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The Role of Social Factors in Shaping Public Perceptions of CCS: Results of Multi-State Focus Group Interviews in the U.S.

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Abstract

Three of the U.S. Department of Energy's (DOE's) Regional Carbon Sequestration Partnerships analyzed community perspectives on carbon capture and storage (CCS) through focus groups and interviews in five communities. These perspectives were analyzed in the context of each community's history and its social and economic characteristics. The results were considered for their insights into specific concerns within each region, as well as to assess inter-region commonalities. In all cases, factors such as past experience with government, existing low socioeconomic status, desire for compensation, and/or perceived benefit to the community were of greater concern than the concern about the risks of the technology itself. This paper discusses the findings from the joint review of the focus groups and the potential lessons for application to CCS deployment.

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1. Introduction

Over the last decade, many of the experts and advocates working in climate change have recommended further research into whether carbon dioxide (CO_2) capture and sequestration (CCS) may be a viable and important

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technological response to climate change. However, all new technologies face challenges with respect to social acceptability, especially those that may involve new risks, large-scale infrastructure, and significant government involvement—all features of CCS. Some of the most critical challenges to social acceptability may come from the perceptions and preferences of communities near whom CCS infrastructure may be located. Thus, it is important to evaluate what might explain and influence the views of communities that may be directly impacted by the siting of this technology.

The U.S. Department of Energy's (DOE's) Regional Carbon Sequestration Partnerships provide a valuable opportunity for examining this question. Initiated in 2003, the program forms a nationwide network of seven partnerships among government agencies, private companies, universities and non-governmental organizations designed to assess the viability of different approaches to carbon sequestration. The program is being implemented in three phases and is currently in the final year of the second phase of implementing over 20 small-scale field tests and the first year of the third phase of implementing a large-volume test in each region. Public acceptability is recognized as an important aspect of the program; outreach activities and research into public perceptions of the technology are a funded component. This paper reports on a collaborative social research effort among three partnerships—the West Coast Regional Carbon Sequestration Partnership, (WESTCARB), Southwest Regional Carbon Sequestration Partnership (SWP), and the Midwest Regional Carbon Sequestration Partnership (MRCSP). Researchers from these three partnerships conducted a series of focus groups in the states of California, Ohio, Texas, New Mexico and a test interview in Washington, D.C. The results were considered for their insights into particular concerns within each region, and they were also compared to see if common themes emerged from the multi-state effort.

In all cases, social factors, such as existing low socioeconomic status, desire for compensation, benefits to the community and past experience with government were of greater concern than concern about the risks of the technology itself. For example, in California, a community's sense of its own empowerment was an important indicator of its willingness to consider hosting a geologic sequestration project, perhaps even more than the perception of technological risks. Three factors seem to influence a community's sense of empowerment: history of environmental problems, relationship to the oil and gas industry, and socioeconomic status. In New Mexico and Texas, community members' concerns focused on fairness, trust and the logistics of CCS—concerns about surface owner rights, liability, and ownership of the injected CO_2. In Ohio, issues of trust were central to focus group participants' perceptions of CCS in that they doubted the ability of the government or the project developers to ensure their safety. This underlying distrust of government and the private sector was an even greater concern than the risks of CCS technology per se.

These and other insights have significant implications for future research and the conduct of public outreach for CCS projects. They also have implications for more fundamental issues such as the design of CCS projects and, most broadly, for appropriate practices for the planning and implementation of large-scale greenhouse gas control technologies. This paper discusses the findings from the joint review of the focus groups and the potential lessons for research and application to CCS deployment.

2. Methodology

Social researchers from the three regional carbon sequestration partnerships collaborated in developing, testing and implementing a common focus group protocol to examine public perceptions of carbon sequestration, including both terrestrial and geologic sequestration. The researchers' intent was to benefit from the opportunity provided by the DOE nation-wide program to compare results from three very different geographic and cultural regions of the United States: the west (California's Central Valley), southwest (New Mexico and Arizona), and Midwest (Ohio). The focus group discussion guides were developed, piloted, and conducted in 2006 and 2007 during the second phase of the program as plans for conducting small-scale tests were being developed.

All focus groups used a similar protocol drawn up collaboratively by the three partnership researchers. The protocol built on previously published surveys in developing a discussion guides that focused on seven broad topics: (1) societal concerns, (2) familiarity with climate change, (3) attitudes about potential climate change impacts, (4) familiarity with carbon sequestration, (5) reactions to carbon sequestration policy frameworks, (6) perceived advantages and disadvantages of carbon sequestration, and (7) attitudes towards potential safeguards to mitigate

risks from carbon sequestration. Focus groups were deemed to be an appropriate research tool because the approach allowed enough flexibility for each partnership to focus on regional concerns while also ensuring that its similar structure would enable comparison among the regions. The discussion guides were supplemented by brief, DOE-approved information sheets about both geologic and terrestrial sequestration to provide background information.

The data from the focus groups were supplemented by individual discussions and observations undertaken during implementation of the pilot projects. To assist in interpreting the focus group findings, the WESTCARB and SWP Partnerships conducted individual interviews both locally (WESTCARB) and regionally (SWP). SWP also used a short questionnaire regarding opinions about sequestration. MRCSP compiled information separately from the focus groups in informal public meetings and discussions at each of the three Phase II and their Phase III field test sites. Clearly, the focus group and individual interview data make no claim to statistical significance. However, given the low level of public knowledge about climate change and geologic sequestration, these types of data, collected in a more open-ended manner than a survey questionnaire, avoid the danger of eliciting pseudo opinions, or non-attitudes [1]. Focus groups and probing questions allow multiple dimensions important to participants to emerge through interaction and discussion and allow the researcher to understand differing public perspectives [2]. In an emerging area such as sequestration, they are especially valuable as a first step in identifying fruitful directions for future research.

Selecting the communities for the focus groups proved to be an interesting challenge. The Phase II field demonstrations are primarily scientific research projects designed to contribute to our technical understanding of sequestration processes and techniques. At the same time, an enormous benefit of these projects is that they are providing a wealth of practical experience in the siting, permitting, constructing and implementing of carbon dioxide injection wells. The Phase II projects are so small, involving injection of about 10,000 tons each (note – many were less than 10K, some were huge – 100-200K in one partnership, for example) that they are very unlikely to pose any significant risk. So on one hand, there is an emphasis on getting the projects completed to reap the scientific benefits. Yet on the other hand, a significant part of the practical experience is derived by working with the public to better understand their perceptions and attitudes towards CCS.

In selecting communities for social research, the dilemma is, to what extent do social research activities themselves influence the success of the scientific research projects and/or the public perception of CCS? In response to these considerations, the focus groups were conducted in three types of communities: those under active consideration to be a host community, those that by analogy could potentially host projects but were not under active consideration for the pilots, and communities that would be unlikely to host projects.

WESTCARB conducted its discussions in both a potential and an actively considered host site community where tests of sequestration in depleted natural gas fields were planned. To conduct an injection test, surface rights and often mineral rights have to be acquired in the areas where the carbon dioxide will be injected. The potential host community was a site that otherwise appeared suitable for sequestration but was dropped from consideration because the cost and time necessary to obtain property rights from the large number of property owners involved were prohibitive. WESTCARB conducted two focus groups and a series of interviews in this potential host community as well as three focus groups in a second community that was still actively under consideration for locating the pilot test.

SWP conducted five focus groups as well as a series of interviews in and near (within 50 miles) two communities that were directly impacted by hosting pilot tests. The New Mexico site hosted a test for injecting CO_2 into coal beds to enhance the recovery of coal bed methane, the primary energy source for natural gas. The Texas site hosted tests of sequestration in depleted oil wells to achieve enhanced oil recovery (EOR). One focus group each was conducted at the New Mexico and Texas host sites, and three were conducted in nearby New Mexico communities that were indirectly impacted. Because public interest was insufficient to support focus groups, individual interviews were conducted in nearby Texas communities.

MRCSP selected a community that would be unlikely to host a sequestration project because of population and urban density but was located in a state with significant sequestration potential and historically dependent on coal for electrical power generation. MRCSP conducted two focus groups in Columbus, Ohio.

The focus group communities differed in demographic characteristics. The WESTCARB and SWP communities were rural; MRCSP's was urban. The population in one WESTCARB community had low median incomes, low education levels, and a large proportion of Hispanics; the economy was in a downturn. The other community was

largely white, well-educated, and had higher median incomes. Focus group participants largely reflected these sociocultural differences. The SWP communities varied; all had lower median incomes than the State median but the proportions of Hispanic, white and American Indian populations differed (one had a high proportion of American Indian, and another had a high proportion of white persons). However, focus group participants were largely white and well educated. The MRCSP Columbus population was largely white, and focus group participants were well educated.

Recruitment approaches also differed, depending on what was most feasible in each study community. WESTCARB recruited one group to represent people of local standing; others were recruited by snowball or nominated sampling, flyers, and radio advertisements. SWP recruited through newspaper and radio advertisements, local internet-based community calendars, and word of mouth. MRCSP recruited one group of "influentials" from personal contact with environmental groups, business associations, the public sector, civic groups, and another group randomly selected from the local telephone directory.

3. Findings

3.1. Knowledge of Climate Change and CCS

Focus group participants displayed varying levels of knowledge about climate change and its causes. Both WESTCARB populations knew that climate change was occurring. The better-educated groups understood its anthropogenic causes and had thought about its possible impacts on their community, while the groups with lower education levels were just vaguely aware of the phenomenon. Many in the former group had heard of sequestration; almost none in the latter group knew about CCS as a mitigation technology or knew that they were under consideration as a test site.

Although SWP participants had heard of sequestration, they did not appear to have a clear sense of the potential scale of sequestration that might be deployed. They generally supported the idea of supporting research on the topic. They thought landowners should be encouraged to engage in terrestrial sequestration activities. They were not concerned that carbon sequestration might delay a shift away from fossil fuels and strongly supported carbon sequestration as part of a larger energy strategy. When offered potential reasons to support research on carbon sequestration, they were most supportive of doing so because they believed it is important to test new technologies prior to deployment, somewhat supportive of doing so because it would help remove carbon from the atmosphere during a transition of the overall energy system, and uncertain whether the support of DOE and relevant industry provided a good reason to conduct research on carbon sequestration. When asked about solutions, many responded that a wide range of solutions, from nuclear power to conservation measures, are needed.

In Ohio, both focus groups were familiar with climate change and most seemed to think it was happening. The groups differed, however, in their knowledge of sequestration, especially of geologic sequestration. Most of the "influentials" had heard of it and some were even familiar with non-partnership demonstrations being conducted by large locally based utilities; however, the majority in the randomly selected group were not familiar with it. In this location also, none of the participants appeared to have an accurate sense of the potential scale of sequestration that might be deployed. Concern was expressed that moving to sequestration was a short-term solution, but most agreed that if research and development could demonstrate that geologic sequestration was a safe and low-cost alternative to emitting carbon dioxide, they would support it.

3.2. Trust and Fairness

The most striking finding in all three regional focus groups was the predominance of social concerns. Although all of the groups expressed safety concerns, in all cases, trust in authority and concerns about the fairness of CCS implementation procedures were the most strongly expressed concerns. In the Southwest, questions regarding fairness and trust predominated. In the Midwest, trust in the government and in the information they disseminated was a pervasive issue. In the West, communities expressed distrust in both the government and the private sector, but the level of distrust was higher in the lower income, relatively disempowered community.

WESTCARB

In California, a community's sense of empowerment was an important indicator of its willingness to host a geologic sequestration project. The WESTCARB researchers defined a community's sense of empowerment as 1) its ability to mitigate community-defined risks of the technology and 2) its ability to ensure that just procedures would be followed in implementing that technology. They explained this finding by citing Hirschman's [3] argument that a community's sense of empowerment allows it members to exercise "voice" and to seek redress if they are being harmed. Accordingly, empowerment protects against the downside risk of hosting a field test site. The community's history of environmental problems and its history with the oil and gas industry, both of which contributed to trust or distrust in the relevant authorities, seemed to influence its sense of empowerment. In both California communities, a central concern was the perceived deficiency in the quality of expert knowledge in the face of unknown technological risks. Other commonly expressed concerns were potential changes to the quality of the town, decreased property values, the need for benefit to the local community, the desire for transparency and participation and the need for redress should anything go wrong. Most notable, however, was that the two communities differed in terms of their expectation of redress. The community populated by lower income and less educated persons did not expect to have redress, whereas the higher income and educated community believed in their power to achieve recourse. The lower income community members based their fear on their previous experience of neglect both by industry and by government —and their belief that no one would listen to them and the project would go ahead regardless of their opinions. They expressed the belief that CCS sites were likely to be located in similarly poor and voiceless communities: "Why is it here?" The researchers concluded that the key fear was not the risk of sequestration per se but the risk of being neglected or ignored if the project turned out to be more harmful than expected.

SOUTHWEST

In New Mexico and Texas, health concerns (air and water quality) related to the energy industry were a large part of the discussion. However, the predominant themes again centred on social issues, in particular, issues of trust and fairness. In both states, participants expressed distrust of the companies representing the fossil fuel industry and the federal government. All focus groups included participants who expressed strong reservations regarding anything related to DOE and to specific coal, oil, and gas companies. They cited negative experiences with these organizations, sometimes telling detailed stories of wrongs done to them. New Mexico participants were especially likely to express a belief that they had little control over decisions regarding energy production and were unlikely to gain that control. They repeatedly stated that both government and industry had used their region as a "sacrifice zone."

Participants in the SWP focus groups also expressed safety concerns—but again, in relationship to issues of trust. They claimed that sequestration technology was still experimental and that the companies and government wanted to use them as guinea pigs to test the new technology. Information about monitoring did not allay their concerns because they did not trust those who were conducting the monitoring. They also expressed confusion about from whom they should obtain information or whom they should contact if a problem occurred. They told of past frustrations they had experienced when attempting to communicate their concerns and saw no reason why this should change now.

A concern raised was how geologic sequestration operations might impact landowner rights. Related to this were concerns about liability. As with previous concerns, they shared horror stories–for example, the story of a large company that laid a pipeline across someone's pasture, but when increased temperatures from the pipelines severely limited both quantity and quality of forage in the alfalfa field, the rancher was unable to obtain compensation for his economic loss. Interestingly, despite all their concerns, all the SWP groups expressed generalized support for energy production. They recognized that energy costs were increasing, but felt that they had borne an unfair proportion of the costs.

The Texas and New Mexico groups had one significant difference. While the New Mexico groups were concerned about carbon sequestration as a new development, Texas participants did not see it as anything new. Although they shared the distrust in companies representing the energy industry and the federal government, they saw no particular problem with geologic sequestration. This may be related to the fact that the pilot project was

EOR, something that these communities had become accustomed to over the past several years. Also, although Texas participants were equally likely to distrust both government and industry, one of the groups was less likely to be concerned about fairness or procedural justice. Instead, they were more focused on how they might obtain a portion of the economic profit from EOR, even if all they got were the "crumbs" that fell from the table.

MIDWEST

In Ohio, issues of trust were central to focus group participants' perceptions of CCS. This underlying distrust of government and the private sector to protect the public or the environment was an even greater concern than the risks of CCS technology per se. Many in the "influential" group were primarily involved with regional, state and local government; their distrust seemed to stem from the observation that the "science" of sequestration is still being researched, so the answers to some questions just are not yet known. In the case of the randomly selected group, a pervasive lack of trust in government to protect human safety and the environment from the potential adverse effects of sequestration was evident. Their lack of trust was backed up by numerous direct examples of ways in which there had previously been a breakdown – and in some cases it was suggested that there was a knowing breakdown – in governmental oversight and failure to protect the interests of the community.

4. Insights from the Sociocultural and Procedural Justice Literature

While much of the research into CCS has pointed to public perceptions of the technological risks of the technology, sociocultural theorists point to the social processes within which opinions about a particular issue are formed. People bring to their evaluation of that issue their cultural frame of reference—their values, social interactions and differing experiences, and their way of interpreting and responding to the world [4,5,6]. Rather than beginning with the technology and the attributes of that technology, this school of thought would examine first the human value system and how that impacts the proposed technology. As Bradbury et al. [7] concluded in their study of community perspectives on the risks of incineration and other technologies for disposing of the nation's stockpile of chemical weapons, residents did not think about technology or risk in isolation from their broader life experiences. The community conflicts identified in these authors' studies were not only about the technical risk of the proposed technology, but also about a number of broader, social issues that have been hidden by the nearly exclusive focus on technological attributes. Critical social factors included the fairness and openness of the decision-making process, previous experiences and relationships with the project developers and governmental institutions, and accountability (who will take care of our community if something goes wrong?).

Wynne [8] similarly highlights the social nature of technology and risk and argues that technical analyses frequently fail to address the key societal issues at stake. As a result, resolution of the policy problem becomes more difficult as new technical issues are continually raised and the perception of a gap in responsibility for social issues exacerbates the overall level of concern. He emphasizes that technology is social in origin, character, and effects—the implications of technological development are the social relationships involved in innovation and implementation, and the key uncertainties stem not so much from technical uncertainties, as addressed in technical risk analysis for example, but from uncertainties over potential social changes, social relationships, and social institutions. Similarly, as noted by Rayner and Cantor [9], decisions about technology and risk inevitably involve decisions concerning the level, acceptability, and distribution of risk. Thus, the essential policy question is ethical: How fair is safe enough?

These findings from the sociocultural school are reinforced by the procedural justice literature. Lind and Tyler [10] define procedural justice as "the extent to which the dynamics of the decision process are judged to be fair." They argue that whether or not they approve of the final outcome, people respond more positively to outcomes coming from social processes deemed fair than those perceived as biased (see also Thibaut and Walker[11]; Borsuk et al. [12]). Gangl [13] notes a difference between pragmatic and ethical issues: in pragmatic issues the outcome matters more than the fairness of the process, whereas in ethical issues, process is more important. People involved in a process want to have some impact or control over decisions. Moreover, when people deal with third parties and other authorities with which they have little direct contact, their assessments of procedural justice are more strongly influenced by trust in the institutions of the decision makers.

5. Implications for CCS Implementation and Future Research

Consistent with the above literature that essentially critiques the domination of technological risk issues in discussions related to CCS, the data gathered by the three research efforts point very clearly to the overriding importance of social factors in planning and implementing CCS projects. Resolution of safety issues such as those related to potential leakage, seismicity, and long-term containment are, and will continue to be, essential to successful deployment of the technology. But, as highlighted by the focus groups and interviews, *management* of these safety risks is the critical factor for public acceptance.

Based on these data, key management questions for the public are:

- How can we have a say in what happens? Who is in charge? Will the process be fair and will anyone listen to us?
- What will happen if something goes wrong? Can we trust the project developers and the government to take care of any problems—what have our previous relationships with these entities shown us?
- What is the benefit to our community? How does the proposed project fit into or improve our way of life?

From a development and deployment perspective, therefore, it behooves industry and government developers to place greater emphasis on these types of procedural and managerial concerns. Effectively, this will require a greater emphasis on upfront social analysis and planning than is currently practiced. The regional partnerships program is notable for its funding and recognition of the importance of outreach. But none of the three partnerships discussed here included social factors in their selection of potential host sites for field tests of sequestration. Rather, they have focused on the willingness of one of their partners to host a field test (admittedly a considerable challenge) and on the technical aspects of the proposed test. For example, the key criteria laid out by DOE in selecting a large-volume Phase III test focus on the availability of a reliable and sufficient source of carbon dioxide and a potentially effective storage formation. While these are clearly essential, our data suggest that they are not sufficient in meeting the acknowledged need for public acceptance. Indeed, one-way "outreach" after site selection is not the same as a pre-site selection, two-way mutual exchange of information and views between developers and potentially affected communities. Additional criteria would have asked the partnerships to conduct preliminary consultations with potentially affected communities, assess whether the field tests would be perceived as beneficial, and discuss with them requirements for a successful test from the community's perspective.

Based on our findings, key questions for further research are:

1. How can social factors be incorporated and used to develop mutually agreeable projects rather than simply help in the site selection process? In the technical site characterization that typically occurs, a site judged to be basically suitable for CCS requires very site-specific design, construction, and operation activities to ensure safely. Should a comparable characterization be conducted to assess social characteristics? This would, in effect, require both a technical and a social characterization of the proposed project area. What are the disadvantages of such an approach? And should site-specific communication/negotiation/compensation strategies be adopted that address the community's perception of the risk?

2. If adopted, when should such a social site characterization start? How should it be factored into the selection process and how much should be conducted? The development of private enterprise is not always so encumbered – will this always be the case for CCS or just the initial projects?

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