95	0.0000	-0.75	0.0000	-2.95
knowsite	-0.1413	-1.62	-0.1661	-1.84	0.1282	1.2	0.0782	0.71	0.0760	0.87	0.0070	0.71
hearboni	0.0299	0.27	0.0377	0.33	-0.0763	-0.56	-0.0894	-0.65	-0.1278	-1.14	-0.1145	-0.65
impexpos5	-0.3903	-2.94	-0.3863	-2.91	0.5233	3.7	0.5304	3.74	0.0385	0.3	0.0411	3.74
social	0.0191	0.19	-0.0150	-0.15	-0.1158	-0.97	-0.1200	-1	0.0222	0.22	-0.2112	-1
civico	0.1691	1.14	0.1890	1.27	-0.2919	-1.72	-0.2910	-1.72	0.0213	0.14	0.3302	-1.72
ambiente	0.1324	1.15	0.1541	1.33	0.1871	1.3	0.2071	1.42	0.1761	1.52	0.1621	1.42
venezia			-0.2837	-2.38			0.0074	0.05			-0.8733	0.05
napoli			-0.0802	-0.65			0.2824	1.84			-0.5172	1.84
bari			-0.2714	-2.15			-0.0348	-0.23			-0.0928	-0.23
_cut1	-1.9557	-3.05	-2.1683	-3.33	-0.2598	-0.35	-0.1522	-0.87333	-0.8689	-1.38	-1.3678	-0.87
_cut2	-1.6718	-2.61	-1.8816	-2.89	-0.0376	-0.05	0.0719	-0.51721	-0.5178	-0.82	-0.8114	-0.52
_cut3	-1.2544	-1.96	-1.4619	-2.25	0.3757	0.51	0.4880	-0.0928	-0.0987	-0.16	-0.1457	-0.09
_cut4	-1.0160	-1.59	-1.2229	-1.88	0.9794	1.33	1.0945	0.235135	0.2246	0.36	0.3689	0.24

Table 4.C. Ordinal probit models.

	dep.var.: elderly				dep.var.: child			
	Coeff.	t stat	Coeff.	t stat	Coeff.	t stat	Coeff.	t stat
eta	0.0157	0.57	0.0161	0.58	-0.0481	-1.35	-0.0509	-1.41
eta2	0.0000	-0.05	0.0000	-0.03	0.0006	1.6	0.0007	1.68
male	0.0923	1.11	0.0818	0.98	0.0461	0.46	0.0317	0.31
figli	-0.0364	-0.38	-0.0973	-1.01	0.2525	2.14	0.1768	1.46
hhsize65	0.0360	0.38	0.0600	0.62	0.1253	1.05	0.1533	1.26
diploma	-0.2783	-2.94	-0.2364	-2.47	0.0155	1.30E-01	0.0689	0.58
laurea	-0.4977	-3.6	-0.3986	-2.83	-0.3894	-2.45	-0.2860	-1.75
incpuntuale	0.0000	-0.29	0.0000	0.22	0.0000	-1.63	0.0000	-0.74
knowsite	0.1616	1.91	0.0733	0.84	0.1843	1.78	0.0967	0.91
hearboni	-0.2398	-2.2	-0.2478	-2.26	0.0099	0.08	0.0155	0.12
impexpos5	0.0513	0.41	0.0601	0.47	0.4074	2.92	0.4156	2.97
social	-0.1416	-1.45	-0.1347	-1.36	-0.1070	-0.91	-0.0765	-0.64
civico	-0.0200	-0.14	0.0004	0	0.1081	0.61	0.0851	0.49
ambiente	0.0717	0.64	0.0834	0.74	0.1403	1.01	0.1468	1.04
venezia			-0.2703	-2.26			-0.0846	-0.65
napoli			-0.0661	-0.55			0.4429	2.98
bari			0.2835	2.34			0.3492	2.32
_cut1	-0.8590	-1.41	-0.8521	1.66	-2.1153	-2.74	-1.9721	-2.50
_cut2	-0.4090	-0.67	-0.3977	1.69	-1.9370	-2.51	-1.7893	-2.28
_cut3	0.2722	0.45	0.2932	1.53	-1.5937	-2.07	-1.4389	-1.84
_cut4	0.7051	1.16	0.7352	1.58	-1.0845	-1.41	-0.9207	-1.18

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