

FROM THE TECHNOLOGY CORNER: REDEVELOPING LANDFILLS

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Introduction

There has been much recent interest in reclaiming real estate formerly occupied by municipal landfills in many jurisdictions. For years, closed landfill sites were used, if at all, primarily for passive recreation. Over the last 25 years, however, an increasing number of closed landfills have been used for a variety of industrial, commercial and residential purposes.

Throughout North America, agencies of federal, state and local government have begun new initiatives (Brownfields) to redevelop sites that are “tainted” environmentally. In many respects, closed landfills are classic Brownfield opportunities, as they often are near good transportation and other public infrastructure. Despite often attractive locations, however, closed landfill sites often are regarded as being too affected by environmental challenges to be successfully redeveloped. Experience shows otherwise, if legal and technical issues are properly addressed.

There are several legal and technical issues that must be addressed when redeveloping a former landfill site.

Legal Issues

Recent changes to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA, or Superfund) offer some liability protection for those who can qualify as bona fide prospective purchasers of property where historical releases of hazardous substances may have occurred.

Under Section 222 of the Small Business Liability Relief and Brownfields Revitalization Act, a bona fide prospective purchaser can receive liability protections if specific conditions are met. A prospective purchaser of a closed landfill site probably can meet these conditions, provided that they take reasonable steps to mitigate the hazards presented by developing such a site.

Municipalities face liabilities under a variety of theories if they allow development on “the old town dump” without requiring appropriate mitigation measures, including those to address technical problems presented by settlement, foundation support, and gas generation. Fortunately, there are several proven approaches to requiring proper mitigation. Los Angeles has had a specific program governing construction near closed landfills and other sources of potentially explosive gases for more than 25 years. Alexandria, Virginia, also has had such an ordinance since the mid-1970s. Texas has a statewide program governing redevelopment of closed landfills. The more established regulatory programs (e.g., Los Angeles and Alexandria, to name two) require developers to have mitigation measures designed by engineers experienced in such projects.

Technical Issues

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. It should be noted that although methane gas migration is perhaps the most significant hazard that must be mitigated to successfully develop a closed landfill, methane gas is not a hazardous substance under CERCLA.

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). Some passive systems are designed to be converted to active systems (*e.g.*, to extract gas from the ventilation system) if it proves necessary.

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.

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.

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). 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 re-graded 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 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.

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.

Conclusion

Scores of closed landfills in the United States have been successfully developed into productive land uses. Development ranges from institutional and residential to a wide variety of commercial, retail, and industrial land uses, in addition to more traditional closed landfill uses (e.g., passive recreation, golf courses, etc.).

However, the challenges inherent in development of a closed landfill can be significant. Experience has shown that technical challenges such as settlement, deep foundations and gas protection can be met. Legal liability challenges continue to present impediments to landfill redevelopment; however, recent Brownfield policy initiatives at the federal and state levels suggest that such impediments also can be overcome.

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