Evaluation of the Public Review Process and Risk Communication at High-Level Biocontainment Laboratories

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Abstract

The proposed construction of NIH-NIAID biodefense labs provided an opportunity to study real time developments in the public review process for high-level biocontainment facilities and compare them with literature findings on other biocontainment labs and complex science/technology projects. The goals of this study were to examine the types of issues and concerns raised in the review process, evaluate the importance of different factors in the public debate, and understand what features, if any, arose in situations with and without controversies. Based on an analysis of environmental impact documents, detailed timelines and media and Internet communications, it was possible to identify common issues and features associated with the lab reviews. Issues of trust and transparency, concerns about secret, or classified research, undisclosed accidents and a lack of due process were repeatedly found in controversial situations. The lessons learned from this study are relevant to current and future biocontainment projects, and highlight the importance of developing trust, implementing comprehensive early proactive risk communication plans, and maintaining open communication even after operations begin. Current governmental restrictions on transparency and openness associated with biodefense and terrorism make communication increasingly difficult, and have implications for long-term public trust and perceptions about biosecurity.

Introduction

In late 2002, the National Institutes of Health, National Institute of Allergy and Infectious Diseases (NIH-NIAID) published a request for proposals to construct multiple biocontainment laboratories in support of its strategic biodefense research plan. This NIAID construction grant program provided an opportunity to study real-time developments in the review, approval and construction of numerous high-level biocontainment facilities and compare them with literature findings about complex science and technology projects in general and other biocontainment labs in particular. The goals of this study were: to identify the types of issues and concerns raised in the review process, to evaluate the importance of different factors in the public debate, and to determine what features, if any, were associated with controversial and non-controversial situations.

Background: Risk Communication and Biocontainment

Research has identified a list of qualitative factors like trust, familiarity, catastrophic potential and individual control that have strong effects on perceptions and levels of concern about risks (NRC, 1989; Slovic, 2000). In addition, there are well-recognized differences in lay vs. expert responses to technological and biological risks that can impact public discussions (Slovic, 2000; Savadori et al., 2004). In essence, *how* information is shared may be as important as *what* is presented about a complex project. Those who seek to "educate" people through a one-way delivery of information and insistent assurances about safety are often unsuccessful (Leiss, 1996; Fischhoff et al., 2004).

In the past five years, several researchers have analyzed the siting and construction of some notable biocontainment laboratories, providing case studies of both good and bad community relations experiences (Lofstedt, 2002; Keith & Wagener, 2004; Fell & Bailey, 2005). According to these researchers, lack of communication and miscommunication with the public are major factors in failure, or near failure of projects. While accurate, detailed message content is necessary, it is likewise important to recognize that trust, transparency, competence, and avoiding secrecy are essential for effective risk communication. If the public is distrustful of officials because of credibility problems, past history, or social alienation, even the best-designed risk communication efforts may be unsuccessful, or impeded. Overall, communication must be a proactive dialogue that addresses the needs of diverse audiences and stakeholders, starts from the earliest planning stages of a project, and continues through project operations. In the design of this study, the presence, or absence of all these factors was noted during the experiences at different laboratories.

Previous reviews of biocontainment labs focused mainly on local, or regional environmental impacts; today's deliberations also include broader public health and biosecurity issues that have arisen in the post 9/11 era. In monitoring the progress of these new NIAID projects, attention was also focused on whether differences between biosafety and biosecurity are reflected in public debates. In this study, biocontainment labs were viewed as test beds for examining an unusual mix of highly emotive issues and activities—combining typical public health

concerns with genetic engineering, bioterrorism, and emerging infectious diseases (EIDs) in one place. Although biocontainment labs represent a technological solution to some vexing societal problems, they also have the potential for accidents, leaks, or diversions that might impact local citizens or the broader public in serious and worrisome ways.

Research Approach/Methodology

This study is based on information about new and recent BSL-4 and BSL-3 biocontainment facilities with an emphasis on labs in the NIAID biodefense program. Data on facilities were collected from varied sources, including agency data, environmental impact statements (EISs), environmental assessments (EAs), and hearings; web sites, media sources and journal articles; as well as interviews with individuals at NIH, specific facilities/locales, and citizens' organizations. The main BSL-4 facilities in this study were the Boston National Laboratory (BNL), Galveston National Laboratory (GNL), and the Integrated Research Facility at Rocky Mountain Laboratory (IRFRML). Information was also gathered on three other BSL-4 labs for comparative purposes, including an unsuccessful NIAID proposal from UC Davis, and two Canadian facilities, Winnipeg and Toronto/Etobicoke. In addition, nine NIAID BSL-3 labs were analyzed, as well as one unsuccessful BSL-3 grant proposal from University of Washington, which was included because of its controversial reception locally. In total, the labs represent a mix of successful, unsuccessful and delayed projects.

Most information was collected between 2002 and late 2005, roughly spanning the time from NIAID's first announcement of the construction grant program to the end of the federal reviews for the labs. Selective monitoring of some labs continued into 2006 in order to follow continuing legal challenges, opposition, or sporadic media coverage and Internet communications. Because the study focused on debate and potential controversy, particular attention was focused on activities of citizens' groups and relevant opposition concerns.

In general, collected information included data on the project and facilities; accident records; nature of the respective communities and public involvement; risk communication plans and activities; and media and Internet coverage on biodefense, emerging infectious diseases, emergency preparedness, and related topics. The accumulated information was used to compile detailed databases and timetables about most of the proposed NIAID laboratories, and also to determine the impact of local and national events on individual project reviews.

Findings

The NIAID BSL-4 labs ranged in size from 82,411 to 194,000 gross square feet (GSF) with costs ranging from $67-178 million; the BSL-3 labs ranged from 18,000 to 41,000 GSF, with costs of $7 to 32 million. Direct comparisons between and among the labs were made possible because they were all integral to NIAID's strategic plan for biodefense preparedness, and required to comply with the National Environmental Policy Act (NEPA). NEPA compliance imposed similar procedures and timetables with public notifications, open release of documents, opportunities for public comment, and formal government response to public input. It also provided information on project alternatives, accident scenarios, and possible mitigation. Each laboratory was also required to outline a risk communication strategy for outreach and public involvement during the review process. NIAID sponsored several workshops for public relations and communication staffs on lessons learned from earlier biocontainment projects, and suggested ways to tailor the information to their individual projects (Hedetneimi, 2005). Summary information on the NIH BSL-4 labs is provided below beginning with the NIAID labs at Galveston, Boston, and Hamilton/RML (Table 1), and followed by comparative information on two Canadian labs and an unsuccessful UC Davis proposed facility.

Galveston National Laboratory (GNL)

The proposed GNL is in the center of an existing biomedical complex at the University of Texas Medical Branch (UTMB) campus within an 84-acre site with approximately 77 major buildings. UTMB has safely operated high containment laboratories for multiple years, and currently operates a suite of eight BSL-3 labs (over 5,200 sq. ft.) and ABSL-3 labs (2,400 sq. ft.) in the Keiller Building, as well the Robert E. Shope BSL-4 lab (2,100 sq. ft.).

The GNL facility was planned to be 82,411 GSF in a new reinforced concrete seven-story building with a range of functional areas, including: BSL-4 and ABSL-4 (Animal) Labs (6,488 sq. ft. and 5,874 sq. ft. respectively); BSL-3 and ABSL-3 labs (8,964 sq. ft. and 8,380 sq. ft. respectively); BSL-3 insectaries (879 sq. ft.); BSL-2 labs (16,368 sq. ft.); and animal support areas (8,733 sq. ft.), office and conference rooms (14,724 sq. ft.), and support facilities (12,001 sq. ft.). The total cost of the lab is estimated at $167 million, with $110 million from NIAID and the remainder matched by UTMB.

The NEPA process for the GNL proceeded in textbook fashion from 2002 to 2005 with essentially no opposition, or public debate about the project. UTMB held numerous community meetings starting two months before the application was submitted to NIAID and continued them for an entire year until the NEPA process began. These community meetings directly followed years of proactive public education about biocontainment associated with an earlier, privately funded UTMB BSL-4 lab, which became operational in July 2004. No lawsuits, or Freedom of Information Act (FOIA) requests were filed against the project, and no accidents or leaks were re-

Table 1

Comparative characteristics of proposed NIAID BSL-4 labs.
NOTE: Highlighted boxes indicate where one lab is distinctly different from the others.

	GNL	BNL	RML
Facility and Institution Characteristics			
Gross Square Footage	82,411 GSF	194,000 GSF	105,132 GSF (includes upgrades to existing power, boiler, and utility services)
Combined New BSL-3/4 Area	30,585 sf.	24,000 sf.	9,710 sf.
# New Permanent Jobs	270	660	100
Facility Cost ($Million)	$167	$178	$67
Lab Site	Within urban Med./Res. complex in urban area of Galveston, Texas.	Adjacent to Med./Res. complex in highly urban, mixed residential and commercial area of Boston.	Within federal disease research complex adjacent to rural residential area in Hamilton, Montana.
Recent Accident History (Including During NEPA Review Process)	None	Multiple Tularemia exposures in 2004; Info disclosed *by media* (1/05).	Lab worker exposures to Q fever (2/05) and Salmonella (6/04); Info released *by NIH* to media.
Research History and Expertise	> 20 yrs. expertise in tropical and emerging infectious diseases; safe operating record with BSL-2/3/4 labs	Long-term research expertise, but a new consortium for EIDs; will draw experts from multiple Boston area institutions with strengths in biomed and pharmaceutical research.	100-yr. research history on combatting infectious and re-emerging diseases, vector-borne diseases. Existing biocontainment experience
Neighborhood Characteristics and Issues			
Population Density Nearby	628 persons/sq. mi.	>>16,000/sq. mi.	<20/sq. mi.
Nearest Residence to New lab	>>1000 ft.	~ 300 ft.	400-500 ft.
% Minority/Low Income Population in Neighborhood	34% / 22%	52% / 48%	4% / 14%
Env. Justice Concerns Raised?	NO	YES (Civil Rights Action)	NO
General Tone of Local Comments	Tell us about operations and policies to assure us it will be safe.	Locally Unacceptable Land Use (LULU)	If you must build it, let us know how you'll do it safely.
Features of Public Debate and Risk Communication			
Prominent Scientists on Both Sides of Lab Debate	NO	YES (strong pro/con debate)	NO (scientists mainly pro lab)
# of Active Opposition Groups (Names of Lead Groups)	0	~ 25 (ACE, Safety Net, Conserv. Law Fdn. etc.) see www.ace-ej.org/BiolabWeb/Whoelse.html	3 Coalition for a Safe Lab (CSL), Friends of the Bitterroot (FOB), Women's Voices for the Earth
In Communication with Other Opposition Groups Elsewhere?	NO	YES	YES
SDEIS Issued	NO	YES	YES
FOIA Requests About Lab	NONE	MULTIPLE	MULTIPLE
# Legal and/or Government Actions During Debate Over Lab	0	> 15 Federal/State/Local	2 (Federal FOIA and NEPA)
# Comments in EIS Process	418	778	366
# Community Meetings in Time Before Proposal Submitted	> 8 in 4 weeks	9 in 3 weeks	0
# Committee Meetings (and Months) Before First EIS Scoping Meeting.	>24 Mtgs. (15 months)	32 Mtgs. (13 months)	~ 10 Meetings (8 months) (only 2 listed in EA)
# Community Meetings in NEPA Process	>>25 (11 mos.)	>150 (22 mos.)	~ 50 (18 mos.) (only 8 listed in EA)
Public Comments Raised About Nature of Communications	None (Highest EPA rating for EIS: Lack of Objections)	Condescending, arrogant, secretive; misrepresented level of public support; unwilling to meet	Condescending; arrogant; questioned locals knowledge

ported for any other containment labs at UTMB. Groundbreaking occurred with fanfare and media attention in August 2005 accompanied by a scientific symposium on Biodefense and Emerging Infectious Diseases. As of August 2006, UTMB still maintained a comprehensive web site on the lab, which included a construction web cam (www.utmb.edu/gnl/const/index.shtml) to provide updated public information about the status of the project.

Boston National Laboratory (BNL)

The proposed BNL (official name: National EID Laboratories, or NEIDL) at Boston University Medical Center (BUMC) will be part of a new 14-acre research complex with 30 buildings in the south end of Boston, Massachusetts. Owned and operated by BUMC, BNL facilities will enable research collaboration between investigators from BUMC and research institutions and Universities in the Greater Boston area. The BNL will be a new 126-ft. tall building with four stories of occupied biomedical research space and three stories of mechanical/building support. The facility will include BSL-4 (13,100 sq. ft.) and BSL-3 (10,900 sq. ft.) laboratories; BSL-4 and -3 associated animal holding/support space (15,400 sq. ft.); BSL-2 labs (17,700 sq. ft.); clinical research space (3,500 sq. ft.); and office/building support spaces (15,400 sq. ft. and 8,100 sq. ft. respectively). The total cost of the 194,000 GSF facility is estimated at $178 million, with $128 million from NIAID and the remainder matched by BUMC.

The BNL is located in a densely urban environment with a total population of 53,470 people within a 1-mile radius comprised of seven distinct neighborhoods. According to U.S. Census data (2000), densities in the surrounding area average over 16,000 people/sq. mile (from a low of 10,000 to 20,000 people/sq. mile in mixed residential-industrial areas to a high of 67,000 to 105,000 people/sq. mile in residential sections). The nearest residences are located about 300 feet from the BNL site. The population around the lab is approximately 52% minority and 48% low income.

BNL's NEPA process was more complicated and contentious than GNL's at every step, including the addition of a supplemental EIS (SEIS) to address the many public concerns raised by the draft EIS (DEIS). Opposition surfaced very early in the planning process and eventually translated into state and federal lawsuits, public protests, and public hearings at the city and state levels, and intense media coverage for months. Midway in the review process, the media disclosed that BUMC had withheld information about lab acquired Tularemia infections that sickened BU workers on two separate occasions in 2004. Public allegations about withheld information resulted in charges of distrust and a renewed scrutiny of the project by public health officials, city and state lawmakers, the media, and opposition groups. BUMC was eventually fined by OSHA for the incident and strongly criticized by the local public health commission. Subsequently, calls for greater oversight of biocontainment labs arose from both the public and elected officials. Throughout it all, BUMC undertook extensive and varied community efforts to educate stakeholders about the lab and seek public acceptance, which included such unusual tactics as full page newspaper ads signed by hundreds of scientists, and paid ads on local transit vehicles. Opposition lawsuits and legal actions at both the state and federal levels hounded the project starting before the NIH award was announced in September 2003 and continuing into late 2006. Even with the start of construction in spring 2006, opponents vowed to continue their legal fight against the lab suggesting that even if the lab is built, it might still be possible to prevent its operation at the intended BSL-4 level.

Rocky Mountain Laboratories Integrated Research Facility (RML-IRF)

The proposed RML-IRF is located in Hamilton, Montana in rural Ravalli County. The RML complex is a state-of-the-art NIH intramural research facility with over 30 buildings on a 33-acre campus. The IRF project will include new high containment laboratory facilities and major infrastructure upgrades, with 105,132 GSF of new space comprised of high containment laboratories, animal research and support space (BSL-4, -3 and -2 labs at 6,760 sq. ft.; 2,950 sq. ft.; and 14,650 sq. ft. respectively) and office/public areas (25,650 sq. ft.); and infrastructure improvements including a boiler addition (1,810 sq. ft.) and chiller/mechanical area (51,288 sq. ft.). Project costs are estimated at $67 million, supported by NIAID intramural funds. The area around RML has a population density of only 20/sq. mi., with less than 4% minority and 14% low income residents. Overall, the EIS reported that the project would have only slight impacts on the traffic, water and sewage infrastructure. Positive local economic effects were anticipated from construction and operation of the project ($18.9 million during construction and 100 new lab employees upon completion).

The NEPA process for the RML-IRF was somewhat contentious from the start, although less so than in Boston. Problems began with the announcement of a planned Environmental Assessment (EA) process for the proposed BSL-4 lab in February 2002. There were no community meetings prior to the first EA scoping session in July 2002 during which citizens questioned why a comprehensive EIS was not being done. A new citizens group (Committee for a Safe Lab) was established in August 2002 and a coalition of citizens' groups held public meetings to discuss the project and argue that a full EIS should be conducted. Within a month, NIH announced that an EIS would be completed and the NEPA process resumed with a revised schedule.

Many questions about the project remained after the DEIS was released in May 2003, leading to another formal FOIA request by citizens' groups in August 2003 and

a subsequent SDEIS, which was released in late December 2003. Near the end of the NEPA process, RML added a public affairs staff member to keep the public updated on RML activities (October 2003). In spring 2004, the coalition of citizens' groups filed a FOIA lawsuit to obtain information it had previously requested. Upon completion of the NEPA process, the citizens' coalition asked for a meeting with the RML Director in August 2004; when their request was denied, the coalition filed a NEPA lawsuit requesting the EIS be redone and a temporary restraining order (TRO) be issued against the lab (Kaiser, 2004a). Within a week a federal judge dismissed the TRO, but ruled that the NIH and citizens' groups must engage in mediation to resolve the issues (Kaiser, 2004b). A final resolution was reached through mediation in late September 2004 (U.S. District Court, 2004).

Construction of the lab was 95% complete as of August 2006. Local and state political ramifications from the lab were minimal throughout the public debate. Once a formal agreement was reached, communications between the lab and the community improved considerably due, in part, to seminars and facility tours, the disclosure of draft emergency plans, increased citizen involvement on RML committees, and the development of a new master plan (Race, 2006).

Overview and Comparison of the Decision-Making Process at GNL, BNL, and RML Laboratories

The collective experiences at these three BSL-4 labs were quite different: Boston's was the most controversial; RML's was moderately contentious; and Galveston's was essentially routine and trouble-free. An analysis was undertaken to determine if specifics about the labs would correspond in any ways with the observed order of difficulty. Would the similarity or dissimilarity of important features such as the physical nature of the individual projects; their local areas; or the nature of the public debate presage the respective controversies, or lack thereof? Table 1 presents comparative characteristics of the three NIAID BSL-4 labs, with highlighted boxes indicating situations where one project appears distinctly different from the other two.

Institutional and Facility Characteristics: The Boston lab clearly had the most contentious review and was also different in a number of institutional and facility characteristics. BNL is the largest project in GSF, the most expensive ($178 million vs. $167 and $67 million for GNL and RML respectively); and will create more than double the number of permanent jobs as the other labs (660 vs. 270/200 for GNL and RML). All three labs are similarly located within, or adjacent to established medical/research complexes, and will continue biomedical uses on the proposed sites. GNL was alone in having no lab accidents during the NEPA process. BUMC experienced the highly publicized Tularemia infections during the public review process that were disclosed by the media via an anonymous tip. The poor reporting of the Tularemia infections ultimately led to the dismissal of BUMC's Chief of Infectious Diseases, the very person who was responsible for biosafety training in the new BNL. Although lab accidents also occurred at RML, they were disclosed first by NIH rather than by a news report and didn't translate into a public issue in the lab debate. Finally, BUMC was different from GNL and RML in its research history and expertise. While BUMC and collaborating institutions are well-known for their strong biomedical and pharmaceutical expertise, they do not have the same publicly acknowledged history of biocontainment research on highly infectious animal, tropical, or EIDs as RML and UTMB.

Neighborhood Characteristics: The neighborhood characteristics and issues for BNL were different from RML and GNL in every feature. The BNL has by far the highest population density, orders of magnitude greater than the others (>16,000 vs. 628 [GNL] and <20 person/mi2 [RML]). BNL is also located closest to nearby multi-family residences (300 feet for BNL compared with >1,000 feet and 400-500 feet for GNL and RML respectively). Equally as important, significant focus was placed on environmental justice and socioeconomic issues for the BNL, but far less at the other two labs (BNL had a 54% minority/48% low income population vs. 34%/22% and 4%/14% respectively at GNL and RML). In Boston, this difference was associated with subsequent civil rights action against BNL, but not at the other labs. Finally, the local citizens' groups in Boston maintained their opposition from the start based on their premise that the lab project was an example of locally unacceptable land use in a highly urban area (LULU); whereas both GNL and RML public comments focused on mainly operational issues associated with known facilities (essentially a focus on safety).

Public Debate and Communication: Analysis of the communication features also revealed important differences. In Boston, hundreds of prominent scientists were involved on both sides of the debate about the lab, whereas scientists at RML and GNL were mainly pro-lab if involved at all. Boston had the largest number (over 25) of highly organized environmental and citizens' groups involved, although thee groups led the main opposition. RML had fewer opposition groups in the area, but the three active groups were very knowledgeable about the NEPA process and willing to challenge the project legally, similar to opposition groups in Boston. Both the Boston and RML opposition groups availed themselves of FOIA requests and lawsuits, and were active on many fronts including NEPA process, online newsletters, media releases, protests, ad campaigns, legal actions, and fund raising. RML and BNL opponents also communicated with citizens' groups elsewhere who were fighting local labs and/or pushing for greater oversight of biodefense research

nationwide. In Galveston, no citizens' groups opposed the GNL facility, or were involved in the nationwide debate over biodefense research, even though there are groups in the area that have challenged other projects related to oil drilling, and transportation plans (Curtis, 2006).

GNL and Boston were similar in the ways they handled initial community meetings (eight to nine small group meetings in the month before the lab announcement), while RML had no separate community meetings prior to the lab announcement since it was a congressionally mandated project, and began with less lead time than other BSL-4 labs (Race, 2006). Of the three NIAID labs, GNL had the longest duration risk communication program in advance of the new lab announcement, dovetailing with outreach on biocontainment that began in 1997 for UTMB's BSL-4 Shope Lab. Both Boston and GNL held a string of community briefings leading up to the first NEPA scoping meeting (24 and 32 meetings in one year). Data supplied by RML staff, but not reported in the EA, indicates that there were about 10 public meetings held during the eight months leading up to the first EIS scooping session and 50 community and local presentations during the NEPA process (Race, 2006). Surprisingly, the lab with the greatest controversy had mounted the largest number of community meetings—more than 150 meetings during the NEPA process for BNL compared with 25 and 50 for GNL and RML.

Finally, while GNL received no negative comments about its communications and EIS process, interviews and media accounts for both RML and BNL indicated that citizen opponents were upset over the tone of their meetings and interactions with experts (Race, 2006). They felt that the experts were dismissive of their questions, considered their concerns baseless, and were telling them what would be done rather than discussing public concerns; moreover, individuals expressed offense at being talked down to by "arrogant, condescending experts." In both locations, requests for more information about the planned labs were denied, leading eventually to opponents' FOIA requests and later lawsuits to obtain details.

Comparison of Public Concerns about NIAID BSL-4 Labs

Further analysis was undertaken to discern any patterns in public concerns that might correspond with the degree of controversy at each location. Table 2 indicates the types of public concerns raised in the NEPA process for the three BSL-4 Labs. An attempt was made to review public comment and attitudes associated with the first BSL-4 Lab in Galveston (Shope Lab) to determine if they mirrored the pattern seen with GNL, particularly since the literature indicated that early meetings were hostile. The Shope Lab was planned to address UTMB's mission in public health and EIDs, while the new GNL focuses on EIDs as well as biodefense and bioterrorism. However, no EIS was done for the Shope Lab because it was privately funded and there is no Texas equivalent of a NEPA-like review process, making comparison impossible (Curtis, 2006). The analysis was compiled using reported comments from the final EISs as raw data with numbers indicating the combined total of oral and written comments submitted by category during the entire NEPA process for each lab. To understand more about these differences, information in Table 2 was further analyzed by focusing preferentially on all categories that encompassed the top five categories for each lab (highlighted in Table 2). Because the original NEPA comments fell roughly into 15-20 major categories, any category representing over 10% of the comments was deemed noteworthy.

Figure 1 is a graphic presentation of these top NEPA comment categories showing the strong variation in local responses. In the categories related to Normal Operations, all three labs recorded many questions, although the emphases were different among them. In general, the GNL comments emphasized questions on *how* operations and policies would be implemented. This is consistent with a citizenry that is familiar with this type of lab, because one already exists in their area. For RML, the main focus was on emergency response plans rather than normal operation per se, emphasizing the need to know about emergency coordination with local first responders and public health officials. Like RML, Boston's questions also emphasized Emergency Response Plans and evacuations, rather than normal operations, and were particularly focused on the difficulty of evacuation and emergency response to a biological crisis in densely populated Boston. Repeatedly they asserted that a BNL in the planned area was a locally unacceptable land use (LULU). Interestingly, in Galveston, few questions were asked specifically about emergency response plans, perhaps because of trust, or firsthand experiences (the successful shutdown of UTMB's labs according to written plans in the face of approaching hurricanes Katrina and Rita in 2005).

Citizens in Boston asked very few questions related to local environmental impacts of various types, perhaps because the site is located in a highly urban area and citizens were focused from the start on opposition, not operations. In contrast, both GNL and RML queries focused on how emissions, wastes, or infrastructure demands might impact their local area. Citizens near RML were particularly concerned about waste and pollution (mainly air pollution via incineration) that might impact the valley.

For BNL and RML, but not GNL, comments in the category of NEPA requirements emphasized the lack of "alternatives" presented in the EIS. The well-organized opposition groups in both Hamilton and Boston were familiar with NEPA compliance expectations, which typically involve the analysis and discussion of at least several alternative sites in detail. In all three EISs, NIH analyzed only the proposed site and the no action alternative, dismissing all other potential sites because they didn't meet the needs of the NIH program. In Galveston, this lack of

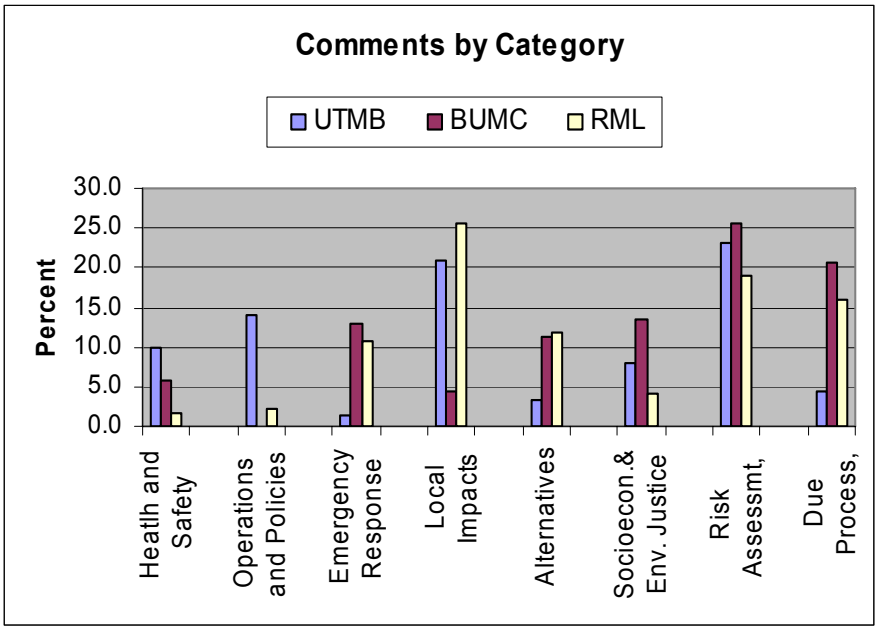
Table 2

Comparison of Public Comments Raised in NEPA Process. Indicates actual numbers and percents of total comments received in public meetings, scoping sessions, phone calls, e-mails and/or comments in response to DEIS and SDEIS documents. NOTE: Bold/highlighted numbers indicate top five categories of concern for each lab.

Comments by Category	GNL	GNL	BNL	BNL	RML	RML
	#	%	#	%	#	%
Normal Operations and Plans						
Health and Human Safety	41	**9.8%**	44	5.7%	6	1.6%
Policy/Operations	58	**13.9%**	0	0.0%	8	2.2%
Emergency Response Plans	6	1.4%	100	**12.9%**	39	**10.7%**
Classified Research/DNA Research	0	0.0%	19	2.4%	12	3.3%
Local Impacts						
Infrastructure Utilities	26	6.2%	0	0.0%	22	6.0%
Waste Management Pollution	36	**8.6%**	16	2.1%	64	**17.5%**
Traffic and Transportation	20	4.8%	4	0.5%	8	2.2%
NEPA Required Information						
Alternatives	14	3.3%	87	**11.2%**	43	**11.7%**
Socioeconomic and Env. Justice	34	**8.1%**	106	**13.6%**	15	4.1%
Risk Assessments, Scenarios, Terrorism	97	**23.2%**	200	**25.7%**	70	**19.1%**
Proposed Action	26	6.2%	0	0.0%	3	0.8%
Cumulative Impacts	5	1.2%	15	1.9%	0	0.0%
Procedural Matters						
Due Process, NEPA Compliance, Access to Information, Trust	19	4.5%	161	**20.7%**	59	**16.1%**
Misc. (Costs, Schedule, Outside Scope, etc.)	36	8.6%	26	3.3%	17	4.6%
Total # Comments	418	100.0%	778	100.0%	366	100.0%

Figure 1

Comparison of comments for NIAID BSL-4 Labs.



analysis of multiple alternative sites never became an issue, perhaps because UTMB had communicated to the local public for at least a decade about plans to build BSL-4 facilities and become a world class research center on tropical and emerging infectious diseases.

Socioeconomic and environmental justice concerns were absent at RML, but evident at both GNL and Boston, but for different reasons. Opponents in Boston argued strongly that the large proportion of minority and low-income people living near the proposed lab translated to serious environmental justice concerns. They filed a formal complaint under the Civil Rights Act with the federal Department of Health and Human Services (HHS) asserting that the project would disproportionately impact disadvantaged groups, a position in contrast to the assertions in the EIS. (A decision on this federal civil rights action was still pending in late 2006.) In Galveston, the socioeconomic concerns focused not on minority, or low-income residents near the lab, but rather on the equitable distribution of benefits from new jobs, particularly during construction.

All locales used the NEPA process similarly when asking about their projects' risk assessments, worst case scenarios, and terrorism risks. Citizens wanted to know how NIH reached its conclusions that construction and operation of the labs would not result in accidental exposures, whether by system malfunction, human error, or terrorist acts. Clearly, citizens have come to expect that the environmental review process—whether federal or state—will present important information and fully address their concerns.

Dissatisfaction with responses, concerns about withheld information, questions about trustworthiness, and repeated comments about lack of due process were recorded at both Boston and Hamilton, but not at Galveston. They were also accompanied by charges that the EIS analyses were inadequate, or improperly conducted, leading to multiple lawsuits of several types (NEPA, MEPA, and FOIA). The GNL, on the other hand, received very few questions related to legal compliance, and essentially none suggesting any concerns about withheld information, or mistrust. For GNL, risk communication efforts throughout the NEPA process, and continuing through construction via web site, web cam, or public symposium on EIDs appear to have reassured the public that they will be kept adequately informed about the lab and its activities as needed.

For the RML project, concerns about due process, secrecy and emergency planning were resolved through court action and legally binding mediation (Kaiser, 2004a and 2004b), which ultimately allowed the lab to be built, and also established a new openness and involvement with the community. The resolution of issues at RML suggests that it is possible to regain trust and move forward, but it takes proactive communication with the stakeholders (Keith & Wagener, 2004). While the NEPA and FOIA lawsuits brought by a coalition of local citizens' groups were unwelcome challenges to RML administrators, the mediated outcome provided a sense of closure and ushered in a new beginning and a welcome dialogue of sorts. Based on interviews with key members of the citizens' groups and a lab staff member (Race, 2006), RML is committed to a risk communication plan and has been holding regular seminars and lectures for the public featuring researchers from the lab. RML officials also agreed to provide information on emergency plans and notifications, to increase the number of community members on the Institutional Biosafety Committee, to move the meetings of the Community Liaison Committee to more accessible locations, and even to phase out a long-contentious incinerator for general refuse disposal. As indication of the improved relations, citizens' opposition and protests ceased around the time that construction of the new lab began.

In Boston, it is premature to say how the multiple legal challenges over the BNL proposal will eventually be resolved, although the citizens' groups vowed to continue efforts to stop the lab from being built even after construction got underway in May 2006. Challenges in courts and regulatory arenas continue at the time of this writing in September 2006 including New lab oversight regulations by Boston Public Health Commission; a state court ruling and an agency requirement that BU submit a revised supplemental MEPA environmental impact report; and a citizens' legal request for a TRO against NIH to stop funding of the BNL until federal NEPA challenges are resolved.

Issues Repeatedly Observed in Public Reviews of High Containment Biolabs

Analysis and monitoring were also undertaken on 13 other biocontainment labs, although in less detail than the three discussed above. Information was gathered from published reports on an unfunded BSL-4 lab proposal from UC Davis, and two previously built Canadian BSL-4 labs (Fell & Bailey, 2005; Lofstedt, 2002; Keith & Wagener, 2004; Enserink, 2000a and 2000b). Ten BSL-3 labs were also analyzed using a combination of NEPA documents, media reports and information from web sites. None of the nine funded NIAID BSL-3 projects resulted in much attention, or debate in community meetings, or generated any public controversies. Even two projects with accidental escape and loss of lab animals during the review process (New Jersey, Tulane) did not experience increased concern or opposition over the lapses. The only controversial BSL-3 lab was one proposed by the University of Washington, which experienced intense local opposition due primarily to concerns about secrecy, classified research and inappropriate site location. (Details on the UW lab controversy and public concerns are available from the author at mracemom@aol.com.) The combined information from all 16 labs was further analyzed to com-

pare controversial vs. non-controversial experiences.

Previous researchers have suggested that the effectiveness of risk communication is associated with certain key factors, most importantly trust, transparency, and two-way information exchange (Slovic, 2000). Table 3 was compiled using a combination of NEPA comments and an extensive review of media and Internet information on each lab studied. Using data from this study and other published reports, the table records the presence, or absence of, key issues in projects with and without controversies. "Presence" of issues is based on whether a particular issue was specifically and repeatedly documented during the public discussions of all types, not just in NEPA comments. The table also indicates the status of each facility, noting whether it is completed, or largely built, delayed, operational, or stopped completely as of August 2006. Figure 2 provides a graphical presentation of the same information.

Of all the labs studied, the Galveston Lab was the only major facility that was entirely free of controversy, a fact attributed at least in part to its long-term, open and proactive communications (Curtis, 2006). As a group, the smaller, less costly NIAID BSL-3 labs were likewise uncontroversial, perhaps in part because of the widespread occurrence and familiarity with BSL-3 labs in general. The five other BSL-4 labs in this study and the controversial UW BSL-3 lab each experienced varied problems with repeated public, legal, or political challenges and accompanying delays of various lengths. The outcome for the BNL is still awaiting legal rulings (September 2006) that will determine whether it can be completed, or operated.

Focusing specifically on those labs where the controversies occurred, serious and persistent questions of *trust* were evident in every case, whether briefly, or for a sustained time. Even Winnipeg with its exemplary, proactive, and long-term communications strategy admitted that a minor incident involving undisclosed release of wastewater into the sewer (reported by the media), damaged their reputation, caused a long delay and required a concerted effort and additional time to rebuild the public trust (Keith & Wagener, 2004). The evidence for trust as a top priority in public decision-making about biocontainment labs reaffirms the findings and assertions of many previous researchers. Attention to factual details is clearly essential in reviews of complex science/technology projects, but without trust this information can become secondary in the debate.

Strong concerns about *secrecy and classified research* were evident in two-thirds of labs with controversies. Only the two Canadian BSL-4 labs had no concerns raised about secret or classified research. This highlights a difference between the purely public health missions of the past and the current blurring of public health, biodefense and bioterrorism in the post-9/11 era. The issue of classified research and secrecy was also linked to citizens' concerns about emergency responses and restrictions on notifications about what select agents are being used. University-associated labs experienced especially heated debates over secrecy and classified research, which could impact the open publication of research re-

Table 3

Key Issues Present/Absent in Public Discussions

LABS:	GNL	BNL	RML	UCD	Toronto	Winpg	NIAID BSL-3s	UW BSL-3
STATUS:	B/O	B/D	B	S	B/D/S	B/D/O	*	S
ISSUES:								
Trust		X	X	X	X	X		X
Classified Res.		X	X	X				X
Due Process		X	X		X			X
Transparency		X	X		X			
Actual Accidents		X		X		X	**	
Res. Agenda		X		X				X
Location (LULU)		X			X			X
Pollution			X		X			

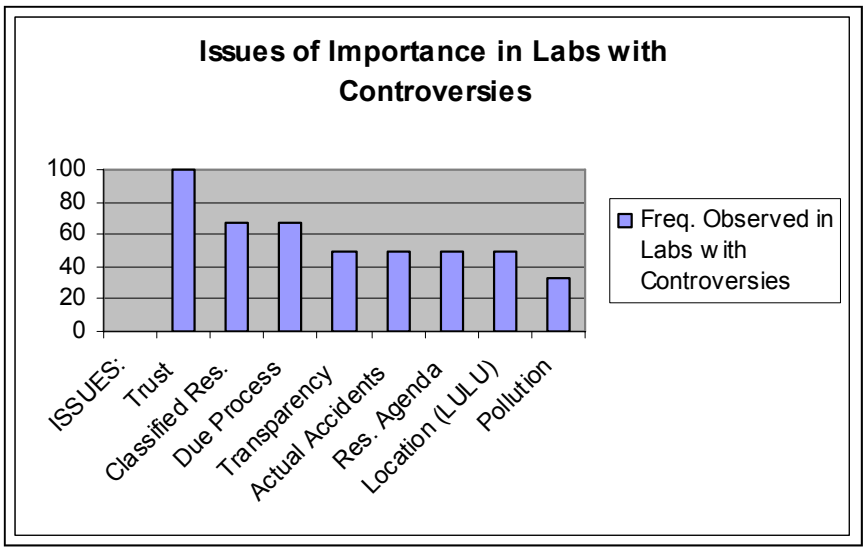
LABS: Darkened boxes indicate labs where controversies occurred.

STATUS: B = Built or currently under construction; O = Operational; S = Stopped; D = Delayed; * = details not studied

ISSUES: Highlighted boxes (X) indicate specific issues documented in NEPA documents and/or media coverage at labs where controversies were analyzed.

** = two accidents occurred at NIAID-BSL-3 labs, but each was disclosed by NIH rather than the mass media and resulted in no controversy.

Figure 2
Issues of importance in labs with controversies.



sults. The mixed messages and flip-flopping of interpretations on how the Bioterrorism Act would apply to future research at NIAID biodefense labs no doubt contributed to this continuing concern.

Due process was also an issue in two-thirds of controversial labs. Controversies over both U.S. and Canadian labs demonstrate that serious challenges can, and will, be mounted using available regulatory, court, media, and political avenues even if the opposition represents only a minority of the public. When institutions decide how to fulfill the review process (EA rather than EIS, or a limited number of alternatives analyzed) they may set the stage for potentially greater conflict by providing legal hooks for court challenges by opposition groups. Given the controversial nature of biodefense labs, and the anxiety over possible accidents and terrorism, it is not surprising that due process issues were used as impediments to these projects.

Half the controversial labs shared four additional issues in common: a *lack of transparency*, *accidents*, questions about *local control of research agenda*, allegations about *locally unacceptable land uses* (LULU as distinct from NIMBY (not in my backyard). Transparency in this situation refers to the open release of relevant information needed to evaluate a project during its review and also relates to institutional attitudes and actions regarding the release of information in general. Repeatedly, when information was withheld, dialogue began poorly and rarely improved without extensive work. The lack of transparency is not unique to this era of biosecurity and secrecy; it was also one of the issues responsible for the difficulties at the Etobicoke (Canada) lab a decade ago. At every turn, a lack of transparency impacted the sense of trust. Interestingly, neither UW nor UCD labs registered concerns about transparency as each of them provided extensive and open information from the start. Thus, transparency is a necessary starting expectation, but other issues may have greater weight in the debate overall.

Accidents were noted in a number of labs, but concern and controversies over accidents become notable only in situations with non-disclosure of information by the sponsoring institution. In essence, it appears there was more concern about institutional trust than the accident itself. This is consistent with recent experimental research on increases and decreases of public trust (White & Eiser, 2006). How risk managers respond to events may be interpreted as indicative of competence, or lack thereof, as well a reflection of institutional attitudes toward the public.

Issues over local control of research agendas were evident mainly for University facilities. Both faculty members and the public raised questions about the required commitment of 20 years for an NIAID research mission, particularly in light of changing legal interpretations related to terrorism, federal government authority, and citizens' rights. Reassurances from NIH about local control of research agendas, and restrictions against classified research apparently did not satisfy opponents.

Finally, while a number of individuals probably have NIMBY attitudes about any projects in their areas, opposition groups in the recent lab controversies acknowledged the importance of constructing biocontainment labs, but presented strong reasons why particular labs were inappropriate for selected locations, or whether too many were being built nationwide. Whether the LULU issues eventually prevail will depend on judgments of the courts, or perhaps political considerations (Toronto/Etobicoke lab). Nevertheless, both site appropriateness and consideration of alternative sites remain important elements in environmental decision-making. Surprisingly, concerns about local pollution and related impacts occurred in only one-third of the lab controversies.

Conclusion

The findings in this study are consistent with earlier research on risk communication, highlighting the importance of trust and open communication in public decision-making, particularly when it comes to biocontainment labs. Even if a project has political and majority support, it is clear that the activities of a small number of opponents can significantly impede a project, or even cause its demise through legal challenges and other actions. Lack of trust was manifest at every lab where controversies occurred, leading to varying combinations of legal or political challenges, construction delays, or even project cancellation. Concerns about secrecy/classified research and a lack of due process were also seen in two thirds of controversial labs. Lack of transparency, undisclosed accidents, concerns about local control of research agendas, and assertions of unsuitable site locations were observed in half of all controversial labs. Unlike BSL-4 labs established prior to 9/11 when public health, emerging diseases, and biosafety predominated the discussions, the current crop of biodefense labs experienced the added burdens of biosecurity and bioterrorism concerns, as well as questions about secrecy and research control, particularly for university-associated facilities. Interestingly, of the 10 BSL-3 labs studied, only one experienced intense local debate, which coincided with persistent questions about trust, secrecy, research control, and unsuitable location, similar to the features of controversial BSL-4 labs.

Biosecurity related issues (as opposed to biosafety per se) have clearly complicated the current debate over current planned BSL-4 labs for NIAID. Since trust, transparency and information availability are at the very center of effective risk communication, anything interfering with the flow of needed information is likely to be problematic. The current lack of openness related to biosecurity and biodefense information likely contributed to undermining trust in risk managers and officials associated with the labs. At this juncture, finding ways to rebuild trust and demonstrate suitable transparency and openness with the public will be important when labs become operational. Recent research has shown that building, or losing trust is associated with how honest and open the risk managers are perceived to be by the public, and how they handle accidents, or complex events in the face of uncertainty (White & Eiser, 2006). The challenge of finding a balance between public security and public openness will continue to be particularly difficult in the face of current concerns about terrorism and the continuing debate over biodefense priorities and spending.

Although this cohort of NIAID biocontainment labs was required to have risk communication plans as part of their project plans (Hedetneimi, 2006), it is likely they were developed for local siting and decision-making considerations and drew from lessons learned in earlier biosafety and public health debates. Because the communication plans were crafted before biodefense-associated issues were widely debated, they may have omitted the important underlying fact that the BSL-4 biodefense/biocontainment labs have come to represent a highly dreaded risk, in essence a stigmatized technology (Flynn et al., 2001). Collectively they now exhibit the same mix of negative emotions, risk perceptions and stigma associated with other dreaded risks like "nuclear" or terrorism (Peters et al., 2004; Gigerenzer, 2006). As such, they represent low probability, high consequence risks that can cause both direct damage (in this case from accidents with infectious agents) and indirect damage, mediated through the minds of citizens (Lightstone et al., 2006). It is known that people tend to react to dreaded risks with avoidance behavior (Slovic, 1987). Even in situations involving terrorism and the *voluntary* risks of travel, worry and emotion have been shown to play significant roles in judgments and decision-making (Fischhoff et al., 2004).

For the proposed BSL-4 biocontainment labs, the exposure to hazards associated from biodefense research is entirely involuntary, and leads the public to focus heavily on a host of novel uncontrollable risks, both perceived and actual. In addition to concerns about terrorism, biocontainment labs also involve recombinant DNA technologies and genetic engineering, which are also perceived differently by experts vs. the public (Savadori et al., 2004). For those who conduct research on hazardous bioagents, the labs and associated risks are familiar, understood and accepted; such is not the case with lay audiences. In addition, experts judge the risks of medical biotechnology and its applications as less harmful, more useful, and more familiar than lay audiences, who focus far more on potential harm. In the current debate over biocontainment labs, the experts are emphasizing societal benefits from conducting needed research, while the concerned public is focusing on personal and local risks, or the broader political dimensions of biodefense. This technological stigmatization has become a powerful aspect of the current debate—one that has not yet been addressed adequately during public communications. It is clear that attempts to educate the public about real vs. perceived hazards of biocontainment and biosecurity involve far more than just the dissemination of scientific and technological information. Future risk communication plans about biodefense research and biocontainment labs will need to incorporate an understanding and acknowledgement of how strongly emotional and affective reactions can impact behaviors and skew public responses. In addition, it will be important that institutions address lingering concerns about trust, lab oversight and operations once labs are permitted to go "hot." If risk communication is confined mainly to the approval and construction phases of a project, it is not likely to be sufficient. Ongoing communications involving true public dialogue and engagement—not just press releases and announcements—must be part of the lifetime of these facilities. More than

ever, effective risk communication is essential for maintaining and, in many cases, rebuilding public trust both locally and nationally in this current era of bioterrorism and biodefense concerns.

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