

Coping with Environmental Risks: Development of a Market for Environmental Liability Insurance in China

Patricia Born*
Florida State University

Dongmei Chen**
Fudan University

May 2013

* Corresponding Author. Patricia Born, Midyette Eminent Scholar in Risk and Insurance and Director, Center for Insurance Research, Dept. of Risk Management/Insurance, Real Estate and Legal Studies, Florida State University, College of Business, 821 Academic Way Tallahassee, FL 32306-1110; Email: pborn@cob.fsu.edu; Phone: 850-644-7884, Fax: 850-644-4077.

** Dongmei Chen, Associate Professor and Director, Department of Insurance, Fudan University-School of Economics, 600 Guoquan Road, Shanghai, China, 200433; Email: dmchen05@gmail.com; Phone: 0086-21-65643750, Fax:0086-21-65647719

Coping with Environmental Risks: Development of a Market for Environmental Liability Insurance in China

Abstract

With 30 years' high-speed growth and development, China has surprised the whole world with fascinating progress in its economy. However, one of the downsides of this remarkable development is serious environmental pollution throughout the country. Air quality in most Chinese cities is increasingly contaminated by coal-burning power plants, construction debris, and automobile exhaust from millions of cars packing the roads. Studies suggest that over half of all river sections monitored for water quality are unsafe for human contact (Wang et al., 2008). Most of China's rural areas have no system in place to treat waste water. Although China has some of the strictest environmental protection laws in the world, they are not enforced adequately, especially in rural areas.

In this project, we evaluate the regulation requiring Chinese manufacturers to purchase environmental liability insurance. Specifically, we explore the implications of establishing a market for environmental liability insurance that is suitable for China's situation, with the function of reducing pollution, punishing the polluters and compensating the victims. The inherent objective of such a system is to reduce the financial burden on the Chinese government of dealing with environmental issues, i.e., abatement and clean up costs. We draw experiences and lessons from U.S. environmental regulations and the U.S. environmental liability insurance market as they have developed to address these issues in the U.S.

KEYWORDS: Environmental Liability, Environmental Regulation

Coping with Environmental Risks: Development of a Market for Environmental Liability Insurance in China

1. Introduction

With 30 years' high-speed growth and development, China has surprised the whole world with fascinating progress in its economy. However, one of the downsides of this remarkable development is serious environmental pollution throughout the country. Air quality in most Chinese cities is increasingly contaminated by coal-burning power plants, construction debris, and automobile exhaust from millions of cars packing the roads. Studies suggest that over half of all river sections monitored for water quality are unsafe for human contact (Wang et al., 2008). Most of China's rural areas have no system in place to treat waste water. Although China has some of the strictest environmental protection laws in the world, and environmental policies remain at the forefront of the government agenda, it remains unclear whether China's environment is improving.¹ Faced with such a serious environmental situation, it is necessary to consider developing a new pollution reduction and responsibility system.

In the US, a wide range of environmental policies are in place at the federal level. Most of the regulatory attention, and subsequent policies, took shape in the 1970s, after several major environmental disasters, including Love Canal (New York) and the Cuyahoga River fire (Ohio). The regulatory authority in this area is the U.S. Environmental Protection Agency (EPA), which conducts environmental research and is the primary authority for setting and enforcing national standards. Environmental standards are implemented in consultation with state and local governments; permitting, monitoring, and enforcement responsibility also extends to the state and local governments. One most prominent regulation is the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), also known as Superfund, passed by the US Congress in

¹ See Vennemo et al (2009) for a discussion and analysis of pollution indicators. The authors contend that improvement can be shown at the local level, but they find scattered success with addressing regional pollution problems.

1980. This legislation establishes regulation addressing abandoned waste sites and assigns liability for releases of hazardous wastes to the persons responsible.² The measure brings environmental liability to the attention of the business community through strict, joint and several liability, which requires responsible parties to cover the costs of clean-up without regard to the percentage of individual environmental contribution or harm. It also hinders the transfer and sale of contaminated property. Following CERCLA and several judicial decisions in the 1980s, a market for environmental liability insurance began to develop quite rapidly.

The United States has adopted a “polluter pays” principle as the foundation of environmental liability. Basically, the polluter is forced to bear the burden of prevention and remediating the consequences of operations that affect the environment, e.g., cleaning up and effectively disposing of hazardous waste. Most importantly, the principle establishes that the parties who generate pollution, not the government or others, should bear these costs.

China’s regulatory focus on environmental protection started with the *Environmental Protection Law of the People's Republic of China*, passed in 1989. This was followed by the *Law of the People's Republic of China on the Prevention and Control of Environmental Pollution Caused by Solid Wastes* in 1996 and the *Clean Manufacturing Law* (2003). The Solid Waste Law was modified in 2004 to include a "polluter pays" liability scheme for site contamination, and included requirements that the State Environmental Protection Administration (SEPA) be notified of the release of hazardous substances. SEPA has authority to order remediation by the parties responsible for pollution. It can also intervene when a specific pollution risk is identified. For example, in 2005, SEPA cut off the primary water supply to four million people living in the city of Harbin in northeastern China when a chemical plant explosion resulted in the contamination of the city's drinking water source, the Songhua River. Local agencies are responsible for supervision of remediation and cleanup. Monitoring and remediation efforts are guided by certain quality standards such as the PRC Soil

² A third component of the measure established a trust fund mechanism to recover U.S. Environmental Protection Agency (EPA) clean-up costs, when a responsible party cannot be identified.

Environmental Quality Standard (GB GB15618-1995) and the Groundwater Environmental Quality Standard (GB/T 14848-1993).

By 2004, the Chinese environmental regulatory framework included “twenty statutes, more than forty regulations, approximately five hundred standards, and more than six hundred other legal norm-creating documents primarily addressing pollution control, natural resource conservation, and management of the environmental stewardship aspects of consumer products” (Ferris and Zhang, 2003, p.581). Despite the attention, consistent enforcement and a clear system of responsibility remain a serious concern. In 2010, the revised Tort Liability Law of the People’s Republic of China came into effect.³ Although it does not create any new laws, it reinforces the way that liability is imposed on polluters. The revised Law has the potential to expand firms’ exposure to liability significantly, but remains vague in several regards (e.g., lack of procedural and enforcement guidance). Clarification will only be provided over time through the judicial interpretation of the Law.

In this paper, we provide an assessment of public and private sector activities and policies that will encourage a smooth-functioning market for environmental liability insurance in China. This is particularly important given the Chinese government’s recent mandate that specific firms purchase environmental liability insurance. To date, although much research has considered the application of liability for environmental events in China, there has been much less consideration as to the feasibility of developing a market to insure this risk.⁴ We think this research will be of interest to academics and policymakers concerned with general environmental liability issues around the world. Our research provides a thoughtful comparison of the U.S. systems of environmental regulation and environmental liability, both of which can provide valuable lessons for China in addressing the fundamental goal of creating and maintaining a cleaner environment. Most importantly, we recognize the goal of reducing the financial burden on the Chinese government in addressing environmental issues, i.e., abatement and clean-up costs.

³ See Bublick (2011).

⁴ Ren and Shang (2010) provide a basic outline and some considerations for insuring environmental risks in China.

Further, we evaluate the recent law that requires heavy polluting industries (e.g., lead battery manufacturers) to purchase environmental liability insurance.⁵ While this move indicates a strong attempt to shift the burden of liability to firms, it is unclear whether the mandate will provide a strong enough incentive for firms to mitigate against environmental damages.

The paper proceeds as follows. In Section 2 we discuss relevant regulations pertaining to the environment in China. We compare the objectives and scope of these regulations to similar environmental regulations in the US and consider, to some extent, features of regulations in other countries. We proceed in Section 3 with a similar discussion and comparison of the Chinese and US legal systems as they pertain to the determination of liability. In particular, we evaluate features of the legal systems that contribute to the likelihood that firms may be found liable for an environmental event, given the regulatory regime presented in Section 2. The risk of being fined or sued is necessarily related to the firm's decision to manage this risk, and therefore drives the decision to purchase protection against this risk, to mitigate the risk, or to implement other risk management techniques. In Section 4 we provide evidence pertaining to the enforcement of the regulations in both China and the U.S. We discuss several examples of environmental disasters and consider whether similar regulations achieve similar outcomes in the two countries. The desirable and essential features of an insurance policy for environmental risks are then presented in Section 5. We consider the typical features of policies sold in the US and consider their applicability in the Chinese market. We report, in this section, on the results of a pilot program enacted for a small set of Chinese communities, and consider the recent extension of this program which mandates that all Chinese manufacturing firms in certain high-risk categories purchase environmental liability insurance. In Section 6 we discuss some additional considerations for encouraging private firms to manage environmental risks. A final section concludes.

⁵ The *Guiding Opinions on Pilot Scheme for Compulsory Environmental Pollution Liability Insurance* was jointly promulgated by the Ministry of Environmental Protection and the China Insurance Regulatory Commission on February 12, 2013. It extends pilot programs for environmental liability insurance that were implemented in eight geographical areas in 2009.

2. China's Environmental Regulations

In the first phase of our project, we feel it is necessary to develop an understanding of the objectives and scope of China's regulations as they pertain to pollution activities. Confronted with the rising costs of environmental degradation associated with rapid economic growth, the Chinese central government has gradually recognized that the conventional path of encouraging economic growth at the expense of the environment had to be changed, and thus has been moving away from a pattern of "develop first, and then treat the pollution." China adopted its first environmental law in 1979 and environmental protection has been a basic national policy since the 1980s. The State Environmental Protection Committee was established in 1984 and the first Environmental Protection Law formally issued in 1989.

Environmental protection is changing from the downstream, after-the-event management of the past to today's whole-process supervision and control. The *Cleaner Production Promotion Law* and the *Law of the People's Republic of China on Appraising of Environmental Impacts*, which went into effect on January 1 and September 1, 2003 respectively, provide guarantees to implement this strategy. The former requires full control over all the production links -- from production design, choice of energy resources and raw materials, technology, equipment maintenance, to waste recycling -- so as to reduce pollution and promote resource recycling. The latter requires all authorities at city level and above to make environmental impact assessments when making plans for land use, construction and development of districts, river basins and sea areas.

In the *Tort Law of the People's Republic of China*, there is an important principle put forward: where any dispute arises over an environmental pollution, the polluter shall assume the burden to prove that it should not be liable or its liability could be mitigated under certain circumstances as provided for by law or to prove that there is no causation between its conduct and the harm. Unexpected incidents cost the government significant financial and material resources. In order to avoid the situation that its rampant environmental pollution problem will only worsen before it gets better, China's environmental regulatory agency is trying to change the incentive structure and

establish an institution for fundamentally ensuring local officials to be more environmentally responsible for their decision making.

While China has enacted hundreds of standards in this area, we reviewed a set of representative regulations so that we can describe (1) the targets of such regulation, (2) the party responsible for enforcement, and (3) the penalty structure and incentives for mitigation. Most importantly, we wish to ascertain the likelihood that firms are held liable for polluting; this requires knowledge of the scope of the regulations, and some facts about how they are enforced. We reviewed the following regulations, which are summarized in Appendix A:

1. Environmental Protection Law of the People's Republic of China
2. Law of the People's Republic of China on the Prevention and Control of Atmospheric Pollution
3. Hazardous materials control standard for motor vehicle gasoline (Grade IV and V)
4. Law on Prevention and Control of Water Pollution
5. Marine Environment Protection Law of the People's Republic of China
6. Law of the People's Republic of China on Prevention and Control of Pollution From Environmental Noise
7. Law of the People's Republic of China on Prevention and Control of Radioactive Pollution
8. Regulations on Safety and Protection of Radioactive Isotopes and Radioactive Ray Devices
9. Regulations on Management of Safety and Protection of Radioactive Isotopes and Radioactive Ray Devices
10. Law of the People's Republic of China on Promoting Clean Production
11. Law of the People's Republic of China on the Prevention and Control of Environmental Pollution Caused by Solid Wastes
12. Administrative Measures for the Prevention and Control of Environmental Pollution by Electronic Waste

For comparison, we reviewed the following major environmental regulations in the U.S., which are summarized in Appendix B:

1. Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA, aka Superfund)
2. Clean Air Act (CAA)
3. Chemical Safety Information, Site Security and Fuels Regulatory Relief Act
4. Clean Water Act (CWA)
5. Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA)
6. Federal Environmental Pesticide Control Act (FEPCA)
7. Food Quality Protection Act (FQPA)
8. Toxic Substances Control Act (TSCA)
9. Asbestos Hazard Emergency Response Act (AHERA)
10. Radon Reduction Act (PL 100-551)
11. Lead-Based Paint Exposure Reduction Act
12. Marine Protection, Research, and Sanctuaries Act
13. Ocean Dumping Ban
14. United States Public Vessel Medical Waste Anti-Dumping Act

We note that in a comparative analysis of the Chinese and U.S. policies, the basic principles addressed in the policies are very similar. Both countries have established policies generally pertaining to the cleanliness of air, water, and land. Both countries have established standards pertaining to particular sources of pollution, such as gasoline.⁶ Further, both sets of environmental protection laws explicitly prescribe that any pollution victims, individual or department, have the right to claim indemnity, and polluters must pay for losses incurred. Differences in the regulatory regimes lie in the way in which the policies are enforced and the manner in which responsible parties are forced to pay. The EPA is responsible for enforcement of all environmental regulations in the U.S., through various agencies charged with specific environmental issues, e.g., the Office of Air and Radiation (OAR) is responsible for administering the Clean Air Act, the Atomic Energy Act, the Waste Isolation Pilot Plant Land Withdrawal Act, and other applicable environmental laws. In China, the State Environmental Protection Administration (SEPA), under the Ministry of Environmental Protection, is responsible for establishment and enforcement of environmental standards, but the general implementation is relegated to “competent departments under the State Council and local People's governments at various levels.”

We note that each country has also enacted some policies that address more unique sources or causes of pollution. For example, China has a federal regulations addressing noise and the disposal of old automobiles. One standard presents requirements for limiting the use of hazardous materials in wallpaper, its raw materials and production process. It is apparent, however, that the scope of regulations in each country is broad and, hence, creates a wide range of potential situations in which a firm may be found liable for an act of polluting.

It cannot be ignored that the Chinese central government put 7.84 billion yuan into reducing and controlling the pollution of the Songhua River in the past five years, not including the matching

⁶ The EPA regulations require that manufacturers and importers of gasoline, diesel fuel, and fuel additives register their products, and test them for health effects, before sale. A standard issued in 1973 called for a gradual phase-down of lead, which is now banned in motor vehicle gasoline as of 1995. More recently, the Agency has focused on the establishment of standards to ensure the effectiveness of advanced emission control technologies in vehicles.

funds from relevant local governments.⁷ There is a great gap between the government input and penalties assessed for the Songhua River. On the other hand, it is estimated that the amount of fines in the U.S. for British Petroleum (BP) after the Deepwater Oil Leak exceeded \$41 billion. These vastly different penalties for similar accidents suggest that enforcement of environmental regulations in China has a long way to go.

3. Assessment of Penalties and Compensation for Victims

We turn now to a brief overview of the issues more directly related to the cost of environmental events. Specifically, if a market for liability insurance is to exist, then the risk of being found liable for an environmental event and the subsequent costs for such violations must be “real” and quantifiable. We determined, in the previous section, that the scope of *potential* violations is fairly similar when we look at Chinese and US regulations. Thus, firms’ demand for liability insurance would also be similar, if the possibility of being charged and the size of the penalties as well as the cost of compensating victims, were roughly the same. We suspect that this is not the case, in general, and note that, even in the U.S., the probability of being charged for violating an environmental regulation, and the amount of potential damages that must be paid, are subject to much variability. Each country has, over time, enacted additional regulations that clarify procedures with respect to administration of the environmental protection regulations,⁸ but these come short of establishing a clear process of assessing the expected cost of a violation.

Assessment of Penalties

Our first consideration is a foundation for imposing environmental liability.⁹ As mentioned previously, the U.S. has adopted a “polluter pays” principle as the foundation of environmental liability. Polluters, if charged, are forced to bear the burden of prevention and remediating the consequences of operations that affect the environment, e.g., cleaning up and effectively disposing of

⁷ http://www.mep.gov.cn/zhxx/hjyw/201106/t20110601_211472.htm

⁸ See Appendix C for examples.

⁹ There is a wide range of literature addressing the development of liability for environmental events in the U.S. and in China. Here, we provide a basic summary of the fundamentals of the U.S. and Chinese liability systems and refer you to Bublick (2011), [input more sources](#) for more comprehensive discussions.

hazardous waste. China also follows a “polluter pays” principle, as stated in the Environmental Protection Law.¹⁰ Most importantly, the principle establishes that the parties who generate pollution, not the government or others, should bear these costs. Adherence to this principle requires authorities to supervise activities, enforce violations, levy fees, and monitor compliance.

A review of actions by the EPA indicates the use of several different avenues for charging a firm for violating an environmental regulation. For example, the Clean Air Act gives the EPA authority to limit emissions of air pollutants coming from certain facilities (e.g., chemical plants and steel mills). The amendment of 1990 instituted a program that allows larger industrial and commercial facilities to obtain an operating permit. These permits, which are issued by states and tribes for a permit fee, include information on which pollutants are being released by the facility, how much may be released, the steps the facility is required to take to reduce the pollution, and requirements for measuring and reporting emissions.

Prior to the 1990 Amendments, the EPA had little success in penalizing facilities for violating the Act. Any violation required the Agency to take the PRP to court. The Amendments gave the EPA more power by increasing the range of civil and criminal sanctions available. Now, when the EPA finds a violation, the agency can issue an order to require compliance, force the payment of a penalty under an administrative penalty order, or initiate civil judicial action.

Liability under CERCLA is triggered if hazardous substances are detected at a facility, or if there is a release of these hazardous substances. The targeted PRP may be held liable for government cleanup costs, damages to natural resources, health assessment expenses, and expenses of performing an immediate cleanup if danger is imminent. The parties that may be held liable include the current owners and operators of a facility or the past owners and operators of a facility at the time hazardous wastes were disposed. Transporters and those who arranged for transportation, of the hazardous waste from the site may also be held liable.

¹⁰ Article 19 of the Law states that measures must be taken to protect the ecological environment while natural resources are being developed or utilized. Article 28 states the polluter’s liability for the elimination and control of pollution.

CERCLA enforcement addresses compliance with an agreement to perform specific clean-up activities. There are several penalties for PRPs that do not meet the requirements of this agreement. First, they may have to pay a statutory penalty of up to \$37,500 for each day of non-compliance, with the exact amount depending on the type of agreement and the nature, severity, and duration of the non-compliance. An agreement may include a stipulated penalty that has been negotiated between the EPA and the PRP for the specific form of non-compliance. These are intended to incentivize the PRP to comply with the agreement. If a unilateral administrative order is issued, the EPA can recover up to three times its costs from the noncompliant PRP.

The EPA's general civil penalty policy provides some guidance for establishing appropriate penalties. Specifically, the penalties should (1) be large enough to serve as a deterrent, (2) treat the PRP fairly and equitably, and (3) encourage a timely resolution of the environmental problem. The agency also uses computer models to help analyze costs and calculate penalties. Nevertheless, the severity of penalties varies quite substantially, thus creating an additional source of uncertainty with environmental risks.

In China, enforcement of environmental regulations is complicated on several fronts. The first problem stems from a lack of specificity in the regulations. For example, the requirement that firms "shall gradually adopt measures to control nitrogen oxide" is difficult to enforce without an established timeframe or acceptable target level. According to Beyer (2006), although the SEPA has formal authority, "this national agency does not have much leverage in ensuring that national regulations and standards are enforced at the local level. It is common practice that environmental issues are treated more as a matter of policy rather than law and personal relations are often decisive. Fees and fines are rarely determined authoritatively; instead, they are often negotiated and fall far below the cost of damage that the harmful activity has caused, as well as below expenses for pollution control facilities. The money derived from fees is made available to the polluters in the form of grants and credits nominally for investments in control facilities; however, no adequate supervisory mechanism exists" (pp. 207).

Compensation of Victims

The U.S. and China both have detailed tort and criminal laws to address remedies for environmental events. In the U.S., the principal mechanism for remedying harms is tort law, which is derived from a combination of common-law principles and legislative enactments. In civil courts, plaintiffs may see money damages or injunctions; tortfeasors are not subject to fines or incarceration. For over a century, U.S. tort law has touched on a wide range of events, including toxic and environmental torts. Increasing complexity in the environmental area has led to enactment of more defined laws for addressing environmental harms, to such an extent that tort law is now perceived to be simply a gap filling mechanism (Latham et al., 2011).

China's legal system also provides for a set of civil remedies based in tort law principles. They can be found in the 2010 Tort Liability Law of the People's Republic of China, the general Civil Law Code, and the 1989 basic Environmental Protection Law framework legislation. These provisions detail the principles of liability and proof and processes for individuals to litigate claims for personal and property damage caused by pollution. Klee and Thomas (1997) note that "most environmental-related disputes are brought to the People's courts in the form of civil actions and typically result in a mediated agreement between the parties." They further indicate that "there is virtually no environmental case law to guide the interpretation of undefined terms."

For serious pollution incidents, especially when human life is lost or serious harm is caused, China's environmental laws and Criminal Code provide for criminal sanctions (Faure & Zhang, 2011).¹¹ Amendments to the Criminal Code in 1997 formally introduced provisions that penalize serious violations of environmental law. Consequences include fines and up to seven years of imprisonment for especially severe events.

¹¹ The Interpretation of the Supreme People's Court on Some Issues Concerning the Specific Application of Law in the Trial of Criminal Cases Involving Environmental Pollution was adopted at the 1391st meeting of the Judicial Committee of the Supreme People's Court in 2006. It specifies the conditions under which a case "leads to heavy losses of public or private property" as (1) causing a loss of public or private property of more than 300,000 Yuan; (2) Causing a loss of fundamental functions of, or permanent destructions to, 5 mu or more of the basic farmland, shelter forestland, or special-purpose forestland; or 10 mu or more of other farmlands; or 20 mu or more of other lands; or (3) Causing the death of 50 m³ or more of forests or other woods; or 2500 young trees or more.

It is important to note that there is no separate, independent judiciary or a legal system apart from the ruling Chinese Communist Party. Consequently, the system lacks neutrality, because the Party approves all court appointments at all levels and also has the power to affect verdicts. Chinese legal system has particular drawbacks as they relate to the enforcement of environmental liability. Specifically, the lack of neutrality means there is no effective recourse available to individuals whose interests are harmed by the actions of Party officials, laws, and institutions. Under a goal for rapid economic modernization, it is a challenge to address individuals seeking compensation from environmental pollution that results from the desire for economic growth and economic competitive advantage. According to Moser and Yang (2011), environmental tort plaintiffs encounter many challenges in seeking redress. They note that victims of pollution can directly petition the local environmental protection bureau to investigate the pollution, to identify the source of pollution, the specific pollutant, and to provide relief. However, opportunities in which to make grievances, seek compensation, or pursue some form of justice in China are further complicated by a lack of capacity in the legal system.¹²

4. Enforcement of Environmental Regulations: Evidence

In this section, we provide some evidence of the scope of the regulatory responses to violations of environmental regulations. Our main goal here is to emphasize the variety of ways firms are penalized, and enforce our assertion that the environmental liability risk contains several sources of uncertainty. In particular, we note that (1) the regulations targeting acts of pollution are often vague in details, (2) enforcement of the regulations is not consistent, and (3) the amount for which firms are held liable is variable.

Evidence from China

Compared to the huge economic loss by environmental pollution in China, the penalties and compensations have been quite trivial. There is a phenomenon in China such that there is a “high cost for those who comply with the law and light penalties for violators”. For instance, Jinye Industry and

¹² According to (), there is one lawyer per 10,000 people in China versus one lawyer per 550 people in the United States.

Trade Co. Ltd., which opened three and half years ago, had paid 10 million yuan (\$1.5 million U.S.) in taxes, but its pollution cost billions and affected the lives of 26,000 people.¹³ Moreover, the pollution levy that is actually paid is based only by the pollutant that exceeds its standard by the greatest amount, and not on all the pollutants that exceed the standards. Table 1 shows the number of events and total penalties of environmental pollution accidents in China for the past decade. The direct economic loss varies substantially over time, but interestingly, the penalties and compensation remain quite small in comparison.

Table 1. Summary of Environmental Pollution Accidents in China, 1999-2008

Year	Environmental Pollution Accidents (N)						Direct Economic Loss (¥10000)	Penalties and Compensation (¥10000)
	Total	Water Pollution	Air Pollution	Solid Waste Pollution	Noise Harm	Other		
1999	1614	888	582	80	40	24	5710.6	2116.3
2000	2411	1138	864	103	266	40	17808	3683
2001	1842	1096	576	39	80	51	12272	3264
2002	1921	1097	597	109	97	21	4641	3141
2003	1843	1042	654	56	50	41	3375	2392
2004	1441	753	569	47	36	36	36366	3964
2005	1406	693	538	48	63	64	10515	3082
2006	842	482	232	45	6	77	13471	8416
2007	462	178	134	58	7	85	3278	807
2008	474	198	141	45	-	90	18186	927

Source: CEInet Industry Database

As noted in the previous section, our review of the regulations suggests the actual penalties can vary substantially. To confirm the actual practice, we reviewed a sample of events in China for which facilities were charged for some form of violation. A short summary of these violations, which emphasizes the particular type of penalty applied, and the enforcing party, is provided in Table 2. We note that the amount for which firms are found liable are most often determined in court, and these cases often involve criminal charges in addition to civil penalties.

¹³ http://www.mwr.gov.cn/english/news/200906/t20090603_102997.html

Table 2. Sample cases indicating use of penalties: China (2005-2013)

Water May 2013	The MEP fined 88 companies 6.13 million yuan for violations resulting in underground water pollution in a 40-day campaign focused in north China. The campaign covered 25,875 companies that discharge waste water and a total of 558 violation cases were investigated.
Oil Nov. 2011	In 2011, liable parties paid 1.683 billion yuan as compensation for the damage to the environment caused by Penglai 19-3-oil-field oil spill incident.
Solid waste March 2011	A manufacturing town in east China's Zhejiang Province has probed 33 pollution cases and arrested 24 people in an environmental policy overhaul following a lead poisoning scandal that sickened more than 100 villagers. The environmental protection office in the Luqiao district in the city of Taizhou had fined 18 heavily polluting companies for a total of 2.85 million yuan (436,335 U.S. dollars) and demanded immediate changes ranging from the replacement of their facilities to relocation.
Water/oil June 2010	In the arsenic pollution of Yangzonghai Lake, three executives -- board chairman Li Dahong, general manager Li Yaohong and production department chief Jin Dadong -- found liable of causing serious environmental pollution. Li Dahong was sentenced to four years in prison with a fine of 300,000 yuan (43,923 U.S. dollars). The other two each got a three-year jail term plus a fine of 150,000 yuan. The company was fined 16 million yuan.
Solid waste July 2008	Two leakages of acidic copper solution at the Zijinshan Gold and Copper Mine copper plant, occurring on July 3 and July 16 respectively, resulted in material water pollution of the Ting River, causing a direct economic loss of more than 31 million yuan., and also polluting drinking water for tens of thousands of people. Zijin Mining Group Co has been fined 30 million yuan (US\$4.5 million) by a court in Fujian Province for a major pollution accident last year. The court allowed a deduction of the administrative fine of 9.56 million yuan - imposed by Fujian's environmental protection authority - which Zijin has already paid. Five managers and employees directly responsible for the incident were sentenced to imprisonment of up to four years and six months and were also ordered to pay fines, and 12 government officials fired in connection with the contamination.
Water/oil December 2005	A blast at a chemical plant of Jilin Petrochemical Company under China National Petroleum Corporation (CNPC) on November 13 sent an 80-kilometer-long slick of benzene into the Songhua River, which flows through Jilin and Heilongjiang provinces. The direct loss brought about by the accident might amount to some 1.5 billion yuan. Took 10 million yuan from Heilongjiang governor's fund to control pollution, and the government also allocated funds for purchase of activated carbon to upgrade water filtration systems and for evaluation of environment after the polluted water passed by. CNPC paid a mere 5 million yuan to the local government and 1 million yuan in fines to the environmental authorities.

As we performed our review of cases in China, we found that the amount of information publicly shared regarding noncompliance with environmental regulations is very limited. We note that if this information is not readily available to firms operating in China, it may be even more difficult for firms to evaluate their exposure to environmental risk. That is, without some idea of how often the regulations are enforced and the penalties that are applied, it is likely that firms will misestimate the risk. As it is a relatively new risk to these firms, we feel it is likely that they underestimate their exposure.

Evidence from the United States

The U.S. EPA fines hundreds of companies each year for violations of environmental pollution regulations. In its Enforcement and Compliance Results report for 2011,¹⁴ the agency notes consistent activity over the past few years. As shown in Table 3 below, polluters cited during 2011 will pay more than \$100 million in civil penalties. Estimated effects of the 2011 activities include a reduction in hazardous waste of 3.6 billion pounds and a reduction of 900 million cubic yards of contaminated water. According to the report issued in 2008, the amount of pollution reduced in 2008 was approximately equal to the reductions achieved in the previous four years combined.

Table 3. Summary of EPA Enforcement and Compliance Results, 2007-2011

Year	Administrative Penalties Assessed* (\$millions)	Civil Judicial Penalties Assessed* (\$millions)	# Civil Investigations	Number of Civil Judicial & Administrative Cases Initiated
2011	\$48	\$104	177	3283
2010	\$34	\$72	282	3436
2009	\$33	\$61	246	3779
2008	\$40	\$92	222	3726
2007	\$33	\$43	346	3762

* Expressed in 2011 dollars.

As noted in the previous section, our review of the regulations suggests the EPA can take a variety of actions to penalize a facility for failing to meet regulation. To confirm the actual practice, we reviewed a sample of events for which facilities were charged for some form of violation. A short summary of these violations, which emphasizes the particular type of penalty applied, and the enforcing party, is provided in Table 4. We note that the amount for which firms are found liable are most often determined in court, but some amounts are settled out of court, or involve only a fine or clean-up bill.

¹⁴ <http://www.epa.gov/compliance/resources/reports/endofyear/eoy2010/index.html>

Table 4. Sample cases indicating use of penalties: U.S. (2008-2013)¹⁵

Hazardous waste/air May 2013	A Cuyahoga County judge has ordered a company and its affiliates to pay more than \$1 million in civil penalties for mishandling hazardous waste at its East 90th Street facility in Cleveland. \$863,000 of the penalty is for hazardous-waste violations, and the rest is for air-pollution violations.
Water May 2012	Washington State Department of Ecology charged Alcoa Wenatchee Works \$8,000 for discharging excessive amounts of aluminum and fluoride to the Columbia River on May 3, 2012, violating daily limits allowed by its pollution discharge permit. Aluminum discharges were nearly 30 pounds more than allowed, and fluoride discharges were 76 pounds over the daily allowance.
Water/oil Feb 2011	A federal judge in Baltimore on Wednesday fined a Greek ship management company \$2.4 million and imposed two years probation for violating federal oil-pollution laws.
Clean Water May 2011	A company accused of dumping sludge on the ground near the Cochecho River (New Hampshire) has agreed to pay a \$20,000 fine. The attorney general's office and Department of Environmental Services say a judge has approved a settlement between the state and Lydall Filtration/Separation, Inc. The state had sued the company, alleging that it violated state water pollution regulations by removing sludge from its lagoons and depositing it on the ground without a permit and within 300 feet of the river. The company has since removed the sludge and shipped it to an authorized facility.
Water/oil 2010	US Asphalt company was fined \$68400 for violations of oil pollution regulations in addition to a \$500k clean-up bill.
Water 2009	Modesto City in California has been awarded \$18.3m in compensation over a ten-year-old ground water pollution case. The city claimed about \$100m in compensation to remove perchloroethylene (PERC) from its groundwater in 1998, which was polluted when companies including Dow Chemical failed to warn dry cleaners of the ill effects of letting PERC wash into sewers. The city has already received \$23m from other chemical producers in settlements, making it ineligible for the new damages. Dow was found guilty for not warning at least one dry cleaner and was held accountable along with PPG in another case, which makes the companies liable for the fine.
April 2011	A developer has been ordered to pay \$49,447 in fines for pollution violations during construction of a residential development in Genesee (Ohio), according to a news release from the state attorney general's office. The developer in August 2009 failed to stop pollutants from flowing into a nearby wetland and failed to implement and maintain erosion control measures, both of which violate state pollution laws.
Air and solid waste 2010	A trucking firm and its owner were penalized \$50,000 in a Waukesha County (Ohio) Circuit Court for violating state air pollution and transportation of solid waste laws. According to the complaint, Butterfield Trucking, Inc. illegally transported and burned demolition waste from the Evangelical and Reformed United Church of Christ. The church was destroyed in a fire in December 2005. The waste contained asbestos floor tile and was illegally burned in an open pit in the Town of Genesee on June 25, 2006, according to the complaint. In addition, Butterfield and his company were found to have transported solid waste without the appropriate state licenses, according to a press release.
Air 2009	Wolf Paving Co. Inc. will pay \$31,784 in fines and spend \$136,433 on environmental projects to settle state charges that the company violated its air-pollution permit. Tests of the company's portable asphalt plant (Ohio) in 2006 revealed its emissions had more particulate matter than was permitted, according to the complaint. The company also did not keep adequate records of its emissions and operations. The company will pay its fees in installments between January 2010 and October 2011. The company also agreed to build a storage facility to recycle asphalt shingles and pave some of the land around its buildings.
Air 2008	American Electric Power, a coal-fired electric utility company, agreed to install pollution controls and take other measures that will reduce a record 1.6 billion pounds of air pollution. The company also agreed to pay a \$15 million penalty, <i>the largest ever paid by an electric utility for New Source Review violations of the Clean Air Act, and one of the largest settlements in EPA history.</i>

¹⁵ Descriptions of events drawn from various newspaper sources.

Air 2008	The agreement of Jenn Feng Industrial Company, a Taiwanese manufacturer, and three American corporations to pay \$2 million, the largest civil penalty ever for violations of Clean Air Act non-road engine regulations, for importing 200,000 chainsaws that failed to meet federal air pollution requirements.
Water 2008	The agreement of Massey Energy Company, Inc., Central Appalachia's largest coal producer, to shell out \$20 million penalty, the largest of its kind, for discharging pollution into local waterways.
Water/oil 2008	British Petroleum Exploration (Alaska), Inc., pleading guilty and being ordered to pay a \$12 million criminal fine and \$4 million in restitution to the state of Alaska for two pipeline leaks, one of which was the largest spill ever on the state's North Slope.
Pesticide 2010	Monsanto Company Inc., of St. Louis, Missouri, agreed to pay a \$2.5 million penalty to resolve misbranding violations related to the sale and distribution of cotton seed products containing genetically engineered pesticides. <i>This is the largest civil administrative penalty settlement ever received under the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA).</i>
Hazardous waste 2010	The EPA fined Western Refining Southwest, Inc. for failing to adequately monitor benzene discharges and illegally disposing hazardous waste. The company is in noncompliance of a Consent Agreement and Final Order (CAFO) filed in Aug. 2009. In 2009, EPA and the New Mexico Environmental Department (NMED) brought the violations to the attention of Western. Western agreed to pay \$734,008, cease all discharges of benzene and close two aeration lagoons that received hazardous waste.
Water 2010	The EPA ordered Greenville Livestock Inc. to pay a \$40,000 fine for its failure to comply with the Clean Water Act. An investigation conducted by the EPA found that Greenville, a concentrated animal feeding operation, did not use the best management practices to prevent the discharge of animal production waste and manure. It was also discovered that Greenville did not hold a Clean Water Act permit to discharge such wastes.
Hazardous waste 2010	EPA fined Chemical Waste Management, Inc. more than \$300,000 for failure to properly manage PCBs at its Kettleman Hills Hazardous Waste Landfill. During a series of 2010 inspections, EPA investigators found that CWM improperly managed PCBs at the facility. Further analysis revealed spills next to the facility's PCB Storage and Flushing Building. Samples taken by EPA and CWM in and around the building detected PCBs at elevated levels ranging from 2.1 parts per million (ppm) up to 440 ppm. These levels are above the regulatory limit of 1 ppm and, in soil, show PCBs were improperly disposed of in violation of federal law.
Water/oil 2008	Rowan Companies, Inc., a major oil and gas drilling company, pled guilty and paid a \$7 million dollar fine for three Clean Water Act felonies for discharging pollutants into the Gulf of Mexico from one of its oil rigs and for failing to notify the government of the discharges. Rowan also paid \$1 million for preservation and protection projects off the coasts of Texas and Louisiana. Nine supervisory employees of Rowan also pled guilty and were fined.
Water 2008	A prosecution that advances EPA's water enforcement priority was brought against Archer Daniels Midland (ADM) Company's Chattanooga, Tennessee facility, which manufactures high-quality paper products from raw cotton. The company lacked equipment needed to contain spills and other releases. ADM pled guilty to negligently discharging pollutants from the plant into Chattanooga Creek, a tributary of the Tennessee River, and was sentenced to pay a \$100,000 criminal fine and another \$100,000 in restitution to three environmental agencies and associations.
Air 2008	Cleve Allen George, the owner of the Virgin Islands Asbestos Removal Company, received 33 months in prison for multiple Clean Air Act convictions for illegal removal of asbestos-containing material at a low-income housing project and making false statements to federal agencies about air quality monitoring at the site. The owner was also sentenced to three years of supervised release and required to pay for baseline X-rays for exposed workers.

The cases show the variety of penalties applied for different failures to comply with environmental regulations in the U.S. This review is certainly not sufficient to establish a conclusion

regarding the likelihood of assessment; instead, we simply emphasize that there appears to be substantial uncertainty in how the penalty for noncompliance is applied. This risk should motivate firms to purchase insurance protection, as some of these particularly large penalties could be financially devastating.

On the other hand, we note that much more detail regarding the penalty process is made public in the U.S. than in China. While there may be a lot of variation across the cases we surveyed, a sample of similar infractions would not be difficult to compile, and would likely give firms a good sense of their exposure to particular environmental liability risks. This transparency has been a key factor supporting the growth of the demand for environmental liability insurance in the U.S., and is necessary to stimulate demand for environmental liability insurance in China.

5. Insuring Environmental Liability

Now we turn to the main point of our assessment. Our review thus far emphasizes what we believe are the most critical components of the environmental liability risk: the existence of a law or regulation, an enforcement mechanism which penalizes breaches of the law, and costs for noncompliance. We consider now the necessary components for establishing insurability of this risk. **In particular, we will address the mechanisms needed to set up a structure for risk pooling to deal with joint liability; the challenges of applying scientific models to price the environmental risk; reducing the risk of evolution of environmental regulations by claim occurrence basis liability coverage, and confirming insurers' policy coverage through required policy clauses rather than through judicial decision.**

Here we emphasize that commercial insurance plays a crucial role in dealing with the risk of environmental pollution. Environmental liability insurance is beneficial for the development of insurance, environmental protection and pollution victim's rights. Moreover, a commercial insurance system may inhibit the manufacture of pollution through effective underwriting and encouragement of effective risk management. A well-developed legal system of environmental liability is an important basis of environmental liability insurance and support of the government is an important complement of environmental liability insurance.

Environmental Liability Insurance in China

Environmental pollution liability insurance was first introduced in the city of Dalian in 1991 (Congjun and Bin Chik, 2012). The coverage developed very slowly, as only 15 firms had purchased the coverage between 1991 and 1994.

Article 66 of the revised *Marine Environment Protection Law of China, 1999* stipulates that, “To improve and implement the system of civil compensation liability for oil pollution damage by the state; according to the principle of owners and cargo interests jointly bearing risks for civil compensation liability for oil pollution damage, to establish insurance for oil pollution of ships and the system of fund for compensation for oil pollution damage. The concrete ways to implement insurance for oil pollution of ships and the system of fund for compensation for oil pollution damage shall be stipulated by the State Council.” This provision provides legal basis for implementing compulsory insurance for oil pollution of ships and establishing the system of fund for compensation for oil pollution damage in China. According to this provision, compulsory insurance and a funding system are indispensable components of the legal system of compensation for oil pollution damage of ships engaging in sabotage in China, and are also the key points from which to improve the compensation system (Yang and Lin, 2005). Insurers have made a breakthrough in the policy-driven ship pollution liability insurance and have formed a model characterized by “government promotion, market operation.”

The *Guiding Opinions on Pilot Scheme for Compulsory Environmental Pollution Liability Insurance* was jointly promulgated by the Ministry of Environmental Protection (MEP) and the China Insurance Regulatory Commission (CIRC) on February 12, 2013. This latest rule builds on the *Guiding Opinions on Environmental Liability Insurance* that were implemented in 2008, and is the latest attempt by the Chinese government to use market instruments to tackle environmental issues. The mandated insurance products will target plants producing hazardous chemicals and petrochemicals, as well as plants treating hazardous waste, all of which have a high risk of pollution accidents. The policy will cover insured companies from cleanup costs following environmental accidents and from pollution treatment costs.

Following the first *Opinion* in 2009, and under the guidance of MEP and CIRC, pilot projects on green insurance were conducted in whole or in part of nine provinces and municipalities. A dozen insurers introduced environmental pollution liability insurance coverage. Hebei Province, Shenyang City of Liaoning Province, and Shanghai Municipality included articles pertaining to environmental pollution liability insurance in the local environmental laws. The People's governments of Hunan Province and Kunming City of Yunnan Province issued their opinions on introducing this kind of insurance. Zhuzhou City of Henan Province reduced the pollutant discharge fees for any businesses that purchased environmental pollution liability insurances, with the reduction being up to 50% of the premium concerned. This move has prompted businesses to be more active in purchasing such insurances.¹⁶

Strictly speaking, only one kind of pollution liability insurance has been sold in China, although the available policies are called the different names in different areas in China. Table 5 provides some basic descriptions of these coverages. While there is good information about the basic coverage, specific policy features are not available.

Table 5. Types of Environmental Liability Insurance Policies Available in China

Policy	Description of Coverage	Policy Features
Pollution Legal Liability	Coverage intends to third parties for bodily injury or property damage, includes coverage for cleanup of the insured property for a regulatory ordered known contamination and the cost of cleanup for contamination which occurs after the policy goes into effect. Includes defense costs.	Period: not more than one year
Kunming City Pollution Legal Liability	Coverage includes the direct economic loss for third parties from sudden accidents. Includes two additional insurance options for onsite clean-up costs and compensation for special damages. [Provided in response to a mandate for 396 firms around Dianchi Lake waters to purchase environmental liability coverage].	Policy limit: ¥100 million
Suzhou City Pollution Legal Liability	Includes the direct economic loss for third parties from sudden accidents. Includes clauses addressing natural disasters, pollution clean-up cost, pollution salvage charges, evacuation costs; also provides special damage compensation terms.	Policy limit: ¥200 million Premiums: not more than 2.5%

¹⁶ MEP: Report on the State of the Environment In China, 2009. See Congjun and Bin Chik (2012) for a discussion of the results of the pilot program in Baoding, Hebei Province.

	[A cooperative insurance program that involved 66 firms, with coinsurance by four insurance companies]	
Shipping pollution liability insurance	Includes direct loss or damage property of third parties outside of vessel; direct environmental damage caused by a pollution accident and costs of taking reasonable recovery measures (not including environmental damage loss of profit). Includes the cost to comply with orders or instructions for preventing or mitigating pollution issued by government or relevant authorities.	n/a

The new mandate makes clear the types of companies that are required to purchase environmental liability insurance (see Table 6), and provides details about the coverage that is required. Policies must include (1) third-party liabilities arising out of sudden and accidental new pollution (personal injuries, death or property loss), (2) necessary and reasonable expenses incurred by the insured to save any third party’s life (including expenses for medical treatment) or to prevent or mitigate the loss of property of any third party, and (3) necessary and reasonable clean-up expenses incurred by the insured in order to control the extent of pollution or to remediate contaminated waters and land in accordance to environmental legislation.

Table 6. Companies/Industries for which Environmental Pollution Liability Insurance Coverage is Required or Recommended, as stated in the *Guiding Opinions on Pilot Scheme for Compulsory Environmental Pollution Liability Insurance*

Required	Recommended
<ul style="list-style-type: none"> • Miners and processors of heavy non-ferrous metal ore • Heavy non-ferrous metal smelting • Lead battery manufacturing • Leather and leather product • Chemical raw material and chemical product manufacturing 	<ul style="list-style-type: none"> • Petrochemical • Producers, warehouse, users and transporters of dangerous chemicals • Hazardous waste treatment industry • Industries with dioxin emission

The *Opinion* allows insurance companies to include additional contractual indemnity provisions beyond these mandated coverages, and they may differentially price policies according to a quantified environmental risk assessment and classification process. Regulators have not issued guidelines regarding the quantitative risk assessments to be conducted in order to set the limits of

indemnity. Since underwriting expertise may take some time, coinsurance pools will be established to shield insurers from catastrophic losses.

Generally, China's insurance market is an admitted market which means insurance policies must be written by a locally licensed insurer. However, a number of international underwriters have recently been allowed to underwrite environmental insurance in China.

Environmental Liability Insurance in the U.S.

In the United States, pollution liability was initially covered through Commercial Liability Insurance Policies, as it was not excluded.¹⁷ However, over the past 25 years, a number of very large cases led insurers to insert an exclusion specific to pollution in the CGL policy.¹⁸ In turn, insurers began offering specific coverages to address environmental liability exposures. A number of large, well-known insurers now offer environmental insurance, including XL Environmental, Zurich-American Insurance (through its Steadfast subsidiary, Kemper Environmental (part of the Kemper Group), American International Group Environmental, Chartis, and Chubb. Many smaller companies also have carved out a niche in the environmental insurance field.

The first ELI policies were designed specifically for firms to demonstrate financial responsibility for cleanup of a contaminated site, often required as part of a property transaction. The market has expanded by offering products that appeal to broader purposes, beyond those required by government regulations to buy insurance. For example, when mold claims were on the rise, insurers

¹⁷ Some of the early environmental insurance policies grew from the need to reclaim "brownfields," tainted inner-city sites such as abandoned factories that could be redeveloped for another purpose if the contamination could be removed or contained.

¹⁸ The exclusion includes: "Bodily injury" or "property damage" arising out of the actual, alleged or threatened discharge, dispersal, seepage, migration, release or escape of "pollutants":

- a) At or from any premises, site or location which is or was at any time owned or occupied by, or rented or loaned to, any insured. However, this subparagraph does not apply to:
 - i) "Bodily injury" if sustained within a building and caused by smoke, fumes, vapor or soot from equipment used to heat that building;
 - ii) "Bodily injury" or "property damage" for which you may be held liable, if you are a contractor and the owner or lessee of such premises, site or location has been added to your policy as an additional insured with respect to your ongoing operations performed for that additional insured at that premises, site or location and such premises, site or location is not and never was owned or occupied by, or rented or loaned to, any insured, other than that additional insured; or
 - iii) "Bodily injury" or "property damage" arising out of heat, smoke or fumes from a "hostile fire"

expanded ELI coverage to include coverage for mold claims, which appealed to the broader real estate industry.

Environmental liability insurance policies come in several varieties. The most common forms are summarized in Table 6 below.¹⁹ In general, all environmental liability policies have the same basic structure and contain three essential elements: (1) coverage for unknown and/or specified known pollution conditions,²⁰ (2) conditions for coverage, and (3) exclusions to coverage. The policies are generally written on a claims-made basis, meaning the policy will only cover claims if: (1) they are brought against the insured, or the contamination is discovered by the insured, in the policy period, or (2) the insured gives written notice of the claim or contamination to the insurer within the policy period.

Table 6. Types of Environmental Liability Insurance Policies Available in the U.S.

Policy	Description of Coverage	Policy Features
Pollution Legal Liability	Includes coverage for cleanup of the insured property for both a voluntary cleanup and/or a regulatory ordered cleanup for unknown and, in some circumstances, known contamination and the cost of cleanup for contamination which occurs after the policy goes into effect. Includes defense costs. Coverage extends to third parties for bodily injury or property damage, and may also include coverage for loss of income/loss of rents resulting from a pollution condition.	Period: 1-10 years Policy limit: \$1-150 million Deductibles: \$25,000- \$1 million Premiums: \$10,000-300,000
Cleanup “Cost Cap”	Includes coverage for unanticipated increases in the cost of cleanup. Typical coverage is triggered only in the event of: discovery of unidentified pollution, pollution in excess of what was estimated, a change in regulatory requirements, or failure of the remediation plan. This coverage does not include defense costs and also excludes cleanup of contamination not specifically covered in the policy.	Period: Average 5 years Policy limit: \$1 - 25 million Self-insured retention: 110-130% of full cost of cleanup Premiums:8-20% of cleanup cost
Combined PL and CC Policies	A hybrid of the two types above.	Period: negotiable

¹⁹ Other policies include...

²⁰ The Contractor’s Pollution Liability Policy defines “pollution conditions” as “the discharge, dispersal, release, seepage, migration or escape of smoke, vapors, soot, fumes, acids, alkalis, toxic chemicals, liquids or gases, waste materials or other irritants, contaminants or pollutants into or upon the land, the atmosphere or any watercourse or body of water, which results in bodily injury, property damage or cleanup costs.” (GIC-OGCPLCP (7/99))

		<p>Policy limits: \$1-100 million</p> <p>Deductibles: \$100,000 (PL) plus 110% of cleanup (CC)</p> <p>Premiums: \$50,000 average</p>
"Stop Loss"	<p>Combines traditional environmental insurance with self-insurance. The insured and the insurer agree on the estimated expenses for cleaning up known contamination. The insured then agrees to a large deductible or a self-insured retention (the "stop loss" amount). The insurer bears the risk of all cleanup expenses in excess of the stop loss amount, up to the policy limit.</p>	n/a
Lender Pollution Liability	<p>Provides coverage to a lender that will trigger when a borrower defaults on the loan and the property is contaminated. When coverage is "triggered," the insurance policy will pay to the lender the remediation costs or the outstanding loan balance, whichever is smaller.</p>	<p>Period: 1-10 years</p> <p>Average policy limit: \$1-25 million</p> <p>Average deductible: \$10,000-250,000</p> <p>Average premiums: \$25,000-150,000</p>
Finite Risk/Pre-funded*	<p>The Responsible Party pays an insurer the full present value of the projected cleanup cost. The insurer is then responsible for costs of cleanup.</p>	<p>Period: typically 30 years</p> <p>PV of cleanup cost is collected by insurer at the beginning of the cleanup project. Insurer assumes the credit and timing risk.</p>

Sources: EPA and insurance company websites.

* In most arrangements, a third-party takes ownership of the known environmental conditions in a given property through a contract (buyout) which typically dictates the use of a finite risk insurance policy. The third party collects a cash payment and assumes all obligations for remediation and liability associated with known pollution conditions, including negotiating with the EPA or other regulatory bodies. The finite risk insurance policy protects the ceding company in the event of the failure of the third party.

As Table 6 indicates, insurance coverage is available for a wide range of pollution-related losses: bodily injury, third-party property damage, and on-site and off-site cleanup. Other policies, and/or add-ons to these policies, include coverage for business interruption expenses, costs to transport contaminated materials, and non-owned disposal site coverage to protect operators of landfills or other locations where the contaminated materials eventually are deposited. One particular variant of the PL policy, the Property Transfer policy, is designed specifically for the parties involved in a property transaction (buyer, seller, developer, and/or lender). A Contractor's Pollution Liability policy provides coverage for third-party claims for bodily injury and/or property damage, and also

covers the cost of remediation for pollution incidents that result from the contractor's covered job site operations.

While there were significant legal battles when pollution incidents were covered under the CGL policy, ELI policies do not tend to involve much litigation because these policies are specifically designed to pay these sorts of claims. Analysts suggest that the key factors that serve to limit the litigation include (1) limited defense expense coverage, (2) claims-made coverage with defense inside the policy limits, and (3) provision of environmental consulting services.²¹ Further, the policies often have short coverage periods – one to two years – which help to limit insurers' exposure and the potential for litigation.

Environmental liability insurance has become an important item in many real estate transactions. The coverage can benefit purchasers, sellers, lenders, and other potentially responsible parties. Further, it is valuable for the procurement of financing for contaminated property, and helps to lower a developer's risk in acquiring and developing known contaminated property.

6. Other Considerations

We consider now several important issues regarding insurability of environmental risks, in general. The answers to these questions may seem obvious, but nevertheless, these issues deserve further analysis as we consider the ultimate goal of reducing pollution.

Should coverage be mandatory?

Richardson (2002) evaluates the role of insurance markets in managing environmental risks. In particular, he questions whether such insurance should be compulsory. He notes that the EU White Paper on Environmental Liability suggests that there should be a statutory financial cap on environmental damages, thus reducing uncertainty and increasing the viability of insurance markets. But he argues that the uncertainty can be addressed via policy limits, thus preserving incentives for mitigation and loss control on the part of the insured.

²¹ Source: William Hazelton, Senior VP at ACE Environmental Risk in New York.

Coverage for environmental liability is not mandatory in the U.S., but since 2008, and more recently with the *Opinion* issued this year, China has been actively encouraging and now mandating purchase for firms in some industries. In order to avoid a system whereby firms decide simply to pay the penalties that may arise out of operations, a mandate to purchase insurance, coupled with policy premiums that reflect mitigation efforts, may be necessary to ensure the availability and adequacy of funds for cleanup and compensation for victims.

Is third-party coverage optimal?

One option to consider is first-party victim insurance. This approach would allow individuals to purchase a desired amount of protection; insurers could differentiate risks through underwriting and thus control the problem of adverse selection. The main drawback to this approach is that a large amount of environmental damage is to ecosystems in which there is no individual to claim a loss.²² Moreover, the concept goes against the “polluter pays” principle and does not provide incentives for control.

Do firms need additional incentives for undertaking mitigation activities?

Khanna et al (2009) investigates the relationship between regulatory pressures and firm level technological changes that reduce unregulated emissions. Using a treatment effects model with panel data for a sample of S&P 500 firms over the period 1994–1996, they find that the threat of anticipated regulations is important for creating the incentives to undertake incremental adoption of pollution prevention techniques.

Insurance coverage for environmental liability should also provide incentives for firms to reduce pollution as well. At a minimum, efforts to control potential losses should be reflected in premium reductions, and insurers can assist firms in determining the types of mitigation efforts that are most effective.

²² There are now over 170 Federal laws that regulate environmental activities that may affect wildlife (Fairbrother, 2009).

As another possibility, public programs may be designed to provide economic incentives for firms to reduce pollution. In the U.S., many such programs exist, often established at the state or more local level.²³ After a series of pollution-related settlements between the Sierra Club and developers in Bakersfield, California, the Kern County Air Pollution Mitigation fund was in formed in 1995 to fulfill the intent of the settlements. Basically, the fund receives air pollution mitigation fees paid by property developers, and these fees are then used to support grants designed to reduce particular or ozone air pollution in the area. As of March 2011, the Fund has awarded over \$1.5 million in grants to support clean air projects, indicating there has been considerable mitigation activity by firms in the area. As additional air pollution mitigation fees are paid into the Fund, additional grants are possible.²⁴

Who Should Finance Disaster Recovery?

In many cases, a pollution event stems from a wider disaster, such as a natural catastrophe. Recently, a tornado in Joplin, Missouri, was responsible for creating a variety of chemical leaks at facilities wrecked by the tornado. The EPA was quick to perform inspections at over 30 facilities in the area. The response to such events is dictated by various U.S. regulations, such as the National Oil and Hazardous Substances Pollution Contingency Plan (NCP).

Australia has a National Plan to Combat Pollution of the Sea by Oil and Other Noxious and Hazardous Substances, which has operated since 1973. The Plan imposes a responsibility to protect natural and man-made environments from the adverse effects of oil pollution and minimize those effects where protection is not possible. To this end, a fixed wing aerial dispersant spraying capability has been implemented and a research and development program has been put in place.

Is More Transparency Needed?

²³ See for example, pollution mitigation programs supported by the Texas State Energy Conservation Office (SECO) at http://www.seco.cpa.state.tx.us/pollution_projects.htm and the California EPA Air Resources Board at <http://www.arb.ca.gov/planning/tsaq/cmaq/cmaq.htm>

²⁴ The grant making program is administered by the Rose Foundation for Communities and the Environment, a grantmaking public charity with experience in administering court-ordered restitution funds, which also serves as the Fund's trustee.

Earlier, we noted a scarcity of information pertaining to pollution events in China. A massive environmental campaign in China was prompted by a lead poisoning scandal in March 2011, when untreated industrial emissions from Taizhou Suqi Storage Battery Co. Ltd. in Luqiao district poisoned 168 villagers. The victims, including 53 children, had excessively high levels of lead in their blood.²⁵

While reports of pollution events are limited, reports of food-related events continue to make headlines. In May of 2011, reports indicated that farmers in Jiangsu province misused fertilizer on the watermelon crops: over-fertilizing caused whole fields of watermelons to explode. Such events put China's food safety rules and their implementation in the limelight.²⁶ In early 2011, and again in early 2013, officials reported unsafe levels of the toxic metal cadmium in rice. A sharp increase in demand for imported rice indicates public awareness, if not understanding, of the consequences of pollution.

Jones (1987) explains the objectives behind supplementing financial penalties with additional stipulations. Noting that "other factors besides cold, hard, economic realities can motivate or deter individuals and groups," she explains that "settlements of enforcement cases may require that the violator publicize in trade or public media the fact that his company violated the law and was caught, and advise the reader not to make the same mistake." This practice of publicizing cases creates an expectation among other firms and may serve as a strong disincentive for violating regulations.

Interestingly, in a 2001 presentation, the EPA noted that 96 percent of publicly-traded companies with federally-imposed toxic cleanup expenses failed to properly disclose this information to their shareholders.²⁷

How Important Is Activism and Special Interest Groups?

²⁵ http://news.xinhuanet.com/english2010/china/2011-04/19/c_13835782.htm

²⁶ China has increased inspections and established standards for food safety for grading the performance of local government officials that can result to a social unrest among rural citizens. The deadly case of the melamine-tainted milk which killed at least six children in 2008, prompted the government to execute two people involved in the scandal and form a food-safety commission led by Vice Premier Li Keqiang.

²⁷ U.S. EPA, March 2001 presentation to the American Bar Association Conference on Environmental Law.

There are over 100 national environmental interest groups operating in the U.S. today.²⁸

While many have a very specific focus, e.g., birds, forests, or wetlands, they all have an interest in preserving the environment and thus serve as advocates for the support, strengthening, and expansion of U.S. environmental regulations. Hill (1968) argues that special interest and pressure groups serve to give the government a “blank check” to enact policy by providing the tacit support of public opinion. Clearly, environmental interest groups have celebrated many public policymaking victories over the years. For example, in 2009, environmental groups pressured an appeals court to vacate a U.S. EPA rule that has allowed pesticides to be applied to U.S. waters without a Clean Water Act permit. In early 2011, the *Coalition for Environmental Health*, partnering with *Californians for a Healthy and Green Economy* (CHANGE), educated public and state leaders about severe flaws in a proposal for Green Chemistry rules and convinced the California Department of Toxic Substances to table the proposal.

There is less evidence as to the success of special interest groups in assisting in the enforcement of existing regulations, but to the extent that these groups advertise their activities quite widely in efforts to seek donations from the public, we suspect they contribute significantly to public awareness of pollution issues. Firms cannot ignore this phenomenon, and thus are likely to manage polluting activities simply to maintain their reputations and avoid bad press.

Special interest groups with a focus on the environment are a relatively newer phenomenon in China, but their role in affecting policy and enforcement may be growing.²⁹ *Friends of Nature* was formed in 1994 with a focus on raising awareness about environmental issues. They conduct workshops, field trips, and educational events for teachers. *Green Earth Volunteers*, founded in 1996, is a group of environmental activists who focus on global environmental issues. The organization

²⁸ A list of environmental interest groups and environmental academic/research organizations is available at <http://www4.ncsu.edu/~leung/ioua2.html>.

²⁹ In addition to environmental protection-related groups, we note that advocacy organizations, such as the Center for Legal Assistance to Pollution Victims, rely heavily on the Tort Law provisions to vindicate environmental interests. The Center has been involved in hundreds of cases since it was established in 1998. The first environmental public interest law firm, Beijing Huanzhu Law Firm was established in Beijing in 2011.

includes a variety of individuals and encourages the public to participate in environmental monitoring. *Global Village of Beijing* was organized in 1996 to promote the development of “green” communities.

Yang and Zhang (2012) provide an interesting study of China’s environmental complaint mechanism. They show that the mechanism “has been heavily used by the general public to voice its concerns and frustrations with environmental problems and has been successful in promoting environmental awareness and engaging the public.” They note that mechanism’s effectiveness in protecting the environment and strengthening environmental enforcement and compliance is questionable.

To the extent that interest groups and complaint mechanisms help raise awareness of the Chinese citizenry, successful enforcement of environmental regulations and development of a smooth-functioning environmental liability insurance system will be enhanced.

7. Conclusion and Recommendations

Our research suggests some important considerations for the development of a market for liability insurance in China. The insurance industry in China is growing rapidly, with a compounded annual growth rate of 25% since 2001. However, the market for environmental liability insurance is extremely young and underdeveloped.

The magnitude of potential losses due to adverse environmental events in China is overwhelming. These events adversely impact millions of people both economically and socially. The risk of environmental disasters imposes significant fiscal pressure on the Chinese government. The government and citizenry could benefit significantly from the implementation of an environmental liability insurance system that merges insurance for pollution liability with risk reduction and mitigation efforts. Such a system could take a variety of forms, but the following objectives should be emphasized. First, the system should reduce the financial vulnerability of firms to environmental disasters by providing them with access to affordably priced catastrophe insurance. Ideally, such a system would reduce government fiscal risk exposure to environmental disasters through a nationwide transfer of firms’ financial responsibility for losses, which reduce firms’ assets, to the private insurance industry. Finally, it should create economic incentives for firms to reduce their potential for

causing or contributing to pollution overtime by encouraging proactive risk management. It is thus essential that insurance premiums reflect firms' risk, and reward firms for taking precautions. An additional related objective and benefit would be promoting the growth of the domestic insurance industry.

A need for environmental liability insurance clearly exists in China, but the risk is currently not well defined, and thus complicates both the demand and supply for coverage. This market failure can only be solved if the national government provides information to clarify existing environmental regulations. It is equally important that national and local governments take a more consistent approach to enforcement of environmental regulations; polluters must be held accountable for paying penalties, and these penalties must be imposed consistently. And finally, pollution events and resulting penalties must be advertised publicly, so that incentives for mitigation and a better understanding of the environmental liability risk is promoted.

Until these issues are resolved, the development of a smooth-functioning market for environmental liability insurance will be slow. The government of China may wish to consider forming a national environmental liability insurance mechanism, or reinsurance pool, to address suppliers' lack of experience with the risk and subsequent reluctance to provide insurance for a risk that is not well-defined. On the demand side, coverage will likely be purchased only by those firms for which it is mandated; willingness-to-pay for this coverage is complicated by the inability to estimate their risk. The main form of coverage should address liability for third-party losses resulting from an act of pollution to air, water, and land. Over time, specific coverage limits can be mandated in a variety of ways, including (1) establishing a flat minimum amount for all firms, with the option to purchase higher limits, (2) completely negotiable policy limits, or (3) setting an insured limit based on median property values in the province (or some similar formula). Further study is needed to determine the best option. Other forms of coverage, such as those used in the U.S. to cover cleanup costs, may be developed in the future. Because environmental liability losses are different than other types of insured losses, the government may wish to establish a separate regulatory framework for this segment of the industry. To encourage mitigation activities, the environmental insurance policy should be risk rated, such that premium rates charged to firms will vary based on their activities. As

noted previously, this will take some time as there is insufficient experience to date with underwriting these risks.

It is most important that the government of China clarify any special legislation related to the environment and establish a strong system of enforcement of these regulations. Further, the government will need to enforce the compulsory insurance requirement, and should consider methods for encouraging individual communities to engage in risk mitigation efforts. Over time, insurance premium rates will reflect the progress achieved by communities in implementing their risk management programs.

References

- Abraham, Kenneth S. (1988) "Environmental Liability and the Limits of Insurance," *Columbia Law Review* 88 (5): 942-988.
- Bennett, Paul (2000) "Anti-Trust? European Competition Law and Mutual Environmental Insurance," *Economic Geography* 76(1): 50-67.
- Beyer, Stefanie (2006) "Environmental Law and Policy in the People's Republic of China," *Chinese Journal of International Law* 5 (1): 185-211.
- Bublick, Ellen M. (2011) "China's New Tort Law: The Promise of Reasonable Care," *Asian-Pacific Law & Policy Journal* 13 (1): 36-53.
- Congjun, Liu and Abdul Razak Bin Chik (2012) "Developing Environmental Pollution Liability Insurance: the Countermeasures - A Case Study of Baoding, Hebei Province, China," Working Paper 2012.
- Faure, Michael G. and Zhang, Hao (2011) "Environmental Criminal Law in China: A Critical Analysis," *Environmental Law Reporter* 41:
- Ferris, Richard J. and Hongjun Zhang (2003) "Reaching Out to the Rule of Law: China's Continuing Efforts to Develop an Effective Environmental Law Regime," *William & Mary Bill of Rights Journal* 11: 569-602.
- Fairbrother, A. (2009) "Federal environmental legislation in the U.S. for protection of wildlife and regulation of environmental contaminants," *Ecotoxicology* 18: 784-790.
- Freeman, Paul K. and Howard Kunreuther (1996) "The Roles of Insurance and Well-Specified Standards in Dealing with Environmental Risks," *Managerial and Decision Economics* 17(5): 517-530.
- Goulder, L.H. and I.W.H. Parry (2008) "Instrument Choice in Environmental Policy," *Environmental Economics Policy* 2 (2): 152-174.
- Hill, Gladwin (1968-1969) "The Politics of Air Pollution: Public Interest and Pressure Groups," *Arizona Law Journal* 10: 37-47.

- Jones, Carol H. (1987) "Penalties are on the Rise," *EPA Journal* 13: 8-9.
- Khanna, Madhu, George Deltas and Donna Ramirez Harrington (2009) "Adoption of Pollution Prevention Techniques: The Role of Management Systems and Regulatory Pressures," *Environmental and Resource Economics* 44 (1): 85-106.
- Klee, Julia Epley, and Felicity C. Thomas (1997) "An Evolving Environmental Framework." *China Business Review*, January/February, 34-40.
- Latham, Mark, Victor E. Schwartz, and Christopher E. Appel, "The Intersection of Tort and Environmental Law: Where the Twains Should Meet and Depart," *Fordham Law Review* 80 (2): 737-773.
- Moser, Adam and Tseming Yang (2011) "Environmental Tort Litigation in China," *Environmental Law Reporter* 41: 10895-10901.
- Nelson, Paul (2000) "Australia's National Plan to Combat Pollution of the Sea by Oil and Other Noxious and Hazardous Substances – Overview and Current Issues," *Spill Science & Technology Bulletin* 6 (1): 3-11
- Ren, Guoqiang and Jinyan Shang (2010) "The conditions of China's environmental liability insurance system," IEEE Proceedings from the 4th International Conference on Bioinformatics and Biomedical Engineering, June 18-20, 2010.
- Richardson, Benjamin J. (2002) "Mandating Environmental Liability Insurance," *Duke Environmental Law & Policy Forum* 12: 293.
- Susmita Dasgupta, Benoit Laplante, Nlandu Maming, Hua Wang (2001) "Inspections, pollution prices, and environmental performance: evidence from China", *Ecological Economics* 36: 487-498.
- Vennemo, Haakon, Kristin Aunan, Henrik Lindhjem, and Hans Martin Seip (2009) "Environmental Pollution in China: Status and Trends," *Review of Environmental Economics and Policy* 3 (2): 209-230.
- Wang, Mark, Michael Webber, Brian Finlayson and Jon Barnett (2008) "Rural Industries and Water Pollution in China," *Journal of Environmental Management* 86: 648-659.
- Yang, Tseming and Zhang, Xuehua (2012) "Public Participation in Environmental Enforcement . . . with Chinese Characteristics?: A Comparative Assessment of China's Environmental Complaint Mechanism," *Vermont Law School Research Paper* No. 11-21. Available at SSRN: <http://ssrn.com/abstract=1920611>.
- Yunfu Yang and Cuizhu Lin (2005) "Scope of Losses of Compensation for Damages due to Oil Pollution of Ships in Chinese Waters", *US-China Law Review* 2 (12): 55-62.

Appendix A. Key Environmental Regulations: China

Full list available at: <http://www.lawinfochina.com/>

- **Environmental Protection Law of the People's Republic of China** (All contaminants). Broad authority given to local people's government to take effective measures to remove or alleviate environmental hazards. Enforcement by local government at or above the county level.
- **Law of the People's Republic of China on the Prevention and Control of Atmospheric Pollution, and Hazardous materials control standard for motor vehicle gasoline** (Grade IV and V) (GWKB 1.1-2011). Target is all atmosphere polluters. Aim of the law is to protect the environment and human health, prevent and control vehicle emissions, raise clean level of vehicle petrol and facilitating technical progress and optimization of industrial structure. The State implements a system of collecting fees for the discharge of pollutants on the basis of the categories and quantities of the atmospheric pollutants discharged. All units and individuals shall have the obligation to protect the atmospheric environment and shall have the right to report on or file charges against units or individuals that cause pollution to the atmospheric environment. The relevant administrative departments under the people's governments at or above the county level shall, within their respective functions, supervise and administer the prevention and control of atmospheric pollution. Requires that the administrative department of environmental protection under the State Council shall establish national standards for atmospheric environment quality. The administrative department of environmental protections under the people's governments at or above the county level shall be the instrument conducting unified supervision and management of the prevention and control of atmospheric pollution. The administrative departments of public security, transportation, railways and fishery at various levels shall, by performing their respective functions, conduct supervision and management of the atmospheric pollution caused by motor-driven vehicles and vessels.
- **Law on Prevention and Control of Water Pollution**. Target is all water emissions; intended for prevention and control of pollution of rivers, lakes, canals, irrigation channels, reservoirs and other surface waters and ground waters within the territory of the People's Republic of China. For consequential damages and loss, polluter shall be fined. If a water pollution accident is relatively serious, the persons who are responsible for the accident shall be given administrative sanctions by the unit to which they belong or by the competent department at a higher level. Requires that the environmental protection department of the State Council establish national water environment quality standards. The fees paid for pollutant discharge and for excess discharge must be used for prevention and control of water pollution and may not be used for any other purposes. The Law is enforced by the environmental protection department of the people's government at or above the county level; the fishery supervision and administration department or the navigation administration office of the communications department
- **Marine Environment Protection Law of the People's Republic of China**. Target is all vessels, platforms, airborne vehicles and submersibles, as well as all enterprises, institutions and individuals engaged in navigation, exploration, exploitation, production, scientific research or other activities in the sea areas. Violator shall remedy the pollution damage within a definite time, pay a pollutant discharge fee, pay the cost for eliminating the pollution and compensate for the losses sustained by the state; violator may also receive a warning or pay a fine. Units or individuals who have suffered damage caused by marine environmental pollution shall be entitled to claim compensation from the party which caused the pollution damage. The Harbor Superintendency Administration of the People's Republic of China is responsible for supervising, investigating and dealing with the discharge of pollutants from vessels and for exercising surveillance over the waters of the port areas; it is also in charge of environmental protection against pollution damage caused by vessels. The state fisheries administration and fishing harbor superintendency agencies is responsible for supervising the discharge of pollutants by vessels in the fishing harbors and for exercising surveillance over the waters shall be responsible for supervising the discharge of pollutants by military vessels and exercising surveillance over the waters of the naval ports.
- **Law of the People's Republic of China on Prevention and Control of Pollution From Environmental Noise**. Target is industrial enterprises that produce environmental noise pollution. Firms may be fined or ordered to suspend production or to relocate or close down in light of the hazards so caused, in addition to paying fees for excessive emission of noise as required by the State. The fees collected from excessive emission of pollution must be used for prevention and control of pollution and may not be appropriated for any other use. The competent administrative departments for environmental protection of the people's governments at or above the county level and other departments or institutions in charge of supervision and administration of the prevention and control of environmental noise pollution.
- **Law of the People's Republic of China on Prevention and Control of Radioactive Pollution, Regulations on Safety and Protection of Radioactive Isotopes and Radioactive Ray Devices, and Regulations on Management of Safety and Protection of Radioactive Isotopes and Radioactive Ray Devices** (No.18 Order of MEP). Target is any unit that manufacturers, sells and utilizes radioactive isotopes and radioactive ray devices. Firm must cease the illegal acts, and make a correction within a time limit. If the entity fails to make a correction within the time limit, it shall be ordered to cease its production or business, or its permit shall be suspended. If there are any illegal proceeds, such

illegal proceeds shall be confiscated. If the illegal proceeds amount to 100,000 Yuan or more, the entity shall be imposed upon a fine of not less than one time but not more than five times of the illegal proceeds. If there are no illegal proceeds or the illegal proceeds are less than 100,000 Yuan, the entity shall be imposed upon a fine of not less than 10,000 Yuan but not more than 100,000 Yuan. If a crime is constituted, it shall be investigated for criminal liabilities. The State encourages and supports the scientific research and the technical development and utilization for the prevention and control of radioactive pollution, and extends advanced technologies for the prevention and control of radioactive pollution. The State supports the carrying-out of international exchanges and cooperation for the prevention and control of radioactive pollution. The people's government at the county level or above shall reward the entities and individuals that have made prominent achievements in the prevention and control of radioactive pollution. The Laws are enforced by the administrative department of environmental protection and the administrative department of health.

- **Law of the People's Republic of China on Promoting Clean Production.** Target is all entities that are engaged in the activities of production and services and the departments in charge of relevant administration. The production technologies, techniques, equipment and products that are wasting resources or seriously polluting the environment shall be eliminated during prescribed time periods. The State Council shall formulate financial and taxation policies that can contribute to the implementation of clean production. The Law calls for organization and support for the establishment of information systems of clean production and systems of technological consultation services so as to provide to the general public the methods and technologies of clean production, information and services concerning the demand and supply of reproducible wastes, and the policies concerning clean production, etc. The administrative department of economy and trade of the State Council publishes catalogues regularly about the orientation of technologies, techniques, equipments and products of clean production. The administrative department of economy and trade under the State Council shall be responsible for organizing and conciliating the promotion of clean production within the whole country. The people's governments on the county level and above shall be responsible for the promotion of the clean production within their respective administrative jurisdictions.
- **Law of the People's Republic of China on the Prevention and Control of Environmental Pollution Caused by Solid Waste and Administrative Measures for the Prevention and Control of Environmental Pollution by Electronic Waste.** Target is solid wastes emissions not including marine environmental pollution by solid wastes or environmental pollution by radioactive solid wastes. Calls for the prevention and control of environmental pollution by the dismantling, utilization and disposal of electronic waste within the territory of the People's Republic of China. For the prevention and control of environmental pollution by solid wastes, the State implements the principle that any entity or individual causing the pollution shall be responsible for it in accordance with law. The manufacturers, sellers, importers and users shall be responsible for the prevention and control of solid wastes pollution produced thereby. In case it is de facto impossible for it to confirm the entity that has originally discharged the hazardous wastes as illegally collected, the illegal collector of the hazardous wastes shall be deemed as the producer of the hazardous wastes and shall shoulder the responsibilities of disposal. Polluting firm shall eliminate hazards, compensate losses according to law and take measures to reconstitute to the previous environmental condition if any environmental pollution by solid wastes is caused. For a damage suit arising from the environmental pollution by solid wastes, the polluting party shall assume the burden of proof for the statutory causes for exemption and the nonexistence of causation between its act and harmful consequences. The environmental protection administrative department of the State Council shall conduct unified supervision and management of the prevention and control of environmental pollution by solid wastes throughout the country. The environmental protection administrative departments of the local people's governments at or above the county level shall conduct unified supervision and management of the prevention and control of environmental pollution by solid wastes within their own administrative areas. The construction administrative department of the State Council and the environmental sanitation administrative departments of the local people's governments at or above the county level shall be responsible for supervising and administering the cleaning, collection, storage, transportation and disposal of urban consumer wastes

Appendix B. Key Environmental Regulations: United States

Full list available at: <http://www.epa.gov/lawsregs/laws/>

- **Comprehensive Environmental Response, Compensation and Liability Act of 1980** (CERCLA, aka Superfund). Target is all contaminators. Act allows the EPA to clean up such sites and to compel responsible parties to perform cleanups or reimburse the government for EPA-lead cleanups. Violators must reimburse government for EPA-lead cleanups; EPA and the Department of Justice can enter into settlement agreements (administrative orders on consent or consent decrees) with potentially responsible parties to cleanup a site or pay for cleanup conducted by EPA. Statutory penalties of \$37,500/day; other penalties may apply. Act is enforced by the EPA's Office of Solid Waste and Emergency Response (OSWER).
- **Clean Air Act (CAA) 1963 and Chemical Safety Information, Site Security and Fuels Regulatory Relief Act.** The act regulates air emissions from stationary and mobile sources. CSISSFRR contains provisions for reporting and disseminating information under Section 112(r) of the Clean Air Act. [Note: In 1990, Congress dramatically revised and expanded the Clean Air Act, providing EPA even broader authority to implement and enforce regulations reducing air pollutant emissions. The 1990 Amendments also placed an increased emphasis on more cost-effective approaches to reduce air pollution.]. The Act gives EPA the authority to limit emissions of air pollutants coming from sources like chemical plants, utilities, and steel mills. The EPA may assess fines for violations. EPA must approve state, tribal, and local agency plans for reducing air pollution. If a plan does not meet the necessary requirements, EPA can issue sanctions against the state and, if necessary, take over enforcing the Clean Air Act in that area.
- **Clean Water Act (CWA)** (original title: Federal Water Pollution Control Amendments of 1972) 33 U.S.C. §1251 et seq. (1972). The basis of the CWA was enacted in 1948 and was called the Federal Water Pollution Control Act, but the Act was significantly reorganized and expanded in 1972. "Clean Water Act" became the Act's common name with amendments in 1977. In passing the 1972 CWA, Congress said that our nation's surface waters should no longer be used as waste conveyances or treatment systems. Bodies of water are regulated according to their designation of use: e.g. drinking water, recreation, aquatic life, etc. Target is all water emissions. The Act establishes the basic structure for regulating discharges of pollutants into the waters of the United States and regulating quality standards for surface waters. The CWA made it unlawful to discharge any pollutant from a point source into navigable waters, unless a permit was obtained. EPA's National Pollutant Discharge Elimination System (NPDES) permit program controls discharges. Point sources are discrete conveyances such as pipes or man-made ditches. Individual homes that are connected to a municipal system, use a septic system, or do not have a surface discharge do not need an NPDES permit; however, industrial, municipal, and other facilities must obtain permits if their discharges go directly to surface waters. Evolution of CWA programs over the last decade has also included something of a shift from a program-by-program, source-by-source, pollutant-by-pollutant approach to more holistic watershed-based strategies. Under the watershed approach equal emphasis is placed on protecting healthy waters and restoring impaired ones. Under the CWA, EPA has implemented pollution control programs such as setting wastewater standards for industry. The Act also sets water quality standards for all contaminants in surface waters. The CWA requires anyone who wants to discharge pollutants to first obtain an NPDES permit, or else that discharge will be considered illegal. The Act allows for civil fines as well as the cost of clean-up, economic damages and potential criminal liability. Fines are intended to recover the economic benefit the violator gained by not complying. The EPA and the Corps agreed in 1990 to define mitigation as the three steps of avoidance, minimization, and compensation, principles which must be applied to permit decisions in the form of the environmental criteria in EPA's 404(b)(1) Guidelines. Through the 1980s and 1990s, the compensation component of mitigation has become nearly the sole focus of mitigation policy development, and has been the subject of numerous guidance documents and memoranda since 1990. Avoidance and minimization have received far less policy attention, and this lack of policy development may represent a missed opportunity to implement effective wetland conservation. The EPA has the authority to implement pollution control programs such as setting wastewater standards for industry. NPDES issues permits, but it acts under the authority of EPA.
- **Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) (1947), Federal Environmental Pesticide Control Act (FEPCA)(1972) and Food Quality Protection Act (FQPA).** [FIFRA was essentially rewritten in 1972 when it was amended by the Federal Environmental Pesticide Control Act (FEPCA). The law has been amended numerous times since 1972, including some significant amendments in the form of the Food Quality Protection Act (FQPA) of 1996]. Target is all users and manufacturers of Pesticides. The Act established procedures for registering pesticides with the U.S. Department of Agriculture and established labeling provisions. The original law was primarily concerned with the efficacy of pesticides and did not regulate pesticide use. In its current form, FIFRA mandates that EPA regulate the use and sale of pesticides to protect human health and preserve the environment. The EPA is specifically authorized to: (1) strengthen the registration process by shifting the burden of proof to the chemical manufacturer, (2) enforce compliance against banned and unregistered products, and (3) promulgate the regulatory framework missing from the original law. The Act requires that registrations be reviewed every 15 years and requires EPA to reregister all pesticides that were registered before 1984. The goal is to update labeling and use requirements and reduce potential risks associated with older pesticide active ingredients -- those first registered when the standards for government approval were less

stringent than they are today. This comprehensive reevaluation of pesticide safety in light of current standards is critical to protecting human health and the environment. Violators are subject to fines. FIFRA provides EPA with the authority to oversee the sale and use of pesticides. However, because FIFRA does not fully preempt state/tribal or local law, each state/tribe and local government may also regulate pesticide use. As a part of the pesticide registration, EPA must classify the product or some uses of the product as "restricted use" if they may cause unreasonable adverse effects even when used as directed on the product labeling. The EPA may inspect manufacturers and users of pesticides and can take enforcement actions against facilities that are not in compliance with FIFRA.

- **Toxic Substances Control Act (TSCA)**(1976), **Asbestos Hazard Emergency Response Act (AHERA)** (P.L. 99-519)(1986), **Radon Reduction Act** (PL 100-551)(1988), and **Lead-Based Paint Exposure Reduction Act** (PL 102-550)(1992). The Acts target chemical manufacturers, importers, and processors; requires reporting and record-keeping by persons who manufacture, import, process, and/or distribute chemical substances in commerce. The Acts include provisions for testing of existing chemical substances and mixtures, regulation of hazardous chemical substances and mixtures, manufacture and processing notices, in addition to managing imminent hazards and reporting and recordkeeping requirements. The EPA may issue a civil administrative complaint to any person or company who violates the Toxic Substances Control Act. The complaint may impose a civil penalty, including recovery of any economic benefit of non-compliance, and may also require correction of the violation. Penalties for violations of TSCA may be up to \$27,500 per violation (per day). The Acts provide EPA with authority to require reporting, record-keeping and testing requirements, and restrictions relating to chemical substances and/or mixtures. Certain substances are generally excluded from TSCA, including, among others, food, drugs, cosmetics and pesticides.
- **Marine Protection, Research, and Sanctuaries Act** (16 USC §1401 et seq. (1988)), **Ocean Dumping Ban** (amendment), and **United States Public Vessel Medical Waste Anti-Dumping Act** (1988). The Acts generally prohibit (1) transportation of material from the United States for the purpose of ocean dumping; (2) transportation of material from anywhere for the purpose of ocean dumping by U.S. agencies or U.S.-flagged vessels; (3) dumping of material transported from outside the United States into the U.S. territorial sea. Acts make it unlawful for any person to dump, or transport for the purpose of dumping, sewage sludge or industrial waste into ocean waters after December 31, 1991. Acts prohibit any person from dumping, or transporting for the purpose of dumping, sewage sludge or industrial waste into ocean waters unless the person: (1) enters into a compliance or enforcement agreement (which includes a plan negotiated by the dumper, the State, and EPA for terminating dumping as well as a schedule which EPA believes will result in the termination of the dumping), and (2) obtains a permit issued by EPA under authority of sec. 102 of the Marine Protection, Research, and Sanctuaries Act (MPRSA). The PVMWA adds medical wastes to the list of materials the dumping of which is prohibited under the Ocean Dumping Act; increases the civil penalties for illegal dumping of medical wastes under the Ocean Dumping Act and includes a provision for forfeiture of the vessel; and provides increased criminal sanctions under the Ocean Dumping Act for illegal dumping of medical wastes; defines "medical waste" for purposes of the CWA using the same definition as for the MPRSA; and, incorporates the term "medical waste" into the list of pollutants for which the discharge is prohibited under sec. 301(f) of the CWA. A permit is required to deviate from these dumping prohibitions. The Acts provide for the payment of special fees for dumping and any penalties incurred by a dumper to be deposited into certain funds for use in finding alternatives to ocean. The EPA is charged with developing ocean dumping criteria to be used in evaluating permit applications. The MPRSA provisions administered by EPA are published in Title 33 of the U.S. Code. The MPRSA provisions that address marine sanctuaries are administered by the National Oceanic and Atmospheric Administration and are published in Title 16 of the U.S. Code.