

CONSTRUCTION OVER OLD LANDFILLS

Michael W. McLaughlin, P.E.

Senior Vice President

SCS Engineers

11260 Roger Bacon Drive

Reston, Virginia 20190

(703) 471-6150

INTRODUCTION

There has been much recent interest in reclaiming real estate formerly occupied by municipal landfills. Recent changes to regulatory programs offer both opportunity and new challenges for converting old landfills into productive real estate development.

Throughout North America, agencies of Federal, State and Local government have begun new initiatives to redevelop formerly used sites which are "tainted" environmentally. The initiatives have been given various names, including Land Recycling in Pennsylvania, and Brownfield at the U.S. Environmental Protection Agency.

From the legal perspective, there are several concerns which must be addressed when redeveloping a former landfill site for a productive use. Liability concerns regarding potential environmental claims under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA, or Superfund) can dissuade private developers and their lenders. Technical challenges to reusing landfills include the problems presented by settlement, foundation support, gas generation, and worker health and safety.



TECHNICAL ISSUES

As it ages, municipal solid waste in a landfill decomposes and consolidates. Active settlement can take place for many years, depending upon the depth of the trash fill, the types of wastes present (e.g., construction and demolition waste versus municipal solid waste), and the method of placement (e.g., trench versus area fill). Before buildings or other improvements can be constructed on a landfill site, estimates of expected settlement must be made based upon experience, empirical settlement observations, and numerical models.

Heavy loads will surcharge the waste mass and accelerate consolidation and settlement. Many site operators stockpile cover soils, or excess wastes, on portions of the landfill prior to final closure; such operating practices should be identified and considered when estimating settlement and differential settlement rates.

Although some buildings have been constructed using floating foundations (normally after replacing a few feet of the underlying trash with structural fill), most larger buildings and sensitive structures constructed over landfills are provided with deep foundations (e.g., piles or caissons). A combination has been used over old shallow landfills, in which building walls are constructed on piles or caissons, while a floating floor slab is constructed.

The result often is a stable building, surrounded by a settling ground surface as the underlying landfill consolidates. At one California landfill, a hinged slab was connected to a retail building on one side, and allowed to “float” with the land surface on the other side. If settlement causes the slab to sink too far on the floating side, it can be jacked up and the land surface regraded to create a proper entranceway to the building.

Where utilities enter natural ground or fixed structures supported on deep foundations, allowance must be made for differential settlement. Flexible utility connections have been developed for such applications. Pipe runs beneath buildings constructed on deep



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foundations should be hung from the overlying structural concrete slabs with non-corrosive hangers, and surrounded by non-cohesive backfill material. Otherwise, settlement of the underlying fill could cause the pipe to be pulled away from the building.

As solid waste decomposes, landfill gas, which consists of methane and carbon dioxide, is produced. If allowed to accumulate within a confined area in the presence of an ignition source, methane can explode. Any improvements constructed on or near a landfill should incorporate appropriate landfill gas protection measures.

Several approaches are available to protect structures from landfill gas. Active control technologies include landfill gas extraction (normally followed by flaring, if gas production rates warrant treatment) to remove landfill gases before they reach structures, and air injection or air curtain systems to create positive pressures to drive landfill gases away from structures.

Passive control technologies include use of membrane barriers and vents to prevent gases from entering structures, and monitoring and alarm systems to warn of accumulating gases. Passive systems are commonly used where the landfill is old, and most of the decomposition has occurred (i.e., gas production rates are low). Passive systems also may be appropriate where the building will have limited usage, or is of open construction (e.g. open parking structures having six or more air changes per hour).

Landfill gas control systems protecting higher occupancy buildings often have redundant systems (e.g., barriers and active extraction and monitoring alarms), especially when the landfill is not old. Special care must be taken where utilities or other site features penetrate barrier systems; landfill gas will follow preferential flow paths along utility trenches and enter buildings at points of penetration unless properly sealed.



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Landfill gas protection systems require proper operation, monitoring, and maintenance. Monitoring alarm sensors can become “poisoned” by landfill gas constituents and rendered useless. Landfill gas condensate and corrosive gas constituents can affect mechanical systems. As the closed landfill ages, landfill gas production patterns change, thus requiring adjustments in extraction system operation.

Landfills contain wastes, some of which may be hazardous. Older landfills--those which predate regulations requiring hazardous wastes to be managed in separate hazardous waste facilities--can contain a variety of industrial wastes such as solvents and sludges which require special handling and care if excavated. Many landfills were used to dispose asbestos-containing building materials, which also require special handling and regulatory notifications.

Workers who may be exposed to hazardous substances during excavation of utility trenches or other subsurface site features should be properly trained to handle such materials safely. Work space air monitoring and perimeter air monitoring may be necessary to assure that site workers and neighbors are not harmed by migrating chemicals. Documentation of training, monitoring, and medical monitoring may be required by Federal or state regulations. If drums of liquid wastes or other special materials are encountered during the construction activities, special contingency plans should be put into effect to characterize and stockpile such materials.

A written health and safety plan, specific to work on landfills, should be prepared and followed during construction. The Solid Waste Association of North America has published “A Compilation of Landfill Gas Field Practices and Procedures” (March, 1992) which provides some common-sense elements for such plans.

LEGAL ISSUES

Under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA, or Superfund), owners or lessees of facilities from which there has been a



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release or a threatened release of a hazardous substance can be liable for all public and private costs of response to the release, even if the release took place many years earlier. The liability can be imposed even if the facility owner or operator was not negligent (the liability is "strict"). And response costs for typical landfill sites under Superfund can be substantial (e.g., the U.S. Environmental Protection Agency uses an average \$25-30 million for sites listed on the Superfund National Priorities List).

The prospect of strict, joint, several, retroactive, and substantial liability for Superfund response costs presents a challenge for anyone seeking to redevelop a landfill. Of course, such environmental stigma is not unique to landfills; many former industrial properties also lie dormant and undeveloped due to Superfund concerns. A new term, "brownfield," has been given to restoring tainted properties to productive use by overcoming the stigma associated with limited or moderate environmental contamination caused by previous site uses.

Federal and state agencies have begun to address the brownfield problem with a series of initiatives. The U.S. Environmental Protection Agency announced a series of new policies and initiatives in 1995 to promote redevelopment of brownfield areas. These include increased use of negotiated covenants not to use Superfund to sue developers trying to redevelop tainted lands, and new policies not to pursue innocent landowners affected by migration beneath their property of contaminated groundwater from offsite.

Municipal owners of landfills also will benefit from several EPA Superfund initiatives which recognize the unique position municipalities hold as government agencies primarily responsible for the health and welfare of their citizens. Superfund is not well-suited to municipal landfill sites, in which large quantities of household trash are mixed with relatively small amounts of hazardous substances from industry. EPA has announced a presumptive remedy for landfill sites (capping), and has demonstrated a new flexibility in dealing with municipalities which own landfills.

CONCLUSION



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Closed landfills have been successfully developed into productive land uses. However, the challenges inherent in development of a closed landfill are substantial. Experience has shown that technical challenges such as settlement, deep foundations, gas protection, and health and safety issues, can be met. Legal liability challenges continue to present impediments to landfill redevelopment; however, recent “brownfield” policy initiatives at the Federal and state levels, coupled with increasing experience on the part of national lending institutions, suggest that such impediments also can be overcome.

