UNIQUE LFG ISSUES ON URBAN INACTIVE LANDFILLS

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ABSTRACT

As urban development needs increase, we are beginning to see increased development on and adjacent to closed and inactive urban landfills. These sites have the potential to pose both health and environmental risks to either the on-site development and/or the surrounding community if they are not managed properly. In many cases, these sites are not under active oversight by regulatory agencies, or they have escaped regulation due to the fact that they have been inactive for many years. As such, the proper safeguards and environmental management programs are not always in place at these sites to prevent them from causing negative impacts.

There are literally hundreds of closed/inactive landfills in the Southern California area alone, and the majority of these sites do not have any type of landfill gas (LFG) migration monitoring system, much less a LFG collection and control system (GCCS). As a result of land shortages, development is encroaching upon these landfill sites, and some former landfill properties are being considered for redevelopment. This can bring the former landfill into scrutiny due to the potential for significant surface emissions of LFG constituents, off-site lateral LFG migration, vertical LFG migration and interaction with groundwater, odor concerns, as well as subsurface combustible gas issues.

When the proposed development is on the former landfill, these issues are typically addressed in California through completion of an environmental impact report (EIR) under the California Environmental Quality Act (CEQA) for the redevelopment project. However, development adjacent to or near landfills is not always met with the same level of analysis and consideration. Historically, many developments have occurred adjacent to landfills with minimal, if any, concern given to the impacts on the development from the landfill. This type of situation can throw an unsuspecting site owner into a regulatory enforcement situation without forewarning and/or bring the owner of the landfill property (who may have had nothing to do with placing the refuse there in the first place) into serious conflict with the neighboring development and surrounding community.

The paper summarizes the technical, regulatory, jurisdictional, community, and logistical issues that affect LFG issues at inactive urban landfills, particularly as they relate to several example sites that are specifically evaluated in the paper. In addition, the paper presents five case studies of the investigation and assessment of LFG from urban landfills; some sparked by development on the landfill, and others by adjacent development or community concerns. Finally, some of the specialized solutions that have been implemented to resolve these unique urban development situations are discussed and described.

INTRODUCTION

Development on and adjacent to closed/inactive urban landfills appears to be on the increase as urban and suburban areas encroach upon these sites. These sites can present health, safety, and environmental concerns for the on-site project and/or the surrounding community. These sites are typically not under active oversight by regulatory agencies, or they have escaped regulation for various reasons. Therefore, the proper safeguards are not always in place at these sites to prevent them from causing negative impacts. This can quickly change when a proposed development occurs as further detailed below.

BACKGROUND

In 1970, there were an estimated 20,000 active landfills located throughout the United States. By 1988, this

number had decreased to approximately 8,000. By 1996 the number was around 3,500 (USEPA, 2003). Excluding the thousands of landfills, open dumps, and burn pits, located throughout the United States that stopped accepting waste prior to 1970, 82% of the landfills located in the United States were either closed or inactive in 1996.

In California, out of approximately 3,400 identified disposal sites, over 80% are designated abandoned, closed, inactive, or pending regulatory determination (CIWMB, 2003). Both the federal and state trends indicate that in Los Angeles County alone, there are literally hundreds of closed/inactive sites.

Unfortunately, the majority of these closed/inactive landfills, whether located nationwide, within California, or in Los Angeles County, while once located away from urban build-up, have seen urban development surround and sometimes occur on top of the former landfill.

These sites have the potential to pose both health and environmental risks to either the on-site development and/or the surrounding community if they are not managed properly. This is especially true for the thousands of landfills nationwide that stopped accepting waste prior to 1976.

Federal Regulations

Prior to 1976, there were few restrictions on the type of materials that could be disposed of in a municipal solid waste (MSW) landfill. Hazardous wastes, industrial sludges and various chemicals were routinely placed in landfills, especially prior to the 1970s when the US Environmental Protection Agency (USEPA) began developing the first hazardous waste management regulations.

In 1976, Subtitle C of the Resource Conservation and Recovery Act (RCRA Subtitle C) was promulgated which enacted land disposal restrictions on certain hazardous wastes, as well as set forth stringent permitting and recordkeeping requirements for hazardous waste treatment storage and disposal facilities.

The RCRA statute was further refined in 1991 with the promulgation of RCRA Subtitle D. RCRA Subtitle D set forth criteria for the operation of a MSW landfill, one of which pertained to the closure and post-closure care requirements for MSW landfills. LFG migration monitoring and possible remediation were listed among these requirements. RCRA Subtitle D also placed requirements for load checking and household hazardous waste restrictions to prevent hazardous materials from entering the landfill.

State and Local Regulations

In addition to federal requirements, state governments can set forth their own regulations pertaining to MSW landfills which may be more stringent than their federal counterparts. For example, in California, MSW landfills are regulated by the California Integrated Waste Management Board (CIWMB) under the California Code of Regulations (CCR), Title 27. Title 27 contains several sections specific to monitoring and controlling LFG emissions from closed landfills. Title 27 also empowers the CIWMB to designate local enforcement agencies (LEAs) which provide regulatory oversight to landfills at a local level.

URBAN INACTIVE LANDFILL ISSUES

There are several unique issues that usually arise associated with the post-closure care of inactive/closed urban landfills. Each of these issues has a direct affect on LFG management.

1. Property Ownership
2. Availability of Historical Information
3. Adjacent Land Use
4. On-Site Development
5. Regulatory Oversight
6. Alternative Sources of Contamination

Property Ownership Issues

It is not uncommon to see once rural, expansive properties, subdivided in order to accommodate smaller urban development. One of the most common issues that arise on older (closed prior to 1965) urban inactive landfills is the subdivision of the landfill property (and possibly refuse footprint) from one into several properties.

At a minimum, the presence of refuse from one former landfill on multiple properties will create logistical difficulties. These can include the necessity for site access agreements as well as cost-sharing arrangements. In a worst-case, all work at the site would be done through litigation under the Comprehensive Environmental Response Compensation and Litigation (CERCLA) Act, or similar regulation which allows the designation of financial liability.

It is also common to find that the current owner of a landfill site acquired the property after refuse filling operations ceased. In these circumstances, the new owner may or may not be aware of their obligations under federal and state law. Interestingly enough, within California, the LEA or CIWMB has the authority to require the owner of a landfill to bring the site into compliance in regard to

LFG migration issues, but not the former operator (CCR Title 27, Section 20919).

This apparent loophole in the regulations has created its fair share of litigation in regard to the responsible parties associated with the costs for enforcement-based investigation and remediation projects. On one hand, 99% of the wording regarding responsibility contained in Title 27 refers to both the owner and the operator. However, this section which assigns responsibility to only the owner is unfortunately the same section that grants LEAs the authority to require investigation and clean up in the event of a perceived hazard. As may be surmised, this issue is the source of much contention between litigants in already difficult court proceedings.

Availability of Historical Information

One of the most significant issues associated with any inactive landfill is the availability of historical data. Unless the site closed or became inactive after 1991, the chances are slim that operational data from refuse filling operations will exist for a given landfill. This includes the detailed operational information necessary to develop even the most basic LFG assessment, such as:

- **Amount of waste.** The amount of decomposable refuse in a landfill is directly proportional to the amount of LFG that will ultimately be generated from the site.
- **The operational period of the landfill.** The volume of LFG generated from a landfill is directly related to the number of years that a site has been in operation. Usually, the longer the site operated, the greater the volume of waste deposited, and subsequently, the greater the resulting LFG generation.
- **The date the landfill stopped accepting waste**. It is widely held that the largest amount of LFG is generated the year after a landfill stops accepting waste. Therefore, the date that a landfill stopped accepting waste provides perspective as to the nature, extent, and duration of LFG migration issues. This is especially true considering that the amount of LFG generated from landfills decreases every year following the closure of a landfill.
- **Thickness, depth and lateral extent of waste.** This information contributes toward the creation of both a valid LFG generation model as well as the determining the proper placement of perimeter migration monitoring wells and other investigation/remediation components.
- **Type and thickness of cover material.** The type and thickness of cover material is directly related to the potential for surface emissions of LFG. An engineered cover has a greater permeability than a standard soil cover. This permeability relates directly to the migration potential for LFG through the landfill surface, as does the overall thickness of the cover. In fact, the potential for LFG emissions through the cover of a landfill is such a significant issue that, in California, many air districts have developed thresholds for surface emissions and require periodic monitoring, even for inactive landfills without a GCCS.
- **Filling style.** The manner in which refuse is placed in a landfill can also affect the generation and migration of LFG. For example, in a trench fill, where the trenches are placed side-to-side along their long axis, LFG tends to migrate from the ends of the trench. In a canyon fill, LFG migration may follow the coarse-grained sediments in the historic canyon channel.
- **Nature of deposited waste.** The type of waste disposed in a landfill (i.e., hazardous waste, MSW, inert waste, etc.) influences the need for and implementation of LFG assessments. By their nature, LFG is not generated at inert landfills (or in portions of MSW landfills designated as inert). In addition, the type of control device necessary to mitigate LFG with significant levels of volatile organic compounds (VOCs) is different that the type of control system necessary to control the VOCs associated with MSW landfills (USEPA, 1996).

In addition to these general difficulties of obtaining historical operational data for inactive landfills, urban inactive site have the added challenge of having to search multiple locations and agencies for information. For example, it is not uncommon to find information relating to the entire operational history of a landfill to be filed with a building department under an assumed address for the landfill. This problem compounds when it is associated with some of the subdivision and reapportionment issues discussed above, where the original address of a landfill may no longer exists due the rededication or renumbering of a city street associated with redevelopment.

Pertinent data to the landfill operations and extent may also be present in regulatory files for any of the surrounding properties, if it still exists at all. For sites where the ownership has been transferred to a new owner, the new owner may not have gotten all of the historic data when the site was acquired and the previous owner may not have felt any obligation to maintain these records for a property they did not own. These issues are compounded by the fact that a vast number of the closed/inactive landfills located in urban areas were not owned and operated by the same company, making it more difficult to find operational data.

Adjacent Land Use

The development and end-use of property adjacent to inactive landfills has undergone varying levels of regulatory scrutiny until recently. Back in the late 1950s and early 1960s, it was not uncommon to find a housing development located adjacent to a closed and/or inactive landfill with only a minimum of concern given to the potential for LFG migration. While this is primarily due to the proposed end use of many of these landfills as parks and open space, the lack of perimeter LFG migration control quickly became apparent in the decades following the development of adjacent lands.

In 1969, the fedreral government enacted the National Environmental Policy Act (NEPA). NEPA established policy and provided a framework for environmental planning and decision making. When planning projects or issuing permits for federal projects, including those adjacent to landfills, federal agencies conduct environmental reviews to consider the potential impacts on the environment by their proposed actions. However, NEPA was not often used to address smaller development projects.

In 1989, California enacted a more stringent version of NEPA, the California Environmental Quality Act (CEQA). CEQA requires the evaluation of the environmental impact of any proposed project that will require a change in required issuance of a conditional use permit (CUP) or enactment of zoning ordinances. Thus, since a CUP is required for any new landfill or landfill expansion project, the impacts on the adjacent properties are evaluated. This was not the case prior to 1989 in California.

However, even after the promulgation of NEPA and CEQA, urban development has still encroached upon closed/inactive urban landfills. This is through mitigation measures designed to protect adjacent properties against LFG migration. RCRA Subtitle D does not contain any provisions for the control of off site properties. At the state level, in California CCR Title 27, only contains provisions for the control of LFG migration from the landfill perimeter. However, in some instances, local governments are making creating provisions for the development of properties adjacent to landfills by creating their own guidelines for the protection of adjacent properties. For example, in Los Angeles County, there is a building code which references the requirement to install a methane mitigation system (e.g., passive venting and installation of a membrane) for any new structure located within 1,000 feet of a landfill.

In addition to the technical and regulatory issues that must be faced when considering adjacent property use, there can also be a political/public relations component associated with LFG assessment/remediation project. People that own residential properties adjacent to closed/inactive urban landfills tend to not want be reminded of the presence of the landfill on a day to day basis. To this end, the design and cost of a GCCS may be affected by adjacent property owner requests to have the system invisible to them in order to protect their property values. This type of situation has happened frequently on urban inactive landfills that have been developed as open space (parks) and golf courses or otherwise incorporated into residential-type developments.

On-Site Development

The existence of, and potential for, on-site development should be one of the first considerations when evaluating or addressing LFG issues on urban inactive landfills. For example, the type and amount of cover placed on a developed landfill can be dramatically different from the cover on an undeveloped site. Some developed urban inactive landfills are paved while others have had a significant amount of soils and/or vegetation added to accommodate open space developments such as golf courses and parks. This cover can, and does effect the emissions of LFG through the surface of the landfill.

The placement and design of probes and GCCS components (LFG extraction wells, header lines, flare stations, etc.) must also take existing and/or planned on-site development into consideration. Based on a proposed development, additional costs may be incurred by completing all wells, header lines, etc. below grade. This can also affect the costs of long-term maintenance at these facilities.

Even with the subgrade location of GCCS components, a proposed development on a landfill must consider additional factors, such as installation of methane membranes beneath all proposed buildings, the effects of landfill settlement on the proposed development and the overall stability of the landfill as a construction platform, given that the average settlement on an urban inactive landfill can range from 0 to 0.4 inches per year based on the type of refuse, type of filling operation, etc.

As a result, one of the most popular developments for small urban inactive landfills in the 1960s and 1970s were trailer parks. The mobile homes at these properties did not require foundations, provided a minimal distributed load, and were elevated off the ground, with a permeable decorative skirt located underneath the residence. More recently, these types of developments have not been proven to be economically feasible, considering CEQA and NEPA requirements.

Regulatory Oversight

As mentioned previously, there are federal, state, and local regulatory requirements that pertain to closed/inactive landfills. However, in an urban environment, there is potential for the involvement of other regulatory agencies that do not normally provide oversight on landfills. For example, the USEPA may get involved in a landfill investigation if the landfill is a component of a Brownfields development grant. This happened at a landfill located in Southern California and although the site was a former burn dump, the USEPA required an LFG assessment and installation of permanent wells. LFG was never detected at the site.

The involvement of other regulatory agencies brings in new perspectives on the nature of contamination associated with landfills. It is not uncommon to see neophyte regulatory agencies treat landfills as if they were just large underground storage tanks, confusing LFG and soil vapor, as well as looking at in-refuse sampling in order to determine the extent and nature of subsurface contamination in the soil profile.

In recent years, in California, the State of California Department of Toxic Substances Control (DTSC) has become increasingly involved in the investigation of historic urban landfills due to the unknown nature of the refuse that was originally placed in the site. Since many of these sites closed prior to the promulgation of either RCRA Subtitles C or D, there is a distinct possibility that hazardous wastes were disposed in these facilities. Therefore, under the mandate provided to DTSC by the California EPA, DTSC feels compelled to oversee the investigation and remediation of many historic MSW landfills. This is especially true for landfills proposed for redevelopment, where DTSC becomes involved from the CEQA perspective. One of the case studies presented in this paper (Landfill #2) summarizes a site where there was a total of seven regulatory agencies involved in the assessment of LFG emissions from a landfill.

Alternative Sources of Contamination

Due to the nature of disposal site operations, as urban development encroaches on a landfill, in general, the type of the adjacent development tends to be industrial. This industrial development can, and usually does, have some form of associated hazardous materials and/or waste. These industrial operations can have air emissions, urban runoff, and subsurface contamination that can actually end up contaminating an adjacent landfill

This point is clearly illustrated when considering the evaluation of methyl-tert-butyl-ether (MTBE) in LFG and groundwater samples from landfills that stopped accepting waste prior to the introduction of MTBE. As discussed in the case study for Landfill #3, MTBE contamination was discovered in a groundwater well located downgradient from the landfill. However, due to the location of this landfill in tidal marshlands, the source of MTBE was eventually traced to urban runoff from the adjacent river.

In addition, the development of urban infrastructure (road, freeways, flood channels, etc.) can end up adding contamination to the surface soils of a landfill. In the case of the construction of flood channels on and adjacent to landfills, while water migration from the bottom of the flood channel can certainly carry LFG contaminants down to groundwater, the water that leaches into a landfill from an urban flood channel can be a source of contamination as well.

To confuse matters even further, in some instances, urban landfills have been sited adjacent to other urban landfills. However, each landfill may contain an entirely different type of waste, and therefore entirely different types of contaminants.

Although there is significant potential for both soil and groundwater contamination associated with a former landfill, the potential additional sources of contamination in the vicinity should also be considered.

CASE STUDIES

Landfill #1

Landfill #1 is a 115-acre former cut and cover landfill located in Southern California. The site operated as an interim refuse fill site for a 5-year period, from 1960 to 1965, during the construction of a larger, regional landfill in the vicinity.

The site is currently developed as a golf course. The site is bordered to the north by a City street and residences, to the west by a city street and a river, to the south by developed golf course, and to the east by residences and commercial buildings.

At the time of closure, the site was located in an undeveloped area. Following the cessation of refuse filling activties, the site was closed, capped with a 4-5 foot soil cap, and converted to a golf course, which opened in 1961. Later, in approximately 1976, two resisidential developments were placed adjacent to the site. In order to

place the residences, a portion of the landfill was excavated and a gas barrier system was installed along the entire eastern perimeter of the site.

Landfill #1 is currently under enforcement with the LEA due to lateral LFG migration issues along the eastern boundary of the site. All five of the perimeter migration monitoring probes located along the eastern perimeter of the site have methane concentrations in excess for the LEA threshold of 5% in subsurface perimeter wells. An LFG assessment has been conducted for the site.

Unique issues that arose during the LFG assessment of Landfill #1 were:

- Property ownership issues,
- Availability of historical information
- Adjacent land use issues and
- On-site development issues

Property Ownership Issues:
One of the first issues that arose during a recent assessment of the site was the fact that the golf course property did not encompass the entire refuse extent. Specifically, a small portion of refuse along the eastern boundary of the site was found to be located on a neighboring property.

Once it was determined that the refuse perimeter was not completely contained on the golf course property, right-of-entry agreements had to be obtained from the adjacent property owner to allow for the installation of a perimeter probe in this area. However, the determination of refuse on the adjacent property also opened a conduit for potential cost recovery.

Availability of Historic Information:
During the initial data gathering and review phase for the LFG assessment, the only information pertaining to the partial excavation of the landfill in 1976 was on-file with the City building department, filed under the general address range for the development that was built after the excavation was completed.

Of special note during the historical document review, an interview with one of the original golf course groundskeepers revealed plans for a perimeter gas migration barrier, which was reportedly installed in 1974 and 1976. Field reconnaissance verified the presence of a portion of the previous gas barrier system.

Adjacent Land Use Issues:
The adjacent land use along the eastern perimeter of Landfill #1, coupled with the perimeter probe violations reported during the LFG assessment are leading to the conclusions that the most likely solution for eastern perimeter compliance will be the installation of GCCS.

On-site Development Issues:
Any GCCS proposed for Landfill #1 will have to incorporate the existing development of the landfill as a golf course, and will need to consider the adjacent residential property use.

In addition, any proposed GCCS may be able to incorporate components of the previously identified GCCS at the site.

Landfill #2

Landfill #2 is a 34-acre, former MSW landfill located in located in Southern California, that is currently owned by three entities, two private landowners and a County agency. The site operated as a canyon fill from 1951 to 1957. As such, the western boundary of the refuse abuts a hillside, and the eastern boundary is at grade with the adjacent property. The maximum thickness of refuse along the western perimeter is 170 feet.

The site is currently undeveloped. The site is bordered to the north by a correctional facility, to the east by a major interstate freeway, to the south by another landfill, and to the west by a correctional facility and a hillside with residences located at the top.

Landfill #2 is currently under regulatory enforcement by the LEA in regard to previous documented subsurface combustion episodes at the site as well as an inadequate perimeter migration monitoring probe placement and violations along the northern perimeter of the site (toward the correctional facility). A full LFG assessment is currently being completed for the site.

Unique issues that arose during the data review and LFG assessment of Landfill #2 were:

- Property ownership issues,
- Adjacent land use issues and
- Regulatory oversight issues.

Property Ownership Issues:
None of the current owners of Landfill #2 owned or operated the site during previous refuse fill operations. In fact, there is evidence to suggest that one of the private owners is not even aware that there is refuse on their property.

At the time of the initial remediation of the subsurface combustion issues at the site, two of the three property owners agreed to split costs associated with the

remediation of the subsurface combustions issues. This becomes a unique issue when it is explained that the county, who owns only 10% of the total refuse volume in the landfill, owns a full 25% of the perimeter of the site, which happens to be the perimeter in violation.

Adjacent Land Use Issues:
The most unique issue associated with adjacent land use was the proposed placement of the perimeter migration monitoring probes at the site. As mentioned above, the western perimeter of the landfill is one of the compliance perimeters, where violations of LEA thresholds had been detected. Due to the nature of the fill operations (canyon fill) the western boundary of refuse abuts a hillside, that increases another 40 feet in elevation prior to leveling out at the level of the adjacent residences.

Therefore, in order to incorporate the off-site development into the design of the perimeter probe monitoring system, the western boundary perimeter probes will be placed 40-feet above grade, and drilled down to a depth that is even with the top, middle, and bottom of refuse within 1,000 feet of the location of the probe.

Regulatory Oversight Issues:
One of the most unique issues associated with the regulatory oversight at Landfill #2 was the number of different regulatory agencies that were involved in the project during the initial emergency response associated with the subsurface combustion event

The subsurface combustion was originally reported to the local fire department as an odor complaint associated with the former landfill. A subsequent inspection by fire department personnel identified smoke rising from a series of cracks located along the northwestern corer of the site.

Local fire department personnel contacted both the USEPA and the LEA in order to assure regulatory oversight for the combustion event. These agencies in turn alerted other regulatory agencies. At the pinnacle of the field investigation and mitigation of the subsurface combustion event, a total of six different regulatory agencies were involved.

Landfill #3

Landfill #3 is a 115-acre, former MSW landfill that is currently owned and formerly operated by a City, located in Southern California. The site operated as a cut and cover MSW landfill from 1954 to 1959. Reportedly, over 2 million gallons of industrial wastes were disposed on in Landfill #3.

The site is currently undeveloped. The site is bordered to the north by city streets and commercial developments, to the east by a major interstate freeway and a river, to the south by a theme park, and to the west by an ocean bay, which is used heavily fir recreational purposes. Due to its location, Landfill #3 has come under recent scrutiny from the general public in regard to the potential for contamination associated with LFG migration to adjacent properties as well as LFG and leachate migration to the ocean.

Landfill #3 is currently in the process of the development of an LFG Assessment and site investigation workplan. More details are provides in the Regulatory Oversight Issues section below.

Unique issues that arose during the LFG assessment of Landfill #3 were:

- Regulatory oversight issues and
- Alternative sources of contamination.

Regulatory Oversight Issues:
The most unique issue associated with regulatory oversight at Landfill #3 is the technical advisory committee (TAC) that has been established for the landfill assessment and remediation project. In order to address public concerns about the assessment and remediation of Landfill #3, the City formed the TAC, which is comprised of representatives from the public at-large, grassroots organizations, and city personnel. The mandate of the TAC is to assure that the investigation and assessment of Landfill #3 is performed in an open forum with the participation of the public.

Alternative Sources of Contamination:
As mentioned previously, MTBE contamination was discovered in a groundwater well located downgradient from Landfill #3. However, due to the location of this landfill in tidal marshlands, the source of MTBE was eventually traced to urban runoff from the adjacent river.

While investigations are ongoing for this site, due to its proximity to a major interstate freeway, it is anticipated that upwind and down wind samples will both contain concentrations of petroleum hydrocarbons what may be attributable to exhaust emissions from automobiles and trucks.

Landfill #4

Landfill #4 is a 348-acre former trench/cut and cover MSW landfill, currently owned by six different entities and located in Southern California. The site accepted MSW over an 11-year period (1948 through 1959) during

which an estimated 3-5 million tons of waste were disposed. The refuse has a maximum depth of 20 feet below grade.

Landfill #4 is currently divided into six different developments, which include two golf courses, a flood control channel, a major interstate freeway, an apartment complex, and a nursery. The site is bordered to the north by a county park, an elementary school, and residences, to the east by major street (with residences on the opposite side), to the south by a flood control channel and another landfill, and to the west by a city street (with two landfills and several industrial facilities located across the street). In addition, a major interstate freeway and a flood control channel bisect the site.

Landfill #4 is currently awaiting a regulatory enforcement decision by the USEPA in regard to placing the site on the National Priorities List (NPL), associated with the detection of hazardous materials in gas and groundwater beneath the site. In addition, there have been recent attempts to develop the western half of the site.

Unique issues that arose during the LFG assessment of Landfill #4 were:

- Property ownership issues,
- Adjacent land use issues,
- On-site development issues and
- Regulatory oversight issues.

Property Ownership Issues:

The coordination of LFG assessment and remediation activities between six different property owners is a difficult prospect. In order to sidestep this potential delay, the USEPA has only identified the two majority land owners as responsible parties (RPs) in regard to regulatory enforcement activities at the site. Under CERCLA, the USEPA is not obligated to identify each and every potential RP, only to identify the ones that can finance the investigation, remediation, and possible cost recovery efforts. CERCLA has provisions allowing the RPs to pursue other property owners (through litigation) to recover their costs.

In addition, historical data review indicated that refuse had been excavated and removed from the site in order to install both the interstate freeway and the flood control channel. Therefore, the fact that refuse has been removed from two of the six property owners further confuses the issue of responsibility for previous LFG migration impacts to groundwater and/or adjacent properties.

Adjacent Land Use Issues:

The primary issues associated with adjacent land use at Landfill #4 is the presence of an elementary school adjacent to the landfill to the north (across a city street). The presence of the school has brought increased public as well as regulatory scrutiny to the assessment and remediation of LFG issues at this site. For example, under their mandate to protect public schools DTSC became involved with Landfill #4 by performing a Preliminary Endangerment Assessment (PEA) (an assessment usually reserved for facilities that are sources of contamination), on the school site adjacent to the landfill. The results of the PEA are discussed in the regulatory section below.

On-site Development Issues:

The entire surface of Landfill #4 currently has some form of development. The majority of the surface of Landfill #4 is developed as open space (e.g., golf courses, airship landing field, vacant land, and nursery). Recently, the owner of the western portion of Landfill #4 was evaluating the feasibility of developing their portion of Landfill #4 with commercial/retail development.

The development plan evaluated the economic feasibility associated with the technical and environmental requirements for placing a large commercial/retail development over the landfill. This included evaluating the placement of methane mitigation (e.g., GCCS and membrane system) beneath each building, structural engineering considerations for buildings (e.g., caissons), as well as CEQA requirements associated with the project.

Regulatory Oversight Issues:

As mentioned above, currently the USEPA is considering adding Landfill #4 to the NPL. However, DTSC has offered to step in as the regulatory lead in order to forgo some of the difficulties and stigma associated with investigating and remediating an NPL site.

In addition, the results of the PEA conducted at the school identified MTBE present in shallow subsurface soils in the parking lot of the school. Subsequent delineation of the MTBE plume identified the source of contamination as the school parking lot.

Landfill #5

Landfill #5 is a 14-acre, former burn dump and MSW landfill, that is currently owned by a City and previously operated by a County, located in Southern California. The site operated as a burn dump from 1928 to 1949, and from 1949 to 1958, operated as an MSW landfill.

The site is currently developed as a City park. The site is bordered to the northwest by a flood control channel, to

the east by an apartment complex and to the north, west, and south by City streets. It should be mentioned that residences are located across all of the City streets bordering Landfill #5. In addition, a water supply well and a daycare facility are located on the opposite side of the flood control channel from the landfill, approximately 75 feet away from refuse.

Landfill #5 is currently under regulatory enforcement by the LEA in regard to perimeter gas migration monitoring probe violations along the eastern perimeter of the site (toward the residences). A gas extraction system limited to the eastern compliance perimeter is currently being installed at the site under the oversight of the LEA. Unique issues that arose during the LFG assessment of Landfill #5 were:

- Property ownership issues and
- Availability of historical information.

Property Ownership Issues:

During the initial LFG assessment, it was discovered that the footprint of the former Landfill #5 burn dump extended off of the southern boundary of the site, into the city street. However, since the city owns both the streets as well as the landfill, the only difficulties encountered with different property owners in regard to the investigation were questions in regard to the long-term integrity and stability of subsurface utilities in the street as well as the potential for street settlement.

Availability of Historic Information:

One of the unique issues that arose in regard to obtaining historical operational data for Landfill #5 was the fact that the city, who at one time had almost all of the documentation for the operational history of both the burn dump and MSW landfill, had lost the data over time. As it tuned out, over the years different various city council members and city staff were interested in potentially developing the site, and had slowing taken the various reports and files held by the City. Subsequently, once the city council or staff member left their post and returned to private life, the reports did not always return to the City.

CONCLUSIONS

As the case studies have shown, the six unique issues summarized in this paper can, and do arise associated with the post-closure care and/or development of closed and inactive urban landfills. In addition, each of these areas has a direct affect on LFG management decisions and should be considered during the assessment of LFG emissions from any closed/inactive urban landfill.

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