

The role of stakeholder attitudes in managing contaminated sites: survey of Romanian stakeholder awareness

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Abstract The past decade has seen substantial policy effort directed at promoting the reclamation and reuse of urban brownfield or potentially contaminated land. This paper is based on the results of a survey regarding the role of stakeholder attitudes in managing contaminated sites at the Romanian level. Findings indicate that effective policies and programmes need to be framed within an understanding of the different needs of national development. While different perceptions were identified in regard to the meanings of several concepts and terms used in this field, important aspects related to the need for developing a correctly ranked and coordinated decision-making process were also identified. Additional findings indicate gaps in the legal mechanisms intended to promote brownfield rehabilitation in the course of redevelopment. At the same time, the survey respondents suggested several recommendations such as the necessity of developing a risk assessment to establish the level and extent of contamination that can endanger human health and the environmental integrity on a site and also the need for greater compatibility between land-use planning processes and environmental legislation related to contaminated site management. The paper presents general conclusions engaging all the recommendations drawn from the survey questionnaire as well as from the general current situation in Romania.

Keywords Contaminated sites · Management process · Stakeholders · Decision making · Attitude survey

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Introduction

Since the second half of the nineteenth century, in particular, industrialisation decline and migration associated with economic change has generated many contaminated areas all over Europe (CLARINET 2002; European Environment Agency 2005). Today, the reduction in the use of ‘greenfield’ sites through contaminated site regeneration plays a key role in European sustainable development strategies (European Commission 2006a, b, c, d). The dilemma is that, although much progress has been made during recent decades, especially in the EU member states, Central and Eastern European countries still have to deal with many unresolved challenges as regards large-scale areas of contaminated land (World Bank 2010; International Committee on Contaminated Land 2011; Stezar et al. 2011).

The process of decision-making for the management of environmental resources is multifaceted and complex and merits research (Cihakova Aguilar 2009; Marcomini et al. 2009). As noted in the work of Kiker et al. (2005), effective environmental decision making demands the right consideration of (multi)-criteria derived from environmental, ecological, technological, economic, financial, and socio-political factors. Thus, from an environmental management perspective, it is critical to understand which issues are considered most important. At the same time, a crucial aspect of a decision-making process for generally sustainable management is that of participation by relevant organisations and people. In fact, such participation is cited by UNDP (1997) and the Commission of the European Communities (2001) as one of the characteristics of good governance. As reported by the Organisation for Economic Co-operation and Development (2004), some important benefits derived from the involvement of public stakeholders in the decision-making process include offering more socially acceptable choices, widening the range of choices considered, better conflict-management, increased legitimacy of the decision-making process, and better

information to stakeholders and/or public. Moreover, Charles (Bartsch and Wells 2005) often referred to as the ‘father of brownfields’, stresses the importance of stakeholder involvement.

To date, these research and policy-making activities have mostly concentrated on realising the first part of McCarthy's (2002) challenge, namely reduce the primary barriers to redevelopment of contaminated land. On the more technical side, much research has focused on devising effective remediation approaches and technologies (Bonano et al. 2000; Bardos and Vik 2001; Khan et al. 2004; Marcomini et al. 2009). In addition, several researchers (Alberini and Longo 2005; Burger 2002; Schädler et al. 2011) acknowledge the importance of the human dimension of economic growth. In the context of contaminated sites redevelopment and economic growth, the broad issue to be addressed is the human dimension of stakeholder engagement in rebuilding urban communities (Thomas 2003).

Romania is a south-eastern European country where the domain of contaminated site management started to develop at the regulatory level in 2007 (Guvernul României 2007a, b). As there is, as yet, no ‘one-for-all’ worldwide solution to support the development of contaminated land regeneration, even at European Community level, positive issues can be expected only if policy/regulatory improvements specifically consider the social, economic, and political contexts that concern the entire process of regeneration. These contexts include specific attitudes of stakeholders towards risks, in relation with the knowledge and the legal appropriations for adaptive possibilities of each entity. According to the Romanian National Environmental Agency (NEPA), 2,580 questionnaires from economic agents, as well as local councils, were received in 2011 for the national inventory of contaminated sites, whilst in the proposed strategy for the management of Romanian contaminated sites, 1,856 such sites were stipulated (Băceanu 2011; Ministerul Mediului și Pădurilor 2011). Even though there are expressly developed approaches, methodologies and tools available in literature to support experts, stakeholders and decision makers to deal with specific phases of the contaminated sites regeneration process, the knowledge and awareness survey of different stakeholders is a necessity in Romania. This paper presents an inventory and comparative analysis of different stakeholders' opinions (whether engaged in education, research, regulatory authorities, contractors, site developers, or environmental experts) by means of an attitude survey, to have an overview of the situation at national level.

Current situation regarding contaminated sites inventory in Romania

Considering the fact that the proposed strategy regarding the management of contaminated sites issued in 2011 was rejected (because it did not identify the objective of the document, namely contaminated sites), it is now considered important to develop, as efficiently as possible, a national site inventory.

According to information from the NEPA, the development of a national inventory for contaminated sites begun in 2006. In this regard the activities managed by different structures of the NEPA were mainly focused on air, water and biodiversity. At the same time, it is noted that the term ‘soil’, used until 2006, was referring only to the superficial layer. Thus, the general geological structure, respectively soil and subsoil, where human activities can be involved, was not considered an issue of awareness and knowledge of environmental quality and protection till 2006, namely the year when monitoring in the field of contaminated site management was introduced. This was as a consequence of the proposal for a soil framework directive at European Union level (ANPM 2010).

Based on the data in (1) the Annual Reports regarding environmental factors state of the NEPA during 2006–2009, (ANPM 2007, ANPM 2008, ANPM 2009) (2) the Annual Report regarding environmental factors state of the eight REPAs in 2010, (ARPM CLUJ 2010, ARPM BUCURESTI 2010, ARPM GALAȚI 2010, ARPM SIBIU 2010, ARPM CRAIOVA 2010, ARPM PITESTI 2010, ARPM BACĂU 2010, ARPM TIMISOARA 2010) and (3) the data in the presentation made by Eng. Ioan Băceanu Ph.D., in October 2011 at the Sarma Project workshop, Bucharest, the authors developed a statistical evolution of this inventory for the period 2006–2011. The results are presented in Table 1. Some notes have to be added for a good understanding of the presented and analysed information, namely:

1. In the report of the NEPA in 2008, the situation of the potentially contaminated sites is presented as a total area (ha), and not as the number of sites;
2. The NEPA Report in 2010 does not include the inventory of the potentially contaminated/contaminated sites that was used as information source in the Reports of the eight REPAs; the number of contaminated sites was introduced in the category of potentially contaminated sites due to the fact that in the reports of the REPAs these were defined as both potentially contaminated/contaminated sites and the authors did not have any other information sources regarding these sites; and
3. For 2011 no data were available in the EPA reports during the execution of this paper; thus, information from the presentation of Eng. Ioan Băceanu Ph.D.,¹ in October 2011 at the Sarma Project workshop, Bucharest, was used.
4. In the executive summary and recommendation section of the ‘Report of the Working Group on Contamination VOLUME IV Working together towards a Risk Based

¹ Currently, a representative in the National EPA, Wastes and Chemical Hazardous Substances, Soil and Subsoil Direction, Soil and Subsoil Protection Bureau. In his presentation he shows the number of questionnaires sent to the economic agents and local authorities that own such sites, and which will be filled in the national database CoSiS (this database includes all information regarding contaminated sites in Romania, but the access to it is restricted for the environmental authorities).

Table 1 Potentially contaminated/contaminated sites inventory for the period 2006–2011 in Romania

Region/report	1 NE Bacău	2 SE Galați	3 S Muntenia Pitești	4 SW Oltenia Craiova	5 W Timișoara	6 NW Cluj-Napoca	7 Centre Sibiu	8 București-Ilfov	Total
Inventory of potentially contaminated sites									
Report NEPA 2006									
Report NEPA 2007									
Report NEPA 2008 (ha)	786	448	910	468	317	421	355	101	3,806
Report NEPA 2009	33	33	0	15	77	153	49	5	365
Reports REPA 2010	148	105	?	257	157	255	47	7	976 ^a
PPT ^b 2011	503	497	533	205	231	253	241	57	2,520
Inventory of contaminated sites									
Report NEPA 2006	155	383	155	71	129	65	81	13	1,052
Report NEPA 2007	155	395	150	229	190	92	107	21	1,339
Report NEPA 2008 (ha)	111	72	321	104	33	65	75	7	788
Report NEPA 2009	111	72	321	104	33	65	75	7	788
Reports REPA 2010									
PPT ^b 2011									

^a Excluding the region S Muntenia Pitești (for the computation in 2010 due to the lack of data from the report in what regards this region)

^b PPT presentation of Eng. Ioan Baceanu Ph.D. in October 2011 at the SarmaProject workshop, Bucharest (inventory established based on the number of questionnaires sent to the economic agents and local authorities that own such sites)

Land Management, Task group on Contaminated land management, Final Report, 21 May 2004’, Author Victor Dries, A ‘potentially contaminated site’ is: ‘site where an activity is or has been operated that may have caused soil contamination’ and ‘A contaminated site’ is: a site with confirmed presence of ‘dangerous substances’ caused by man in such a level that they may pose a significant risk to a receptor in such a way that action is needed to manage the risks. The risk is evaluated on a site-specific base taking into account current and expected uses of the site. At the same time, in the contaminated sites management national strategy are presented and defined the terms of: A historically contaminated area is: ‘A contiguous site (land or aquifer) on which anthropogenic activities determined the presence of some pollutants in concentrations that pose or can pose immediate or long-term risk for human health and the environment’ and A potentially contaminated historical area: A contiguous site (land or aquifer) on which historical and/or current activities might have generated an impact on human health and the environment.

(* Currently a representative in the National EPA, Wastes and Chemical Hazardous Substances, Soil and Subsoil Direction, Soil and Subsoil Protection Bureau. In his presentation he shows the number of questionnaires sent to the economic agents and local authorities that own such sites, and which will be filled in the national database CoSiS (this database includes all information regarding contaminated sites in Romania, but the access to it is restricted for the environmental authorities)). (**At the moment the REPA's

were dissolved by the law no. 1000 in 17.10.2012 regarding reorganisation and functioning of the National Environmental Protection Agency and of public institutions subordinated to it, and 42 local EPA's manage the environmental issues, including in what regards contaminated sites management.)

Figure 1 presents the development regions in Romania, based on which the REPA management and influence was established.

Apart from the information sources presented above, it is important to mention that in the proposal for a contaminated sites management national strategy in 2011, the number of inventoried potentially contaminated sites was 1,865.

Taking into account the situation outlined in Table 1, it can be observed that the inventoried data are difficult to analyse as they present in a scanty way the situation at regional level. The



Fig. 1 The eight regions of development in Romania (<http://www.apdr.ro/content.aspx?item=1818&lang=RO>)

lack of a unitary method of presenting the data by the regulatory authorities may lead to different interpretations and misunderstandings in regard to the terms used to define these sites, namely, ‘contaminated’, ‘potentially contaminated’ and ‘possibly contaminated’. What is not very clear is the context in which these terms are used and so it is difficult to distinguish, in certain situations, the contaminated sites from the potentially contaminated ones. At the same time, the data are not consistently reproduced, namely because in some reports they are presented as the areas occupied by these sites, or their number, or as the site activities that could have led to the land contamination.

Nevertheless, another important aspect to be mentioned is the fact that in the EPA reports it is stated that not all these sites can be referred to as needing a pollution investigation and assessment in accordance with the current regulations, but only in terms of establishing the presence of historical pollution. This implies the possibility that some areas could be monitored as contaminated sites without taking into account the natural environment quality of attenuation; for example, some modifications might have occurred from the date of the last environmental study regarding the situation on the analysed sites.

Survey methodology

In carrying out this study, a survey was conducted through a sociological questionnaire which was sent to 130 Romanian stakeholders involved in the six principal fields (see later) of management of contaminated sites.

Sociological investigation is considered to be a particular activity within the field of sociological research (i.e. field empirical research) in that it uses mostly questionnaire and interview techniques for obtaining information (Rotariu and Iluț 1997). Based on interrogative ways to obtain information, ‘the sociological survey has a non-experimental character, with a relatively low degree of control of the researcher on the variables analyzed’ (Mărginean 2000). Moser (1967) notes that the term ‘sociological investigation’ is difficult to define because it covers a ‘large variety of research, from traditional analyzes of poverty to public opinion polls, surveys for urban planning, market research as well as numerous investigations organized research institutes’. As observed by Marginean (2000), sociological investigation often combines interrogative methods of obtaining information with the study of documents or scientific observation, so drawing a firm dividing barrier between what is meant by ‘sociological field research’ and ‘sociological investigation’ is not justified. Thus, it should be noted that sociological investigation is distinguished from other types of concrete sociological research (such as field and empirical) by using mainly the questionnaire and interview to obtain information and refraining from experiment. Conversely, compared with public opinion surveys, sociological investigation differs in that it is aimed not only

towards knowledge of subjective aspects (such as opinions, attitudes, aspirations, interests, etc.), but also towards objective aspects (such as family structure, living conditions, etc.) and not compulsory using sampling (Cooper 1988; Bourmer 1996).

Defining the questionnaire as a research tool in technical socio-human sciences is not at all a simple operation. Not even the terminology (i.e. ‘questionnaire’, ‘form’, ‘test’, ‘inventory’, ‘scale’, ‘sample’, etc.) is universally accepted (Chelcea 2001).

To reiterate, to capture the perceptions and attitudes towards the management of contaminated sites, we conducted a postal questionnaire which was to be filled in both by domain experts and other stakeholders involved in the process, namely national authorities, researchers and academics, environmental consultants/experts, the operators in the private sector and contractors.

The main steps taken to perform the survey were:

- a. Establishing the paper scope

The paper goal is to present the opinions on the development level of contaminated sites management in Romania through the experience of the primary stakeholders involved in this process.
- b. Identifying subjects

Stakeholders involved in filling in the questionnaire are:

 - Academia (universities),
 - Research institutes,
 - Private sector (environmental assessors/auditors certified in Romania);
 - National authorities (Environmental Protection Agencies—local, regional, national level, Ministry of the Environment and Forests, and Ministry of Regional Development and Tourism),
 - Contractors (accredited analysis laboratories and geological services providers), and
 - Developers (owners/developers of potentially contaminated sites).

The stakeholder categories chosen for this study were based on authors experience and expertise in the field as well as based on existent literature and regulatory reports where stakeholder categories are presented. Thus, it can be ascertained that their answers are pertinent and documented.

The estimated number at national level of potential participants of interest is about 2,500, most of whom are represented by the owners of potentially contaminated sites (1,856 potentially contaminated sites according to the proposed *contaminated sites management national strategy*, version 2011); the other categories each had fewer than 100. It should be noted, however, that the number of 1,856 was presented without evidence support in the proposed strategy, as outlined in ‘Current situation regarding contaminated

sites inventory in Romania’; it should also be noted that any operator could hold more than one inventoried site. 130 questionnaires were sent, the selection also taking into account available access to contact details and responses were received from 73 (about 56 %). It can be noticed that more than half of the approached stakeholders gave answers to the questionnaires.

c. Questionnaire application/processing

Given the relatively reduced number of people involved in completing the questionnaire, as well as their diverse locations, they were sent by e-mail, the same way they were returned after they were filled in.

d. Questionnaire development

The questionnaire was developed using closed questions (i.e. multiple choice) as well as open ones (which require the respondent to provide their own answer). The questionnaire has five parts that relate to (1) contaminated site management, (2) site investigation, (3) risk assessment for contaminated sites, (4) remediation, and (5) respondent recommendations. The 15 questions were distributed within these sectors.

The questionnaire was, prior to dispatch, analysed by some international experts (see Acknowledgements) and a series of representatives from academia and authorities in Romania, who provided suggestions on aspects that should be modified or completed in the questionnaire form, all based on their experience.

e. Responding to questionnaire

Each of the respondents was asked to fill in answers to questions based on their experience in the field. These responses were completed independently and individually.

f. Data analysis

Data were analysed using Statistical Package for the Social Sciences software (SPSS) version 19 (SPSS, 2012). SPSS for Windows is a software package for statistical analysis of data. Although there is a variety of programs of this kind (SAS, Statistics for Windows, GraphPad, MS Excel, which also has statistical functions), SPSS is distinguished by its rigorous structure and ease of use.

Using SPSS, the responses were analysed and the percentages recorded for each of the questions, using cross tabulation process. For correct and efficient data processing in SPSS, each question was analysed to extract from the answers received, common variables and responses.

Results and discussion

Respondent profiles

The questionnaire response data were processed with the frequency function of SPSS. The results are presented below.

The proportions of overall responses received from each of the series of professional categories were approximately as follows (see Fig. 2):

In terms of the relevant experience of respondents, the category under 3 years accounted for about 23 %, those with 3 to 5 years about 27 %, those with 5 to 10 years about 18 % and those with over 10 years’ experience about 32 % (Fig. 3). Thus, about 50 % had at least 5 years’ experience.

As shown in Table 2 and Fig. 4a–d, it can be observed that for the ‘under 3 years’ experience, the large majority of respondents come from authorities, as is also the case for the 3 to 5 years range. However, for the range of experience ‘5 to 10 years’, there were similar percentages for the private sector and contractors. For ‘over 10 years experience’, the maximum percentage was recorded in the research field, followed closely by education. On the other hand, the actual numbers of respondents in all groups (that is apart from developers) were very similar. These data could suggest that there is greater experience within the research and education fields which is not unexpected in an emerging field of activity. However, it is important to note the very significant proportion (i.e. about 70 %) of ‘authority’ respondents who have fewer than 5 years experience. All in all it can be seen that most of the respondents who answered the questionnaires have more than 5 years of experience, and are part of the academia and/or research.

Analyses of responses

Responses to the following aspects of the questionnaire were analysed:

- EU harmonisation,
- Decision-making stages,
- Interactions between stakeholders,
- Investigation and assessment methods,
- Timing and nature of risk assessments,
- Factors influencing remediation options,
- Stakeholder involvement, and
- Respondent recommendations.

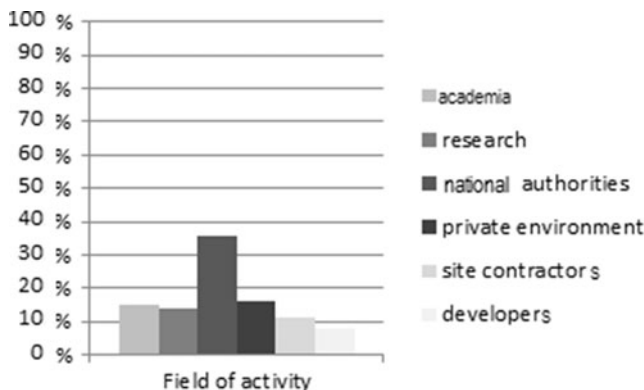


Fig. 2 Distribution of responses for each field of activity

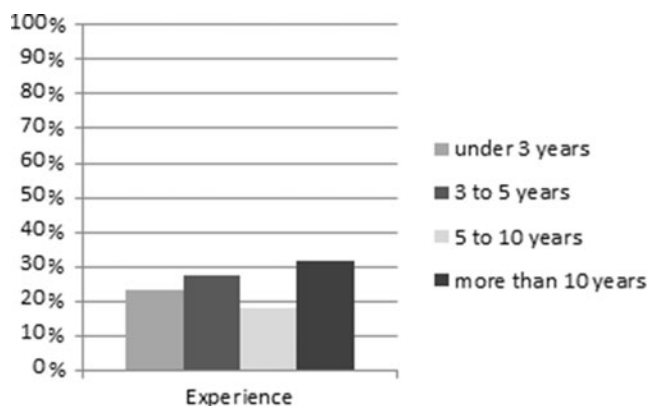


Fig. 3 Distribution of respondents based on duration of their experience

EU harmonisation

In what regards EU harmonisation in this field, the following question was addressed: ‘Is it necessary or beneficial, to harmonise legislation and guidelines related to the assessment and management of contaminated sites at the European level? (Give arguments)’. Figure 5a–d presents the opinions of respondents regarding the harmonisation, or not, of the relevant legislation at EU level. A large majority (89 %) gave positive responses regarding the need of and/or benefit from the harmonisation of legislation and guidance related to the management of contaminated sites in the EU; those who were against this action representing 11 %. Of those who responded affirmatively to this question, 40 % considered it necessary for the harmonising legislation to be consistent with other environmental areas that have European Directives, and which are then transposed nationally. A low percentage (18 %) argued that harmonisation is necessary in order to use the experience of countries that already have knowledge in investigating this field. Of those 18 %, 6.8 % argued that harmonisation is not necessary because each EU member state has or should have its own legal framework, guidelines and rules for the management of contaminated sites. Given the lack of consensus at EU level in the field of contaminated sites, each Member State has implemented its own guidelines, laws, terms and specific adjacent aspects. As can be seen, also those who responded to

this questionnaire believe that for the efficiency of action which is needed in this area, there is a need for a general framework to be implemented in each Member State.

Decision-making stages

For the purpose of identifying the awareness regarding the decision-making process the respondents were required to answer the following question: ‘Based on your experience, which do you consider to be the main steps of the decision-making process related to the assessment and management of contaminated sites? Please highlight and describe them in a few words’.

97 % of respondents answered the question regarding the main stages of decision-making management of contaminated sites.

Three per cent answered that they do not know what the main stages are. The response rate to this question was high (although in some cases respondents had different opinions) and it can be clearly seen that the main stages identified and considered by respondents are: characterisation, preliminary investigation, detailed investigation, risk assessment and remedial/rehabilitation/reconstruction action, namely the main milestones already stipulated in Romanian legislation, namely GD 1408/2007 and GD 1403/2007 (Fig. 6).

Interactions between stakeholders

During the decision-making process an important aspect is the interaction between different stakeholders, thus the question ‘At what stage do you think the opinions of other stakeholders should be taken into account during the decision-making process for the management of contaminated sites? (Give arguments)’ was addressed. According to the variants of response, the stages of the decision-making process regarding the management of contaminated sites in which the views of other stakeholders should be taken into account, showed the following:

- Remedial/rehabilitation/reconstruction stage (71 %),
- Risk assessment stage (47 %),

Table 2 Relationship between duration of experience and field of activity

Experience	Field of activity					
	Academia (%)	Research (%)	Authorities (%)	Private sector (%)	Contractors (%)	Developers (%)
Under 3 years	9	10	31	17	12	24
Between 3 and 5 years	27	30	39	17	25	0
Between 5 and 10 years	18	10	15	25	25	76
Above 10 years	46	50	15	42	38	0
Field totals (% (no.))	100	100	100	100	100	100

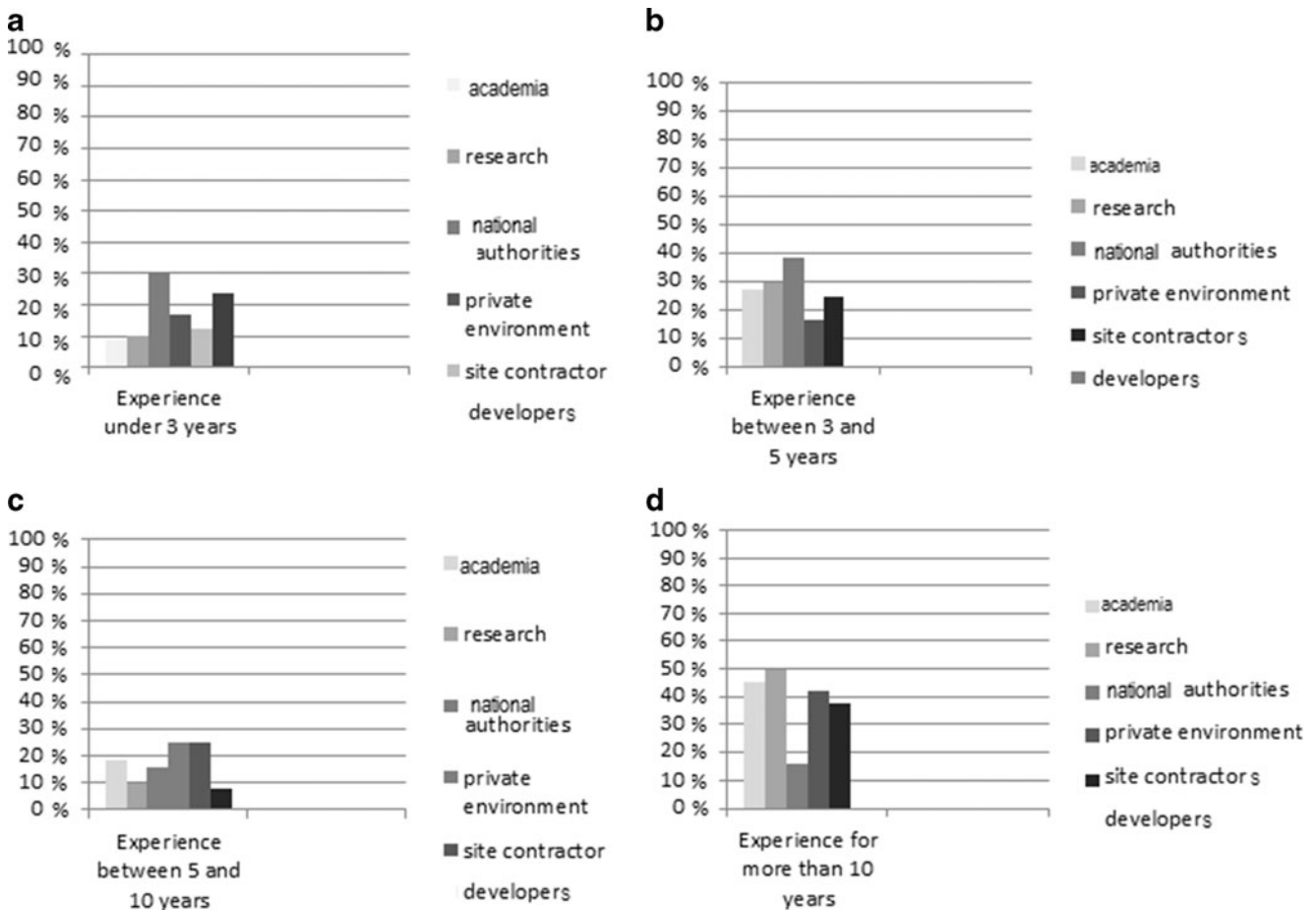


Fig. 4 a–d Graphical representation of the distribution based on *field of activity* vs. *experience in the field*

Preliminary investigation stage (44 %)
 Detailed investigation (44 %),
 Inventory stage (29 %), and
 Post-remedial monitoring (21 %).
 Answered that they ‘do not know’ (6 %).

The arguments of the respondents accumulated relatively low percentages because of lack of responses, respectively 14 % of them felt that stakeholders must be involved in the decision-making process after the risk assessment stage, i.e. after the characterisation and investigation stages of the site have been completed and remediation targets set; 36 % have answered that stakeholders should be involved in all stages, for better dissemination and understanding of the results; 12 % have answered that the involvement should be in the stage of implementation of remedial actions, depending on the future use of land and a share of 7 % answered that they do not know. For this question it can be observed that the major percentage was achieved by the argument that stakeholders should be involved at all stages, for better dissemination and understanding of the results. This can be a benefit, because the discussions and consensus among

stakeholders can reduce costs and time allocated to each project, streamlining decision making.

Investigation and assessment methods

Taking into account the current state and development in the field, both internationally and nationally, the stakeholders were asked to present their knowledge and awareness regarding investigation and assessment methods, respectively through the question: ‘Which do you consider to be the most used and/or efficient investigation and analysis methods for historically contaminated land, and why?’. According to variants of responses, the most used and/or efficient methods of investigation and analysis of historically contaminated land were considered to be the ones in Fig. 7.

The answers confirm existing methods in the proposed technical guidance for investigating and assessing contaminated sites in Romania. The large majority of responses relating to the geological and geochemical methods show that these are used primarily and mainly in environmental studies conducted for the soil environmental factor so far in Romania.

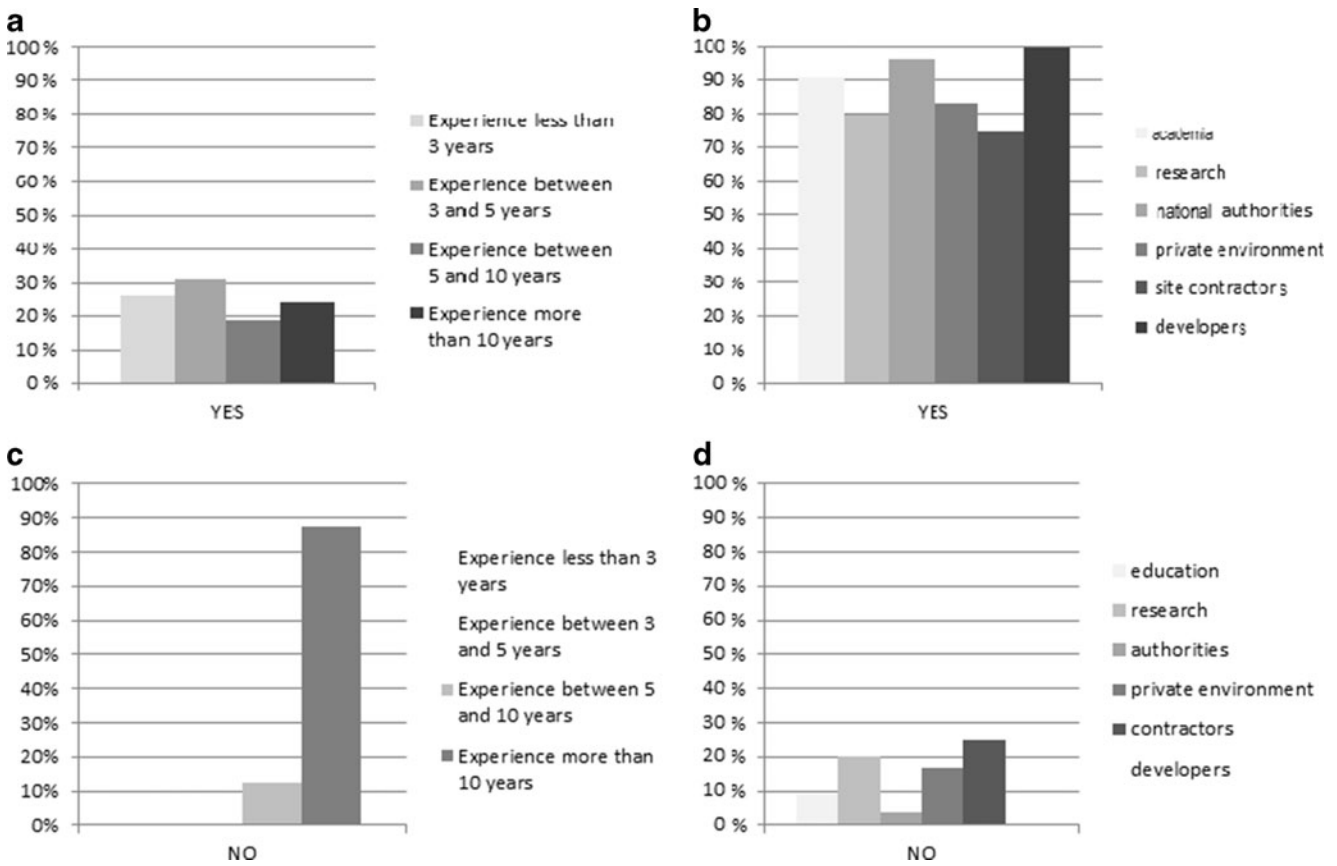


Fig. 5 a–d Distribution of opinions regarding legislation harmonisation at EU level

It may be noted that geophysical methods have a relatively high percentage, so we can assume that they are used increasingly, besides the geological and geochemical ones.

Timing and nature of risk assessments

For the question ‘Do you consider the risk assessment a necessary phase during the management process of an industrial contaminated site? (Give arguments)’, 100 % of respondents answered ‘yes’, namely that risk assessment is

required in the management of a historically contaminated industrial site. The need for risk assessment was identified by respondents as follows:

- To quantify the importance of the hazards and consequences for human health and the environment (29 %);
- To establish remedial objectives and cost efficiency (19 %);
- After the steps previous to risk assessment (15 %); and
- After identifying the actual pollution (15 %).

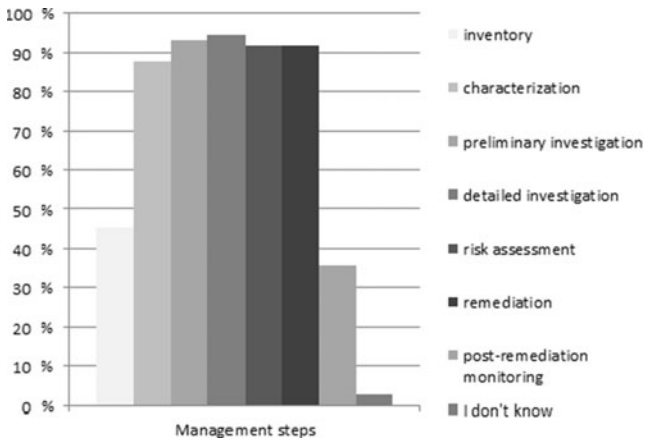


Fig. 6 Distribution of responses identifying site management stages

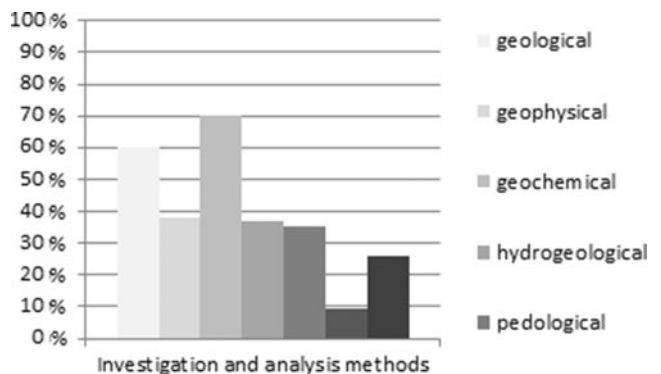


Fig. 7 Distribution of answers regarding investigation and assessment methods

Given that all the respondents answered ‘yes’ to this question, the options ‘I do not know’ and ‘It is not needed’, did not obtain any percentage. The 100 % answer shows the need for carrying out the risk assessment and to establish the spatial extent of contamination on a site. It is also important to note that this response is consistent with the international approaches in this field, most of them based on risk assessment.

Given the question ‘Do you consider that different levels of risk assessment should be carried out during the different stages of site management process? (Give arguments)’, affirmative answers were 44 %, compared with 56 % negative responses, regarding achieving different levels of risk assessment during the various stages of decision making. Of those who responded negatively, 18 % considered that risk assessment should be performed only when the results of investigations of the site are known, and 1 % considered that risk assessment should be performed only when the regulatory authorities demand it. Of the respondents that answered positively, 11 % considered that risk assessment should be carried out after each stage of investigation conducted on site, 12 % considered that risk assessment should be carried out on several levels, taking into account the extent of contamination both spatially and with depth, 16 % consider that it should be performed in order to see if changes can occur during the stages of a contaminated site management. For the version ‘I do not know’ there were no responses. The greater percentage recorded for this question was for the ‘no’ choice, namely that it is not required to have different levels of risk assessment during their various stages of decision making. The other extreme recorded a slightly lower percentage, the difference being 12 %.

Presenting the views of respondents it can be concluded that risk assessment should be performed when its implementation is justified based on site investigation results obtained in earlier stages. Similar aspects are present in GD 1408/2007, namely ‘Art 22. After analyzing the final geological investigation report on assessment of geological environment pollution, the competent authority for environmental protection decides whether pollution of the geological environment on the site has a significant impact on human health and the environment, and demands from the owner of land or developer of the site the elaboration of a risk assessment study according to existing specific legislation’.

Regarding the need for different types of risk assessment (Fig. 8), (respectively the question ‘Do you consider that both human health and ecological risk assessments are necessary at all stages, or only one of these? (Give arguments)’) human health risk assessment recorded 100 % response, and ecological risk assessment recorded 95 %, nobody selecting the ‘None of the two versions above’.

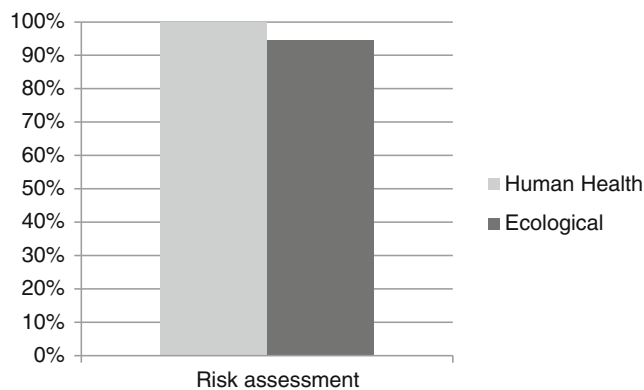


Fig. 8 Percentages usage of different types of risk assessment

As for the arguments regarding the rationale for risk assessments, the following responses were noted:

- Human health risk assessment must be performed because human health is a priority in the short term - 12 %;*
- Environmental risk assessment should be performed as medium and long term can cause further damage to human health—8 %;*
- Both because human health and the environment are affected by contamination—30 % and*
- Both can be performed depending on future use of land—6 %.*

Although the percentage difference between risk assessment for human health and environmental risk assessment is only 6 %, it is evident that the inclination of respondents is to prioritise human health risk assessment.

For the question regarding risk assessment methodologies (‘In your opinion which do you consider to be the most used, respectively efficient methodology (i.e. ASTM, Dutch Intervention, CLEA (UK) etc.) for contaminated sites risk assessment and why?’) 18 % selected ASTM, 14 % selected the Dutch Intervention values, 0 % for the UK CLEA model, and 25 % for ‘other methodologies’. 44 % selected ‘I do not know’ (Fig. 9).

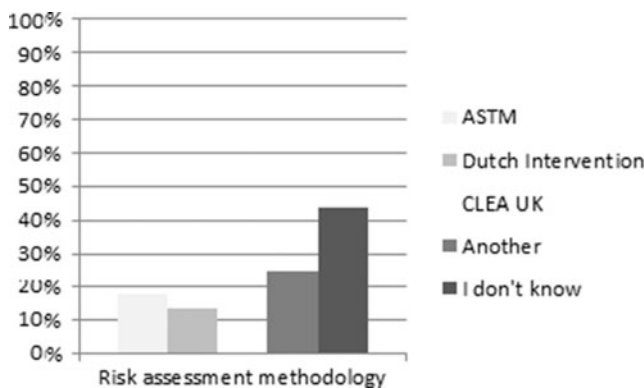


Fig. 9 Level of knowledge regarding suitable risk assessment methodologies

Arguments of those who chose one of the presented methodologies or suggested another one, were:

- As Romania is an EU member state, the methodologies used in this space should be applied (19 %),
- The methodology was recommended by other experts in the field (14 %), and
- ‘Any of the methodologies should be used, provided they are applied correctly and appropriately according to the data obtained’ (22 %).

It is remarkable that there was a high percentage (44 %) who answered ‘I do not know’ to this question. Accordingly, we can assume that either risk assessment does not fall within their sphere of interest or they lack experience. It is also important to note the relatively high percentage (22 %) who selected: *Any of them provided they are applied correctly and appropriately according to the data obtained*; this suggests experience and the inclination to reduce the level of uncertainty in any analysis performed.

In regard to the necessity of doing regional risk assessments, (respectively the question ‘Is regional risk assessment necessary along with the site-specific risk assessment? (Give arguments)’), 52 % answered positively and 48 % answered negatively. The answers to this question could be grouped as follows:

- It is necessary only if there are potential on-going contamination sources, e.g. from operational industries (16 %);
- It is not necessary if the site-specific risk assessment has been correctly developed (10 %); and
- It is necessary if there is the need to integrate contaminated sites at regional and national level (16 %).

In addition, 4 % answered ‘I do not know’. For this question it can be observed that 4 % more respondents considered that regional risk assessment should also be done compared with those who do not see it as being necessary. At the international level this type of assessment is more frequently used, an example being the Spatial Decision Support System for Regional Assessment of Degraded Land Project (Pizzol et al. 2011). In addition, it is important to note that, based on the arguments of the respondents; there is a different perception of the meaning of ‘regional’. In the literature, regional risk assessment is defined as being a risk assessment procedure that uses spatial aspects and takes into account the presence of several habitats, of several sources that can emit many stress factors that can have an impact upon the final receptors, as well as on landscape features that influence estimation of risk (Landis 2005). The scope of risk assessment methodologies at a regional scale is ‘the description and estimation of risks resulting from pollution and physical disturbances at a regional level’ (Hunsaker et al. 1990).

Factors influencing remediation options

In regard to the remediation stage (the question ‘Which do you consider to be the main categories of factors that should be taken into account when remediation works are being designed and implemented?’) the main categories of factors which respondents considered should be taken into account when remedial actions are designed and implemented, are shown in Fig. 10.

Thus the highest percentage was registered for the natural factors (such as geological and hydrogeological structure, climate, and geomorphology), followed by the anthropogenic ones (such as location of buildings on the site before and after remedial actions, presence of oil pipelines, and drainage/sewerage), so it can be interpreted that the respondents consider the knowledge, investigation and analysis of site conditions, as well as knowing the potential obstacles for these actions, as being the most relevant issues. An important percentage was also been registered for economic factors, and thus it can be noted that also of importance is the efficiency of any actions taking into account the adjacent costs.

Stakeholder involvement

In response to the question ‘Do you consider as being useful or essential to hold discussions and negotiations with the financial owners during the decision making process regarding the establishment of the necessary remediation intervention for a site? (Give arguments)’, 96 % answered affirmatively, and only 4 % answered negatively (Fig. 11). The arguments presented by the ‘yes’ respondents were:

- The results of each step of the decision-making process must be known by all the involved stakeholders—32 %;
- The regulatory authorities should also speak with the economic agents—6 %; and
- Discussions are important for cost efficiency—27 %.

The ‘no’ respondents suggested that the regulatory authorities should decide the actions that need to be implemented (1 %).

The high percentage of ‘yes’ respondents (96 %) indicated their availability to communicate during any of the actions

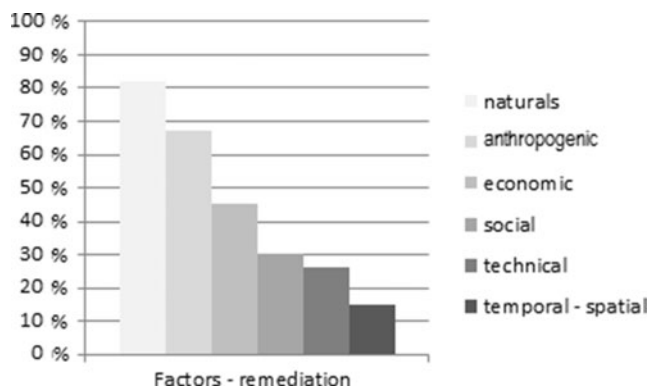


Fig. 10 Opinions on factors that should influence the remedial process



Fig. 11 Involvement of stakeholders in decision-making according to respondents

conducted along the decision-making process, including for setting the necessary level of remediation.

Respondent recommendations

In the case of respondents’ recommendations, (the question ‘What are the most important aspects/issues related to overall risk assessment and management?’) (Fig. 11), the analysis of all the questionnaires enabled categories of their recommendations to be defined as follows based on the data filled in by the questioned subjects:

- Develop investigations and assessment taking into account the site specificity (50 %);
- Develop remedial actions based on risk assessment, cost/efficiency analysis and cost benefit analysis (44 %);
- Involve all stakeholders in the decision-making process for the management of contaminated sites for a good dissemination and application of results (32 %);
- Apply the best remediation technologies (both from a scientific point of view, as well as from the point of view of the site specificity) in accordance with the results of the risk assessment and taking into account the sustainable development principle (23 %);
- Protect human health and the environment (25 %);
- Take into account the future land use (48 %);
- Instruct and train stakeholders (19 %);
- Establish the level of uncertainty for all the data used in analyses (12 %);
- Correct the coordination and ranking of the decision-making process (23 %); and
- Correct the lack of a complete specific legislative framework and its implementation in Romania (43 %).

Principal survey conclusions

As the field of contaminated site management has developed considerably at Romanian level since 2007, it was considered important to understand better the views and attitudes towards

this field by all the stakeholders involved. Thus, the current paper focused on surveying these views and attitudes through a series of specific questions set out in a questionnaire. An analysis of the responses received from more than 70 respondents, who are operating in several different roles, shows that there are differences between the views and attitudes of different stakeholders involved in the decision making process.

Based on the questionnaire analysis, the following general three principal conclusions can be drawn, namely:

- Taking into account that at the Romanian level the field of contaminated sites management is relatively new (i.e. in 2007 two legislative acts were issued) the stakeholders involved in the decision-making process encounter obstacles in regard to regulatory issues, research, and a lack of practical applications; at the same time, in the current legislation a parallel between the land-use planning and the environmental legislation also applicable in the case of contaminated sites management, is not made;
- Even though the current Romanian legislation regarding the management of contaminated sites mentions the necessity of developing a risk assessment to establish the level and extent of contamination on a site, a well-structured and detailed methodology for human health and/or ecological risk assessment is not yet available (except for the one in the Decree 184/1997, which is extremely simple and full of gaps); the need of risk assessment in the field was emphasised by the results of the questionnaire which showed that 100 % of respondents stated that this is a necessary step; and
- Based on respondents recommendations it would be helpful to establish partnerships for participating in international projects that include application aspects as well as dissemination aspects so as to train the stakeholders in Romania involved in this field, i.e. optimise the value of the experience gained in other EU Member States.

Concluding comments

This survey has demonstrated that the major stakeholders have a key role to play in the continuing development of contaminated sites management to tackle decision-making issues. However, if the potential in the field is to be realised as a setting in which theoretical and practical issues can be addressed then, first and foremost, stakeholders need to recognise that their commitment should be both public and sustained; public, because this demonstrates a conviction that action is needed, and sustained because changing attitudes, beliefs and behaviour (be it at the individual or the organisational level) takes time.

It is usual for several stakeholders dealing with this field to be involved in different types of programmes. Different stakeholders bring different perspectives, skills, understanding, and resources to the relationship and this must be recognised as a strength. In working together, stakeholders should utilise these differences in the building of strong and effective interventions, and solutions feedback. The public as stakeholder was not considered to be part of this paper as we mainly focused on experienced stakeholders' levels of awareness and knowledge in order to present the views of those directly involved in the decision-making process. The basic principles of collaborative working need to be in place, namely the sharing of power, responsibility and authority for change. The successful adoption of these principles requires trust between stakeholders, good communication and an absence of blame when progress becomes difficult.

The improvement of the Romanian regulatory framework in the field, dissemination and exchange of knowledge and expertise, implementation of more practical projects, collaboration with other organisation in EU Member States, for example, are goals that many stakeholders possess independently of one another. Their ability to influence these goals in isolation is not as great as their ability to influence them when working collaboratively with others. Thus, given the commonality of goals and the potential benefits, decision-making process outcomes, potential stakeholders need to identify ways in which they can collaborate effectively.

The engagement of stakeholders is facilitated when they are 'buying in', i.e. committing to, a clear plan of action which has objectives which they can relate to and agree with. Leaders at all levels and dimensions of the field need to consider how to gain this 'buy in' by stakeholders as plans and proposals are created and consulted on. Having clear strategies, whether they relate to legislative issues or practical rehabilitation projects, for example, provide a good starting point. When these are backed up by sound action plans, clear and deliverable goals, and when all the benefits of the intervention are clearly stated for each of the stakeholders, then engagement of the full range of potential stakeholders is more likely.

The management of contaminated sites in general, and the steps involved in particular situations, normally require huge capital outlay. The key message is that all projects should incorporate an appropriate amount of information and action (such as site characterisation, investigations, risk assessment, remedial actions, and monitoring) so that their implementation can lead to an efficient feedback and cost/benefit report. All stakeholders have something to contribute to the decision-making process but this does not need to be in the form of direct financial aid. The contribution of all stakeholders (whether financial or in kind through knowledge, skills and experience) should, therefore, be valued and appreciated.

Whilst this paper has identified stakeholders directly involved in the decision-making process for contaminated sites

management, and presented their awareness and knowledge in the field, it is beyond the scope of this paper to establish definite and sophisticated criteria for action to implement rehabilitation programmes/projects. Stakeholders obviously have a hugely significant role in putting a programme into action, and the survey answers show that each stakeholder can become involved. Future research should seek to establish theoretical and practical aspects to enable stakeholders to develop this field further, as well as monitoring their involvement and the degree of awareness and knowledge.

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