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RESEARCH REPORT

Institutional Controls in Use

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**INSTITUTIONAL CONTROLS
IN USE**

**A REPORT BY THE ENVIRONMENTAL LAW INSTITUTE
TO THE ENVIRONMENTAL PROTECTION AGENCY**

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EXECUTIVE SUMMARY

Institutional controls are a mechanism for providing a certain degree of safety in the absence of technology which could clean a site thoroughly, including a legal mechanism designed to ensure that sites are used only for the purposes for which they were remedied. There are many types of controls, each of which can be designed to meet specific site needs. Institutional controls can also provide flexibility by lengthening the time frame for site cleanup.

If, as seems likely, Congress amends the Superfund program to take future land use into account in selecting the type and level of cleanup at a site, institutional controls will become an important and integral element of many remedial actions. Because different levels or types of cleanups would be undertaken-- for example, at sites which will be used for industrial purposes as opposed to sites that will be used for residential uses-- flexible but long lasting mechanisms such as institutional controls will be necessary to ensure that land uses continue to be compatible with the level of cleanup at a site for as long as residual contamination presents risks. This report anticipates amendments to Superfund and describes in concrete terms how institutional controls have been used at Superfund sites and in similar situations in the past. Experience with past use of institutional controls provides Superfund policymakers with valuable examples and knowledge about how best to use these tools to protect humans for as long as risk remains at a site.

DEFINITIONS AND METHODOLOGY

As used in this report, institutional controls are legal or institutional mechanisms employed at industrial or similar sites to ensure that such sites will continue to be used for industrial or other purposes that are compatible with the cleanup, while triggering a review of the need for further cleanup if the user proposes to put the site to residential use or to another use for which the residual contamination might present unacceptable risks. The report, *Institutional Controls in*

Use, highlights the various ways in which institutional controls can be used in the context of Superfund site cleanups to protect human and environmental health and safety.

The recommendations made in the report are based on an analysis of how institutional controls perform in various federal, state and local non-Superfund programs. Investigation of the use of institutional controls in programs other than Superfund can assist parties responsible for cleanup by providing them with insight into appropriate use of institutional controls and by providing examples of effective controls. The report also identifies some of the weaknesses of the different types of controls and provides some insights about how to reduce the likelihood of failure of the controls. The research can also assist policymakers in addressing key liability, standard-setting, and cleanup standards issues now part of the Superfund reform debate. Although there are currently some Superfund cleanup sites which use institutional controls (fences, warning signs, or temporary use restrictions) as temporary measures, such controls have been disfavored since 1987 due to the preference for permanent remedies that treat contaminants.

The report identifies existing federal, state, local, and private programs that use institutional controls to protect the public. Federal programs examined include: disposal of high- and low-level radioactive waste; floodplain management; protection of sole source aquifers under the Safe Drinking Water Act; siting of hazardous waste treatment, storage and disposal facilities (TSDFs); siting of nuclear power plants; closure and post-closure care of hazardous waste TSDFs; and prevention of development of coastal barrier islands. At the state and local levels, the report focuses on four states, Connecticut, Oregon, Vermont, and Florida and analyzes institutional controls used as facets of well-head protection programs; cleanups under state authorities of non-NPL contaminated sites; and protection of buried utility facilities. The report also examines the use of conservation easements and restrictive covenants by private parties to preserve land and prevent environmental harm.

FINDINGS

Direct mechanisms

Direct mechanisms of land and groundwater use control, such as: property ownership; regulatory permitting; and physical control of facilities needed to use groundwater, can be more effective than indirect mechanisms. Direct mechanisms of control are more likely to ensure that contaminated properties do not "fall between the cracks" due to poor property tracking, mistakes by several authorities, or confusion about regulatory responsibility. Implementation of controls by a single authority, and effective documentation of and open access to information about contaminated properties are recommended to protect human and environmental health and safety.

Implementation by single authority. Condemnation, property ownership, physical control of wells, and regulatory permitting, all of which can be implemented by a single authority, may be used to avoid problems with overlapping jurisdiction and lack of coordination common to systems relying on multiple authorities.

Effective system for documenting and providing access to information. Implementation requires that there be an effective system for documenting and providing access to information concerning the contamination and restricted use of properties. This notice must be long-term and well-coordinated to ensure that subsequent users of property are fully aware of the property's history and restrictions.

Notice

Effective methods of providing notice of the restricted use of contaminated land and groundwater and of maintaining records of restrictions must be devised. This is especially important for property which is not government-owned, since private owners do not necessarily have policies in place to coordinate the continued

provision of notice. Without such notice, the initial controls lose their effectiveness because there is not an ongoing process of preventing property uses that are incompatible with the residual contamination. Notice must be given to persons/entities using the property and to any future users. The timing of notice should be scheduled to avoid lapses during which uses could change, and should serve as a continuing and frequent reminder for both long term and new users of the property.

Hydrogeologic assessment and cataloging of contamination

States are facing a dearth of technical and financial resources to invest in hydrogeologic assessment and cataloging of contamination sources for wellhead areas. There is also a continuing danger that groundwater will be polluted despite controls and assessment. Although deed restrictions, local zoning, and easements can be effective institutional controls for regulating future land use, the potential for migration of contaminated groundwater can mean that, even when land and groundwater uses are limited, those use restrictions may not have been effective if contaminants migrate beyond the area covered by restrictions.

Thorough analysis of hydrogeologic vulnerability of a site. The adoption of vulnerability and/or mobility criteria, which emphasizes risk due to migration of contamination in groundwater, is recommended because it addresses not just the problem of the levels of contamination at a site, but also makes predictions about movement of contamination across space and time.

State testing of private wells. None of the four states surveyed has the authority to prevent consumption of groundwater from private wells. There is no required sampling of private wells, although some states, including Oregon, do provide limited free sampling of private wells. Although public water must be tested, citizens with their own sources of water may be at risk from contaminated groundwater. State testing of private wells would decrease the risk to citizens with their own sources of water.

Permanency

The controls used to prevent human contact with hazardous substances must be designed to last longer than the contamination, and incentives and procedures must be created to ensure that longevity. Hazardous substances that can last longer than a human lifetime present a particular challenge to those designing institutional controls.

Procedures for long-term siting of hazardous material. The Department of Energy (DOE) faces the daunting prospect of burying nuclear waste which presents a radioactive risk over many thousands of years. Incentives and procedures used by DOE include long-term record-keeping with mechanisms for language relay and redundancy of information at many sites to reduce the risk that information will be lost, vandalized, or not understood by future cultures. The original siting of the waste must also minimize the likelihood of tampering or release into the water table by natural or interference processes. Similar incentives and procedures are advisable at Superfund sites where residual contamination may remain toxic for decades. Institutional controls and the incentives and procedures designed to maintain those controls should be tailored to the risks at a site and to the time over which the risks will remain.

Minimizing risk to future populations. Recent research in other fields indicates that the majority of risk from contaminated sites and groundwater is to future populations. Superfund cleanups should be designed to protect future users of the sites, possibly even more than to protect current residents, especially in the case of groundwater. Effectively restricting the future use of groundwater at a site may be sufficient to protect future human populations. But the key is assuring that the restrictions remain effective for as long as the risk remains.

Caution and precision in planning Because institutional controls are prone to failure due to changes in priorities, funding, the governmental system, or other conditions, the report advises extreme caution and precision in the planning for use of an institutional controls system. Some controls, such as

signs and fences, fail because they are not maintained. Others, such as records and notices, fail because the institutions responsible for "spreading the word" do not do so. Others fail because people choose to ignore warnings, fences, or other rules or physical barriers.

Redundancy

Those considering the use of institutional controls at Superfund or other sites must understand the limitations of such controls, but also be aware that redundancy, the use of multiple overlapping institutional controls, may increase the protection of human and environmental health and safety by reducing the chance of failure. Redundancy can be achieved in a number of ways: controls can be of different types operating on different populations or in different timeframes; and some controls can be passive while others depend on active administration by human institutions. Public participation in the choice of controls can improve their effectiveness by revealing which controls people are most likely to obey.

USE OF INSTITUTIONAL CONTROLS AS PART OF A SUPERFUND REMEDY: LESSONS FROM OTHER PROGRAMS

I. INTRODUCTION

Many of the proposals to revise the federal Superfund program as part of its reauthorization provide that future land use be taken into consideration when the cleanup standards for a particular site are determined.¹ Each of these proposals relies on the use of institutional controls to assure that the actual use to which a site is put after cleanup is compatible with the level of cleanup completed. Many of the proposals do not mention institutional controls explicitly, but all participants recognize that it would be irresponsible to allow land use at a site cleaned up to a standard based on continuation of an industrial use to change to residential use. The typical situation envisaged is the cleanup of a site that has been used for industrial purposes to a standard that would protect human health and safety, assuming that the site continued to be used for industrial purposes. Usually this would result in higher levels of residual contamination than would cleanup intended to allow for residential use. In this context, institutional controls are legal and institutional mechanisms used to ensure that such a site continues to be used for industrial purposes and to trigger a review of the need for further cleanup if a user proposes to put the site to residential use, or to another type of use for which the residual contamination might present unacceptable risks.

There has been little analysis of how institutional controls would work, what types might be used, how effective they would be or how difficult they would be to

administer. In this report, the Environmental Law Institute (ELI) analyzes the use of institutional controls in other federal, state and local programs intended to protect public health and safety, as well as some private uses of institutional controls. Background information was provided by previous ELI studies, Survey and Analysis of State Ground-Water Programs, Survey and Analysis of State Ground-Water Classification Systems and Program Operations, and Preliminary Report: Institutional Groundwater Use Controls in Three Selected States.

The first step of this study was to identify existing programs that use institutional controls to protect the public. Among the federal programs that use institutional controls are: disposal of high- and low-level radioactive waste; floodplain management; protection of sole source aquifers under the Safe Drinking Water Act; siting of hazardous waste treatment, storage and disposal facilities (TSDFs); siting of nuclear power plants; closure and post-closure care of hazardous waste TSDFs; and prevention of development on coastal barrier islands. Institutional controls are also used in a number of state and local programs, including: well-head protection programs; cleanups of non-NPL contaminated sites under state authorities; and protection of buried utility facilities. Conservation easements and restrictive covenants are examples of the use of institutional controls by private parties to preserve beneficial uses of land or to prevent harmful uses.

Much of the information for this analysis was obtained through telephone interviews with federal staff involved with the Federal Emergency Management Act (FEMA) floodplain management and mitigation program, the U.S. Army Corps of Engineers, the Department of Energy (DOE) and state Superfund and drinking water supply programs in Connecticut, Florida, Oregon and Vermont. These states were selected because of their geographical distribution, established groundwater programs, and reliance on groundwater supplies. State staff were asked about authorities and programs for 1) preventing the consumption of contaminated groundwater and 2) restricting land use to protect public health and/or groundwater. The second category includes wellhead or aquifer protection efforts which illustrate some of the issues associated with placing controls on both existing and future land uses. Examining these states' experiences and authorities proved an efficient method of identifying technical, economic, public health, and practical issues associated with the implementation of institutional controls.

In this study, ELI analyzes institutional controls currently in use in terms of the situations in which they have been used, how they are used, their success or effectiveness, the ease or difficulty with which they may be administered, limitations placed on their use, who is involved in their application and whether any general principles can be derived from these experiences to guide the use of institutional controls in the federal Superfund program.

II. INSTITUTIONAL CONTROLS IN THE SUPERFUND CONTEXT

Institutional controls are currently in use at some Superfund sites and are employed to protect groundwater use in other contexts. Under current Superfund practice, institutional controls are most frequently used as temporary measures to reduce risks at sites until design of the remedial action is completed and construction is underway. These controls vary from warning signs to fences to temporary use restrictions. Institutional controls may also be used when remediation is not technically and/or economically feasible. In order to meet CERCLA's fundamental purpose, institutional controls intended to restrict the use of contaminated land and groundwater must reduce short- and long-term public health risks. With specific regard to groundwater, institutional controls must prevent the human consumption of contaminated groundwater and the migration of contaminated groundwater.

When part of a final remedial action, institutional controls impose limitations on land uses in specific contaminated areas in lieu of requiring a more comprehensive cleanup. The goal is to improve the cost-effectiveness of cleanups by making them consistent with the use to which the site will be put after the cleanup is completed. This usually means that sources of contamination, such as barrels, tanks and impoundments containing hazardous substances, are removed and that contaminated surface soils are treated or removed. Contaminated groundwater, on the other hand, may not be treated if the post-cleanup land use will not involve groundwater use or will involve the use of groundwater for industrial or other purposes to which the contamination presents no obstacle.

Institutional controls are needed in these situations to prevent users of a site from changing the site's use to one that might expose people to the contamination left in place. Alternatively, the institutional control might be designed to ensure that any change in use would be preceded by a risk assessment and that any needed additional cleanup would be done before instituting the new use. Institutional controls might, for example, be designed to provide notice that the groundwater is not potable or to prevent drilling or excavating in certain areas.

Some states have experimented with various types of institutional controls as a part of their own cleanups of contaminated sites. Connecticut has struggled recently with the issue of effective notice and record-keeping for contaminated property. The Connecticut Department of Environmental Protection (DEP) proposed a bill in the last legislative session that would have provided for DEP enforcement of institutional controls with civil penalty and citizen suit provisions. The citizen suit provision was intended to serve as a key aspect of implementation by encouraging community oversight of contaminated property. Annual notice of a property's cleanup/contamination status was to be given to neighboring property owners, the deed office and any other relevant local government regulatory and planning agencies. However, the legislation that was eventually adopted did not include these provisions. The new law states that an "environmental use restriction" must be placed on contaminated property and filed in a DEP registry if the property cannot meet remedial criteria.² For example, if hazardous matter such as contaminated metal is found under a structure, the structure is not required to be torn down, but the contamination will be noted on the deed so that new owners will be aware of the condition and can perform a cleanup if the structure is ever torn down. In the case of volatile organics, owners must put in vent systems and then receive approval from the DEP to avoid having a restriction put on the deed.³ Any subsequent dealings with the property, including access to title, would have to proceed through the DEP. The new law will not become effective until DEP promulgates regulations. The agency is uncertain how it will administer this new responsibility for property transactions.

III. INSTITUTIONAL CONTROLS IN PRACTICE

Existing laws and regulatory programs impose institutional controls in three general contexts -- either (1) limiting the uses of land in order to protect particularly valuable features or existing uses (e.g., aquifer protection programs, wellhead protection, historic preservation, conservation easements for preservation or recreation); (2) limiting land uses because they are incompatible with certain existing natural hazards (e.g., construction in floodplains, nuclear power plants or hazardous waste TSDFs on earthquake faults); or (3) limiting future uses because they are incompatible with certain human-created hazards (e.g., closure of hazardous waste facilities, excavations around buried utility facilities). Institutional controls can also be categorized according to the party imposing restrictions on land use. They may be imposed by private parties or by local, state or federal government agencies. An effective institutional control can be coordinated by any of the preceding agencies, often cooperatively. The description of the methods for its implementation should be accompanied by a practical and guaranteed enforcement scheme. Without clearly delineated implementation schedules and a pragmatic enforcement strategy for infractions, an institutional control may not achieve the desired effect and may prove to be dangerous or lead to more problems. Each of these contexts suggests ways in which institutional controls may be structured.

A. Protection of Areas and Uses from Incompatible Uses

1. Conservation Areas: Easements, Reversions, and Restrictive Covenants

Almost from the time the concept of private property was created, private parties have tried to control or restrict the use of property owned by others. Many lands have been subjected to use restrictions through the vehicle of easements. A party who is the owner of a fee simple interest (the most complete level of ownership, allowing the owner's heirs to inherit) in a parcel of land may be subject to an easement owned by another. The easement may have been sold to the other party by the fee simple owner, or it may have been retained by a predecessor in the owner's chain of title. In any event, the easement limits the uses that may be made

of the owner's land.⁴ As a standard element of property law, easements are governed and enforced by state common law and thus there may be minor variations among the states.

a. How easements operate

A conservation easement restricts the fee simple owner to uses that are compatible with conservation of environmental values, scenery, or other purposes. Conservation easements were not a part of the common law of property due to the historical way in which the concept of easements developed; but all but three or four states have passed statutes authorizing conservation easements and establishing basic rules for their use. An owner of land grants a conservation easement to an entity that is considered the holder of the easement. If the owner violates the terms of the easement -- by constructing a building in the area covered by the easement, for example -- the holder of the easement may bring suit to restrain the owner's action. If the holder of the easement does not act, however, no third party has the basis to restrain the owner. Moreover, if the holder of the easement does not act promptly, s/he may be deemed to have given up his/her power to enforce the easement (based on the doctrine of laches, or inexcusable delay), or may lose the easement interest altogether (due to the doctrine of adverse possession).

A variation on this theme is the situation in which the owner of a parcel of land deeds it to another person or entity while retaining a reversionary interest. The terms of the conveyance spell out the conditions under which the land reverts to the original owner (or the owner's successors). Essentially, the land is under a restrictive covenant which must be complied with by each owner in the chain of title; if an owner does not comply, the original owner (or the original owner's successors) may bring an action in court to recover the land.

Each of these approaches has been used in the environmental context to control land uses. For example, The Nature Conservancy holds conservation easements over numerous parcels of land that are in private ownership. Governmental entities also own conservation easements.

One fairly complex case involving both conservation easements and reversionary interests was Friends of the Shawangunks, Inc. v. Clark, 754 F. 2d 446 (2d Cir. 1985). The State of New York had acquired a conservation easement over privately owned forest lands using monies from the federal Land and Water Conservation Fund (LWCF). The LWCF contains a provision that if lands acquired with its resources are taken out of public recreational uses, the lands revert to the federal government unless the federal government approves the substitution of other recreational lands. A private resort company purchased the lands that were subject to the state's conservation easement and proposed to build a golf course on them. Obviously, if the golf course had been incompatible with the conservation easement, the state had the power, but not the duty, to stop the golf course by asserting its easement in court. In this case, the state took the position that the golf course was compatible with the easement, thus freeing the resort to go ahead. The federal government could then have stepped in to assert its reversionary interest in the easement, on the grounds that the state was wrong and that the easement land was being taken out of public recreational use. But the federal government expressed the opinion that there was no action triggering a governmental reversion. At this point, a citizens' group filed suit against the federal government on the grounds that the federal government's assertion that there was no action was arbitrary and capricious and contrary to law. The U.S. Court of Appeals agreed, and ordered the federal government to review the proposed action.

Reversionary interests, particularly when held by the federal government, can last a long time. Equitable defenses such as laches, waiver, and estoppel typically do not apply to the federal government as they would to private entities or individuals holding reversionary interests. In United States v. Florida, 482 F. 2d 205 (5th Cir. 1973), the United States successfully asserted a reversionary interest more than 20 years after a state had ceased to use former federal lands for "public park purposes" as required in a 1947 deed from the War Assets Administration. Thus, although the existence of a reversionary interest is no guarantee that incompatible activities will not occur, it may put a halt to such activities (or at least result in the acquisition of lands).

Restrictive covenants are one other example of a control which developers have used to determine future land use. Restrictive covenants are deed restrictions

which prohibit specific types of development or construction on lands. They have often been included in the deeds either by an owner or when platted by a developer, sometimes before zoning laws are in place in the areas where the lands are found. As opposed to zoning, which is a policing mechanism operated by state and local governments, covenants are private controls between a developer or a past owner and the current owner of property, and do not protect public health or safety. Although some restrictive covenants have been removed by judicial order, especially those which were racist in their intent, many remain on deeds today. Like conservation easements, restrictive covenants are governed by state property law, and thus vary from state to state.

Evidence from Columbus, Ohio, for example indicates that restrictive covenants played a large role in determining the present layout and character of the city. Developers and subdividers could use covenants to ensure that the neighborhoods they were creating would continue to be exclusive; they limited by covenant future ownership, architectural design, the presence of "nuisance" buildings, and the number of people allowed to live in a house.

Restrictive covenants have drawn controversy because of the injudiciousness with which they were originally applied. Many were intended to maintain elite neighborhoods. However, the concept of a restrictive covenant may be useful in the context of Superfund as an example of how to indicate prohibited future uses in a deed. Since a restrictive covenant can be used on an individual plot of land or an entire subdivision, it is a flexible mechanism. A covenant, like an easement, still must have the support of state law to be enforced. Therefore, to succeed as an institutional control under Superfund, mechanisms would need to be developed to ensure enforceability at the state level.

b. Evaluation

Conservation easements typically are used by private parties, a property owner and another individual or organization, to impose restrictions on the use of the subject property according to the agreement reached between those two parties. The conservation easement is, then, a flexible tool that can be used to solve a

variety of problems through adjustment of its specific terms. The easement is also widely available, but in normal use depends on willing property owners and private parties able to pay for it. Easements rely on existing property law, including state statutes authorizing conservation easements, and property records systems, both of which will continue to operate regardless of whether greater use is made of easements. Thus, no major systemic changes would need be made to permit the use of easements as an institutional control component of remedial actions at Superfund sites.

Relatively little government staff time would be needed to administer an easement as part of a Superfund remedial action, but periodic site visits would be necessary to ensure that the terms of the easement were being observed. More problematic for the EPA would be the fact that easements are governed by property law that differs from state to state. Thus, the adoption by EPA of a nationwide strategy involving the use of easements as institutional controls would present significant administrative burdens for those charged with ensuring that the applicable rules were followed in each state. This would add to the work of EPA attorneys, who do not generally need to know the property law of specific states. Compliance with each state's particular rules would be a far less significant burden if the states were authorized to administer the Superfund program, because attorneys in each state could be expected to know the rules for their state.

The above evaluation also applies generally to restrictive covenants, however the variability of state law applicable to restrictive covenants makes them less attractive for the federal government to use as an institutional control for sites under direct federal supervision. This mechanism would be easier to administer if states were authorized to administer the federal Superfund program.

2. Aquifer and Wellhead Protection Programs

a. Program Operation

The Safe Drinking Water Act provides for the protection of sole source aquifers designated by the Administrator.⁵ Applications are accepted for the

designation, and must include a comprehensive management plan for the proposed protection area. It must also include specific actions and management practices to be implemented, and may include limits on government financially assisted activities and projects affecting the watershed, as well as land use control techniques such as clustering, transfer of development rights, and other innovative measures. The Safe Drinking Water Act also provides for state programs for wellhead protection areas.⁶ Each of these may include institutional controls.

Federal designation of a sole source aquifer as such gives the designated area a higher profile, and means that the EPA has stronger powers to work with federal agencies to safeguard public health by protecting the aquifers. The EPA has agreements with federal agencies (e.g., Department of Transportation) which specify that the EPA can review proposed projects located in sole source aquifers. Attempts are made to include sole source review in other review procedures, such as an Environmental Impact Statement (EIS). A regional EPA office will often comment on draft environmental impact statements until the EIS meets standards. Other preventative measures carried out by the EPA include documenting cumulative and secondary impacts and drafting spreadsheets to predict the potential effects of a given project on a sole source aquifer. Generally, EPA has been able to work closely enough with other federal agencies to assure protection of the aquifers or to mitigate any damages. In the worst case scenario, however, an EPA administrator can veto a proposed federal action in a sole source aquifer if it poses a threat to public health or safety.⁷

States have adopted a variety of strategies for protecting well water quality or protecting users by limiting the uses allowed of contaminated water. On the local level, water suppliers have led the way in facilitating initiatives by petitioning for sole source aquifer status. The types of controls used in these states and municipalities might also be used as part of a Superfund remedial action. This study did not attempt to investigate all the states, or even a representative sample. Rather, staff in four states were asked about their programs and whether they used institutional controls.

The four states take several different approaches to restricting use of contaminated groundwater and issuing notice of acceptable uses. As part of its

groundwater law, Connecticut maintains a published map of existing quality and classified uses of its groundwater resources. The lowest class (GB) allows no human consumption of groundwater. Groundwater underlying Superfund sites and other known contamination sites has been placed in this class and mapped for all to see.

Vermont also has a groundwater classification system and has reclassified groundwater at two Superfund sites from Class 3 to Class 4 (not suitable for human consumption). This was accomplished by an order of the Secretary of Natural Resources and will be entered into a State GIS system that is currently under development with USEPA Superfund support.

Oregon has the authority to place a deed restriction on the use of groundwater underlying land that is sold after being cleaned up, if there is reason to suspect any contamination remains. The deed restriction is filed at the title office and a record is also kept at the Department of Environmental Quality (DEQ).

In addition to classification, Florida has a program to delineate aquifers or portions of aquifers known to be contaminated by any toxic substance. The most extensive delineation has been done for aquifers contaminated by ethylene dibromide (EDB) used in citrus growing. These delineated areas are subject to additional well restrictions. The five water management districts which issue well permits require more stringent siting and construction specifications for new wells in these areas. These requirements add an estimated \$5,000 to the cost of drilling a well. Once new wells are drilled, the water is tested for contamination. If contamination is found (in excess of state groundwater and federal drinking water standards), the state has to "fix" the well or provide alternative drinking water supplies. If contamination is found in an existing well in a newly delineated area, the state must also fix it or provide alternative water supplies. This applies to both public and private wells. Although the program would appear to be costly for the state, it is actually saving the state money because the cost of more protective wells is assumed by private property owners.

Some states also use more general approaches. Oregon has a comprehensive land use planning statute that is intended to prevent or avoid the problems that can arise when contaminated sites are used in ways that are not compatible with the

level of cleanup and residual contamination. Oregon's municipalities are required to submit land use plans to the state on a periodic basis for review. Recently, state employees discovered a housing development that had been constructed on top of a closed landfill. The State had previously notified the county that no use could be made of the site without State approval, but that control had failed. The State sampled wells of the residents of these homes and found contamination. The State has prevented further development of the site, but current residents are using bottled water. This type of situation is a growing problem in Oregon with the proliferation of development in previously rural areas that may have been used as disposal sites.

Despite Oregon's existing land use planning law, land use restrictions intended to protect groundwater supplies have become politically controversial. The State's recent effort to establish a wellhead protection program was blocked by dominant agricultural interests representing it as an expansive "taking" of private property. For purposes of protecting the quality of water supplies, Oregon's counties currently are authorized to condemn land on which public wells are located. The proposed wellhead program was portrayed as an extension of this existing authority to areas of suspected contamination around private wells.

In Vermont, the state land use permit system is an example of a more direct control mechanism that has been effectively used to protect groundwater. Under legislation enacted in 1970 (Act 250), any development or new land use must meet 10 criteria to obtain a construction and use permit. One of these criteria is that the use will not contaminate groundwater or surface water. These permitting conditions have prevented potentially harmful activities that might otherwise have gone unnoticed until problems developed. As part of its wellhead protection program, the State has recently conditioned permits for public water system operation (3 year term renewal) or waivers from unnecessary monitoring requirements on the submission of groundwater source protection plans. These plans are required to identify potential contamination sources and measures needed to protect groundwater within designated wellhead areas, as well as providing contingency plans for alternative supplies.

b. Evaluation

The effectiveness of permits in preventing changes in land use depends upon the extent of compliance with the permits and the conditions placed on them. Ensuring compliance requires an administrative system of compliance verification and some type of action to bring violators back into compliance. Such action may range from reminders of the permit conditions to compliance assistance to enforcement actions. Thus, an effective permit system may require an extensive administrative system. In many situations such a system will be in place for other reasons and the permit program may become an additional responsibility of existing staff.

Although some regulatory and permitting approaches have been challenged as "takings" of private property for public use without just compensation, few such challenges have legal merit. Even the required dedication of an easement-- a property interest-- is not a taking if it bears a sufficient relationship to the impact of the regulated activity.⁸

3. **Historic Preservation**

a. The National Historic Preservation Act (NHPA)

The National Historic Preservation Act (NHPA) is a consultation and mitigation mechanism to protect historic resources.⁹ It establishes the National Register of Historic Places, and protects properties "eligible" for the Register, whether or not they have been registered. Section 106 of the NHPA limits undertakings of federal agencies (activities they conduct, fund, subsidize, or license) that may affect a property eligible for listing by requiring the federal agency to consult with the State Historic Preservation Officer (SHPO) and/or the Advisory Council on Historic Preservation; it does not prohibit such undertakings, but is a procedural safeguard.

b. Evaluation

Consultation can be effective as an institutional control to prevent harm to historic properties if the federal agencies actually consult the SHPO or the Advisory Council and then modify their proposed actions to avoid harming the property. This depends on an extensive administrative system, including appointing SHPOs and an Advisory Council and publicizing the consultation requirement to all federal agencies. The system was not expected to prevent harm to all eligible properties and it does not. Consultation, thus, is not effective as an institutional control where the goal is to prevent changes in land use, but could be effective as a mechanism for alerting an environmental agency that a land owner intends to change the use of a contaminated parcel.

B. Siting Restrictions in Natural Hazard Areas

Land use controls are sometimes necessary because of natural hazards such as earthquake zones, fire areas, floodplains, etc. Apart from federal laws concerning floodplains,¹⁰ there are few general federal controls on siting.

In contrast, states and localities may have substantial restrictions reflected in land use planning requirements and permitting. California, for example, requires comprehensive land use planning by local governments and requires Environmental Impact Reviews of proposed construction or other activity. Other states with comprehensive land use planning requirements include Vermont, Florida, Oregon and New Jersey.

1. Floodplains

Development in floodplains is restricted both by the U.S. Army Corps of Engineers ("the Corps") and the Federal Emergency Management Agency (FEMA).

a. U.S. Army Corps of Engineers

While the Corps has no authority to regulate the use of private lands directly, the Corps can, in conjunction with a Corps-sponsored project, influence land use in and around these areas by requiring state and local land use controls. Enacting and enforcing these land use controls is the responsibility of state and local governments, but the Corps does have the authority to require beneficiary communities to take such actions when potential development would affect Corps-sponsored projects.¹¹ The Corps uses this authority only very rarely, and the only recent incident of the Corps exerting such authority occurred with respect to Four Mile Run (Alexandria, VA), where the local authorities of that highly populated area had to agree to submit any further land use plans to the Chief of the Corps for review. Because the area was so densely populated and developers were overtopping properties, the Corps insisted on review before building higher levees, and local officials readily agreed to such review.

Corps projects include levees, emergency warning systems (riverine and hurricane), retaining and detention structures, floodproofing buildings, and acquiring property. Projects are undertaken under a 50-50 cost-share with the sponsoring community. The sponsoring community can be a city, county, or any other entity with authority to tax, regulate, and enter into binding agreements.¹²

To ensure that land use restrictions stipulated by the Corps are enforceable and enforced, the Corps includes these institutional controls in the Local Cooperative Agreement (LCA) it signs with the community sponsor at the outset of a project. LCAs normally include provisions establishing the responsibility of the community sponsor to analyze potential effects from any proposed development, prohibiting the sponsor from allowing new development that might adversely affect the completed project, requiring the sponsor to obtain Corps concurrence that any new development in the identified area will not in fact have any adverse affect, and requiring the local sponsor to participate in the National Flood Insurance Program before, during, and after construction of the project.¹³

Authority for such control, administered by the Flood Plain Management Services and Coastal Resources Branch of the Corps, derives from the need to

protect federal investments in related projects,¹⁴ (although the majority of projects protect the private sector) and from the Corps mandate to ensure local participation in the National Flood Insurance Program.¹⁵ Such development controls must be thoroughly discussed during the feasibility stage of the planning process, and must follow the same public participation process as other aspects of Corps projects.¹⁶

To ensure compliance, the Corps accompanies the responsible local officials on periodic (at least annual) site inspections. For example, the Corps may go out with the local authority to inspect a levee to make sure that the grass is mowed and trees are not allowed to grow on the levee. If the locality is in violation, and refuses to comply with the terms of the contract, the Corps may undertake legal action, but this is rarely necessary.

It should be noted that although the Corps does not normally seek to institute development controls for upstream or non-flood plain areas,¹⁷ such areas may be affected by shifts away from development in the floodplain areas.

b. Federal Emergency Management Agency (FEMA)

FEMA covers a broader area than does the Corps, but the controls it uses are also indirect. To be eligible for FEMA flood insurance, the local government which is responsible for regulating land use must apply for coverage for the entire area within its jurisdiction. The state government must also apply for coverage of property in its jurisdiction. This prevents a state or community from allowing uninsured development in certain areas of its floodplains while the majority of the community remains eligible for insurance. Thus, FEMA provides communities with an incentive to restrict floodplain development. Such development is likely to be opposed, for example, by citizens not living in the floodplain who would be denied insurance. Some states reinforce this incentive by requiring National Flood Insurance Program as a part of the state floodplain program.

Community applicants for insurance must submit "ordinances authorizing actions regulating land use," including "zoning, building, and subdivision

regulations, health codes...and any other corrective and preventive measure enacted to reduce or prevent" flood damage.¹⁸ In order to qualify for flood insurance, communities must also adopt "adequate flood plain management regulations consistent with Federal criteria." These regulations must be legally enforceable, must be uniformly applied to all the community's land (both public and private), and must take precedence over "any less restrictive conflicting local laws, ordinances or codes."¹⁹ Communities may, and are encouraged to, adopt more restrictive criteria.²⁰

Minimum standards to be included in local land management regulations include requiring permits for all proposed construction, reviewing proposed development to assure that all required state and federal permits have been received, reviewing permit applications to determine if proposed development will be safe from flooding, and requiring any necessary modifications. FEMA regulations specify criteria for the community to consider in formulating development goals and floodplain management regulations, including "[f]ull disclosure to all prospective and interested parties (including but not limited to purchasers and renters) that (i) certain structures are located within flood-prone areas, (ii) variances have been granted for certain structures located within flood-prone areas, and (iii) premium rates ... substantially increase as the elevations decrease."²¹ The criteria also include "consistency between state, regional and local ... programs."²² Communities must include in their planning process the importance of steering development away from flood and erosion-prone areas; the possibility of reserving such areas as open space; coordination with state and regional efforts; and preventative actions such as setbacks, relocation and acquisition.²³

If eligible communities fail to enforce these requirements adequately, the Administrator may begin probation proceedings by informing the community, issuing press releases, and advising policy holders of the impending probation and accompanying premium increases. The community has 90 days to correct deficiencies (or demonstrate compliance) and avoid probation.²⁴ If the community fails to satisfy the Administrator, and is placed on probation, premiums are increased, and the community is subject to suspension of eligibility. Suspended communities are not eligible for flood insurance. A community may be subject to suspension (without a probation period) not only for failing to enforce floodplain

requirements, but also for repealing any flood plain restrictions. Policies erroneously sold or renewed in a suspended community are voidable by the Administrator. A suspended community may only be reinstated by submitting local legislative or executive orders enforcing flood plain requirements.²⁵

Though the community may have some latitude in defining its floodway, once the floodway has been determined the community must prohibit development in that area, unless such encroachments would not result in increased flood levels. The community may apply for a conditional Flood Insurance Rate Map (FIRM) and floodway revision,²⁶ and may, with possible Administrator review, grant a variance from its requirements. Such a variance will not, however, prevent insurance premiums from increasing.²⁷

Corps officials note that while it has a constant stream of enforcement work under the §404 program, there has been little enforcement activity within the Flood Plain Management program. Although as noted above, one of the Corps' responsibilities is to ensure that localities participate in NFIP and other programs, FEMA regional directors are responsible for placing communities on probation if their floodplain management programs are not in keeping with NFIP criteria.²⁸ Since the Corps has no direct enforcement authority, if the Corps annual review of flood plain management projects reveals any problems, the Corps is almost always able to work things out with the local authorities.

A recent OMB Report by the Inter-Agency Flood Plain Management Review Committee to the Administrator of the Flood Plain Management Task Force entitled "*Sharing the Challenge: Floodplain Management into the 21st Century*," discusses some of these issues. One problem that the report cites is that no agency has real enforcement power over floodplains.²⁹

According to FEMA, of the 18,401 communities that participate in the flood insurance program, 413 had been suspended because the community had not adopted or had repealed the necessary restrictions or regulations. Only 6 communities have ever been suspended (and one of these has since been reinstated) because of a lack of local enforcement, because this is difficult to determine or prove. Few communities are suspended, because once a community is put on

probation and faces the loss of subsidized insurance, public pressure usually forces the relevant authority to take the necessary action to avoid suspension. Twenty-nine communities have withdrawn from the program.

FEMA also reports that prior to the 1973 passage of the Flood Disaster Protection Act, offers of subsidized insurance was not motivating communities to pass the necessary regulations. The Act mandated the purchase of flood insurance as a condition of receiving federal funds for flood disaster assistance--for example, an uninsured community could not get a federally-subsidized loan to rebuild structures. No federal assistance for permanent repair can be provided. In addition, when a community is not participating in the program, lending institutions are required to notify prospective borrowers that they will not get any assistance if their property is damaged by a flood and the area is declared by the President to be a disaster area.

c. Evaluation

The limits of indirect controls are illustrated by the fact that FEMA's floodplain management restrictions on flood insurance have not succeeded in preventing flood damage. The destruction that occurred in the Midwestern floodplains in 1993 was due in large part to the fact that flooding levels exceeded the 100-year flood planning benchmark. However, extensive habitation of the floodplain had occurred, despite the federal flood insurance requirements, because structures existing at the time eligibility requirements became effective (1970) were grandfathered. These structures were to become ineligible for insurance if 50% or more of the building were damaged in a subsequent flood. The percentage of damage was often assessed by local builders whose interests lay with the community and who had an incentive to promote insured rebuilding. The disparity between local and federal interpretations of eligibility requirements and land use is one of the program difficulties to be addressed by the current Presidential task force on floodplain management and mitigation.

Meanwhile, the federal government, through FEMA, is encouraging floodplain residents to participate in a locally or state-coordinated buyout program. The Hazard Mitigation Grant Program (HMGP) gives grants to local governments

to cover up to 75% of the costs of acquiring properties or relocating residents to non-floodplain areas. The HUD Community Development Block Grant (CDBG) is another source of funding for buyout and relocation. Other policies and procedures used in hazard mitigation are categorical exclusion, environmental contract, deed restriction and title conveyance, all of which either prevent further settlement on hazardous land or enhance the process of identifying potentially threatening land. Such programs and tools aim to permanently prevent future flood loss or injury by paying residents to leave their properties and accompanying structures and move to "higher ground". These programs are institutional controls which both ensure that people will not reinvest in flood plains and will not move into communities which have been evacuated. Their other obvious benefit is that people who participate in the program are safe from the dangers inherent to living in a flood plain. As of May, 1995, the EPA has considered drafting a new federal policy which would increase the agency's ability to relocate people living near Superfund sites.³⁰ This example demonstrates that an institutional control like that of flood plain resident relocation can also translate into other types of situations where human life requires protection from hazards.

2. Coastal Barrier Islands

Development on coastal barrier islands demonstrates that for institutional controls to be effective they may need to address activities outside as well as inside the affected area. While the Coastal Barrier Resources Act bars federal assistance for projects that develop these areas, federally assisted projects such as roads and bridges to barrier islands or sewage treatment plants that can serve barrier islands, make barrier islands more accessible, and promote, or at least facilitate, barrier island development. Proponents of greater barrier island protection have argued for eliminating federal subsidization of activities that directly or indirectly contribute to coastal barrier destruction.

3. Earthquake Zones

Apart from those governing floodplains, federal siting restrictions are relatively rare and limited to particular kinds of facilities. For example, new RCRA treatment, storage, and disposal facilities (TSDFs) may not be sited in earthquake zones (within 200 feet of faults displaced in Holocene times), and may only be sited in 100-year floodplains if designed to prevent washout of hazardous waste.³¹ A facility cannot obtain a permit if it violates these siting criteria.

Any facility that is constructed or rehabilitated with EPA funds must first receive the approval of the EPA Seismic Safety Office. This has proven to be an effective mechanism for ensuring that all new projects meet the written standards of the Seismic Safety Office.³² There has recently been a move to draft written standards in conjunction with the grants administration department of the EPA to subject to seismic controls any construction project to which the agency grants money. If this were to become a checklist item or a condition of grants, EPA could guarantee an even higher rate of seismic compliance for facilities.

In the wake of the most recent earthquake activity in California, the EPA recommends performance standards to avoid destruction of mechanical and electrical units in buildings. The concern is that if ducts are not seismically resistant, there may be hazardous releases as a result of an earthquake. While performance standards which would prohibit such emissions are currently only recommendations, some in EPA are hopeful that they will become policy akin to the existing seismic standards discussed above.

Similarly, nuclear power generating facilities must meet certain siting criteria in order to receive a construction license from the Nuclear Regulatory Commission.³³ Nuclear waste disposal facilities are also subject to siting criteria. The federal regulations governing the siting of such facilities list a variety of "potentially adverse conditions", including seismic and igneous activity. If any of these conditions exists at a prospective disposal site, the applicant must demonstrate that the ability of the site to meet applicable performance criteria has not been compromised.

C. Incompatible Uses of Human Hazard Sites

1. Laws Concerning Closure of Hazardous Waste Facilities or Cleanup of Hazardous Substance Sites under State Cleanup Programs

Sixteen states require, under certain conditions, that their land recordation systems (deed records) used in proving the title to land include information on hazardous wastes or substances that were present on the site.³⁴ A number of these states, such as Iowa, require this information for permitted hazardous waste treatment, storage, and disposal facilities.³⁵ Others require such recordation in connection with the cleanup of sites on the state's inventory of hazardous sites. In Missouri, notice that a site has been placed on or removed from the state registry is placed in the deed records by the state.³⁶ In North Carolina, property owners must prepare and file the notice. New York required its county clerks to index in the land records by July 1, 1993, all sites listed in the Registry of Inactive Hazardous Waste Sites.³⁷

EPA regulations require permitted hazardous waste disposal facilities to record a notice in local deed records upon closure of their first and last units within 60 days after certification of such closure.³⁸ The notice must "in perpetuity notify any potential purchaser of the property that -- (i) the land has been used to manage hazardous wastes; and (ii) its use is restricted under 40 CFR Subpart G regulations; and (iii) the survey plat" providing information on the wastes and their locations has been filed with the local zoning or land use planning authority and the EPA Regional Administrator.

The use restrictions referred to are simply postclosure monitoring and maintenance for 30 years (if required), and limitation of access during all or part of the postclosure period if hazardous wastes may remain exposed, or "access by the public or domestic livestock may pose a hazard to human health."³⁹ Also, postclosure use of property "must never be allowed to disturb the integrity of the final cover, liner(s), or any other components of the containment system, or the function of the facility's monitoring systems" except as authorized by the Regional

Administrator as "necessary to the proposed use of the property," or to reduce a threat to health or the environment.⁴⁰

Because these restrictions on use during the postclosure period are regulatory, they bind only the owner/operator. There is no direct regulatory authority assuring that others-- including purchasers of the land-- may not undertake incompatible activities; the regulation controls only the owner/operator. The deed notice concerning use restrictions does not itself restrict the use; at most, it notifies potential purchasers and establishes a possible basis for an assertion of EPA jurisdiction over the purchaser.

2. Nuclear Waste Disposal Sites

Federal regulations call for a variety of institutional controls on radioactive waste disposal sites. The licensing requirements for land disposal of low-level radioactive waste acknowledge that "it is possible but unlikely that persons might occupy the [disposal] site in the future and engage in normal pursuits without knowing that they were receiving radiation exposure."⁴¹ Accordingly, the regulations provide for controls to protect such persons, whom they term "inadvertent intruders."

The regulations for low-level disposal units require that all units be located on land owned in fee (with no property interests held by others) by the Federal or a State government. They also require that "the land owner or custodial agency shall carry out an institutional control program to physically control access to the disposal site following transfer of control of the disposal site from the disposal site operator."⁴² This program must include an environmental monitoring program, surveillance, custodial care, and the administration of funds to cover the costs of these activities. The regulations further indicate that "institutional controls may not be relied upon for more than 100 years."⁴³

The types of controls required at a particular low-level waste site depend on the hazards posed by the waste disposed of at that site. The regulations note that two types of controls are available for preventing inadvertent intrusion:

institutional controls and physical barriers. At sites used for the disposal of waste designated as Class A or Class B (waste which is expected to present an acceptable hazard within 100 years of its disposal), institutional controls which will be reliable for 100 years are required. These controls need not constitute a prohibition on use of the land; during this 100-year period, "the government landowner administering the active institutional control program has flexibility in controlling site access which may include allowing productive uses of the land."⁴⁴ At sites used for the disposal of more hazardous Class C waste, physical barriers which will be effective for 500 years, such as deep disposal or concrete covers, must be employed. At all low-level waste sites, the boundaries and locations of disposal units must be mapped with land surveys, and near-surface units marked with permanent survey marker control points referenced to U.S. Geological Survey (USGS) or National Geodetic Survey (NGS) survey control stations.⁴⁵

Also subject to requirements for institutional controls are sites at which high-level radioactive waste is placed in geologic repositories. Such sites may be located only on acquired land under the jurisdiction and control of the Department of Energy (DOE), or on lands permanently withdrawn and reserved for its use. Lands used for such sites must also be free of encumbrances, including mining rights, right-of-way easements, and all other rights arising under lease, rights of entry, deed, patent, mortgage, appropriation, prescription or otherwise. DOE must exercise any jurisdiction and control over surface and subsurface estates which is necessary to prevent human actions that could threaten the integrity of the geologic repository, and must obtain water rights at the site.⁴⁶

Before closing a high-level waste site, DOE must submit to the Nuclear Regulatory Commission (NRC) an application to amend its disposal license. This application must indicate measures to be employed (including land use controls, construction of monuments, and preservation of records) in order to "regulate or prevent activities that could impair the long-term isolation of emplaced waste within the geologic repository and to assure that relevant information will be preserved for the use of future generations." At a minimum, these measures must include identification of the site with monuments "designed, fabricated and emplaced to be as permanent as is practicable," and the placement of records "in archives and land record systems of local, State and Federal government agencies, and archives

elsewhere in the world, that would be likely to be consulted by potential human intruders."⁴⁷

Although disposal methods for high-level waste are intended to render the waste inaccessible to potential intruders, physical barriers are required to prevent both inadvertent intrusion and migration of high-level waste. The regulations note that "during the first several hundred years following permanent closure of a geologic repository ... special emphasis is placed upon the ability to contain the wastes by waste packages within an engineered barrier system."⁴⁸

No permanent low-level or high-level waste disposal sites are yet in operation so these regulations have not been applied to date. It is clear from their terms, however, that they are the most stringent institutional controls adopted in the U.S. They depend on multiple institutions of federal, state and local government. Multiple institutions are necessary due to the assumption that during the long time over which the controls must be effective at least some of these institutions will fail to maintain the controls for which they are responsible. Thus these rules rely on the principle of redundancy to improve the possibility that some controls will remain effective at protecting future generations throughout the period of risk. These controls will thus entail a high degree of effort to administer, but that effort will be diffused over a wide variety of institutions.

3. Buried Utility Facilities

A variety of institutional controls may be used to ensure that buried power and gas lines are not disturbed. Some of these controls take the form of requirements that apply to utility companies. When utility companies place underground gas lines on private lands, for example, they may be required to mark the location of these lines with warning signs. The federal Department of Transportation requires that each state have a "one-call" telephone hotline law.⁴⁹ States can require that "one-call" centers be established by local governments and be joined by all local utility operators or be operated by those utilities. Citizens are urged to call these hotlines before beginning any kind of excavation. For example, by calling "Miss Utility," the District of Columbia's hotline, citizens can get information about the location of power and gas lines and may request that a utility

representative visit the site of their proposed excavation in order to test for the presence of underground facilities. Utility companies may also engage in public information campaigns which include television, radio, and print media reminders to "call before digging."

Other requirements apply to local governments. Local governments may be required to provide builders and excavators with information about the location of underground facilities.⁵⁰ The District of Columbia maintains a public database for this purpose. Local governments may also be required to inform utility companies about planned construction or excavation that might affect their facilities; D.C.'s Department of Transportation is required to provide utilities with copies of all approved permit drawings for projects in areas where utility facilities are present.⁵¹

A third group of requirements apply to those engaging in construction or excavation projects that might affect buried utility facilities. Municipal construction codes may require that citizens notify utility companies before engaging in any construction or excavation in areas where buried facilities are present. Builders or excavators may also be required to plan their operations so as to minimize interference with buried facilities, and to maintain a specific clearance between buried facilities and mechanized excavation equipment. Violators may be required to pay damages to the utilities and may be subject to civil penalties if they fail to comply by ignoring a one-call law, or fail to dig in a safe and prudent way (generally taken to mean hand digging).⁵²

Like the institutional controls planned for nuclear waste disposal sites, those used to avoid damage to buried utilities are redundant. Several factors contribute to the need for this redundancy: the risk that damage to gas or electrical lines could cause death, serious injury or property damage; the difficulty of determining the precise location of the utilities without specialized knowledge or equipment; and the many actors who could damage the utilities or who have some responsibility for them. These controls rely on existing institutions, including local government agencies and the utility companies, to provide frequent reminders to the public about the risk and the resources available to avoid the risk. The signs, public service advertisements, staff time to answer inquiries and maintain accurate maps of the location of utilities are a considerable administrative burden and cost. These burdens

and costs are spread across several institutions including governmental agencies and the utilities themselves. Unfortunately, these controls sometimes fail, which is not surprising given the ubiquity of buried electrical, gas and oil lines and the high numbers of people excavating, but which causes significant property damage, injury and loss of life.⁵³

IV. PRINCIPLES FOR USE OF INSTITUTIONAL CONTROLS AT SUPERFUND SITES

The long experience with institutional controls in a variety of contexts can be extremely useful to policymakers deciding how to make the best use of institutional controls as part of the process of reducing the risk at Superfund and other sites contaminated by toxic substances. Analysis of the situations in which institutional controls have been successful and the situations in which they have failed, along with the types of controls used in those situations and the burdens and costs of implementing those controls allows the articulation of some principles for applying such controls at Superfund sites.

A. Direct Mechanisms of Land and Groundwater Use Control Produce More Effective Institutional Controls

A direct mechanism of land and groundwater use control is one that is implemented by a single authority to achieve a defined outcome. These include property ownership, regulatory permitting, and control of the facilities needed to use the land or groundwater. While the relative effectiveness of direct controls may appear to be obvious, the experiences with indirect controls point to common institutional problems of overlapping jurisdiction, lack of coordination, and limited regulatory authority. Where there is shared responsibility or control between government and/or private entities, contaminated properties may "fall through the regulatory cracks" and result in the failure of the institutional controls. This may be due to one or more of the following factors: the absence of an interactive land use database or historical record, the lack of institutional coordination, and/or differing interpretations of restrictive requirements.

Examples of the limits of interjurisdictional decision-making include Oregon's experience with its land use planning law; the number of accidents involving buried utilities resulting in explosions, electrocutions and oil leaks; and the common practice of building homes and other structures within floodplains and on coastal barrier islands, despite the controls intended to discourage or prevent such development.

These problems demonstrate the advantage of direct controls and the need for redundancy of institutional controls. Particularly in situations where there is shared responsibility for controls, layers of overlapping controls can provide a safety net if a contaminated site falls through a crack between agencies. The rules for high-level radioactive waste demonstrate how the principle of redundancy can be used.

B. Effective Methods of Providing Notice of the Restricted Use of Contaminated Land and Groundwater and of Maintaining Records of Restrictions Must be Devised

If the property is not government-owned (or, in the case of radioactive waste, even if it is) or condemned, maintaining the continuity of institutional controls depends upon effective notice of remaining contamination and restricted use. Notice must be given to any person/entity using the property and to any future users. The notice should also serve as a continuing or frequent reminder of the restrictions so that long term users do not forget and so that new users begin their use with notice. Thus, the timing of notice should be sufficient to avoid lapses during which uses could change.

C. The Difficulty of Preventing Human Consumption of Contaminated Groundwater from Private Wells Presents a Challenge to Effective Implementation of Institutional Controls

Information available in this investigation indicates that none of the states has the authority to prevent consumption of contaminated groundwater from private wells. While most people would not choose to drink contaminated water if aware of it, the required sampling of public wells does not extend to private wells. Therefore, contamination of private wells by a plume from an institutionally controlled site could go undetected and uncorrected. A number of states, including Oregon, provide limited free sampling of private well water. Testing is limited primarily to areas of suspected nitrate contamination, which requires a relatively inexpensive test. However, at sites where numerous chemical compounds may be found, water testing could be costly and technically difficult.

Most states have groundwater classification systems in place, but even if the water is classified as non-potable, it does not necessarily result in condemnation or replacement of private wells. Florida delineates areas of contamination, with private well permits conditioned on stringent siting and construction requirements and state sampling of new wells and existing wells in newly delineated areas. This approach might be effectively applied at unremediated sites.

D. The Resource Intensive Nature of Wellhead Protection Efforts May Increase the Cost and Administrative Burden of Implementing Institutional Controls

Currently, the primary obstacle to state wellhead protection programs is the lack of technical and financial resources to undertake the necessary hydrogeologic assessment and cataloging of contamination sources for wellhead areas. This highlights the fact that mapping and understanding contaminant movement and groundwater migration are resource intensive activities. If these analyses are not undertaken, there is no assurance of public health protection or prevention of

further contamination. In addition, the determination of any acceptable future use of the land and underlying groundwater is contingent on a thorough hydrogeologic assessment.

While the economic infeasibility of remediation to residential standards may be a consideration favoring the use of institutional controls, the importance of rigorous analyses and monitoring to ensure that the institutional control does not fail must also be considered.

*E. The Potential for Migration of Groundwater Contamination
May Limit the Situations Where Institutional Controls
Would be Appropriate*

Institutional controls have not been effective if further contamination of groundwater occurs which poses a continuing risk to human health. State officials interviewed for this analysis expressed concern about the potential for migration of contamination even if land and groundwater uses are restricted. Therefore, a thorough analysis of the hydrogeologic vulnerability of a site is advisable before institutional controls are considered. Adoption of vulnerability and/or mobility criteria could provide a basis for evaluating the suitability of a specific site.

Connecticut has adopted a protective groundwater program because of the hydrogeologic vulnerability of the State's groundwater resources which provide the majority of its water supply. The State's intent in putting forth institutional control legislation was that such controls should be used only in rare circumstances. State staff believe that deed restrictions cannot effectively be placed on groundwater. If a site is not completely cleaned up, migrating groundwater will inevitably produce contamination downgradient. Therefore, the state officials stressed that decisions to employ institutional controls should be based on technical- and not economic-infeasibility.

Currently, the State uses mobility criteria — not risk to human health — as the basis for cleanup requirements. Heretofore, the state has not approved a less stringent cleanup standard coupled with a use restriction at any hazardous waste site.

The institutional control legislation recently passed by the State identified three situations in which use restrictions would apply after mobility criteria had been met. These situations are:

- 1) allow cleanup of chemical compounds in soil to industrial or commercial exposure levels (rather than residential) if the deed restricts use of land and groundwater;
- 2) allow contaminated soil beneath an existing building to remain in place if no threat to groundwater or direct exposure exists, deed would require maintenance of the structure; and
- 3) allow waste to remain under a cap if there is no other technologically feasible way to dispose of it, and deed restriction would ensure no subsequent activity could disturb it.⁵⁴

F. Institutional Controls Must be Designed to Last Longer than the Contamination, and Incentives and Procedures Must be Created to Ensure that Longevity

The DOE can exercise direct control in the placement of institutional controls at radioactive waste sites but the persistence of radioactive risk over many thousands of years presents a set of issues different from those faced by EPA and the states at sites contaminated by nonradioactive toxic substances. The U.S. Nuclear Regulatory Commission rule requires that a radioactive waste repository be sited on lands under jurisdiction and control of DOE or on land permanently set aside by the U.S. government.⁵⁵ In addition, a "control zone surrounding the geologic operations area is to be established." Jurisdiction over and control of surface and subsurface uses are to be maintained by DOE to prevent adverse human action. Therefore, a key issue for DOE is whether it and other subsequent institutions can survive as long as the waste and property needs to be controlled.

The types of incentives that could be created for long-term record-keeping are an important issue at DOE sites with radioactive waste. Two approaches

presented to DOE for restricting human interference at a high-level radioactive waste site over the long-term were: 1) to establish a new community in proximity to the site (risk levels permitting) which would have an historical knowledge of the property and could monitor any violations or interference at the site; and 2) to locate other compatible waste material storage and disposal systems at the site to further isolate it and increase the incentive for thorough record-keeping ("Reducing the Likelihood of Future Human Activities That Could Affect Geologic High-Level Waste Repositories," Human Interference Task Force, prepared for Office of Nuclear Waste Isolation, Battelle Memorial Institute, May 1984). Both of these options seek to increase the likelihood that the institutional controls will outlast the risk from the contamination.

In the Superfund context a mechanism for achieving this purpose is to transfer title to the contaminated land to an independent entity. That entity's sole interest then would be in the land and it would have the incentive to maintain the effectiveness of the controls.

G. The Method of Assessing Risks is a Significant Determinant of Institutional Control Options

Decisions regarding the suitability of a site for institutional controls are affected by the assessment of current and future risks posed by the site. Implicit in Connecticut's policy, with its emphasis on mobility criteria, is that no future groundwater contamination risk is acceptable regardless of the level of human health risk.

An analysis of current and future risks posed by Superfund sites, undertaken by W. Kip Viscusi and James T. Hamilton,⁵⁶ presents a different set of institutional control policy alternatives based on risk assessment. In their examination of 77 of the 276 sites for which a Record of Decision (ROD) was issued between 1991 and 1992, an "overwhelming preponderance of risks" (90 percent of all the risk-weighted pathways) is to future populations for potential land and groundwater uses that represent a change from current uses. They conclude therefore, that the predominant view that Superfund cleanups are intended to protect current residents

located near Superfund sites is generally false. For the sites studied by Viscusi and Hamilton, risks to current residents are significant for a small number of sites.

The authors applied the risk assessment methodology that EPA used for its record of decision (ROD) determinations and collected additional data when necessary to determine exposure risks. Exposure by ingestion of contaminated groundwater was found to constitute 37 percent of the total exposure pathways and 31 percent of cancer risk pathways. The percent of current cancer pathway risk (frequency weighted by total magnitude of risk) associated with groundwater was 33 percent as compared to future pathway risk of 49 percent.

The authors maintain that maximum risk rather than the assessment of risk-weighted pathways is emphasized in RODs. Therefore, they assert that excessive attention may have been given to "groundwater hazards since these risks are frequently the maximum site pathways." They conclude that an analysis which takes into account the frequency of exposure pathways as well as their severity suggests that the role of groundwater contamination is much less than indicated by maximum risk assessment.⁵⁷ Therefore, effectively restricting the future use of groundwater at a site may be a viable method of protecting human populations from the risks Superfund was intended to address.

V. CONCLUSIONS AND RECOMMENDATIONS

A number of the above principles relate to the fundamental difficulty of dealing with invisible risks. Contaminated groundwater is one of these invisible risks and the experiences of some states suggest some mechanisms for increasing the effectiveness of institutional controls on groundwater. On the technical level, monitoring groundwater contamination movement should be an important part of institutional controls at Superfund sites. Mechanisms should also be established to reevaluate the compatibility of land and water uses with cleanup levels if the uses change. Any of these types of changes, whether in uses or migration of the contamination, should trigger reconsideration of the cleanup and uses of the site or of new areas of contamination. Thus, for institutional controls to be effective in reducing the risks associated with Superfund sites, some controls may need to

operate outside the contaminated area. For example, restrictions on some off-site activities may be needed if they would promote activities that would be incompatible with the remedial action.

Experience with institutional controls by a variety of governmental agencies dealing with a variety of risks indicates that they can be effective at reducing people's exposure to risks. These experiences also demonstrate that the most frequently used institutional controls cannot prevent harm. In other words, most institutional controls fail at some point or in some situations. The results of such failure range from human consumption of contaminated groundwater, which may have immediate or future health consequences or may not have any discernible effect on health, to property damage, to serious injury or death to humans.

Institutional controls may fail because the institutions fail or stop performing their function. This can happen due to changes in priorities and funding or fundamental changes in the governmental system, any of which may eliminate the institution or its ability to perform the assigned function. Controls such as fences, signs or markers may fail over time because they wear out, are buried or otherwise obscured by unrelated activities, or because they are removed by vandals or even as part of legitimate activities. Records and notices may fail because the institutions charged with maintaining the records or publicizing the notice fail to do so. This can happen for many reasons. Records and notice may also fail simply because people do not consult them or choose not to behave as the notice giver expected them to behave after receiving notice of the risk.

Anyone intending to use institutional controls to reduce risks to humans should take into consideration the variability of human response to institutions, rules, warnings, and restrictions. Some people will do what they want to do regardless of rules, warnings or restrictions; some will find ways around rules or physical barriers; and others will ignore certain kinds of risks such as invisible ones like buried cables or pipes, rare floods, and contaminated soil or groundwater.

These cautionary considerations suggest some principles that should improve the effectiveness of institutional controls at superfund or other contaminated sites. The principle of redundancy can significantly decrease the odds of failure. This can

be applied in several ways: institutional controls can be layered so that if one fails another will operate on anyone missed by (or who avoids) the failed control; controls can be of different types operating on different populations or in different timeframes; and some controls can be passive while others depend on active administration by human institutions. The effectiveness of controls can also be improved by publicizing them and the need for them. Public participation in the choice of controls and in their operation can be part of this effort and, more importantly, can reveal which controls people are most likely to heed. Institutional controls can also be designed to create incentives in favor of maintaining the effectiveness of the control.

APPENDIX A

Easements

An easement is a grant of an interest in land that entitles a person to use the land possessed by another, or to restrict the possible uses of the land subject to the easement.

I. Affirmative or Negative Easements

Easements are either affirmative or negative. The owner of an affirmative easement has the right to go onto another's land (the "servient land"), and do some act on that land. Most easements are affirmative. A typical example would be a landowner granting a right of way over her land from a public highway to her neighbor's land.

On the other hand, the owner of a negative easement can prevent the owner of the servient land from doing some otherwise privileged act on the servient land. A negative easement is rare and is generally not permitted unless it is an easement for light, for air, for subjacent or lateral support, or for the flow of an artificial stream. For example, a landowner granting his neighbor an easement for light and air will promise the neighbor not to construct any structure on his property which interferes with the free flow of light and air from his property to the neighbor's land.

II. Appurtenant or In Gross Easements

All easements are either appurtenant to other land or in gross. An easement is appurtenant when it was created to benefit and does in fact benefit the possessor of

land with regard to her interest in the land. The land benefitted is called the dominant land; the land burdened is the servient land. The servient land usually is, but does not have to be, adjacent to the dominant estate. If an easement does not benefit its owner in the use and enjoyment of her land, but merely gives her the right to use the servient estate, the easement is in gross. The benefit to the holder is personal rather than in connection with her land. For example, a landowner might grant a scenic easement over her land to her town's Society for the Preservation of Scenic Views, which owns no land in the town. An easement in gross also exists where an electric utility is granted the right to string poles and wires over a landowner's property.

III. Conservation Easements

With a conservation easement, a property owner restricts the type and amount of development that may take place on his or her property. In general, a conservation easement "runs with the land", binding the original owner and all subsequent owners by the restriction of the easement. The easement may be characterized as negative in gross, because it restricts the possible uses of the land without benefiting another parcel of land.

Since courts traditionally have disfavored negative easements, states have been forced to pass specific legislation permitting the use of conservation easements. The Uniform Conservation Easement Act of 1981 served as a model for legislation in fourteen states and the District of Columbia. Other states enacted conservation easement statutes using a modified approach. Conservation easements may be created for a specific term or may be easements in perpetuity.

A state or charitable organization may establish a conservation easement by buying the development rights to a parcel of land. This technique, called "purchase of development rights" (PDR), has been increasingly used to preserve farmland. In the agricultural context, PDR involves the purchase of an easement on qualified farmland that restricts the land to agricultural uses.

Alternatively, a land owner may donate development rights to a charitable organization or a land trust. In addition to protecting the land, a conservation easement

donation may result in significant income tax and estate tax savings for the donor. This allowance has contributed greatly to the popularity of conservation easement donations, and resulted in an increase in the use of land trusts and conservation easements as a method of conservation.

APPENDIX B

Land Use Control and Zoning

I. LAND USE REGULATION

A. Zoning

The most common form of local land use control is zoning. Under a typical zoning system, all or part of a city or community is divided geographically into zones, and different regulations are written to apply to each zone. The regulations set out in zoning ordinances differ from zone to zone, but they apply uniformly to all parcels of land located within a zone.

Zoning ordinances generally regulate the size of land parcels, the size of structures on the land, and the nature of the activity which occurs on the land or in the structure.

Zoning is best known for its creation of use districts, zones where certain activities are prohibited, although those same activities are permitted in other zones in the community. An original premise behind zoning was that some uses of land are incompatible and must be kept separated for the protection of one or both of them. In particular, residential areas were zoned to protect them from commercial and industrial intrusion.

Zoning was originally "cumulative", meaning that lower uses (commercial and industrial) were excluded from higher use (residential) zones, whereas higher uses were permitted in lower use zones. Today, commercial and industrial areas are often given similar protection against the intrusion of residences. Under this noncumulative zoning, the enumerated uses are exclusive within each district.

Zoning ordinances exclude activities either by explicitly enumerating the uses which are prohibited in a zone, or by listing only those uses which are permitted, thereby excluding all others not enumerated. Serious questions of validity are raised when a zoning ordinance excludes a lawful use from everywhere within a community. In Cadoux v. Planning & Zoning Commission of Town of Weston, 408 U.S. 924 (1972), a zoning ordinance classified the entire town as residential and farming, thereby excluding all commercial activities. It was upheld on the ground that "the business and industrial needs of its inhabitants are supplied by other accessible areas in the community at large." On the other hand, in Exton Quarries, Inc. v. Zoning Bd. of Adjustment of West Whiteland Township, 228 A.2d 169 (1966), the Pennsylvania Supreme Court held that a zoning ordinance which entirely excluded rock quarries was invalid because "a zoning ordinance which totally excludes a particular business from an entire municipality must bear a more substantial relationship to the public health, safety, morals and general welfare than an ordinance which merely confines that business to a certain area in the community."

1. Residential

Residential uses are commonly subdivided according to intensity. Categories may include single family, two family and multiple family residences. Other categories may include or exclude different kinds of residential use: hotels, motels, apartment complexes, mobile home parks, boarding houses, fraternity and sorority houses, dormitories and various forms of institutional housing.

The exclusion of apartment buildings in single family residential zones has been upheld as constitutional ever since the Supreme Court first validated zoning in Village of Euclid v. Ambler Realty Co., 272 U.S. 365 (1926). However, the exclusion of housing which best accommodates low-income persons may be held invalid as exclusionary.

2. Commercial

Most communities have both commercial and residential zones. There may be only one commercial category, covering all permitted commercial uses, or there may be multiple categories or a central commercial district. Garages and gas stations may be treated specially, as is also often done with regard to liquor stores, bars, theaters and restaurants. Some ordinances attempt to bring all such activities together, whereas others seek to disperse them.

3. Industrial; Performance Standards

It is possible to classify various types of industry and create zones for each. Many communities have set aside areas as exclusive industrial parks, prohibiting residential and commercial activities there to keep them from interfering with the industrial activities. Industrial regulations often are directed not at the specific activity being conducted but at the external effects created by the activity. In Brechner v. Incorporated Village of Lake Success, 183 N.E.2d 81 (1962), the zoning ordinance provided that in a district which permits "offices, scientific and research laboratories, assembly, fabrication and finishing of articles, and storage facilities," there is prohibited "any use which will cause smoke, gas, dust, odor or other pollutant, noise perceptible beyond the boundaries of the site of the use, discharge of waste into any watercourse, dissemination of glare, vibration, heat or electromagnetic interference beyond the immediate site, or physical hazard by reason of fire, explosion or radiation."

4. Special Exceptions and Floating Zones

If the community believes that some activities might be appropriate within a certain zone, depending upon the existence of other factors, it may create a category of conditionally permitted uses to cover them. These uses are permitted only after a discretionary decision has been made by the zoning agency; they are usually called special exceptions. Since it is possible for the zoning agency to permit the activity to occur only under certain conditions, they are also known as conditional uses. While the agency may have the discretion to grant, deny or condition a permit, it may only do

so if the zoning ordinance includes the activity as one permitted as a special exception or conditional use.

A city may create a zoning classification, but not actually indicate any particular district for it at that time, instead declaring standards which must be met for a particular parcel of land or project to qualify for such designation. Thereafter an interested owner must apply to have his land reclassified and the appropriate administrative body determines guidelines. These zones are referred to as "floating zones".

B. Zoning Relief (Administration)

1. Variances

A zoning ordinance will usually provide that a property owner suffering unnecessary hardship under a zoning ordinance may be entitled to a variance permitting him to deviate from the ordinance in respect to some aspect of lot, building or activity regulation. The Standard State Zoning Enabling Act authorizes a board of adjustment to grant variances. Variances usually require that there be special circumstances unique to the parcel, that the hardship not be self-inflicted, that suitable conditions be imposed so as to minimize adverse effects on the neighborhood, and that the intent of the comprehensive plan be preserved.

For Example, California's enabling legislation provides that

[v]ariances from the terms of the zoning ordinances shall be granted only when special circumstances applicable to the property, including size, shape, topography, location or surroundings, or the strict application of the zoning ordinance deprives such property of privileges enjoyed by other property in the vicinity and under identical zoning classification. Any variance granted shall be subject to such conditions as will assure that the adjustment thereby authorized shall not constitute a grant of special privileges inconsistent with the limitations upon other properties in the vicinity and zone in which such property is situated. A variance shall not be granted for a parcel of property which

authorizes a use or activity which is not otherwise expressly authorized by the zone regulation governing the parcel of property." Cal. Gov't Code § 65906 (West 1983).

2. Rezoning (Amendments)

A property owner may seek relief by attempting to have the existing ordinance amended. This may occur by revision of the text of the zoning, or by amendment to the zoning map. Rezoning of property is a legislative act, done by the city council or other legislative body. When an amendment or rezoning not in accordance with the comprehensive plan is granted for the benefit of an owner rather than the general welfare, it may be characterized as "spot zoning," and may be invalidated by the courts. In MacDonald v. Board of County Commissioners for Prince Georges County, 510 A.2d 325 (1965), the rezoning of a parcel from low density residential to mixed commercial and residential by the county was invalidated because no mistake was shown in the original zoning classification, nor was there any change in condition in the area since the original classification, as required by Maryland law. Furthermore, in Fasano v. Board of County Commissioners of Washington County, 507 P.2d 23 (1973), the rezoning of a parcel of land from single family residential to "planned residential," so as to permit a mobile home park to be constructed there, was invalidated on the grounds that the party proposing the change in zoning had failed to establish a public need for change of the kind in question or that such need was best served by changing the classification of that particular parcel compared with other available property, as required in Oregon.

3. Contract Zoning

Where a city or community agrees to zone or rezone a particular tract of land upon the condition that the owner execute a contract or covenant restricting the use of the tract in specified ways, it is referred to as "contract zoning" or "conditional zoning." It is a method whereby, upon application by the owner, the city can tailor planning considerations to the particular parcel, permitting the owner to develop the

land in ways that do not harm the neighborhood. Some courts do not permit these arrangements, maintaining that they violate the principle of zoning uniformity, or because they amount to bargaining away local police power, or are not authorized by statute. In Ziemer v. County of Peoria, 338 N.E.2d 145 (1975), Peoria County rezoned a five acre tract of land from agricultural to commercial in order to permit the owner to construct a dance hall, after obtaining the owner's agreement to restrict the premises to such a use and to waive the right to engage in any other use permitted under the commercial zoning classification. The owner also agreed to dedicate land to the county to provide access to the highway, which the owner did by way of recorded restrictive covenant.

II. LAND USE REGULATION PROCESS

A. Federal Regulation

The federal government has never exercised general land use control over privately owned land. It does regulate all land which it either owns or administers, and by virtue of its supremacy, is not subject to state or local control where it does so regulate. Furthermore, although there is no federal zoning or national land use plan operating in the United States, the federal government through its commerce and budgetary powers plays a significant indirect role in the regulation of land uses. For example, under the 1970 Clean Air Amendments to the Clean Air Act (42 U.S.C. §§ 7401-7671q), state and local governments are required to submit plans for improving air quality standards to the Environmental Protection Agency. These plans include location of shopping centers, sports complexes, sewer lines and industrial developments.

B. State Regulation

Some land is regulated directly at the state level. Certain areas of a state, such as those critical to environmental concerns, may be subject to a direct state permitting process over and above or in lieu of the local procedure. Alternatively, the state may make threshold classifications of land, confining local regulation to control within those classifications. In Vermont, a building or development permit must be obtained not

only from the local agency, but also from a state agency, thus giving the state a veto over local development. Vt. Stat. Ann. tit. 10, §151 (1984).

C. Regional Regulation

Certain lands may be subject to control by a regional agency, operating below the state level but above the local level. The region may come into existence because communities there decide to form a regional association, or it may be created by the state directly because of statewide interest in the region. The Regional Planning Act in Minnesota provides that any two or more counties, cities or towns may enter into an agreement for the conduct of regional planning activities, which shall provide for a regional planning board to prepare a regional development plan for review by the participants. Minn. Stat. § 462.371 (West 1985).

D. Local Regulation

Power to regulate land derives from police power and is therefore vested in the state. However, state legislatures have generally delegated the regulation of land to their cities and counties. Delegation occurs through enactment of a zoning enabling act, a subdivision enabling act, or similar form of statutory authorization. These statutes both enable and set limits on local regulation of land. A land use regulation not authorized by the enabling act may be voided because it is beyond the authority of the local body. The California Government Code provides that the legislative body of any county or city may, "[r]egulate the use of buildings, structures and land as between industry, business, residents, open space, including agriculture, recreation, enjoyment of scenic beauty and use of natural resources, and other purposes." Cal. Gov't Code § 65850(a) (West 1983). Since most local use regulation requires state authorization, any novel regulation may be challenged on the ground that it was not authorized.

E. Citizen Regulation

Citizens not content with official regulation of land in the community may seek to nullify official acts by the power of referendum, or they may undertake to enact laws by the power of initiative. Many significant land use decisions come into being from the initiative process or are repudiated by referenda. Height limits and growth restrictions are often created by the initiative process; the referendum is often employed to reject the approval of some large scale commercial or residential project.

III. PLANNING

State enabling acts generally require that local land use regulation be done in conjunction with planning. This may require no more than some forethought and generalized consideration of the communities needs. Or, at the other extreme, it may require the drafting of a separate document which sets forth goals and policies with regard to some physical aspect of the community. The requirement may further mandate that all subsequently enacted land use regulation be consistent with the plan.

IV. CONSTITUTIONAL LIMITATIONS AND JUDICIAL REVIEW

A. Arbitrary and Capricious

Local land use regulation, even when it is legislative, may be overturned if it is deemed by a court to be arbitrary and capricious. The particular zoning classification applied to an individual parcel of land, or the distinction between the activities excluded and included within a single zoning category are often the subject of concern. In Udell v. Haas, 235 N.E.2d 897 (1964), the decision of the Village of Lake Success, New York, to reclassify a parcel of property from business to residential was invalidated because the only sensible use of the property was commercial and all the surrounding property was zoned and in fact used commercially.

B. Due Process and First Amendment Rights

Persons whose interests will be affected by a land use proposal are entitled to procedural fairness with regard to its enactment and enforcement. Procedural due process issues are raised in numerous ways in the land use regulation process, including the adequacy of the notice, the opportunity to speak at a hearing, and the right to an unbiased decision. Substantive due process considerations are occasionally used by courts to invalidate land use measures which they consider either to be excessively arbitrary and inconsistent with the general welfare, or too intrusive on personal liberty.

If a land use restriction is proven to be infringing upon some First Amendment or related right, that restriction may not be upheld. This is particularly the case with regard to regulation of speech and religious activities or family associations.

C. Taking

A land use regulation which causes a severe economic burden to the property owner may be attacked as constituting a taking of property without the payment of just compensation, in violation of the Fifth Amendment of the Constitution. The courts have never reached a consensus or single theory as to when a regulation amounts to a taking of property. In Pennsylvania Coal Co. v. Mahon, 260 U.S. 393 (1922), a 1921 Pennsylvania statute prohibiting the mining of anthracite coal when the removal would cause residences on the surface to subside was held invalid as taking the coal company's property rights in the coal which it owned but could no longer mine. Conversely, in Keystone Bituminous Coal Ass'n v. De Benedicts, 480 U.S. 470 (1987), a 1966 Pennsylvania statute prohibiting the mining of bituminous coal when removal would cause residences and public structures to subside was upheld as validly protecting the public interest in health, the environment and "fiscal integrity" and not a taking of property.

A variety of factors appear with some regularity in judicial consideration of this issue. They include the nature of the government activity, the nature of the owner's property interest, the extent of the loss, the public benefit, the uniformity of the loss, mitigation and compensation measures, and relief.

1. The Nature of the Government Activity

A government may take land by overzealous regulation as much as by the institution of formal eminent domain proceedings. It is sometimes said that the more the governmental activity resembles the acquisition of resources for itself rather than the regulation of competing private interests, the more likely it is that a taking will be found. Thus, downzoning of property adjacent to the municipal airport may be viewed as an attempt by the community to avoid having to purchase that property or pay its owners nuisance damages, and thus held invalid, whereas the same degree of downzoning might be held valid where it is done in order to protect an adjacent residential neighborhood from industrial intrusion. For example, in Loretto v. Teleprompter Manhattan CATV Corp., 458 U.S. 419 (1982), a New York statute authorizing cable television companies to install lines and boxes on the roofs of apartment buildings was said to constitute a taking of property because it authorized a permanent physical occupation and eliminated the owner's right to exclude even though there was only minimal physical interference with property. Alternatively, in Penn Central Transportation Co. v. City of New York, 438 U.S. 104 (1978), a New York City landmark preservation ordinance which prohibited a railroad company from constructing a skyscraper over the Grand Central Terminal did not constitute a taking of the right to exploit a potential property right (rental income of \$3 million yearly) since the owner was earning a reasonable rate of return on the existing structure.

However, the Supreme Court seems to be moving away from the liberal view of government preservation efforts exemplified by Penn Central. In Nollan v. California Coastal Commission, 483 U.S. 825 (1987), the Court held that including a condition in a building permit that the landowner must grant a public easement across his land constituted a "taking" in violation of the Fifth Amendment. The Court, in Nollan, found that the easement did not further the interests advanced by California and warned the easement exactions would be scrutinized by the Court for potential violations of the Takings Clause. Most recently, in Dolan v. City of Tigard, 114 S.Ct. 2309 (1994), the Court added that requiring a public easement as a condition of permission to build or expand is an unconstitutional "taking" unless the government can show a "rough proportionality" between the requirement and the particular harm posed by the development, like increased traffic or a heightened danger of flooding. In addition, the Court gave local government the burden of justifying its restriction,

thereby altering current law which provides that the landowner seeking to challenge a land use restriction has the burden of proving that the regulation would remove all or substantially all economic value from the property.

Thus, in evaluating similar government provisions, it must be determined whether an "essential nexus" exists between a legitimate state interest and the conditions imposed for development. If one does, then it must be decided if the exactions demanded by the conditions bears the required relationship to the projected impact of the proposed development.

2. The Nature of the Owner's Property Interest

Not all losses of value are deemed takings of property. Courts use such phrases as "distinct investment-backed expectations" or "vested rights" to indicate property interests most entitled to protection. The loss of value caused by downzoning an undeveloped parcel of property is not as likely to be declared a taking as the same financial loss when it results from an order for the abatement of an existing nonconforming use or structure.

3. The Extent of the Loss

The fact that the value of a parcel falls due to the imposition of some new regulation upon it does not automatically mean that part of the property has therefore been taken by the government. Only when the reduction goes "too far" are the courts likely to maintain that a taking has occurred. In Village of Euclid v. Ambler Realty, 272 U.S. 365 (1926), as a result of imposing a zoning classification on property, its value fell 75% from \$10,000 to \$2,500 per acre. Nevertheless, in the first case to consider the validity of zoning, the Supreme Court upheld the ordinance. Restrictions causing losses of 87% and 95% have been sustained in other cases. In fact, the Supreme Court noted that takings law is full of "all-or-nothing" situations. For example, in Lucas v. South Carolina Coastal Council, 112 S.Ct. 2886 (1992), because the state's Beachfront Management Act prohibited the owner of two beachfront lots from building houses on them, the state trial court found that he was deprived of all economic use of his

property. The state supreme court nevertheless upheld the Act. The Supreme Court ruled that such a total deprivation generally constitutes a taking of property unless common law nuisance rules would have led to the same prohibition.

The duration of the loss is often considered relevant. A temporary deprivation of value may be upheld, even though the property may have no economic value whatsoever during the interim. Growth management ordinances which postpone an owner's right to develop for several years are sometimes upheld on the ground that the loss is only temporary. However, in First English Evangelical Lutheran Church v. County of Los Angeles, 482 U.S. 304 (1987), the Supreme Court found a possible temporary taking in the denial of a permit to rebuild.

4. The Public Benefit

Sometimes a balancing test is used, comparing the loss to the owner and the benefit gained by the public. If the benefit is of dubious public value to begin with, or is seen as only favoring a few, it is less likely that a significant economic loss to an owner will be tolerated. Sometimes it is said that property may be regulated in order to eliminate a burden it would otherwise cast upon others but not in order to compel it to confer a benefit upon others. Critics say that this formula is merely circular.

5. Sharing the Loss

An ordinance which restricts everyone similarly is more likely to be upheld than one which singles out one parcel to bear an economic loss for the sake of others. Landmark designation that selects out individual buildings is sometimes attacked on this basis; when upheld, it is on the basis that the landmark law is part of a comprehensive plan or that the owner of the landmark benefits by the designation of other landmarks within the community. Reverse spot zoning, the downzoning of one parcel out of many for the sake of others, may be invalidated on this ground. This may be relevant to the federal Superfund program, in cases where contaminated properties are in residential zones.

6. Mitigation and Compensation Measures

Variations are designed to be administrative mechanisms for avoiding the taking of property. By virtue of being eligible for a variance in a hardship situation, a property owner may lose his or her ability to contend that the ordinance constitutes a taking of property.

Other land use ordinances give affected property owners offsetting compensation. Tax abatement is common for buildings given landmark status. Some communities have "transferable development rights" (TDR) systems, where an owner of restricted property is permitted to transfer its unused development potential to other less restricted land elsewhere in the community. This could be useful as part of controls on contaminated property, where TDRs could be sold by the owner of a contaminated site to developers or landowners in need of development rights to allow them to construct in receiving zones.

7. Relief

Where an ordinance is overrestrictive it may be invalidated by the courts, but property owners may believe that such relief does little to deter officials from simply enacting an alternative which is different in content, but similarly repressive. Therefore, aggrieved owners may seek to recover damages instead of, or in addition to, invalidation. For example, in First English Evangelical Lutheran Church v. County of Los Angeles, 482 U.S. 304 (1987), the Supreme Court decided the Constitution required payment of compensation for the time during which the regulation denied the owner use of his land.

ENDNOTES

1. *See, e.g.*, the "Superfund Reform Outline", released on June 28, 1995, by Senator Bob Smith, Chairman, Subcommittee on Superfund, Waste Control and Risk Assessment. In it, Senator Smith proposes that quantification of actual or planned future use of contaminated land and water be required, and that the remedy for groundwater cleanup be determined based on considerations of current and future use. The report also contains a stipulation about institutional controls: "the EPA shall be directed to consider all options for addressing contamination at a site including, containment, treatment, institutional controls, natural attenuation, or a combination of these alternatives, and select the remedy that protects human health and the environment at the lowest cost." (p. 8) *Also see*, A Remedy for Superfund: Designing a Better Way of Cleaning Up America, 3, 47-51 (Clean Sites, Feb. 1994); *A Proposal to Reform the Superfund Remedy Selection Process*, 3, 8, 10 (Chemical Manufacturers Association, Oct. 1993); *Improving Remedy Selection and the Settlement Process*, 6, (International City/County Management Association's Superfund Consortium, Aug. 1993); *Testimony of Dr. Benjamin F. Chavis before the Senate Subcommittee on Superfund, Recycling and Solid Waste Management*, 10 (Alliance for a Superfund Action Plan, Apr. 1994); *Report to the House of Delegates*, 2 (American Bar Association, Feb. 1994).
2. Connecticut General Statutes §22A-- 133n-133s (Public Acts 94-198, 95-190).
3. Phone conversation with Jan Czczotka, Property Transfer Program, Connecticut DEP, July 17, 1995.
4. For further discussion of easements see Appendix A.
5. 42 U.S.C. § 300h-6.
6. 42 U.S.C. § 300h-7.
7. Telephone conversations with Robert Mendoza, Section Chief, Groundwater Management, USEPA Region 1 (June 1995); and David Chin, Environmental Engineer, TAS, GWM and Water Supply Branch, USEPA Region 1 (June 1995).
8. Dolan v. City of Tigard, 114 S.Ct. 2309 (1994).
9. 16 U.S.C. § 470.
10. See discussion infra.
11. *Draft Army Corps of Engineers Memorandum from Dan M. Mauldin, Chief, Planning Division Directorate of Civil Works; re: Corps Authority over Flood Plain Development Relating to Local Flood Protection Projects; May 1988; p.1.* For a discussion of local land use control and zoning, see Appendix A *infra*.
12. Telephone conversations with Bob Plot, Economist, Army Corps of Engineers, 1994; Jerry Peterson, Chief of Floodplain Management Services and Coastal Resources Branch, Army Corps of Engineers, July, 1995. *See also*, Water Resources Development Act of 1986, Public Law 99-662, 100 Stat. 4082 (codified at various titles of USC).
13. Mauldin, p. 2.
14. Flood Control Act of 1936 (33 U.S.C. §§ 701a -701f, and 701h) and 33 CFR §208.10.

15. Water Resources Development Act of 1986, Public Law 99-662, 100 Stat. 4082 (codified at various titles of U.S.C.). *See also* Mauldin, *supra* at 2.
16. Mauldin, *supra* at 2.
17. Mauldin, *supra* at 4.
18. 44 CFR §59.22.
19. 44 CFR §60.1.
20. 44 CFR §60.1.
21. 44 CFR §60.22(c)3.
22. 44 CFR §60.22.
23. 44 CFR §60.24.
24. 44 CFR §59.24.
25. 44 CFR §59.24.
26. 44 CFR §60.3.
27. 44 CFR §60.6(a).
28. *Answers to Questions about the National Flood Insurance Program (FIA-2)*, Federal Emergency Management Agency, March 1992.
29. *But see* Rutherford H. Platt, Report on Reports, 37 ENVIRONMENT 25 (Jan/Feb 1995)(noting FEMA's obligation to disqualify communities that do not meet the standards for flood insurance and apparent unwillingness to do so).
30. *Inside EPA*, May 19, 1995, p. 4.
31. 40 CFR §264.18.
32. Phone interview with Lance Swanhorst, EPA Seismic Safety Coordinator, June 6, 1995.
33. 10 CFR §§100.10, 50.34(a)(1).
34. *An Analysis of State Superfund Programs: 50-State Study, 1993 Update*, U.S. EPA, OSWER, Pub. 9375.6-08C, EPA540/R-94/008, PB94-963230 (Dec. 1993) at 34-6 & 102-4.
35. *Id.*
36. *Id.*
37. *Id.*
38. 40 CFR §264.119(b)(1).

39. 40 CFR §264.117.
40. *Id.*
41. 10 CFR §61.7(b)(3).
42. 10 CFR §61.59(b).
43. 10 CFR §61.59(b).
44. 10 CFR §61.7(b)(3).
45. 10 CFR §61.52(a)(7).
46. 10 CFR §60.121.
47. 10 CFR §60.51(a)(2).
48. 10 CFR §60.102.
49. 49 CFR §§ 198.31-198.39, implementing section 20 of the Natural Gas Pipeline Safety Act of 1968 (49 App. U.S.C. 1687).
50. Each state has a provision in its "one-call" bill that sets out requirements for municipalities and local areas. *See e.g.* Maryland law Art. 78, subsection 28a. The District of Columbia is the only municipality to have been exempted from such requirements. (Phone interview with Mike Warmack, General Manager of Maryland Miss Utility, July 7, 1995).
51. D.C. Code Ann. § 43-1703.
52. *E.g.* Maryland law Art. 78, subsection 28a.
53. According to Robert J. Eiber, Director, Pipeline Transitions Programs, Battelle National Laboratory, "On the average for U.S. gas pipelines, there are 18 injuries and 7 fatalities per year" (p. B2-16). U.S. Department of Transportation Gas Pipeline Incident Data from July 1984-1990 indicates that outside force or third party damage resulted in 214 incidents over 315,000 miles (0.105 incidents/1000 mi-yr). 36.4 of those incidents resulted from third parties, 0.3 resulted from subsidence, and 2.3 resulted from earth movement. In all 122 injuries and 44 fatalities occurred during the time period (p. B2-14). *Proceedings, National Pipeline Safety Summit: Newark, New Jersey, June 20, 1994*. U.S. Department of Transportation Research and Special Programs Administration, Office of Pipeline Safety.
54. *See* Connecticut General Statutes §22A-- 133n-133s (Public Acts 94-198, 95-190)
55. 10 CFR §60.
56. *The American Enterprise*, March/April 1994, pp. 38-45.
57. *Id.* at 44.

APPENDIX C

Summary Table

Area of Concern	Control Mechanism	Statutory Source	Administering Entity	Effectiveness	Ease of Administration
Protection of Conservation Areas	Easements and Reversions	State law	Holder of easement or reversionary interest (typically private parties)	Easements are a flexible and widely available tool that can be used to solve a variety of problems.	Relatively little government staff time is required for administration of easements, though periodic site visits are necessary. A potential problem with the use of easements under the Superfund program is that administering attorneys would need to become familiar with state property law.
	Designation of sole source aquifers	Federal law	Federal government	Designating an aquifer as a sole source of drinking water can be effective in preventing contamination because a set of prohibitions and regulations becomes applicable.	This program requires an administrative structure and substantial staff to designate sole source aquifers and to enforce rules to prevent contamination.
Aquifer Protection	Land use planning requirements, land use permit systems	State law	State and municipal and governments	Effectiveness of land use planning requirements and permit systems depends on level of compliance.	Ensuring compliance requires an administrative system of compliance verification and some enforcement capacity.
	Monitoring and mapping of contaminant movement	State law	State governments	Monitoring and mapping can effectively show where contamination exists, but does not itself reduce risk.	Monitoring the movement of contaminated groundwater can be expensive and requires periodic efforts over a long time

Area of Concern	Control Mechanism	Statutory Source	Administering Entity	Effectiveness	Ease of Administration
	Deed restrictions on groundwater use	State law	State governments	The effectiveness of deed restrictions depends on property owners acting in accordance with the deeds which may not be reliable.	Relies on existing institutions, such as county recorders, which will continue to operate as long as required by state law. Deed restrictions will not require substantial state staff time.
	Delineation of contaminated aquifers, restrictions on wells in delineated areas	State law	State governments	Depends on compliance with restrictions by individuals.	Delineation of contaminated aquifers requires specialized expertise and testing facilities.
Historic Preservation	Requirement for consultation with preservation officer prior to federally supported project affecting potential historic site	Federal law	Federal government	Consultation is not effective in preventing changes in land use. May be effective in alerting government of intended changes in land use.	Extensive administrative structure required for appointing preservation officers and publicizing consultation requirements.
Development in Floodplains	Requirement that adequate local land use controls be enacted and enforced	Federal law	Federal government (U.S. Army Corps of Engineers, FEMA)	Indirect controls have not been effective in preventing development in floodplains.	Requires extensive federal and local administrative structures to oversee and enforce the requirements for local rules and to put the local rules in place.
Development on Coastal Barrier Islands	Prohibition on federal assistance to projects developing barrier islands	Federal law	Federal government	Permits some projects to receive assistance which, while they do not develop barrier islands, facilitate development.	Relatively little government staff time and administrative structure is devoted to this program.
Hazardous Waste Facility Closure, Hazardous Waste Cleanup	Deed recordation requirements	State law, federal (EPA) regulations	State and federal governments	Deed recordation does not prevent changes in land use; serves only to notify prospective purchasers of potential hazards.	Relies on extensive existing administrative structure that is maintained for other purposes.
Hazardous Waste Facility Closure	Postclosure use restrictions	Federal (EPA) regulations	Federal government (EPA)	May not be effective in preventing changes in land use. Because these regulations bind only owners and operators, there is no guarantee that others, including successive purchasers, will not change land use.	Extensive administrative structure of detailed regulations and specialized enforcement staff is needed to implement these restrictions.

Area of Concern	Control Mechanism	Statutory Source	Administering Entity	Effectiveness	Ease of Administration
Nuclear Waste Disposal	Requirement that disposal sites be owned by government	Federal law	Federal, state and local governments	The institutional controls on nuclear waste disposal are the most comprehensive in the United States. Their effectiveness is expected to depend upon redundancy. The effectiveness of the ownership requirement and of monitoring and recordkeeping requirements will also depend on the longevity of administering entities.	Redundant controls require extensive administrative effort, but effort is distributed among many government agencies.
	Monitoring and recordkeeping requirements	Federal law	Federal, state and local governments		
	Warning systems and physical barriers	Federal law	Federal, state and local governments		
Buried Utility Facilities	Information distribution requirements (utility companies must mark facility locations and maintain hotlines; local governments must inform builders about facility locations and utility companies about proposed construction; those engaging in construction must notify utility companies of potential impacts)	State law, local ordinances	State and local governments	As with the institutional controls on nuclear waste disposal sites, redundancy helps to guarantee effectiveness. Information requirements cannot prevent impacts to utility facilities. They function by making all parties aware of potential hazards.	Redundancy requires significant effort, but effort is distributed among local and state governments, utility companies, and builders
	Planning requirements for builders and excavators; requirements that impacts to utility facilities be avoided	State law, local ordinances	State and local governments		

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