



Land Use and Remedy Selection: Experience from the Field – The Abex Site

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Preface

As the United States Congress debates revisions to the federal Superfund law, one of the most important topics of discussion is the degree to which cleanups at Superfund sites should be based on their expected future land use. This discussion has engaged the Superfund community for several years. Despite this apparent interest in linking cleanup with land use, however, surprisingly little analysis has been done on what role land use already plays in selecting remedies. RFF researchers have addressed the shortfall with case studies at three Superfund sites--Abex Corporation in Portsmouth, Virginia, Industri-Plex in Woburn, Massachusetts, and Fort Ord near Monterey, California--where land use has played a prominent role in the remedy selection process. Each of the case studies includes a description of: the contamination at the site; the different stakeholders involved in the remedy selection process; and the influence that land use considerations have had on this process.

The three case studies are part of a larger RFF research project on land use and remedy selection that was funded in part under a grant from the U.S. Environmental Protection Agency. The final report for that project, *Linking Land Use and Superfund Cleanups: Uncharted Territory*, is available from RFF's publications office (202-328-5000) or on RFF's web page (www.rff.org).

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Jan Mazurek and Robert Hersh*

INTRODUCTION¹

At the Abex site in Portsmouth, Virginia lead contaminated soil was identified as early as 1986 as a threat to public health and the environment. While the extent and levels of contamination have been well documented, the level of cleanup required to protect community members from lead-laden soils has been debated by EPA, potentially responsible parties (PRPs), and local residents for nine years. This debate has been fueled, in part, by the role(s) land use has played in the remedy selection process.

First, we provide a historical background of the site and the adjacent area, including a description of processes that contributed to the original soil contamination, as well as the concomitant evolution of land use in the surrounding community. In the second half of the paper we discuss how different dimensions of land use--risk assessment, institutional controls, and public involvement--informed the choice of a cleanup remedy at Abex.

This case study will attempt to describe and analyze how the parties involved in the site cleanup have used “land use” to further what are essentially competing interests. For EPA and the Virginia Department of Waste Management (VDWM), the lead agency at the site until 1992, land use initially referred to exposure assumptions used to assess potential risks to both current and future residents, a primary consideration in the development of cleanup goals at the site. For the responsible parties (PRPs), the Abex Corporation, the City of Portsmouth and the Portsmouth Redevelopment Housing Authority (PRHA), land use has taken on a somewhat different meaning in the course of the remedial investigation. In the cleanup plan they submitted to EPA in 1993, and which prompted a ROD amendment the following year, the central land use issues refer not to the estimation of potential risks to

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¹ Interviews for this case study were carried out between October 1995 and May 1996. Our discussion of the Abex site does not refer to events that have occurred after May 1996.

individuals based on hypothetical land uses, but rather to the degree of protection afforded local residents by a rezoning plan. This plan sought to relocate private home owners, demolish their homes, and “cap” part of the site with a municipal facility. The third part of the triangle at Abex, the local community, has assigned a more troubling and politicized set of meanings to land use issues at Abex. For the nearly five hundred African American residents living in public housing projects and in private homes on the site, the threat of lead, insidious, pervasive, and for so long a silent hazard in the very midst of the community, has transformed the way they view their homes and neighborhood, the way they use their land. As one resident put it in a letter to EPA written in 1992, when the extent of lead contamination at the site was made public:

“My wife and I have been a resident of this community for thirty-two years. Our daughter was nine years old when we moved into our home. This is where we had planned to rear our family and where we had planned to spend the rest of our lives enjoying our life and spend playing with our grandchildren and great grandchildren. Now I have learned that the area where I live had been designated as the Abex Superfund site. My whole yard is highly contaminated with lead. This is the yard where my family and I enjoyed playing in and working in for thirty-two years.”²

The story of Abex is in many ways suffused by a bitter irony. Once listed on the NPL, the mechanisms of Superfund came to bear upon the site. EPA emergency removal actions did eliminate immediate threats to public health at the site. However, the very thoroughness of a Superfund investigation for a long-term clean-up plan, the extensive sampling and analysis needed to evaluate levels of contamination, the modeling of risks, the development of cleanup goals, the methodical comparisons of remedial alternatives, all of these factors have worked against the desire of the local community for prompt action.

The Abex site provides us with a cautionary tale about the role of land use in remedy selection. For more than a decade, disagreements about the Abex cleanup have revolved around contested facts, judgments based on scientific uncertainty, fears of liability, and the financial self interest of the parties paying for cleanup. For the local residents still living on

² Resident’s letter to EPA, July 3, 1992 Administration Record, AR500441-2.

the site this has led to both outrage and frustration that for ten years developing an approach to cleanup hedged with uncertainties and protracted legal considerations, has taken precedence over cleanup actions; moreover while many residents have long believed that relocation was the most reasonable course of action, the final remedy for the Abex site specifies relocation only for one “public,” the homeowners of the Effingham residences, not for the tenants in public housing.

To elucidate the role of land use at Abex, the first section of the paper describes the history of the site and traces the process by which site contamination was brought to the attention of local, state, and federal government officials. The second section begins with the site’s listing on the National Priorities List, and provides an overview of the site’s baseline risk assessment and then describes in greater detail how the role of land use in remedy selection changed from the initial feasibility study, conducted by engineering consultants for the Abex Corporation in October of 1991, to the Amended Record of Decision (ROD), released by EPA in August of 1994. In the final section we will draw upon the Abex site to consider more broadly the policy implications for Superfund when land use considerations become more central to remedy selection. Abex forces us to ask a number of questions about the role of land use in remedy selection: incorporating land use more fully into remedy selection involves tradeoffs between present and future risks. Who balances these tradeoffs and whose interests are served when land use is used to negotiate a remedy? To the extent that local land use decisions are often made by the most powerful interests in a community, how can low income and minority residents participate effectively in the decision-making process?

2.0 HISTORICAL BACKGROUND

2.1 Site Description

The Abex site in Portsmouth Virginia is located in one of the city’s oldest urban neighborhoods, less than a mile from the U.S. Navy’s extensive shipyards. The site is relatively flat and is approximately 10 feet above sea level. The site lies in the Coastal Plain and is underlain by undistinguished fill material, sand, and fine grain sediments. Groundwater is beneath the site and is contained in the sandy soils at depths ranging between one and eight feet.

2.2 Contamination

The surface and subsoils of the site are contaminated with lead, the legacy of many years of foundry operations. From 1928 until 1978 the Abex Corporation operated a foundry to recycle railroad journal bearings. In this operation, used bearings made primarily of bronze and lined with lead were melted in furnaces and then recast in sand molds. When cooled, the bearings were removed from the molds and the waste sand, contaminated with lead and other heavy metals, was discarded. In the course of fifty years of manufacturing, Abex disposed of 3,500 cubic yards of lead-laden furnace sands in a one acre parcel adjacent to the foundry in what are the Abex and McCready Lots (see Figure 1).

The foundry and the sand disposal lot are situated not, as one might imagine, in a heavily industrialized landscape, but rather in a part of Portsmouth that for much of this century has been “in almost continuous flux . . . with structures being built, torn down and replaced at irregular intervals.”³ Over the years, much of this contaminated sand has been used as fill material for residential and commercial development that has occurred near the foundry. According to an analysis of aerial photographs of the site taken from 1937 to 1985, the natural drainage channels and streams that were evident to the north of the site in 1937 had been filled by 1950. It was on these former drainage channels, that in 1964, the Portsmouth Housing and Redevelopment Authority constructed a 160-unit, federally subsidized, low-income housing project known as Washington Park. Ten years later, the city of Portsmouth sold 17 freestanding parcels of land to the south of the foundry, known as the Effingham residences, to private buyers. This land too would prove to be contaminated with high levels of lead in the soil. In both cases, the residents at risk from lead were predominantly African Americans.

In 1978, three years after the Effingham residences were constructed, the Abex Corporation closed the foundry. The company graded the sand disposal area (e.g. the Abex lot). In 1984 Holland Enterprises of Suffolk, Virginia, a truck hauling business, purchased a portion of the site containing the abandoned foundry and five other buildings. This property is now referred to as the Holland Property. In recent decades many of the properties near the foundry and the disposal lots have changed hands or were redeveloped. In addition to the

³ USEPA. 1987. Site Analysis Abex Corporation, Portsmouth, Virginia, p. iii.

Figure 1. Site Features

Figure 1 is available from the authors,
Center for Risk Management, Resources for the Future.

Washington Park Housing Projects and the Effingham residences, the 700 foot radius examined in this phase of the remedy selection process, known in EPA parlance as “Operable Unit Number One” (OU1), includes a playground, a drug rehabilitation center, and private row homes. The properties within the site boundary are:

Property	Zoning
Holland Properties (the foundry and outbuildings)	commercial/industrial
Washington Park Housing Estate (160 family unit)	residential
Effingham Residences (private housing)	residential
Abex Lot (Sand Disposal Pit)	commercial/industrial
McCready Lot (Sand Disposal Pit)	commercial/industrial
Effingham playground	residential
7th Street Row Houses	residential
Drug Rehabilitation Center	commercial/industrial
Shopping Center	commercial/industrial
Vacant Lots	residential

Note: Zoning before rezoning plan put into effect April 1995

2.3 The Changing Local Community

Like many older inner city communities the population surrounding the Abex site has declined in recent decades and has become increasingly segregated along racial lines as white workers moved from the central city to the suburbs. From the turn of the century until the late 1950s, the land in between the foundry and the river was mostly filled with lower to middle class housing, occupied by predominately white, working class families. At the height of the employment boom in the Navy Shipyards, during the Second World War and its immediate aftermath, nearly 31,000 persons lived within a one mile radius of the site. By 1970, however, the population had declined by more than a third to 19,940 and by 1980 it fell to 15,100.

After whites abandoned the neighborhoods, the area increasingly fell into decay and attracted drug dealers and prostitutes who were drawn by the Norfolk Naval shipyards. In response, the City of Portsmouth in conjunction with the redevelopment arm of PRHA, a non-profit agency with a state charter, during the 1960s and 1970s stepped in and acquired, demolished and attempted to redevelop 35 blocks of land. Today, much of the land in-between Abex and the river remains vacant, suggesting that even before Abex was listed as a

Superfund site, there were long-standing barriers that made it difficult for the city to attract private investment to the area.

2.4 First Signs of Trouble

In the early 1980s local doctors reported that some children from the Washington Park projects had elevated blood lead levels. The children registered lead levels of 48, 53, and 58 micrograms per deciliter, an amount far exceeding the level of concern of 10 mg/dl set by the Centers for Disease Control in 1991. This was an alarming finding. Children are particularly vulnerable to the effects of lead, and at such high levels, lead can irreversibly damage a child's central nervous system, impair the workings of internal organs, and lead to depression, mood swings, and loss of memory.

The families of these children sued the Abex Corporation, claiming personal injury. While never admitting liability, Abex paid five families from the Washington Park housing project from \$1,000 to \$12,000 to settle out of court in the early 1980s. The dispute, if it had gone to trial, would have proven difficult for all parties. With the publicity of a trial, especially one covering the emotive issue of childhood lead poisoning, the Abex Corp. would likely receive further attention from regulatory agencies. For the families to prove that the lead in their children's bodies had come from the Abex foundry would be an extremely difficult task in view of the many sources of lead in the urban environment; the very ubiquity of lead sources in the city may in part explain why it took so long for the Abex foundry and sand disposal lots to become recognized as a public health problem. Indeed Washington Park children were likely to be exposed to lead paint chips and lead dust; moreover one couldn't state with any certainty the lead in the soil was linked to the smelting and recasting operations carried out at Abex. In a city with many polluting industries and with the cycle of building and demolition that occurred in the vicinity of the Abex site, the case could be made that the soil had been contaminated by emissions from past industrial practices, or by the many construction/demolition jobs that occurred on and around the site. The extent of lead contamination in urban Portsmouth may explain why no further investigation of the Abex site was undertaken until 1983.

2.5 Preliminary Investigations

EPA Region III first sent a team to the site in 1983, after physicians continued to report elevated blood lead levels in children who lived near the former foundry. The NUS Corporation of Pittsburgh conducted a non-sampling Preliminary Assessment of the Abex site. This fieldwork took place on January 20 1983. NUS personnel returned on July 12, 1984 and took four soil samples, three from Abex and one background soil sample, due east of the Abex lot. The site samples had lead concentrations ranging from 450 to 10,400 mg/kg; the background soil sample had a concentration of 2,750 mg/kg. These results suggest that lead contaminated soil could have potentially contributed to the elevated blood lead levels found in local children. Levels in excess of 400 mg/kg in residential areas are considered a risk to human health.

Though high lead levels were reported in the June 1984 investigations, for reasons that are unclear, more extensive sampling of the site was not carried out for two years. In 1986, EPA expanded testing into the Washington Park Housing yards and other properties adjoining the Abex site. Because much of the fill had been transported off the foundry lot and used to level adjacent areas, some spots in Washington Park and locations where residential homes had been built were found to have higher lead levels than the lead levels found in the sand disposal lot (the Abex lot). Results of the additional soil samples from Washington Park and other properties indicated lead concentrations of up to 12,800 mg/kg.⁴

2.6 Removal Action under CERCLA

In response to the high concentrations of lead discovered in soil samples taken from residential areas, the Abex Corporation voluntarily agreed to perform an emergency cleanup of the sand disposal area and adjacent soil contamination in May 1986. EPA then used its authority under Section 106 of CERCLA, to enter into a Consent Order with the Abex Corporation in August of 1986. The company agreed to excavate and remove contaminated soil, ranging in depth of six to twelve inches, from part of the Washington Park Housing Projects, the Effingham Playground, and the Seventh Street row homes.

⁴ USEPA. 1994. Superfund Record of Decision Amendment: Abex, p. 13.

The data collected during the preliminary investigation and additional data from the extensive soil sampling and testing conducted under the CERCLA Emergency Removal Action Work Plan (from 1987 to 1988) were used to rank the site in EPA's Hazardous Ranking System (HRS). The HRS score for the Abex site exceeded 28.5, the level at which a site is proposed for inclusion on the National Priorities Lists (NPL). In June of 1988 EPA proposed the Abex site for the NPL and in August of 1990 the site was placed on the NPL.

The proposed listing of the site on the NPL, however, did not accelerate the pace of site cleanup. Nearly a year and half later, in October 1989, the Virginia Department of Waste Management, at the time the lead agency at the site, entered into an Administrative Order of Consent with Abex. Under the terms of the agreement, Abex agreed to perform the remedial investigation/ feasibility study (RI/FS) at the site to determine the extent of site contamination and to identify remedial alternatives to cleanup the site. Soon thereafter contractors for Abex, dressed in full protective clothing, arrived at the Abex site and proceeded to remove soil. The long and difficult process of site cleanup had begun in earnest.

3.0 LAND USE IN REMEDY SELECTION

Overview

At the Abex site, much of the debate over the cleanup of the site has hinged on the question: how many cubic yards of lead-laden soil need to be removed to ensure the safety of local residents?

At Abex one approach would be to remove all contaminated soils which pose unacceptable health risks to residents. There are two essential questions to consider under this approach: What concentration of lead poses unacceptable health risks to local residents? And by what pathways (e.g. ingestion, inhalation, dermal contact, etc.) do individuals come into contact with lead in surface soils and subsoils? Land use assumptions in the risk assessment are at the heart of these considerations for they set out the kinds of activities likely to occur at the site (e.g., accidental ingestion of lead from digging in the dirt) and the individuals who may be at risk (e.g., children). Over the years, different cleanup strategies have called for removal of the contaminated soil to varying depths, depending on the likelihood of residents' exposure, a matter discussed more fully in the baseline risk section below. The principle focus of soil removal is to reduce risk by removing the contaminant.

At Abex a second approach to site cleanup would be to “manage” the risks from the site by controlling exposure, through the use of land use controls, such as deed restrictions, rezoning, and physical barriers. These controls impose restrictions on the uses of the site in place of more comprehensive and costly cleanup and are intended to act as a barrier, to separate the public from levels of contamination that exceed acceptable health risks. When institutional controls are used in conjunction with containment strategies, the technical adequacy of the remedy becomes dependent upon a number of non-technical complications, such as the efficacy of local government administration to enforce controls on the use of the land (e.g. exposure limits). This approach involves weighing the initial cost savings land use controls can bring to a remedy, against the likelihood of the remedy’s long-term success and the acceptance of the remedy to the local community.

The two groups of local residents at Abex--the renters of the Washington Park Housing project and the home owners of the Effingham properties--argued their case for a remedy from a very different set of positions and land use assumptions than those used by the other parties at the site. From the transcripts of public meetings, where local residents discussed remedial alternatives with staff from the EPA, VDWM, and ATSDR, the lack of certainty in discussions of risk, a convention of the discipline, did little to dispel public concern or answer the central questions raised again and again in public comment periods: Is the site safe? Can my children play outside? Has the lead made my child sick? In place of risk-based definitions of safety and the use of institutional controls to prevent exposure to site contamination, both groups of residents argued that the site would never be safe, that no remedy would ultimately protect their health, and that the only fair solution would be permanent relocation away from the lead problem.

From the outset, private homeowners had an advantage over Washington Park residents in their quest for relocation because some of the homeowners, as property owners, had grounds for separate lawsuits against Abex for potentially exposing them to health hazards. Equally important, however, was the fact that private homeowners were unified and able to effectively represent their views to the city, the state, and to EPA. Homeowners used their existing neighborhood association as a way to disseminate information and develop a campaign to lobby the city, the state, and EPA for relocation. In contrast, Washington Park residents lacked sufficient political cohesion to mount a successful lawsuit. While EPA tried to elicit the community’s concerns through various mechanisms, the residents maintained

divergent viewpoints. It was therefore difficult to find a spokesperson who could effectively represent their different interests.

The two “publics” at Abex raised a challenge to both EPA and the PRPs about the role the affected public should have to shape a remedy. To the extent that local residents saw the remedy as negotiated, with land use a prime bargaining chip for the PRPs and EPA, the cleanup raised issues of political exclusion and led to deep public cynicism and anger.

In this section we discuss how these three dimensions of land use--risk assessment, institutional controls, and public involvement--informed the choice of a cleanup remedy at Abex. To provide the necessary background, we will first describe the nature and extent of contamination found during the site investigation. We then look at the site’s baseline risk assessment, particularly at how land use assumptions informed decisions about the levels of chemical contamination that could remain on-site. Thus from the characterization of risk in the baseline risk assessment to the development of remedial goals and a cleanup strategy, land use assumptions enabled EPA, the PRPs, and the local residents at Abex to argue and justify their positions concerning the level of cleanup required at the site.

3.1 The Remedial Investigation (RI)

In the course of the remedial investigation (RI) for the first operable unit (OU1), beginning in October of 1990, contractors for the Abex corporation collected and tested over one thousand soil samples from the Abex site. While these samples were tested for other metals, notably antimony, nickel, copper, tin and zinc, the focus of the RI was to determine the extent of lead contamination in the surface soils and in the subsoils within the 700 foot radius, designated as OU1, which surrounds the foundry. The contractors performed a less extensive investigation of the groundwater, surface water and sediments, media which will be addressed more thoroughly as part of a second operable unit. (As a result groundwater applicable or relevant and appropriate requirements (ARARS) have not come into play thus far at the site.)

The results of the RI showed that lead contamination was pervasive throughout the 700-foot radius surrounding the foundry. Despite the removal action of 1986 that removed the majority of lead-contaminated surface soils from Washington Park and other residential neighborhoods, the RI found isolated surface areas within the project that exceeded 500 mg/kg, the maximum concentration level permitted by EPA in residential areas, while surface soils at the Effingham residences reached 7,890 mg/kg. in places. The scale of the problem

was perhaps greater than anticipated. Lead contamination extended generally about one to four feet into the subsurface soils. In Washington Park lead levels of up to 46,500 mg/kg were discovered in soils between one and four feet in depth. In the Effingham residences, concentrations of 8,000 mg/kg were found in certain areas at depths of one to four feet. Similarly the Effingham Playground, adjacent to the foundry, was found not only to contain surface soils with lead exceeding 500 mg/kg, but to have lead levels of up to 5,000 mg/kg four feet down.

In the non-residential areas of the site the RI found even higher lead levels in the soils. Floor dirt within the foundry contained lead levels of up to 100,000mg/kg, with outdoor soils on the Holland Property showing levels of up to 58,000 mg/kg within the top two feet. While the foundry area is fenced and guarded by a 24-hour security service, a report published 1990s by federal health inspectors notes that children may have occasionally breached the fence.⁵ The Abex lot had lead concentrations ranging up to 24,000 mg/kg in the first four feet of soil. Similarly, the McCready lot contained lead levels of 4,750 mg/kg in the top two feet of soil. The results of the RI are provided below.

Table 1. Extent of Soil Contamination at the Abex Site

Lead Contamination	Surface Soil			Subsurface Soil		
	n (mg/kg)	Mean (mg/kg)	97.5th % UCL	n (mg/kg)	Mean (mg/kg)	97.5% UCL
Washington Park Housing Project	135	260	289	93	2,926	20,744
Effingham Residential Area	48	1,302	1,688	38	1,545	8,632
Seventh Street Row Homes	0	---	---	29	974	8,834
Effingham Playground	36	267	326	34	1,869	8,526
Holland Property Abex Lot McCready Lot	41	33,000	46,800	46	8,937	44,954
Vacant Lots Drug Rehabilitation Center	86	609	848	101	849	7,345

Key: *n:* the number of samples collected
mean: the average concentration of the samples collected; units are milligram per kilogram
97.5% UCL: Upper Confidence Limit; the concentration at which there is a 97.5% probability that the actual mean concentration is below

⁵ Agency for Toxic Substances and Disease Registry. 1990. "Preliminary Health Assessment: Abex Corporation, Portsmouth, Elizabeth County, Virginia. CERCLIS No. VAD980551683.

3.2 The Baseline Risk Assessment

After the collection and analysis of soil and groundwater samples in the RI, the baseline risk assessment evaluated the toxicity of the chemicals found on site and used land use assumptions to map out the ways in which persons on or near the site might come into contact with these substances. These land use assumptions specified the possible pathways, or in other words, the routes a chemical would take from the source of contamination to an exposed individual.

Land use assumptions in the baseline risk assessment can help determine whether a site cleanup is deemed necessary and, if remediation occurs, the amount of residual contamination that can remain on site. In this regard, the designation of a site, or portions of the site, as residential or industrial is important. Each land use category carries with it standard values for the frequency, duration, and contact rate that an exposed individual is assumed to bear⁶. These estimates of exposure vary for each land use scenario and are taken into account for both current and future uses.

While EPA has been criticized for basing Superfund cleanups on residential uses, even at former industrial sites with little prospect of residential development in the future, this has not been the case at Abex. The risk assessment for the Abex site was based on the assumption that current land use was not expected to change significantly, residential areas would remain residential and the Abex Lot, the Holland Property, and the Drug Rehabilitation Center would continue to support industrial/commercial uses. (The risk assessment was carried out before the rezoning plan was proposed by the Abex Corporation, the City of Portsmouth, and the Portsmouth Redevelopment and Housing Authority in October of 1993 which would change all residential properties on the site, except for Washington Park, to industrial/commercial.)

The risk assessment concluded that lead was the primary chemical of concern and that site contamination presented unacceptable risks to current residents. The pathways of exposure were incidental soil ingestion (particularly by children), inhalation of dust, and consumption of food grown in local gardens. Moreover, contamination would pose

⁶ For residential use, for example, the standard values for soil and dust ingestion for adults is 100 mg. per day for 350 days/year, with a duration of 30 years. For commercial and industrial land uses an exposed individual is assumed to ingest 50 mg. of soil and dust per day, for 250 days/year, over the course of 25 years. RAGS 1-1⁶.

unacceptable risks to workers within the former foundry building which was not operating at the time, however.

Much of the early infighting between PRPs and the regulatory agencies in selecting a remedy for the remaining contamination in the OU1 site area, centers upon these land use assumptions used in the risk assessment. The risk assessment, conducted by a consultant for the Abex Corp., did not address the issue of future exposure to contaminated subsoils. This exclusion is illuminating. It provides a clear example of how land use assumptions employed in the risk assessment can enlarge or reduce, so to speak, the level of contamination on site. The PRP-led risk assessment assumed that public exposure to subsoil contamination was for all intent and purposes non-existent.

During the early stages of the investigation, Abex Corp. sought to maintain a distinction between the risks posed to local residents from surface contamination as compared to subsoil contamination. The company believed that it was highly unlikely for residents to come into contact with contaminated subsoils below twelve inches, or to contaminated soil under the paved Abex and McCready lots. EPA however maintained that both surface soil and subsoils posed risks to local residents; they posited that routine activities on the part of the residents, such as installing decks, fence posts, and digging in the garden could expose residents to subsurface soils. Thus early in the remedial investigation land use assumptions to calculate potential risks were sharply contested. The risk assessment was not merely a formal exercise; nor were the disagreements between EPA and Abex without consequence. In view of the substantial volumes of contaminated subsoil discovered during the site investigation, a cleanup plan that called for excavating and removing contaminated subsoil would be much more costly than one restricted to eliminating risks posed by contaminated surface soils. The disagreement concerning what constituted a protective remedy would extend into the development of remedial alternatives.

3.3 Cleanup Decisions

After the baseline risk assessment and remedial investigation were completed in 1991, the regulatory agencies and the PRPs, with the input of the local community, developed a number of cleanup options for the site. From 1991 to 1994, five cleanup plans were devised. They include:

- The preferred alternative in the Feasibility Study, prepared for Abex Corporation by Geo Engineering, October 1991 (revised February 1992)
- The Virginia Department of Waste Management's (VDWM) Proposed Plan May 1992
- The EPA Superfund Record of Decision (ROD) Sept. 1992
- A remedy proposed in the document "An Assessment of the Potential for Lead Exposure After Remediation at the Abex Site", prepared for Abex Corporation by Cambridge Environmental Inc., October 1993
- The EPA Superfund Record of Decision Amendment, August 1994

In broad terms, the major components of the plans involve: excavation, treatment, and off-site disposal of contaminated soils from residential and commercial/industrial areas; the decontamination or demolition of the foundry and other outbuildings on the Holland property; and the use of institutional controls to protect individuals from contact with contaminated soil left on site, including paved and landscaped "caps", warning notices to prevent soil excavation, and rezoning residential properties. Table 2 below, however, suggests there is considerable variation in the levels of cleanup required and the emphasis assigned to institutional controls in each plan.

The Abex Feasibility Study, 1991

Compared to the later cleanup plans, this initial attempt to frame a cleanup is most firmly based on the assumption that risk can be controlled if the exposure pathway, linking the individual to the source of contamination, is severed. Rather than reducing the large volumes of contaminated subsoils, this proposal contends that the reduction of risk to acceptable levels can be achieved through limited soil removal and the maintenance of physical barriers. The feasibility study calls for the removal of the first foot of contaminated soil (>500ppm) in areas of possible cultivation, and for the removal of the first six inches of contaminated soil (>500ppm) in residential areas. Decontamination of the Holland property is proposed, and the study recommends removal of contaminated soil (>1000ppm) from the first six inches of the foundry site and from other unpaved industrial area. For the Abex and McCready lots, no soil excavation is envisaged; the asphalt on both the Abex and McCready

lots would be maintained to prevent contact with residual contamination. This preferred alternative, because it involves limited subsoil excavation, is the least expensive (6.2 million dollars) of the cleanup plans under consideration.

TABLE 2: Proposed Cleanup Levels at Abex

Area	ABEX Feasibility Study 1991 (preferred alternative)	VDWM/EPA Proposed Plan 1992	EPA ROD 1992	Abex Risk Assessment 1993 (proposed remedy)	EPA ROD Amendment 1994
Effingham Residential	Soil >500ppm to 1 foot in areas of possible cultivation: Soil >500ppm to 6 inches; clean backfill.	Soil>500ppm to 2 feet; Soil>5000ppm to water table; clean backfill.	Soil>500ppm to water table; clean backfill.	building demolition; Soil >500ppm to 1 foot:	building demolition; Soil>500ppm to 1 foot; Soil>1000ppm from 1-2 feet; rezoning; institutional controls.
Effingham Playground	not specified	Soil>500ppm to 2 feet; Soil>5000ppm to water table; cap.	Soil>500ppm to water table; cap.	Soil >500ppm to 1 foot; cap.	demolition Soil>500ppm to 1 foot; Soil>1000ppm from 1-2 feet; rezoning.
Abex Lot	maintain cap	Soil>500ppm to 2 feet; Soil>5000ppm to water table	Soil>500ppm to 1 foot; Soil>1000ppm to water table	soil >500ppm to water table:	soil >500ppm to water table:
Holland Property/ McCready Lot	foundry de-contaminated: Soil >1000ppm to 6 inches; maintain cap at McCready lot	foundry de-contaminated; Soil>500ppm to 2 feet; Soil>5000ppm to water table, cap.	building demolition; Soil>500ppm to 1 foot; Soil>1000ppm to water table	building demolition; Soil >500ppm to 1 foot; cap; maintain cap at McCready lot	building demolition; Soil>500ppm to 1 foot; Soil>1000ppm from 1 to 2 feet; institutional controls.
Seventh St. Row houses	not specified	Soil>500ppm to 2 feet; Soil>5000ppm to water table.	Soil>500ppm to water table.	building demolition; Soil >500ppm to 12 inches.	building demolition; Soil>500ppm to 1 foot; Soil>1000ppm from 1-2 feet; rezoning; institutional controls.
Washington Park Housing	Soil >500ppm to 12 inches in areas of possible cultivation: Soil >500ppm to 6 inches	Soil>500ppm to 2 feet; Soil>5000ppm to water table.	Soil>500ppm to water table.	Soil >500ppm to water table.	Soil>500ppm to water table.
Cost (millions)	6.2	16.2	28.9	No costs provided.	31.5

Notes: *institutional controls refers to soil excavation permits*
rezoning refers to changes from residential to industrial use
cap consists of clean backfill under asphalt, concrete, building foundation or landscaping

The VDWM/EPA Proposed Plan

The 1992 remediation plan proposed by the Commonwealth of Virginia and EPA called for more soil removal than did the preferred remedial alternative of the Abex feasibility study. The estimated \$16 million remedy called for removal down to two feet of surface soils with lead in excess of 500 mg/kg. Soils below two feet in the former waste disposal area would be removed where lead levels exceeded 5000 mg/kg. Contaminated soil would be stabilized on site and disposed off site. Excavated areas would be replaced with clean soil and replanted. Compared to the feasibility study, the VDWM/EPA proposal is more responsive to risks that could arise from the activities of site residents such as gardening and construction activities, and shows a greater concern for the long-term effectiveness and permanence of the remedy. By increasing the depth of soil removal to two feet in residential areas, the agency assumed contact with contaminated subsoils, associated with gardening and construction work, would be effectively eliminated. And by removing subsurface soils (>5000mg/kg) to the water table, the plan sought to limit the long-term problem of lead contaminating possible drinking water sources. The cost for this cleanup was estimated at \$16.2 million dollars.

The EPA Record of Decision 1992

In response to public comments to the VDWM/EPA plan, the 1992 EPA remedy (EPA was now the lead agency at the site) called for even more soil excavation than the VDWM/EPA plan. Soil with lead in excess of 500 mg/km would be excavated down to the water table at Washington Park, the Seventh Street Row Homes, and the Effingham homes and playground. For the areas then zoned commercial/industrial such as the foundry, and the Abex and McCready lots, the remedy called for the removal of contaminated soil to one foot where lead was found in excess of 500 mg/kg. Below one foot, soil with lead in excess of 1000 mg/kg would be removed down to the water table. All existing foundry structures and cement or asphalt cover would be removed and the EPA would monitor air quality at the foundry and in homes. The high estimated cost of the remedy, \$28.9 million dollars reflected the substantial amount of excavation required.

While the EPA remedy was the most stringent plan put forward--the remedy rejected institutional controls in residential areas and sought to remove rather than cover the bulk of the lead contaminated soils--a number of local residents, during the public comment period,

expressed concern that the EPA remedy would not restore their community, nor adequately protect their health. They demanded permanent relocation, an option that EPA did not recommend, for in the Agency's view the remedy was rigorous and offered long-term protection to local residents. These divergent views helped a new set of land use issues emerge at the site.

The demand of the Washington Park residents and the private homeowners for permanent relocation is a complicated matter that forces us to see the role of land use in remedy selection in a slightly different light from its use in risk assessment. For the local residents land use issues were inextricably bound to notions of authority and power, and both the Washington Park residents and the homeowners of the Effingham properties felt that, as the affected community, they had little say in determining cleanup decisions and that the site investigation was done to them rather than for them.

Both sets of residents mistrusted the 1992 remedial decision for reasons that go far beyond the technical adequacy of the remedy. Transcripts from the public hearings show that many residents were troubled by the fact that the decision came so many years after environmental managers first arrived at the site in 1983. Moreover, residents could not understand why the state and EPA had not informed them of the severity of the lead contamination sooner and why the emergency removal actions in 1986 failed to remove all of the contamination. Although VDWM had been the lead on the site through the remedial investigation, the lead reverted to EPA following issuance of the VDWM/EPA Proposed Plan. EPA initiated an extensive effort during the summer of 1992 to inform residents of the remedial investigation findings and the proposed cleanup options. The residents challenged EPA, in part, because of perceived oversights in the remedial investigation up to that point. For example, EPA had not addressed the issue of contaminated soil in the crawl spaces beneath the homes because EPA had believed that the homes were constructed on concrete slabs. In response, EPA sampled the soil in the crawl spaces and factored the cost of removing contaminated soil from the crawl spaces in the 1992 ROD. EPA estimated the cost to be \$21,333 for each of the Effingham private homes. One homeowner, a professional contractor, placed the costs at around \$50,000 per unit--more than the fair market value of some of the homes. For property owners, there was a fundamental concern that their homes would decline in value. In addition to the crawl space issue, the VDWM/EPA proposed plan

did not discuss the need to relocate residents temporarily during the actual cleanup. Residents became anxious when the contractor conducting the short-term emergency cleanup to remove the remaining surface soil contamination advised them to take their pets to a kennel during the soil removal, but made no mention about whether or not residents should make plans to leave. After residents expressed their concerns, EPA included provisions for temporary relocation of residents, as necessary, in the 1992 ROD during the more extensive subsurface soil cleanup.

In this climate of hostility and mistrust, environmental managers had a difficult time delivering answers to allay the fears of most residents about the extent of lead contamination and the possible health effects from exposure during the site cleanup and post remediation. Risk communication between technical professionals and the public is difficult at the best of times. At Abex, in the tinderbox of emotions at the site, it is not surprising that environmental managers could not adequately explain how removal of the contaminated soil would reduce risk. Many Washington Park residents and all the private homeowners concluded that no amount of soil removal would ever adequately protect them and restore the integrity of the neighborhood. Initially considered by local homeowners an ally against the city and Abex, EPA, by 1992 had become the focal points of local residents' frustrations.

ABEX Plan 1993

Although, local residents raised the issue of permanent relocation in May of 1992, a year after EPA released the ROD, the issue of permanent relocation and future land use took on new force with the release of the 1993 Abex plan to clean up the site. This plan came at a strategic moment. It united the interests of the PRPs with those of private homeowners; it advocated less extensive soil excavation along with permanent relocation. The central element in the plan was to finance the relocation of private residents (Washington Park tenants would not be relocated), and to construct a municipal building on the site. The essential argument in the PRP plan is that once these properties were rezoned, the extent of cleanup required should be revised downward. Whereas the ROD required the excavation of contaminated soil exceeding 500 mg/kg down to the water table in **residential areas**, the Abex plan argued that, as these areas would no longer be in residential use, a protective cleanup in these areas could be achieved by removing only the first foot of contaminated soil (>500mg/kg).

The plan however, did not unite the interests of all parties involved in the site cleanup. Under the Abex plan, however, only the Effingham private residences, the Seventh Street Row houses, and the Effingham playground would be rezoned from residential to commercial/light industrial. The Washington Park complex would remain a residential area, residents would not be relocated, and the area would be cleaned up to the level specified in the ROD. Contaminated soil in Washington Park with concentrations greater than 500 mg/kg would be excavated down to the water table and replaced with clean, fill dirt. Similarly, soils in the sand disposal lots with concentrations exceeding 500 mg/kg would be removed down to one foot. The city would include a warning sheet over deeper soils and replace the contaminated soil with clean dirt.

The 1993 Abex plan marked an important departure from the preceding plans because it relied more centrally on institutional controls to maintain the integrity of the remedy. To prevent future exposure to deeper soils, the city promised to adopt institutional controls for the rezoned property, including excavation permits, deed restrictions, and building code revisions. Abex would give the city deeds for the cleaned up Abex and McCready lots and thus the transfer would place the entire area under municipal government control.

The PRP plan, based in part on managing risks through land use controls, found considerable support in political circles. In order to persuade EPA to relocate the residents, the city, PRHA, and Abex Corp. enlisted the help of Congressmen including Senators Charles R. Robb and John W. Warner, and Representative Norman Sisisky. EPA faced considerable pressure to reconsider its remedy for the site, but the agency disagreed with a number of provisions in the PRP plan, particularly the use of institutional controls. It is clear from reviewing both the VDWM/EPA proposed plan and the 1992 ROD, that EPA had previously rejected the use of institutional controls on residential property.⁷ The PRP plan, it was argued, did not challenge this position, but rather sought to establish institutional controls on **former** residential properties that would be rezoned for commercial/light industrial uses under their plan.

⁷ USEPA. 1992 Superfund Record of Decision (ROD); Abex Site, p. 45.

The EPA Amended Record of Decision 1994

In order to approve the PRP plan, EPA required the city to first rezone the property and propose a set of institutional controls for the areas which would be rezoned to commercial/light industrial uses. After the city proposed to make the zoning change, EPA amended its remedy in 1994.⁸ The terms of the amended ROD were agreed upon by the city, PRHA, and Abex under the consent decree signed in September 1995, and made final in federal court in April, 1996.

The EPA amended ROD and subsequent consent decree contain several contingency provisions to protect private homeowners and Washington Park tenants should the city fail to rezone the Effingham playground, private homes and Seventh Street Row Homes from residential to commercial/industrial and the PRHA fail to purchase the residences. The remedy stipulates that if the city fails to rezone the residential areas by the times specifically approved by EPA in the Remedial Design Workplan, the Effingham residencies, playground, and Seventh Street Row Homes will be cleaned up by the Abex Corporation to the same residential levels as Washington Park (i.e. soil in excess of 500 mg/kg excavated down to the water table). The consent decree furthermore requires the PRHA to purchase and/or acquire by condemnation the private residences within 18 months of the date of entry of the Consent Decree. In addition, the city is required to construct a permanent city facility (such as a firehouse or police station) within three years of the date the PRHA purchase or condemn the private residences. Under the terms of the Consent Decree, if the city facility is not built, Abex Corporation is required to cleanup the Effingham area to residential standards. The Council of the City of Portsmouth approved the zoning amendment ordinance at a meeting held on April 25, 1995.⁹ EPA has no involvement in the arms-length buyout, which has been separately negotiated among the private homeowners and the three PRPs. According to EPA, the buyout of the private homeowners was largely complete by July, 1996.

The EPA amended remedy requires more stringent cleanup levels than the PRP plan. In the rezoned areas, the amended remedy requires excavation of contaminated soil

⁸ USEPA. 1994. "EPA Superfund Record of Decision Amendment," EPA/AMD/R03-94/190.

⁹ Zoning Amendment Ordinance Z-95-09. Adopted by the Council of the City of Portsmouth, Virginia on April 25, 1995.

(>1000mg/kg) to two feet rather than one, and requires removal of the asphalt cover of the McCready Lot and excavation of contaminated soil (>1000 mg/kg) down to a level of two feet. The PRP plan recommended maintaining the asphalt cover as the PRP plan stipulated. Moreover, for the residents who would remain, the tenants of the public housing units, the amended remedy calls for the same level of cleanup as specified in the 1992 ROD. Soil with lead in concentrations greater than 500 mg/kg would be excavated down to the water table (about four feet) and replaced with clean, fill dirt. The remedy also contains provisions to temporarily locate some Washington Park tenants during the clean up, as necessary.

EPA's initial estimate for the cost of cleanup under the amended remedy was estimated at \$31.4 million. The changing dynamics of the remedy caused agency contractors, to revise their cost estimates to somewhere in between \$20 and \$28 million dollars. The cost varies depending on the assumptions used to estimate the volume of soil removed. As a result, the accuracy of the revised estimate remains uncertain.

CONCLUSION

Incorporating land use more fully into remedy selection, as Abex suggests, can change the dynamics of site cleanup and makes the question "what level of cleanup is protective and who decides?" much more ambiguous. Before the rezoning plan and the amended remedy, the 1992 remedy provided similar levels of protection for all residents of the site. With the 1993 Abex proposal to rezone the site and to relocate private homeowners but not the housing complex residents, the EPA has faced an intractable problem: how can the agency make what it considers a protective remedy acceptable to all of the local Washington Park tenants? For some of the Washington Park tenants, the amended remedy only confirms their view that the Abex cleanup served a range of interests for groups more powerful than themselves.

Had the State of Virginia and the EPA made the residents who live at the site fully aware of the risks when the emergency removal actions were conducted, it is conceivable that much of the public controversy surrounding the subsequent remedy selection process could have been avoided. By failing to present information to residents in a timely manner and in non-technical terms that the citizens could understand, environmental managers may have unwittingly intensified the public's shock over living on top of lead-tainted soil.

The inclusion of land use issues into Superfund complicates the position of EPA. Many residents at Abex wanted the agency to assume powers beyond the scope of its authority under CERCLA in order to relocate them from the site. In contrast, the PRPs and some private residents looked to EPA to give local actors more autonomy in governing cleanup at Abex. In essence, the revised remedy is a good faith agreement that the local actors who originally redeveloped the parts of the site for residential use will possess sufficient technical and financial resources to maintain the integrity of the remedy and keep the rezoned lot zoned as commercial/light industrial. The question remains as to what extent will EPA ultimately be responsible for enforcing the institutional controls it selected at Abex? EPA understands its involvement in land use as primarily technical in nature and maintains that determining land uses is essentially a local matter. However, it may be difficult for EPA to maintain such tight distinctions in practice. The Abex site clearly demonstrates that local land use processes are by nature political, driven by financial considerations, and often partisan. At Abex land use issues--from exposure assessments to institutional controls--have affected the remedial selection process and have exacerbated conflicts embedded in the site cleanup.

Appendix A: Interviews

U.S. Environmental Protection Agency, Region III Philadelphia, PA

Ron Davis, Remedial Project Manager

Reginald Harris, Toxicologist

Kathy Hodgekiss, General Remedial Branch

Kimberly A Hummel, Chief, VA/WV Remedial Section

Jean Kane, Regional Counsel,

Leanne Nurse, Community Relations Coordinator

Harold Yates, Community Relations Coordinator

Department of Environment Quality, Commonwealth of Virginia, Richmond, VA

Paul Kohler, Analytical Chemical, Section Chief

Steve Mihalko, Project Director, 1991-1993

Paul Spaulding, Applicable or Relevant and Appropriate Requirements (ARARS)
Coordinator

U.S. Department of Housing and Urban Development

Andre Basmachian, District Director, Department of Housing and Urban Development,
Richmond, VA

Portsmouth Redevelopment Housing Authority, Portsmouth, VA

Susan Hansen, Esq. Cooper, Spong, and Davis, Portsmouth, VA

Abex Corp.

Jerry Homsy, Esq. Zevnick, Horton, Guibord & McGovern, Chicago, IL

Portsmouth Public Housing Tenants and Spokesman

Michael V. Hernandez, Esq. Regent University School of Law Virginia Beach, VA

Helen Person, Resident

Madison Ward Civic League

Charlie Riddick, Homeowner