California Integrated
Waste Management Board

Inspection Guidance for State Minimum Standards at Closed, Illegal, and Abandoned Disposal Sites

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Cleanup Branch, Closed, Illegal, and Abandoned Sites
California Integrated Waste Management Board
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1. Introduction

The content of this manual is for inspection guidance only; the determination of a disposal site's compliance status with State of California solid waste regulations shall be based upon the conditions of the site, itself. Therefore, the inspector must be aware of the intent of, and enforce all applicable regulations when conducting an inspection of a disposal site.

1.1 Background. The inspection responsibility of Local Enforcement Agencies (LEAs) at Closed, Illegal and Abandoned Sites (CIA) is critical to the protection of public health and safety and the environment. The standards with which CIA sites must comply to protect public health and safety and the environment are relatively straight forward and focus in the areas of: gas monitoring and control, cover, grading, drainage, erosion, and security measures. These areas, however, lend themselves to interpretation as to whether a violation or an area-of-concern exists. When evaluating the condition of the landfill and the possible impacts to public health and safety and the environment, the inspector should consider, in addition to the applicable regulations, factors such as:

- the type of CIA site being inspected
- site location
- surrounding land uses and the frequency of the land uses
- the existence and proximity of sensitive receptors, whether temporary or permanent
- the land uses upon the disposal site, itself
- proposed postclosure land use of the site and adjacent properties

The inspector's historical knowledge of the site can also be useful, such as, awareness of previous site investigations and corrective remedial actions. Also, the inspector's knowledge of applicable regulations and field experience in evaluating various site conditions are beneficial to the inspection process in determining the existence of an area-of-concern or a violation.

Unlike permitted landfill facilities, operating on and after January 1, 1988, which are required to maintain financial assurances to meet the costs of remedying non-compliant operating and closure requirements, CIA sites, that closed prior to that time, are not subject to the current financial assurances requirement. Thus the availability of financial resources may be lacking to meet costly requirements in order to correct deficiencies at a CIA site. Providing the site owner the opportunity to address remedial issues while the deficiencies are considered an area-of-concern can be less costly than addressing a cited violation. For instance, repairing minor erosion of the site's cover, in which waste is not exposed, generally is less costly than remedying a violation of extensive erosion which has progressed to the point of damaging the cover and resulting in exposed waste.

While an area-of-concern can be used to address minor deficiencies, the citing of a violation can support justification to bring about more intensive requirements such as: the installation of gas controls, see figure 1, a gas monitoring network, see figure 2, installation of a final cover, drainage and erosion controls, slope reconfiguration, matting and seeding, and installation of fences and gates.

The inspector is responsible for documenting the findings of the inspection. Completed inspection forms are forwarded to the California Integrated Waste Management Board (CIWMB) for inclusion

into the Solid Waste Information System database. The documentation becomes supportive data in effecting:

- Enforcement actions, through due process
- The use of the CIWMB Solid Waste Cleanup Program, if applicable to the CIA site
- Requirements to remediate a site as a result of proposed and approved post-closure development
- Requirements to remediate the site when existing development and sensitive receptors are impacted
- The requirement to implement applicable regulatory Sections of Title 27, Chapter 3, Subchapter 5, Article 2, per Section 21100(d)

Inspection, documentation and tracking of site conditions, especially land-use changes, of CIA sites are key tasks performed by LEAs to ensure that CIA sites do not pose a threat to public health and safety and the environment. Without objective guidance, the task of inspecting CIA sites can be burdensome in determining what "compliance" or non-compliance is, with respect to a general set of standards.

Figure 1 - Gas Control for Structures

Figure 2 - Structure Monitoring

1.2 Purpose. This inspection guidance manual was developed to assist the LEA, RWQCB, and CIWMB staff in implementing best management practices in order to objectively evaluate compliance of CIA sites with applicable regulatory State minimum standards (SMS).

For the purposes of this guidance document, CIA sites are those sites which ceased operating prior to January 1, 1988, and closed under the standards in effect at the time. For inspection requirements, the applicable SMS pertaining to CIA sites are established in Subchapter 4, of California Code of Regulations (CCR), Title 27, Division 2, Chapter 3 (except for the post-closure land use standard which applies to all new post-closure development). Additionally, per Section 21100(d) of 27 CCR, Subchapter 5, the LEA may apply regulatory standards established in Subchapter 5, of CCR, Title 27, provided the LEA makes the necessary finding that the standards in Subchapter 5 are necessary to protect public health and safety and the environment. (See Appendix A)

1.3 Statutory Authority. Public Resource Code (PRC) 44100 et seq. provides statutory authority for investigating solid waste disposal sites. PRC 45013 provides statutory authority for the CIWMB to provide guidance to the LEA to inspect and investigate CIA sites. Section 18083 of CCR, Title 14, Division 7, Chapter 5, Article 2, cites the duties and responsibilities for the LEA to inspect disposal sites.

1.4 Site Access. Site access to disposal sites for inspection and investigation are authorized by Public Resources Code (PRC), Section 44101(b).

Permission is required to access all CIA sites that are privately owned, or if publicly owned are restricted from general public access for reasons, such as for public safety and military security; this may include the land area of the disposal site, structures (residential and facility) and gas monitoring systems or facility systems and other site specific conditions. Unless there is an imminent threat to public health and safety or the environment (see below), the LEA should refrain from entering a disposal site that requires consent to enter without an access agreement.

Where site access permission is required it is preferable to obtain written consent versus verbal consent, as written consent documents the site access agreement. The consent shall be from the property owner or designated agent. It is recommended that the agreement be such that access is authorized to accommodate the inspection frequency requirements per Title 14 of the CCR. Where consent for site access is denied, the LEA must then obtain a warrant for site access through the appropriate judicial court. Additionally, in cases where an inspection warrant was duly obtained and access is still denied by the property owner or designated agent, or if the inspector has reason to believe that personal safety is threatened by an individual or individuals, then it is recommended that the local police, sheriff, or appropriate law enforcement agency should be contacted to accompany the inspector during the inspection. If necessary, site conditions can possibly be observed through aerial surveillance or viewed from adjacent property or easements that are open to general public access until access authority can be obtained and arrangements made to enter the site. If an LEA makes an off-site observation that an imminent threat to public health and safety or the environment exists at the site, the LEA should consider ones personal safety and contact the agency best suited to respond to the threat (or otherwise ensure that such agency is contacted), and await their arrival and defer to their authority to allow them to enter the affected site. The LEA should not enter the site unless so requested by the responding agency to enter and assist under their authority and so long as issues relating to the LEA's personal safety in assisting are adequately addressed.

CIA sites, that are located within properties which are open to the general public, such as a disposal site that is utilized as a public park or recreation area, may be accessed for inspection by the LEA as required. It is recommended that the LEA be aware of operating hours of the public property or facility and conduct inspections when the hour is unrestricted. It is also recommended that the LEA inform the responsible public agency for the site of the site inspection requirements per Titles 14 and 27 of the CCR. This may be a one-time notification and written notification is preferable.

An example of a site access agreement form is provided on the CIA website at http://www.ciwmb.ca.gov/LEACentral/Forms/#CIA.

1.5 Inspection Forms. Closed site inspection form, CIWMB 188, is used to document the results of CIA inspections and to provide information for inclusion in the CIWMB's Solid Waste Information System (SWIS) database. This database is used for a variety of purposes to include tracking compliance, investigations, permit status, etc. The form is available at http://www.ciwmb.ca.gov/LEACentral/Forms/default.htm#CIA. (See Appendix B).

1.6 Site Investigation Process. The site investigation process (SIP) was developed by the CIWMB to assist LEAs with a "one-time" collection of site data and information for CIA sites. The SIP provides criteria to determine if further actions (e.g., investigation, enforcement, remediation) are warranted. The SIP can also be used for justification of inspection frequency reductions. Additionally, the SIP is designed to provide technical assistance to LEAs in assessing SMS (e.g., gas migration, cover, grading, drainage, erosion control, security) at CIA sites. CIWMB staff uses

the SIP as a “screening” tool to prioritize sites for investigation and remediation. SIP guidance can be found at: http://www.ciwmb.ca.gov/LEACentral/CIA/SIP/.

1.7 Site Inspection Preparation. Determining compliance of a site with state minimum standards requires site information and data collection prior to physical inspection of the site. The type of information to be collected can be found on SIP forms. Generally gas, cover, grading, drainage and erosion conditions at a site require a site specific understanding of historical gas monitoring data (figure 3), gas monitoring network construction, site topography, regional hydrology, subsurface geology (figure 4), surface soils and land-uses. This understanding can come from environmental investigation reports (e.g. Air and Water Solid Waste Assessment Test (SWAT) reports), through conducting the SIP process, or performing a phase I office investigation and/or phase II field investigation. The purpose of a physical (visual) inspection of the site is generally to ascertain land-uses; determine evidence of drainage problems, erosion or inadequate cover (daylighting of waste); check for an adequate gas monitoring network; and potentially screen landfill gas monitoring probes to compare results to historical readings. Through preparation, research, and physical inspection the LEA can adequately assess site conditions to determine if additional information or field data is needed or that a violation or area of concern does or does not exist.

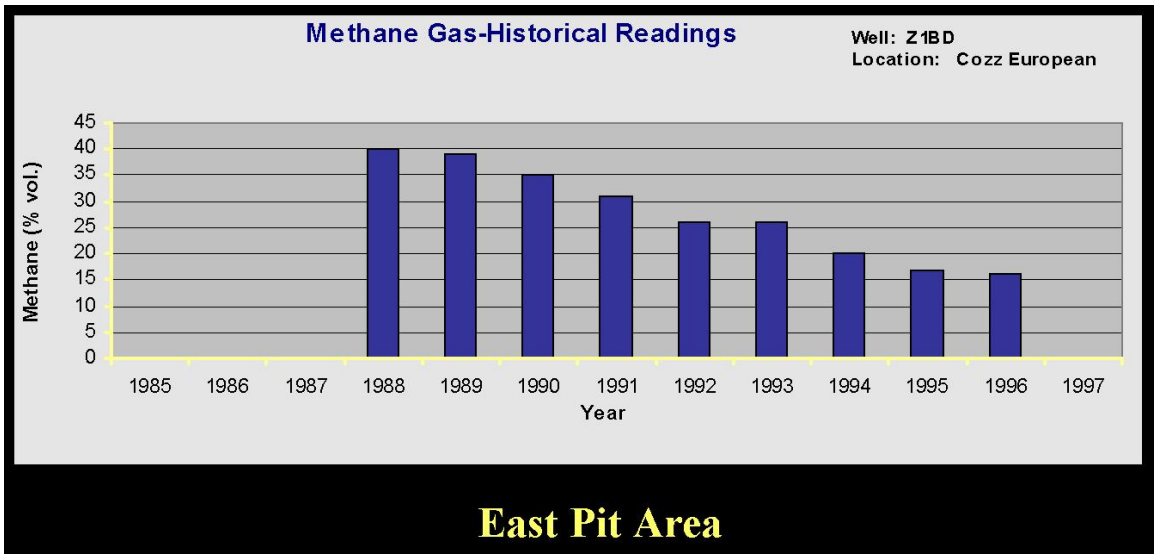

Figure 3 - Gas Monitoring Data (Time-Trend Analysis on a Gas Monitoring Probe)

BAS BORING LOG

Date 4-9-01 Boring No. B-L1 Sheet 1 of 1

Project Name NEWPORT TERRACE CONDOMINIUMS Job No. 9968-BRB1

Drilling Co. GREGG DRILLING Type of Rig DIRECT PUSH

Hole Diameter 2-INCH Drive Weight NA Drop NA

Elevation Top of Hole _____ Reference or Datum _____

Depth Feet	Graphic Log	Sample Number	Soil Class. U.S.C.S.	OVM (ppm)	SOIL DESCRIPTION Logged by R. BAUER Sampled by R. BAUER
			SM		Shrubs Gray silty SAND, topsoil, rootlets, moist.
					TRASH / REFUSE
5					
					2-17' Plastic, metal, green waste, glass, newspapers, slightly moist, with green-black sand and clay soil, strong petroleum odor. Tile and concrete fragments from 9-13'.
10					
			WASTE		
15					
					17-21' Trash and refuse, glass, paper, plastic, metal, newspapers with a green-black sandy clay soil. Very strong LFG odor, methane measured at 46%.
20					
					21-27' Trash and refuse, glass, plastic cardboard and newspapers, dry to slightly moist.
25					
					NATIVE
		SL1-29	SC		27-29' Light yellow-brown clayey SAND, very fine grained, dry to slightly moist, with orange iron staining laminations.
30					TD=29 FT. NO GW. GAS PROBE FROM 17-27 FEET. TRASH 2-27 FEET

Figure 4 - Boring Log (Site subsurface geology)

1.8 Illegal Disposal Sites. Application of SMS for cover, grading, drainage, erosion control, and gas monitoring and control to illegal disposal sites is not appropriate. Illegal disposal sites should be investigated and then appropriate enforcement actions should be taken against the current property owner for removal of waste from the property (clean closure). Procedures for clean closing a site can be found at http://www.ciwmb.ca.gov/LEAAdvisory/16/. Alternatively, although unlikely, the owner could obtain a solid waste facility permit to make the "illegal" site legal. If this occurs the site no longer is a CIA site but an active solid waste facility.

Figures 5, 6, and 7 are examples of illegal disposal sites.

Figure 5 - Illegal Disposal Site

Figure 6. - C&D Disposal Site Fire

Figure 7 - Illegal disposal occurring at easily accessed remote areas

1.9 Document Organization. This document is organized by topic area. Within each topic area there are three (3) sections: background, standard, and compliance factors. Background provides baseline information; Standard quotes the applicable CIA site standard; and Compliance Factors lists the factors to be considered in determining the status of a site.

2. Gas Monitoring & Control

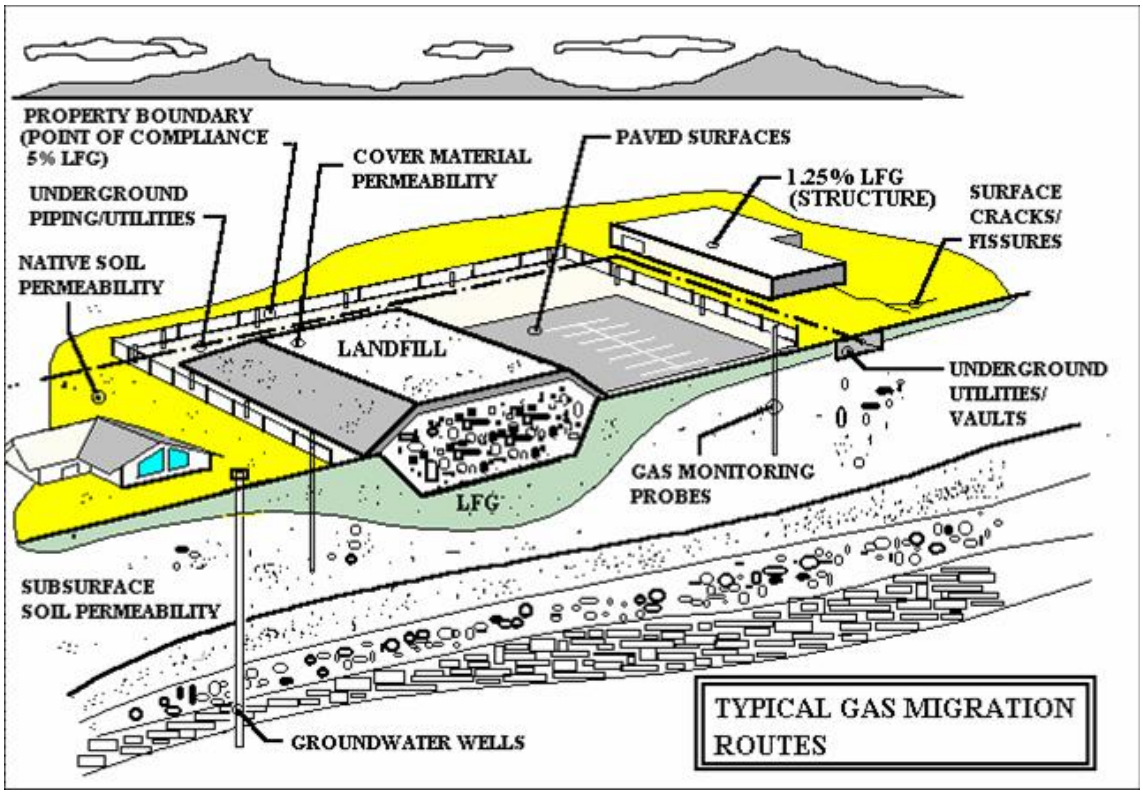

Figure 8 - Typical Gas Migration Routes from a Disposal Site

2.1 Gas Monitoring and Control at Disposal Sites. In May 2003, a 32-year old, New York City Engineer who entered a manhole near a landfill to retrieve a storm water flow meter, was asphyxiated and killed when he was overcome by landfill gas that had migrated into the confined space and displaced ambient oxygen levels to less than 1%. Landfill gas migration occurring in developed areas is probably the greatest single threat to public health and safety from closed disposal sites. Left unchecked, migrating landfill gas in explosive concentrations can and has entered dwellings, utility corridors, wells, and construction excavations. Federal and State Regulations, relating to the monitoring and control of landfill gases, were promulgated specifically for the purpose of protecting public health and safety from landfill gas migration hazards (40 CFR Subtitle D and 27 CCR Section 20925). With the rapid growth of many California cities, especially into former outlying "city limit" rural areas, determining impacts and mitigations from old closed disposal sites is critical to the protection of public health and safety. Therefore, it is extremely important for landfill inspectors to ensure that adequate and documented gas monitoring data is available before determining that landfill gas control is not necessary for the site (issuing a waiver pursuant 27 CCR Section 20919).

Many closed disposal sites do not have adequate gas monitoring systems which meet the monitoring network and well construction requirements of 27 CCR Section 20925 (e.g., 1000 ft spacing between wells, multi-depth wells, wells bored to the depth waste, and are gravel packed and well-bore sealed between intervals, see figures 9. If a site does not have an adequate monitoring network, it is unlikely that adequate monitoring data would be obtained to show that no potential exists for gas migration from the site to adjacent properties. Since methanogenic

processes are dependent on the moisture content of the waste, changing hydrologic conditions at a site can influence the production of landfill gas.
These changes could be due to rainfall, run-off, fluctuations in groundwater elevations, or other factors.
.
Surface permeability and subsurface construction can impact the conditions under which gas migrates laterally from the site, see figure 8. These uncertainties in site conditions predicate that landfill gas monitoring data be taken over a period of time (a minimum of two years) and a specified frequency, e.g. quarterly or monthly. Single or "one-time" sampling events are generally not adequate because monitoring data is taken at a specific time and will not reflect the temporal nature of gas production at a site due to local hydrologic conditions impacting moisture content of waste.

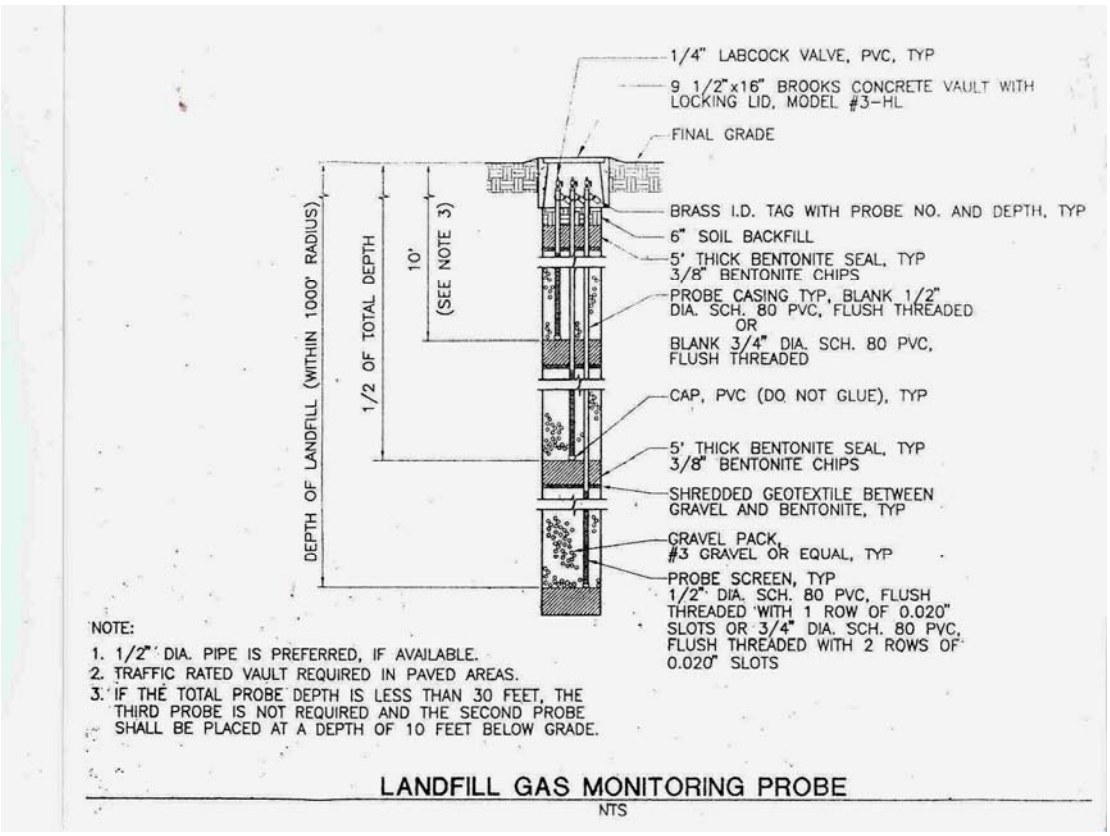

Figure 9 - 27 CCR Section 20925 Gas Monitoring Probe Construction (typical)

2.2 Standard – Gas Control

20919. CIWMB - Gas Control. (T14:Section 17705)

Where the enforcement agency, the local fire control authority, or the CIWMB has cause to believe a hazard or nuisance may be created by landfill decomposition gases, they shall so notify the owner. Thereafter, the site owner shall cause the site to be monitored for presence and movement of gases, and shall take necessary action to control such gases. The site owner shall inform the operator of any actions ordered by the EA, the local fire control authority or the CIWMB concerning gas control methods. The monitoring program shall be developed pursuant to the specifications of the above agencies. The monitoring program shall not be discontinued until

authorized to do so in writing by the requiring agency. Results of the monitoring shall be submitted to the appropriate agencies. If monitoring indicates methane gas movement away from the site, the owner shall, within a period of time specified by the requiring agency, construct a gas control system approved by that agency. The agency may waive this requirement if satisfactory evidence is presented indicating that adjacent properties are safe from hazard or nuisance caused by methane gas movement. The operator shall duly inform the disposal site owner of possible landfill gas problems.

2.3 Compliance Factors – Gas Control. For a site that has sensitive land-uses, i.e. residential, school, etc., and received unburned MSW which has indications of differential settlement and where gas generation is typical of local climatic and hydrologic conditions (or if Air SWAT was performed and indicated gas was present):

- Is an adequate (and LEA approved) gas monitoring network in place (27 CCR 20925 specifies monitoring probe construction, consideration of structures, receptors, geology, etc.)? SWAT probe data is suspect (Figure 10) since the methodology for placing SWAT probes was to drive a 6-ft long steel pipe containing a small sampling hole in its tip into the ground. For sites with no sensitive land-uses on or adjacent to the disposal site, a more flexible schedule for complying with gas monitoring and control regulations may be acceptable. However, any waiver to gas monitoring and control requirements, especially where sensitive land-use may be proposed or considered, must be substantiated by gas monitoring data.

- Are sensitive receptors (e.g., residential development, public access areas, etc.) located nearby?

- Is Historical documentation of gas monitoring data is available (monthly or quarterly frequency for minimum 2 yr period)?

- Does gas monitoring data for the site exceed 5% by volume in air at the property boundary or 1.25% by volume in air in structures based on monitoring data?

- Have gas controls been implemented where monitoring probes have exceeded 5% by volume in air at the facility property boundary or 1.25% by volume in air in onsite structures (gas extraction system, perimeter barrier trench, gas alarms for structures, etc., see Figure 11.

- Are enclosed, inhabitable structures on top of or near the landfill?

- Has an Air SWAT been performed, and if performed did probes or internal landfill gas samples contain significant concentrations of landfill gas, e.g. >5% by volume in air

- Have the waste extents been adequately defined through non-intrusive and/or intrusive investigation (drilling or trenching) to determine if structures are on or within 1000 ft of waste and that gas monitoring probes are not located in waste?

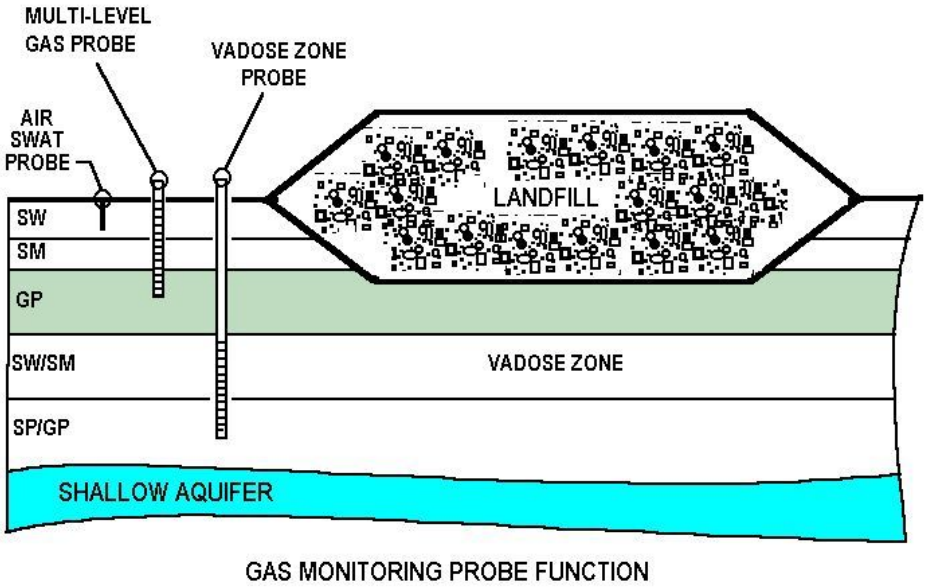

Figure 10 - Air SWAT Probe shown relative to 27 CCR Probe

Figure 11 - Continuous Monitoring Equipment

3. Grading of Fill Surfaces (Cover)

3.1 Disposal Sites. Landfill cover protects public health and safety by providing a physical barrier between buried waste and receptor populations. A final cover can:

- prevent waste contents from becoming airborne contaminants (such as lead contaminated soil, asbestos products, etc),
- provide a barrier and conveyances against surface water intrusion due to storm water run-on and run-off
- reduce or prevent release of odors, methane gas
- reduce or prevent vector access, such as rodents, to buried trash
- prevent attractions, such as children, and bottle hunters

Poorly covered and graded sites can increase the hazards and risks of landfilled wastes by exposing receptors to physical and airborne hazards. A poorly graded site can degrade surface water by allowing contact with waste and forming leachate or water intrusion through landfilled areas. Poorly graded sites can also cause maintenance issues such as cover erosion. A well-designed and constructed final cover not only provides the greatest risk reduction from hazards posed by landfilled waste but also minimizes the need for long-term maintenance and may reduce long-term costs.

3.2 Standard – Grading of Fill Surfaces (Cover)

20650. CIWMB - Grading of Fill Surfaces. (T14:Section 17710)

Covered surfaces of the disposal area shall be graded to promote lateral runoff of precipitation and to prevent ponding. Grades shall be established of sufficient slopes to account for future settlement of the fill surface. Other effective maintenance methods may be allowed by the enforcement agency

3.3 Compliance Factors – Grading of Fill Surfaces (Cover)

- Is there a minimum of two feet of clean soil cover? How was this verified?

- Is cover graded to 3% and compacted (85%)?

- Is the covered graded and sloped to minimize run-off velocity (and subsequent erosion problems)? Does cover have no slopes, e.g. 1/2:1, 1:1, 2:1 that would cause erosion problems (3:1 and 4:1 slopes would be considered OK)? For slopes steeper than 3:1, is a 15-ft wide bench in place for each 50 vertical feet of rise. Are slope lengths for slopes steeper than 4:1no greater than 100 feet?

- Does cover have adequate vegetation to prevent soil loss?

- Have the waste extents been adequately defined (horizontal and vertical) through non-intrusive and intrusive investigation to ensure all waste is adequately covered and graded?

- Is there evidence of exposed waste due to nominal cover, erosion, steep slopes or vandalism?
- Have waste characteristics been determined through sampling and analysis (are there hazardous levels of lead)?
- Is there ponding water at deck areas (differential settlement could also cause)?
- Is the cover soil highly erodible (silty-soil)?
- What type of erosion controls are in place to prevent damage to the cover (drainage controls, grading and slopes, vegetation, erosion-control mats)?

Figures 12 and 13 depict inadequate and damaged cover. Figure 14 depicts historical data regarding a site investigation to determine cover thickness. Figures 15, and 16, depict adequate cover after completion of a site remediation.

Figure 12 - Inadequate cover

Figure 13 - Vectors damaging cover

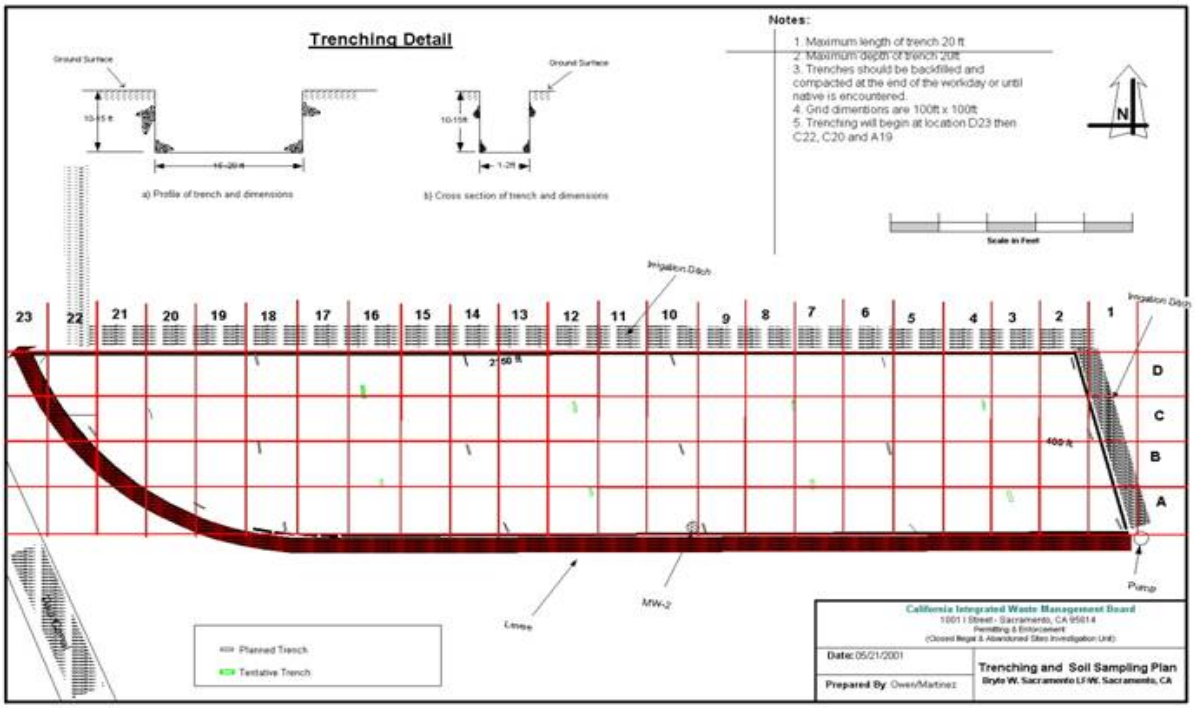

Figure 14 - A trench location plan used to determine the horizontal and vertical extent, and cover thickness of a disposal site

Figure 15 - Final Cover Grades

Figure 16 - Slope Cover

4. Drainage & Erosion Control

4.1 Drainage & erosion conditions at disposal sites. Whether or not significant capital drainage improvements are required at a site depend on the regional watershed conditions where the site is located. An impact on old disposal sites in terms of cover erosion, storm water intrusion and an increase in gas production or moisture content due to hydrologic "loading" at a site depends on the quantity of water a site receives from local hydrologic conditions. In topographically significant sites, e.g. mountains, hills and ravines, storm water is shed and confluence in rivers, creeks, streams, or seasonal streams. Disposal sites that are located in hydrologically significant watersheds may need to have drainage conveyances and storage constructed to handle overland flows that may cause cover erosion and water intrusion. Note that disposal areas that are in tidal areas or situated in areas with shallow water tables, are also located in hydrologically significant areas, however the impact on these sites is from groundwater which may impact landfill gas production, but may not impact cover erosion.

Storm water and wind erosion damage to a landfill cover is both difficult to repair and increases the long-term post-closure maintenance and repair costs for the cover. Erosion of a landfill cover can cause waste to be exposed and reduce the thickness of the cap. Carefully planned grading and drainage design measures can reduce cover erosion through reducing run-off flows and velocities and specifying surface erosion controls such as vegetative covers, erosion-net, straw-crimping or rock armoring. These improvements, performed initially will minimize long-term maintenance care and repair costs as well as increase the aesthetic value of the disposal area.

Inspection for erosion damage to final cover systems requires that an inspector is aware of regional watershed conditions that may impact run-on to the site, and be familiar with final cover grading contours and drainage features of the site which promote run-off. Erosion often occurs due to storm water flows and velocities that exceed drainage design capacities and "blow-outs" may occur along drainage features.

4.2 Standard – Drainage and Erosion Control

20820. CIWMB - Drainage and Erosion Control. (T14:Section 17708, 17715)

(a) The drainage system shall be designed and maintained to:

(1) ensure integrity of roads, structures, and gas monitoring and control systems;

(2) prevent safety hazards; and

(3) prevent exposure of waste.

4.3 Compliance Factors – Drainage and Erosion Control

- Was site designed and constructed with drainage control system?
- Is offsite run-on of water diverted or managed using drainage channels and conveyances, berms, energy dissipation devices, etc.?

- Is on-siite run-off diverted, slowed, captured using berms, swales, conveyances (trapezoid channels, v-ditches, energy dissipation, rip-rap pads, deck berms, sedimentation basins, etc.)?

- Is site graded and sloped to control overland flow quantities and velocities?

- Does site have soils with low erodibility, (e.g., high in clays, sands, gravel, etc.)?

- Do slopes and grading or drainage control prevent erosion, (e.g., short and shallow slope lengths, low-overland flow velocity (non-erosive velocity)?

- Is there lush cover vegetation or erosion control matting (straw crimping or rock armoring)?

- Is there significant offsite run-on to manage from local watershed (canyons, hills, confluence areas), which requires diversion? A regional topographic relief map, e.g. 10 mile radius of site, should be reviewed to determine the impacts of the watershed on the site.

- Is there ponding water on flat deck areas (differential settlement could also cause)?

- Are there signs of cover erosion from overland flow, e.g. “erosion rilling”?

- Is drainage or drainage confluences causing cover erosion?

- Is drainage carrying trash or leachate from landfill to nearby surface water?

- Has eroded cover caused waste to be exposed?

- Is site drainage functioning according to plans (e.g., discharge to correct location and causing damage)?

- If applicable, is the sedimentation pond of adequate size?

Refer to Figures 17 through 19 for an example of slope design, and examples of drainage and erosion problems cited at various disposal sites.

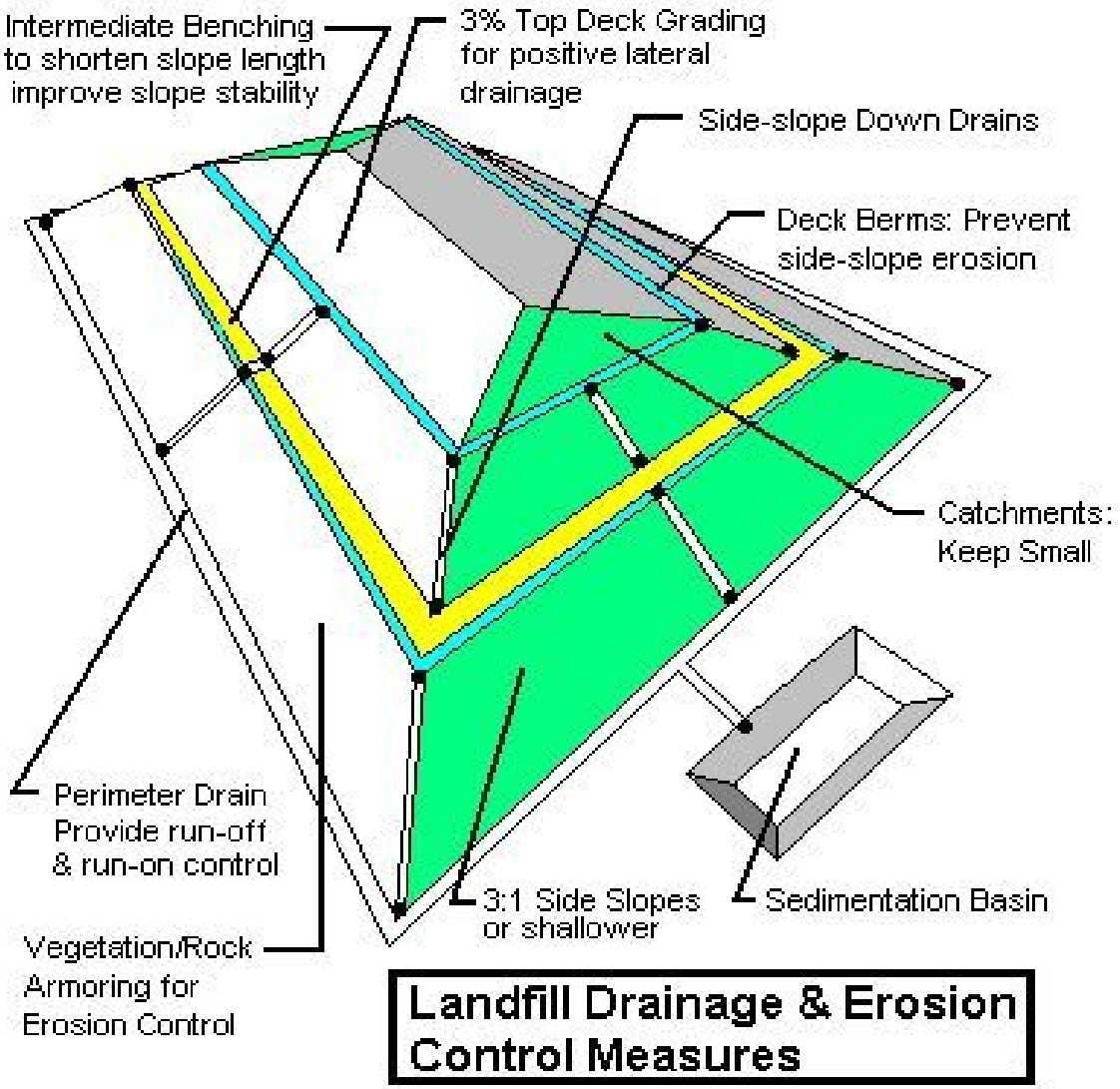

Figure 17 - Landfill Drainage and Erosion Control Measures

Figure 18 - Ponding on Landfill Surface

Figure 19 - Examples of Erosion Damage. Photos1& 3 - Slope Erosion Rills due to erodible soil, lack of vegetative cover, control of run-on to slope, Photo 2 - Massive slope erosion due to erodible soils, large watershed confluence area, high run-off velocity, oversteepened waste slope, Photo 4 - Erosion damage due to large drainage confluence area and erodible soils.

Photo 1

Photo 2

Photo 3

Photo 4

5. Security Standard

5.1 Security at Disposal Sites. Land-use encroachment (residential development of adjacent properties) and Illegal disposal activities at closed disposal sites are the primary security concerns for many closed disposal sites. Vandalism of closed site improvements, monitoring wells and gas control systems may also be a security concern. Since many municipal sites had been operating many years prior to closing, local populations may continue to illegally dispose of wastes on the property or along access roads to the property if no adequate physical barriers, deterrence or security measures are in place. Typically security violations are not normally cited by themselves, but usually in conjunction with another violation or areas of concern for another standard, e.g. gas, cover, drainage. Security measures are most important when illegal disposal activities are occurring at a site. Generally an owner will have to reduce or minimize access through physical barriers such as fencing, gates and road blocks. Posted signs should also be placed to warn trespassers of potential consequences of illegal disposal.

5.2 Standard – Site Security

20530. CIWMB - Site Security. (T14:Section 17658)

The site shall be designed to discourage unauthorized access by persons and vehicles by using a perimeter barrier or topographic constraints. Areas within the site where open storage or ponding of hazardous materials occurs shall be separately fenced or otherwise secured as determined by the EA. The EA may also require that other areas of the site be fenced to create an appropriate level of security

5.3 Compliance Factors – Site Security

- Is the site in an urban area, with residential encroachment with no adequate personnel, or vehicular access barriers, especially if other standards are in violation (gas, cover, drainage, etc.)? Note: this type of violation would not normally apply to developed sites with approved post-closure land use (PCLU) applications (e.g., golf course, soccer field, park, etc.)

- Are illegal disposal activities or nuisance dumping evident?

- Is there evidence of vandalism of landfill monitoring and control devices such as gas monitoring probes, ground water wells, landfill gas control system components?

- Is there evidence of digging or excavation of waste, removal of blue bottles, scavenging activities ("bottle hunting")?

- Is there a “legacy" or local history of site indicating illegal dumping, illicit activities, "meeting place", etc.?

- Is there evidence of unauthorized pedestrian and vehicular access?

- Is there evidence of people illegally living on site, such as make-shift shelters

Figures 20 through 23 are examples of sites that are in compliance and non-compliance with site security standards.

Figure 20 - Adequate site security

Figure 21 - Security issue, a makeshift shelter

Figure 22 - Unauthorized activity (paintball games)

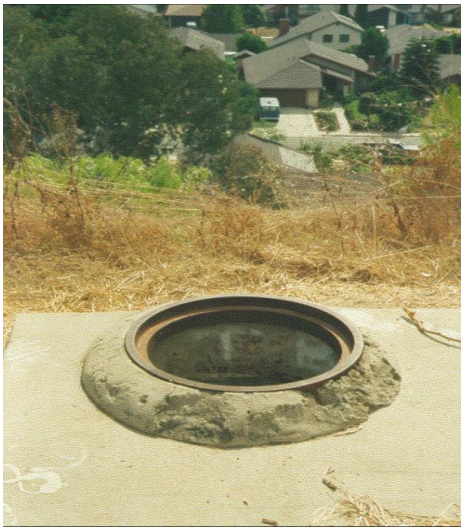

Figure 23 - Hazardous opening near a residential area

6. Post-Closure Land-Use Standard

6.1 Post-closure land use (PCLU) at CIA Sites. The development of closed disposal sites in California has caused many concerns regarding public health and safety from hazards associated with disposal sites such as landfill gas migration, differential settlement, and waste exposure due to excavation activities. Many old disposal sites with post-closure land uses exist in primarily developed areas of California, particularly in southern California (Los Angeles, Orange, and San Diego Counties) and in certain areas of northern California (Bay Area Counties and Sacramento and surrounding counties). The development of disposal sites which were not provided with mitigation measures for typical hazards have led to many enforcement actions by LEAs to protect public health and safety. The “in-fill” development is encroaching on many former municipal landfills and disposal sites that are located at the fringe of cities and populations centers. The review of land use for disposal sites and implementation of construction standards for building structures near disposal sites are critical to the protection of public health and safety from hazards posed by landfilled waste.

A former gravel quarry, landfilled in the 1960s, was developed into a commercial tract development in the 1970s. During and subsequent to the development of the site, issues to protect public health and safety and the environment arose. One worker, who was installing pilings for a warehouse foundation, was killed while trying to retrieve a drill bit from a piling hole (displacement of air by landfill gas had caused an oxygen deficient environment in and near hole). Throughout the 1980s and 1990s, issues, of explosive conditions in buildings due to gas migration and detection of explosive levels of gas at the boundary gas probes, were cited and documented by the LEA during inspections of the site. Differential settlement occurred that caused damage to building foundations, lot grades, and utility systems, and adversely impacted drainage. Several properties required expensive grading projects to correct settlement problems (the cost of many of these grading projects exceeded the original purchase value of the property). The site is currently undergoing a plan to remedy gas and settlement issues almost 24 years later.

Technical, economic, and legal issues, pertaining to disposal areas within a site to be developed, should be considered and addressed during the planning stage of the project. Also, during the planning stage, the project developers should contact governmental regulatory agencies to identify regulatory requirements pertaining to the disposal area. These issues and requirements may include: (a) defining the horizontal and vertical extents of the waste; gas migration, cover, grading, drainage, and erosion conditions; waste characteristics for disposal site classification; and differential settlement impacts, (b) determining land use restrictions, institutional controls, and real estate disclosure criteria and (c) costs for maintenance and repair of closure improvements. If these feasibility issues and costs are not considered in the planning and development stages of a project, problems such as gas migration and damage to foundations and utility systems from differential settlement can occur which are both difficult and costly to remedy and repair after development. In one case an auto dealership was constructed over a 3-acre landfill in the early 1980s. The development encountered both gas migration and differential settlement problems that eventually led to demolition of the building in 1999. Costs for construction, mitigation and finally demolition are estimated at over $2 million (does not include litigation, court costs, settlements, and fines).

It should be noted that the PCLU standards apply to any developments proposed for disposal sites after November 1989.

6.2 Standard – Post-Closure Land Use. State Minimum Standards for Post-closure land-use of disposal sites in California can be found in 27 CCR Section 21190. PCLU regulations were enacted in 1989 as part of the integrated waste management statutes to control and mitigate the effects of development on population and environmental receptors. All proposed or planned PCLUs must be submitted and approved by the local enforcement agency (LEA) prior to implementation:

21190. CIWMB – Post-closure Land Use. (T14:Section 17796)

(a) Proposed post-closure land uses shall be designed and maintained to:

(1) protect public health and safety and prevent damage to structures, roads, utilities and gas monitoring and control systems;

(2) prevent public contact with waste, landfill gas and leachate; and

(3) prevent landfill gas explosions.

(b) The site design shall consider one or more proposed uses of the site toward which the operator will direct its efforts, or shall show development as open space, graded to harmonize with the setting and landscaped with native shrubbery or low maintenance ground cover.
(c) All proposed post-closure land uses, other than non-irrigated open space, on sites implementing closure or on closed sites shall be submitted to the EA, RWQCB, local air district and local land use agency. The EA shall review and approve proposed post-losure land uses if the project involves structures within 1,000 feet of the disposal area, structures on top of waste, modification of the low permeability layer, or irrigation over waste.
(d) Construction on the site shall maintain the integrity of the final cover, drainage and erosion control systems, and gas monitoring and control systems. The owner or operator shall demonstrate to the satisfaction of the EA that the activities will not pose a threat to public health and safety and the environment. Any proposed modification or replacement of the low permeability layer of the final cover shall begin upon approval by the EA, and the RWQCB.
(e) Construction of structural improvements on top of landfilled areas during the post-closure period shall meet the following conditions:

(1) automatic methane gas sensors, designed to trigger an audible alarm when methane concentrations are detected, shall be installed in all buildings;

(2) enclosed basement construction is prohibited;

(3) buildings shall be constructed to mitigate the effects of gas accumulation, which may include an active gas collection or passive vent systems;

(4) buildings and utilities shall be constructed to mitigate the effects of differential settlement. All utility connections shall be designed with flexible connections and utility collars;

(5) utilities shall not be installed in or below any low permeability layer of final cover;

(6) pilings shall not be installed in or through any bottom liner unless approved by the RWQCB;

(7) if pilings are installed in or through the low permeability layer of final cover, then the low permeability layer must be replaced or repaired; and

(8) periodic methane gas monitoring shall be conducted inside all buildings and underground utilities in accordance with section 20933 of Article 6, of Subchapter 4 of this Chapter.

(f) The EA may require that an additional soil layer or building pad be placed on the final cover prior to construction to protect the integrity and function of the various layers of final cover.
(g) All on site construction within 1,000 feet of the boundary of any disposal area shall be designed and constructed in accordance with the following, or in accordance with an equivalent design which will prevent gas migration into the building, unless an exemption has been issued:

(1) a geomembrane or equivalent system with low permeability to landfill gas shall be installed between the concrete floor slab of the building and subgrade;

(2) a permeable layer of open graded material of clean aggregate with a minimum thickness of 12 inches shall be installed between the geomembrane and the subgrade or slab;

(3) a geotextile filter shall be utilized to prevent the introduction of fines into the permeable layer;

(4) perforated venting pipes shall be installed within the permeable layer, and shall be designed to operate without clogging;

(5) the venting pipe shall be constructed with the ability to be connected to an induced draft exhaust system;

(6) automatic methane gas sensors shall be installed within the permeable gas layer, and inside the building to trigger an audible alarm when methane gas concentrations are detected; and

(7) periodic methane gas monitoring shall be conducted inside all buildings and underground utilities in accordance with Article 6, of Subchapter 4 of this chapter (section 20920 et seq.).

6.3 Compliance Factors – Post-closure Land Use

- Is a development proposed for a documented disposal site (e.g., receiving inspections by the LEA)?
- Has a post-closure land use plan been submitted to the LEA for approval?
- Have gas migration mitigations (e.g. continuous monitoring systems, foundation gas barriers, etc.) been installed or proposed for structures constructed on or within 1000 feet of a disposal site especially at sites with documented gas violations at the property boundary?

- If developer discovers undocumented disposal site during site investigation or site development, does developer seek LEA approval/coordination for the development that is already in progress?

- Is gas migration documented and exceeds the 1.25% by volume in air in structures and 5% by volume in air at the property boundary?

- Is an investigation, monitoring, or mitigations proposed for landfill gas migration, cover or differential settlement as part of development plans?

- Is gas monitoring data available from an approved gas monitoring network especially if residential land-uses are proposed on or adjacent to the site?

- Are buildings or other enclosed structures are sited over landfilled waste?

- Is investigation data or information available on the waste extents or cover?

- Will subdivision into multiple parcels of the original landfill property occur as part of development? *Subdivision of the landfill will cause technical and legal feasibility issues with respect to investigation and remedy of disposal site conditions. Enforcement of disposal site standards for multiple property owners can cause complex litigation, depending on whether or not a single association represents the owners. Subdivision makes remedial measures difficult to implement due to site access, building structures and utilities, and redesignated property lines with respect to original landfill boundaries.*

Figures 24 through 26, below, depict various types of post-closure development that can take place on and adjacent to CIA disposal sites.

Figure 24 - Aerial photo depicts condominiums located adjacent to landfill area (park with trees)

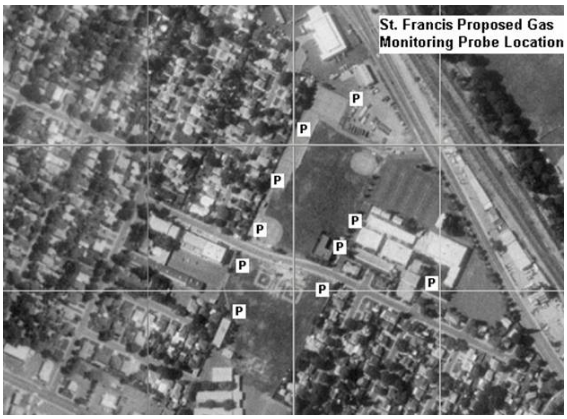

Figure 25 - Aerial photo depicts school campus and surrounding residential area

Figure 26 - Commercial Development of Landfill

APPENDIX A

State Minimum Standards – CIA Sites			
Applicable Sections and Articles of Title 27, Chapter 3, Subchapter 4 for CIA sites		Applicable Sections and Article of Title 27, Chapter 3, Subchapter 5 when Section 21100(d) is applied to CIA sites, as required by the LEA	
Section 20530, Article 1	Site Security	Section 21135, Article 2	Site Security
Section 20650, Article 1	Grading of Fill Surfaces (Cover)	Section 21140, Article 2	Final Cover
Section 20820, Article 4	Drainage and Erosion Control	Section 21150, Article 2	Final Grading
		Section 21190, Article 2	Post Closure Land Use
Note: Section 20919 – Gas Control – is applicable to CIA sites where landfill gas is being generated or is suspected of being generated. Additional sections of the Gas Standard may also apply, as necessary.			
Section 20919, Article 6, Title 27, Chapter 3, Subchapter 4	Gas Control		

Appendix B

State of California
CIWMB 188
(Rev 01/07)

California Integrated Waste Management Board

Closed Disposal Site Inspection Report

Blue or Black Ink Pen

Page 1 of ___

Enforcement Agency:

FACILITY FILE NUMBER (99-xx-9999)
__ __ – __ __ __ – __ __ __ __

INSPECTION DATE (MM/DD/YYYY)
/ /

PROGRAM CODE *(Select only one code)*
◯LEA Periodic ◯CIWMB Closed Sites ◯CIWMB Focused
◯LEA Focused ◯CIWMB Enforcement Agent ◯CIWMB Periodic

Time In:
Time Out:
Inspection Time

For Official CIWMB Use Only
Received Date
◯**Attachments On File (Not Scanned)**

Facility Name

Received By (Operator) Signature

Facility Location

Owner Signature (if present)

Inspector

Inspector Signature

Also Present (Name)

THE ABOVE FACILITY WAS INSPECTED FOR COMPLIANCE WITH APPLICABLE SECTIONS OF DIVISION 30 OF THE PUBLIC RESOURCES CODE (PRC), AND TITLE 14 AND TITLE 27 CALIFORNIA CODE OF REGULATIONS (CCR).

THE STANDARDS BELOW ARE CONSIDERED IN COMPLIANCE UNLESS OTHERWISE MARKED WITH ONE OF THE FOLLOWING: V=VIOLATION A=AREA OF CONCERN

POSTCLOSURE	V	A
20750 - SITE MAINTENANCE	◯	◯
21180 - POSTCLOSURE MAINTENANCE	◯	◯
21190 - POSTCLOSURE LAND USE	◯	◯
GAS MONITORING AND CONTROL SYSTEMS		
20918 - EXEMPTIONS	◯	◯
20919 - GAS CONTROLS	◯	◯
20919.5 - EXPLOSIVE GAS CONTROL	◯	◯
20921 - GAS MONITORING AND CONTROLS	◯	◯
20923 - MONITORING	◯	◯
20925 - PERIMETER MONITORING NETWORK	◯	◯
20931 - STRUCTURE MONITORING	◯	◯
20932 - MONITORED PARAMETERS	◯	◯
20933 - MONITORING FREQUENCY	◯	◯
20934 - REPORTING	◯	◯
20937 - CONTROL	◯	◯
GRADING/FINAL COVER		
20650 - GRADING OF FILL SURFACES	◯	◯
21140 - FINAL COVER	◯	◯
21142 - FINAL GRADING	◯	◯
21145 - SLOPE STABILITY	◯	◯

DRAINAGE AND EROSION CONTROL	V	A
20820 - DRAINAGE/EROSION	◯	◯
21150 - DRAINAGE/EROSION CONTROL	◯	◯
MONITORING AND CONTROL SYSTEMS		
20790 - LEACHATE CONTROL	◯	◯
20830 - LITTER CONTROL	◯	◯
21160 - LF GAS CONTROL/LECHATE CONTACT	◯	◯
SECURITY		
20530 - SITE SECURITY	◯	◯
21135 - SECURITY AT CLOSED SITES	◯	◯
21137 - STRUCTURAL REMOVAL	◯	◯
RECORDS		
21130 - EMERGENCY RESPONSE PLAN	◯	◯
21170 - RECORDING	◯	◯
21200 - CHANGE OF OWNERSHIP	◯	◯
CLOSURE PLANS		
21880 - CERTIFICATION OF CLOSURE	◯	◯
21890 - REVISION OF APPROVED PLANS FOR C/PC MAINTENANCE	◯	◯
OTHER		
	◯	◯
	◯	◯
	◯	◯

Comments: *(Note: for additional or continued comments use the CIWMB 03 or attach additional pages.)*

INSTRUCTIONS ON BACK **Correct:** ● **Incorrect:** ⊘ ⊘ ✓

E X A M P L E 1 2 3

Top White - CIWMB Middle Pink - LEA Bottom - Yellow