



*Voluntary Siting of Noxious Facilities:
Additional Thoughts and Empirical Evidence¹*

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Introduction

Failed attempts to find technical or political solutions to siting problems have provoked a profound change in the way siting procedures are structured. A first step was to introduce risk information programs as a means to improve the Defend Announce Defend approach. There is empirical evidence that information has a systematic effect on the way people form their risk perceptions and subsequently adjust behavior (Smith et al. 1990; Viscusi et al. 1987). Whether these processes strictly follow the expected utility model or can better be explained by taking framing effects and other anomalies into account is still an open question. The key role of information, however, is undisputed.

In a recent study, the Environmental Protection Agency found confirmation for the wide discrepancies between the risk assessments of its technical experts and the perceptions of the general public (Smith 1992). In addition, every accident and the discovery of hitherto unknown hazards brought about the question of fallible and possibly, biased experts (Otway 1987). As a result, it became clear that if communities were to accept noxious facilities on their grounds, information alone would not suffice to convince them. Information programs needed to be amended.

As a second step, public participation programs were included in siting procedures. The public was not only informed about the facilities it was expected to host, but people had a limited say in siting procedures and, to a lesser extent, in the design of the facilities. Governments and developers hoped that the use of more democratic processes would help to legitimize decisions to place these special burdens on citizens. As pointed out in Howard

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Kunreuther's contribution to this volume, many of these participation processes have since unraveled.

Along with the frustration among developers and governments over siting difficulties, a tendency to reverse the democratization of siting processes is growing. An authoritative approach with the central government deciding where to build what type of facility is seen as the better and sometimes only solution. The Swiss government's decision in early 1993 to speed up the siting of a low level radioactive waste facility by overruling the cantons' say and possible popular referenda is but one example for this tendency (*Neue Züricher Zeitung* 40, 18.2.1993). We will argue that legislated siting programs did not fail because they were too democratic. On the contrary, clarifying the local opponents' entitlements by granting them the explicit right to deny the construction of any unwanted facility on their grounds seems to be the most promising way out of the siting dilemma.

Entitlement Structure

At the heart of the siting problem is a dispute over the existing entitlement structure, i.e. the distribution of property rights. The entitlement structure determines if the local opponents have to bear the negative effects of a noxious facility or if they can call upon the state to protect their interests. Developers (private or state) expect the state's help in siting noxious facilities for it is the benefit of a larger group of citizens, and quite often public health in general, that they claim to pursue. Moreover, it is usually state agencies that had permitted the production processes which finally resulted in the toxic wastes under dispute. On the other side of the battle line, the status quo as defined by host communities unwilling to accept facilities consists of entitlements to physical safety and long-term health. As with the developers, they too turn to the state to protect their rights.

It is the prime task of the state to define and enforce property rights. Only when these are known can the parties to environmental disputes start to trade off their interests. If the state protects the communities from having to accept noxious facilities on their grounds, it is the developers who must offer a compensation package attractive enough to the prospective host community so that they accept the facility. If the state entitles the developer to site the project in a chosen community, it is the community who must compensate the developer if it forgoes its rights. The state's role is not an easy one. Given considerable transaction costs it cannot assign these rights arbitrarily (Coase 1960). While granted the power of eminent domain, governments up for re-election are reluctant to openly turn against host communities supported by environmental groups. Past incidents such as the Wackersdorf Nuclear Fuel Reprocessing Plant Project in Germany suggest that even the use of excessive force does not guarantee "successful" siting. If the government does not take

action, the outcome is usually favorable for the host community which is in many cases able to gather legal support against the facility or to show at least enough determination to fight against the project to make it look economically unfeasible (O'Hare 1983; Samuels 1971). The government's reluctance or inability to take action does not improve the situation. As years go by and communities turn down project after project, siting problems become more and more pressing.

Public Participation

By incorporating public participation schemes into siting procedures, legislators had hoped to find a way to acknowledge the host communities' entitlements without formally enforcing them and thereby making siting impossible. Legislated siting programs typically did not include the right of the community to the final decision, but sought ways to improve the chance of acceptance by establishing communication between the developer and the community. In our view, these types of public participation programs fail to solve the siting problem because they fail to clarify the underlying entitlement structure that is at the heart of the conflict.

This is not to say that risk communication is not important. Communication, as outlined in the facility siting Credo, described by Kunreuther et al. (1991), is itself a key essence in disputes over entitlement structures. New information regarding the risks of a facility, accidents at other facilities, and advances in technology determines the terms of trade under existing entitlement structures and provides powerful incentives to change them (Bromley 1992). However, when property rights are not clearly defined, there is no basis for trade. As a consequence, information designed to facilitate this trade cannot bring about a solution.

The Lottery / Auction Mechanism

The Lottery/Auction mechanism proposed by Howard Kunreuther achieves the clarification of the entitlement structure that is essential to establish trade. It does not focus on the way negotiations and communication between the developer and the prospective host community should be structured. Instead, its focus is on decision making and, therefore, on the assignment of property rights. Taking the willingness of the communities to participate in the mechanism as a starting point, communities are fully entitled to decide whether or not a facility should be built on their ground. No doubt remains about the entitlement structure. It is the developers who have to offer a "benefit sharing package" attractive enough to make communities participate.

Having assigned the property rights, the lottery / auction mechanism seeks to combine considerations of efficiency with the requirement for fairness

(Kunreuther and Portney 1991). The latter is to be brought about by the lottery, the former by auctioning off any surpluses that might have accrued in the first round of decision making.

Fairness

A test of the facility siting Credo that lists the most important elements of successful siting clearly shows the importance of fairness considerations (Kunreuther et al. 1992). Several variables such as trust, multiple options, geographic distribution and voluntariness are related to notions of fairness. While accepting the importance of fairness, however, we remain skeptical as to whether a lottery is generally seen as a fair mechanism. Our own research suggests that it is not.

To acquire insights into the perceived fairness of different decision making mechanisms, a study among 1,750 households in Zurich and Berlin was conducted by one of the present authors (Frey and Pommerehne 1993). Two situations of excess demand were presented: Respondents had to decide how to distribute 100 bottles of water to 200 thirsty hikers in the first situation, and the distribution of snow shovels the morning after a snow storm in the second. Four alternative decision making systems were given:

- a traditional procedure where a fixed rule was applied, in this case "first come, first served";
- a random mechanism where each person had the same chance to get a bottle of water or a snow shovel;
- a delegation of the decision to local authorities, who could decide on the distribution in accordance with their own principles; and finally
- the use of the price mechanism, i.e. a price increase for water and shovels that would clear the market.

In academic writings by economists the price as well as random mechanisms are advocated. The former will bring about efficient outcomes and is seen as an ideal tool to settle environmental disputes (Kneese and Schultze 1975; Baumol and Oates 1979). Random mechanisms have also been suggested as rational procedures, particularly for voting (Intriligator 1973; Mueller 1978). The view of the public, however, is quite different. The price as well as random mechanisms are not considered to be fair in situations of excess demand (see Table 1).

Table 1: Subjective Evaluations of Alternative Allocation Procedures (in percentage of all respondents)

Allocation procedure for water bottles				
Evaluation	price	tradition	random	administration
fair	27%	76%	14%	43%
unfair	73%	24%	86%	57%

Subjective fairness clearly ranks the traditional procedure of "first come, first served" as the fairest. This is surprising since this decision making system does not take into account the thirstiness and thus the "needs" of individuals. The random mechanism is seen as the least fair. Only 14 percent judge it to be fair. The case for the lottery is not entirely lost, though. The ranking seems to depend on the specific situation. When asked to choose a fair rule to allocate snow shovels, the result was as exhibited in Table 2.

Table 2: Subjective Evaluations of Alternative Allocation Procedures (in percentage of all respondents)

Allocation procedure for snow shovels				
Evaluation	price	tradition	random	administration
fair	23%	93%	27%	48%
unfair	77%	7%	73%	52%

In this case, a random mechanism is judged to be considerably fairer (27% instead of 14%). Compared with other decision making systems, however, random mechanisms such as lotteries still do not fare very well. Further empirical research will have to analyze whether lotteries are accepted as a decision making system in the context of siting problems. Based on our own study, however, people do not seem to attribute random mechanisms much fairness. Moreover, the use of a lottery seems to be in contradiction with another guideline of the facility siting Credo: "Choose the solution that best

addresses the problem" (Kunreuther et al. 1991). If people truly believe that there is a "best solution" to the siting problem, be it technical or political, it must strike them as odd to select the starting point for the auction, and possibly the final outcome, by chance.

Auction

To introduce an auction as the second stage of the siting process certainly appeals to economists and all those concerned with efficiency. In the absence of collusion the auction will bring about an efficient allocation of facilities. However, the results of our research suggest that the use of the price system does not seem to find much acceptance either. The preoccupation with distributional aspects of decisions is an important reason for the reluctance to use prices as a decision making process.

Distributional consequences of allocation decisions are often dismissed by economists on the grounds that (free) compensation is possible. The lottery/auction mechanism asks the communities to state the compensation demanded. The competitive structure of the auction then forces the communities to lower their compensation demands. Differences in demand for compensation essentially stem from differences in risk assessment, and differences in the evaluation of future income generated by compensation packages. The latter are the reason for the rejection of the price mechanism by the public in general and special interest groups in particular (Kearl 1979; Frey 1986; Kahneman et al. 1986). In this respect, to combine the lottery with the use of the price system bears the risk of destroying whatever credibility and fairness the lottery was attributed in the first place. Once the mechanism has been applied a few times with the result that the facility is built in relatively poor communities, the whole mechanism might be seen as an elegant way to take advantage of communities in need for funds.

Conclusion

The lottery/auction mechanism developed by Howard Kunreuther combines important elements of successful siting procedures. Its major achievement is the clarification of the underlying entitlement structure which forms the basis for any trade in environmental disputes. In view of a *de facto* entitlement of prospective host communities to deny the siting of noxious facilities – the unwillingness or inability of governments to enforce siting decisions results in a *de facto* entitlement – we feel it is the right choice to formally acknowledge the communities' rights. The mechanism further addresses two key aspects of siting schemes: fairness and efficiency. While we agree on the importance of those aspects, empirical research does not support the view that lotteries and auctions are perceived as fair decision making systems. Further empirical

research is needed to evaluate these mechanisms as parts of siting procedures or suggest other ways to reconcile demands for fairness with efficiency considerations.

Taking the prospective host communities' willingness to participate in a lottery/auction mechanism as a starting point provides the ultimate empirical test. If communities can be motivated to participate *ex ante* – before the facility's location is decided – and accept the results *ex post* – after the siting decision has been made – the fairness requirements are met. Drawing conclusions from other research, however, we fear that the mechanism will entice no more enthusiasm than the prospects of siting a facility in one's own backyard.

References

- Baumol, William A., and Wallace E. Oates, *Economics, Environmental Policy, and the Quality of Life*. (Prentice Hall: Englewood Cliffs, 1979).
- Bromley, Daniel W., "Entitlements and Public Policy in Environmental Risks," in: Bromley, Daniel W. and Kathleen Segerson (eds.), *The Social Response to Environmental Risk*. (Kluwer: Boston 1992), pp. 1-22.
- Coase, Ronald, "The Problem of Social Cost," *Journal of Law and Economics* 3: 1-44 (October 1960).
- Frey, Bruno S., "Economists Favour the Price System – Who Else Does?" *Kyklos* 39: 537-563 (1986).
- Frey, Bruno S., and Werner W. Pommerehne, "On the Fairness of Pricing – An Empirical Survey among the General Population," *Journal of Economic Behavior and Organization* 20: 295-307 (1993).
- Intriligator, Michel D., "A Probabilistic Model of Social Choice," *Review of Economic Studies* 15: 553-560 (1973).
- Kahneman, Daniel, Jack Knetsch, and Richard Thaler, "Fairness as a Constraint on Profit Seeking: Entitlements in the Market," *American Economic Review* 76: 728-741 (September 1986).
- Kearl, James R., Clayne L. Pope, Gordon C. Whiting, and Larry T. Wimmer, "A Confusion of Economists?" *American Economic Review, Papers and Proceedings* 69: 28-37 (May 1979).
- Kneese, Allen V., and Charles Schultz, *Pollution, Prices, and Public Policy*. (Brookings Institution: Washington D.C. 1975).
- Kunreuther, Howard, Thomas D. Aarts, and Kevin Fitzgerald, *Siting Noxious Facilities: A Test of the Facility Siting Credo*. Report 92-03-01 (Wharton School, Risk and Decision Processes Center: Philadelphia 1992).
- Kunreuther, Howard, and Paul Portney, "Wheel of Fortune: A Lottery / Auction Mechanism for Siting of Noxious Facilities." *Journal of Energy Engineering* 117: 125-132 (December 1991).

Kunreuther, Howard, Lawrence Susskind, and Thomas D. Aarts, "The Facility Siting Credo. Guidelines for an Effective Facility Siting Process." (University of Pennsylvania: Philadelphia 1991).

Mueller, Dennis C., "Voting by Veto," *Journal of Public Economics* 10: 57-75 (August 1978).

Neue Zürcher Zeitung, No. 40 from 18.2.1993. (Verlag für die Neue Zürcher Zeitung, Zurich 1993).

O'Hare, Michael, Lawrence Bacow, and Debra Sanderson, *Facility Siting and Public Opposition*. (Van Nostrand Reinhold: New York 1983).

Otway, H., "Experts, Risk Communication and Democracy," *Risk Analysis* 7: 125-129 (1987).

Samuels, Warren, "The Interrelations between Legal and Economic Processes," *Journal of Law and Economics* 14: 435-450 (October 1971).

Smith, V. Kerry, "Environmental Risk Perception and Valuation: Conventional Versus Prospective Reference Theory," in: Bromley, Daniel W. and Kathleen Segerson (eds.), *The Social Response to Environmental Risk*. (Kluwer: Boston 1992), pp. 23-56.

Smith, V. Kerry, William H. Desvousges, F. Reed Johnson, and Ann Fisher, "Can Public Information Programs Affect Risk Perceptions?" *Journal of Policy Analysis and Management* 9: 41-59 (Winter 1990).

Viscusi, W. Kip, Wesley A. Magat, and Joel Huber, "An Investigation of the Rationality of Consumer Valuations of Multiple Health Risks," *Rand Journal of Economics* 18: 465-479 (Winter 1987).



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