

The Complexities of Discussing Soil Vapor Extraction Techniques with Non-Scientists

Jabro, J.D.¹ – Jabro, A.D. – Domalski, R.

¹Northern Plains Agricultural Research Laboratory, USDA-ARS, 1500 N. Central Avenue Sidney, MT 59270; phone: 406-433-9442; fax: 406-433-5038; E-mail: jayjabro@ars.usda.gov

1. Abstract

The Centre County Kepone Site is approximately 32.2 acres on which a chemical manufacturing plant and a portion of the Spring Creek watershed are located. Kepone and mirex were custom manufactured between 1959 and 1974. Earthen lagoons were used to manage onsite waste disposal. Concrete lagoons were later constructed and macadamized with asphalt. Treated water was also sprayed on open grassy areas or spray fields. Thornton Spring, a part of the watershed, was later found to be impacted by the plant's waste water treatment efforts. The complete aftermath was a National Priority Listing and contaminated groundwater, surface water, soils, sediments, and fish tissue which present both a carcinogenic and non-carcinogenic risk to human health. The clean up effort was divided into two phases: groundwater remediation and soil remediation. In the Record of Decision (RD), the soil remediation effort was soil extraction. The company petitioned the EPA to amend the RD to consider both soil vapor extraction (SVE), which is a method that applies a vacuum to the unsaturated soil, or soil that is groundwater free to induce the controlled flow of air and remove volatile organic compounds and soil limited excavation. Explaining how soil vapor extraction works and presenting the results of a 5-year pilot study conducted to gain EPA support to a non-scientific community can be difficult. Meeting with stakeholders to address concerns and presenting information in non-technocratic ways alters public perception and in this instance altered the RD.

2. Introduction

In 1977, Rutgers AG, a privately held company headquartered in Germany, operated manufacturing sites in the United States, Italy, and Canada, purchased a manufacturing operation from Aubrey Nease in State College, PA for \$5.5 million. It employed 100 and was situated on the outskirts of a university town. In 1993, the company commissioned a perception study to ascertain the community's perceptions of its business practices. Jabro (1993) reported that the 830 respondents indicated they knew little to nothing about the company but perceived it as polluting, killing fish and dangerous. Rutgers launched a Community Advisory Council (CAC) to establish open communication with the community and serve as liaisons between the company and the community. The results of the study were distributed to the community in the company's annual newsletter, *Neighbors* at the request of the CAC.

The liaisons were members of the Community Advisory Council (CAC) composed of 12 community residents from diverse sectors of the community who served 3-year terms. More than 100 residents who served on the CAC responded to annual survey. The surveys solicited their impressions on the quality and value of the CAC, ways to enhance meeting content, and questions from community residents about the quality of the experience. The respondents consistently evaluated the experience as informative, educational and exemplary (Jabro 2004). Rutgers grew to depend on the CAC for insight and feedback regarding remediation activities and communication with the community about those and other activities.

2.1 Remediation Activities - Center County Kepone Site

According to Scorecard (www.scorecard.org), and the Environmental Protection Agency (www.epa.gov), the site earned a National Priority Listing on September 13, 1988 and was dubbed "The Centre County KEPONE Site". The batch chemical manufacturing plant manufactured Mirex in 1973 and 1974, and Kepone in 1958, 1959, and 1963.

Progress wastes were originally disposed of on-site in a spray irrigation field and lagoon and stored in drums. The company later removed the drums and contaminated soil, treated the material in the lagoon to harden it, and buried it on-site. The material from the lagoon failed to harden properly, and contaminants were leaching to ground water and surface water. In 1982, the company excavated and removed the material and started to treat contaminated ground water.

Various Volatile Organic Compounds (VOCS) and the pesticides Kepone and Mirex have been detected in on-site and off-site ground water, soil, sediments, and surface water. Polycyclic aromatic hydrocarbons (PAHS) have been detected in on-site sediments and soils, and petrochemicals have been detected in off-site drainage ditch sediment. Threats to human health include accidental ingestion of or direct contact with contaminated surface water, soil, ground water, and sediment, as well as eating contaminated fish.

2.2 Remediation Plan

There are seven steps to remediate a site: Remedial Investigation (RI) or a detailed study to identify type and extent of contamination and threats to the environment and community. Clean up options are suggested. The second step is a Feasibility Study (FS) where screening and evaluation of potential clean up methods are conducted. Step 3 is Proposed Clean up Plan, which describes the various clean up options under consideration and EPA's preferred methods. It is also during Step 3 that the community is offered at least 30 days to comment on the Proposed Plan and is invited to a public meeting. Step 4 is the Record of Decision (ROD) which delineates the methods to clean up the site and is binding by the EPA. The fifth step is the Consent Decree which describes the formal agreement between the EOA and ROC and established the legal, administrative and technical framework for the clean up. The sixth step is the Remedial or clean up design which documents the clean up method was designed to address site conditions with specific work areas and methods. The final step is the Implementation or Remedial Action where clean up commences and work is executed. At any point in time, the public has access to all information about the site and is invited to comment at public meetings or written, electronic or oral communication. (<http://www.epa.gov/reg3hwmd/super/centcity/menu.htm>). More than 20 years into the process and approximately \$17 million dollars later, the site is still in the process of remediation with the actual effort divided into two distinct locations: OU1 and OU2. The need for this division stemmed from a process called soil vapor extraction, which will take a number of years to complete.

The clean up plan was implemented in two phases. Phase 1 focused on groundwater remediation and phase 2 dealt with soil remediation. ROC awarded a contract to USFilter to implement the key components of the plan for Phase 1, which was supervised by the U.S. EPA and the PaDEP. Phase 2 dealt with soil remediation. ROCX proposed an innovative alternative, Soil Vapor Extraction, which according to Pederson and Curtis (1991) is a well known clean up method that applies a vacuum to the unsaturated soil or soil that is groundwater free to induce the controlled flow of air and remove VOC's from the soil. A vacuum blower and a system of vertical or horizontal extraction wells installed to a desired depth is how the typical SVE system is installed. The vacuum induces a controlled flow of air and removes volatile and semi-volatile organic compounds. Gas leaving the soil containing contaminants may be treated to recover or destroy the contaminants. Rutgers performed SVE field tests from 1995 through 1997 and prepared a focused Feasibility Study (FFS) comparing the effectiveness of SVE vs. soil extraction. The work was reviewed and approved by the EPA, PaDEP and EPA's Office of Research and Development. SVE was determined to be more effective and cost efficient. Rutgers formally requested a change in the Record of Decision to allow for SVE and limited excavation that had Kepone and Mirex concentrations exceeding the EPA's clean up standards.

A public meeting was called by EPA for August 28, 2000 to discuss the proposed change in the Record of Decision for Phase 2 of the clean up activities. EPA's presentation was highly technical and appeared more persuasive than informative, which concerned attendees. CAC members who attended the meeting urged the company to more accurately explain soil vapor extraction and the specific changes to the ROD.

3. Material and Methods

3.1 Content Analysis

A content analysis of written, oral, and electronic comments during and after the EPA public hearing was conducted. Five themes emerged and are presented in Table 1: Analysis of EPA Public Hearing Feedback.

Table 1 Analysis of EPA Public Hearing Feedback

Comment Classification	Example
Health	Kepone is what's it's all about. They can't get rid of it.
Environment	SVE won't remove Kepone. It is a chemical that resists treatment.
Political	EPA caved in; they've loosened their standards for the company.
Economic	Yeah, I'll be this technique saves the company a lot of money at the expense of public health.
Technological	SVE has been used internationally, but not a lot of evidence to support it can work in this situation.

CAC members indicated their on-going attendance at CAC meetings privileged them to “insider information” or bi-monthly reports about the operation of SVE equipment and its ability to reduce VOC’s in the affected soil. The community did not engage in this on-going dialogue, but read about remediation updates in the annual company newsletter. It was determined that a plan of action must be designed and implemented in order to rectify public perception of the remediation process, health impact, technology, government influence, and economic impact to the company. There was very little time to act and an effective plan needed to be developed. The members of the Community Advisory Council agreed to participate in a Nominal Group Technique to brainstorm specific audiences to address and key messages to promote.

3.2 Identification of an Information Dissemination Plan using Nominal Group Technique

The Nominal Group Technique (Delbeca, Van de Ven and Gustafson, 1975; Cummings, 2004) is a method utilized to maximize the effectiveness and efficiency of teams in decision-making and problem solving tasks. The CAC identified the problem as miscommunication and misinformation about SVE. The facilitator implemented the six step NGT process to determine how to proceed. Table 2 extrapolates the key points of each step of the process.

Table 2 Steps in Nominal Group Technique Process

NGT Process Step	Outcome
1. Silent idea generation	Task: Identify stakeholder groups; key message to communicate about SVE
2. Round-robin sharing of ideas	Groups: political, social, neighbors, schools, universities, civic and environmental groups, daycare facilities, Chamber of Commerce, local government, media Key Message: SVE is more effective; SVE more efficient; testing, used nationally. Use layman’s terms, visualize process and distribute information everywhere.
3. Feedback to group	Narrow focus and prioritize stakeholder groups; EPA must certify area is clean long term.
4. Explanatory group discussion	CAC members presented their rationale for the group and key message that ranked first. Discussion and reflection period.
5. Individual re-assessment	Revisit Task to identify key stakeholder groups; limit to four. Key Message: limit to two.
6. Mathematical aggregation of revised judgments	Majority of responses favored stakeholder groups: public officials, community groups (schools, universities, civic and environmental groups), neighbors residing within a mile radius of the plant and media. Key message: EPA monitored and approved SVE; Kepone and Mirex removed with soil excavation; VOC removed with SVE; site won’t be cleared until all impacted areas are clean.

After the majority responses were presented, discussed, and refined, the group brainstormed possible distribution venues. There were limited funds available to create multiple brochures

4. Results and Discussion

- The Nominal Group Technique provided an impetus for the company to proceed with information dissemination to four stakeholder groups and three strong key messages. Plant management concurred with the CAC’s findings and began the arduous process of implementing their plan. The following actions were performed:
- Information letters were sent to elected public officials detailing the history of the site and the present request for SVE as a remedial alternative.

- Presentations and discussions of the clean up effort and Rutgers' proposed SVE effort were made all over the county.
- The manager of remediation projects, Rainer Domalski, PhD, enjoyed public speaking and welcomed any and all opportunities to discuss the clean up effort.
- A special edition of the *Neighbors* newsletter was devoted to the entire clean up effort. It stated in a message to the neighbors, "the CAC has advised us that we need to better explain the clean up process underway at our plant (Jabro, 2000, p.1). To ensure that all newsletter readers would contextualize the information, it offered the following discussion areas: 1) the history of the National Priority List designation to the present status of the remediation effort at the plant; 2) Visualization of the soil vapor extraction procedure and a narrative to explain how SVE works; 3) Contact information for the Department of Environmental Protection and the Environmental Protection Agency.
- Tours were provided for the media and Dr. Domalski was available for interviews on demand.

The Department of Environmental Protection attempted to provide the appropriate forum for the community to better understand soil vapor extraction as a viable alternative to soil excavation. However, the manner in which the information was presented to the community was highly technical and somewhat confusing. Community residents indicated EPA was biased which created uncertainty and disbelief for some participants. The results of the content analysis of written, oral and electronic communication regarding the presentation strongly supported miscommunication and misunderstanding about the remediation effort and SVE. The Nominal Group Technique empowered the community advisory council to aid Rutgers management in determining the critical stakeholder groups, key messages and distribution outlets to promote the effectiveness of SVE specifically and the remediation effort generally. The company received accolades for their outreach efforts. In March 2001, the Environmental Protection Agency issued an amendment to the 1995 Record of Decision, which allowed soil vapor extraction as a clean up alternative at ROC. The vacuum system was installed in February of 2003 with 27 wells aerating the ground consistently and transforming the contaminants to the vapor state, which are then burned at 1,600°C.

The Community Advisory Council was briefed about the progress of the extraction effort and toured the wells in the spring. Shortly thereafter, Rutgers made a decision to close the State College manufacturing site. On June 29, 2005 the In-Pharma technologist.com posted a news release that stated, "Rutgers plans sales of five business units." Within a matter of months, Rutgers Corporation was no longer a producer of any chemical product. The Manager of Remediation Projects resides in State College and oversees the remediation effort. It is likely that he'll retire from this position. The remediation should be complete somewhere around 2012.

5. References

- Cummings, J.N. (2004). Work Groups, structural diversity and knowledge sharing in a global organization. *Management Science* 50 (3):352-364.
- Delbeca, A., Van de Ven, A., and Gustafson, D. (1975). *Group techniques for Program Planning*. IL: Scott Foresman.
- Environmental Protection Agency Superfund Site located at (<http://epa.gov/reg3hwmd/super/centcnty/menu.htm>) retrieved on November 17, 2007.
- Jabro, A.D. (1997, June). Centre county Community Perception Study. *Neighbors Newsletter*, 1-4.
- Jabro, A.D. (2000). Remediation Update. *Neighbors Newsletter*, 1-4.
- Jabro, A.D. (2002). Rutgers Organics Corporation Community Advisory Council Annual Audit Results. Unpublished report.
- Scorecard Site located at (<http://www.scorecard.org>) retrieved on October 24, 2007.
- Smeltz, D. (2004, February 15). ROC Superfund efforts linger. *Center Daily Times*. A-1.