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Community Ecology and Capacity: Advancing Environmental Communication Strategies among Diverse Stakeholders

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1. Introduction

Many socioeconomically and geographically diverse communities in the United States have been challenged by occurrences of environmental contamination and the related complex public health issues. The investigations associated with such concerns have traditionally been the responsibility of governmental agencies. Communities facing potential environmental exposures often believe that government-based environmental agencies are not adequately addressing their concerns regarding risk, thus resulting in their misunderstanding and distrust of the regulatory process. A schism develops whereby the community perceives that government is either not doing enough to address their concerns and/or are being influenced by the relevant industry. The governmental agencies involved perceive that the community possesses an inaccurate or irrational perception of the potential risks. As a result, a stressful relationship often arises.

Recommendations for effective risk communication have been developed and published (Covello & Sandman, 2001; Hance *et al.*, 1989; Sandman, 1989). Research has also demonstrated the importance of developing relationships among stakeholders and its impact on information delivery and reception (ATSDR, 2004). Given that stakeholder groups perceive risk differently, it is imperative for each group to appreciate the viewpoints of all involved to engage in effective dialog (Park *et al.*, 2001; Tinker *et al.*, 2001).

Cox (2006) defines environmental communication as "...the pragmatic and constitutive vehicle for our understanding of the environment as well as our relationships to the natural world; it is the symbolic medium that we use in constructing environmental problems and negotiating society's different responses to them." Although opportunities for public participation in environmental assessments have greatly increased, the environmental communication process among key stakeholders needs further evaluation (Charnley & Engelbert, 2005; McKinney & Harmon, 2002). The purpose of this chapter is to describe an evaluative process to develop and propose recommendations that could improve the environmental communication that occurs among diverse stakeholders, such as an environmental regulation and protection agency, waste disposal and energy producing facilities, community activists and the general public. Two case studies will be presented; the first describes the management of environmental permitting decisions in several disparate communities; and the second describes the management and perception of health risks from a single-owner waste-to-energy facility in two distinct communities. To

accomplish this goal, this chapter will: 1.) examine how a state environmental agency and waste disposal and energy producing facilities describe their environmental communication experiences regarding various permitting operations and the risk perceptions of the impacted communities; 2.) identify effective communication methods; 3.) discuss the strengths and limitations of these activities; and 4.) propose recommendations for practitioners to advance environmental communication strategies among these key stakeholders.

1.1 Community ecology and capacity

Communities are important determinants in environmental health-related problems for populations. A community's ecology (i.e., its social, cultural, economic, and political composition) can affect how a persistent and/or perceived environmental health problem is addressed. For example, the primary stakeholders in a refugee resettlement community's childhood lead poisoning problem include the residents/resettled refugees in poor quality housing, refugee resettlement agencies, social service agencies, the local city health department, housing agencies, city building inspectors, realtors, property owners/managers, child care providers, health care community, etc. Some stakeholders view the childhood lead poisoning problem in the community as indicative of a larger issue, namely a community that is undergoing growth and diversification due to its refugee and immigrant resettlement status. Hence, others believe they are not able to solve the problem due to its enormity and complexity. As a result, this persistent environmental public health issue propagates in the community with varied efforts (Caron & Serrell, 2009; Wehrly, 2006). Childhood lead poisoning has been described as a wicked persistent environmental public health problem that is multi-factorial in nature and possesses no clear resolution due to the involvement of numerous stakeholders who define the problem differently and who pose uncoordinated solutions. Since wicked problems often possess no definitive solutions, remediation must focus on how to best manage them (Caron & Serrell, 2009). As part of a management practice for complex environmental public health issues, we propose that the community's ecology - its political, ethnic and socioeconomic factors, including zoning laws, housing policies, cultural behavior, and language barriers - is a key determinant in shaping a population's perception of risk and in developing effective communication strategies. In addition, understanding a community's ecology can contribute to building the community's capacity to affect the local management and communication of persistent and/or perceived environmental public health issues.

2. Case study: managing environmental permitting decisions in dissimilar communities

The stakeholders considered in this work include a state environmental agency, facility managers of Title V operating facilities and community residents living near the facilities. Specifically, the New Hampshire Department of Environmental Services, Air Resources Division (NHDES ARD) is responsible for monitoring and regulating air quality that is protective of public health and the natural environment in the State of New Hampshire (ARD, 2010). NHDES ARD accomplishes this goal via numerous programs including a statewide permitting program to assure compliance with the Title V federal mandate. The purpose of the Title V permitting process is to ensure that facilities will not emit hazardous pollutants to a degree which could negatively affect human health. Specifically, the Title V mandate states that facilities which emit over 100 tons of any regulated pollutant, such as

carbon monoxide and sulfur oxides; or emit over 50 tons of nitrous oxides; or emit 10 tons of any of the federally regulated hazardous air pollutants need to apply to the state environmental agency for a Title V permit (ARD, 2008).

Table 1 outlines the Title V operating facilities examined in this study: Turnkey Recycling and Environmental Enterprises, a solid waste management facility in operation since 1979 in Rochester, New Hampshire (NH); Mt. Carberry Landfill, historically used as a landfill for pulp and paper byproducts and a solid waste disposal site since 1989 in Berlin, NH; Four Hills Landfill, a solid waste disposal site since 1970 in Nashua, NH; Indeck Energy Services, Inc., a biomass electric generating facility in operation since 1987 in Alexandria, NH; Schiller Station, historically a coal burning facility from 1950 through 2006 and now a woodchip burning operation in Portsmouth, NH; and Wheelabrator Technologies, Inc., a solid waste energy plant in operation since 1987 in Claremont, NH.

Facility Name	Type of Industry	In Operation Since	Location	Population of Community ¹
Turnkey Recycling and Environmental Enterprises	Landfill	1979	Rochester, NH	30,527
Mt. Carberry	Landfill	1989	Berlin, NH	10,109
Four Hills	Landfill	1970	Nashua, NH	86,837
Indeck Energy Services, Inc.	Electricity	1987	Alexandria, NH	1,521
Schiller Station	Electricity	1950	Portsmouth, NH	20,495
Wheelabrator Technologies, Inc.	Incinerator	1987	Claremont, NH	13,097

Table 1. Facility stakeholders involved in the environmental communication of permitting decisions.

The community members living in the midst of these Title V operating facilities represent the final stakeholder group. The demographics of these communities are diverse with three communities considered rural and the remaining considered urban.

3. Methods

Data collection and analysis of the interactions among key stakeholders were conducted using collective case study methodology (Cottrell & McKenzie, 2005). Data was collected from publicly available New Hampshire Department of Environmental Services (NHDES) documents concerning specific Title V operating facilities in the State of New Hampshire. These documents were in the form of written or e-mail correspondence, phone logs and

¹ U.S. Census Bureau. *Population Finder*. (<http://www.census.gov/>)

public hearing audio tapes and written testimonies. A structured questionnaire was applied to each occurrence of communication. Each document was reviewed and information abstracted regarding the date and type of communication; origin of concern; responder; general summary of concern; action requested; response time; total number of complaints per facility; method of ongoing communication; whether feelings of distrust or doubt were expressed by the community with respect to facility operations; the type of organization(s) the community member contacted prior/following to communicating with the state agency or facility; and non-verbal communication (e.g., body language) at public hearings. Abstracted information was first organized in chronological order by facility; duplicate records were removed; and a search for potentially missed documents was conducted. A document summarizing record review information for each site was constructed. Additionally, public inquiries/concerns received about each facility were reviewed and classified into thematic areas.

Semi-structured interviews were conducted, following Institutional Review Board approval from the University of New Hampshire, with NHDES employees involved in the Title V permitting process and Title V operating facility managers. Respondents were asked questions about the public's perception of their work and whether the facility's operations were considered to be contentious or non-contentious; the health and environmental concerns of the impacted community; and who they considered the major stakeholders. Respondents were asked if they had experience conducting and/or attending a public hearing about their facility. Information pertaining to the type and number of concerns communicated by the public was collected, as well as how these issues were addressed. With respect to the environmental management of concerns, the respondents were queried as to whether or not they believed they were proactive in involving the community and if there was a professional at their respective organizations who was responsible for handling the public's concerns. The last series of questions posed to the respondents inquired about whether they thought improving environmental communication among all stakeholders would enhance working relationships; whether an appointed liaison would assist with environmental communication; and what specific recommendations they have to improve the communication of environmental permitting decisions among stakeholders.

The interviews were transcribed and a content analysis, using QSR NVivo (a computer-assisted qualitative data analysis program), was conducted of the structured interview responses to extract and code recurring themes.

4. Results

4.1 Structured questionnaires

Tables 2A-F summarize the correspondence information among stakeholders regarding each facility. In general, public inquiries were fielded by NHDES ARD staff and/or the NHDES Complaint Manager. Inquiries were typically answered in two days or less. The concerns expressed ranged from health concerns (e.g., cancer, respiratory illness) to nuisance complaints (e.g., odor, noise, traffic). The actions most often requested involved scheduling a public hearing, extending the public comment period, conducting air and water quality testing, and initiating an independent investigation of NHDES' administration. In some instances, the community members present at the public hearing called for the closure of the facility. Distrust of NHDES and/or the facility was expressed for the majority of sites. One exception to this sentiment was the Mt. Carberry Landfill.

Common frustrations voiced by citizens included the inability to locate the appropriate representative, either at NHDES or the facility, to communicate their concern(s) and dissatisfaction with the response to their inquiry, thus leading them to contact the Environmental Protection Agency (EPA) or a local official to relay their concerns. Figures 1-6 represent photographs of each facility examined.

Turnkey Recycling and Environmental Enterprises	Correspondence Content	Phone	E-mail	Public Hearing	Written
	Time period of Correspondence	2004, 2005	2003, 2004, 2005	2004	2004
	Total Number	59	7	7	7
	Responder	NHDES ARD; NHDES Complaint Manager	NHDES ARD; Title V Program Manager	NHDES ARD; Title V Permitting Engineer; Facility Manager	None
	Summary of Concern	Odor	Odor	Health (cancer); Odor; Air quality; Water quality	Health (colitis); Odor; Air quality; Water quality
	Response Time	Same day	Same day	Same day	Not applicable
	Action Requested	None	Public hearing	Air and water quality testing; Deny permit; Close facility	Air and water quality testing; Deny permit; Close facility; Investigate NHDES
	Perception of Distrust	Yes	Yes	Yes	Yes
	Ongoing Communication	None	None	None	None
	Other Organizations Contacted	None	Director of Waste Management Services	None	Director of Waste Management Services

Table 2A. Correspondence among stakeholders involved in the environmental communication of permitting decisions for a landfill facility.

<i>Mt. Carberry Landfill</i>	<i>Correspondence Content</i>	<i>Phone</i>	<i>E-mail</i>	<i>Public Hearing</i>	<i>Written</i>
	Time period of Correspondence	2006	No e-mail correspondence	2007	2007
	Total Number	16		1	4
	Responder	NHDES ARD		NHDES ARD and Facility Manager	NHDES and Director of NHDES
	Summary of Concern	Odor		None – in support of facility	Title V permitting process
	Response Time	Same day		Same day	Two days
	Action Requested	None		Extension of public comment period	Public hearing
	Perception of Distrust	No		No	No
	Ongoing Communication	NHDES Follow-up		None	None
	Other Organizations Contacted	No		No	No

Table 2B. Correspondence among stakeholders involved in the environmental communication of permitting decisions for a landfill facility.



Fig. 1. Turnkey Recycling and Environmental Enterprises, Rochester, New Hampshire. Source: <http://www.greenrightnow.com/wabc/2009/05/19/unh-first-university-to-use-landfill-gas-as-primary-fuel-source/#more-3818>



Fig. 2A. Mt. Carberry Landfill, Berlin, NH.

Fig. 2B. Flare at Mt. Carberry Landfill, Berlin, NH.

Source for both photos: <http://www.avrrdd.org/avrrdd-mt-carberry-landfill-berlin-nh.html>



Fig. 3. Four Hills Landfill in Nashua, NH.

Source: <http://www.gonashua.com/CityGovernment/Departments/PublicWorks/SolidWaste/tabid/135/Default.aspx>

<i>Four Hills Landfill</i>	<i>Correspondence Content</i>	<i>Phone</i>	<i>E-mail</i>	<i>Public Hearing</i>	<i>Written</i>
	Time period of Correspondence	2007, 2008, 2009	2008	No public hearing	No written correspondence
	Total Number	9	1		
	Responder	NHDES ARD; NHDES Complaint Manager	NHDES Complaint Manager		
	Summary of Concern	Odor; Noise	Odor		
	Response Time	1-2 days	Same day		
	Action Requested	None	None		
	Perception of Distrust	No	No		
	Ongoing Communication	None	Yes (via e-mail)		
	Other Organizations Contacted	EPA; Mayor's office; local health department	No		

Table 2C. Correspondence among stakeholders involved in the environmental communication of permitting decisions for a landfill facility.



Fig. 4. Indeck Energy Services, Inc., Alexandria, NH.
Source: http://www.indeckenergy.com/Alternative_Fuels.php

<i>Indeck Energy Services, Inc.</i>	<i>Correspondence Content</i>	<i>Phone</i>	<i>E-mail</i>	<i>Public Hearing</i>	<i>Written</i>
	Time period of Correspondence	1986, 1991, 2008, 2009	No e-mail correspondence	2000, 2007	1986, 1999, 2007
	Total Number	5		21	7
	Responder	NHDES Complaint Manager		NHDES ARD and Facility Manager	NHDES ARD and NHDES Director
	Summary of Concern	Air quality; Noise		Air quality, In support of permit for economic reasons	Odor; Noise; Traffic; Air quality
	Response Time	Same day		Same day	Two days
	Action Requested	Air quality testing		Air quality testing; more information on facility operations	Information on facility operations and plans; Request a public hearing
	Perception of Distrust	Yes		Yes	Yes
	Ongoing Communication	None		None	None
	Other Organizations Contacted	No		No	No

Table 2D. Correspondence among stakeholders involved in the environmental communication of permitting decisions for an energy (electricity) facility.

<i>Schiller Station</i>	<i>Correspondence Content</i>	<i>Phone</i>	<i>E-mail</i>	<i>Public Hearing</i>	<i>Written</i>
	Time period of Correspondence	2002, 2004, 2007	2003, 2006, 2007	2004	2004
	Total Number	5	3	3	3
	Responder	NHDES ARD; NHDES Complaint Manager	NHDES ARD; NHDES Complaint Manager	NHDES ARD and Facility Manager	NHDES ARD
	Summary of Concern	Coal dust damaged property; Air quality	Health (cancer, allergies); Coal dust damaged property; Air quality	Coal dust damaged property; Air quality	Coal dust damaged property; Air quality
	Response Time	Same day	Same day	Same day	Two days
	Action Requested	None	None	Air quality testing; One organization in support of the facility's operation	Air quality testing of ambient air in homes; Requested a public hearing
	Perception of Distrust	No	No	Yes	Yes
	Ongoing Communication	None	None	None	None
	Other Organizations Contacted	No	No	No	No

Table 2E. Correspondence among stakeholders involved in the environmental communication of permitting decisions for an energy (electricity) facility.



Fig. 5. Schiller Station, Portsmouth, NH.

Source: <http://www.unhenergyclub.com/pastevents.php>



Fig. 6. Wheelabrator Technologies, Inc., Claremont, NH.

Source: <http://www.wheelabratortechnologies.com/index.cfm/our-clean-energy-plants/waste-to-energy-plants/wheelabrator-claremont-company-lp/>

Wheelabrator Technologies, Inc.	Correspondence Content	Phone	E-mail	Public Hearing	Written
	Time period of Correspondence	2005, 2006	2007	No public hearing	1995
	Total Number	5	1		11
	Responder	NHDES ARD; NHDES Complaint Manager	NHDES ARD; NHDES Complaint Manager		NHDES ARD; NHDES Director
	Summary of Concern	Health (respiratory illness); Odor; Air quality	Health (respiratory illness); Air quality		General health concerns; Air quality; Water quality; Failure of facility to comply with EPA's emission standards
	Response Time	Same day	Same day		Two days
	Action Requested	Air quality testing	Air quality testing		Facility must engage in smoke stack emission testing; Development of more strict emission standards; Facility must become compliant with emission standards; Deny permit; Facility should communicate with the affected community
	Perception of Distrust	Yes	Yes		Yes
	Ongoing Communication	None	None		None
	Other Organizations Contacted	EPA	EPA		No

Table 2F. Correspondence among stakeholders involved in the environmental communication of permitting decisions for an incineration facility.

4.2 Structured interviews

Both NHDES employees and Title V operating facility managers reported interacting with the public about environmental concerns and agreeing on who the stakeholders were in the environmental permitting process. All respondents believed that the respective facility was viewed positively by the public at the time of the interview. Initially, they may not have been viewed favorably but “Once there was some transparency developed, the public

welcomed the facility. They were happy that the facility was going to provide jobs in the area.” However, the incinerator was regarded by both NHDES and the facility manager as having a negative public perception. Interestingly, another incinerator, owned by the same parent company, located in a different part of the state is perceived positively by the surrounding community. The next case study examines the differences in environmental communication utilized by this facility in two distinct communities.

One landfill experienced public outcry when it announced that it would be purchasing and re-opening a facility that had been closed for fifteen years. According to NHDES, this facility did not engage the surrounding community in their plans and the community attended the public hearing to obtain an update on the facility’s approach. Many of the issues presented at the public hearing could have been addressed beforehand but the facility was not proactive in involving the public. Another landfill facility manager reported that “Hearings have generally been a good experience, especially when the public doesn’t show up.” The facility manager from a similar site commented that “Our facility does a horrible job reaching out to the public...we are lacking in outreach.” In contrast, the Mt. Carberry Landfill held three public meetings. The first two meetings were sponsored by the facility owners and allowed “...the public to voice their concerns...” and served as informational sessions. When the official public hearing was held, all of the issues had been addressed and there was no conflict. The facility manager for Mt. Carberry reported that “We told the public what was going on, how we were going to solve the problem, and we told them that we would keep them involved all along the way – and we did!”

When asked if NHDES and the facility were proactive in involving the public in the permitting process, there were varied responses including “...NHDES and my facility have been reactive instead of proactive” and “We [facility] weren’t that involved actually” and “I think it’s been a combination of both.”

When asked if improving environmental communication would benefit the environmental permitting process, the responses varied. NHDES stated “Yes, hopefully, ideally. The more ongoing non-regulatory communication, the less issues are able to build up over time...There needs to be a continuous avenue for people to easily voice their concerns.” One facility manager stated “We feel that it isn’t very practical or efficient to reach out to the community before any kind of permitting decisions are started.” Another manager specifically noted that their “...filing for a Title V permit was completely voluntary...We don’t meet the guidelines to be considered a major polluting landfill. We applied for a Title V permit to be proactive.” The responses were also mixed about whether an appointed liaison would help improve environmental communication. NHDES stated “This depends on who they are affiliated with...If there was a person in this position, it would be helpful if each stakeholder had trust in this person. However, how this trust is built is unclear. It is quite possible that this person could be another barrier in the communication process and act as another layer of litigation.” One facility manager stated that “...one person, one contact would be very beneficial in improving environmental communication.” In contrast, another facility manager stated that “A person who has this position would get ‘beat up’ by all the stakeholders involved. I would have to say ‘No’.”

Table 3 summarizes the recommendations of NHDES and the facility managers to improve the communication with impacted communities regarding environmental permitting decisions. Key recommendations include conducting more informal “conversation” type meetings prior to the public hearing; presenting information at an appropriate educational level; and engaging in public outreach via the Internet, mailings, print media and/or a

community liaison; integrating a practice of transparency of information among stakeholders; and creating a uniform meeting setup.

<ul style="list-style-type: none">• Hold informal “conversational” type meetings prior to the public hearing for concerns and questions to be addressed (NHDES ARD)• Alter the meeting room setup for the public hearing so an “Us” versus “Them” scenario is not created (NHDES ARD)• Keep people informed via web sites, mailings, and newspapers (Landfill facility)• Community liaison who could share information among stakeholders (Incinerator facility)• Be transparent with information and the facility’s operations (Landfill facility)• Acknowledge differences in public perception (Electricity generating facility)• Explain the permitting process and emission standards to the public in an educationally appropriate manner (Landfill facility)• Facilities need to be more involved in the community (Landfill facility)
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Table 3. Summary of recommendations from state agency representatives and facility managers on how to improve environmental communication to the public.

5. Managing environmental permitting decisions in dissimilar communities: discussion

Effective environmental communication among all stakeholders is essential when addressing environmental health risks. Bennett (1999) and McComas (2003) describe how organizations will earn the trust of the community based on the content and delivery of their communication; the willingness for an inclusive, community-based participatory interaction; and their reputation for taking action. There is agreement that environmental communication among stakeholders be an integral component of the working relationship and that resources be allocated to develop public outreach plans that are tailored to the specific community (Brauer et al., 2004; Parkin, 2004). Given that stakeholder groups perceive risk differently, it is imperative for each group to appreciate the viewpoints of all involved to engage in effective dialog (Park et al, 2001; Tinker et al., 2001). Therefore, we propose that effective and proactive environmental communication that considers the community’s ecology (i.e., social, cultural, economic and political composition) among all stakeholders in all types of communities with a regulated industry is essential when addressing perceived health risks to the environmental and population. Based on our systematic examination of the environmental communication that occurred among a state environmental agency, six Title V operating facilities and the public concerning environmental permitting decisions perceived to impact human health, we developed recommendations to facilitate best practices in environmental communication. These recommendations for practitioners are presented in Section 10: Recommendations.

6. Case study: managing perceived health risks from a single-owner waste-to-energy facility in two distinct communities

The perceived health risks and environmental communication from two waste-to-energy facilities operated by the same parent company are examined in this work. Waste

Management, Inc., of Houston, Texas owns Wheelabrator Technologies, Inc. which operates several waste-to-energy facilities across the United States. Wheelabrator operates two such municipal solid waste incinerators in Claremont, New Hampshire (NH) and Concord, NH, respectively. The Claremont, NH facility began operation in 1987 and provides disposal of up to 200 tons of municipal solid waste daily for approximately 70,000 people. This facility can provide electricity to 5,600 homes. The Concord, NH facility began operation in 1989 and provides disposal of up to 500 tons of municipal solid waste daily for approximately 150,000 people. This facility can provide electricity to 17,000 homes (Wheelabrator, 2010).

These facilities use the same waste-to-energy method and are considered Title V operating facilities by the New Hampshire Department of Environmental Services (NHDES). The purpose of the Title V permitting process is to ensure that facilities will not emit hazardous pollutants to a degree which could negatively affect human health. Specifically, facilities which emit over 100 tons of any regulated pollutant, such as carbon monoxide and sulfur oxides; emit over 50 tons of nitrous oxides; or emit 10 tons of any of the federally regulated hazardous air pollutants need to apply to the state environmental agency for a Title V permit (ARD, 2008).

As required by current NHDES permits, the Wheelabrator sites continuously monitor carbon monoxide, sulfur dioxide, particulate matter, as well as other emission indicators such as steam flow and temperature. All monitoring and operational information are maintained in facility records, in accordance with state and federal requirements. “[NH]DES oversees and witnesses the performance of annual relative accuracy tests and audits facility records in order to ensure the accuracy of Wheelabrator’s continuous emissions monitoring system. [NH]DES also conducts full Compliance Evaluations at least every two years, witnesses annual compliance stack tests and reviews resultant stack test reports for accuracy” (ATSDR, 2009).

6.1 Two communities: home to the same environmental policy

The demographics of the Claremont and Concord New Hampshire communities are similar with respect to age and sex. Both communities are also classified as cities. However, the demographic information for education, economic and housing characteristics are different. Table 4 outlines selected demographic characteristics of these two communities.

Briefly, Claremont is a city in the western part of New Hampshire with a population of 12,968. It is situated along the Connecticut River in Sullivan County. It is the largest incorporated community in Sullivan County and ranks 22nd in population size among cities and towns in New Hampshire. The majority of the population (97.7%) is White and 78.7% of the population 25 years of age and older have completed high school while 12.8% have a Bachelor’s degree. The median household income in 1999 was \$34,949 and the median value of a single-family owner-occupied home was \$79,800 (Census, 2010).

Concord is the state capital with a population of 42,255. It is situated along the Merrimack River in Merrimack County and ranks 3rd in population size among cities and town in New Hampshire. The majority of the population (95.5%) is White and 88.6% of the population 25 years of age and older have completed high school while 30.7% have a Bachelor’s degree. The median household income in 1999 was \$42,447 and the median value of a single-family owner-occupied home was \$112,300 (Census, 2010).

6.2 Stakeholders in environmental communication

The stakeholders considered in this work include a state environmental agency, community activists living near the facilities and the general public. Specifically, the New Hampshire Department of Environmental Services, Air Resources Division (NHDES ARD) is responsible for monitoring and regulating air quality that is protective of public health and the natural environment in the State of New Hampshire (ARD, 2010). NHDES ARD accomplishes this goal via numerous programs including a statewide permitting program to assure compliance with the Title V federal mandate (ARD, 2008). Citizens Leading for Environmental Action and Responsibility (CLEAR) is a community activist group that is primarily comprised of Claremont, NH residents. The mission of CLEAR is to “...respect and value the people, the environment, the public health, the political process, and the economics of our community and region;...encourage public participation in the decision-making process to promote the principles of environmental, political, social, and economic health;...commit to an organizational framework that is non-profit, open, democratic, and accountable” (CLEAR, 2010). The general public living or spending time in the communities that house these Title V operating facilities represents the final stakeholder group. Figure 7 represents photographs of the industry examined.

	Claremont, NH	Concord, NH
Total population ²	12,968	42,255
Race: White	97.7%	95.5%
High school graduate	78.7%	88.6%
Bachelor’s degree	12.8%	30.7%
Median household income ³	\$34,949	\$42,447
Median value of a single-family owner-occupied home	\$79,800	\$112,300

Table 4. Demographic characteristics of two communities that host a waste-to-energy facility⁴.

² Population estimate for 2008, U.S. Census Bureau, *Population Finder*. (<http://www.census.gov/>)
³ Median household income for 1999, U.S. Census Bureau, *Population Finder*. (<http://www.census.gov/>)



Fig. 7. A and B. Wheelabrator Technologies, Inc. in Claremont and Concord, NH, respectively.

Source: <http://www.wheelabratortechologies.com/index.cfm/our-clean-energy-plants/waste-to-energy-plants/wheelabrator-claremont-company-lp/>

7. Methods

7.1 Survey instrument

Following Institutional Review Board approval from the University of New Hampshire, a cross-sectional study design was utilized to examine the sources, believability and utility of information and perceptions about environmental health issues among a relevant sample of residents and visitors of the two study communities. Self-report questionnaires utilizing a 4-point Likert scale and multiple choice questions were administered over a five month period at different times and locations (e.g., retail locations and churches of various denominations) in each community. These anonymous surveys were immediately collected from the participants upon completion. Alternatively, participants could choose to mail their completed survey to the University of New Hampshire via self-addressed and stamped envelopes.

All questionnaires had a cover letter attached that explained the purpose of the study and emphasized the anonymity and confidentiality of the results. Participants were told to keep this letter for their records. There were no incentives for participating in this study. Additional open-ended comments from participants were recorded at the end of the survey.

The 19-item questionnaire was designed to determine demographic information, self-reported knowledge about sources and believability of information and perceptions about environmental health issues in the community. Revisions were made during the pilot testing phase of the questionnaire. Ambiguities associated with the survey content were not identified during test trials that were conducted prior to official questionnaire administration.

The survey questions were organized into four sections. First, respondents were asked for demographic information (e.g., length of residence in the community, education level, annual income) and questions pertaining to their interest and level of participation in community issues. Respondents were then asked how often they think about their physical environment

⁴ Source: U.S. Census Bureau. *Population Finder*. (<http://www.census.gov/>)

and to choose what environmental health issue in their community concerned them the most from the following list: water quality, land conservation, air pollution, food security and other. This question was followed by an inquiry regarding whether the respondents thought they were well-informed about environmental health issues in their community. Next, respondents were asked to indicate where they would rank their environmental issue of interest relative to other issues (e.g., property taxes) affecting their local community.

In order to determine sources of environmental health information, respondents were asked to choose from the following sources in the next section of the survey: federal agencies (e.g., Environmental Protection Agency, Agency of Toxic Substances and Disease Registry); state agencies (e.g., New Hampshire Department of Environmental Services, New Hampshire Department of Health and Human Services); local government (e.g., city councilor or Mayor); environmental groups (e.g., Greenpeace); academia (university presentations, studies, peer-reviewed literature); media sources (e.g., newspaper, television, radio, Internet); other. Respondents were instructed to circle all that applied to them. Respondents were then asked to rate their believability of the above-mentioned sources of information. Next, in order to determine which media sources were the most useful, respondents were asked to choose from the following sources: television programs, print resources (e.g., pamphlets), newspaper articles or editorials, community meetings, informational websites.

The third series of questions pertained to the respondent's attitude about public meetings. Respondents were asked if they had ever attended a public meeting and whether they believed public meetings were an effective means to communicate environmental health information. Next, respondents were asked if they believed whether their opinion, if voiced at a public meeting, would be taken seriously by officials.

Finally, the last series of survey questions inquired whether or not the respondents believed the status of their personal health is related to the condition of the environment. Respondents were specifically asked if they were familiar with trash incineration and whether or not they believed it to be an effective form of waste disposal.

All data were analyzed using the Statistical Package for Social Sciences. Descriptive analyses were done for each of the participant responses by determining frequencies and proportions. Comparisons of responses were made across both communities by utilizing the chi-square statistic, cross tabulations and independent sample t-tests to assess the statistical significance of these comparisons. For statistical tests, P-values less than 0.05 were considered to be statistically significant. Unknowns were accounted for in all variables.

7.2 Structured interview instrument

Structured interviews were conducted, following Institutional Review Board approval from the University of New Hampshire, with DES employees involved in Title V permitting and environmental health investigations and community activists from CLEAR to examine the experiences that shaped both parties' perceptions of current environmental communication methods.

Participants were asked semi-structured, open-ended questions about the public's perception of their work, whether the facilities' operations were considered to be contentious or non-contentious and the health and environmental concerns regarding the facilities. Participants were asked if they had experience conducting and/or attending a public hearing about the facility. Information pertaining to the type and number of concerns communicated by the public was collected, as well as how these issues were addressed. With respect to the environmental management of concerns, NHDES was

queried as to whether or not they believed they were proactive in involving the community and if they employed a professional who was responsible for handling the public’s concerns. CLEAR was queried as to their perception in regards of their inclusion, by NHDES, in health investigations concerning the facility and communication efforts from NHDES. The last series of questions posed to the participants inquired about whether they thought improving environmental communication among all stakeholders would enhance working relationships; the usefulness of having an appointed community liaison to assist with environmental communication; and what specific recommendations they have to improve the environmental communication among stakeholders. The interviews were transcribed and a content analysis, using QSR NVivo (a computer-assisted qualitative data analysis program), was conducted of the structured interview responses to extract and code recurring themes.

8. Results

8.1 Two communities: sources, believability and utility of information and perceptions about environmental health issues

One hundred and nine of 250 surveys (44% response rate) were completed and returned by community members and/or visitors to the Claremont and Concord, NH communities. Of the completed 109 surveys, 54 were from the Claremont community and 55 were from the Concord community.

As shown in Table 5, survey results indicate statistically significant differences between the Claremont, NH and Concord, NH survey respondents with respect to demographic

	Claremont, NH	Concord, NH	P-value
College education	53.0%	92.2%	0.000
Annual income \$25,000 or greater	55.5%	98.2%	0.000
Lived in the community for ten years or more	51.9%	76.4%	0.008
Active in community issues	42.6%	65.5%	0.017
Ranked the priority of environmental issues higher than other community issues (e.g., property taxes)	38.5%	64.2%	0.008
Familiar with trash incineration as a waste disposal method	75.5%	92.6%	0.015

Table 5. Demographic characteristics of two communities and survey respondents’ interest in environmental health issues in their community that hosts a waste-to-energy facility.

characteristics and involvement in environmental health issues. For example, Concord, NH respondents reported higher annual incomes of \$25,000 or more (98.2%) compared to Claremont, NH respondents (55.5%). In terms of education level, more Concord, NH respondents completed college education (92.2%) compared to Claremont, NH respondents (53.0%). In addition, Concord, NH respondents were more likely to have lived in their

community for more than ten years (76.4%) compared to Claremont, NH respondents (51.9%). Concord, NH respondents were also identified as being more active in community issues (65.5%) compared to Claremont, NH respondents (42.6%). Furthermore, 64.2% of Concord, NH respondents ranked the priority of environmental health issues higher than other community issues (e.g., property taxes) compared to 38.5% of Claremont, NH respondents. Lastly, 92.6% of Concord, NH respondents and 75.5% of Claremont, NH respondents were familiar with trash incineration as a waste disposal effort.

As shown in Table 6, survey results demonstrate statistically significant differences and similarities between these two communities with respect to information sources, believability and usefulness. For instance, Concord, NH respondents were more likely to not only obtain information from state agencies (61.1%), but they were also more likely to believe it (67.3%) compared to Claremont, NH respondents. Also, Concord, NH respondents were more likely to obtain information from environmental groups (50.0%) compared to Claremont, NH respondents (18.5%). Interestingly, both Concord, NH (92.6%) and Claremont, NH (79.6%) respondents were very likely to obtain information from media sources such as newspapers, television, radio and the Internet. However, Claremont, NH respondents were more likely to believe media sources (46.0%) and use (56.6%) the information from the television compared to Concord, NH respondents. Yet, respondents from both the Concord, NH (55.6%) and the Claremont, NH (66.0%) communities reported newspapers to be the most useful source of information.

In terms of having attended public meetings in the past and their effectiveness, both communities were similar in their responses. For example, respondents in the Concord, NH (70.9%) and Claremont, NH (56.6%) communities reported that they had attended a public meeting in the past. Respondents from Concord, NH (52.7%) and Claremont, NH (64.3%) reported that they found such a venue useful for communicating environmental health information. However, respondents from Concord, NH (31.5%) and Claremont, NH (24.5%) reported that if they voiced their opinion in a public meeting, they believed that their comments would not be taken seriously by officials in attendance.

Furthermore, respondents from Concord, NH (63.6%) and Claremont, NH (58.5%) believed that the condition of the environment plays a role in their personal health. Respondents from Concord, NH (92.6%) and Claremont, NH (75.5%) reported that they were familiar with trash incineration but these same respondents did not believe it was an effective means of waste disposal (58.0% and 61.4%, respectively.)

Cross-tabulation analyses indicated several statistically significant relationships (Table 7). For example, respondents with a college education were more likely to use environmental groups (43.4%) and the Internet (43.4%) as a source of environmental health information compared to respondents without a college education. Respondents who did not have a college education reported television (70.8%) as a useful media source for communicating environmental health information. In addition, respondents with a college education were more likely to report ever having attended a public meeting (70.2%), as well as being familiar with trash incineration as a disposal method (89.2%). Similarly, respondents who reported being more active in community issues were also more likely to report ever having attended a public meeting (81.0%), as well as being familiar with trash incineration as a disposal method (91.4%). Lastly, there were also significant relationships identified between living in the community for ten years or more and being well informed about community issues (62.3%).

	Claremont, NH	Concord, NH	P-value
Sources of environmental health information			
State Agencies	24.1%	61.1%	0.000
Environmental Groups	18.5%	50.0%	0.001
Media Sources	79.6%	92.6%	0.051
Believability of sources of environmental health information			
State Agencies	42.3%	67.3%	0.030
Media Sources	46.0%	28.3%	0.042
Useful media sources for obtaining environmental health information			
Television	56.6%	18.5%	0.000
Newspapers	66.0%	55.6%	0.267

Table 6. Survey respondents’ sources, believability and usefulness of environmental health information from two communities that host a waste-to-energy facility.

Level of Education	No College Education	College Education	P-value
Environmental groups as source of environmental information	4.0%	43.4%	0.000
Television as useful media source for obtaining environmental information	70.8%	27.7%	0.000
Internet as useful media source for obtaining environmental information	20.8%	43.4%	0.045
Ever attended a public meeting	41.7%	70.2%	0.010
Familiar with trash incineration as a waste disposal method	66.7%	89.2%	0.008
Involvement in Community Issues	Less Active	More Active	P-value
Ever attended a public meeting	44.0%	81.0%	0.000
Familiar with trash incineration as a waste disposal method	75.5%	91.4%	0.025
Length of time lived in community	Less than Ten Years	More than Ten Years	P-value
Active in community issues	38.5%	62.9%	0.014
Well-informed about environmental health issues in the community	39.5%	62.3%	0.023

Table 7. Demographic characteristics and survey respondents’ practices about environmental health information and issues from two communities that host a waste-to-energy facility.

8.2 State agency and community activists as stakeholders: perception of environmental communication

Twelve individual structured interviews with NHDES employees involved in Title V permitting and environmental health investigations and community activists from CLEAR were conducted to examine the experiences that shaped their perception of current environmental communication methods.

Through structured interviews with NHDES and a review of publicly available documents (e.g., phone records, e-mail and written correspondence and public hearing recordings) housed at NHDES, it was determined that the public inquiries concerning the Wheelabrator companies were mainly for the facility in Claremont, NH and not Concord, NH, even though they have identical operations. The public inquiries were fielded by NHDES ARD staff and/or the NHDES Complaint Manager. The concerns expressed ranged from health issues (e.g., cancer, respiratory illness) to nuisance complaints (e.g., odor, noise) to environmental issues (e.g., poor air and water quality), all of which were perceived to be due to the operation of the incinerator. The actions most often requested by the public for the Claremont, NH facility included air and water quality testing, compliance evaluations with state and federal emission standards and communication from the facility with the affected community. In some instances, the community members called for the closure of the facility. Distrust of NHDES and/or the facility was expressed in the public documents. Structured interviews with community activists (n=7) demonstrated that they “feel there is more that should be done regarding this issue (waste-to-energy).” All interviewees discussed this theme in their individual interviews. The activists recommended that state government should further restrict trash incineration. Several interviewees discussed the recent ban on construction and demolition material incineration and pointed out that if this material is outlawed, everything should be banned.

Another theme that emerged was the activists’ perception that the state agency pays inadequate attention to the issue of waste incineration in their communities. The activists are also very distrustful of state and industry involvement because many believe the company that owns the two municipal waste incinerators of interest, discusses with NHDES when random emissions testing will occur in advance so the incinerator will burn “cleaner trash” on the testing days. They believe that this skews the data so any emission report released by NHDES is not accurate.

When asked about efforts to improve environmental communication, community activists had mixed reactions. The majority of activists reported that the state agency did a decent job at communicating environmental health information. Beyond typical communication venues, such as newspapers, Internet, and public meetings, activists were hard pressed to suggest anything new. Several community activists mentioned that there was discussion about creating a community panel to review environmental community issues. Decisions regarding the environment (and the incinerator) would go to this panel for review. This idea was met with opposition by the local government and never came to fruition.

Community activists were asked about the effectiveness of having a community liaison located in their community. This individual would gather concerns and questions from the community, relay those concerns and questions to the appropriate state agency and then disseminate information back to the community. Unanimous support among the activists for such a position of this nature was expressed.

Interviews with NHDES regulators and investigators (n=5) revealed their belief that community activists do not acknowledge the state’s effort to respond to their concerns. On

multiple occasions, requests made by community activists were explored, such as the concern that the Claremont, NH facility was responsible for excessive cancer in that community. As a result, NHDES, in conjunction with the Agency for Toxic Substances and Disease Registry, conducted a community health investigation and analyzed twenty-four major cancer types from 1987-2001. It was determined, from the available data, the cancer rates for the specific types of cancer analyzed were within the expected range (ATSDR, 2006). This was a time-consuming endeavor and utilized many staff and budgetary resources. When results were presented to the community, activists were not pleased with the findings and discredited the initiative. The activists argued that the community health investigation was not done in a way that was inclusive of the community, and that the analysis was unacceptable and the results were inaccurate. As a result, state regulators believed that there was not much that could be done to remedy community activists concerns short of closing the Claremont, NH facility.

Another major theme expressed by NHDES involved community activists' communication with their organization. Direct questions and concerns were reported to be more effective than emotional propaganda from activists. An example expressed multiple times in NHDES interviews was that there were "two types of community activists." There are the community activists that send emotional propaganda, such as hundreds of postcards with dead fish on them to NHDES claiming that the mercury emitted from the Claremont, NH facility is killing all the fish. Other types of emotional propaganda that have been used by this reported "type" of activist include the mailing of pictures of residents who have died from cancer with messages explaining that the negligence of NHDES to shut down the facility was the direct cause of their death. In contrast, the "other type" of community activist sends specific questions and concerns that NHDES can investigate and reply with factual data. This type of communication was preferred and was believed to be more effective.

NHDES regulators and investigators were asked if it would be effective to have a community liaison position in New Hampshire communities where a contentious relationship exists between a community and an industry within the community. The responses were mixed about whether an appointed community liaison would help improve environmental communication. NHDES stated "This depends on who they are affiliated with...If there was a person in this position, it would be helpful if each stakeholder had trust in this person. However, how this trust is built is unclear. It is quite possible that this person could be another barrier in the communication process and act as another layer of litigation."

9. Managing perceived health risks from a single-owner waste-to-energy facility in two distinct communities: discussion

An ongoing, practical challenge for state agencies involved in investigating community concerns related to an industrial process perceived to impact the environment and human health is how to most effectively communicate with the community as a key stakeholder. We propose that investigators and regulators need to be able to 1.) identify the community's ecology, that is the community's social, cultural, economic and political composition and 2.) understand the community's ecology to engage in effective environmental communication. State agencies frequently describe communities as groups of people living within a certain area, while communities may describe themselves on a

more detailed level, such as by their socioeconomic status, religious beliefs, race/ethnicity, etc. (Parkin, 2004). We present the relationships between the demographic characteristics of two communities that host an identical waste-to-energy facility owned by the same parent company, and various communicative structures, such as the sources, believability and utility of environmental health information accessed by these populations, as well as their level of knowledge about trash incineration, the industrial process of concern. We demonstrate that disparate populations that host a similar industry access and believe different sources of environmental health information rank the priority of environmental health issues compared to community health issues differently and have different levels of activity on community issues. Our work suggests that ecological and demographic differences in communities need to be assessed, in order to identify the multidimensional components of the communities' risk perception and to be able to determine the most effective means by which to communicate environmental information.

Interestingly, a review of publicly available documents and structured interviews with community activists and agency stakeholders determined that although two NH communities host an identical municipal waste incinerator, the Claremont community, compared to the Concord community, was more vociferous in regards to their perception that the facility was a risk to the health of the population and their environment. In addition, the Claremont community was hesitant to believe the results of a health consultation and public health assessment conducted by NHDES and the federal Agency of Toxic Substances and Disease Registry that determined "...the Claremont area was in compliance with all National Ambient Air Quality Standards..." for the following criteria pollutants: sulfur dioxide, particulate matter less than 2.5 microns in diameter, ozone and nitrogen dioxide; and that "...cancer rates for 24 major cancer types were all within their expected ranges..." over the fifteen-year period studied (ATSDR, 2006; ATSDR, 2009). We suggest that demographic differences may contribute to the dissimilarity in risk perception of two communities for this industrial process, however, it is not the sole factor. We propose that effective and proactive environmental communicative structures that take into consideration the community's ecology among *all stakeholders in all types of communities* with a regulated industry is essential when addressing perceived health risks to the environment and population. Such practices could result in improved relationships with communities and public perception and expectations of community health investigations.

10. Recommendations for practitioners

Both case studies utilized the cultural-experiential model of risk, which requests information regarding the experience and views of impacted populations and their assessment of risk (Cox, 2006). We propose that part of effective environmental communication on the part of practitioners involves not only understanding the community's ecology but also the importance of engaging the public sphere to help build the community's capacity to address the environmental health issue of concern. Cox (2006) defines the public sphere as "The realm of influence created when individuals engage others in communication – through conversation, argument, debate, questions and nonverbal acts – about subjects of shared concern of topics that affect a wider community." The public sphere needs to be the common ground to communicate misunderstandings, knowledge deficits and environmental education. We utilized the cultural-experiential model to better understand

the public sphere experienced by dissimilar communities that host different regulated industries, and in one instance, an identical industry.

Based on our systematic examination of the environmental communication preferences and practices among a state environmental agency, Title V operating facilities, community activists and the general public concerning environmental permitting decisions perceived to impact human health, we developed the below recommendations to facilitate best practices in environmental communication:

1. *Initiate communication early with the community:* Proactive communication to potentially affected communities by state agencies and neighboring facilities could facilitate the relationship among stakeholders and serve as the foundation for next steps. This recommendation arose from the experiences of two facilities which were completely different in their public outreach practices. One was not proactive in involving the community during the environmental permitting process and waited until the public hearing to address the community and explain the intent of their facility's operations. In this case, the relationship between the facility and public was strained from the beginning of the permitting process and the situation became the facility *versus* the public, instead of the facility working *with* the public. In contrast, the other facility was proactive in involving the community and held public information sessions prior to the public hearing to address the community's concerns.

2. *Provide seminars to educate facility managers about public engagement:* The state agency could offer seminars designed to educate facility managers on public outreach practices prior to the Title V permitting process. These educational seminars would provide opportunities for facilities to develop an understanding of the concerns typically raised by communities and discuss how to be a "good neighbor" based on best practices.

3. *Require the permit application be accompanied by a public outreach plan:* In order to maintain the neutrality of the official Title V permitting process, yet be proactive in communicating with stakeholders, the state agency could require the facility to include several objective public outreach activities that support public participation. An example could include engaging the community prior to the public hearing, via non-regulatory communication, which would ease the environmental permitting process by providing an opportunity for concerns to be addressed.

4. *Advocate representatives from state government public health and environmental health bureaus be present at public hearings:* The concerns expressed by the public are so varied that no one agency could address them. The inability to answer questions during public hearings led to the community's frustration and increased stress on the communication among the stakeholders. Therefore, representatives from each public health and environmental health state bureau should be represented on the public hearing panel to address a broad array of questions and reduce the feelings of distrust.

5. *Establish citizen advisory committees:* This action could provide an opportunity for citizens to voice their concerns or ask questions about the facility operations on a regular basis. One facility manager explained that this has been a great way for the public to have direct communication with officials about the permitting process and their concerns.

6. *Establishment of a community liaison position:* The community liaison position is a neutral party who would be located in the community and have an established relationship with the community. He/she would gather concerns and questions from the community, relay those

concerns and questions to the appropriate state agency and then disseminate information back to the community. Similar to the community panel mentioned by community activists in Claremont, NH, this action could provide an opportunity for citizens to voice their concerns, ask questions about the facility operations on a regular basis and allow for the community to play a role in policy and program development.

7. *Be accountable for communication among stakeholders:* State agency(ies) and industry need to understand the best way to communicate with the community. To accommodate the high number of complaints the facility was receiving, one landfill utilized web-based technology for the public to express their concerns. However, it is important that this communication be “two-way.” For example, numerous entries stated that many inquiries had been filed online, yet the problems complained about were still in existence and the facility failed to respond to any concerns. Therefore, as part of the routine evaluation of their communication with the public, facilities need to establish processes to assure a timely response to the public’s comments. In addition, Claremont, NH respondents (56.6%) reported environmental health information obtained from the television more useful compared to Concord, NH respondents (18.5%). In addition, it is important that this communication be “two-way.” Therefore, as part of the routine evaluation of their communication with the public, state agencies and facilities need to establish processes to assure a timely response to the public’s comments. A community liaison could be proactive in this practice.

8. *Increase state agency awareness:* In several instances, the public contacted the EPA because they were unaware of who to contact at state government or the facility. Increasing awareness of the state agency as a stakeholder in the environmental permitting process would help the public understand who to contact concerning environmental issues and facilitate relationship-building between the state and the public. This may be accomplished through state agency and facility-sponsored community events or attendance at existing community events to raise awareness.

9. *Use of appropriate information and meeting logistics:* Information complexity as a communication barrier for the public was evident in the public hearing audiotapes and interviews with facility managers. For example, the public requested clarification by NHDES ARD concerning emissions and health effects and asked what “all the figures and tables meant.” Furthermore, facility managers expressed concern that the information presented by NHDES ARD to the public was too complex, thus leading the public to contact the facility. Taking the time to understand the community’s ecology will help state agencies develop appropriate information that is communicated in an effective forum for that community. Hence, this practice will be community-specific.

In addition, the room for public hearings is traditionally organized in a polarized manner where the state agency and the facility are at one end and the community is at the other end. This creates an “us” versus “them” perception, which can inhibit positive communication among stakeholders. It would be optimal for the room to be organized so the stakeholders are interspersed at a roundtable. This format allows each participant to see each other and not feel as though any one viewpoint is valued over another.

10. *Provide routine updates to stakeholders:* State agency and Title V facilities should provide concerned community members updates about progress made to address their concerns. These updates could be communicated via a list-serve; mass mailings of a newsletter; and updates posted to NHDES’ and the facility’s web page. This practice would keep the public informed about what the state agency and facilities are doing and can dissuade distrust or contention from developing.

Our recommendations provide a set of communicative structures to help advance effective environmental communication among stakeholders when dealing with regulated industry in different types of communities. Such practices may increase the community's trust in government, as well as their belief in the credibility of community health investigations and their acceptance of the results (Charnley & Engelbert, 2005).

11. Future work

Our future work involves examining how creative partnerships, such as those between academia and the community can further advance environmental communication strategies. Although academic institutions are rich resources for improving the health of the public and the environment, academic partnerships with community organizations can be challenging. Yet, such partnerships have been shown to translate science and best practices into social action and policy change at the local community level (Serrell et al., 2009).

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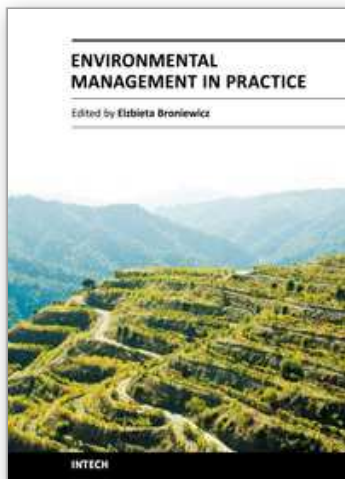
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In recent years the topic of environmental management has become very common. In sustainable development conditions, central and local governments much more often notice the need of acting in ways that diminish negative impact on environment. Environmental management may take place on many different levels - starting from global level, e.g. climate changes, through national and regional level (environmental policy) and ending on micro level. This publication shows many examples of environmental management. The diversity of presented aspects within environmental management and approaching the subject from the perspective of various countries contributes greatly to the development of environmental management field of research.

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