

Project Description

SAFE SCIENCE: GOVERNING GREEN LABORATORIES

"To understand the varying impact of law, we must look at the competition between legal institutions and institutions associated with other spheres. We must also ask how the setting for those competitions - very often an organization - shapes the outcome" (Heimer 1998).

On June 18, 2001, the First Circuit Federal Court in Boston recorded a consent decree between the U.S. Environmental Protection Agency ("EPA") and the University¹ in which the EPA alleged that The University violated certain provisions of the Resource Conservation and Recovery Act ("RCRA"), the Clean Air Act ("CAA"), and the Clean Water Act ("CWA"). Without admitting any violation of law or any liability, the University agreed in the decree to settle the matter without a trial on any issues of fact or law. From the District court's perspective, this was a routine matter that took little time or attention. From the perspective of the EPA and the University however, this was a major occasion, the culmination of three years of lengthy, detailed negotiations that both parties hoped would ultimately produce the means for sustainable environmentally sound research practices for the nation. Both parties viewed this agreement as an opportunity to create a model of safe, healthy, and 'green'² laboratories.

The agreement between the EPA and the University is an example of a relatively new form of regulation "that seeks directly to promote the management of private firms in ways that meet public goals" (Coglianese and Lazer 2001:1). Although most regulation attempts to manage some activities of private firms, this strategy supplants more familiar policies that mandate either the use of specific technologies or specific levels of performance. This management based strategy locates the design, standard setting, and implementation of regulation within the regulated organization itself, creating a form of private management in the public interest, or what students of governmentality call regulation at a distance.

As important as the style of regulation it set in place, the June 18th consent decree stipulated a five year deadline for compliance. Normally, EPA consent decrees demand compliance within a year. The five year window for compliance signaled a new kind of regulatory collaboration in which a private organization not only reforms its own practices but assumes responsibility to invent and disseminate new models of environmental, health, and safety management. From the point of view of both parties, the consent decree turned liabilities into investments, creating the possibility of a win-win situation. From the government's perspective, private educational institutions are notoriously difficult to regulate. Not only do they enjoy a relatively unusual degree of autonomy (secured by trusts, moral status, and epistemological authority), but the vast range of activities and dispersed authority create seemingly intransigent obstacles to regulation, especially regulation that was principally designed for mass production industries. By extending the time frame for compliance, and thus contracting with the University to invent a new management system for research universities, the consent decree offered the EPA an opportunity to solve some of its most intractable regulatory problems. From the University's perspective, the alleged violations threatened the University's reputation, while also creating the prospect of heavy fines and costs. Litigation to

¹ Throughout this proposal, I will refer to the site of my research as "The University." Informed consent has been secured from the institution, from the groups and persons I am observing and interviewing on the basis of assured confidentiality. If it is not possible to maintain that confidentiality in the ultimately published work, I will have to secure consent for each publication from any informants who may be identifiable.

² I use the term "green" here and in the title of this project as a colloquial label to designate a wide spectrum of conditions and practices designed to secure clean air, water, and conservation of natural resources. It is not meant to suggest or ally with any political party or lobby.

challenge the allegations would only expose the University to unfavorable publicity and expense, with no assurance of an ultimately favorable outcome. An unfavorable decision court would expose the University to yet more bad publicity and would likely open the University, as it had other campuses, to surveillance and policing by consultants hired expressly for this purpose. By assuming responsibility for designing and making publicly available a new management system for educational and research laboratories, the University created an opportunity to enhance, rather than diminish, its reputation for excellence and innovation.

I propose to study the development and implementation of this new environmental, health and safety system("EHS"). While much research tries to determine if regulation works, and whether it is cost effective, too few studies have looked at the ground level - inside the organizations, at the shop floor level - to trace the behavioral and cognitive threads between the routines of daily work and EHS regulations. Most studies look at the macro level of the organizations, tracing variations in emissions, air quality, volumes of waste disposal, costs and benefits, but rarely looking at the cultural conditions that create compliance or resistance to regulation. In part this focus on the outputs of organizations rather than in their culture and practices is a consequence of exclusion; researchers are often denied access to the workers and their spaces, with management insisting that data collection begin and end at the managerial level. By conducting this research in the more open university setting, I can overcome the barriers that have been erected in corporate settings to an in-depth cultural analysis of regulatory compliance.³ By observing the invention of the new EHS organization, its implementation, and dissemination across very different organizational units in the University, I hope to unpack the black box of regulatory culture by mapping the ways in which local organizational cultures influence environmental, health and safety practices and create, where it exists, responsive regulation (Ayres and Braithewaite 1992) and the possibility of sustainable improvement in environmental conditions. Through participant observation, interviewing, and ethnographic analysis, I will be able to capture the variations in interpretation and consciousness that are sedimented in and through organizational cultures (Silbey 1992; Ewick and Silbey 1998, Henry 1983, Heimer, Edelman and Suchman 1997). I hope to bridge the divide between macro, instrumental and economic analyses of regulation with an in-depth analysis of what it means to manage green laboratories.

Since March 2001, I have been observing the deliberations, and interviewing members of the faculty, administration, and staff working on the design of the University's new EHS systems. I have also begun observing in some of the University's research laboratories to map routine laboratory practices before the invention and implementation of the new systems. Documenting this history is a valuable project in and of itself because this agreement promises to invent a new template for the nation's environmental practices. How can government regulate in the public interest such inherently innovative and flexible organizations as scientific laboratories, especially when they are embedded in an institution that prizes freedom? This is important not only because of the increasing significance of scientific and educational institutions in our current economy, but because these institutions serve as models for new emerging organizational forms which depend on innovation, flexibility and large knowledge-bases. Thus, in addition to its historic significance, however, this consent decree offers a unique, time-bound opportunity to investigate significant questions at the intersections of science, law, and public policy.

This project will advance current understanding of how regulation works, and does not work, by incorporating an in-depth analysis of the role of local organizational cultures and social control into models of regulatory compliance. How, and in what ways, do local organizational cultures instantiate or challenge legal norms and regulations? What forms of surveillance and control operate, and with what effects, in professional/collegial versus bureaucratic/hierarchical organizations? In

³ The salient difference between a corporate setting and the University may not be the difference between profit and non-profit organization; the university, after all, must meet its costs and cannot operate at a deficit. The organizational culture -- bureaucratic vs. professional collegial -- may be more significant.

addition, the research will analyze the meanings of law, regulation, and safe practices circulating among several normative communities: technicians, custodians, clerical staff, scientists and engineers, university administrators, in-house counsel and government regulators.. Within the socio-legal literature, this study will expand the understanding of legal consciousness by examining a community where norms of consistency, authority, and due process are interpreted very differently than they are within the law. Moreover, we will be able to look at organizations where the bottom line and cost efficiency is only one of several operative values (cf. Ayres and Braithewaite 1992). Finally, this research promises to expand the already significant roster of ethnographies of laboratory practices while focusing on the creation and work of boundary objects and organizations that mediate the worlds of science, law, and politics.

I. The Problem: A Conflict of Cultures? Consistent Conformity in Scientific Laboratories

This research will examine scientific laboratories as a site of legal regulation and governance in American society. I focus this project on science and scientists because, as a social institution and practice, science has been relatively less studied by social scientists generally and socio-legal scholars specifically. Although the historical record suggests that law and science have been cooperating for centuries, mutually constructing, stabilizing and reinforcing each other (Ezrahi 1990; Porter 1995; Shapin and Shaffer 1985, Shapin 1994), a common depiction of two distinct and warring cultures persists (Goldberg 1987, 1990, 1994; Schuck 1993). It is clear, moreover, despite their mutual constitution that "science and law [frequently] approach the world in profoundly different ways," with "lawyers and scientists speak[ing] and think[ing] in different languages" (Faigman 1998:6). The intersections between law and science have become a strongly contested terrain where idealized and institutionalized differences have had significant consequences for individuals, institutions, and communities.

The increasing use of science in litigation alone suggests the importance of focusing a socio-legal lens on science. Thus, much socio-legal research has studied the ways in which science is introduced into legal disputes, courtrooms, or policy debates, (see for example, Faigman 1998; Faigman, Kaye, Saks, and Sanders 1997; Breyer 1993; Huber 1991; Lempert 1988; Lempert and Sanders 1986; Monahan and Walker 1994). Taking a "law first" perspective (cf. Sarat and Kearns 1993), science is often examined for the technical assistance it offers (or fails to offer) in establishing social and physical facts for legal projects. Importantly, however, the consent decree between the University and the EPA is not quite like these other projects; it seems to reverse more familiar trajectories. Rather than science entering the legal domain -- as evidence or expert witness -- the consent decree inserts the law directly into the house of science: the research process and the laboratory. Thus, we might describe this project as taking a "science first" approach, tracing the role of law at its extremities rather than at its heart. We will conduct an ascending analysis from inside the places and with the behaviors the law wants to transform, tracing back and forth from the laboratories to what we more often consider the law's central axes: the courts, legislatures, administrative agencies, statutes and regulations.

The University is a professional-bureaucracy (Mintzberg 1979,1981; Freidson 2001). One side is collegial, collectively governed, participatory, consensual, and democratic. The other side of the organization is a Weberian, hierarchical, top down bureaucracy with descending lines of authority and increasing specialization. These organizational structures have implications for the differential interpretations of and responses to legal mandates, for how regulation is experienced, and what self-governance might mean. Herein also lies the gravamen of the EPA's complaint and the heart of the regulatory dilemma.

What was regarded as academic freedom by the faculty and University administration looked like mismanagement to the EPA. What is required by the EPA - consistent conformity - is abhorred by the University. The EPA mandate is directed to the entire University organization, but in fact the

University is at least two organizations and many local cultures. Thus, the following discussion will be presented in four sections: (1) scope of the EPA findings and consent decree; (2) faculty interpretations of environmental regulation; (3) staff interpretations of regulations; and (4) institutional approach to the consent decree.

(a) Scope of the EPA findings and consent decree. Three years prior to the filing of the consent decree, the EPA gave notice to the University that it would be conducting an inspection. Immediately, negotiations began to determine which of the more than 500 laboratories and departments would be inspected and when. Given the wide range of activities and types of possible contaminants, it was important to see different kinds of laboratories and functional areas; yet it would be impossible to visit every location where there might be emissions, spills, or hazardous waste. The University had established a very good record for compliance with OSHA regulations. The University had also invested heavily in a variety of management and monitoring systems with nearly two dozen different offices and committees distributing responsibility for keeping toxic and radioactive materials secure and the staff, students, and faculty safe. Although there were accidents every once in a while - a fire in a laboratory, an eye damaged by a laser because the warning light was not observed by an intruder -- the University's record was remarkably fine with a relatively low rate of accidents and a perfect record with regard to the most hazardous materials. There had been no toxic emissions, no spills, no radioactive leaks, no improper disposal of hazardous materials.

Nonetheless, when the EPA completed its five day inspection, it recorded over 3,000 violations of RCRA, CAA, CWA, and their implementing regulations. Despite the large number of discrete violations, both the EPA and the University regarded all but one as minor infractions.⁴ The University's major failure, according to the EPA, was its lack of uniform practices across departments and laboratories on the campus. There was no clear, hierarchical organizational infrastructure for compliance with environmental laws, no systems approach to environmental management, no clear delineation of roles and responsibilities and, most importantly, no obvious modes of accountability for compliance. One laboratory or department was a model of good practice while another produced no accidents, spills, or emissions but could not demonstrate what practices it followed to prevent such accidents. The line of command from the laboratory or department through the safety office to the leadership of the University was opaque to the inspectors and thus it was impossible to say who was responsible for what.

(b) Faculty response to regulation. The academic side of the organization is administered through a broad hierarchical structure that collects authority in departments, then schools, and then the senior administration. However, this line authority (from department chairs to deans to provost, president, and board chairman), is exercised on a limited number of process (rather than substantive) issues: e.g. budget, hiring, tenure, fund raising, and building. Greatly dispersed authority and autonomous decision making governs most matters central to the University's substantive mission and core activities of education and research. Although few faculty members can determine financial, space, or appointment matters by themselves, or even in collaboration with colleagues, all faculty members independently decide what they will do research about and how they will do that research. With regard to teaching, there is also significant autonomy, although the general topics - rarely the specific content - of courses are reviewed by faculty committees. This system is familiar throughout American higher education and is especially strong at this University. The faculty's productivity and prestige are frequently credited, by the administration, to the degree of system of independence faculty enjoy at this University.

⁴ Examples of the violations included: "failure to label many small containers of hazardous waste with information regarding their contents, the words hazardous waste or the type of hazard associated with the waste"; "failure to mark many small containers of hazardous waste with the date that accumulation began"; "although the University had a spill prevention, control, and countermeasure (SPCC) Plan, as required under the CWA, the plan did not account for all the oil stored on campus..."

To some lab scientists, the law always looks like a hindrance impeding research. Those who view the regulations this way offer dozens of examples of how constrained they are by all the rules and how afraid they are by what might happen with a new "improved" system. *"I would say the ... situation was an adversarial relationship between the safety police and researchers and faculty. Occasionally some sort of proclamation would come through -- like you can't wear shorts if you work in the lab -- that people would treat derisively and ignore totally... The chemists didn't have much respect for the safety inspectors who did come by [for the guys who make the rules] because they weren't as smart in chemistry as we are, and they came and were saying you're not using this properly. But they didn't know what the structure and properties of the chemicals were. They would lose credibility in front of the students. It was a really bad situation."* Disdain for the regulations was publicly displayed by one investigator whose humorous response to a poor inspection was described as follows: *"So Goody, had a bit of a problem [in his lab] -- I don't think its there anymore -- but he had on his website, for a while, a quote from that letter I sent. My words in that letter were that, 'if your group had been here when the EPA did their inspection, you definitely would have been the worst lab in the department'. So he actually had one of those scrolling things on the bottom of his web page -- front of his website - which just had quote 'worst lab in the department' unquote... Then he was supplanted by Shoemaker. When Shoemaker had a bad inspection, I said, 'Oh man, Goody, I don't think you're in the lead anymore. He created a running thing which said, we are no longer the worst lab. For the link to the worst lab etc."* Another researcher explained to me that such outside monitoring is a waste; no one cares more than the researcher to secure his laboratory, the students and post-docs within, and the research animals. *"Look,"* he said, *"it's a big pain because we want the mice healthy. People are going to want them healthy because they can't do their experiments [otherwise]."* Because the scientists care more because they have a direct interest in securing the health and safety of their experimental animals, he claimed, the spot inspections and detective work of the government agencies was a big waste of time and energy.

Of course, not all faculty express this same hostile derision. More importantly, most laboratories are complying with the environmental, health, and safety rules, whatever their opinion about the necessity or efficacy of those regulations. Many laboratories, are examples of perfect compliance; some are doing even more than is required and are models of what a future of sustainable improvement in environmental, health, and safety practices might look like. At several meetings, I have heard researchers echo the comments of one of their colleagues: *"The environmental practices we are trying to get everyone to adopt are not additions to what we do. We have to see these things as part of what we do. We cannot be scientists in one way and environmental citizens in another."*

(c) Staff interpretations. Faculty autonomy contrasts markedly with the tight, hierarchical control that generally characterizes most non-academic departments and offices in the University. The campus facilities (e.g. physical plant, athletics, dormitories, food service, motor pool, accounting, human resources, procurement, community relations, development, public relations, admissions, medical and health services, safety protection office) are managed like most formal bureaucracies with narrow areas of specialization and strong oversight and accountability. The differences in freedom and responsibility are regularly discussed by staff who, even when they are not actually subject to regular supervision nonetheless, define themselves in direct contrast to the tenured faculty. As one facilities manager told me, *"Look, I have to go along with these rules [EPA regulations] no matter what. And I will and so will all the rest of us on this side of the University. If I don't, I get fired. I get fired because my boss gets pissed. My boss gets pissed because the Vice-president gets upset because the University has to pay a fine for my screwing up. But the faculty? Look, they only follow the law if it makes sense to them. They have tenure and an independent stream of revenue. They do what makes sense to them, but they can always find a reason something doesn't make sense."*⁵

⁵ All italicized text, with the exception of cited epigraphs, are quotations from observations and interviews with University staff and faculty.

(d) "The Problem" and the Institution's approach. The way in which these scientists will be environmentally sound researchers is, at present, not entirely clear. What is clear, however, is that the consent decree, as interpreted by both the EPA and the University, demands "consistent conformity" with federal regulations across the entire university -- from the physical plant facilities that are managed by line authority to laboratories in the relatively autonomous spaces of academic freedom. "*The Problem*" appears clear to the three attorneys who have been hired to oversee the design of the new EHS system: this is a classic conflict of cultures; conformity in one culture, by definition, creates deviance in the other (Sellin 1938). While the EPA demands hierarchical control and responsibility from the lab bench to the University President, the same administrators believe that the University produces the very best science by leaving each investigator to design and manage her own research, space, and group. "*The EPA wants specificity and line authority,*" one of the lawyers told me, "*but the University needs flexibility.*" How is the University going to turn the resisters and comics into conformers? How do they plan to create "consistent conformity" without destroying the culture of excellence, flexibility, and autonomy that produces excellence and innovation?

According to one member of the faculty who has been overseeing safety issues in his department, the University must take on the job of regulating itself. His remarks illustrate beautifully the self-regulation that is at the heart of what Foucault described as governmentality (1995) and what Ayres and Braithwaite (1992) describe as responsive regulation. "*It is not good policy for there to be one uniform policy for the entire university. In the past, that didn't produce an effective safety system because of the hostility between the researchers affected and the professional safety people. The researchers felt that they had no stake in the creation of the laws. And the laws, any rules, tend to interfere in some way with research if only in terms of making it less convenient to do certain things. And the fact is that some of the benefits are not immediately apparent like, I'm not going to get cancer thirty years from now. It is not necessarily easy for people to see the long term benefits of these short term inconveniences. The inconveniences feel like they are being applied from on high. Naturally people are less cooperative...If we involve everybody at the beginning making the rules, they are more likely to appreciate why these are important and necessary; they are more likely to cooperate.*"

II. Cultural Variation and Laboratory Practice.

From my research thus far, I have identified eight research laboratories and four facilities departments that vary in their organizational structure, degree of professional autonomy, and compliance with regulatory mandates. Although the organizational structure may not correlate with the local cultures, I will begin my ethnographic exploration by first noting the organizational variation and then trying to map the differences in relationships, interpretive schema, patterns of accommodation or resistance, alongside these organizational dimensions. In this sense, I may be privileging formal structural considerations but only to get started and systematize some of my observations.

Laboratory authority structures vary. Some are tightly managed where weekly group meetings include reports of all "problems," "accidents," and other housekeeping matters as well as the central discussion of the progress of the research. As one principal investigator ("PI") told me, "*I don't want them to tell me every time there is a jar without a cap, or a torn label, but they sure enough better tell me at the end of the week how many there have been this week. Otherwise how I am going to correct the problem.*" "*How do you correct the problem,*" I asked. "*It depends. This is an educational institution after all. You always get a chance to improve. But if there is a character who is creating repeated problems, and dangerous condition for everyone, I don't want him in my lab.*" Other PIs don't want to be bothered daily, or weekly. Some have lab managers who are supposed to take care of all of this housekeeping and bother the PI only for problems they cannot handle themselves. This distant management may generate a very different set of relationships and norms,

specifically conveying a very different commitment to the safety regime. I need to observe the variations within and across the labs. I will distinguish laboratories in which the PI's authority and management of the day to day lab is tightly coupled from laboratories in which the PIs authority is delegated. Non-laboratory facilities are managed through typical bureaucratic hierarchy of command and control, surveillance and discipline.

Laboratories also vary in the degree to which they actually pose an health, safety or environmental risk. Some laboratories are using toxic chemicals, biological , and radioactive materials. Others are using lasers on biological and/or toxic substances. Yet others use no biological or radioactive materials but use very heavy equipment with high voltage. Finally, some laboratories have no specifically designated biological substances, radioactive materials, or large equipment but have solvents and cleansers which are often not perceived by the users to require special handling. Nonetheless, they are environmental threats and because of the lack of local sensitivity to their risks, often pose greater hazards. Using the legislated standards of risk for controlled substances, the laboratories range from laboratories whose only relevant substances or equipment are solvents and cleansers (low risk) to those using radioactive materials on biological phenomenon (high perceived risk). In between, we have laboratories that use lasers and other potentially risky equipment on various materials.⁶ Finally, the laboratories and facilities vary by the degree to which they have been considered good or bad actors in the past, model citizens or needing improvement. I have schematically summarized these variations in Table 1.

	Research Laboratories				Facilities	
	tightly coupled authority		delegated authority			
	<i>high risk</i>	<i>low risk</i>	<i>high risk</i>	<i>low risk</i>	<i>high risk</i>	<i>low risk</i>
model citizens	Lab A	Lab B	Lab C	Lab D	Facility I	Facility J
needs to improve	Lab E	Lab F	Lab G	Lab H	Facility K	Facility L

III. Theoretical Resources

Regulatory Enforcement and Compliance: An Instrumentalist Perspective. Studies of regulatory enforcement have occupied socio-legal scholars for a long while as part of an effort to describe the relationship between law-on-the books and the law-in-action. Taking the instrumentality of law quite seriously, that law is not merely a symbolic articulation of general norms but a use of state power for organizing social relations and producing specific conditions, research has attempted to document the ways in which law succeeds or fails in its regulatory capacities. Through the 1980s, however, researchers declared the regulatory state a failure (Sunstein 1990). A consensus developed among scholars that things never quite work out as they ought when legislation is translated into administrative enforcement. Much effort was devoted to understanding and attempting to explain how agencies mandated to serve the public become ineffective and indolent, often ending up serving the very same interests they were meant to control (Bernstein 1995, Edelman 1964, Shapiro 1968,

⁶ The Center for Disease Control identifies four biosafety levels for activities involving infectious microorganisms and laboratory animals. The levels are designated in ascending order, from Biosafety Level 1 (BL1) to BL4, according to degree of protection provided to personnel, the environmental, and the community. Most University laboratories with biological organisms are BL1 or BL2. BL3 and BL4 laboratories are normally isolated from other laboratories.

Kolko 1965, Orren 1974, Sunstein 1990,). The explanations ranged from analyses of the symbolic nature of the legislative process that produces inconsistent mandates (Edelman 1964), the inevitability of discretion (Davis 1972; Kadish and Kadish 1973), to analyses of the segmented structure of a system that encourages a division of the commonweal among interested parties to the exclusion of the unorganized public (Lowi 1969; 1978). Looking closely at enforcement practices among low ranking "street-level" agents entrusted with day-to-day enforcement responsibilities, researchers showed how, by choosing among courses of action and inaction, individual law enforcement officers become the agents of clarification and elaboration of their own authorizing mandates (Jowell 1975:14). It appears that in the process of "working out" and "working in" legislative mandates, organizations -- through their agents -- cannot help but modify the goals they were designed to serve (Hawkins and Thomas 1984, Silbey 1980-81, 1984; Bittner and Silbey 1982, Lipsky 1980).. Thus, it was suggested that excessive or uncontrolled discretion impedes the efficacy of regulatory schemes and, more importantly, undermines the rule of law because it leads to lax and inconsistent enforcement colored by non-legal considerations.

In response to the discovery of discretion and its consequences, more extensive rulemaking was attempted to confine, structure, and review administrative discretion. Bardach and Kagan (1981) noted a shift "away from a traditional enforcement style that relied heavily on persuasion, warnings, and informal negotiations, and towards a legalistic style that stressed strict application of legal regulations and prompt impositions of heavier legal sanctions for all detected violations." They described a system of legalistic rule writing and unreasonable regulation: one size fits all regulations that ignored variations in industrial and geographic conditions. To prevent capture in the field, policymakers seemed to adopt a precautionary principle -- if there is any risk, regulate - that led, like the discretionary model, to its own unintended consequences. Unreasonable, legalistic regulation seemed to encourage corporate resistance. Companies would do the minimum that would be acceptable under the rules and then expend huge sums on legal teams who would actively resist the regulations through litigation and lobbying.

Since the publication of these classic studies, regulators have adopted more pluralistic approaches. The policies are variously labeled, emphasizing one or another aspect of rule making or enforcement practice: e.g. deterrence and compliance (Reiss 1984); technology based regulations or best means available versus performance based standards (Sunstein; Morag-Levine); command and control (Fischer and Schot 1993) and adversarial regulation (Jasanoff 1990) versus creative compliance, (McBarnett and Whelan 1997, Baldwin 1997), cooperative, negotiated (Suskind and Cruikshank 1987, Harter 1982; but see Coglianese 1997,2001) or responsive regulation (Ayres and Braithwaite 1992). Although there have been dramatic improvements through this range of policy initiatives (Bok 1996; Davies and Mazurek 1998; Portney and Stavins 2000; US EPA 2000), most academic observers believe that serious environmental problems persist (Coglianese and Nash 2001; Elliott and Charnley 1998) and continued or sustained improvement is unlikely under these approaches. We seem to have reached a point of diminishing returns. Moreover, it is the new organizational forms characteristic of the information society do not respond well to external regulation.

Organizational Cultures and Governmentality: A Constitutive Perspective. In a very recent comparative study of fourteen sites of environmental regulation, Kagan and Gunningham (2001) show that much of the variation in rate and degree of compliance cannot be explained by economic or legal factors. The authors hypothesize that local organizational cultures may be the most salient variable determining the effectiveness of environmental regulations to transform local practices. This important effort to synthesize the previous research on regulation invites us to look inside the regulated organizations rather than simply at their outputs and thus to introduce a more cultural and constitutive perspective to studies of environmental regulation.

Researchers in various disciplines seem to be reaching consensus that organizational culture is a key variable influencing the dynamics of compliance and the probability of sustainable improvement. Several terms, such as "regulatory culture," "regulatory style," "governing style," "regulatory context," or "policy culture" are used to refer to characteristic features of politics, science and the law that purportedly describe or explain -- it is not clear which -- variations among jurisdictions, agencies, and even nations (Epp 2001; Vogel 1986). Given the wide range of phenomenon covered by the terms and the general lack of specificity, the concept of regulatory culture may mask more than it reveals, creating a new black box of unexplained variation in regulatory practices and consequences. The term regulatory culture often points to what we do not understand about how regulation works or fails to work. Nonetheless, it offers the possibility of an advance on overly instrumental, economic or legalistic analyses by recognizing the interactive, interpersonal ground of social relations through which all law and regulation, as well as science, is constituted. Given the history of regulatory failures and experiments, it is important to focus on this relatively under theorized and understudied facet of the regulatory state.

A cultural (or constitutive) perspective rejects a purely instrumental or functional notion of law as command, a set of devices serving a variety of social purposes (including workplace and environmental regulation), devices that are either effective or ineffective, purposes that are achieved or not. Rather than beginning with the notion that law exists independently and outside of the subjects it purportedly regulates (e.g. persons, workplaces, universities, scientific laboratories), research from a constitutive perspective describes the mediating practices through which micro transactions between persons cumulate and condense into particular forms of subjectivity and distinctive institutions, including law, science, property, or market. From a constitutive perspective, law is more than a set of commands that reinscribes moral values or economic interests existing independently or prior to law, not merely an epi-phenomenon produced by deeper structural forces. As a corollary, the publicly exchanged ideals, aspirations and meanings - cultural stuff of social life - does not exist in pristine independence of aspirations and purposes encoded in law. The purposes and ideals of law (e.g. environmental legislation, regulations, and standards) are a major part of the cultural understandings of what constitutes safety, health, and nature itself (Delaney 2001). What we expect of each other, of the state, of business, of universities and of science, is in part shaped by law, even if those goals are not fully achieved in practice. In both its ideals and its practices (Silbey 1985; Ewick and Silbey 1999), law is part of the processes that actively contribute to the composition of social forces; law is a part of everyday social transactions without which those relations would not be decipherable or interpretable (Ewick and Silbey 1998). Finally, this cultural perspective overcomes a purely individualistic or subjective conception of law as a linear aggregation of individual actions. The law is not the consequence of independently self-determining individuals who collect their wills for mutually self-interested ends. Rather, individual actions, wills, desires, compliant or resistant actions, are mediated through legal (and non-legal) symbols, institutions, and organizations. This is a reciprocal and recursive process of mutual construction; neither law nor social relations (science, property, education) exist independently of the other.

In order to understand the constitution⁷ of regulation, what some might consider a much deeper form of efficacy, we need to locate the EHS system within the various forms of governance operating in the University. Science and technology studies, and others who study organizational cultures, have begun to do exactly this, to document the ways in which organizational contexts provide the conduits between formal law, organizational contexts, and scientific practices (Jasanoff 1987,1990). Although a mature conceptual framework is not yet in place "for addressing the constitutional implications of epochal changes in science and technology" (Jasanoff 1999), evidence is accumulating about the ways in which "modes of authorization in science and the law build upon,

⁷ "The notion of constitutions has to be broadened to include the full range of processes by which individuals in modern societies order their relationships with the institutions that govern their lives." (Jasanoff)

mimic or incorporate one another" (Jasanoff 1991:1,2; Smith and Wynne 1989; Wynne 1982, 1988, 1989).

Just as the law can be understood to both constitute and be constituted by everyday social interactions, so too, "the products of science and technology (or technoscience) not only influence but also, importantly, embed human norms and institutions (Jasanoff et. al 1995). Technological artifacts such as ozone holes, genes, Dolly, smart bombs, computers, and the oncomouse are all seen by S&TS researchers as repositories of human commitments, reasoning, moral judgments, and social practices" (Jasanoff 1999; , see also Bijker et. al. 1987; Haraway 1991, Latour and Woolgar 1979; Latour 1988, 1993; Mackenzie 1990; Pinch 1993; Star 1999). Although much modern culture attempts to keep separate the worlds of nature and culture (e.g. science, politics, law), they are nonetheless so intimately married in our language, law, and science that we rarely take account of the implications (Latour 1993, Delaney 2001). Although contemporary scholars have become hypersensitive to this pervasive hybridity, we have not yet accounted "satisfactorily for the [distribution of similarities and] divergences among our constitutional understandings [of science and law] in different times and cultures" (Jasanoff 1999).

Two insights from these constitutive perspectives on law and science will be important in guiding this ethnography of environmental regulation of laboratories. The first derives from the work of Michel Foucault and his followers who have theorized historical transformations in social control. By describing local practices in medicine, criminology, alcohol control, and risk management, scholars have been able to document more systemic, institutional changes (Foucault 1979,1980, 1995; Baker and Simon 2001; Valverde 1998; Rose 1989, 1999; O'Malley 1994, 1996). Rather than punishing bodies (as we did for thousands of years), or purposely rehabilitating personalities (as western societies did for the last two centuries), much contemporary social control is exercised at a distance by regulating space (Ewick and Silbey 2002). In its engagement with science, this regulation at a distance is quite marked, as some of the faculty's comments and the University's first responses to the consent decree suggest. In this system that Foucault termed "governmentality," the law identifies the kinds of spaces that demand regulation (e.g. research laboratories, swimming pools), spaces in which an organization then defines for itself and its members what constitutes compliance. In this post-modern form of regulation "at a distance," scientists take on the mission of the law, align their interests with those of the law, and produce through this process "the content of the form" - of both law and science (cf. White 1987). Not only is this regulation less general because it is more directed, it may also be more efficient because it is more specific; it may also be more efficient because the individual becomes her own agent of enforcement - choosing to enter and conform or remain outside the regulated space.

Science and technology studies have adopted the term "boundary work" to describe the social transactions that mediate between law and science (Gieryn 1995, 1999). Scholars vary in the degree to which they see these boundaries as more or less given, or in the process of being built, maintained, defended and broken down (Miller 2000). Nonetheless, "recognizing that there is no unbridgeable chasm between science and nonscience and that the flexibility of boundary work may threaten some important values and interests," scholars have suggested that boundary objects and standardized packages stabilize boundary work by creating shared practices (Guston 2001:400; Fujimura 1991, Moore 1996; Miller 2001). Guston suggests, however, that "more general changes in culture or more specific changes in practices may be necessary" to mediate the law/science boundary. (2001:400-401). Boundary organizations may provide just those needed opportunities "to create boundary objects and standardized packages and to involve participation of actors from both sides of the ... frontier of the two relatively different social worlds of [law] and science" (Guston 1999, 2000, 2001). It may be useful to analyze the University's proposed EHS system, and the EHS office specifically, in terms of the boundary work they do translating legal mandates, expectations of hierarchical control, and aspirations for consistent conformity into the culture of frontier science and how the scientists penetrate the regulatory mandate to forge accommodations for their familiar work patterns. Because a

boundary organization serves two masters, Jasanoff (1996:397) has labeled its work, "co-production," the simultaneous production of knowledge and social order. In other words, from the perspective of this research project, the boundary work could produce "green" laboratories.

Thus, the consent decree between the EPA and the University is a policy experiment hoping to produce innovative and sustainable green practices. Adopting a cultural perspective, the research question shifts from whether regulation works to how regulation is interpreted and experienced. Theoretical work on the implementation of regulation suggests three hypotheses,⁸ which will guide this study.

- 1) To the extent that a regulatory model assumes that organizations are bureaucracies, where new rules can be added to old rules with direct lines of responsibility and accountability, EPA compliance will have an easier ride on the administrative than on the academic side of the house.
 - a. It follows, therefore, that implementation will occur in a cost effective way;
 - b. It also follows that implementation will result in more compliance.

- 2) Differences in the implementation of EPA guidelines are not just observable through differences in outcome and measure, but also in the degree to which the legal norms of environmental regulation are constituted in and through the culture of the organizational unit.
 - a. To the degree that an organization is more professional in its organization and culture or shares a commitment to "green" practices they will be more compliant;
 - b. To the degree that an organization is professional in orientation and culture, it will be less concerned with the costs attached to implementation.

- 3) Boundary work will be stabilized through the consensually created training and "licensing" systems created to implement the consent decree.
 - a. To the degree that inspections and enforcement is a collective responsibility, not located at either side of the boundary between science and regulation, it will be more effective and resisted less.
 - b. To the degree that the EHS system creates possibilities for local adaptations rather than a uniform, one model fits all, organizational structure across the boundary, compliance will be more consistent.

IV. Research Design and Work Plan

For this project, I will be conducting ethnographic fieldwork in the University to document and analyze the creation of a new EHS system for research laboratories. The fieldwork activities include interviewing, observation, and document collection. It is sometimes supplemented by systematic data collection with standardized instruments for observation and via small surveys. According to Van Maanen, "fieldwork usually means living with and living like those who are studied. In its broadest, most conventional sense, fieldwork demands the full-time involvement of a researcher over a lengthy period of time (typically unspecified) and consists mostly of ongoing interaction with the human targets of study on their home ground" (1988:2). Ethnography is the written product of the fieldwork and a standard method for those who wish to describe the culture of a group or organization. As the written representation of a culture (or selected aspects of a culture), ethnography "carries quite serious intellectual and moral responsibilities, for the images of others inscribed in writing are most assuredly not neutral. Ethnographic writings can and do inform human conduct and judgment in innumerable ways by pointing to the choices and restrictions that reside at the very heart of social life" (Van Maanen 1988:1). In effect, as Van Maanen writes, "ethnographies join culture and fieldwork...[they] are documents that pose questions at the margins between two

⁸ Of course, ethnographic research does not test hypotheses. But formulating my questions this way provides a measure of synergy with research using other methods.

cultures. They necessarily decode one culture while recoding it for another" audience (Barthes, 1972).

In this project, I will attempt to accurately represent the current and changed practices in the laboratories, the EHS office, and the administration of the University. While representing the daily routines, decision making processes, and official policy changes, I will also depict these everyday practices in and through the lenses provided by social scientific research on regulation and laboratory science. I will be guided in my observations and interviews by the questions derived from previous research on regulation, organizational cultures, and scientific laboratories as outlined above. Finally, an ethnography that is sensitive to social structures seems the only way such a study could be done. Because my focus is the intersection of three social phenomenon - state regulatory bodies and regulations, university organization and scientific laboratories, my sites include the university structures, changes in those structures in response to the regulatory mandate, the scientific laboratory and changes in response to regulation.

Work to date. During a sabbatical leave, spring semester 2001, I began the preparatory research on this project. I submitted a human subjects application to the University's Institutional Review Board and received approval for the project and the consent forms that will be used for all observations and interviews.

Formal Committee Meetings. In April 2001, I began observing committee meetings, small group meetings, as well discussions among the University's counsel and staff as they completed negotiations of the consent decree and initiated the process of designing a new EHS system. Since September, I have been aided by a research assistant who attends meetings during my class hours or large meetings where it is helpful to have more than one observer. The formal meetings include those of a committee for facilities, a committee for research laboratories and a committee of administrators and faculty overseeing the work of these two working committees. One or both of us attend each meeting, sitting silently at the side of the room, taking notes on the proceedings. I sometimes interview members of the committees individually; We receive copies of all documents and have been included in all mailing lists.⁹

Interviews with key informants. I have also been interviewing senior administrators,¹⁰ key faculty, and members of the committees overseeing health, safety, and environmental policies and practices. The purpose of these interviews is to develop a firsthand understanding of the decision making process and goals of the Environmental Management Systems (EMS), as well as the history of the negotiations that led to the consent decree.

Laboratory visits. Since September 2001, I have been visiting laboratories and interviewing lab directors, PIs, some safety and chemical hygiene officers within labs and on the EHS staff. I have also been observing the meetings of facilities managers as they discuss the forthcoming changes in the EHS system and their concerns. From these observations and interviews, I have identified the variation that seems to exist in organizational structure, risk, and past performance.

⁹ I have been given permission for this activity by the chairs of the committees and the directors of the EHS initiative, the attorney hired by the University to manage this process. I have secured Human Subjects approval from the University for my observations of committees, laboratories and interviews with students, faculty, staff and administrators.

¹⁰ A portion of these interviews will focus on the lawyers who are supervising the project, and working as in-house counsel to the University. This is not a direct focus of the project but it is too rich a source of data to forgo the opportunity to create a small comparison to other studies of the legal profession and especially in house counsel.

Work to be done: I will continue these activities: observing committee and small group, as well as large public, meetings., and interviewing key informants. In addition, I will be expanding the research sites to include the EPA agents, the EHS management office, and more consistent daily observations in the laboratories and facilities.

One on one interviewing. I have completed some in-depth, long interviews. I will be doing more throughout the project. Some interviews will be more formal scheduled sessions, the questions prepared in a semi-structured protocol, i.e., a series of open ended questions that are designed to allow the respondent to describe, in his/her words, the rationale, goals, problems and policy solutions. The interview will be developed, however, only after more observation in the laboratories, and of the committee work, so that the questions will respond to what I have observed. In addition, interviews will be conducted, informally, with students working in laboratories, while they are working there, and with staff and faculty before and after meetings which include the large committee meetings, small group discussions, and large public meetings organized to solicit feedback from the University community. For the most part, these informal interviews seek informants' interpretations of what is happening in the meetings or laboratory. Usually, I ask questions in the context of an ongoing observation or conversation among the parties I am observing.

EPA administrators and agents. Also, I hope to be able to interview the agents who inspected the University three years ago and the lawyers who negotiated the consent decree. My interviews with the University's attorneys have provided some background for the project but I hope to gather additional information about the EPA's perspective.

Environmental Management Office. With this grant, I hope to place a research associate in the Environmental Management office for daily participant observation. This office is a new phenomenon in the University and one of the first products of the consent decree. Until the last summer, responsibility for overseeing various forms of safety and health hazards on campus had been distributed among 20 or more different offices (e.g. radioactive materials, biological materials, toxic waste, environmental health, chemical hygiene, lasers, fire prevention, etc.). A person seeking permission to use radioactive materials would call one office and call another to discuss a proposed laser experiment. If the sample to be analyzed included biological materials, a third distinct person needed to be brought in to secure the local campus "license" to use the materials or equipment. No research could proceed without the local permits, but coordination was the individual researcher's responsibility, compliance with the permit was also the individual researcher's responsibility, and if there were any problems, it was the individual researcher's job to find the right staff office and person from whom to get help. This was the system of dispersed responsibility that the EPA considered no system and no accountability for compliance. The first step of reorganization has involved the creation of a central Environmental Health and Safety office with a hierarchical structure and division of labor for the distinct laboratories and investigators on campus. The current slogan used by the EHS to characterize this transformation is "one number, one person." All departments and laboratories on campus will eventually be assigned a dedicated EHS liaison who will collect from among her colleagues in the EHS office the relevant persons and expertise needed for the particular laboratory and experimental materials and conditions. These changes are just beginning with the move to new offices as the first step, spatially as well as organizationally consolidating the expertise that had been distributed across the campus.

The EHS office is an example of what Guston (2001) calls a boundary organization. The changes in this office are critical for the laboratory scientists because, "for most people, the legal system is both remote and arcane, and popular understandings of law and legality come largely from day to day experience in concrete bureaucratic settings, not from exposure to abstract doctrine (Macaulay 1987; Sarat 1990; Ewick and Silbey 1992, 1998a, Fuller et al, 1997). In mundane organizational encounters, formal structures - [such as an EHS office] - symbolize commitment to legal objectives, while informal norms give content to legal principles" (Edelman and Suchman:500).

Thus it is critical to observe the relationship between the transformations in this office and transactions with the laboratories.

Laboratory Observations. Laboratory observations are key to this project. These will take place across a spectrum in which past practice and need for improvement varies with the authority structure and degree of environmental and health risk in the site. (See table 1 above). I have approached members of the faculty for permission to "hang around" their laboratories, and for my research assistant to do so as well. Interestingly, every member of the faculty whom I contacted agreed to our research in their laboratory. Although it is important to follow the discussions out of which the EHS system design is emerging, it is even more critical to trace the ways in which the law, the EPA, and the regulatory regime is being interpreted and responded to by actors within the organization. The entire EHS organization is created and mobilized to serve the research ongoing in the laboratories and, thus if we are to bridge previous research on regulation with an analysis of the organizational contexts of compliance, we must spend most of our time at this ground level of EHS practices. The culture of autonomy and freedom that characterizes the university has its *raison d'etre* at this ground and center of the University's organization. If there is to be compliance, or violation, of federal law, it will be in the laboratories.

Although the variation among laboratories (Table 1) resembles the format for presenting the results of a quantitative data analysis more than a project of participant observation and ethnography, it seems useful to represent the systematic nature of the fieldwork. By conducting interviews and observations in laboratories and facilities that vary along these dimensions, I will be able to distinguish compliance practices in organizations that are within the line authority of the University administration (where staff are directly accountable to supervisors with responsibility for evaluation and termination) from compliance practices in the domains of academic freedom, with mentoring relations between faculty and students, and collegial relations among faculty and department chairs and Deans. By studying the laboratory/facilities practices and the EHS office, I will be able to compare the interpretations of law and regulation (of what constitutes risk and safety, of what may provide minimal versus sustainable improvement) by those directly enacting those practices with those responsible for providing only technical assistance.

Data management. All field notes are typed up using Microsoft Word and kept in files organizationally and by topic. We record in our notebooks a description of what is going on in front of us and our queries about what is happening. These notes are typed up at the end of every day or at most at the end of two days. All tape recorded interviews are transcribed by a person hired for this purpose. The transcriptions are also kept in Microsoft Word files. These are backed up regularly, and printed out as completed. Because of the number of interviews already conducted, ongoing, and to be continued, management of the transcriptions and files this is a time consuming process. I am planning to hire a person to work 3/4 time on this task alone rather than hire an assortment of people to do the transcribing as I have been doing.

Data analysis. The goal of my analysis is to specify the various ways in which research scientists and others subject to regulatory regimes express and interpret their relationships to law and legal institutions, as well as the specific goal of sustainable green laboratory practices. I want both to capture my informants' words and interpretations as well as identify analytic and conceptual themes of concern to socio-legal scholars, social studies of science, as well as government regulators. Thus, my analysis of the field notes and interviews will develop from my general understanding of the literatures on regulation, governmentality, organizational contexts, and science practices, with an openness to the need to reformulate questions and categories as new themes emerge from the data and fieldwork. I will work through the interviews and observation notes in a progression of increasingly contextualized interpretations from manifest content (specific language) and references. The next stage of the analysis, and the more familiar method of ethnographic interpretation, will move away from the observation of discrete phrases toward an examination of the thematic content. Once again,

my strategy will involve an attention to both theoretically and empirically emergent themes as well as references in the literature. Obviously, the analysis of thematic content is considerably less mechanistic than the syntactical content analysis. Words are discrete, visible, and easily identifiable units that can be observed, counted, and measured. The identification of themes is, however, more dependent upon the researchers' close reading and interpretation of the narrative structure of the interviews (Ewick and Silbey 1995)..

Feasibility, time allocation, and work products. I will spend approximately 3/4 of all non teaching time on this project and one half of every summer. The post-doctoral associate will spend full time on this project for two years and two summers. The technical assistant will spend 3/4 time transcribing interviews and managing the data files. Although the University's design, implementation, and dissemination of the EHS system will take four more years following the start of this grant, I can complete some aspects of the work within the two year period of the grant. I can complete the analysis of the consent decree negotiations, the responses of the various constituents in the University to the results of the inspection and the consent decree. I can also complete an account of the transformation of the EHS office organization and the first adaptations by the staff to the new centralization and reallocation of responsibility. Also, I will be able to observe the practices in place and the organizational changes mandated under the new system, along with the first adaptations in those labs that redistribute responsibility over the summer of 2002, as some plan to do. Thus I will be able to compare laboratories undergoing changes with those anticipating but not yet reacculturating themselves. The anticipation of change seems to be provoking resistance in some quarters while it is welcomed in others. I will be able to follow these adjustments as they are happening. I plan to spend all research time observing and interviewing from July 2002 through December 2003. I plan to spend from January 2003 through June 2003 writing papers for publication and presentation at professional conferences (Law and Society Association, American Sociological Association, and Society for Social Studies of Science).

V. Previous NSF Funded Research. None within last five years.

VI. Significance

Everyday social transactions now take place through new organizational forms, through intelligent machines, distant connections, and virtual worlds. Yet, we operate with models of law and government that were invented more than two hundred, even two thousand, years ago. This project will follow the development of a model for how government can regulate in the public interest inherently innovative and flexible organizations - just those kinds of organizations that have both invented and typify our contemporary social worlds. How can government regulate these organizations -- scientific laboratories -- especially when they are embedded in an institution that prizes academic freedom? This is important not only because of the increasing significance of scientific and educational institutions in our current economy, but also because these institutions serve as models for new emerging organizational forms which depend on innovation, flexibility and large knowledge bases. Importantly, creating safe green laboratories can provide a model of how we can have both freedom and safety.