

משפט וסביבה – סדנת פרופ' יובל לוי ושות'
The Prof. Yuval Levy & Co. Law and Environment Workshop

משפט וסביבה – מאמרים בדרך
Law and Environment Working Papers
1/5775

Moral Hazard, Property, and Nuclear Energy

Bruce R. Huber
Notre Dame Law School

11 November 2014

Workshop Coordinators:

Prof. Issachar Rosen-Zvi
issirz@post.tau.ac.il

Dr. David Schorr
dschorr@tau.ac.il

מנחי הסדנה:

פרופ' יששכר רוזן-צבי
issirz@post.tau.ac.il

ד"ר דוד שור
dschorr@tau.ac.il

MORAL HAZARD, PROPERTY, AND NUCLEAR ENERGY

Bruce R. Huber
Associate Professor of Law, Notre Dame Law School
Notre Dame, Indiana, USA

1. Introduction

The tension between the pragmatic and normative dimensions of law is acute in the context of energy. Energy often lies at the intersection of conflicting imperatives: reducing fossil fuel emissions, for example, is crucial to mitigating climate change, yet fossil fuels are also perceived as crucial to global economic development. Nuclear energy presents a similar dilemma. It offers carbon-free energy in massive quantities, but entails risks that will endure for thousands of years; it solves a problem today, but imposes a great burden on future generations.

Policy makers, having deemed the benefits of nuclear power to exceed the costs, have developed complex regulatory schemes intended to safeguard nuclear development and to protect the public from the possibility of harm. So thorough are such schemes that nearly all nuclear research and development takes place under the watchful eye of government. Modern nuclear regulation typically relies on substantial governmental involvement even in private technological development, strict and ongoing government supervision of private activities, and implicit governmental “backstopping” of all costs and liabilities associated with nuclear projects. Underlying each of these prongs are the assumptions that government is capable of incentivizing both public and private actors to deal appropriately and safely with nuclear harms, and itself dealing with disaster should it ever occur.

Yet there exists an enormous moral hazard problem when actors of today, whether private or public, are unlikely to bear themselves the consequences of their activities. At present,

neither liability schemes nor existing regulation are well designed to deal with harms in the distant future, especially those that are speculative or unknown. If harm becomes actionable only long after the conduct that created the harm, liability arising from that conduct may be imposed too late to shape the relevant behavior. And governments, even when not immune from liability, are motivated by different incentives than private entities, and therefore may not respond to regulatory signals as would a rational private actor.

These problems are raised squarely by nuclear materials, which can cause enormous human harm for thousands of years. The legal mechanisms deployed to date to address nuclear activities include pooled reserves, funded by reactor operators, and backstopping by public funds should private funding fail. In the case of disaster on the scale of Fukushima, property remediation will take place—if at all—principally at the public’s expense. Lawmakers have generally failed to ensure that the public is spared the future expenses that could arise in connection with activities taking place today. More importantly, the mismatch between future harms and the present requirements of law is a persistent feature of modern environmental governance. The ongoing failure of American political institutions to address the disposal of nuclear waste, for example, stands as a chilling reminder that these institutions are structurally handicapped from addressing problems associated with future harms. The American public has unwittingly and by default assumed a fantastic set of liabilities associated with long-term nuclear harms.

At the same time, nuclear power occupies an import position in the energy systems of many nations. Not only do nuclear plants supply reliable baseload power at a low marginal cost, but this power is very low in carbon emissions. The process of nuclear power generation itself is virtually carbon-free; other lifecycle emissions, associated with uranium mining and plant

operation, are very small in relation to nearly all-other large-scale sources of energy. Furthermore, nuclear energy use thus far has proven remarkably benign to human health. In the wake of the Fukushima disaster, George Monbiot, a notable British environmentalist, abandoned his “nuclear-neutrality” because, in his words:

A crappy old plant with inadequate safety features was hit by a monster earthquake and a vast tsunami. The electricity supply failed, knocking out the cooling system. The reactors began to explode and melt down. The disaster exposed a familiar legacy of poor design and corner-cutting. Yet, as far as we know, no one has yet received a lethal dose of radiation.¹

Indeed, one wonders why nuclear power has been so vilified by many environmentalists for so long when the burning of coal has quietly killed tens of thousands over the past several decades. On a per-unit basis, nuclear energy has led to far fewer fatalities than any other major source of energy.

This paper questions whether law and lawmaking institutions have evolved sufficiently to address appropriately the long-term risks associated with nuclear technology. This inquiry is particularly timely at the present moment. Many developed economies first built out their nuclear generating capacity during the 1970s and 80s, and then paused as the initial economic justifications for nuclear power weakened. This first set of nuclear reactors is approaching the end of its useful life.² In polities such as the United States and the United Kingdom, important decisions about systemic reliance on nuclear power must be made in the next ten to fifteen years. Both countries, for example, presently rely on nuclear generation for 15-20% of their electricity supply. Either new nuclear power plants must be constructed to replace the old, the operating licenses for aging plants must be extended, or other sources of generation must be constructed

¹ George Monbiot, *Why Fukushima Made Me Stop Worrying and Love Nuclear Power*, THE

² The operating licenses for the existing fleet of nuclear power reactors in the United States, for example, will expire by 2040. See U.S. ENERGY INFORMATION ADMINISTRATION, ANNUAL ENERGY REVIEW 2010 283 (2011).

rapidly and on a grand scale to replace retired nuclear plants. The first two approaches represent, obviously, a renewed commitment to nuclear power—and one made under quite different circumstances than existed nearly a half century ago when nuclear power was first embraced. It is well worth asking, then, whether present laws and legal-political institutions are bearing the weight of responsibility for nuclear development in ways that safeguard the interests of present and future generations.

This paper will proceed as follows. Section 2 provides some conceptual and analytical background, explaining some fundamental concepts in the law and economic analysis of property law and regulation.³ Section 3 describes the state of nuclear energy regulation in the United States. Section 4 offers some analysis of this scheme, and Section 5 concludes.

2. Background

Let us begin with some conceptual background. The “spillover” or externality is a familiar concept⁴: a handy if imprecise definition is simply *the effects of a transaction on those not party to the transaction*. Externalities can be positive or negative; a third party might benefit from or be harmed by others’ dealings. The social problem of negative externalities is that entities may have incentives to act in socially undesirable ways if the personal benefits they

³ The lens of property law is given pride of place throughout the paper; throughout its evolution, the law of property has confronted the tension between an owner’s right to use property as he or she pleases and others’ right to remain unharmed by the owner’s activities. The common law doctrine of nuisance, and the modern regulatory schemes that have largely supplanted it, squarely address this tension.

⁴ Despite widespread familiarity with the concept, it eludes precise definition. *See* Dan Kelly, *Strategic Spillovers*, 111 COLUM. L. REV. 1641, 1643 n6 (2011) (providing a summary of economists’ usage of the terms). I use “spillover” and “externality” interchangeably.

obtain from doing so exceed the personal costs. A great deal of law can be understood as a social attempt to limit the occurrence of negative externalities.

The generation of nuclear power, like any other economic activity, involves both public and private costs and benefits. By and large, however, public debate about nuclear power ignores the private incentives at stake and treats the issue primarily as a public concern. This may be quite appropriate: although energy companies are profit-seeking entities, nuclear technology is safeguarded by all manner of governmental intervention. Nuclear scientists are a highly trained, highly professionalized corps that some have described as more loyal to their science than to their corporate employers.

But when nuclear power is compared to other dangerous or risky land uses, it seems most strange indeed that private incentives are left out of most policy analyses. It is quite conventional in standard law-and-economics analysis to inquire into the private incentives facing business decision makers. In this section, therefore, we will examine some background in economic analysis of property use and regulation, as though nuclear energy generation were “just another land use.” The central questions of this paper are as follows: (a) Do private actors responsible for nuclear power generation take on an appropriate portion of its costs? (b) Do public actors responsible for approving and regulating nuclear power generation take on an appropriate portion of its costs?

2.1 Spillovers and the Law of Property

The law of property in particular is often understood to include various doctrines aimed at limiting spillover effects. Historically, the law of real property responded to dangerous property-

based conditions via the law of nuisance. If a landowner maintained a nuisance on his or her property and another person was injured as a consequence, the landowner could be subjected to liability or, in some circumstances, ordered to abate the nuisance. Liability provided both a remedy to the injured party and a disincentive to future owners to maintain similar nuisances. The efficacy of nuisance as a mechanism for regulating property uses, however, is limited in several crucial respects. Because liability is retrospective, nuisance shapes current behavior only imperfectly. Furthermore, conventional nuisance analysis requires a balancing of harms with the social benefits arising from the asserted nuisance; socially beneficial activities are often allowed to endure despite causing environmental and other damage. Finally, nuisance provides little help where harms are diffuse or delayed, because the burden of proving causation may prove insurmountable or the party causing the nuisance may no longer be available or solvent.

In the modern regulatory state, nuisance law has given way to pervasive land use regulation. Regulation is prospective rather than retrospective, so once concerns about the constitutionality of regulation were laid to rest,⁵ lawmakers used regulation to control landowners' behavior *ex ante*. Today, nearly every conceivable use of property is subject to some form of regulation. But regulation too is imperfect as a means of social control over the uses of property. The efficacy of regulation depends on the ability of regulators to design rules appropriate to the risks they seek to contain, to promulgate such rules effectively, to monitor compliance, and ultimately to enforce rules and sanction noncompliance. In the American case at least, regulators commonly fail at one or more of these tasks. The following sections will briefly, and quite generally, describe the nature and causes of these failings.

⁵ Accounts of the modern constitutional law of regulation generally begin with *Munn v. Illinois*, 94 U.S. 113 (1876).

2.2 Abandonment and Negative Value Property

Central to the success of land use regulation, and nuisance as well, is the link between owner and real property. With ownership comes various responsibilities and duties. As many have noted, the benefits of ownership give these duties and responsibilities a self-enforcing quality: the owner who takes on the duties of ownership is entitled to reap the value of improvements to and appreciation in property. This in part explains the social utility and widespread usage of the fee estate or complete ownership of property.⁶ Straightforward self-interest impels most owners to care for, maintain, and even improve their property over time. The owner is likely to regard real property in particular as a valuable asset which may be sold or passed upon death to a loved one. Breach of regulatory duties, or liability arising from a successful nuisance action, negatively impact the value of property. Both the common law and regulation operate on the assumption that property owners will generally internalize the foreseeable penalties imposed by law; by adjusting the magnitude of the relevant penalties, lawmakers can shape the current behavior of owners according to the public interest. By contrast, real property that is unowned may be stripped of its value and abandoned, as has been typical of forests and mineral regions throughout history.⁷ It is for this reason that modern property law generally disallows the abandonment of real property: the rule against abandonment, buttressed

⁶ Robert Ellickson, *Property in Land*, 102 YALE L.J. 1315 (1993); Harold Demsetz, *Toward a Theory of Property Rights*, 57 AM. ECON. REV. 347 (1967). Both of these seminal articles applaud the fee simple for forcing owners to adopt an infinite time horizon in order to maximize property's current value.

⁷ Perhaps the most sobering account of this phenomenon is legal historian Willard Hurst's description of the denuding of Wisconsin timberlands in the late 1800s. J. WILLARD HURST, *LAW AND THE CONDITIONS OF FREEDOM IN THE NINETEENTH CENTURY UNITED STATES* (1956).

by owners' self-interest, helps ensure that property owners internalize the costs associated with their use of land.⁸

But even if abandonment is formally disallowed, there remain ways that property owners can extract value from land—either by stripping it of resources, or using it as a “sink” for liabilities—and escape accountability for it. We might think of this as functional abandonment: even though legal title remains in the owner, the owner is able to abandon costs or liabilities and walk away, leaving the costs of property remediation to the public. In fact, such circumstances are so commonplace in the United States that governments have instituted comprehensive programs to address certain categories of functionally abandoned land.

Here are some examples drawn from American law. The federal Leaking Underground Storage Tank (LUST) fund is financed by a \$0.001 tax on each gallon of motor fuel sold in the United States. The fund is used by the U.S. Environmental Protection Agency (EPA) to pay for cleanups from leaking tanks “at sites where the owner or operator is unknown, unwilling, or unable to respond”—generally, abandoned tanks that are now leaking. Another example may be found among the nation’s myriad abandoned and unreclaimed mines and wells, which remain a major environmental and safety problem on both public and private lands. Today, bonding requirements support future reclamation (in theory at least), but existing sites are remediated, if at all, by state or federal funds—some derived from industry-specific taxes, but most paid out of the general fund. Finally, the “Superfund” law in the United States—the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)—was intended to impose liability on surviving entities linked to past pollution. Yet less than 20% of the costs of cleanup for Superfund sites come from responsible parties. Until 1995, Superfund was financed

⁸ See Lior Jacob Strahilevitz, *The Right to Abandon*, 158 U. PA. L. REV. 355 (2010).

principally by taxes on crude oil; since then, the dominant funding source is appropriations from the general fund. The taxpayer at large, then, is ultimately responsible for paying for a great deal of the cleanup of messes left by previous landowners.

Of course, the incentive to socialize costs of property remediation will arise whenever land has a “negative value” in that the cost of remediation exceeds any residual positive land value. In such instances, property owners have an incentive to shed the negative value asset. When law allows them to do so—whether by the letter or simply by way of lax regulatory enforcement—subsequent owners, we may assume, learn that some costs of land use may, in fact, be abandoned to the public.

2.3 Public Property

Liabilities associated with dangerous land uses may also be socialized by locating such land uses on publicly owned land. Just as public lands are sometimes (mis)used as a dumping ground for trash, so also may various land uses leave land in a state of disrepair for subsequent users.

Again, the American experience affords numerous examples. Mining activity on public lands is often associated with enduring harms caused by abandoned mines or inadequate remediation of mined lands. Some of the nation’s most expensive industrial waste cleanup sites are former mining sites. Mining regulation today imposes substantial reclamation requirements, but generally these requirements fall short of ensuring that land is returned to its prior condition. For example, pit mines, in which massive pits are dug out of the earth and fill removed to an adjacent area, are not filled back in when mining is complete. Instead, the massive pumps that

keep groundwater from filling the pits are shut off, allowing a lake to form in the abandoned pit. These lakes are often toxic, but regulators accept this arrangement because the lakes are generally remote and the costs of complete reclamation unacceptably high.

Eduardo Peñalver has noted, in making the claim that the “right” to abandon personal property is illusory, that “the fact that all land is owned means that the owner of an item of personal property who wishes legally to abandon it must intentionally deposit the item on some piece of *owned* land ...”⁹ A party wishing to abandon a chattel, therefore, will not likely place it on her own land, but rather will give it to someone with whom she has contracted to remove it (like a landfill or waste disposal company), or will abandon it via trespass onto land owned by another. Similarly, a party wishing to sever liability for dangerous land use will, to the extent that the use is movable, tend to place the land use on the property of the party most willing to accept that liability. In many instances, public land owners are willing to tolerate land uses that private owners would not.

2.4 Temporal Spillovers

Another set of problems arise with uses of land that deliver present benefits but entail residual risks after the cessation of the beneficial use. It is possible for current users of land to push costs onto future owners of land. As a general matter, owners’ personal stake in preserving the value of property, sharpened as it may be by a regulatory backdrop, prevents liabilities from being pushed onto future owners: owners ultimately bear the costs of property degradation and regulatory noncompliance, because prospective purchasers will insist that such costs are

⁹ Eduardo M. Penalver, *The Illusory Right to Abandon*, 109 MICH. L. REV. 191, 203 (2010).

incorporated into the transaction price. For example, sophisticated property buyers today assess property for environmental contaminants as a matter of course. Potential liability is therefore built into the price of property, which itself serves as a tool for impressing possible future costs upon owners.

There are situations, however, in which this system breaks down. For example, problems can arise when the present occupation of real property is severed from the fee ownership. In such instances, the occupant and fee owner may have different incentives: the occupant, lacking a stake in the long-term well-being of the property, may be able to exploit “play in the joints” of the scheme of property law and regulation. Not unlike a user of public property, an occupant may abuse property and leave liabilities to the fee owner, even if contractual protections are in place. This occurs both in the typical leasehold situation and in certain cases of joint ownership. These problems are relatively well-understood, and the doctrine of waste exemplifies the sorts of legal tools that have been employed by courts to address them. The common law doctrine of waste arose to prevent current occupants from misusing property to the detriment of the fee or residual owner. Legislatures and regulatory bodies have also created various safeguards for owners by, for example, requiring tenants to uphold basic standards of conduct that may exceed the floor created by the doctrine of waste.

But property law has a difficult time addressing harms that arise from, but manifest only after the cessation of, some otherwise beneficial use. Neither nuisance nor existing regulatory schemes are well designed to deal with future harms, especially those that are speculative or unknown. To function properly, liability mechanisms must compel an actor to consider costs before the relevant conduct is undertaken. If harm becomes actionable only long after the initial conduct, liability arising from that conduct may be imposed too late to shape the relevant

behavior. Furthermore, when problems arise after the cessation of the use that caused them, it is not uncommon for the costs of remediation to be socialized. The risks of future harms will only be reflected in the present price of property if those risks are known or suspected; the degree of the impact on price, in turn, will depend on how such risks are understood and calculated as well as the risk tolerance of the transacting parties. Risks that are systematically underestimated, of course, will not bear on property value to a degree that would optimally discourage them.

There are other regulatory approaches to long-term property harms. General antipollution regimes, such as the Clean Water Act, go some distance towards regulating land uses that might inflict damage on- and off-site; there are also many more limited regulatory schemes that are applied in a piecemeal basis. Specific land uses, for example, are subject to regulatory systems tailored to each use. Nuclear power facilities are subject to a great deal of regulation and ongoing oversight. And bonding requirements are commonly used to ensure that oil and gas drillers and mining operations properly reclaim their sites after operations cease.

Of course, the fact that law can force actors to internalize the costs of their activities does not necessarily mean that dangerous or risky activities will not be undertaken. Parties may engage in an activity that taints their land and renders it unsalable, for example, and simply plan to hold on to the property in perpetuity. This situation can lead to blight and other impositions on the public interest; the public may end up paying for remediation even though the property at issue has not been formally abandoned. Consider brownfield redevelopment projects as an example. Despite the relative success of many such projects, there remains a great deal of American property that is effectively out of circulation because its owner lacks the capability to remediate existing damage. As with abandoned wells and mines, then, remediation is likely to include public expenditures.

We can think of all these instances as *temporal spillovers* in that the externality at issue is not suffered by owners adjacent in *space*, but adjacent in *time*. Law has a somewhat difficult time addressing temporal spillovers, because the harm to be remedied may arise only after the party responsible for the harm has ceased operations, abandoned or sold the property, or otherwise cannot be found. Again, basic mechanisms of ownership may in some instances be sufficient to avoid such circumstances—but not always. As we will see shortly, nuclear property is precisely the sort of property for which conventional ownership is insufficient to reflect temporal spillovers.

2.5 Courts, Agencies, Legislatures

Obviously, regulation and legislation are very different from the common law as an institutional matter. The common law is often regarded as having an internal logic, while regulation and legislation are propounded by public law processes and therefore partake of the pathologies of those processes. Nonetheless, some of the shortcomings of the common law doctrines described above—such as nuisance and waste—are replicated in positive law, albeit in different ways.

In the discussion thus far, I have treated regulation as though its goal and substance is the public-oriented remediation of market failure. Regulation ostensibly exists to serve the common good. When officials justify regulatory action, they speak of public purposes—of problematic social and economic conditions that require governmental intervention. The free play of social and market forces, it is claimed, are either responsible for or unable to address adequately the cited ills. Most modern regulatory programs are undergirded by theories of market failure that

purport to identify systematic and predictable shortcomings of unconstrained economic exchange. Economic theory posits that negative externalities present opportunities for government action to increase social efficiency by way of regulation.

Of course, regulation can be corrupted. Private interest or “public choice” theories of regulation posit that small sets of special-interest groups are able systematically to distort regulation for their own private benefit. Few regulatory theorists today would hold unwaveringly to a “public interest” view of regulation.

For purposes of this paper, the most important departure from the public interest ideal occurs with respect to the time horizon of legislative decision makers. In a body of work beginning with David Mayhew’s famous 1974 book *Congress: The Electoral Connection*, political scientists have explored the proposition that legislators’ decisional time horizon is limited by their terms of office. A long line of research now supports that proposition: many areas of public policy display a presentist bias and a corresponding neglect for the interests of the future. The logic is straightforward: elected politicians have a clear incentive to benefit current, not future, constituencies. Although there are electoral demands for policies that are future-regarding, these demands can often be satisfied by symbolic provisions or provisions that are otherwise capable of subsequent manipulation.

Furthermore, there is good reason to believe that the phenomenon of path dependence—the effects of which are widespread¹⁰—is particularly acute in legislative institutions. The current climate in the United States Congress, for example, is marked by impasse. With little in the way of major new legislative initiatives, agencies are increasingly forced to meet new policy demands under aging and often ill-fitting statutory provisions. In the context of nuclear power, these

¹⁰ PAUL PIERSON, *POLITICS IN TIME* (2004).

dynamics mean not only that legislators are likely to under-weight future threats, but that having made such decisions, they are likely to stick.

2.6 Moral Hazard Problems

All of the phenomena list above add up to a substantial and ongoing problem of moral hazard.¹¹ The private and public actors responsible for making decisions about nuclear power are unlikely to bear the full costs of their activities. Many of the risks presented by the generation of nuclear power are ones that private actors can deflect towards public actors, who themselves are unlikely to bear the political costs of errant decisions. Indeed, in an important respect, each generation of voters is in a similar situation, and voters' own incentives certainly bear on those of their elected officials. It is this insight, of course, that undergirds the contemporary discourse of intergenerational equity.

At the same time, it is important to recognize that the problems identified above are, as applied to the specific case of nuclear power generation, theoretical ones. It may be that the nuclear power industry has a heightened awareness of the possibility of untold catastrophic harm, and therefore addresses future risks to the utmost. The same may be true of legislators and regulators. The inquiry here merely raises the question as to whether lawmaking institutions are well-designed to foster adequate decision-making in this sphere. So with this background, we turn now to the actual scheme of nuclear power regulation in the United States.

3. Nuclear Regulation

¹¹ See generally Tom Baker, *On the Genealogy of Moral Hazard*, 75 TEXAS L. REV. 237 (1996).

3.1 The Public Character of Nuclear Property

It is commonly assumed by members of the public that “the government” is responsible for all things nuclear. Only seldom is there public reflection on the role that private, profit-seeking entities play with respect to nuclear technologies. For many years, the absence of such reflection could be attributed to the fact that nuclear power appeared to be on the decline in the United States.

The legal devices outlined above create the general impression that lawmakers have addressed the harms associated with modern industrial land uses, including nuclear power generation. The impression is an insidious one in that it forestalls public debate about long-term hazards arising from contemporary land uses. The public remains very much “on the hook” for harms and damages that cannot be extracted from private parties engaged in such uses, as is evidenced by the public expenditures involved in reclaiming abandoned mines, abandoned wells, and various sites of contamination. The temporal disconnect between a user of property and later harms creates a moral hazard in that the user does not bear the full costs associated with his or her activities.

Consider in particular the real property linked to nuclear power generation. After the initial buildout of nuclear capacity in the 1960s, 70s, and 80s, not a single new nuclear power plant was approved for several decades. Since roughly 2005, nuclear power has been back on the table thanks to a number of federal incentive programs. The recent Fukushima nuclear disaster, however, alerted the world to the possibility that nuclear power facilities are less safe than previously thought; to the possible expenses associated with large-scale nuclear cleanup; and to

the fact that nuclear emergencies have a way of playing out in ways not foreseen even by experts. In the wake of this disaster, regulators in the United States have explored anew the possible domestic risks of nuclear power, especially those risks attributable to rising surface waters as had been problematic in Japan. Greater attention has been given, for example, to the fact that a number of inland nuclear facilities in the United States sit downstream of large dams; although these facilities may be protected against tsunami of the sort that struck Japan, they remain vulnerable to inundation stemming from dam failure upstream.

The risk of dam failure and an ensuing Fukushima-like disaster are small in any given year. But risks such as these persist year after year, and because current techniques for storing spent nuclear fuel do not safeguard against these risks, they are likely to remain present for decades to come. Current actors, whether private or public, may well not be in existence when disaster strikes or harm becomes manifest.

Nuclear power is regulated at the federal level, of course, and an appropriate long-term solution to the treatment and disposal of nuclear waste will require congressional action. But Congress faces a set of well-known collective action problems in dealing with nuclear waste. Theories of collective action failure are borne out by the track record in this instance. Not only has Congress failed to designate a long-term repository for nuclear waste, but it has failed to deal with the financial liability for waste assumed by the federal government pursuant to the Nuclear Waste Policy Act of 1982. In essence, federal taxpayers already owe billions to utilities for managing nuclear waste, and will owe many billions more before a long-term solution is instituted. Short-term, on-site nuclear waste treatment is more vulnerable to a variety of risks than would be long-term disposal; should a disaster occur, public actors will necessarily assume a substantial portion of the associated costs. Therefore utilities in operation today,

notwithstanding their care in the operation of nuclear facilities, are not required to fully internalize the risks attendant to their operations.

It is worth noting that nuclear power facilities represent only the most extreme form of this problem. There are many other kinds of property use in which current owners are similarly free to disregard some of the possible long-term risks of their uses.

3.2 Summary of Nuclear Regulation in the United States

This section will examine, in broad stroke, the liability structures that govern nuclear power in the United States. It will not explore particular safety strategies or technologies or the substantive requirements of nuclear regulation.

When the development of nuclear technology became a shared private-public enterprise in the 1950s, it was thought that private enterprises needed to be shielded from the incredible liabilities that might arise from a nuclear accident in order to encourage the commercialization of nuclear energy. And so perhaps the most important piece of American legislation in the history of private nuclear energy development is the Price-Anderson Nuclear Industries Indemnity Act of 1957.¹² The Price-Anderson Act's clear objective was to foster the development of nuclear energy by, in essence, providing a public indemnification arrangement for private firms. Private investors were unwilling to shoulder the enormous risks inherent in nuclear technology; the public, via this act of Congress, agreed to take on the risks above the threshold defined by the Act. The Act did require private firms to purchase insurance, up to a point.

¹² Codified at 42 U.S.C. § 2210.

Under the statute, firms pay annual premiums for the current maximum private insurance coverage of \$375 million per reactor.¹³ In addition, all firms are liable collectively for what the Act calls “excess loss”—loss in excess of that covered by private insurance. This liability essentially creates a shared risk fund—a second tier of coverage that takes effect if the damages arising in connection with a nuclear accident exceeds \$375 million. Under such circumstances, all companies paying into the risk fund will essentially pay a prorated amount to cover the excess of the single company’s accident. Every operator would be charged a retrospective premium equal to its proportionate share of the excess loss (proportionality is based on the number of covered nuclear reactors), up to a maximum of \$121.3 million per reactor, and to be paid in annual installments no greater than \$17.5 million per year.¹⁴ At present, the fund would provide around \$13.6 billion in total. The American Nuclear Insurers (ANI) is the only pool underwriting nuclear insurance (the first tier); this entity also manages the second conglomerate fund.

Let us postulate, for purposes of discussion, a major nuclear accident on the scale of the Fukushima incident in 2011. Suppose that damages totaled \$50 billion. Assuming the company that owned the facility had only that single reactor, the first \$375 million in damages would be paid by that company’s private insurance from ANI. All other nuclear operators in the United States would then satisfy their obligations to the ANI-managed second tier fund up to its current limit of \$13.6 billion. As to the remaining \$36 billion in damages? These damages would be paid by taxpayers via the general fund.

¹³ Technically, all facilities must purchase the maximum private insurance available at a “reasonable cost” - a number which will vary if the facility is smaller than a typical energy producing plant. As of this year, \$375 million is the maximum amount - per reactor - available from private insurers. Companies pay a premium for each reactor facility, based upon the number of reactors present. Currently, the average premium of a single-unit facility is \$860,000; after an incident, the premium amount a single company pays cannot be more than \$95,800,000.

¹⁴ American Nuclear Insurers, *Need for Nuclear Liability Insurance* (Oct. 2013), available at www.amnucins.com/library.

It is worth noting as well that the Price-Anderson Act has been held to broadly preempt state law liability claims based on theories of tort or nuisance, even though it boast no explicit preemption provision. For example, a set of Colorado residents recently tried to sue a local nuclear provider under state nuisance law. The federal District Court hearing the case issued an opinion on January 28th of this year, declaring that every circuit court to consider the issue has found that the Act effectively supplants state law remedies.¹⁵

3.3 Hanford Case Study

In order to gain a clearer picture of the pathologies inherent in publicly-funded cleanups, let us turn briefly to an example. Hanford, Washington, is one of the first and still the most important sites of nuclear development in the United States. A great deal of early research and development occurred here. Unfortunately, the legacy of this development is a nuclear waste problem of epic proportions.

[. . .]

The host state of Washington has pursued a number of avenues to press the federal government to cleanup Hanford promptly.¹⁶ After entering into a consent decree with the State

¹⁵ *Cook et al. v. Rockwell International Corp. et al.*, No. 90-cv-00181, 2014 WL 300935 (D. Colo. 2014).

¹⁶ As a preliminary matter, it appears that Hanford has spawned its own problems with federal contracting and FMV. A recent article about an affected indian tribe noted that the current company responsible for cleanup is allegedly doing a poor job because they only want the profit. An interviewed tribesman described the situation as a “giant feeding frenzy for contractors.” See Earth Island Journal, http://www.earthisland.org/journal/index.php/elist/eListRead/yakama_nation_fights_for_nuclear_waste_cleanup_at_hanford_site/.

that imposed a cleanup schedule, the federal Department of Energy (DOE) recently declared that it had to amend the decree to delay promised cleanup milestones due to new leaks and complications. The State, perceiving this as simply more stalling by the United States, was unwilling to budge on the original provisions of the decree. The Washington State Department of Ecology issued an administrative order requiring the DOE to start pumping waste out by September of this year. In March, the governor of Washington held a press conference to announce a new cleanup plan calling for the completion of waste treatment by 2047 and regular progress reports by the responsible federal agencies.¹⁷

3.4 Nuclear Waste

In addition, the process of nuclear waste disposal in the United States is in some disorder. The prevailing national plan for waste management during the first wave of nuclear expansion called for the designation of a single national repository for high-level waste.¹⁸ Low level wastes would be addressed via regional disposal sites, and all kinds of waste could be stored on-site at generation facilities for some time while awaiting disposal.

Although the low-level waste process was not been without its glitches, it has essentially worked as envisioned. The high-level waste process, by contrast, has never gotten off the ground. The Yucca Mountain disposal site, long assumed to be the best candidate for a national

¹⁷ It is not only Hanford that suffers from these problems. South Carolina threatened the DOE on June 16, 2014 with a \$193 million fine for failing to meet the agreed-upon timeline for Savannah River Site. In fact, South Carolina is insisting that some money being used for Hanford was actually taken out of the funds allocated for Savannah. They claim that poor contracting has delayed the Hanford timetable, and that federal agencies are essentially rewarding inefficiency with additional money to get things back on track, at the expense of the Savannah site.

¹⁸ See the Nuclear Waste Policy Act, __ U.S.C. __.

repository, has been suspended indefinitely by the Obama administration, despite the billions of dollars that have been spent on its development thus far. The political back-and-forth over Yucca Mountain does not inspire confidence in Congress’ ability to address nuclear waste.

In the meantime, waste is stored on-site. The cooling ponds designed for such waste have reached their capacity at many sites, so utilities have been forced to move to “dry cask” storage in which spent nuclear fuel is cased in enormous concrete casks and stored above-ground. This tactic, originally designed as merely an interim approach, has now become commonplace despite obvious risks.

The liability for the costs of storage lie primarily with the federal government. The United States was obligated by legislation to begin collective waste from generating facilities by the late 1990s and has been in breach of this obligation since then. A steady line of lawsuits in the Federal Court of Claims and the Federal Circuit Court of Appeals has plumbed the precise contours of federal liability. For example, in *Energy Northwest v. United States*,¹⁹ the plant operator was suing for some \$3 million in “loading” fees—expenses incurred in repositioning some dry storage casks due to a lack of space. The United States has paid out hundreds of millions of dollars in settlement fees each year.

4. Rethinking Property.

Why refer to this as a problem of property law? Why not conceive of it as a simple regulatory failure, and a call to improve industry-specific regulation? After all, property law is

¹⁹ 115 Fed. Cl. 69 (2014).

generally conceived as a narrow set of doctrines, distinct from the regulatory schemes that abound today.

The reason for retaining a focus on property is that the problem discussed here is general to property. Land users of many sorts are disassociated from the long-term impacts of current land uses. In the face of relatively pervasive regulation, most landowners assume that they are free to do anything with their property that is not specifically ruled out by law. More generally, private property ownership has long been understood as both a foundational liberty in a democratic policy and the essential instrumentality of the “invisible hand.” It is private ownership that enables owners to capture gains from trade and from specialization. Yet as we learn more about the capacity of modern land uses to create long-term damage to land, it is appropriate that property law generally be reconsidered to account for the public’s long-term interests in clean and healthy property.

As noted previously, the common law exploited the device of ownership to establish limitations on property use via the imposition of liability for nuisance. Ever since, private owners have had to contend with some degree of public interest in private property, whether effected by nuisance or by positive regulation. As lawmakers come to terms with the long-term risks associated with current uses of property, ownership remains a central point of leverage for the imposition of public obligations.

One approach to nuclear property and other long-term harms, then, would focus on regulation, and specifically on the promulgation of specific rules of conduct. Such rules could certainly mitigate long-term risks, but again, their efficacy depends on their design and their enforcement.

Ideally, property rules are self-effectuating in that they simultaneously require actors to internalize costs and allow them to reap benefits attributable to property use. A first-best solution to long-term property harms, then, would likely feature a means of requiring property owners to bear *at present* the discounted cost of even distant harms and remote risks. Calculating such costs presents extraordinary challenges, of course, and given current American political institutions, the balance between present costs and future harms is likely to tilt in favor of allowing activities that carry an immediate economic benefit. But such approaches are underused nonetheless.

Consider, for example, much broader bonding requirements than are currently employed. (Current bonding schemes are generally instituted at the state level, and only for certain specific activities.) Bonding obligations could be adopted as a default approach rather than an exceptional one. They could be designed not only to cover known costs, but also to account for unknown liabilities. Widespread bonding requirements would not only signal to property owners that ownership entails long-term social obligations, but would also facilitate more efficient markets in risk management. More substantial bonding requirements would drive up the cost of doing business, to be sure—but this deterrent effect in the long run would be beneficial. Those engaged in activities associated with long-term risks would be required to internalize that risk to a greater degree. The public would be relieved of some portion of its “backstopping” liability. And voters would remain free to identify those property uses whose risk they are willing to underwrite or subsidize without an up-front bond commitment from the parties involved.

5. Conclusion

This paper raised the question of how the American legal system might better address nuclear property and other uses of property that present long-term risks. It began with a general discussion of how the law of property presently deals with enduring harm related to past uses of property. It proceeds to argue that legal and regulatory approaches to property ought to place a greater emphasis on shaping present-day land use to minimize long-term danger. And we need to do so with the awareness that American political institutions will fail systematically to address certain sorts of problems, especially hazards that are likely to outlive the entity engaging in the activity. Such problems demand greater attention and the development of new legal approaches. Such property uses are in many cases worthwhile, but if a future public is going to backstop these dangerous activities, then it should assume that position with its eyes wide open, and in full knowledge of the possibilities that lie ahead.

In conclusion, property ownership should be reconceived to address the long-term risks associated with various property uses. Nuclear power generation and waste treatment are only the most stark examples of activities that place enormous social risks onto the general public. The public presently assumes such risks largely unawares. Property law should adapt to include more wholesale mechanisms that require industrial actors to internalize the costs of long-term environmental hazards.