Best Management Practices and the Mitigation of Dust Pollution: An Arizona Case Study

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ABSTRACT

This study explores recent rulemaking interactions of agricultural and regulatory parties in developing best management practices for agricultural dust control. Regulatory outcomes are predicted based on each party's interests and power utilizing a mutual gains negotiation framework. A triangulated research design reveals that the final rules satisfied the economic objectives of agricultural interests, met the rulemaking expediency of the regulators, and likely failed to significantly mitigate dust pollution. The analysis provides rare empirical support for the concern that a collaborative rulemaking process can be captured by regulated interests in the sense that required changes in regulatee operational practices are minimized in the adopted regulations with the, at least temporary, approval of the regulator.

Key words: best management practices, dust pollution, negotiation, rule making, regulatory capture

JEL Codes: Q15, Q53, Q58

I. INTRODUCTION

Best Management Practices (BMPs), particularly at state levels, are often integrated into the negotiation process used to design rules for environmental mitigation or natural resource conservation. In this broad context, a BMP is "…a practice or combination of practices that are determined (by state or designated…agency) through problem assessment, examination of alternative practices, and appropriate public participation to be the most effective, practicable (including technological, economic, and institutional considerations) means of preventing or reducing the amount of pollution generated by nonpoint sources to a level compatible with … quality goals."(Ice 2004, p. 685). Expectedly, the tradeoff between meeting environmental goals and maintaining economic viability frequently produces tension in the rule design process (Bailey and Waddell, 1979; Murphy, 1979). However, according to Leathers (1991), reaching the socially optimal tradeoff between producer and environmental objectives should be the goal of any negotiated BMP program, tension or not.

A regulatory negotiation process, commonly referred to as reg-neg, provides a mechanism that encourages the design of bargained solutions acceptable to the regulator and the regulatee. Federal agencies utilizing reg-neg procedures are required to follow the guidelines of the Negotiated Rulemaking Act of 1990 (Coglianese 1997; Harter 2000; Pritzker and Dalton 1995; Ryan 2001; Wondolleck and Ryan 1999). Most states follow an ad-hoc reg-neg process based on their adaptation of the federal guidelines to their unique circumstances (Hadden 1995). Advantages of reg-neg procedures include direct representation, reduced commentary on the final rules, higher compliance rates, improved relationships between regulators and regulated parties, better information flows, and greater public support for the rules. Documented disadvantages include the exclusion of some affected parties, high short-term transaction costs, and outcome (i.e. rule) risk (Fiorino 1998; Kazmierczak and Hughes 1997; Kerwin 1997; Langbein 2002; Polkinghorn 2000).

Outcome risk may emerge when state agencies encourage regulated interests to collaborate in rulemaking. The targeted regulatee may capture the reg-neg process by designing rules that benefit them and not the general public (Stigler, 1971). In their synthesis of the regulatory capture literature, Levine and Forrence (1990) argue that slack--discretion or freedom in rulemaking--represents a necessary condition for regulatory capture. Slack generally exists when monitoring the rulemaking process represents significant transaction costs for other stakeholders. Capture, according to these authors, only occurs when the regulator expects to benefit personally by adopting rules that (1) favor the regulatee and (2) would be opposed by the public. Otherwise, rule making is either Burkean, when the other-regarding regulator promotes rules that the public may or may not support, or a “happy accident” when the policy outcome of the self-interested regulator and the public interest coincide.

Zinn (2002) also recognizes the policy outcome risk associated with reg-neg rulemaking. But rather than defining regulatory capture as binary as do Levine and Forrence, Zinn argues that the degree of capture falls on a continuum where personal enrichment on the part of the regulator is an extreme position. Regulators are exposed to a wide range of pressures and incentives that may move them towards the regulatee's position without requiring some form of personal, individual reward. Political pressure for a timely agreement, budgetary concerns associated with negotiation and implementation, shared regulatory norms and interests, agency discretion (i.e. slack), a desired reputation for collaboration, and the lack of competing interest group involvement (i.e. asymmetric participation) are all factors that determine where the rulemaking process will emerge on the capture continuum. State agencies may benefit, at least organizationally, from capture-like outcomes because they want to minimize complaints from stakeholders, reduce rulemaking costs and deter future litigation (or all of the above). While an expansive literature exists on the theory of regulatory capture, the authors are unaware of any detailed empirical analyses of capture outcomes emerging from the reg-neg process.

The following section presents a brief overview of a rulemaking environment that utilized a reg-neg, BMP design process in Arizona: fugitive dust control. The next section presents a standard mutual gains model that captures the negotiation process for the regulatee and regulator when the payoffs to negotiation are uncertain, followed by a discussion of our triangulated research design. The results are discussed in the context of the mutual gains model and the paper closes with an evaluation of the BMP process as a potential example of mutually advantageous collaboration or regulatory capture. Our hypothesis is that agricultural bargaining power in the reg-neg BMP process led to the legal codification of dust control improvement strategies that were already in common use on most Arizona farms at the time of the negotiations—thereby largely maintaining the status quo.

II. RULEMAKING BACKGROUND

In 1991, the Environmental Protection Agency (EPA) classified portions of Maricopa and Pinal counties in central Arizona as moderate PM_{10} nonattainment areas in violation of the National Ambient Air Quality Standards (NAAQS) of the Clean Air Act (ADEQ 2001a,b; EPA 2001; Fields et.al. 2001). The majority of this 2,916 square mile nonattainment area is in Maricopa County (2,880 square miles) and encompasses the entire Phoenix metro area. PM_{10} is particulate matter composed of small dust particles 10 micrometers in diameter or smaller. The deadline to attain NAAQS was set for December 31, 1994. For the next seven years, the Maricopa Association of Governments (MAG) and Arizona Department of Environmental Quality (ADEQ) struggled to (1) develop and implement a court and EPA acceptable state implementation plan (SIP) and (2) meet court and EPA compliance deadlines. During this period, the EPA reclassified the Maricopa County nonattainment area as serious and re-initiated, in 1997, the development of a federal implementation plan (FIP). As part of the renewed FIP, the EPA initiated collaboration with both the agricultural community and ADEQ to develop PM_{10} control strategies (i.e. reasonably acceptable control methods (RACM) and best available control methods (BACM)) for agricultural sources of fugitive dust.

Within this turbulent tension-filled policy environment, Arizona's governor signed into law Arizona Revised Statutes (ARS) §49-457 (Arizona Best Management Practices Committee) in May 1998. This statute required (1) the state to adopt an agricultural general permit rule, based on BMPs, by June 10, 2000, and (2) farms to adopt the BMPs required by the rule within 18 months of rule implementation. Meanwhile, the EPA promulgated a FIP that included a commitment to (1) propose a RACM for agricultural dust sources by September of 1999, (2) finalize the RACM by April 2000, and (3) implement the control measures by 2001. In September of 1998, ADEQ submitted ARS §49-457 to the EPA for meeting the RACM requirements of the CAA. ADEQ requested that the EPA approve ARS §49-457 in the SIP to replace the EPA's FIP. In December 1998, the EPA proposed approval of ARS §49-457, then finalized this approval, and in June 1999 withdrew their FIP requirements.

ARS §49-457 established a PM_{10} committee and specified the requirements for the PM_{10} BMP permit. BMPs are defined in this law as "techniques verified by scientific research, that on a case by case basis are practical, economically feasible, and effective in reducing PM_{10} particulate emissions from a regulated agricultural activity" (ARS §49-457, (N)(3)). The statute detailed the committee membership as follows: the director of ADEQ (or director's designee), the director of Arizona's Department of Agriculture (ADA) (or director's designee), the dean of the College of Agriculture and Life Sciences (CALS) at the University of Arizona (or dean's designee), the state director of the U.S. Natural Resource Conservation Service (NRCS) (or director's designee), a soil taxonomist from the University of Arizona, and five agricultural producers representing a specific crop: alfalfa, citrus, cotton, grain, and vegetables. The governor made committee appointments for a six-year term. The committee's chairman could be reelected after an initial two-year term. In addition, the PM_{10} BMP Committee could establish a technical committee to generate science-based recommendations.

III. A CONCEPTUAL FRAMEWORK

The mutual gains negotiation model represents a useful analytical framework for the evaluation of potential rulemaking conflicts associated with dust mitigation (Susskind, Levy, and Thomas-Larmer 2000). The model hinges on negotiating parties understanding each other's interests and creating agreements that result in net gains for all involved. A potential negotiation, using the dust mitigation context, is illustrated in Figure 1(a). Each axis is the satisfaction index of the negotiating parties. Satisfaction may also be referred to as "gains", "welfare", or "well-being". A movement northward on the *y*-axis is an increase in the welfare of player A (Agriculture). Likewise, movement to the right on the *x*-axis is an increase in the R's (Regulator) welfare. Each party has a reservation value, their best alternative to a negotiated agreement (BATNA), represented as dotted lines *a* and *r*. In order for the two parties to enter into a negotiation, they must expect that the resulting reg-neg BMP program will be no worse than either of their BATNAs; otherwise, the adversely affected party will choose not to negotiate. At the point of intersection of *a* and *r*, L represents the worst-case scenario that can be achieved through negotiation. Beyond L (to the "northeast") lies an area for which both parties increase their satisfaction by negotiating (zone of potential agreement (ZOPA)). The ZOPA is bounded by the set of efficient agreements for which the maximum possible gains are achieved (the negotiation possibilities frontier (NPF), or efficient frontier). There can be a wide range of agreements along the NPF, some which may favor agriculture (A*) and some of which may favor the regulator (R*). All points on this NPF between M and N are Pareto-efficient, such that maximum possible gains are incurred and neither party can do better without making the other party worse off.

A Nash cooperative bargaining solution demonstrates the importance of bargaining power in this mutual gains model (Dixit and Skeath 2004, pp. 566-575). A's BATNA is to accept an alternative rule designed by R. Assume the opportunity costs associated with this outcome are designated as *a* (Figure 1(b)). If negotiations fail, A cannot expect a better outcome from the R-designed rule than *a*. The net gains to negotiation available to A are associated with moving northward on the y-axis (y-a). Similarly, R's gains from negotiating will be designated as x with the opportunity cost for failure being r, the regulator's BATNA with the net benefit being x-r. The NPF can be represented by $y=f(x)$ where along this frontier lies the set of maximum possible allocations of gains from negotiation available to either party: A receives a total payoff of y-a and R receives a total payoff of x-r.

Now assume that some division of gains is received by each of the bargaining parties such that R receives an h-proportion of the surplus, A receives a k-proportion of the surplus, and the two proportions sum to one. So the objective function to be maximized is $(x-r)^h(y-a)^k$ represented by the contract curves c_1, c_2 and c_3 where $c_1 < c_2 < c_3$ with regard to overall participant satisfaction. To find the cooperative solution to this negotiation we choose x and y to

$$\text{maximize } (x-r)^h(y-a)^k \quad \text{subject to } y=f(x) \tag{1}$$

which gives the unique Nash cooperative solution:

$$(x-r)/h=(y-a)/k \text{ or alternatively } (y-a)/(x-r) = k/h. \tag{2}$$

The final negotiated outcome is dependent on the bargaining power of either party (h and k). The highest possible contract curve subject to the NPF in Figure 1b is c_2 so the tangency (O) is the optimal solution for the negotiation given levels of h and k.

Since the proportions of bargaining power affect the shape of the objective function, there is a range of efficient, optimal solutions for the negotiation. Each of the possible optimal solutions lies along the efficient frontier. As one party's bargaining power increases, the stronger negotiator influences the objective function such that the set of available contract curves (and the optimal agreement) moves in their favor along the NPF. Embedded in the bargaining power variables, h and k, are the abilities of A or R to change one another's perception of the BATNAs, interests, and satisfaction received from the agreement. An increase in h decreases k, corresponding to an increase in *(x-r)* and a decrease in *(y-a)*, respectively. As *h* increases, the set of efficient agreements available become more attractive to R and less so to A. Assume here that point O in Figure 1(b) represents the case where *h* and *k* are equivalent. Then any increase in *h*, or movement southeast away from O on the NPF, means the regulator (R) fares better. All bargaining power belongs to the regulator (*h*=1) at N. Similarly, as *k* increases the efficient agreement shifts northwest along the NPF, improving the outcome for agriculture, the regulatee. When *k*=1, agriculture holds all the bargaining power and the agreement is at point M.

IV. EMPIRICAL PROCEDURES

Case studies provide an opportunity to analyze events of a cause and effect nature that are outside of the investigator's control, thereby making this research approach valuable for understanding the origin, operations, and impact of reg-neg programs and the possibility of regulatory capture (Eisenhardt 1989; Helper 2000; Kennedy and Luzar 1999; Yin 1994). Our triangulated method of case analysis first relies on background information from regulatory documents, published literature, and interviews with both state and federal officials familiar with, but not directly associated with, the rulemaking process (Denzin 1971; Marshall and Rossman 1999; Mohr 1995; Patton 2002). The second component, BMP committee member interviews, provides us with an eyewitness understanding of the reg-neg BMP design process. Finally, a scoring survey evaluates technical experts' opinions on the use of BMPs at the farm level prior to program implementation. We utilize the mutual gains negotiation model to synthesize the information from these three sources.

BMP Committee members were selected for interviews based on their identifiable interests. A list of expected first-best respondents was constructed based on agency affiliation, expected participation, and technical expertise. At least one agricultural representative, one regulator from a governing agency, and one technical expert were chosen for interviews. Those interviewed early in the process were asked to recommend other essential interviewees in order to expand the potential interview pool. The list of final interviewees was determined by their willingness to be interviewed. The original committee appointments (i.e. those that designed the program), a list of all interviewees, and all other survey protocols are available from the authors.

Interview questions for BMP committee members were composed utilizing a two-stage process. First, a list was constructed of all relevant questions about the negotiation process and BMP design decisions. Then these questions were reviewed and revised following the chronological sequence expected for reg-neg design (i.e. decision to use reg-neg, negotiation, rule implementation). This two-stage process produced an interview protocol of six open-ended questions and a series of in-depth, follow-up questions. The open-ended questions were designed so respondents could provide their observations concerning the negotiation process and decision-making. The follow-up questions were reserved for obtaining further details and pacing the interview. Questions required recall concerning negotiation processes that occurred six years prior to the interview. Each respondent received a copy of the questions several days before the interview to allow them time to reflect on past events. Interviewees were informed that their individual views would be kept confidential. Each respondent agreed to volunteer at least one hour of their time for the interview.

Following established case study procedures, the committee interview results were compiled by reviewing each respondent's answers for relevance to the questions and then reconstructing their response following a common chronological interview format. Then the responses for all interviewees were aggregated under each open-ended question and regrouped, when appropriate, into subtopics. Finally a review of emergent themes within the interviews was constructed to capture key components of the reg-neg BMP process into a single narrative.

The expert survey was utilized as a "second best" approach to gather information on BMPs used on farms prior to the regulation; a proposed farm-level survey measuring the extent of *ex ante* and *ex post* dust mitigation practices was not supported by leaders in the agricultural sector. Each agricultural expert (e.g. Extension specialists and faculty) had a professional understanding of farming and worked in the PM_{10} nonattainment area. Each expert was asked to provide their best estimate of the percentage of farms that used each BMP prior to the implementation of the new law. The BMPs were listed and categorized within the survey instrument following each program's enrollment guidelines. The expert scores produce a rough estimate of the degree of BMP use by the agricultural sector prior to the reg-neg process.

The Agricultural PM_{10} BMP Program requires that all farms adopt at least one BMP from each of three categories: Tillage and Harvest, Non-Cropland, and Cropland (Table 1). The scoring model for PM_{10} evaluates one BMP category at a time. Each expert was asked what percent of central Arizona farms used the specific BMP. Two thresholds were set for the scores, at 50+ percent and 80+ percent, to allow for sensitivity and comparison in the analysis. The scoring model for the PM_{10} categories takes the form: If $BMP_i \geq 50\%$ then x_i=1, otherwise x_i=0, and the category point total is the sum $\sum_{i=1}^{n} x_i$, where *BMP* is the percentage score attributed by the expert to the i^{th} BMP in the category, and x_i is the one point score the program awards the farmer applicant. The calculation at the 80 percent threshold takes the same form, where $BMP_i \geq 80\%$.

V. RESULTS AND DISCUSSION

In April 2000, the EPA proposed (1) the approval of the state's Revised Final Plan, and (2) an extension of the serious area attainment date from December 31, 2001 to December 31, 2006. The Agricultural PM_{10} permit was adopted by the PM_{10} BMP Committee in June 2000 and was included in the SIP revision. The PM_{10} BMP Committee identified 30 BMPs expected to reduce emissions in three categories. As noted in Table 1, the Tillage and Harvest category relates to farm management during periods when cropland is physically disturbed. Non-Cropland management consists of land that is not in agricultural production. This may include farm roads, ditches, equipment or storage yards, or land no longer used for crop production. The Cropland category accounts for bare land between harvest and planting periods, fallow lands, and for turn-rows. In order to qualify for the Agricultural PM_{10} general permit, farms must enroll and document the use of at least one BMP from each of these categories in at least one field.

A. BMP Committee Interview Results

In late 1997 ADEQ, MAG, and EPA initially approached the Arizona farming community, during a Farm Bureau meeting, to begin talks with the agricultural community concerning the design of the PM_{10} FIP. According to BMP Committee participants, the EPA was proposing costly FIP measures at that time toward controlling PM_{10} emissions from agricultural sources. The agricultural community quickly mobilized itself and convinced the State Legislature to establish the PM_{10} BMP committee. Members of the Farm Bureau and the vegetable and cotton grower's associations were instrumental in writing and lobbying for ARS §49-457. The precedent for the reg-neg BMP process was established by the Nitrogen BMP rule (ARS §49-248) that was legislated in the late 1980s. The two BMP committees (Nitrogen and

PM_{10}) are structured similarly, with both containing growers from the five major crops in Arizona. The governor selected the specific PM_{10} BMP Committee members who received some preparation, including technical materials and a history of PM_{10} in the Maricopa nonattainment area, as well as mandatory ethics training required of all state committees.

According to PM_{10} BMP Committee interviewees, all parties worked together in a collaborative manner to produce a feasible set of BMPs. During the first meeting, the PM_{10} BMP Committee selected a chairman (a grower) and created an Ad-Hoc Technical Advisory Committee (Ad-Hoc Committee). The first meeting also included reports from government staff on the rulemaking process, the timeline for rulemaking, and background on the PM_{10} problem. Spectators at committee meetings were usually representatives from the EPA (who were not formal members of the committee as the rule was a state-sponsored regulation), agricultural lobbyists, and members of the Ad-Hoc Committee. The public meetings were conducted in an informal manner, allowing spectator input and debate.

Interviewees provided consistent descriptions of participant interests. The dominant interests on the PM_{10} BMP Committee, in number and in persuasive power, were the agricultural interests, broadly defined. Agricultural-connected members provided most of the leadership on both the PM_{10} BMP Committee and the Ad-Hoc Committee. Agricultural members knew each other, while agency representatives and non-agriculture technical experts were unfamiliar with the other committee members. One participant noted that familiarity might have contributed to the decision to elect an agricultural producer as the BMP Committee chair. The goal of the agricultural representatives was to control the costs imposed by the BMPs, according to the respondents. Ad-Hoc Committee experts provided technical expertise on which BMPs would be effective at reducing dust emissions. Some of these technical experts strongly supported agricultural concerns during the discussions. Regulatory agency representatives facilitated the negotiation and the design process, and state agencies provided regulatory information to the PM_{10} BMP Committee during the negotiations.

Interviewed participants provided an in-depth discussion of the deliberation process. The Ad-Hoc Committee developed a comprehensive list of 65 BMPs based on research from a wide range of academic, consultant, federal government, and state (e.g. California) sources. The Ad-Hoc Committee also reviewed questions from the PM_{10} BMP Committee as to effectiveness or applicability of specific BMPs. Most participants agreed that the BMPs selected by the committee were measures that were effective at reducing visible dust, practical to implement (i.e. economically viable), and enforceable. The growers in attendance informed both committees on (1) whether a practice could be implemented, (2) the cost of implementation and (3) how applicable the BMP was to Arizona agriculture.

There were several points of contention debated by PM_{10} BMP Committee members during the negotiations. First, several participants were concerned about the lack of quantitative data available to determine which practices would be more effective in reducing fugitive dust. Some interviewed participants countered that an assessment of each BMP's effectiveness was not necessary because the state requested a reduction in agricultural dust emissions without any specific quantity required. As a result, the committee simply searched for the best practices that could improve air quality. A second point of contention was that the monitoring requirements and specification of general permit requirements were too lenient. Several regulators and technical experts unsuccessfully argued for (1) more prescriptive BMP adoption language in the rule and (2) a more detailed recordkeeping system on how the farm had achieved compliance with the permit.

B. Expert Panel Results

Ten agricultural experts were surveyed to estimate the extent of PM_{10} BMP technology and management practices on farms prior to 2001. Each expert provided an estimated percentage of central Arizona farms, in the subject geographical area, using each BMP prior to the initiation of the PM_{10} program. As noted earlier, the scoring model yields aggregate results for each BMP category at two levels of sensitivity (50+ and 80+ percent) (Table 2). The scores are the total number of BMPs that the expert estimated at or above the sensitivity percentage.

Two of the experts, 1 and 4, scored the agricultural sector as far exceeding the program requirements at both the 50 and 80 percent levels for all three PM_{10} BMP categories. The scores provided by experts 2, 3, 5, 6, and 8 suggest that the Non-Cropland Management was the category most likely not met by the Arizona agriculture sector. At the 80+ percent level, experts 3, 5, and 8 agree that the minimum requirements are met in the Tillage and Harvest, and Cropland Management categories. At 80+ percent, the results of experts 7, 9 and 10 indicate only one category, Tillage and Harvest, was met by the sector prior to 2001. At the 50+ percent level only experts 2 and 10 (with expert 7 abstaining) fail to estimate that the agriculture sector meets the BMP requirements.

The results suggest the PM_{10} BMP Committee incorporated, in at least two categories, BMPs that were already in common use on most commercial farming operations. There were a number of consistently low-scoring BMPs in each category (meaning some approved practices were not widely used), but the number of expert scores above the 50+ and 80+ percent levels indicate that the program was accommodating to existing farm conditions at the time of program design. The agricultural sector was likely to qualify their farms into the BMP program by using current practices such as application of chemicals through irrigation systems, planting according to soil moisture content, or reducing the number of passes during tillage (a practice several experts noted was already popular for economic reasons prior to program inception). It appears that a majority of farm operators only needed to meet the requirements of a single category (e.g. implement one BMP in Non-Cropland Management) in order to fulfill the full requirements of the PM_{10} BMP program.

C. Synthesis

Interview results point to the existence of bargaining power favoring agricultural interests in the reg-neg BMP design process. The structure of the PM_{10} BMP Committee alone suggests bargaining power weighted towards agricultural interests. Some of the general public attending the open meetings also were supportive of agriculture. Several committee members reported that contentious issues, though few, were decided by popular vote, a process that clearly favored agricultural interests. Another source of agricultural influence on the rule design process stems from the political astuteness of the farming sector's leadership. Members of the agricultural community developed the legislation behind the rule, giving agriculture a strong bargaining position from the start. In addition, agricultural members led all committee discussions and negotiations.

The PM_{10} rule design process was characterized by both asymmetric information and asymmetric participation. First, agriculturalists were the primary source of information for whether practices could be implemented on farms and if farmers would adopt them. Secondly, results from the expert survey suggest that there were few new requirements imposed on farmers by the rule because many of the BMPs in the program were already common practice on the majority of the farms. Third, program compliance does not require that qualifying BMPs be new, farms only have to verify which approved practices they are using. Finally, it is important to note again that a farm qualifies for a category if a BMP is implemented on only one field on the farm.

The interviewees noticed the absence of other stakeholders in the rulemaking process. EPA staff participated as observers, as appropriately noted above. However, local representatives from the legislature, cities, health sector, environmental groups, and other advocacy interests were not appointed to the BMP committees and did not participate in the public meetings. As a result, committee input was noticeably skewed towards agricultural interests.

Returning to Figure 1(b), the evidence from committee interviews and expert surveys indicate that the negotiated outcome approximates the "northwest" corner of the ZOPA. First, r, the regulator's BATNA, can be defined as the EPA's FIP. However, the terms of the BATNA were undefined at the time because the EPA, ADEQ, and MAG were working with agriculture to identify suitable control methods prior to the approval to use BMPs. Since the regulator's BATNA was not clearly established, the regulator entered negotiations without a firm bargaining position. Secondly, once entering into negotiation, the BMP Committee composition produced a strong bargaining position for agriculture. In Figure 1(b), if k is greater than h then the negotiated outcome is closer to M. Agricultural representatives negotiated an outcome where incremental program costs for agriculture were minimal and the regulator's outcome is equivalent or only slightly better than pursuing their BATNA.

VI. COLLABORATION OR CAPTURE?

The BMP reg-neg process requires regulator/regulatee collaboration, expecting the benefits associated with the BMP program to outweigh the costs of achieving, or not achieving, public policy goals. Evidence of active regulator/regulatee collaboration weaves its way throughout this case study. Federal, state and agricultural interests invested significant amounts of time, both paid and unpaid, to resolve this environmental policy issue. The threat of EPA's FIP and looming federal deadlines drove ADEQ and the agricultural sector into close collaboration under the watchful eye of the Governor's Office and the State Legislature.

We conclude that the agricultural sector influenced, affected or even controlled the regulatory outcome in the BMP reg-neg process—evidence of regulatory capture (Laffont and Tirole 1991). The interview results indicate the presence of biased advisors, implicit future legal challenges, asymmetric information and participation, and rents earned (Bó 2006). Agriculture was dominant in the BMP negotiations and in writing the legislation. State regulators facilitated the reg-neg process but agricultural interests provided the technical and committee leadership in both cases. "It was agriculture in the driver's seat", as one BMP Committee member observed. State agencies appeared more concerned about achieving a timely agreement than clearly meeting the public policy goals of dust control.

Threats, veiled and unveiled, impacted all sides in the negotiations. For example, the EPA's intentions to implement a FIP focused both the regulator and regulatee's attention on the importance of avoiding significant transaction costs by reaching a mutually acceptable agreement in a timely manner. Whether the selected BMPs generated additional dust control was a secondary concern. The results from the expert surveys indicate that agriculture was not required to make significant changes in their day-to-day operations, therefore rents were earned in the reg-neg process. We can only speculate about whether federal and state regulators understood on-farm reality with regard to the existing use of final BMPs. Willingness to accept frequently used farming practices as BMPs and setting low, farm-level compliance hurdles indicate information asymmetry, the compelling urgency to strike a deal, or both.

VII. A POSTSCRIPT

Under pressure from a wide range of interests, the Arizona State Legislature amended ARS §49-457 in 2007 to require farmers to double the number (i.e. from one to two) of BMPs in each of the three dust control categories. Our research results indicate that most farms complied with this stricter rule without major changes in how they run their businesses.

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REFERENCES

Arizona Department of Environmental Quality. *Governor's Guide to Agricultural PM_{10} Best Management Practices*. Phoenix, Arizona, February, 2001a.

Arizona Department of Environmental Quality. *Final Revised Background Information, Maricopa County PM_{10} Serious Area SIP Revision*. Phoenix, Arizona, June, 2001b.

Arizona Revised Statutes (ARS) § 49-248 Agricultural best management practices advisory committee.

Arizona Revised Statutes (ARS) § 49-457 Agricultural best management practices committee; members; powers; permits; enforcement; preemption; definitions.

Bailey, G. W., Waddell, T.E. "Best Management Practices for Agriculture and Silviculture: An Integrated Overview". *Best Management Practices for Agriculture and Silviculture*, Proceedings of the 1978 Cornell Agricultural Waste Management Conference. R.C. Loehr, D.A. Haith, M.F. Walter, and C.S. Martin, eds. Ann Arbor, Michigan: Ann Arbor Science Publishers, 1979. pp. 33-56.

Bó, E.D., 2006. "Regulatory Capture: A Review". *Oxford Review of Economic Policy* 22(2006):203- 225.

Clean Air Act Amendments of 1990 (104 Stat. 2468, P.L. 101-549) 42 U.S.C. §7401 et. seq.

Coglianese, C. "Assessing Consensus: The Promise and Performance of Negotiated Rulemaking". *Duke Law Journal* 46 (1997):1255-1349.

Denzin, N.K. "The Logic of Naturalistic Inquiry". *Social Forces* 50(1971):166-182.

Dixit, A. and S. Skeath. *Games of Strategy.* 2nd ed. W.W. Norton & Co, New York, 2004.

Eisenhardt, K.M. "Building Theories from Case Study Research". *Academy of Management Review* 14(1989):532-550.

Environmental Protection Agency. *Technical Support Document for Approval and Promulgation of Implementation Plans; Arizona—Maricopa Nonattainment Area; PM-10. Notice of Final Rulemaking*. Phoenix, September, 2001.

Federal Negotiated Rulemaking Act of 1996 5 U.S.C. §§ 561-570 (1994 and Supp. I 1995).

Fields, P.G., M. George, V. Sadeghi and M.E. Wolf. "Estimating the Impacts of Agricultural Best Management Practices in the Maricopa County PM_{10} Non-Attainment Area". Paper presented at the 10th Annual Emissions Inventory Meeting of the Environmental Protection Agency, Denver, Colorado, 2001.

Fiorino, D.J. "Regulatory Negotiation as a Policy Process". *Public Administration Review* (July/August 1998):764-72.

Hadden, S.G. "Regulatory negotiation as citizen participation: A critique". *Fairness and Competence in Citizen Participation: Evaluating Models in Environmental Discourse*. O. Renn, T. Webler and P. Wiedemann, eds., Dordrecht, Netherlands: Kluwer Academic, 1995, pp. 239-252.

Harter, P.J. "Assessing the Assessors: The Actual Performance of Negotiated Rulemaking". *New York University Environmental Law Journal* 9(2000):32-59.

Helper, S. "Economists and Field Research: You Can Observe a Lot Just By Watching. *American Economic Review* 90(2000):228-232.

Ice, G. "History of Innovative Best Management Practice Development and its Role in Addressing Water Quality Limited Water Bodies". *Journal of Environmental Engineering 130(2004): 684-89.*

Kazmierczak, R.F. and D.W. Hughes. "Reasonable Value and the Role of Negotiation in Agriculture's Use of the Environment". *Review of Agricultural Economics* 19(1997):108-121.

Kennedy, P.L. and E.J. Luzar. 1999. "Toward Methodological Inclusivism: The Case for Case Studies". *Review of Agricultural Economics* 21(1999):579-591.

Kerwin, C.M. "Negotiated Rulemaking". *Handbook of Public Law and Administration*. P.J. Cooper and C.A. Newland, eds. San Francisco, California: Jossey-Bass, 1997, pp. 225-36.

Laffont, J.-J. and J. Tirole. "The Politics of Government Decision-Making: A Theory of Regulatory Capture". *Quarterly Journal of Economics* 106(1991):1088-1127.

Langbein, L.I. "Responsive Bureaus, Equity, and Regulatory Negotiation: An Empirical View". *Journal of Policy Analysis and Management* 21(2002):449-65.

Leathers, HD. "Best Management Practices Versus Socially Optimal Practices". *Commodity and Resource Policies in Agricultural Systems* R.E. Just and N. Bockstael, eds. Berlin, Germany: Springer-Verlag, 1991, pp. 293-310.

Levine, M.E. and J.L. Forrence. "Regulatory Capture, Public Interest, and the Public Agenda: Toward a Synthesis". *Journal of Law, Economics, and Organization* 6(1990):167-198.

Marshall, C. and G.B. Rossman. *Designing Qualitative Research,* 3rd ed. Thousand Oaks, California: Sage, 1999.

Mohr, L.B. *Impact Analysis for Program Evaluation*, 2nd ed. Thousand Oaks, California: Sage, 1995.

Murphy, T.A. "Research Needs and Current Activities". *Best Management Practices for Agriculture and Silviculture* Proceedings of the 1978 Cornell Agricultural Waste Management Conference. R.C. Loehr, D.A. Haith, M.F. Walter, and C.S. Martin, eds. Ann Arbor, Michigan: Ann Arbor Science Publishers, 1979, pp. 25-30.

Patton, M.Q. *Qualitative Research & Evaluation Methods,* 3rd ed. Newbury Park, California Sage, 2002.

Polkinghorn, B. "Identity Politics and Environmental Conflict Dynamics: A Reexamination of the Negotiated Rulemaking Process". *Social Conflicts and Collective Identities.* P.G. Coy, and L.M. Woehrle, eds, Lanham, Maryland: Rowman and Littlefield, 2000, pp. 149-167.

Pritzker, D.M and D.S. Dalton, eds. *Negotiated Rulemaking Sourcebook*. Administrative Conference of the United States, Office of the Chairman, Washington, D.C.: US Government Printing Office,1995.

Ryan, C.M. "Leadership in Collaborative Policy Making: An Analysis of Agency Roles in Regulatory Negotiations". *Policy Sciences* 34(2001):221-45.

Stigler, G. "The Theory of Economic Regulation". *Bell Journal of Economics and Management Science* 19(1971):19-42.

Susskind, L., P.F. Levy and J. Thomas-Larmer. *Negotiating Environmental Agreements: How to Avoid Escalating Confrontation, Needless Costs, and Unnecessary Litigation*. Washington, D.C.: Island Press, 2000.

Wondolleck, J.M. and C.M. Ryan. "What Hat Do I Wear Now? An Examination of Agency Roles in Collaborative Processes". *Negotiation Journal* (April 1999):117-133.

Yin, R.K. *Case Study Research: Design and Methods*. 2nd ed., Thousand Oaks, California: Sage, 1994.

Zinn, M.D. "Policing Environmental Regulatory Enforcement: Cooperation, Capture, and Citizen Suits". *Stanford Environmental Law Journal* 21(2002):81-174.

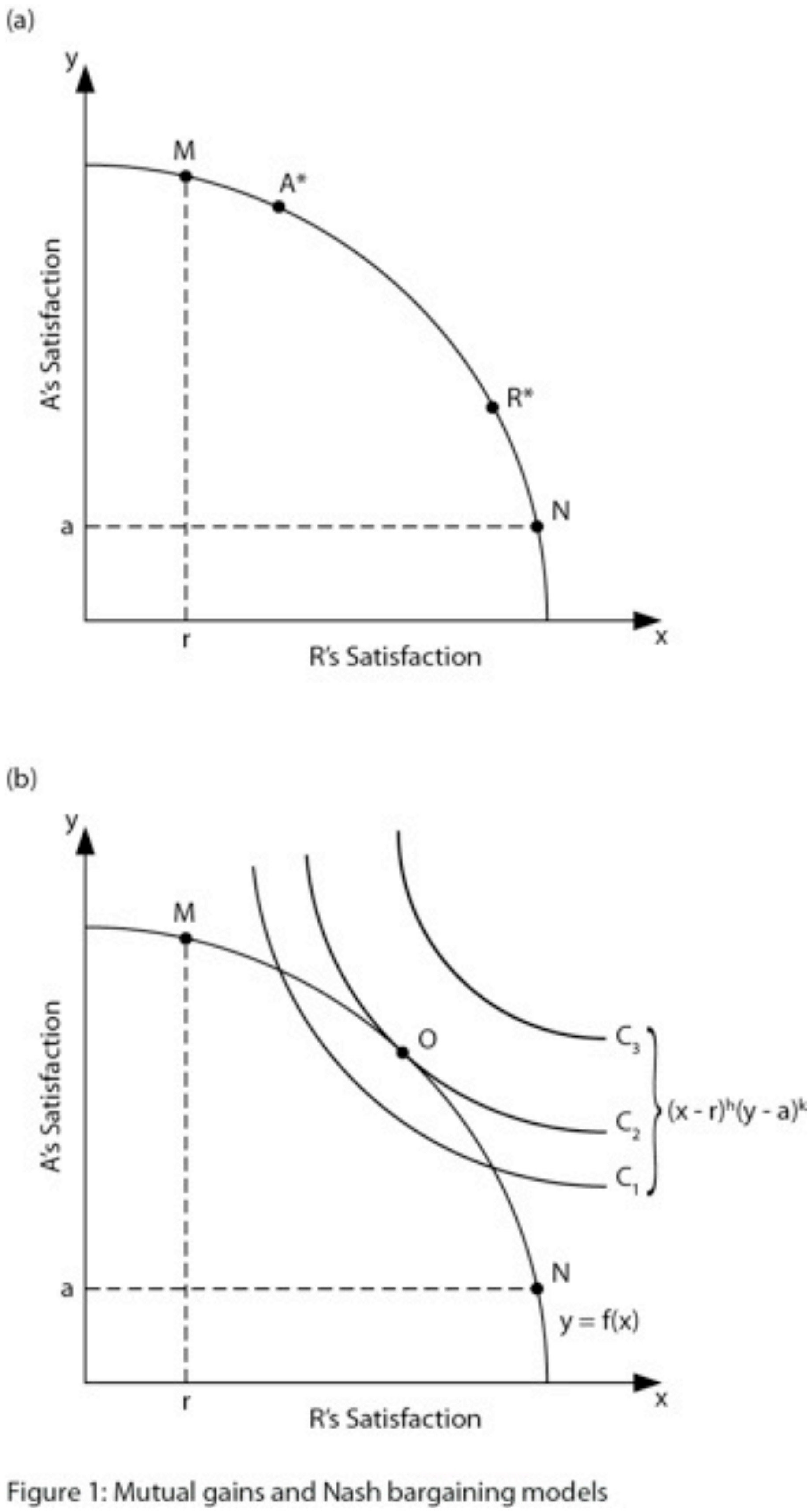

Figure 1: Mutual gains and Nash bargaining models

Table 1: Sample BMPs by Category for Dust Mitigation

Tillage and Harvest

- Chemical Irrigation: application of fertilizers, pesticides, or other agricultural chemicals to cropland through irrigation systems.
- Combining Tractor Operations: performing two or more operations, for tillage, harvesting, planting, or cultivation, in a single tractor or harvester pass.
- Equipment Modification: modifying agricultural equipment with shields, deflectors, dust shrouds, or spray bars to reduce dust emission.
- Limited Activity During a High Wind Event: performing no tillage or soil preparation when on-site wind speed measured at six feet above ground is in excess of 25 mph.
- Multi-Year Crop: crops that are grown continuously for more than one year.

Non-Cropland Management

- Access Restriction: using signs or physical obstructions to prevent public access to non-cropland areas.
- Aggregate Cover: using gravel, concrete, recycled road base or similar material to cover non-cropland.
- Artificial Wind Barrier: creating a physical barrier to the wind.
- Reduce Vehicle Speed: limiting farm vehicles to less than 20 mph on unpaved farm roads.

Cropland Management

- Cover Crop: plants that are grown between crops and protect or improve soils.
- Manure Application: apply animal waste or biosolids.
- Multi-Year Crop: crops that are, or will be, grown continually for more than one year.
- Planting Based on Soil Moisture: applying water to soil prior to planting operations.

Table 2: Expert scoring summary for PM_{10} BMPs utilized prior to 2001

		Expert									
	BMP Category*	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
BMPs Scored at 80+ Percent	Tillage and Harvest	5	2	4	3	3	5	2	4	1	1
	Non-Cropland Management	3	0	0	1	0	0	-	0	0	0
	Cropland Management	4	2	4	4	4	4	0	1	0	0
BMPs Scored at 50+ Percent	Tillage and Harvest	6	3	4	4	6	9	4	7	4	1
	Non-Cropland Management	3	0	1	2	1	2	-	2	1	0
	Cropland Management	4	2	4	6	7	6	4	3	3	0