Testing a Stakeholder Participation Framework for Fielding Bioremediation Technologies

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Abstract: This research is investigating stakeholder attitudes about the use of bioremediation technologies with the objective of reducing conflict among stakeholders. The research protocol includes four closely related components. First, we are testing a framework for stakeholder participation that prescribes appropriate stakeholder involvement strategies based on stakeholders' trust of the other parties involved in technology deployment decision-making. Second, we are assessing conflict among stakeholders regarding the acceptability of *in situ* bioremediation as a means to reduce risks posed by radionuclides and metals in the environment. Third, we are assessing the role that awareness of risk exposure plays in the willingness of stakeholders to engage in problem-solving and making risk tradeoffs. Fourth, we are assessing the potential of using the results of these first three components to forge consensus among stakeholders regarding the use and oversight of bioremediation technologies and stakeholder involvement in the decision process. This poster presents preliminary results of a Q methodological survey of stakeholders who are familiar with radionuclide and heavy metal contamination and DOE efforts to remediate that contamination at Los Alamos, Oak Ridge and Hanford reservations. The Q study allows the research team to diagnose conflict among stakeholders and discover opportunities for consensus.

Interviews

During the summer and fall of 2002, researchers conducted 30 face-to-face stakeholder interviews in the Oak Ridge, TN area; 29 interviews in the Hanford, WA area; and 20 interviews in the Los Alamos, NM area. The interviews were conducted with community leaders, governmental officials, interest group representatives, and other local stakeholders. The interviewers used "snowballing" to identify and interview those who had different perspectives on site remediation and stakeholder participation in site remediation decision-making.

The interviews were tape-recorded and later transcribed. This resulted in 72 useable transcripts (7 tapes of interviews in Los Alamos were of poor quality). Common themes that emerged from these interviews were identified by text analysis using the commercial software program *NVivo*. These common themes guided the research team in selecting statements for use in the Q-study.

Q Methodology

The research team was interested in discovering stakeholder perspectives about two issues: site remediation (i.e., bioremediation) to reduce risks and stakeholder participation preferences in remediation decision-making. To allow stakeholders to reveal their perspectives on these two issues, two sets of 47 statements each were selected from the concourse of statements contained in the interview transcripts. These "Q samples" addressed the themes revealed from the text analysis and captured the breadth of sentiment expressed in the interviews.

Interview subjects were asked to sort the Q samples according to how strongly they agree with the statements. The sorted samples are then statistically processed to reveal common perspectives among the stakeholders.

Stakeholder Perspectives on Bioremediation

Six perspectives on bioremediation were revealed from the Q factor analysis. These six factors accounted for all 33 sorts and 64% of the total variance among sorts. The factor correlations are presented in Table 3. The perspectives captured by factors A, C, and E are moderately correlated and B, D, and F are moderately correlated. This suggests that the six perspectives can be divided into two groups of three perspectives each.

TABLE 3. BIOREMEDIATION FACTOR CORRELATIONS

FACTORS	B	C	D	E	F
A	0.14	0.60	0.05	0.36	-0.01
B		0.16	0.32	0.09	0.45
C			0.00	0.32	-0.14
D				0.03	0.23
E					-0.02

Detailed descriptions of the perspectives captured by the individual factors, as well as the composite perspectives are available from the authors. The composite perspectives are briefly interpreted below:

ACE Composite Perspective: "Risk Optimists"

Interestingly, 18 of the 22 stakeholders who share this composite perspective are male and they are more technically trained. Risk Optimists share the view that zero risk is impossible and that remediation benefits (risk reduction) must be balanced against remediation costs. The label Risk Optimists is adopted because this composite perspective shares an optimistic view toward DOE's risk assessments and their ability to reduce these risks to safe levels.

BDF Composite Perspective: "Risk Pessimists"

Those sharing this composite perspective are dominated by females and include less engineers and physical scientists and more environmental professionals and activists. This composite perspective endorses the view that current risks are quite unacceptable and that DOE and its contractors should be held accountable for the contamination. Risk Pessimists also believe that DOE should be much more open and communicative with the public.

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Stakeholder Perspectives on Participation

Four perspectives on stakeholder participation were revealed from the Q factor analysis. These four factors accounted for 30 of the 33 sorts and 52% of the total variance among sorts.

Preliminary Conclusions

With Respect to Site Remediation

The results of the Q-study over the use of bioremediation resulted six orthogonal factors suggesting that a remediation solution for these three sites that will enjoy widespread stakeholder support is possible.

Areas of consensus among stakeholders relating to site remediation are:
- The contamination must be remediated
- Education of stakeholders on bioremediation is required
- Communications and openness in DOE actions is required
- Efficiency is important – do not waste money and resources

Other areas are orthogonally related; that is, were important to some perspectives and not to others (and therefore were not opposed by any perspective). These include:
- Bioremediation is not the only technique available to remediate subsurface contamination
- Experts are trusted

The following areas are currently controversial:
- The public is at risk from subsurface contamination
- Bioremediation is a long-term solution
- Cost of remediation is important and cost-benefit analysis should govern decisions
- People can avoid risk if they want to, especially if they are more knowledgeable

Despite these controversies, we are optimistic that bioremediation could be acceptable. Our **recommendation** is that experts reach consensus on its effectiveness, it is implemented as soon as feasible, DOE commits to long-term management of the site, and it is not presented as only a cost-cutting measure. We also recommend that DOE expend significant resources in building trust among stakeholders. More regulation is not the answer; fiduciary responsibility is.

With Respect to Stakeholder Participation

The existence of four orthogonal factors, with only a single bipolar loader on three of the factors, suggests that a stakeholder participation strategy may be designed that will enjoy widespread stakeholder support.

Areas of consensus among stakeholders relating to their participation in decision-making are:
- Consultation is more important than deliberation
- Education on bioremediation is important

Areas of orthogonality are:
- Stakeholders should be involved throughout, all points of view should be considered before a decision is made, and access to information should be guaranteed; not involving stakeholders will bring trouble

Areas of controversy are:
- Multi-organizational approaches are best
- Citizen groups suffer from non-representativeness and emotional interference with rational decision-making; in any event, stakeholders don't have time to participate

Based on these findings, we offer the following **recommendations** regarding the involvement of stakeholders in bioremediation decision-making: Stakeholders should be involved throughout the decision-making process but in a consultancy role. A multi-organizational advisory committee that is broadly representative and includes elected officials may be the best strategy. To improve the effectiveness and acceptability of this strategy, DOE must provide participants with complete, timely, succinct, and easy-to-comprehend information. DOE must also be willing to consider seriously the suggestions made by the committee. DOE should work to build trust with the community – not only through its willingness to involve stakeholders – but also through its willingness to consider the welfare of the community in its deliberations.