“Within the general domain of environmental analysis and policy there is a class of pollutants that have come to be called ‘toxic’ substances and ‘hazardous’ materials. Although all pollutants are damaging to some extent, these have been singled out for their special short- or long-run potency.”

Operationally, a chemical is deemed toxic by the EPA if it is any of the following:
1. corrosive
2. ignitable
3. reactive
4. toxic
5. specifically listed by the EPA as hazardous

Problems particular to toxic substances
Toxic substances have a variety of characteristics that make them difficult for economists to address and that make the appropriate regulatory approach different from that of other pollutants.
1. There are too many chemicals that work in too complex a set of ways to completely understand what the possible dangers are, so there is great uncertainty.
2. These chemicals pose problems in even relatively small amounts, which can be difficult, impossible or very costly to monitor, so fees and standards really can't be used.
3. There may be a long time gap between emissions and observed damage, so any system of liability claims may be ineffective at controlling emissions.
4. These chemicals have the capacity to create enough damage to more than bankrupt many firms, so the expected cost to a firm from a toxic release is almost certainly less than the expected damage done to the community, so, again, liability claims will be ineffective and any sort of Coasian negotiation will be impossible.

These problems suggest that effective regulation of toxic substances will differ from effective regulation of other types of pollutants.
What can be done with toxic residuals
1. Dispose of them on land, either legitimately or illegitimately, perhaps by landfilling or injecting into deep wells. There are lots of illegitimate options, too.
2. Treat by chemical processes to make it non-toxic.
3. Render it non-mobile, so it will stay where it is. This often means turning it into glass so that, though still toxic, it will stay where you put it and there will be no externalities.
4. Burn toxic wastes as fuel.
5. Recycle toxic wastes.
6. Find some substitute process or input.

Ideally, a policy will be flexible enough to encourage the most efficient alternative from the above list.

Existing Regulation
The point of this bit of history is to demonstrate how varied the regulatory approach to toxic substances has been over the years.

1938 Food, Drug and Cosmetic Act (FDCA)
- adopts a command and control approach
- prohibits foods, drugs or cosmetics that don’t meet certain criteria
- FDA is the relevant government agency

1947 Federal Insecticide, Fungicide and Rodenticide Act (FIFRA)
- originally intended to certify effectiveness of pesticides, shifted focus in 1960s
- adopts a command and control approach
- substances must be registered with and approved by the EPA
- EPA can cancel registration and remove substance from the market
- economic impacts are taken into account – balancing
- currently allows for limited use of DDT in the U.S.

1970 Occupational Safety and Health Act (OSHA)
- command and control through workplace health and safety standards
- establishes standards for workplace conditions
- requires that workers be informed about the substances with which they work
- reduces accidents
- promotes more efficient labor markets through better worker information

1972 Consumer Product Safety Act (CPSA)
- established the Consumer Product Safety Commission
- relates more to toxicity of consumer products than to environmental issues

1972 Water Pollution Control Act Amendments
- toxic emissions were prohibited
- gave EPA 15 months to come up with a list of toxic chemicals and regulations
- polluters would have one year to come into compliance
- wackiness ensued
1974 Safe Drinking Water Act
-required EPA to set maximum levels for 189 named substances in drinking water
-this turns things around and, instead of keeping chemicals from getting into the environment it takes the approach of keeping chemicals from getting back to us
-one question is, do you force local communities to spend money to bring their drinking water up to standards when they don't want to?

1976 Toxic Substances Control Act (TSCA)
-directs EPA to inventory all chemicals produced or imported from 1975-77
-directs EPA to test existing chemicals and screen new chemicals, so that at the very least allowed for informed voluntary exposure
-directs EPA to regulate chemical use

1976 Resource Conservation and Recovery Act (RCRA)
-gave the federal government the authority to regulate toxic waste
-one challenge to EPA was to define what was hazardous or toxic
-set standards for proper disposal or treatment of wastes
-required that landfills be lined with thick plastic barriers in order to limit mobility of water that flows through the landfill and prevent externalities from the landfill. After all, if the materials in the landfill stay in the landfill, there are no externalities.
-required treatment before land disposal. This is important because containment is almost necessarily temporary. You can't keep something in one place forever; this was sort of the point of the Jurassic Park movies.

1977 Clean Water Act
-identified 65 compounds and about 125 chemicals
-EPA directed to determine and promulgate technology-based effluent standards
-best available technology (BAT) was the basis

1980 The Comprehensive Environmental Response, Compensation and Liability Act (CERCLA or Superfund)
-created a financial fund based mostly on chemical and petroleum taxes until 1995
-created a system for listing and prioritizing toxic sites, this is likely to be political
-granted authority to EPA to clean up sites or identify responsible parties
-created a liability provision for natural resources damage

1986 Emergency Planning and Community Right-To-Know Act (EPCRA)
-created the Toxic Release Inventory (TRI)
-required that states create emergency response plans

1987 Water Quality Act
-directs states to come up with plans to address local hot spots

1990 Clean Air Act Amendments
-identified 189 toxic substances that are to be controlled
-the standards are to be based on maximum achievable control technology (MACT)
In general, the approach with toxics is substitution and waste reduction to reduce the amount of toxics in the waste stream rather than abatement or removal of toxics from the waste stream. This differs from the approach to more bulky conventional pollutants.

CPSA and OSHA are partially focused on generation and distribution of information. This is important as one characteristic of toxic chemicals is that by the time you know that they exist, the damage is irreversible. This is rather unlike acid rain damage, which can be perceived and then reversed, potentially pretty easily.

These regulations take the approach of either stopping really bad chemicals before they’re ever manufactured or requiring that they’re used in ways that minimize environmental impact. This is fundamentally different from dealing with other pollutants in that control is done very early in the process, before the substance is dispersed.

An important factor here is that there are substitutes for most toxic chemicals, whereas there aren’t really good substitutes for, say, BOD in a body of water or SO\(_2\) emissions.

Also, it should be noted that responsibility for toxics is divided between government agencies depending, perhaps, on whether the dangers of toxicity are primarily for consumers, food products or the environment.

A couple of these pieces of legislation deserve some additional comment.

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- required treatment before land disposal. This is important because containment is almost necessarily temporary. You can't keep something in one place forever.

More importantly, RCRA requires that landfills carry insurance against sudden and accidental pollution incidents. That is, a landfill cannot be an undercapitalized operation that just declares bankruptcy when something goes wrong. A landfill must have enough insurance to compensate damaged parties if toxic chemicals leak out of it. There are two important results of this.

1. The insurance company will send lots of tough, nosy inspectors to look at and monitor the landfill's operations, to help insure that they never have to pay any damages. This is a good way of privatizing inspections instead of the Government needing to hire inspectors.
Of course, this monitoring effect will be diminished if the insurer of the landfill rationally reduces their exposure to risk by sharing the risk with other insurers, rather like happened in the financial crisis of 2008. Risk management reduces the demand for careful monitoring and oversight.

2. The capital and insurance requirements will increase the cost of operating landfills and will act as a barrier to entry, limiting the number of landfills and increasing the cost of disposal, giving many people a greater incentive to throw away less material. This may also increase incentives for illegitimate disposal, although a well-organized set of local waste sites might have an incentive to help the police find illegitimate operators.

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4. A liability provision for natural resources damage

It is point #4 that has lead to tons and tons of fighting about cleanup bills under CERCLA. It would be nice to make the polluters pay, but getting them to do so can involve a lot of legal expenses.

In particular, the doctrine of strict, joint and several liability means that any one responsible party that put even a tiny amount of waste into a site could be held responsible for all of the cleanup cost and results in every potentially responsible party fighting like hell to avoid proof of any bit of involvement in a site. It also means that a firm could be liable for damages resulting from their disposal of waste at a site, even if their actions were legal at the time.

It could be better to simply have taxpayers pay for the cleanup and avoid the fighting. This would have been more efficient, but less equitable.

**Joint and Several Liability, Vengeance and Tragedy**

The lesson here about the effect of joint and several liability on environmental outcomes is just one example of a broader principle with both literary and historical precedents.

If you see the idea of joint and several liability as something like an attempt to punish or exact vengeance from someone who has done something wrong, you might consider that such attempts often have disastrous consequences. Here are two examples.

The first is William Shakespeare’s play Titus Andronicus. In the play, a victorious Roman general returns from battling the Goths with a number of prisoners in tow, including the Goth queen and her sons. As vengeance for the many sons he has lost in battle, he orders the execution of the queen’s eldest son in spite of her pleas for Titus to spare her son’s life. This begins a series of horrible actions that leads, ultimately, to the
tragic deaths of just about everyone in the play. Had Titus been merciful, a lot of suffering would have been avoided.

The second is the situation in Europe following World War I. The victorious allies sought vengeance against Germany and subjected it to numerous post-war concessions that were both humiliating and economically devastating. The result of these policies, in addition to the eventual onset of the Great Depression, gave rise to the National Socialist party and, eventually, the onset of World War II. Had the victorious side been more forgiving and generous at the end of the first world war, the second might have been avoided.

One interpretation of joint and several liability is that it represents a desire to punish any and all polluters, perhaps far beyond any reasonable measure of the damage they have done. This led only to a lot of expensive legal battles and comparatively little actual cleanup of contaminated sites.

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**CERCLA and the Corporate Veil – Can a parent company be held liable for subsidiaries’ action? The Case of United States v. Bestfoods**

*United States v. Bestfoods*, No. 97-454 (1998),[1] was a case in which the Supreme Court of the United States held that the indirect liability of a parent corporation under CERCLA is to be determined by its control over a subsidiary’s facility, rather than the relationship between the corporation and subsidiary.

http://en.wikipedia.org/wiki/United_States_v._Bestfoods

**Citation.** 528 U.S. 810, 120 S. Ct. 42, 145 L. Ed. 2d 38, 21 ITRD 1767 (1999)

**Brief Fact Summary.** The United States, brings an action against two parent corporations for the polluting activities of its subsidiary company. The United States Supreme Court must determine whether the parent companies can be liable under section 107(a)(2) of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA).

**Synopsis of Rule of Law.** Under CERCLA, a parent corporation may be liable if the corporate veil can be pierced. Alternatively, a parent corporation may be directly liable as an operator of the polluting facility if it exerted power and control over the operations of its subsidiary that lead to the pollution.

**Facts.** Since 1957, the numerous owners of the site where Cordova Michigan (Cordova MI) now sits have polluted. In 1965, CPC International Incorporated’s (CPC) wholly owned subsidiary bought Ott Chemical Company (Ott). The new company kept Ott’s name, managers and former founder, president and principal shareholder, Arnold Ott, as officers of Ott.

In 1972, CPC sold Ott to Story Chemical Company (Story). Story then sold the plant to Aerojet General Corporation (Aerojet), which created a wholly owned California subsidiary, Cardova Chemical Company (Cardova CA), to purchase the property, who in turn created a wholly owned Michigan subsidiary, Cardova Chemical Company of Michigan (Cardova MI), which manufactured chemicals at the site until 1986.

In 1981, the federal Environmental Protection Agency (EPA) undertook to clean up the site. Subsequently, the United States filed a claim against CPC, Aerojet, Cordova CA, Cordova MI, and Arnold Ott. The parties launched claims against one another. Consequently, the District Court
consolidated the cases for trial in three phases: liability, remedy, and insurance coverage. After completion of the liability phase in favor of the United States, the District Court determined that CPC and Aeroject were liable as the parent corporations of Ott and the Cordova companies because they had “owned or operated” the facility within the meaning of Section 107(a)(2). The District Court held that CPC and Aeroject were directly liable as operators under Section 107(a)(2) because they actively participated in and controlled the subsidiary’s functions and decision-making.

The Court of Appeals for the Sixth Circuit reversed in part. Later, that court granted a rehearing en banc and vacated the panel decision. This time, the court again reversed the District Court in part. The court held that a parent company might be held directly liable as an operator of a facility owned by its subsidiary, but only “when the requirements necessary to pierce the corporate veil [under state law] are met.” Finding that the corporate veil could not be pierced because the subsidiary corporations “maintained separate personalities “and “did not utilize the corporate form to perpetrate fraud or subvert justice,” the court did not extend direct liability to CPC or Aeroject.

The United States Supreme Court granted certiorari “to resolve a conflict among the Circuits over the extent to which parent corporations may be held liable under CERCLA for operating facilities ostensibly under the control of their subsidiaries.”

**Issue.** Whether a parent corporation could be liable for its subsidiary’s pollution under CERCLA?

**Held.** No, unless the corporate veil can be pierced. However, a parent corporation may be directly liable if it actively participated in and exercised control over the operations of that facility. The Court of Appeals’ decision is vacated and remanded.

**Discussion.** Liability under CERCLA is based on the corporation’s “ownership” and “operation” of the polluting facility. A parent corporation is not liable for the acts of its subsidiaries. However, the corporate veil may be pierced and the shareholder may be held derivatively liable for the subsidiary corporation’s conduct if the corporate form would be “misused to accomplish certain wrongful purposes, notably fraud, on the shareholder’s behalf.”

Aside from derivative liability, CERCLA contemplates that any person who operates a polluting facility may be directly liable for her own actions regardless of whether that person is the facility’s owner, the owner’s parent corporation or business partner. Thus, if any act is done on behalf of the parent corporation, the relationship between parent-subsidiary is irrelevant in determining liability as an operator.

Under CERCLA, an operator is “someone who directs the workings of, manages, or conducts the affairs of a facility . . . related to pollution” such as “operations having to do with the leakage or disposal of hazardous waste, or decisions about compliance with environmental regulations.” To determine direct liability, the test is not “whether the parent operates the subsidiary, but rather whether it operates the facility, and that operation is evidenced by participation in the activities of the facility, not the subsidiary.”

Here, there is some evidence to suggest that CPC acted as an operator that participated in the facility’s pollution. Thus, the District Court must reevaluate the extent of CPC’s involvement on the theory of direct operation.

Balancing Costs and Benefits of Toxic Chemicals?
Some laws permit consideration of costs and benefits, while others prohibit consideration of costs and merely require establishment of standards that protect human health with no consideration of costs. Application of these different requirements is fairly inconsistent.

TSCA apparently permits balancing.

FIFRA and FDCA used to permit balancing, but now it has been replaced by, “a reasonable certainty that no harm will result.”

In any case, the data needed to establish standards consistent with either economic balancing of marginal damages and benefits or a vaguely worded legal requirement will probably never exist, so this is almost more of a theological discussion in most cases. It may just be better to specify a technology-based standard or ban a substance than to engage in a theological discussion of how may parts per billion of PCB can dance on the head of a pin without causing cancer.

OSHA – Workplace Health and Safety in an Environmental Economics Course?
Why do we care about workplace health and safety in an environmental economics course?

In part, because toxic chemicals that exist in a workplace could be emitted to the environment and have external effects.

If, however, there is good information about the chemicals present in a workplace, the risks they pose and how to effectively reduce these risks, there should be some sort of compensating wage differential that will compensate workers for the risks they take in their jobs.

If there is compensation, there is no externality.

However, this statement relies on information, and information is a lot like a public good, so these laws are, in part, providing public goods that help to reduce the level of uncompensated externalities that exist in the workplace.

In addition, OSHA, by requiring that a firm inform its employees of what chemicals they're working with, forces a firm to reveal this information. If a firm were to try and cover up the fact that it used and discharged a particular substance, part of the cover-up would be some violation of OSHA requirements. It may well be easier to convict a firm of an OSHA violation than it is to convict them of some sort of civil damages, so it may be that OSHA could be a prosecutorial tool to use against firms that do environmental damage, rather like U.S. tax law being used to convict notorious criminal Al Capone.
Deposits or Subsidies for Proper Disposal

“The two major pathways leading to damage are through accidental releases and releases stemming from improper handling, either at the site of use or at waste disposal facilities.”

Basically, you don’t want people to dispose of toxic chemicals inappropriately, so charging people for proper disposal of chemicals that exist in small amounts and can do great damage in small amounts is probably bad.

There is a great danger in specifying very demanding regulations for landfills as this will greatly increase the cost of legitimate disposal. Indeed, any time you make an activity illegal or costly to do legally, there is a great incentive for organized criminals to step in and turn a profit by offering an illegal alternative. There are lots of examples of this, including drugs, disposal of toxic wastes, tax free cigarettes, sex for hire and, potentially, other things. Basically, if there's a good or service that people want and it is made illegal, criminals will make a profit by providing it.

You want to make proper, safe disposal free, or even to offer some sort of subsidy for proper disposal. You want to bribe people to dispose of toxic chemicals properly.

On the other hand, you don’t make the subsidy so large that people start manufacturing toxic chemicals just to get paid for disposing of them.

In Seattle, household toxic wastes can be disposed of at zero cost at several places around the city. All that is required is an appointment and there is no limit on the quantity of chemicals that can be disposed of.

The solution to reducing the total quantity of toxics, then, lies upstream in the product life cycle. You probably want to tax the original creation of toxic chemicals. These taxes will deter the production of the chemicals in the first place without offering a disincentive for proper disposal.

Taxing creation and subsidizing proper disposal is sort of like a deposit system, though the money is totally fungible (I love that word) and need not be related.

A Proper Disposal Subsidy or Deposit Example
Imagine that production of certain toxic chemical costs $50 per pound. Proper disposal costs $80 per pound, but the substance may be disposed of improperly in a way that does not allow it to be traced back to the responsible firm for $20 per pound.

If a subsidy is to be used to encourage proper disposal of this chemical, the subsidy needs to be greater than the difference between the cost of proper disposal and the cost of improper disposal. Here, this is $80 - $20 = $60. This is the minimum necessary subsidy. However, the subsidy should not be greater than the cost of producing and properly disposing of the chemical, or firms will produce it just to collect the subsidy.
Here, this amount is $50 + $80 = $130. So, a subsidy paid for proper, instead of improper, disposal, would have to be between $60 and $130.

If a deposit, to be paid upon production of the substance, is used, this deposit must only be greater than the difference between the costs of proper and improper disposal, which here would be $60.