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Introduction

Environmental risk presents public decision-makers with a near zero probability of producing an infinitely catastrophic outcome. Thus, environmental risk problems are called zero-infinity dilemmas. Does one regulate risk in anticipation of unlikely catastrophe, or does one allow environment risks and deal with hazards remedially?

The choice is value dependent. Is the use value of accepting risk as important as preventing any harm that may be caused? Are risks, benefits, and/or harms, of symmetric weight? Can they be traded off? Are those imposing risk the same people who will benefit? Are they the same people who will suffer any catastrophic consequences? Does nature have instrumental or intrinsic value?

Answering questions such as these requires assigning values to risks, humans and nature, and then deciding between them. Policy makers must establish a moral standard that defines what is most fundamentally at stake. They must establish the core principle which will determine what is valued and how.[1] But before deciding what

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1 I use "principle" in the singular because I contend that in making collective decisions about policy and law, one must be fair and consistent to all constituents over time. Without this consistency, expectations could not be created, and no one could define or anticipate administrative requirements. Therefore, while one may consider many values in making collective choices, one must, in the end, consistently trump all others. This trump card becomes the core principle of the dominant policy argument for any area of policy/legal choice. Unless one either sacrifices consistency, or assumes that one value will never conflict with another, then a dominate core principle will emerge, over time, to define "conventional" environmental law. While it is possible for a competing argument to replace a conventional one, this takes great effort and political capital.

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principle ought to define environmental risk, they must first understand what principle presently determines our perception environmental risk.

According to Campbell-Mohn,[2] the current application of principle to policy poses many problems. Despite ever-growing public and private expenditures to implement environmental law, surprisingly few actual improvements occur. Often, spending large sums has only kept problems from worsening. Meanwhile, the gap between environmental quality and objectives widens. Congress responds to environmental problems by adding more fixes and creating an acropolis of administrative structures. Still, the administrative capacity to resolve environmental problems diminishes. Eventually, administrative institutions become overwhelmed by the piecemeal approach.[3]

If the current law defining our relationship with nature is not achieving the optimum level of environmental quality (e.g. if it merely chases pollution without prevention or remediation and is inadequate to the task of defining significant risk to human or ecosystem health), then the fundamental principle upon which our law is built may need reconsideration and reform. Most critically, the fundamental principle that sets the standards for "persuasive" policy argument and "reasonable" law may need to be changed.

Some, to improve the general state of affairs, blame government regulation and argue for abandonment of "command and control" if favor of more efficient market mechanisms.[4] If efficiency had not determined policy to date, this might be reasonable. But I argue that it is, and has always been, a core principle.[5] To introduce more market mechanisms would only add fuel to fire.

2 Celia Campbell-Mohn et al., Environmental Law from Resources to Recovery (1993).

3 *Id.*, at *vii.*

4 *See* Terry L. Anderson & Donald R. Leal, Free Market Environmentalism (1991); Stephen Breyer, Breaking The Vicious Circle (1993).

5 One might argue that, say, the Endangered Species Act (16 U.S.C.A. §§ 1531-1544) (ESA) provides an exception to my claim that market assumptions and efficiency are foundations of environmental law. Yet, I argue that market efficiency considerations appear throughout the ESA. For example, in the determination of "critical habitat" (§ 1533 (b)(2)); in the establishment of the Endangered Species Committee (§ 1536 (e)-(p)); and in the allowances for economic hardship exemptions (§ 1539 (b)), to name only a few. Even within the Congressional Findings section of the statute that outlines the reasons for the act, only one of six values ("ecological" § 1531 (a)(3)) can be said to have a completely non-market definition.

Before we make judgments about the future; make new models and solutions[6] and envision the requirements of any alternative principle for environmental risk law and policy; construct competing arguments for what is "truly" at stake in risk decision-making,[7] we need to understand how the principle of efficiency has shaped the way we view the environment and conceptualize our place within it. Specifically, we need to understand how a concern for economic efficiency has created the environmental risk law we now have.

If we assume that any policy paradigm[8] has a core principle which orders and values the components of the physical world into a *context model* for that paradigm, then the context model for the market argument applied to environmental law can be characterized as the Traditional Sector Approach (TSA). This model is a creature of an economic core seeking efficiency where the environmental institutions, laws and policies are actually focused on the economy and its survival in the face of pollution and risk externalities. Two versions of the traditional sector approach are distinguished. How each of these traditional sector approaches are permutations of the search for efficiency applied to environmental risk are described in unregulated markets (TSA-I) and then within the context of government regulation (TSA-II). In describing these models, the changing role of efficiency as a determinant of environmental law and administration through

6 Campbell-Mohn's solution, on the other hand, requires a conceptual re-orientation away from a concentration on individual media or sectors of the environment (land, water, air etc.) to a consideration of the economic process as a series of interfaces between human action and nature, beginning with the extraction of resources from the environment and ending with their reintegration into nature (*supra* note 2, at Chapter 10). "Unlike traditional approaches to environmental law that either explain each statute or group the statutes by media, this [argument] reflects the fact that laws govern activities, not the environment. It develops a new approach, called resource to recovery, that explains all the laws that apply to an activity, from the time resources are allocated for extraction, through their manufacture into products, and on to their disposal." *See* Campbell-Mohn, *supra* note 2, at *vii.*

7 *See* John Martin Gillroy, *Environmental Justice From Human Autonomy* (Forthcoming) for a complete Kantian argument, propounding that the intrinsic value of humanity and nature that ought to set the standards for environmental law and policy.

8 Let us define a policy paradigm as a theoretical framework for understanding the world based upon assumptions about nature, individuals, collective action and the role of the state, that are taken for granted as valid. For a good discussion of this sense of paradigm, *see* Jong S. Jun, Public Administration Chapter 4 (1986), and Gillroy, *supra* note 7, at Chapter 3.

reference to fundamental cases and statutes are examined. This enables one to chart a conceptual history of environmental risk law and to understand the persistence of the principle of efficiency and its TSA in shaping environmental law.

Efficiency and Environmental Law

The first premise of our argument about the conceptual core of environmental risk law and policy is that it was preceded by the meta-policy[9] of economic growth and prosperity where market assumptions and principles held pride of place.[10] The dominant ethic of the first hundred years of our nation's history concerned growth, expansion, and private wealth maximization. This caused us to conceptualize the environment as a source of resources and a receptacle for waste as the American economy expanded. This conceptualization also created the institutions and administrative apparatus of environmental and resource regulation; including the present less than fully effective and uncoordinated policy map.[11]

According to Posner,[12] the core of economic efficiency as a motivating principle is its focus on the welfare preferences of the individual consumer and their wealth maximization. He argues that this definition of efficiency is compatible with the Kaldor Criteria, and the basic assumptions of cost-benefit methodology.[13] Posner contends that this principle lies at the core of economic policy and that it has an ethical imperative in the search for maximizing private and social prosperity through law.

Applied to the context of nature, the goal of creating a national economy and expanding westward can be seen as motivated and justified by the principle of market efficiency. Within the market context, all goods and services can be substituted for one another. Trade is based on the individual's preferences and proceeds until no further trade is profitable to anyone. Efficiency, when transferred into

9 *See* Giandomenico Majone, Evidence, Argument & Persuasion in the Policy Process 146-49 (1989).

10 *See* Gillroy, *supra* note 7, at Chapter 3.

11 Campbell-Mohn has characterized it as such. *See supra* note 2, at *vii. See* also John S. Dryzek, Rational Ecology: Environment and Political Economy (1987).

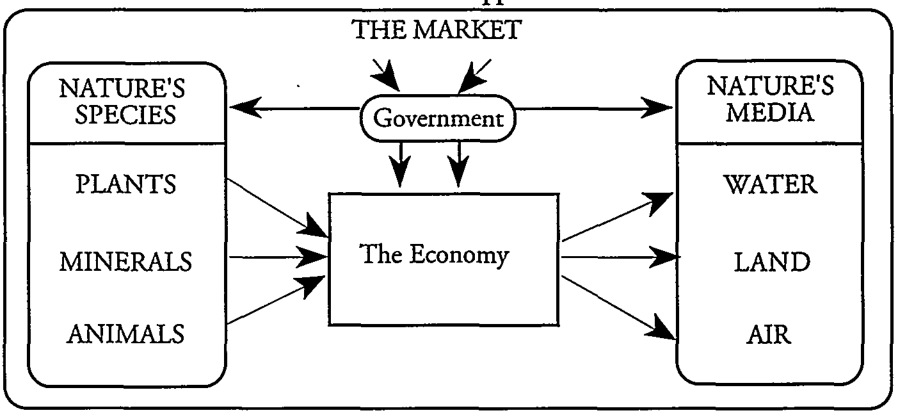
12 Richard Posner, The Economics of Justice (1983).

13 The Moral Dimensions of Public Policy Choice: Beyond The Market Paradigm 6-13 (John Martin Gillroy & Maurice Wade, eds. 1992).

the public realm from the market, gives government the imperative to mimic what the market would do were it able to function and seeks the efficient level of collective (or in this case environmental) goods.

This brings us to the first sector model, TSA-I. In this model, the market dominates policy space and the natural environment is simply one of its sub-systems. As we can see in Figure 1, the core of economic policy, which is set-up to expand the market and produce prosperity, is maximum efficiency. This core principle values everything instrumentally as it contributes to growth and the production of "wanted" things. From the market standpoint, the earth can be described as a wealth of raw material which gives no utility to the consumer in its "raw" state. Therefore, the imperative is to transform as much of this raw material as possible into products and services to improve the economy and maximize the collective wealth.

Figure 1
Traditional Sector Approach I



Efficiency Means the Maximum Use of the Environment, with Government Assitance — To Both Extract Resources and Use Media as Disposal Sinks

The imperative of Kaldor efficiency is to maximize social benefit over cost. The reality of the expanding economy in the 19th and early 20th Centuries was characterized by the perceived zero cost of both environmental media as *sinks,* and virgin materials as *resources.* This zero price for raw materials, and the government's concern to get as much land and resources into private hands as possible, encouraged the market system to absorb as much raw materials into the economic process as its technology could consume and transform.

To facilitate an expanding economy we divided nature into its separate species, minerals and media; and sought an economic use for each. We found immediate tangible market value in some (e.g. timber and fur), and potential in others (e.g. ore), but ultimately we sought only maximum use for market value. This search for efficient and maximized use of nature, created the foundation for present environmental law, policy and institutions.

In addition to the categorization of species and minerals as "natural resources," this expansion of prosperity also conceptualized the use of air, water, and land for the disposal of wastes as a "legitimate" use of nature for the facilitation of efficiency. The near-zero price of resources was matched by the perceived zero cost of waste disposal affecting water, air, and land. Nature presented a bottomless capacity as both an inventory of raw materials to generate wealth and a sink for the free disposal of waste. The imperative to seek maximum benefit was therefore aided by the zero price at both ends of the economic process: extraction and disposal.

TSA-I can be described as a market-driven model where the perception of a boundless and inexpensive nature, combined with the driving force of the normative standard of efficiency,[14] encourages the maximum use of nature to fuel economic progress. In this drama, the government plays the role of making nature available to the economic process, facilitating private commerce and technological innovation. Yet, by the late 19th Century the perception of the free use of the environment was changing. As technology allowed for greater and faster resource use, concerns arose about long-term sustainable efficiency and the supply of resources. Science and technology were assumed to be their own saviors, able to replace any raw materials that ran out. However, for the first time long-term use of nature's species and minerals were being considered. Meanwhile, with growing urban density, where most production was taking place, perception of free waste disposal also changed. Smoke, dirty water, disease, and odors of industrialization caused concern that long-run maximum production created more use of environmental media as sinks than was optimal.

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[14] Normative in the sense that it set the standards by which public choice and action are judged, justified, and evaluated.

From the market point of view, the over use of near zero price of species, minerals, and media in TSA-I, combined with the unregulated advancement of technology caused market failure due to overuse. Without the true price of resources and pollution reflected in the economic calculation of efficiency, and with the growing sophistication of technology, the market failed to take all the necessary contingencies into account while maintaining long-term efficiency. This resulted in too much extraction from the environment and introducing too much pollution back into the system.[15] When the *collective goods* nature of public policy problems causes market failures and the true price of an item is not reflected in its market value, then the role of the government in an efficiency-based regime, is to mimic the market and allocate accordingly, maximizing social benefit over cost.

Instead of allowing the market to set the maximum rate of extraction from, and disposal into the environment, the government should compensate for market failure and set optimal rates of extraction and disposal based on available technology and the natural contingencies of species, minerals, and media. This brings us to the second variant of the traditional sector approach.

In the TSA-II model, instead of having many arrows of extraction and disposal which appear in TSA-I, TSA-II has a single controlled rate of extraction and disposal. The control rate is regulated by government based upon the demands of a materials balance. TSA-II embodies the concept that for each species and mineral a single optimal rate of extraction has been deciphered and for each media a corresponding rate of disposal has been set. In effect, efficiency is defined not in terms of maximization but instead in terms of the search for optimal long-term relationship between the economy and nature. Policy maxims define efficiency so as to establish optimal levels of extraction, pollution and risk. The implication is a government centered search for what economists call the "materials balance".[16]

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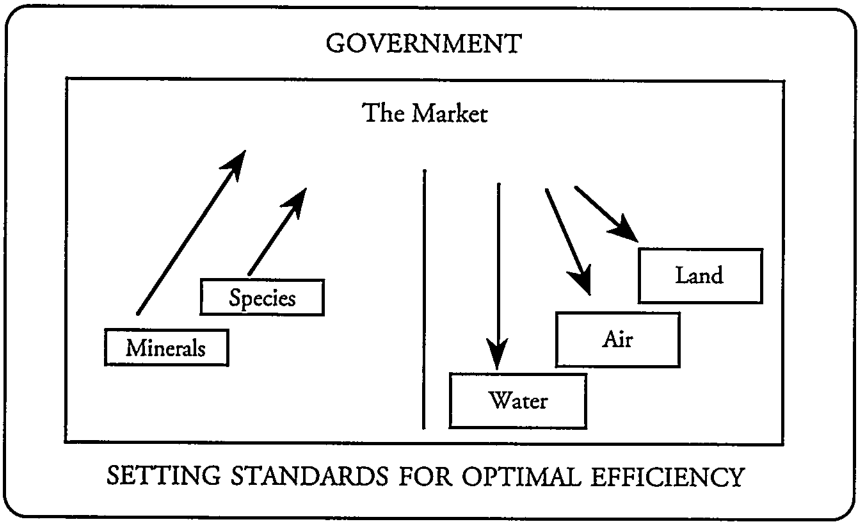
15 Larry E. Ruff, *The Economic Common Sense of Pollution* in Economics of the Environment (Robert Dorfman & Nancy S. Dorfman eds. 1977).

16 *See* Edwin S. Mills & Philip E. Graves, The Economics of Environmental Quality 8-18 (2nd. ed. 1986).

Figure 2
Traditional Sector Approach - II



The materials balance describes all of nature as an inventory of natural resources. Based on the second law of thermodynamics (i.e. that matter cannot be created or destroyed), the economy is assumed to neither create nor destroy nature, but "merely" transform it.[17] All natural material has value to the extent that it can be used to support human life, "fulfill human values"[18] and create economic wealth. As an expression of the principle of efficiency applied to human use of nature, the materials balance assumes that all of nature can be considered as either inventory, product, or waste. All material that is extracted from the environment equals that within the capital stock of products plus that returned to the environment as waste. This equivalence is the "balance". All natural material is therefore a constant quantity in fungible symmetric states of being that change form for the sake of optimizing human economic wealth. The importance of the idea of a materials balance, as an expression of efficiency, is the continued presumption of use.[19] The use of nature for human wealth

17 *Id.*, at 6.

18 David W. Pearce& R. Kerry Turner, Economics of Natural Resources and the Environment 140 (1990).

19 Even "conservationist" oriented economic approaches to nature still assume use as the primary instrumental value of all natural attributes. To make room for natural systems with intrinsic value, we must replace the dominant argument.

maximization accounts for each resource in terms of its form and place in the overall consumption process (i.e. take, use, dispose).

For example, the concept of the optimal level of pollution requires one to assume that pollution is a natural by-product of the economic process and that this process requires that not all pollution be controlled. Defining pollution as "damage to the environment that impairs its usefulness to people,"[20] the argument is that media (e.g. air, water, land, groundwater) have definable tolerance levels which cannot be stressed without the breakdown of that media in its ability to hold and process pollution.[21]

"Tolerance" however, has a more pertinent meaning in terms of the perception of environmental quality by individual consumers. It is not just that, say, the airshed can only absorb X amount of pollution before it is organically incapable of absorbing any more, but also that it can only absorb so much before consumers perceive a change in quality that causes them to lose utility. Both of these definitions of "tolerance" have a place in the discussion and definition of "optimal" levels of pollution. In any case, for a market-based analysis the environment is valuable for natural cleaning and storage. The goal of the efficient system, as described by TSA-II, is to use this "facility" maximally without violating tolerance levels. "Discharge of limited amounts of wastes is a legitimate use of the absorption capacity of each environmental medium."[22]

Environmental capacity to hold and purify pollution is examined against the backdrop of the demands of maximizing individual wealth, which requires as many individuals as possible to avoid the costs of pollution control. If each attempt to avoid pollution costs the individual, and all efforts to control pollution are not necessary to preserve the minimal functioning of environmental media, then one must minimize the costs of pollution control to the economy. Such minimization is accomplished by allowing the maximum amount of pollution possible, while abating just enough so as not to exceed the tolerances of these media as storage and purification devices.[23]

20 Mills & Graves, *supra* note 16, at 18.

21 Robert E. Goodin, The Politics of Rational Man, at 175-6 (1976).

22 Mills & Graves, *supra* note 16, at 19.

23 *See* both Anthony C. Fisher, Resources and Environmental Economics (1981)

The concept of setting optimal levels of extraction and pollution and maintaining a material balance emphasizes, again, the instrumental value of the environment to humanity. Use by species, mineral, and media is the imperative and efficiency the driving principle. The qualitative state of a natural entity or system does not matter, as long as that state serves long-term wealth accumulation. Here the economy neither destroys nor creates but merely transforms trees into lumber or tigers into coats.

Within both TSA-I and II, efficiency remains the core principle of a regulated government market and the basis for environmental law. First, efficiency is the foundation for law and policy of natural resource extraction in the search for optimal efficiency regarding the use of nature's raw materials. Second, efficiency produces law and policy of pollution and risk abatement as the government regulated market seeks the optimal level of contamination. Both models of the traditional sector approach promote the dissection of nature into tangible economic values (i.e. raw materials and absorbent media); the models differ in the connotation of the principle of efficiency.

In TSA-I, efficiency is wealth maximization in a world of zero price for the environment. The principle is defined by market imperatives that co-opt the government to encourage and facilitate the maximum use of nature by keeping prices low or non-existent and providing/protecting technological innovation and infrastructure (e.g. trails, canals, timber roads, legal patents, etc.). Within TSA-II, efficiency is conditioned by the imperative to seek optimal, not maximum, rates of extraction and pollution. In TSA-II, the government has the role of compensating for market failure and defining the "optimal" rates of use and disposal in order to maintain a regulated "materials balance" over time.[24]

Focusing on environmental risk law and policy from the viewpoint of market efficiency, TSA will allow one to see how this principle dominates legal discourse and risk decision-making.

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and Kenneth M. Stokes, Man and the Biosphere: Toward a Coevolutionary Political Economy (1994).

24 The TSA models create a world where resource and pollution issues are separate concerns. It is not surprising that from this model two areas of law, one devoted to resources and the other to pollution and risk abatement, have developed.

From Traditional Pollution to Risk Abatement

A very important area of environmental law, not yet fully understood or regulated, concerns environmental risk. Talbot Page[25] has distinguished environmental risk as a policy issue versus traditional pollution problems in terms of its pervasive uncertainty and the management difficulties presented to a decision-maker trying to regulate a near zero probability of an infinitely catastrophic harm.[26] The regulatory structure of risk law, as present practice, is a direct outgrowth of market assumptions and the TSA context model. Risk regulation, as a meta-policy issue, is like natural resources and pollution abatement law[27] built upon the core principle of efficiency and the evolution of its definition from maximization under TSA-I to optimization under TSA-II.

The issues surrounding risk regulation put the problems of an efficiency-based environmental law into relief. A core of efficiency has led to a counterintuitive and harmful treatment of environmental risk. Specifically, in terms of the burden of proof being placed upon regulators; the defense of economic markets in the face of zero-infinity dilemmas; the failure to comprehensively anticipate the imposition of risk; the demands placed upon science which it cannot accommodate; and the overall neglect of intrinsic value in policy calculations. The law that grows out of a concern for efficiency makes little sense when faced with the uncertainty and management difficulties of environmental risk questions.

Since World War II the human race has been producing natural and synthetic chemical agents to improve wealth and welfare.[28] Initially, in the U.S., these chemicals were produced with no regulation in an atmosphere of competition to maximize their production.[29] In this era

25 Talbot R. Page, *A Generic View of Toxic Chemicals and Similar Risks*, 7 Ecology L.Q. 207 (1978).

26 *See id.*, at 208-216 for a complete examination of the characteristics of the zero-infinity dilemma and how environmental risk is distinct from traditional pollution cases.

27 *See* Gillroy, *supra* note 7, at Chapter 2, for a more complete argument that efficiency has determined both natural resources law and pollution abatement law.

28 *See* Cathy Trost, Elements of Risk (1984), for a history of the synthetic chemical industry in the United States.

29 *Id.* and Robert V. Percival et al., Environmental Regulation: Law, Science, and Policy, at 435 (1992).

of TSA-I, risk agents were produced to create and expand markets for themselves and to increase prosperity and quantity of product. During this era, the stealth characteristics of environmental risk allowed individuals to ignore the effects these agents had in contaminating the environment around them.

In 1962, this attitude toward the environment changed with the publication of *Silent Spring*[30] Although the specific concern of this book was the toxic effects of pesticides, all chemical agents being produced within the economy became a concern for the general public. Before *Silent Spring*, the positive welfare effects of risk agents were assumed to far outweigh any hazard. However, as the calculation of social utility changed, and many began to appreciate that the risks may indeed be real and harmful, risk issues shifted from being considered primarily private market transactions to subjects of "public interest" and deliberation. In issues as diverse as mining for radioactive chemicals, nuclear energy, and the chemical content of food, a growing public concern required a redefinition of efficiency in order to maintain the core standard of risk meta-policy. The new conceptualization came in the form of a shift to TSA-II and its substitution of optimal risk, with its market assumptions and goals, for maximum risk.

Although risk regulation is multi-faceted, with many agencies and bodies of law controlling various sectors of risk production and storage, the legal debate over the shift from TSA-I to TSA-II is evident and ongoing throughout. Based upon an economic definition of a risk as "a known probability" of harm and a market definition of rationality as the ability to accept or decline risk in terms of individual preference, (where environmental risk has no special character but is symmetric with all other risks, like driving a car or walking across a street) courts and public managers searched for the optimally efficient risk as that which was "reasonable" given the core status of markets and wealth maximization[31] in their assumptions about us and our social priorities.

It is this characterization of environmental risk that has provided the standards and language for the legal, political, and policy deliberations about risk regulation. This characterization also makes the core principle

30 Rachel Carson, Silent Spring (1962).

31 Posner, *supra* note 12, at 60, for a more complete explanation of this term and its association with Kaldor efficiency.

of efficiency manifest in the legal search for a "reasonable" amount of risk in the environment. Let us remember that the economic approach to environmental risk assumes that the markets that generate risk are important to us and therefore have a moral standing prior to most environmental considerations. Since the market has already decided whether a certain risk ought to be accepted, the question becomes how much risk, and what kind, ought to be allowed so that an optimal amount is established as part of the greater materials balance.

The assumption is that risk is part of life, all risk is of symmetric instrumental value, and that individual preferences in the market should be the only valid means of regulation for existence of risk-producing technology. The shift from TSA-I to TSA-II, which is a reaction to the consciousness of excess environmental risk on the part of the public, does not seek to replace market efficiency in the definition of risk or the assumptions about its economic value. The only thing that changes is the realization that too much risk could be produced by the economy and regulation is necessary to optimize it so that its social costs will not outweigh its benefits to consumers.

Environmental Risk, Efficiency and the Federal Courts

Let us begin our examination of the shift from TSA-I to TSA-II with a chain of federal court cases[32] that trace the judiciary's struggle to establish the standards for optimal or "reasonable" environmental risk. The point of departure for this investigation is the case of *Reserve Mining Co. v. EPA.*[33] In *Reserve Mining,*[34] the court decided how to regulate dumping of mining by-products into the air and water in and around Lake Superior. In this case, the court made two decisions addressing efficiency, maximization, and optimal efficiency. First, it ruled that agency Environmental Protection Agency (EPA) expertise was sufficient to establish that Reserve Mining was producing too much risk. Second, the court concluded that the economic costs of immediate intervention, even with the existent hazard, would cause

32 My argument is that the following cases provide the critical links in a chain of reasoning that has established our common law of risk regulation.

33 Reserve Mining Co. v. EPA, 514 F2d. 492 (8th Cir. 1975).

34 Percival et al., *supra* note 31, at 442-3. For an analysis of this case and the role of science and ethics in the law, *see* Robert V. Bartlett, The Reserve Mining Controversy (1980).

grave market costs. Therefore, in its remedy, the court decided against closing down the company and instead instituted a "reasonable time" to find alternative ways for disposing of mining operation by-products.

The court in *Reserve Mining* gave EPA the sole authority to decide when an unregulated market had produced too much risk. In our terms, the judiciary established that EPA would be decisive in establishing the demarcation line between TSA-I and TSA-II for environmental risk issues. In addition, once EPA had established that TSA-I was no longer an acceptable context model for meta-policy, the type of regulation considered "reasonable" by preserving the economic market and the specific industry involved in risk production. The court rejected the idea that the excess risk required closing the company or at least reconsidering the role of the risk producing product for the society-at-large and instead assumed that as long as Reserve Mining made a "good faith" effort to dispose of its waste in a better manner,[35] that the economy should proceed with as little interruption as possible.

The court in *Reserve Mining* recognized that "risk", unlike traditional pollution problems, presents a potential hazard rather than an actual one. The opinion in this case addresses the fact that prevention requires *ex ante* regulation of risk.[36] However, once it confirms the agency's power to set the TSA-I/TSA-II threshold for risk, the court considered the protection of human or natural integrity to be secondary to the persistence of the market. For the first time, courts established that when EPA declares TSA-I to be inadequate, the search for optimal risk is ruled by the overriding consciousness that market persistence is of primary "trump" importance.

In this decision, the court did not mandate a specific methodology by which EPA should determine the existence of excess risk as a prerequisite for declaring that TSA-I was invalid for policy argument necessitating TSA-II. The court seemed to say that assessment of risk was not a matter of objective or quantitative science but a policy matter that ought to be left to the discretion of the agency. Although the court

35 *Id.* The "good faith" effort included a $34 million air pollution control program, a $100,000 contribution to the construction of a water filtration plant, and construction of land disposal facilities.

36 *Id.*

recognized that risk was a distinct and harmful reality in the realm of pollution abatement, it also recognized that risk production was simultaneously so established in our economy, and uncertain, that true remedies for protection against excess risk would require drastic (and inefficient) disruptions in the market economy (e.g. shutting down industry, banning products, processes, etc.).

Although the trial court ordered the plant closed, on appeal, the plant was allowed to continue. In a seeming contradiction of findings about the potential harms of environmental risk, the federal court allowed the company time to stop its air and water discharges as if environmental harm were insignificant rather than irreversible, latent, and potentially catastrophic. The court was persuaded by the argument that an individual working for the company would face more certain harm from unemployment than from environmental risk.[37]

The court's allowance of Reserve Mining's continued operation, in the face of a zero-infinity dilemma, makes sense only if the court saw itself as preserving efficiency in the face of a necessity to establish government supervision of risk markets. If this decision is the evolution of optimal from maximum efficiency then it is logical for the courts to charge the EPA experts with establishing the line between TSA-I and TSA-II. At least risk, as well as the threshold for market failure, and the establishment of TSA-II, were considered policy questions and the responsibility of EPA. This, however, would soon change.

Ethyl Corp. v. EPA[38] the next legal case built upon the findings of *Reserve Mining.* This case redefines EPA's authority in deciding when too much risk exists. The *Reserve Mining* court was willing to allow EPA to establish the point at which maximizing efficiency had to be replaced with optimizing efficiency. However, in *Ethyl Corp* the court decided that the EPA's responsibilities acquired more restrictive requirements. The court followed *Reserve Mining* and held that risk did not have to cause actual harm to be regulated. The court required the agency to make a specific connection between the probability of risk and the severity of the harm it causes.[39]

37 Thomas M. Hoban & Richard O. Brooks, Green Justice 49 (1987).

38 Ethyl Corp. v. EPA 541 F.2d 1, (D.C. Cir. 1976) (en banc). *See* Percival et al., *supra* note 29, at 444-45.

39 Percival et al., *supra* note 29, at 445.

To regulate environmental risk, the Administrator was required to establish a "fixed probability of harm" defined by the severity of the potential harm and its specific probability of occurrence at dangerous levels.[40] The variety and severity of risks are now being considered in terms of when too much risk is really present. Whereas the shift from TSA-I to TSA-II, which allows government regulation of risk markets, requires proof and not just expertise. In both *Ethyl Corp* and *Reserve Mining*, the court was hoping to maintain the definition of efficiency as maximization (TSA-I) as long as possible. Whereas in the first decision, the courts allowed EPA to declare TSA-II to be in effect and then minimized its power by allowing a liberal interpretation of the concept of "optimal". In *Ethyl Corp,* the court preempted EPA's declaration against TSA-I until the specific severity of the risk and its specific probabilities were completely examined.[41]

The Supreme Court in *Industrial Union Department AFL-CIO v. American Petroleum Institute ("Benzene case")* moved to TSA-II[42] by limiting the discretion of EPA to unilaterally redefine efficiency as optimality. The *Benzene* case concerns the Occupational Safety & Health Administration's (OSHA) efforts to set an acceptable benzene level for exposed workers. Instead of either deferring to EPA expertise in deciding when maximum risk should be replaced by optimal risk (as in *Reserve Mining*), or establishing general guidelines requiring agency substantiation of excess environmental risk (as in *Ethyl Corp*) the Supreme Court required that EPA set an absolute threshold of "safety" before it can, in effect, replace maximum with optimal efficiency or move to regulate markets for risk.

The *Benzene* case established a definitive threshold between TSA-I and TSA-II. It required that the regulators persuade the court that efficiency defined as maximization had produced too much risk and that harm was real before government intervention in risk markets was

40 *Id.*, at 444.

41 For a cost benefit model that agrees with this mandate, *see* Page, *supra* note 25. In addition, it should be noted that this mandate by the court helped EPA to declare TSA-II in effect and adopt a very conservative definition of optimal in the case of lead. It is less certain that, if the suspected toxic did not have the certainty of harm represented by lead, "maximization" would have remained the pertinent definition of efficiency.

42 Industrial Union Dep't. AFL-CIO v. American Petroleum Inst., 448 U.S. 607 (1980). *See* Percival et al., *supra* note 29, at 457-477.

acceptable public policy. Only after the threshold finding establishes that the definition of efficiency as maximization is posing a "significant harm" can the Administrator, now within TSA-II, proceed to set parameters for optimal risk generation given the needs of the market and the materials balance. The *Industrial Union* Court stated that:[43]

> [the] Act... requires the Secretary, before issuing any standards, to determine that it is reasonably necessary and appropriate to remedy a significant risk of material health impairment. Only after the Secretary has made the threshold determination that such a risk exists with respect to a toxic substance would it be necessary to decide whether [the Act] requires him to select the most protective standard he can consistent with economic and technological feasibility, or whether... benefits of the regulation must be commensurate with the costs of its implementation.
>
> [W]e think it clear that the statute was not designed to require employers to provide absolutely risk-free workplace whenever it is technologically feasible... so long as the cost is not great enough to destroy the entire industry. Rather, both the language and structure of the Act, as well as its legislative history, indicate that it was intended to require the elimination, as far as possible, of significant risk of harm.

Therefore, administrative agencies such as OSHA and EPA can only regulate risk that poses an established harm. They cannot unilaterally declare that efficiency as maximization in a free market has become dysfunctional without first showing that the threshold between TSA-I and TSA-II has been crossed in the form of significant public harm.

The Supreme Court does not allow OSHA experts to employ the methodology they see fit due to speculation that the experts may declare TSA-I dysfunctional when it is not. In the *Benzene* case, the court required that uncertainties become risks; that is, to assign "scientific" probability numbers to the uncertainty of harm. In effect, the Supreme Court mandated that a specific scientific methodology, Quantitative Risk Assessment (QRA) was necessary. QRA sets a significant risk threshold where TSA-I fails and then decides on standards for optimal risk under TSA-II. Setting this specific test methodology seems merely an extension of the risk v. harm balancing

43 448 U.S. 607, 639-641 (1980).

test of *Ethyl Corp.* For now a risk assessment is defined not as a policy problem, but as a scientific calculation of symmetric and economically rational probabilities.

Although the Supreme Court in the *Benzene* case did not mandate cost-benefit methods and did not specifically require OSHA to consider cost in its rule-making, by protecting TSA-I from random regulation and mandating QRA in both setting the threshold of TSA-I and the definition of optimal risk within TSA-II, the Court accomplished the same end: risk efficiency. The *Benzene* case established the priority of QRA in both setting the significant risk threshold and defining optimal or reasonable risk over that threshold. Based on the foundation of economic rationality and market efficiency criteria, the court maintained that "safe does not mean risk-free". Here the court accepts the economic definition of risk and gives no special normative or empirical character to environmental risks, which it assumes are symmetric with all other risks in one's life.[44] There are many activities that we engage in every day (such as driving a car or even breathing city air) that entail some risk of accident or material health impairment; nevertheless, few people would consider those activities safe.[45]

What we have here is the substitution of science for policy, the replacement of deliberation and choice based on normative and empirical considerations with a dedication to numbers and the rational preferences connected to calculate the probability of individual consumer's welfare. The establishment of QRA as a necessary and sufficient condition for defining the threshold for government interference in risk markets require science to play the role of gatekeeper. This is to maintain the primacy of maximum efficiency as the core principle of environmental risk meta-policy. The Supreme Court assumes that people are economically rational consumers and that a market for benzene is evidence of its value in terms of those welfare preferences that set the standard for efficient and therefore "socially better" policy. The moral prerogative of established economic

44 For an argument that there are normative distinctions that make environmental risks asymmetric with other risks in one's life *see* John Martin Gillroy, *Public Policy and Environmental Risk: Political Theory, Human Agency, and the Imprisoned Rider*, 14 Environmental Ethics 217 (1992).

45 Percival, *supra* note 29, at 467.

markets frame the deliberation of the Court and its definition of "reasonable" law.

The Supreme Court, in approaching risk from an efficiency standpoint, seemingly wants unregulated markets for risk (TSA-I) to be allowed to exist in as many cases as possible. Therefore, a specific quantitative ("scientific") test must be used so that preference calculations can be made to establish the existence of excess risk. If it is established that too much risk exists, then the same risk assessment must determine the proper standards for optimal risk under TSA-II. The court introduces QRA in defense of the market and maximum efficiency in order to establish the "risk severity" concerns of *Ethyl Corp.* in both the transition beyond TSA-I and in the definition of optimal risk within TSA-II. Unless real harm from risk can be established, the goal is to deter the interference of government in private economic calculations. As the Chief Justice states, "[p]erfect safety is a chimera; regulation must not strangle human activity in the search for the impossible."[46]

One year after the *Benzene* case, the Supreme Court in the *Cotton Dust* decision, *Textile Manufacturers Institute, Inc. v. Donovan,*[47] seemed to establish a mandate against the use of cost-benefit measures in assessing risk and its remedy.[48] Here Justice Brennan, specifically said that EPA "was not required" to complete a cost benefit analysis in setting its standards for cotton dust. This case is interesting to us in that it involves a risk agent (cotton dust) with a well-known hazard based upon scientific data. OSHA and the court agreed that "exposure to cotton dust presents a significant health hazard to employees" and in effect, QRA had already been used to argue that the threshold between TSA-I and TSA-II had been crossed. The court interpreted the statute to mean that cost-benefit was not necessary and reaffirmed the *Benzene* court decision which required QRA to set a threshold level of "significant risk".

Unlike the *Benzene* case, the court in *Cotton Dust* began their deliberations within TSA-II in search of a standard to define the

46 448 U.S. 607, 664(1980).

47 American Textile Mfr. Inst. v. Donovan 452 U.S. 490 (1981).

48 Mark Sagoff, The Economy of the Earth 214 (1988).

optimal level of risk. For this task the court gives OSHA the option of cost-benefit, but requires what it calls a "feasibility analysis".[49] Although the specific costs and benefits of regulation do not have to be part of the decision process for EPA, and this seems to be a step away from efficiency-based policy, "feasibility analysis" can be seen as a type of efficiency analysis within the context of TSA-II. It is efficient in the same way that technological standards under the Clean Air[50] or Clean Water[51] Acts are efficient in setting a standard for optimal pollution. In effect, to find a feasible standard for acceptable risk, the EPA would have to concern itself with that level of dust control not significantly harming the business involved and achievable through existing technology. For all practical purposes, regulatory requirements would have to be within the "optimal" tolerance range of the markets involved.

Presumably, the Cotton Dust case is the first one in our chronology where the transition from TSA-I to TSA-II is completed. It is an instance where a standard is being set for a "known" excess risk. To set this optimal level of risk the court requires an "analysis showing that performance is possible but not an analysis comparing the cost of compliance with the benefits."[52] Still, if "feasibility" requires that available technology be used and that the "costs" to the market are not excessive, then what is the real difference? In both cases, optimal efficiency and the survival of the market dominate the decision. Both procedures are concerned with what the market considers to be economically and technologically "feasible". We are not concerned with what may be feasible from the standpoint of human or natural systems integrity, but only in terms of efficient outcomes.

The final case in this chain, *NRDC v. EPA*,[53] deals with EPA's regulation of risk from vinyl chloride. This case is a natural end to our legal risk chronology as it mandates a definitive two-step test for efficient risk regulation. The court mandated a two-step process for regulating hazardous air pollutants by the EPA. First EPA must

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49 *See supra* note 48, at 509.

50 42 U.S.C.A. §§ 7411 & 7412.

51 33 U.S.C.A. §§ 1311 & 1316.

52 Roger W. Findley & Daniel A. Farber, Environmental Law in a Nutshell 187 (3rd ed. 1992).

53 NRDC v. EPA, 824 F.2d 1146, (D.C. Cir. 1987) (en banc).

establish an "acceptable" level of risk based solely on health considerations before setting standards that provide for an "ample margin of safety." In determining the ample margin of safety, the administrator may require further reductions in emissions to consider health risks, as well as costs and technological feasibility.[54]

We should here read "health considerations" to mean the use of QRA. The established way of assessing health risk is through QRA and it has been codified as a specific procedure for federal agencies.[55] The curious passage here deals with the idea that economic feasibility criteria, found in step-two, would result in tighter regulations. It is more reasonable to assume that consideration of technology and economic cost would lead to more liberal standards from the market standpoint.

This case itself involves the rendering of two decisions by the D.C. Circuit Court: a 2 to 1 panel decision and a unanimous *en banc* decision that reversed the panels findings. The panel's decision affirmed EPA's choice to forgo a long-term zero emissions goal as its regulatory strategy and, instead, rely on BAT technological standards which "considers economic and technological feasibility".[56]

By emphasizing available technology, the EPA has ensured the maximum regulation against uncertainty without the economic and social displacements that would accompany the closing of an industry or any substantial part of an industry. "By ensuring that costs do not become grossly disproportionate to the level of reduction achieved, the EPA guarantees that the consuming public does not pay an excessive price for the marginal benefits of increasing increments of protection against the unknown."[57]

The *en banc* court reversed the panel and held that EPA could not "primarily" rely on BAT technology within §112 of the Clean Air Act.

[54] Rosemary O'Leary, Environmental Change: Federal Courts and the EPA 110 (1993).

[55] See both National Research Council, Risk Assessment In The Federal Government: Managing The Process (1983) and Joseph V. Rodricks, Calculated Risks: The Toxicity and Human Health Risks of Chemicals in Our Environment (1992) for a complete explanation of QRA.

[56] Percival et al., *supra* note 29, at 857. One could argue that this is the point of both the Benzene and Vinyl Chloride decisions.

[57] NRDC v. EPA, 804 F.2d 710, 722-723, (D.C. Cir. 1986) as quoted in Percival et al., *supra* note 29, at 857.

Instead, the court mandated a two-step process: first a finding of a "safe level" of risk; then the consideration of technology and economic cost to find an optimal standard for control of excess hazard.

From our point of view, this reversal does not represent an anti-efficiency decision, but rather the recognition by the court that the panel decision did not find the necessity of establishing a threshold before setting an optimality standard. The *en banc* court reminds us that it is unacceptable to use technological standards to regulate risk before we have established that TSA-I has been transcended and government-set standards are necessary (i.e. that excess risk exists).

All of the decisions in this chain demonstrate that there has been an effort by the court, within the uncertainty of environmental risk issues, to require that the agency first persuade the court that a "significant risk" exists. In other words, the hazard potential of the risk is excessive and beyond the capacity of markets to adequately regulate them. Only when the threshold between TSA-I and TSA-II has been crossed and has defined efficiency as optimality, is it proper to use any type of government standard setting. Only efficiency defined as optimality requires state regulation of markets. This logic is confirmed in the above two-step test where step one concerns the TSA-I threshold and step two focuses upon TSA-II standard setting.

Both of these decisions about vinyl chloride are fascinating in that, while they specifically address the "ample margin of safety" language of §112 of the Clean Air Act, they actually concern whether maximizing efficiency has produced too much risk; and if so, what tests should contribute to the definition of government-set optimal efficiency. The court specifies the steps and the specific tests which agencies must use in this determination of "reasonable risk". It is clear that the Administrator must first determine if a "significant risk" exists before seeking "the level of emissions that will result in an 'acceptable' risk to health."[58] These decisions are dominated by *ex ante* concerns for economic rationality and risk markets. The process of risk regulation, from the standpoint of the courts, concerns "what risks are acceptable in the world in which we live."[59] In the vinyl chloride case, the *Benzene* decision is quoted to add the economic approach to risk as the principle

58 *Supra* note 54, at 1164.
59 *Id.*, at 1165.

and theoretical assumption which is undebatedly considered valid for both parts of the two-step process.[60]

In step one, QRA turns the uncertainty of harm into the probability of environmental risk and places science in the role of gatekeeper for efficient outcomes as it is used to guard against state involvement in risk markets when these markets have not yet broken down. QRA is being used to establish whether or not the prevailing definition of efficiency as maximization has become dysfunctional, allowing excess risk into the environment. It is incumbent upon QRA to establish that a "significant risk" of severe harm exists. If it can not do so, then TSA-I remains in operations and risk markets operate unencumbered.

Judicial thinking, therefore, establishes a two-step process[61] where QRA provides for efficiency in step one and cost-benefit methods which represent efficiency as the core principle of the meta-policy in step two. Only if QRA establishes that TSA-II is in effect, does efficiency require cost-benefit or feasibility analysis to maintain its status as the core principle of the meta-policy. In step two, as the state becomes a market surrogate in the policy process, the court allows the full use of technological and economic considerations in setting the definition of optimal or reasonable risk. The court in the *Vinyl Chloride* decision defined the second step in the two-part test to be specifically aimed at technological and economic feasibility, thereby routinizing the feasibility analysis first suggested in the *Cotton Dust* decision six years earlier.

Two critical variables in the evolution of environmental risk law are the rise of QRA as a requirement for the court to establish risk levels and the judicial banishment of cost-benefit methods in the first phase of the two-step process. QRA alone determines whether efficiency as maximization has created too much risk. The question for this essay is whether the legal institutionalization of QRA for the purposes of turning uncertainty into risk probability is a departure from our

60 *Id.*

61 This process can be argued to reflect trends in federal policy launched by the Reagan Administration (e.g. Executive Order 12,291, 3 C.F.R. 127 (1981)) but is argued here to be the establishment, by an "independent" judiciary, of the dominance of market assumptions in environmental risk policy choice. Here the market assumptions that had long held pride of place in policy argument are being carried over into the regulation of a new area of legal concern.

contention that market efficiency is the core principle of risk abatement meta-policy. It is argued that it is not.

QRA and cost-benefit methods are both based upon the same definition of economic rationality and operate on the same definition of risk as substitutable, tradable, and preference-based.[62] Both QRA and cost-benefit methods are normative decision procedures that employ a theory of comparative instrumental value that is necessary to make each risk tradable with all others. Efficiency is therefore represented by two distinct "decisionist"[63] methods that have a common foundation of values and definitions: QRA (for step one) and cost-benefit (for step two).

The background assumptions of the market can be seen in the rise of quantitative risk assessment as a "scientific" basis for the assignment of probabilities to environmental uncertainty. If we characterize the economic project as one allowing individuals to trade symmetric risks in a market according to their preferences then the first thing one must do is assign probabilities to risks so that these rational calculations can commence. If cost-benefit method represents economic decisionism[64] in general policy argument about standard setting under TSA-II, then quantitative risk assessment represents economic precepts as scientific decisionism for establishing threshold risk.

In both "decisionist situations," the actor is a unitary decision-maker where there is no conflict of interests or arguments but only logic, evidence, and truth. In the present context, policy is assumed to be applicable to proof from empirical observation and verification by experiment. Both also see policy choice from the decision analysis viewpoint where specific probabilities can be weighed and deliberated before choice.[65] Both are positivist in that the methodology is claimed to deduce conclusions from factual premises which themselves are based on general laws, verifiable by observation and experimentation. Additionally, both are preoccupied with instrumental value and consequences, making no allowances for intrinsic character in either

62 This can be seen in the definition of risk quoted from the Benzene decision, *see supra* note 42.

63 Majone *supra* note 9, at 12-15.

64 *Id.*, at Chapter 1.

65 *Id.*

evaluation or justification. In short, both cost-benefit methods and quantitative risk assessment are non-political, myopic, and ethically instrumentalist.

Efficiency as maximization in TSA-I relies on QRA to protect against instances where the market would be regulated without need; in other words, to protect efficiency as maximization against false positives. A fully-functional and unregulated market under TSA-I is innocent unless QRA can prove it guilty; that is, prove that its products or by-products subject humanity to a "significant risk of harm." In terms of efficiency as optimality under TSA-II, the use of quantitative risk assessment allows a more precise mathematical feel for the "optimal" level of risk and guards against too much regulation encumbering the market. In both steps of the risk regulation test QRA turns uncertainty into risk by the assignment of probabilities. As long as economic precepts provide the background assumptions within which QRA operates, efficiency has the determinative power to utilize the products of QRA in support of risk markets.

Although it has been argued elsewhere[66] that cost-benefit analysis, although ethically impoverished, is not value-free, and while other writers[67] have argued that the "scientific" process that is QRA is also normative in nature, it is believed that this argument has been expanded by contending that QRA is a natural extension of cost-benefit methods, protecting efficiency as maximization in TSA-I from false positives and representing efficiency as optimality under TSA-II. In both instances QRA minimizes regulation and maximizes the level of "reasonable risk" in policy standards.

The chain of federal risk cases illustrates that, within environmental risk regulation, there has not been a full evolution from TSA-I to TSA-II. Even well after the publication of *Silent Spring*, we as a nation, continue to argue about whether or not there is too much human-generated risk in the natural environment.

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66 John Martin Gillroy, *The Ethical Poverty of Cost-Benefit Analysis*, 25 Policy Sciences 83 (1992).

67 Kristen Shrader-Frechette, Burying Uncertainty: Risk and the Case Against Geological Disposal of Nuclear Waste (1993).

Environmental Risk, Efficiency and the Statute Law

The power of efficiency considerations is further supported by an examination of the statutory law of risk regulation.[68] The court decisions, mandating a two-part test. First establishing whether TSA-I still holds and then setting optimal standards for risk considering technological and economic feasibility under TSA-II. Also, the protection of efficiency as maximization appears to dominate risk statutes as well.

For the purposes of argument, three distinct sets of statutes in risk abatement law shall be defined. One group of statutes define the risk threshold between efficiency as maximization in TSA-I and optimal efficiency in TSA-II. Next, there are the laws attempting to provide market solutions for the disposition of risk generated waste produced under TSA-I. Finally, there are those laws assuming TSA-II and seeking to integrate risk abatement into the pre-existing regulatory regime established to set optimal efficiency standards for traditional air and water pollution.

These three categories show a profound effort, on the part of legislators, to fit risk abatement into the pre-existing pollution abatement model. The difference is the distinct management dilemma of regulating risk and its profound uncertainty. Our task here is to describe these statutes as they are and have been applied, and to consider what normative principle sets the standards of success and provides the basis for justification of the meta-policy.

The first set of statutes illustrates how policy defends TSA-I against regulatory intervention and the application of law to the direct setting of threshold risk standards concerning chemical agents and their manufacture. Historically, because markets for risk are originally in effect under TSA-I, efficiency is defined in terms of maximization. When synthetic chemicals were first created and marketed they were produced to maximize welfare with only market demand and technological capabilities determining their formulation and introduction into the environment.

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68 For a more complete examination of risk statute law *see* Carl F. Cranor, Regulating Toxic Substances (1993).

However with the advent of general concern that these chemical agents might be producing excess risk, it became necessary to write legislation that would protect against maximum efficiency producing too much hazard given the chemical agents economic value to our prosperity. The two statutes written to set up the threshold between TSA-I and TSA-II for chemical risk are the Toxic Substances Control Act (TSCA),[69] and the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA).[70]

One line of argument within TSCA offers the possibility of a pre-market testing scheme for the *ex ante* protection of the public health from hazardous chemicals. However, the dominant and decisive argument within this legislation defers to and protects an unregulated risk market by placing the burden of proof on the EPA to demonstrate that too much risk exists before they can issue regulations. EPA must first test to show that unreasonable risk exists and the legislation limits both when and what EPA can demand from the industry, which has few pre-market requirements to account for.

The strongest part of this legislation[71] is the fact that EPA can require the testing of a chemical agent when a "chemical may pose an unreasonable risk to health." In language reminiscent of the risk cases we have reviewed, EPA is required to establish a threshold of "significant" or "unreasonable" risk, and only then can it regulate a chemical in order to find an optimal level of environmental risk.

As one might expect in legislation built upon efficiency as maximization, the burden of proof for finding and stopping a hazard is entirely EPA's.[72] It must test the chemical in terms of QRA and prove an "unreasonable" public risk. After EPA has been notified[73] that a chemical will be marketed, it has little power to stop it. The

69 15 U.S.C.A. §§ 2601-2696.

70 7 U.S.C.A. §§ 136-136y. I concentrate here on FIFRA before it was amended in 1996 by the Food Quality Protection Act. Although these amendments made some changes in the law, the essential definition of environmental risk and the fundamental assumptions about the application of market assumption did not change. My argument, being about fundamental assumptions, is therefore largely unaffected. *See* John Wargo, Our Children's Toxic Legacy 301-9 (Second Ed., 1998).

71 TSCA § 2603(a).

72 For a contrast between EPA risk regulation and FDA risk regulation, which shifts this burden of proof *see* Gillroy *supra* note 7, at Chapter 10.

73 TSCA § 2604.

Administrator can require testing mainly under emergency circumstances,[74] and then only after a costly and time-consuming process during which the manufacturer can market the chemical. Specifically, testing must be done by EPA through the rule-making process.[75] If tt does not commit time and energy to the investigation of the chemical and its effects, then a potentially risk-generating chemical will enter the market without regulation.

Therefore, the production of possible toxic chemicals proceeds in this nation without significant pre-market regulation. Even economists[76] admit that the rate of production in this market precludes the gathering of data on all the possible hazards and that "progress in reducing these data gaps has been quite slow."[77] Considered from the standpoint of protecting environmental and/or human qualities, this may seem counter intuitive, but as an expression of protecting efficiency as maximization from the economic disaster of a false positive risk assessment, it makes perfect sense.

The idea of pre-market testing in TSCA exists for one or two cases in a thousand where a known and very dangerous chemical is proposed for marketing. In this odd instance, the EPA can rely on pre-existing knowledge and scientific studies and take the time to analyze the testing and write the necessary rules that will regulate or ban these particular agents. However, to represent and maintain the core principle of efficiency, most chemicals are marketed first and questioned later if over time they exhibit evidence of widespread negative health effects. But the fact that EPA cannot begin to keep up with the testing and has only regulated a few chemical agents implies a failure if, in fact, the meta-policy was suppose to protect ecosystems and regulate the economy *ex ante*. However, if TSCA is there to allow the free functioning of the market, it will only fail in that rare instance when a chemical blatantly produces too much health hazard for its economic value. As a result, the statutes' failure to regulate this market is, by market efficiency standards, a success.

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74 TSCA § 2607(e).

75 TSCA § 2603.

76 Michael Shapiro, *Toxic Substances Policy*, in Public Policies for Environmental Protection (Paul R. Portey ed., 1990).

77 *Id.*, at 236.

TSCA is an expression of the principle of efficiency in risk regulation where the uncertainty of hazard must be proven, and the threshold between TSA-I and TSA-II is not yet crossed. The second piece of legislation, designed to license the commercial use of poisons as pesticides, helps to define this threshold more succinctly as it simultaneously examines the question of "optimal" risk under TSA-II.

Given the known hazards, FIFRA[78] is more restrictive than TSCA and is concerned with an optimal level of pesticide production. However, it is contended that in designing and implementing FIFRA, EPA has maximized the scope of an efficient risk market within TSA-I. This particular risk market deals with poisonous substances that are intended to kill plant life, and have been known to take unintended human and animal victims. Therefore, it is reasonable and efficient in this case to have the manufacturers of these substances acquire a license in order to market their chemical pesticide. FIFRA protects the market by not allowing EPA to make any judgments about the need for a particular product, or its comparative safety with other products in the field. Regulators within FIFRA can only demand that minimum requirements be met. In addition, EPA is not empowered to make any *economic* judgments. As long as a potential pesticide meets minimum functional and labeling requirements it must be licensed and allowed to take its place in the market.

The policy history of FIFRA[79] is a story of the growth of law from the demands of economic prosperity and technological innovation within agricultural markets. The efficiency of these poisons, their comparative ease of use, and their improvement of crop yield, define them as an issue within the law.[80] Motivated by the goal of efficient crop yield, the administration of pesticide regulation (like the administration of our forests) began within the U.S. Department of Agriculture. This pride of place for efficiency within the meta-policy

78 7 U.S.C.A. §§ 136 et seq.

79 *See* Christopher Bosso, Pesticides & Politics: The Life Cycle of a Public Issue (1987). I am told, by the author, that a revised edition of this argument is now being written.

80 "Pesticides may have provided farmers with a new technological edge in the battle against pests, but the economic imperatives made chemicals absolutely necessary. The new products were relatively cheap and promised to the farmer increased yields at lower costs. Such economic arguments were, if not totally compelling, highly persuasive." *Id.*, at 32.

has caused pesticide regulation, even when transferred to the EPA in 1970, to be designed so as to foster the market while attempting to establish safeguards against the production of excess risk.[81]

Again, like within TSCA, the safeguards exist for that rare case when a particular chemical agent (e.g. DDT) is found to produce too much risk for its economic benefits. In a regulatory framework where the overwhelming imperative is to foster economic prosperity, it is only after DDT has definitively passed over the threshold between TSA-I and TSA-II that it qualifies for further regulation.[82] Like TSCA, FIFRA is legislation in defense of the unregulated TSA-I market and efficiency as maximization. The difference between the two is that the subject of FIFRA is known poisons and therefore a degree of uncertainty is removed from the risk calculation. Because this is a market for poison, more risk is tolerated as a matter of course. License requirements support a "free" market by allowing products to enter the market as long as they meet minimum requirements. This maximizes market entry while it sets up a mechanism where very risky poisons can be identified and regulated. From an efficiency standpoint, this is the measure of success for FIFRA. In both cases, regulation of chemical agents grants the benefit of the doubt to the market and lays (all or most of) the burden of proof on the regulatory agency. The burden of proof is both for the charge that any chemical has or will produce too much risk and for the degree of regulation required for that particular poison in the environment.

In both cases, EPA cannot make any economic judgments about the need for, or comparative safety of, any potentially toxic agent. Therefore, EPA must allow the market to decide a chemical's fate unless it provides such an obvious and immediately known danger that it merits utilizing the courts and the agency's time to get it off of the market. For example, since the passage of FIFRA in 1972, after years of service to the economy, only DDT and ALAR have been successfully banned from U.S. markets. DDT was the most important and widely used pesticide in the U.S. for 30 years and it continues to be exported.[83] The removal of ALAR from the market, after years of

81 *Id.,* at 152-3.

82 Even at this point, after DDT was considered too risky for U.S. sale, foreign sales were allowed to continue.

consideration as a vital chemical to the apple industry, was due to a voluntary withdrawal by the manufacturer due to loss of money and market status.[84] One needs to remember that this predisposition toward minimal interference in risk markets is a success story for the expression of efficiency as the core principle of environmental risk law.

The second category of risk statutes concerns the attempt to find market solutions to the transportation, disposal, and clean-up of toxic waste. In this category, we have two legislative efforts, one an original piece of legislation like FIFRA and TSCA and the other an attempt to graft toxic regulation onto an existing statute. The grafted legislation is the Resource Conservation and Recovery Act (RCRA) which was an amendment to the pre-existing Solid Waste Disposal Act,[85] while the original legislation is the Comprehensive Environmental Response Compensation and Liability Act[86] (CERCLA).

In RCRA and CERCLA are found the most stringent market measures applied to risk. They represent an effort, not only to trace all suspected toxics from cradle to grave, but to allow those who are "harmed" by toxic waste to sue the many "responsible parties" for compensation.[87] Although the regulation of toxic waste under these two legislative mandates has been criticized as heavy handed and cumbersome, from the market point of view and the standpoint of efficiency, one would expect that the regulation of toxic waste would be the most cumbersome.

First, toxic waste no longer provides a positive market benefit that increases welfare but only a negative market cost in terms of storage and health effects. While previously, during the production phase under TSA-I, the potential cost of risk-generating material or technology was outweighed by its benefits in storage as waste. Risk is all external cost and requires regulation to integrate it back into the cost of the manufacturing process. In line with traditional pollution abatement, where disposal involved direct release into nature at zero cost but

83 *See* both Bosso *supra* note 80 and David Pimentel & Hugh Lehman, The Pesticide Question (1996).

84 Percival et al., *supra* note 29, at 490-95.

85 42 U.S.C.A. §§ 6901-6992k.

86 42 U.S.C.A. §§ 9601-9675.

87 *Id.* § 9607.

became regulated by public standards, with risk-generating toxins, it has been collectively decided that these agents can no longer just be released but must be stored and monitored. In the case of toxic waste the TSA-I threshold has been passed and government regulation, within TSA-II, seeking optimal levels of risk from waste and ways to internalize externalities that are "known" hazards, has become conventional to policy-making.

Second, the regulatory tools (statutes) that exist to set the optimal level of risk in the economy, are efficiency-based. RCRA is no more than sound accounting for specific wastes and the attempt to internalize a hazardous externality through follow-up and management of the transportation and disposal of potentially cost-generating compounds. CERCLA has an *ex post* liability mechanism that assigns responsibility to manufacturers and sends them the appropriate market signals that allow them to anticipate cost and figure it into production. Accounting and liability law are efficient means to measure and manage optimal levels of risk from waste, mimic the market, and integrate the cost of hazardous externalities.

In effect, both RCRA and CERCLA are afterthoughts of an efficiency-based environmental law. Risk is maximized in production within TSA-I which generates waste requiring disposal. Crossing into TSA-II, by protecting the market against false positives, a situation has been created where some harm will be done to individuals and nature. The efficient answer to these problems is to adopt a strict accounting system to track the production and allocation of potentially toxic agents without interrupting their production, while setting strict and several liability as a legal standard and hold producers, transporters, and financial underwriters responsible for any harm that does befall the odd individual.[88]

Overall, the efficiency core of environmental law produces risk within TSA-I and requires that responsibility for any future harm from this risk be internalized into market price. RCRA and CERCLA do this. In addition, RCRA and CERCLA try to deal with disposal problems created by the framework of efficiency-based environmental law, concentrating waste from air and water onto land.[89] The final set

88 Percival, *supra* note 29, at 630-56.

of statutes, or more properly amendments to existing statutes, attempt to deal with risk in air and water media by grafting hazardous pollution provisions onto preexisting legislation. Efficiency is defined in terms of optimality under TSA-II. The concern is not for risk from market products themselves but for risk from the by-products of manufacturing that might contaminate our air and water.

To provide for these concerns, §112[90] of the Clean Air Act[91] and §307[92] of the Clean Water Act[93] were created. In both of these cases, technology standards are designated for "hazardous" or "toxic" emissions. The same legislation and technological standards approach connected with the abatement of traditional pollution are now, without significant amendment, being utilized in the regulation of environmental risk. Either environmental risk is no different than traditional cases of air and water pollution, which it is argued is false,[94] or its comprehensive quality and distinct characteristics are being ignored in the codification of air and water risk policy. But let us begin with the legal treatment of traditional pollutants, upon which risk regulation is grafted.

The aim of clean air and clean water legislation is to protect the public health and maintain a level of environmental quality that will support productivity.[95] The objective of both pieces of legislation is for the government to set a "shadow price" for pollution through the establishment of standards that are specific to particular emissions in specific air- or water-sheds. Setting an optimal level of pollution is

89 "The hazardous waste problem faced by the United states is a by-product of an advanced economy and technological life-style. It is also the result of our other environmental laws, which have redirected health and environmental risks from air and water to the land. Coping with the risks of carelessly discarded wastes, while trying to maintain the other aspects of environmental quality and economic well-being, will require a flexible regulatory structure that tries to minimize the costs of transition between the status quo and the future." Roger C. Dower, *Hazardous Wastes*, in Public Policies for Environmental Protection 189 (Paul R. Portey ed., 1990).

90 42 U.S.C.A. § 7412.

91 42 U.S.C.A. §§ 7401-7671q.

92 42 U.S.C.A. § 1317.

93 33 U.S.C.A. §§ 1251-1387.

94 This is not my point alone. See Page *supra* note 25, for a full explanation of the distinctive characteristics of environmental risk as a zero-infinity problem.

95 42 U.S.C.A. §7401 (b)(1).

accomplished both through the setting of ambient air and water quality standards and by the use of technology to control emissions. Both of these statutes therefore attempt to find the optimal level of pollution by the combination of Quality-Based and Technology-Based Standards.

Whether they are National Uniform Ambient Air Quality Standards[96] or Water Quality/Effluent Standards,[97] the quality standards represent the attempt to locate the proper level of pollution through establishing the minimal level of environmental quality needed to maintain human health and aesthetic qualities. Although the traditional "economic" approach to optimal and efficient polluting makes a distinction between charging a "price" per unit of pollution and standard setting.[98] It can be argued that a performance standard and a price on polluting are efficiency-equivalent means to the same end: setting an optimal (i.e. efficient) level of pollution.[99]

Specifically, the quality standard sets the optimal level by defining how clean the air- or water-shed must be and then issuing permits for each type of pollutant equal to the level of waste disposal that will achieve this environmental quality. In essence, the setting of uniform standards, especially when it is left up to the individual industries to meet these restrictions, is more efficient than setting a dollar price per unit of pollution; such price setting requires much more monitoring and administration to achieve the same result.[100] Even if standards are efficiency-equivalent to prices for pollution, with less administrative headaches, specific technology standards as opposed to general quality standards may not be said to grow from a consideration of efficiency. However, technology-based standards establish mechanical requirements for each industry and are an attempt to operationalize an efficient means to attain the ends set by the quality standards. With concern for Best Achievable Control Technology (BACT), Maximum Achievable Control Technology (MACT), Reasonably Available Control Technology (RACT) or Best Conventional Control Technology (BCT),[101] legislation sets technological requirements for

96 42 U.S.C.A. § 7408 (CAA: NAAQS-§108).

97 33 U.S.C.A. § 1311 (CWA: §301).

98 RUFF, *supra* note 16; Mill & Graves *supra* note 16.

99 Majone, *supra* note 9, at 126-33.

100 *Id.*, at 134.

scrubbers and processes that clean waste before it is emitted into environmental media.

As quality standards set the efficient ends for the condition of an environmental media, technology standards mandate specific equipment that a plant must install as a means to higher quality air or water. In the beginning, with the Clean Air Act, the focus was on quality standards. However, with the Clean Water Act just two years later and in the recent rewriting of both air and water legislation, the trend has been toward the ascendancy of technological standards. Does this mean that efficiency is being forsaken?

It is argued that the drift toward technological standards is a reflection not of the replacement of efficiency with another principle but its redefinition. The problem faced by federal abatement law in the last 25 years is twofold. First, it had to retroactively clean up more than optimal level of pollution produced and piled up over many decades by the market within the context of TSA-I. Second, federal law had to establish the means by which an optimal level of pollution (by industry and media) could be established and maintained over time, factoring in technological advancement.[102] The trend toward reliance on technological standards must be characterized by the principle that motivates it. If the primary concern were natural systems and their intrinsic value, then technology standards could be seen as a means to that end, but this is not the case.

Under TSA-I, technology set the rate at which humans use the environment. Technology progressed so quickly that natural systems were stressed beyond an efficient level by pollution. The market answer was to let government set the optimal rate of natural systems use (under TSA-II) and the means to this end was a technology of pollution abatement to counteract a technology of pollution production.

Technological standards are a way to uniformly internalize pollution cost across any sector of the production economy. Such standards require that all current abatement procedures be used to establish optimum pollution for any particular industry at any particular

[101] *E.g.*, under the Clean Water Act, BPT is used for existing point sources; BCT for conventional pollutants; BAT for toxics; BADT for new sources.

[102] Both of these problems have intergenerational implications which are beyond the scope of this essay, and the principle of efficiency, to analyze.

time. The law of technology standards focuses upon "conventional," "reasonable" and "achievable" technology, and does not judge the "necessity" of the polluting production process or alternatives to it. There is no awareness in these standards that particular natural systems require a particular degree of environmental quality prior to our wants or that human integrity must have a cleaner environment than present technology can produce. The focus is on employing available technology and pronouncing the resulting air or water quality as clean enough. In effect, as technology standards have eclipsed quality standards, the setting of the optimal level of pollution has shifted away from how clean the environment ought to be and become more focused upon how clean technology can make our manufacturing process, given current economic and scientific considerations.

One way to understand the seemingly counter-intuitive propensity for decision-makers and regulators to graft risk regulation onto existing abatement legislation is the assumption that they believed they were doing nothing different in abating risk than in abating traditional pollution. In essence, finding efficient or optimal levels of contamination consistent with market functioning and an acceptable materials balance. Given this conceptualization, *technological standards for optimal risk* are a conventional, logical, and efficient solution to toxic air and water contamination.

The only accepted difference within TSA-II is that toxic contaminants are characterized by greater uncertainty and potential harm. A concession is made which mandates a more stringent technological standard for toxic rather than criteria pollutants. For example, hazardous air pollutants are regulated by the application of BACT under §112 of the Clean Air Act. However, understanding that toxins are more hazardous, "best available" technology is still the only regulation standard. Based on an efficiency principle that does not recognize a special class of risk in environmental risk dilemmas, it is necessary to allow the optimal economic use of environmental media. Section 112 of the Clean Air Act mandates that "in setting hazardous air pollution standards, EPA is to consider both the beneficial and adverse economic, environmental, and energy impacts associated with the standard."[103]

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[103] Mary Devine Worobec & Cheryl Hogue, Toxic Substances Controls Guide:

"Efficient" Environmental Risk Law and Policy

Current environmental law has grown from a meta-policy with a core principle of economic efficiency and a policy space where efficiency held pride of place. Within the context of risk abatement, the statutes and their interpretation have consistently defended markets from excess regulation whenever possible. Although one can argue that the statutes examined here have language related to a core of efficiency, as well as language based on the value of natural systems and human integrity. I concede that both lines of argument are part of courts' deliberation, the core principle in legal and policy choice remains either maximum or optimal efficiency. In terms of leaving the burden of proof on the regulators, treating each "resource" or media non-comprehensively from within a market framework and the consideration of all factors effecting the economy, efficiency becomes the official standard and justification for legal risk decision-making.

With the conceptualization of environmental risk law and policy from within the context of TSA-I and TSA-II, the gradual evolution has been traced from maximum to optimal efficiency where the law defends TSA-I as long as possible then unwillingly moves to TSA-II. Due to uncertainty, the courts have been preoccupied with establishing the parameters of the threshold between TSA-I and II. The "science" of risk assessment used in defense of TSA-I, protects the market from false positives. Efforts to find efficiency as optimality, when TSA-II is established, tend toward implementation of traditional technological standards and/or the use of efficiency tools, like accounting and liability law.

The background of environmental law and regulation consists of economic ideas and ideals. Whether it is the economic definition of rational choice or the economic calculus applied to risks as symmetric and preference-based, efficiency requires that risk be regulated in the market where the public is only protected from extremely hazardous substances by the application of current technology to establish optimal levels of risk.

Overall, efficiency remains the core principle of environmental meta-policy, codified in statutes and reinforced by the courts.

Federal Regulation of Chemical in the Environment 121 (2nd ed. 1992).

Although a stronger, non-efficiency argument exists in the environmental meta-policy debate that agrees with Justice Marshall's dissenting opinion in the *Benzene* decision that "today's decision will come to be regarded as an extreme reaction to a regulatory scheme that, as the Members of the plurality perceived it, imposed an unduly harsh burden on regulated industries."[104] Therefore efficiency remains the core principle of environmental risk law.[105] Efficiency dominates the arguments that form the deliberative strata of environmental meta-policy allowing it to define what is "reasonable" setting the standards for law and policy. The long-standing status of efficiency makes it conventional for legislators, administrators, and courts to think primarily of the economy when they regulate the environment.

If existing environmental law is ineffective, unfair, unable to solve problems,[106] and suffers from a piecemeal approach by dividing nature into sectors for use,[107] it is precisely because of the core principle of efficiency. Majone[108] contends that the core principle and how it leads to conceptualizing the policy problem is the most crucial factor in determining the design of any particular meta-policy. For environmental risk law, efficiency defines not only the justification for decision-making but also the standard for success and accountability. Therefore, if environmental risk law is unreasonable and inadequate, it is because the fundamental principle of efficiency, at the base of its policy argument, is an unreasonable and inadequate foundation for the law of environmental risk.

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104 *Supra* note 42, at 198.

105 Other dissenting opinions in major environmental cases also espouse lines of argument that are based on environmental values. It is in the dissenting opinions of the courts that we would expect to find non-core argument attempting to gain the persuasiveness necessary to become the core of a new environmental meta-policy. *See, e.g.*, Justice Douglas' dissent in Sierra Club v. Morton 405 U.S. 727 (1972).

106 Dryzek *supra* note 11, at part I.

107 *See* Campbell-Mohn, *supra* note 2, at 51-71.

108 *See* Majone, *supra* note 9, at 150-154.