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## Conference Paper

# Public Support for Policies Addressing Contaminated Sites: Evidence From a Survey of the Italian Public

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**Public Support for Policies Addressing Contaminated Sites:  
Evidence from a Survey of the Italian Public**

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**Abstract.** Cleaning up contaminated sites is currently considered 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, since contaminated areas are often found in urban areas where the majority of Europe's population resides. Yet, cleaning up is a costly and time consuming effort, with the taxpayers shouldering much of the financial burden, and its benefits are incurred primarily in the future.

In this paper we offer the preliminary results of a survey conducted in 2005 in Italy, where we query people about their awareness of the problems related to contaminated sites—including their perceptions are about the health risks associated with contaminated site exposures—and elicit an assessment of public's preferences regarding various policies currently being considered in Italy and the European Union.

**Keywords:** Public policy, Contaminated Sites, Pollution regulation, Perception of health risks, Social benefits.

**JEL Classification:** I18 (Government Policy; Regulation; Public Health), J18 (Public Policy), K32 (Environmental, Health, and Safety Law), Q53 (Air Pollution; Water Pollution; Noise; Hazardous Waste; Solid Waste, Recycling).

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## **Public Support for Policies Addressing Contaminated Sites: Evidence from a Survey of the Italian Public**

by

Margherita Turvani, Aline Chiabai, Anna Alberini and Stefania Tonin

### **1 Introduction**

Cleaning up contaminated sites is currently considered one of the most environmental policy priorities in many countries.<sup>1</sup> 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. Whether enforcement-based (as it typical of most recent contaminated site programs) or relying on collaboration between private entities, such as developers and investors, residents, and governments (as in many recent “brownfield” initiatives<sup>2</sup>), addressing the problem of contaminated sites is judged to be an important component of sustainable urban regeneration and has important implications in terms of economic development and quality of life for residents and workers.

The new European legislation, which will be in effect starting April 30<sup>th</sup> 2007, (2004/35/CE), draws heavily on the experience of the contaminated sites statute in place in the United States—Superfund, which was established 25 years ago—while trying to avoid some of its drawbacks. The European legislation is based on the “*polluter pays*” principle and on assigning responsibility for the cost of cleanup on those parties who have contributed to creating the contaminated site in the first place.

However, to avoid creating some of the undesirable effects of liability, the new EU

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<sup>1</sup> See Eurobarometer (2005) for statistics about the importance of environmental quality and concern about various types of pollution to the citizens of the European Union.

<sup>2</sup> The United States Environmental Protection Agency defines brownfields as “real property, the expansion, redevelopment, or reuse of which may be complicated by the presence or potential presence of a hazardous substance, pollutant, or contaminant” (US EPA, 2002). It should be kept in mind, however, that not all brownfields are truly contaminated sites, and that not all contaminated sites are brownfields.

legislation will apply only to damage caused after the Directive enters into force in the Member States.<sup>3</sup> It will not, therefore, be retroactive.

The Directive on Environmental Liability points out that site contamination is a problem since it may pose a threat to human health and the environment as a result of releases of contaminants to ground or surface waters, uptake by plants, direct contact by people and fire or explosion of landfill gases. Because contaminated areas are often found in derelict urban areas with previous industrial development, environmental remediation must be combined with redevelopment policies to meet sustainability goals in medium and large cities in Europe, where the majority of Europe's population resides.

The European Commission emphasized the importance of protecting soil from environmental contaminants, and the remediation of contaminated sites represents in present-day environmental policies one of the important priorities for almost all European countries. For example, the Sixth Environmental Action Programme (6<sup>th</sup> EAP) recognised that soil is a finite resource under environmental pressure and advocated a sustainable use of soil. Indeed, surveys of the European public confirm that citizens are quite concerned with the quality of soil and that they feel that public authorities should intervene with appropriate policies.<sup>4</sup>

Individual countries within the European Union have, of course, passed their own statutes to address contaminated sites. These statutes follow the general

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<sup>3</sup> Experience from the United States, where contaminated site legislation based on this approach has been in place for 25 years, shows that the burden of environmental liability and the costs of complying with the environmental legislation have discouraged cleanup and reuse of previously used urban areas. The Superfund program has been criticized by the public for the slow pace of cleanup and by firms for its retroactive feature. It is also widely alleged that the Superfund liability has discouraged the reuse of sites that are feared to have contaminated problems (the so-called "brownfields").

<sup>4</sup> Europeans deem the prevention and mitigation of soil degradation as "very important" (68% of the respondents). Seventy percent of the respondents in the Eurobarometer surveys believes that polluting industrial plants contribute the most to soil degradation while 72% of them agree with the statement that member States must adopt the necessary measures to prevent and mitigate this threat.

principles spelled out in the European Directive. In Italy, for example, Legislative Decree 22/1997 regulates private and public liabilities with respect to remediation, establishes standards for contaminant concentration in different environmental media as a function of land use, and provides guidelines for environmental assessment, investigation and remedial actions.

Regarding financing, the Decree provides that the cleanup interventions 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.

Cleaning up contaminated sites, however, is a costly and time consuming effort, and its benefits are incurred primarily in the future. In 1997 the European Environment Agency (EEA) conducted a survey on expected total remediation expenditures in the EU and EFTA countries and estimated the total figure to be approximately €15 billion, or €190 per capita (EEA, 2000). In Italy, the government allocated about €40 million to remediate the first 41 contaminated sites on the National Priorities List (NPL) (Ministerial Decree N. 468/2001), but total remediation costs for NPL sites are estimated to be about €3,000 million.

Clearly, the high cost of cleanup is a serious source of concern, and initiatives that rely on private and voluntary cleanup—to be encouraged by offering inducements to firms, real estate developers and investors—are currently under consideration at many locales, where they would supplement the more traditional, enforcement-based programs.

In the US, starting in the 1990s, the States began establishing Voluntary Cleanup Programs (VCPs) offering liability relief, other economic inducements such as tax credits or low-cost loans, oversight and expedited approval of cleanup plans,

and simplified cleanup standards in exchange for site cleanup (Bartsch and Dorfman, 2000; Meyer and Van Landingham, 2000). In Europe, the European Commission spells out the conditions under which financial assistance to companies for rehabilitating polluted industrial sites can be considered compatible with the common market. Various initiatives, such as URBAN II<sup>5</sup> and INTERREG<sup>6</sup> initiatives, rely on private-public partnerships and offer incentives for the redevelopment of brownfields, supporting “mixed-use and environmentally-friendly brownfields redevelopment, involving reduced pressures on greenfields development and urban sprawl.”

There have been a number of voluntary remediation programs in Europe, such as the Soil Agreement signed between the Finnish Petroleum Federation (FPF), the Ministry of the Environment, the Association of Finnish Local Authorities and three oil companies in 1996,<sup>7</sup> and the SUBAT agreement in the Netherlands between the Ministries of Environment, of Economic Affairs and Finance, and the National association of integrated Oil companies, the Association of Petroleum Product resellers, and the Automotive Association, financing cleanup and remediation of contaminated soil and water at voluntarily closed petrol stations.

In Italy, the use of voluntary agreements as means to remediation plans and activities is encouraged by Art. 9., sub-section 4, of M.D. 471/1999. Examples of voluntary agreements for the remediation of contaminated sites include the Agreement on the completion of the emergency removal interventions and cleanup and environmental actions for the sites belonging to ACNA C.O (2000). In the same

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<sup>5</sup> Urban II is the Community Initiative of the European Regional Development Fund for sustainable development in the troubled urban districts of the European Union for the period 2000-06.

<sup>6</sup> INTERREG is a Community initiative which aims to stimulate interregional cooperation in the EU between 2000-06. It is financed under the European Regional Development Fund.

<sup>7</sup> The project is largely funded by the oil companies with activities in Finland and the Oil Pollution Compensation Fund (OPCF) operating with the Ministry of the Environment. OPCF is a national government fund to which oil companies pay a fee levied according to their oil imports to Finland.

years the Voluntary Agreement on Chemical Production in Venice–Porto Marghera– was signed.<sup>8</sup>

Little is known, however, about the effectiveness of these programs, and even less is known about whether the public is in favor of them. Is the public supportive of such incentive-based programs? This paper reports on a survey of a sample of Italians, who were asked to report their opinions about various policy options for remediation of contaminated sites.

We ask two research questions: First, does the public accept programs that offer economic inducement to firms, and does it consider them substitutes of or complements with enforcement-based programs? Second, what are the individual factors influencing the acceptance or rejection of such programs?

In addition to allowing us to answer these questions, our survey includes several questions meant to find out how well people know the problem of contaminated sites, and what their perceptions are about the health risks associated with contaminated site exposures. We feel that the results are of interest for two reasons. First, they allow us to assess whether programs policy currently being considered in Italy and the European Commission reflect the public's preferences. Second, people's support of these programs should be an important determinant of their willingness to pay for them, which measures their benefits. We estimate the latter in a separate paper (Alberini et al., 2005).

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<sup>8</sup> The agreement is also known as "Chemical Industry Agreement." Negotiations began between the Veneto Regional Authority, local authorities and central government in 1997 and the "Accordo sulla Chimica" was signed in 1998 by the Ministry of the Environment, the Ministry of Industry, the Ministry of Commerce and Artisans, the Ministry of Public Works, the Veneto Regional Authority, the Venice Provincial Authority, the City of Venice, the Venice Port Authority, the trade unions, the trade association and the industrial union in addition to 17 firms on site. Many of the firms are large multinational chemical companies, such as Agip, EVC and Enichem. The Agreement represents an attempt to solve institutional conflicts among different layers of decision making private and public agencies (Trombetta and Turvani, 2006)

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 the phenomenon. People are aware of possible negative effects on their health and to a large extent believe that these effects may be quite serious (cancer risk).

We find strong support for public action to *prevent* the uncontrolled disposal of hazardous wastes into the environment and *monitor* sites for early detection of contamination problems using ex ante command-and-control approaches. People also see a role for economic incentives to help address existing contamination problems, and the vast majority of our respondents agrees that it is necessary to have publicly financed initiatives to clean up “orphan” sites. Our respondents also have a preference for permanent remediation, even it is more expensive. This preference is broadly consistent with the law’s expressed preference for permanent remediation. Right-to-know policies are appreciated and people feel that better information enhances the chance of success of public programs.

The remainder of the paper is organized as follows. Section 2 presents background information, and section 3 the survey. Section 4 presents the preliminary results of the survey. We present concluding remarks in section 5.

## **2. Background: Contaminated Sites in Italy**

The Italian Law defines as contaminated sites those sites with levels of contamination or chemical, physical or biological alteration of soils, subsoils and of surface or ground water that pose a danger to public health or for the natural or built environment. A site is considered contaminated if even only one of the contaminant levels exceeds that permitted by the law.



Contaminated sites are spread throughout the nation, and are particularly numerous in cities with a strong industrial tradition. In many cases, closed industrial plants have been found to be contaminated sites. Pellow (1998) points out that factors that have contributed to the formation of abandoned contaminated sites include a demographic shift away from the city to the suburbs and urban fringe areas, expanded transportation networks, and the regional redistribution and diffusion of commercial and productive activities with the consequent reorganisation of people's life and consumption habits.

Although the National Priorities List is comprised of only 50 sites, the total number of potentially contaminated sites in Italy is almost 13,000. Of these, about 5,100 are included in the Registry of Contaminated Sites maintained by each Italian Region<sup>9</sup> according to the guidelines provided by the national Environmental Protection Agency (APAT). Almost 420 sites on this registry have been already cleaned up—about 8% of the total number of listed contaminated sites (APAT, 2004).

The contaminants found at many contaminated sites in Italy include chlorinated hydrocarbons, solvents and petroleum constituents (e.g., benzene, toluene, xylene, ethylene), mineral oil and heavy metals, asbestos, and other residues of refining and primary metal processing. These substances pose various risks to human health that range from temporary illnesses, such as respiratory difficulties, to long-term and fatal disease, such as cancer. These risks depend on the length and pathway of exposure, characteristics of the substance, and individual predisposition, due to biological and genetic factors, plus lifestyle.

Cleaning up contaminated sites can mitigate these risks by interrupting exposure pathways and reducing the amount, mobility and toxicity of hazardous

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<sup>9</sup> In Italy, a Region is a jurisdiction roughly comparable to the State in the U.S. or the Province in Canada, or in Germany. Regions have law-making authority and run their own environmental programs and agencies.

substances found in the environment. However, it is important to point out that in many cases the risk reduction—and hence 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 will experience the risk reduction later in life. Second, it is possible that the risk reductions are experienced entirely by future generations (Hersch and Viscusi, 2005).

### **3. The Survey**

To find out what the Italians know about contaminated sites and how supportive they are of various possible policies for addressing them, we developed a survey questionnaire, which we administered to a sample of residents of four Italian cities (Venice, Milan, Bari and Naples) in May 2005. These cities were selected because of their well-known contaminated site problems; all of them are important industrial cities. Two—Milan and Venice—are in northern Italy; the other two are in the South. Milan and Naples are large cities with population one million or more, while Venice and Bari are medium-sized cities (with population around 300,000).

The questionnaire asked respondents if they know about contaminated sites and how they have become aware of them. Did they learn about contaminated sites from the newspapers or television news, or by attending civic association meetings, or in other ways? It also queried them about their perceptions of the possible health risks associated with contaminated site exposures.

For the purposes of this paper, there were two key questions: (i) “How useful are the following public intervention to address the problems related to contaminated sites?” and (ii) “Do you agree with the following statements? When deciding about remediation plans, the Government should:...”

Question (i) was followed by a series of possible public interventions, including (i) regulations intended to *prevent* pollution problems, (ii) monitoring for early *detection* of any contamination problems, (iii) fencing of contaminated site to reduce exposure, (iv) economic incentives to encourage firms to clean up existing contamination, (v) campaigns to inform the public about sites and risks,<sup>10</sup> and (vi) direct government remediation of “orphan” sites.<sup>11</sup> Question (ii) was followed by a number of possible priorities to adopt as part of a contaminated site program.

The final section of the questionnaire asked respondents to report standard socio demographic information, such as age, gender, educational attainment, income and occupation.

The questionnaire was self-administered by the respondents using the computer, resulting in 804 completed questionnaires (about 200 per city). Our respondents were recruited among the residents 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.

## **4. Results**

### *A. Characteristics of the Sample*

Descriptive statistics of the respondents are reported in table 1. As per our sampling plan, about 50% of our respondents are males. The average age in our sample is 47 years, which is slightly more than the average age in the Italian population (42.3 years), but is consistent with our sampling plan.

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<sup>10</sup> Portney (2000) argues that the provision of information does not solely respond to the public’s demand to participate in decision making processes, but is also an efficiency-enhancing mechanism that helps making better-informed decisions, particularly in risk management and self-protecting behaviour (Hadden, 1991).

<sup>11</sup> “Orphan” sites are those sites where the responsible parties cannot be identified or are insolvent.

Thirty-nine percent has a high-school degree and 12% has a university degree. The educational attainment is higher than the average for the Italian population, where 22.4% have a high school degree and 5.5% have a university degree. The average household income is €26,784 per year. This figure is comparable to the average household income in Italy, which is about €27,868 per year (Banca d'Italia, 2002).

About 73% of the respondents are married or living together, 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 from 0 to 15 years old.

Table 1. Socio-demographic characteristics of the respondents.

<b>Variable</b>	<b>Mean</b>	<b>Stand. Devn.</b>	<b>Min</b>	<b>Max</b>
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)	0.39	0.48	0	1
University degree (dummy)	0.12	0.32	0	1
Household size	3.25	1.17	1	8
Household income (euro/yr)	26,784	19,248	5,000	150,000

### *B. Information about contaminated Sites*

Our first order of business is to examine the respondents' knowledge and awareness of the contaminated sites issue. We found that 90% of the respondents have previously heard about contaminated sites. This seems reasonable, since our respondents were selected among the residents of cities with a serious contaminated site problem. Knowledge of sites appears to be related to the respondent's educational attainment. For example, 92.49% of the high educated respondents (high school diploma or college degree) have knowledge of contaminated sites, 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 from media like newspapers and television, 18% from conferences and neighbourhood meetings, and 11% at school or at the university. The propensity to acquire information from events such as neighbourhood meetings and conferences increases with education and is higher for respondents living in proximity of dumps and abandoned factories. Specifically, 26.48% of the more highly educated respondents (persons with a high school diploma or a college degree) get information by participating in these events, against 16.78% of the others—a difference that is statistically significant at the 1% level.

Moreover, 36.41% of the respondents living near dumps and 26% of those living near abandoned factories get their information by participating to meetings or conferences, against 18.98% and 20%, respectively, for people who do not live by waste disposal sites or derelict areas.<sup>12</sup> In interpreting these results, we should keep in mind that living in proximity to these sites may have prompted respondents to attending meetings and conferences.

How many people live or work close to contaminated sites? This is potentially important for answering our two research questions, because personal knowledge of a specific phenomenon or risk may be much different than just an abstract knowledge: emotional and salience of facts become important and we expect people who live or work close to contaminated sites to be more sensitive to the possible consequences of contamination on human health (Slovic et al., 2004). We find that 43% of our respondents know of contamination problems near their living or working site. In the next sections, we will check if personal knowledge influences people’s perceptions of

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<sup>12</sup> Statistically significant at 5% level for abandoned factories, and 1% for dumps.

the health risks associated with contaminated sites and support for policies addressing the contaminated site problem.

### *C. Perceptions of Health Risks*

Earlier research (Hakes and Viscusi, 2003) shows that people are generally anxious about the possible negative effects on human health in a wide variety of risky situations. We are therefore interested in examining people's perceptions about the possible risks posed by exposure to contamination.

In our questionnaire, we ask the following question: "How likely is it for people living near contaminated sites to incur the following diseases?" People selected their answer on a Likert scale with response categories from 1 to 5, where 1=not likely and 5=very likely. We also allowed people to select a "don't know" response category. Table 2 reports the distribution of the responses to these questions.

Table 2. "How likely is it for people living near contaminated sites to incur the following diseases?"

Diseases	<b>1 Not likely</b>	<b>2</b>	<b>3 Somewhat likely</b>	<b>4</b>	<b>5 Very likely</b>	<b>Don't know</b>
Allergies	2.24%	2.99%	17.66%	9.70%	65.30%	2.11%
Temporary respiratory problems	0.75%	1.62%	11.82%	13.68%	71.02%	1.12%
Permanent respiratory problems	1.00%	2.74%	17.04%	15.30%	61.19%	2.74%
Temporary diseases to other organs	1.49%	3.48%	21.02%	16.79%	53.11%	4.10%
Permanent diseases to other organs	1.00%	4.35%	20.27%	17.04%	52.24%	5.10%
Liver diseases	2.11%	5.85%	19.40%	15.30%	45.50%	11.44%
Cancer	0.50%	1.12%	9.70%	10.95%	76.12%	1.92%
Leukaemia	1.49%	3.23%	12.19%	11.44%	61.82%	9.83%
Genetic malformation in fetus	1.49%	4.85%	18.03%	10.32%	57.84%	7.46%

Table 2 shows that contamination at sites is associated to a vast array of diseases and most people rate the listed health risks as “very likely.” These results confirm people’s sensitivity to health risks and even an excessive alarmism among our respondents. This suggests that information campaigns may be useful to clarify the risks posed by hazardous waste sites, alleviate excessive concern and facilitate sounder judgment.

A preliminary probit regressions (reported in table 3) suggests that, when attention is restricted to perceived *cancer* risks, women have a higher risk perception. The propensity to judge cancer risks as very likely increases with age, and decreases with education and with income. The probability of a higher risk perception is positively related with KNOWSITE (a dummy that takes on a value of one if the respondent is aware of contaminated sites near his/her home or workplace).

Table 3. Probit model. Dependent variable: cancer highly likely. N=804.

Variables	Coefficient	Standard error	P value
Female	.2936562	.1007775	0.004
Age	.0108584	.0046007	0.018
Education	-.1041761	.0387338	0.007
Household income	-5.80e-06	2.57e-06	0.024
Knowsite	.3150626	.1032783	0.002
constant	.4979194	.3023961	0.100
Log likelihood	-417.09604		

#### *D. Opinions on public programs and priorities*

Given people’s awareness of contaminated sites issues and concern about the related health risks, we are interested in assessing their opinions about the most appropriate regulation and initiatives the government should undertake. These opinions may be important determinants of the monetized *benefits* of the policies.

People, for example, may care for permanent remediation even if it costs more than short-term removals, may care more for the ecosystem or more for their own

health, may care more for future generations than for themselves, may distrust public programs and opt for individual risk-reducing behaviors, such as moving to a different city or neighbourhood, and protecting themselves and their children (Panel of the National Academy of Public Administration, 1997; Cropper, et al., 1991).

The two questions at the heart of this paper are (i) “How useful are the following public intervention to address the problems related to contaminated sites?” and (ii) “Do you agree with the following statements? When deciding about remediation plans, the Government should...” Question (i) was followed by a series of possible public interventions, and question (ii) by a number of possible priorities.

The possible responses to these questions were in a Likert scale format, ranging from 1=“slightly useful” to 5=“very useful.” As before, we allowed people to select the “don’t know” option, if they so wished. Table 4 displays the distribution of the responses to these questions.

Table 4. “How useful are the following public intervention to address the problems related to contaminated sites?”.

Public intervention plans	<b>1</b> <b>Not useful</b>	<b>2</b>	<b>3</b> <b>Somewhat useful</b>	<b>4</b>	<b>5</b> <b>Very useful</b>	<b>Don't know</b>
1. Fiscal incentives to firms to encourage cleanup and reuse of the contaminated area	4.23%	3.61%	17.04%	9.83%	64.93%	0.37%
2. Requiring firms to adopt pollution control systems, such as filters for discharges into water and fumes	1.00%	0.62%	3.98%	5.35%	89.05%	-
3. Introducing inspections for monitoring soil and water pollution	0.87%	0.75%	3.11%	6.22%	88.81%	0.25%
4. fencing contaminated sites and using signs to limit or forbid access	5.35%	3.11%	11.44%	10.57%	68.53%	1.00%
5. Information campaigns	1.49%	0.87%	5.60%	10.70%	80.85%	0.50%
6. Remediation of those sites where the responsible parties are not identified	1.39%	0.87%	4.73%	6.72%	83.58%	2.11%



Table 4 shows clearly that many respondents found all of these public interventions useful. It is interesting that, as shown in table 4, people are confident that all of the measures are useful to some degree, even though the vast majority seems to trust best regulation and monitoring.

Cross tabulations of the responses also show that only 29% of the respondents believe that it is best to *prevent* contaminated sites, and to do so *exclusively* by command-and-control mechanisms, without economic incentives for firms. Moreover, only 1.24% think that economic incentives *alone* are sufficient to address the existing contaminated sites problems, whereas 64% of the respondents think that *both* types of instruments are very useful and should be implemented *jointly* by the government.

When asked about the priority to assign to each of the above reported strategies,<sup>13</sup> 54.63% of the respondents stated that requiring firms to adopt pollution control systems is the first priority, 36.66% chose inspections for monitoring soil and water pollution as the second most important priority, and 19.2% tax incentives to firms as the third most important priority. The majority of the respondents, when forced to give a priority, opted for preventive regulation and monitoring.

These results lead us to conclude that people have a relatively high degree of trust in government programs: If good regulations are in place and if “the stick” is stiff, the “carrot” may help, but the latter alone is not sufficient.

#### *E. Public Programs' Priorities*

In this section we wish to examine the respondents' beliefs about priorities for public policies in terms of cost and duration of the remediation, benefits for children

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<sup>13</sup> Our question reads as follows: “Among the following public interventions to address the problem of contaminated sites, please select the three which should, in your opinion, be given immediate priority.”

and the elderly, benefits for future generations, and health benefits versus ecosystem benefits. This latter is important to understand the respondents' priorities for health related risks and more general environmental risks. For this purpose we showed the respondents several statements, asking them if and to what extent they agree or disagree with them. Again, we used a Likert scale where 1 means complete disagreement and 5 means complete agreement. Results are displayed in table 5.

Table 5. "Do you agree with the following statements? When deciding about remediation plans, the Government should:..."

Remediation plans	<b>1</b> <b>Completely disagree</b>	<b>2</b>	<b>3</b> <b>Neither agree nor disagree</b>	<b>4</b>	<b>5</b> <b>Completely agree</b>	<b>Don't know</b>
1. Give priority to permanent and effective remediation plans, even if they cost more	0.62%	0.75%	5.85%	12.31%	79.60%	0.87%
2. Implement remediation plans which ensure protection of the 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	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	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	2.49%	1.62%	4.98%	12.56%	76.87%	1.49%
6. Intervene exclusively when contamination could enter in the food chain	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 exposed category	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 exposed category	4.35%	1.99%	5.60%	12.60%	75.25%	0.75%

As shown in table 5, 79.6% of the respondents fully agree with giving priority to permanent cleanup and effective remediation plans, even if they cost more. Fully 76% of the respondents agree completely with investing more resources for the cleanup of areas where children are the most exposed. Thirty-nine percent fully agree in investing more resources for the cleanup of areas where the elderly are the most exposed. Forty percent fully agree in investing resources in remediation plans which will save human lives no earlier than 30 years from now. Finally, 41.42% fully agree with implementing remediation plans only if the contaminated site is a threat for human health, whereas 85.07% state that remediation plans should be implemented in order to guarantee the overall ecosystem, and should thus consider all environmental risks as well as the health risks.

#### *F. A Formal Model of People's Support for Public Policies*

Our objective is to examine which factors influence the respondents' support for the public policies. We propose a model that relates opinions about public interventions to individual characteristics (age, gender, income, education, having children 15 years old and younger, being politically active, etc.), the respondent's perception about cancer risks, which in turn depends on KNOWSITE (awareness of contamination near his home or workplace) and the priorities assigned by the respondent to remediation policies. Formally, we posit that

$$(1) \quad U_{ij} = \text{usefulness of the policy} = f(\mathbf{X}_i, \text{Risk}(K_i), P_i),$$

where  $U_i$  is the perceived usefulness of policy  $j$  for individual  $i$ ,  $\mathbf{X}_i$  is a vector of the individual characteristics of the respondent (gender, age, education, income, having children younger than 15, etc.),  $Risk$  is the perceived health related risk, which may depend on whether the respondent is aware of sites near his home or workplace ( $K_i$ ),

and  $P_i$  are the priorities for remediation policies and confidence that they will be effective. We proxy the latter with the responses to selected questions from table 5 (“Do you agree with the following statements?”).

Because people were offered five ordered response categories, the appropriate statistical model of the responses to the question about the usefulness of the policy is an ordered probit. We report the results of the ordered probit model for economic incentives to firms in table 6. We note that our sample excludes “don’t know” responses.

Table 6. Results of the ordered probit model. Dependent variable: support for incentive instruments. N=801.

Variables	Coefficient	Standard error	P value
Age	.0085687	.0287564	0.766
Age squared	-.000089	.0003106	0.774
Education (years of schooling)	-.0343693	.014719	0.020
Female	.2819048	.0897873	0.002
Household income	-1.22e-06	2.40e-06	0.611
Children up to 15 years old (dummy)	.1248434	.1018589	0.220
Knowsite (dummy)	.1684538	.0908924	0.064
Cancer highly likely (dummy)	.2549066	.1019101	0.012
Political activities (dummy)	.0078258	.1206391	0.948
Voluntary work for environmental organisations (dummy)	-.1886741	.1484421	0.204
Agree very strongly with permanent cleanup, even if more expensive (dummy)	.3568304	.1054852	0.001
Implement remediation only if there is a threat to health (dummy)	.2065295	.0930243	0.026
Acquiring information at conferences (dummy)	-.1551038	.1047745	0.139
Intercept1	-1.312687	.675124	
Intercept2	-.9947818	.6730805	
Intercept3	-.218736	.6710327	
Intercept4	.0899813	.6710906	
Log likelihood	814.93707		

The usefulness of incentive-based mechanisms is positively and significantly correlated with gender (female), higher perceived risk of cancer, and KNOWSITE. Support for economic incentives to firms is thus higher among respondents who are aware of contaminated sites near their home or workplace, an effect that is above and beyond the fact that these respondents are also more sensitive to health related problems (i.e., they perceive higher risk of cancer).

Educational attainment is also significant but the sign of the coefficient on this variable is negative, meaning that highly educated people are *less* likely to be in support of incentive plans. This could be due to distrust in market-based mechanisms or outrage about providing funding to those parties that were responsible for contamination in the first place.

Regarding priorities for remediation policies, we have included answers to two of the policies reported in table 5: (i) whether the respondent fully agrees with permanent remediation plans, even if they are more expensive, and (ii) whether the respondent fully agrees with the need for remediation only if there is a threat to human health. The regression results show that the respondents' agreement with the above policies is positively and significantly correlated with the perceived usefulness of incentives. Respondents who are in favour of permanent remediation, even if more expensive, and those who believe that remediation is important only when human health is concerned are more likely to find incentives to firms very useful.

Neither household income nor age have significant effects on the perceived usefulness of incentive-based instruments. Variables capturing whether the respondent is politically active or if he volunteers for environmental organizations are likewise insignificant. In addition, acquiring information about contaminated sites through conferences or civic association meetings has no influence.

In table 7 we report the results of an ordered probit where the dependent variable is support for remediation implemented by the government when responsible parties are not identified.

Table 7. Results of the ordered probit model. Dependent variable: support for remediation when responsible parties not identified. N=787.

Variables	Coefficient	Standard error	P value
Age	.1707498	.0344704	0.000
Age squared	-.0017833	.0003751	0.000
Education (years of schooling)	-.0114344	.0188387	0.544
Female	-.0476159	.1158811	0.681
Household income	-2.09e-06	3.08e-06	0.497
Children up to 15 years old (dummy)	-.1506069	.1318805	0.253
Knowsite (dummy)	.319367	.1216583	0.009
Cancer highly likely (dummy)	.294257	.1264082	0.020
Political activities (dummy)	.1468754	.1627164	0.367
Voluntary work for environmental organisations (dummy)	.0849931	.2046439	0.678
Agree very strongly with permanent cleanup, even if more expensive (dummy)	.4891178	.1264825	0.000
Implement remediation only if there is a threat to health (dummy)	.0332975	.1215152	0.784
Acquiring information at conferences (dummy)	-.217884	.1337747	0.103
Intercept1	2.072791	.7898199	
Intercept2	2.245356	.7900305	
Intercept3	2.765894	.7923698	
Intercept4	3.175782	.7943506	
Log likelihood	424.69565		

Support for such remediation is an inverted-U function of age and is stronger among those respondents who are aware of contaminated sites near their home or workplace. Respondents in favor of permanent remediation, even if expensive, are strongly in support of remediation plans implemented by the government when responsible parties are not identified. The magnitude of the coefficient on this variable is very large. Education, gender, income, having children younger than 15 years old,

the variables capturing respondent's political activities or voluntary work for environmental organizations and the source of information have no influence.

Table 8 and 9 show the results of a similar ordered probit, where the dependent variable is the support for enforcement, i.e, inspections monitoring soil and water pollution and the adoption of pollution control systems.

Table 8. Results of the ordered probit model. Dependent variable: support for monitoring and inspections. N=802.

Variables	Coefficient	Standard error	P value
Age	.0940772	.0369214	0.011
Age squared	-.0009117	.0004001	0.023
Education (years of schooling)	.0219532	.0197973	0.267
Female	.2444827	.1258321	0.052
Household income	-5.80e-06	2.87e-06	0.043
Children up to 15 years old (dummy)	-.1839115	.1373964	0.181
Knowsite (dummy)	.3656914	.1317547	0.006
Cancer high likely (dummy)	.3165124	.1359025	0.020
Political activities (dummy)	-.2099438	.1600284	0.190
Voluntary work for environmental organisations (dummy)	-.0130417	.2010788	0.948
Agree very strongly with permanent cleanup, even if more expensive (dummy)	.3527456	.1393856	0.011
Implement remediation only if there is a threat to health (dummy)	-.1037664	.1288089	0.420
Acquiring information at conferences (dummy)	-.1560533	.1442201	0.279
Intercept1	.4422838	.8753703	
Intercept2	.695442	.8706669	
Intercept3	1.205973	.8684707	
Intercept4	1.691874	.8694222	
Log likelihood	-344.34095		

Women show stronger support than men for monitoring and inspection mechanisms. The perceived usefulness of inspections is an inverted-U function of age, which means that it increases first with age, then peaks and declines as individuals get older. The effect of respondent's awareness of contaminated sites is

positive and significant, as in the previous probit models of support for other policies. Finally, respondents in favour of permanent remediation, even if more expensive, exhibit stronger support for monitoring and inspections. Support for remediation only when human health is concerned is not significant. All of the other individual characteristics of the respondents are likewise insignificant.

Regarding required pollution control systems (table 9), perceived usefulness depends in a quadratic fashion on age, and is higher for women. Having children younger than 15 years old at home, instead, has a negative effect on the support given to this instrument. Respondents who are aware of contaminated sites show higher support for pollution control mechanisms. Instead, support for this instrument is lower among respondents acquiring information at conferences and other civic association meetings.

Priority for permanent remediation, even if more expensive, is positive and significant. While there is no effect of the variable showing support for implementation of remediation only when human health is threatened. Other variables, like education, income, being politically active or doing voluntary work for environmental organizations have no significant effect.



Table 9. Results of the ordered probit model. Dependent variable: support for pollution control systems, such as filters for discharges into water and fumes. N=802.

Variables	Coefficient	Standard error	P value
Age	.0825159	.0399289	0.039
Age squared	-.0008004	.000438	0.068
Education (years of schooling)	-.0018128	.0197974	0.927
Female	.3037585	.1254772	0.015
Household income	1.72e-06	3.38e-06	0.611
Children up to 15 years old (dummy)	-.3072662	.1380582	0.026
Knowsite (dummy)	.23185	.1280006	0.070
Cancer high likely (dummy)	.3899898	.1350391	0.004
Political activities (dummy)	-.0638781	.1648495	0.698
Voluntary work for environmental organisations (dummy)	-.1171311	.1959013	0.550
Agree very strongly with permanent cleanup, even if more expensive (dummy)	.3082055	.1398266	0.028
Implement remediation only if there is a threat to health (dummy)	-.1949065	.1270112	0.125
Acquiring information at conferences (dummy)	-.2553463	.1407931	0.070
Intercept1	.0332705	.9065301	
Intercept2	.2339924	.903704	
Intercept3	.8436753	.9028191	
Intercept4	1.239039	.9033168	
Log likelihood	-349.92763		

## 5. Conclusions

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 perception of the possible health risks associated with contaminated site exposures. We also inquired about their preferences for a number of public programs for the remediation of contaminated sites.

We have found that people are for the most part aware of the existence of contaminated sites and that the media are a major source of knowledge. We have found that only few of our respondents had acquired their information about

contaminated sites directly in organized events, such as conferences or civic association or neighbourhood meetings, although the tendency to acquire information from organized events tends to be greater among those respondents living by waste disposal sites or derelict areas.

People associate contamination with a high likelihood of incurring health problems, especially cancer. This perception is particularly pronounced among our older respondents, women, and people that work or live close a contaminated site. It is less pronounced among people with higher income and higher educational attainment.

The resulting picture is one of a population with high degree of alertness regarding this environmental issue, which bodes well for our investigation of people's opinions of what should be done about it. The large majority of our sample (89%) judge regulation of emissions and waste disposal—a policy that *prevents* the formation of contaminated sites—as very useful, and likewise considers monitoring and inspections—a policy that *diagnoses* the possible presence of contamination in the environment—very helpful.

Even more important, over two-thirds of the sample are convinced that incentives to firms and property owners are helpful in encouraging cleanup at contaminated areas. Moreover, the Italians seem quite aware of the legacy of past contamination and therefore of the importance of adopting publicly financed programs for cleaning up “orphan” site (84%). People are in favour of permanent remediation, even if more expensive, suggesting that they care about future generations.

The confidence that our respondents place on various policies and their priority for cleanup vary considerably across individuals. For example, women are

more convinced than men that incentives may play a major role in private cleanups, and so do people with personal knowledge of contaminated sites.

We were particularly interested in examining the relationship between support for various policies and the educational attainment of the respondents, and were a bit surprised to find out that the support for economic incentives is actually *lower* among more highly educated people. We speculate that this could be due to outrage about providing funding to those parties that were responsible for contamination in the first place, and/or doubts about the effectiveness of cleanups performed by private parties.

How do our respondents' opinion fit with the actual policies in place in Italy and the principles underlying the Directives of the European Union? The European Union states that "Protecting the environment is essential for the quality of life of current and future generations,"... and that "Public participation is a central element in the common procedures applying across the EU for assessing the environmental impact of public sector policies and programmes and of investment projects."<sup>14</sup>

The European legislation is guided by the "polluter pays" principle, implying both that the polluter may be required to invest in equipment and processes that reach environmental standards and, as in the new Directive on Environmental Liability, that responsibility for the cost of cleanup is placed on those parties who have contributed to creating the contamination problem. This system should both prevent future contamination problems and provide financing for any needed remediation. Furthermore, the European legislation aims at harmonising rules and policies across Europe, while taking advantage of previous experiences.

The results of our survey suggest that the preference of the Italian public is broadly in agreement with this approach: The Italians want to prevent contaminated

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<sup>14</sup> [http://europa.eu.int/pol/env/overview\\_en.htm](http://europa.eu.int/pol/env/overview_en.htm)

sites in the first place, detect promptly any contamination problems, that they want the government to address directly sites for which the responsible parties cannot be found or cannot pay for cleanup. They also favour economic incentives.

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