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Understanding Landfill Gas Standards For Active Sites

**Prepared by:
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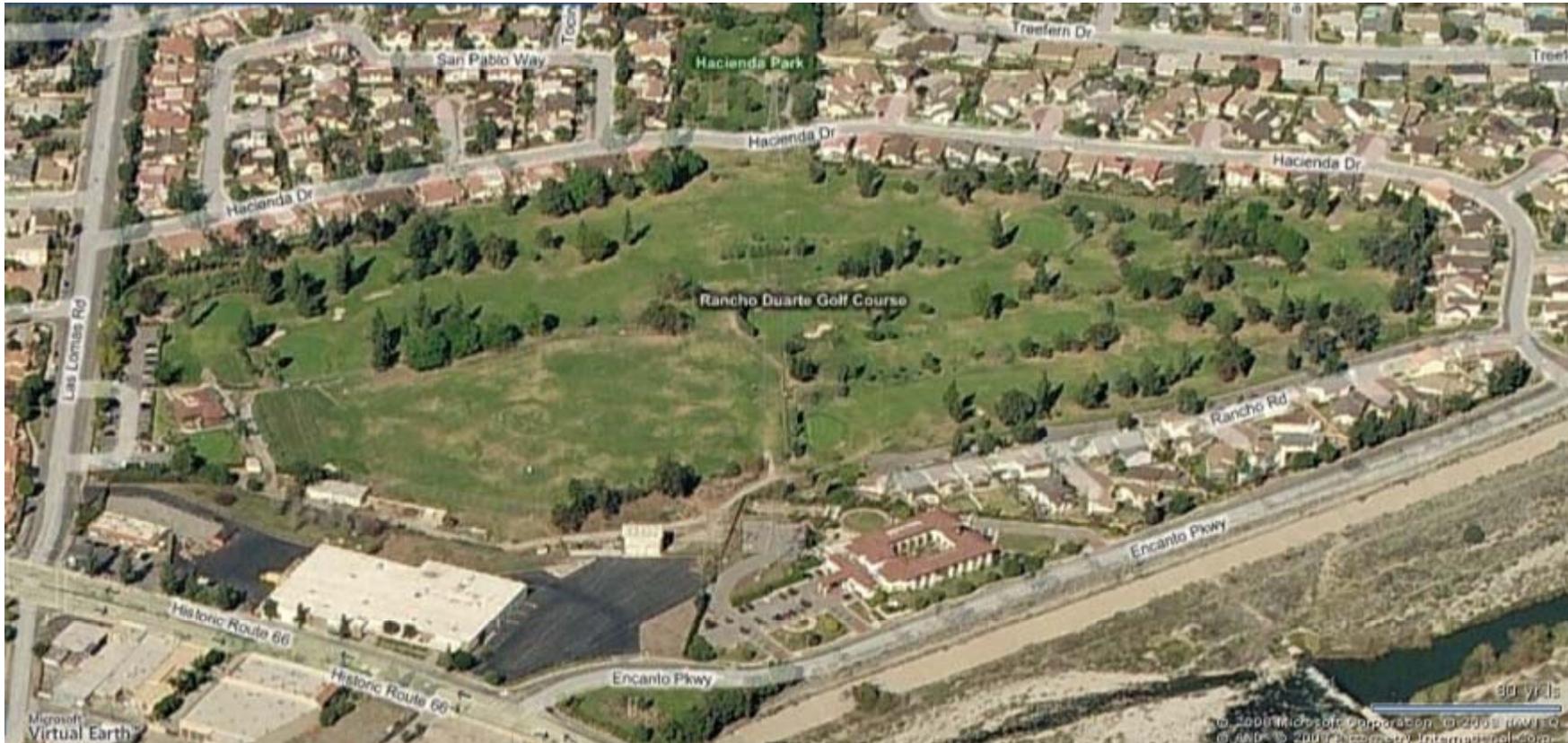
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Course Agenda

1. Introduction & Background: What & Why
2. LFG Standards: Overview & Key Standards
3. LFG Plan Review & Alternatives
4. Group Problems
5. Group Presentations
6. Regulatory Relief & Enforcement Guidance
7. Recommendations from LFG Probe Study
8. Control Measures
9. Questions and Answers

Why did the Feds (SubTitle D) require CA to monitor for landfill gas migration?



Title 27 Standards

- 20918– Exemptions--for non MSW sites only
- 20919 – Gas Control--Original standard & requirement for M&C program
- 20920 – Scope and Applicability for Gas Monitoring and Control Requirements – which sites covered
- 20921– Gas Monitoring and Control –levels of gas, timeline for plans
- 20923–Monitoring---list of program requirements
- 20925– Perimeter Monitoring Network—requirements & alternatives issues
- 20931– Structure Monitoring
- 20932– Monitored Parameters
- 20933– Monitoring Frequency
- 20934– Reporting – what's included
- 20937– Reporting and Control of Excessive Gas Concentrations
- 20939– Control Of Excessive Gas — describes a control system

Purpose of LFG Monitoring Network

To Protect Public H&S and the Environment by...

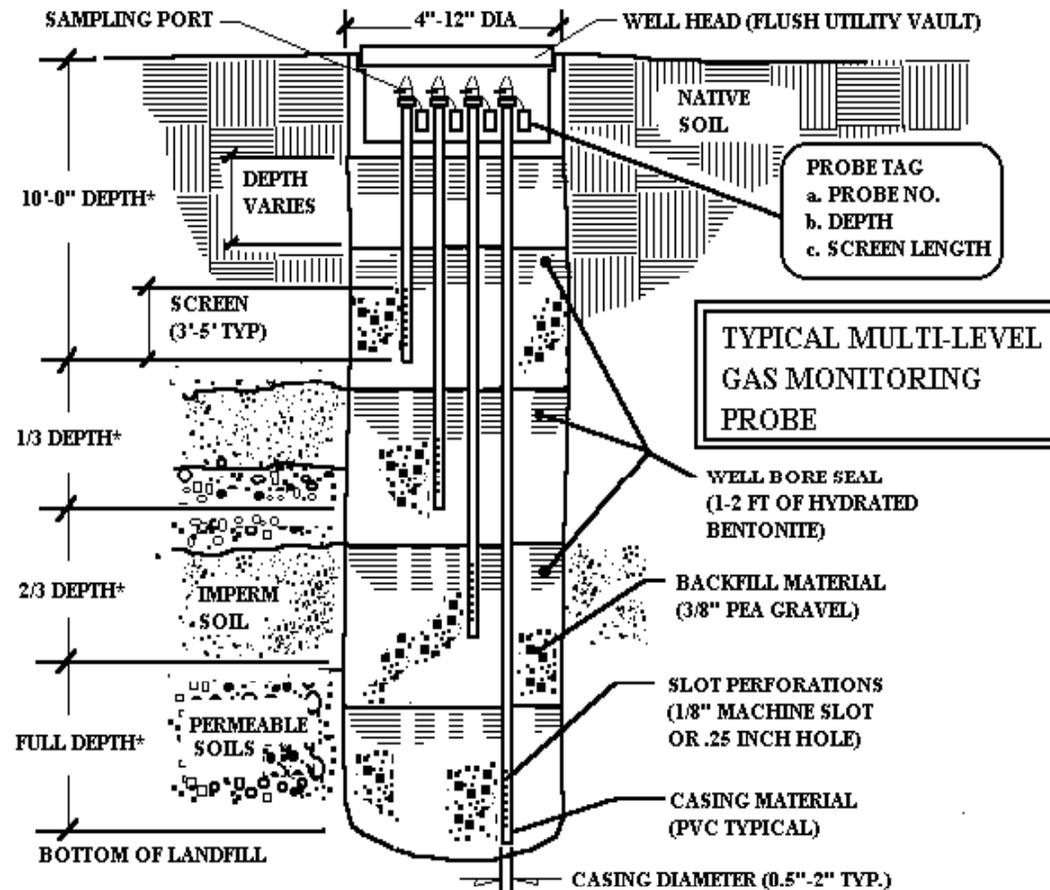
- Detecting migration of LFG
- Determining compliance with migration standard
- Evaluating effectiveness of LFG control system

Well construction

(Sec. 20925)

1. Wells shall be drilled by a licensed drilling contractor.
2. The drilling crew shall be supervised by a design engineer or engineering geologist.
3. Wells shall be logged by a geologist or geotechnical engineer.
4. Soils shall be described using ASTM D2488 84 visual classification.
5. Rock shall be described in a manner appropriate for geologic investigation.

Multi-level LFG Monitoring Probes



LFG Plan Submittal, Review & Alternatives



The Monitoring & Control Network

Shall be designed.....

(Sec. 20923)

1. By a Certified Engineering Geologist or Professional Civil Engineer
2. To include, but not be limited to:
 - Local hydro-geological, hydraulic & soil and rock conditions
 - Location of buildings/structures relative to the disposal area
 - Adjacent land use and inhabitable structures within 1,000 feet of the permitted facility boundary
 - Man-made pathways such as underground construction
 - Nature and age of the waste and its potential to generate LFG

Suggested LFG Monitoring Program Plan

- Table of contents
- **Background:** Discussion of surrounding land uses, past gas issues
- **Existing System Description:** Narrative, Map & Tables
 - Map of all existing gas wells
 - Tables Showing depth of each probe and its screen
 - Drawing showing a typical gas monitoring well
- **Proposed System:** Narrative, Map & Tables similar to above
- **Certification of the Plan by either a CE or a CEG**
 - **If alternative proposed or exemption is sought.....**
- **Site Specific Justification & Supporting Documentation**
 - Geologic cross-sections
 - Boring logs including names of persons logging the borehole.

Table: Detail regarding Wells/Probes

1. Consistent Well & Probe designation/number
(choose one style, GP1 or MW3 or LFGP2, etc.)
2. Depth of Waste (bottom/deepest part of waste)
3. Total Well/bore depth
4. Location (Latitude & Longitude)
5. Wellhead elevation (MSL)
6. Spacing between wells
7. Depth of **each** probe & screen interval
(shallow, intermediate, deep)
8. Alternative requested

EXAMPLE: Monitoring Well Table

Well No.	Depth Waste (msl)	Depth Well (msl)	Depth Well (bgs)	Location (lat/long)	Well Head Elevation (msl)	Spacing Adjacent Wells (ft)	Probe No.	Screen Interval (bgs)	Alternative Requested
LFG-1	1070	1070	130	37.5N 28.4E	1205	1000/975	S-1	5-15	No
							M-1	55-75	
							D-1	110-130	
LFG-2	1070	1060	200	37.6N 28.3E	1265	975/600	S-2	5-20	No
							M-2	55-75	
							D-2	110-130	
							SD-2	180-200	

Sites Required To Submit Plans by September 21, 2008

- Active disposal sites(> 20 TPD)
- Closed sites that did not complete closure by 11/18/90.
- Pre-1988 sites per (27 CCR 21100(d)) for postclosure land use

Suggested LEA Review Process

1. Operator Submits LFG Plan to LEA
2. LEA conducts Completeness Review using “Plan Element Guidance Checklist” –may ask for more info from operator and/or **parallel review** by CIWMB
3. LEA reviews Plan for compliance with standards and either approves or asks for more information.
4. LEA may require more monitoring than minimum standards.
5. LEA Approves Plan and forwards to CIWMB/PLEAS for concurrence.
6. CIWMB acts w/in 60 days to concur or not concur with LEA

Parallel Review Process

1. LEA may send Plan to CIWMB/PLEAS for parallel review-
2. CIWMB engineers provide comments to LEA to incorporate into their request for more information
3. CIWMB will send letter/comments to LEA w/cc: to operator.
 1. If more info needed, process begins again.
 2. If Plan is compliant w/ standards, LEA Approves Plan and forwards to CIWMB/PLEAS for concurrence.

CIWMB Plan Review Approach

Reviewing Plans for.....

1. Completeness of plan submitted
2. Compliance with Standards

CIWMB staff will.....

- Take statements at face value
- Determine if statement supports standard or alternative criteria
- Evaluate if statement is supported by **site-specific** data

Checklist for Plan Completeness Review

1. Wells outside waste footprint?
2. Wells at or near permit boundary?
3. Wells at or within 1,000 feet of each other?
4. Wells drilled to at least equal deepest level of waste?
5. Shallow probes: 5-10 ft of surface?
6. Intermediate probes: at or within 5 ft of half depth of waste?
7. Deep probes: at or within 5 feet of deepest waste?

A Compliant Plan Contains.....

Monitoring wells.....

1. **around** the entire permitted facility boundary or alternative
2. **spaced** at maximum of 1,000 feet. (between wells as you go AROUND the compliance boundary).
3. to the **depth** of waste at the deepest part of the landfill

If An Alternative is Requested, be sure to include.....

- Alternative Requested, either....
 1. **Location**
 2. **Spacing**
 3. **Depth**
- **JUSTIFICATION:** Include Site-specific Geological and hydro-geological supporting information

These are NOT Justifications

- “Large buffer zone”
- “Liner system”
- “Gas control system”
- “Bar hole punches showed no LFG”

Well Location

(Sec. 20925)

Perimeter wells shall be located....

- 1) Around the waste disposal footprint within the permitted property boundary **OR**
- 2) At an alternative compliance boundary closer to the waste footprint

Location Alternative Requirements:

Perimeter wells should be located around waste disposal footprint unless.....

1. Existence of Natural Barriers: **Geologic Barriers**

- No fractures or permeable lenses

OR Hydraulic Barriers

- No Gap between surface water and regional aquifer (Continuous)
- Not perched zone

AND

2. No inhabitable structures or threat to properties (such as agricultural lands) within 1,000 feet of the permitted facility boundary

Alternative Compliance Boundary :

An alternative compliance boundary may be proposed due to

1. Access issues (no road, water, etc.)
2. Geographical Features (ridge, habitat, trees, etc.)
3. Phasing of landfill development (reduce number of wells)

Well Spacing

(Sec. 20925)

1. Based on the nature of structures protected & proximity to refuse.
2. Aligns with gas permeable structural or stratigraphic features.
3. Lateral spacing between monitoring wells shall not exceed 1,000 feet-- PRESUMES no adjacent structures/sensitive land use.
4. Spacing shall be reduced, as necessary, to protect persons and structures.

Spacing Alternative Requirements (Tied to Location)

- No potential adverse impacts on public health, safety, & the environment
- Surrounding land use (existing & proposed or zoned)
- Hydrologic and Geologic Barriers (similar to Location alternative requirements)

Depth

(Sec. 20925)

Generally, all monitoring wells shall equal
Maximum depth of waste

- Shallow probes: 5 to 10 feet deep.
- Intermediate probes: at near half depth of waste.
- Deep probes: at or near the depth of waste.
- Probes may need to go deeper --depth of waste is *minimum* standard, not maximum!
- Only 2 probes required when the depth of waste does not exceed 30 feet.

Note: *Probe screens should be adjusted in the field to reflect site-specific geology*

Depth

(Sec. 20925)

1. Probe screens shall be in soil strata that is permeable to gas migration.
2. Probes shall be:
 - above the seasonal low water table.
 - above and below perched ground water.
 - above bedrock.

Probe Number Alternative Requirements

May only need 2 probes if...

- Shallow wells: < 30 ft
- Fewer preferential pathways

May need > 3 probes if...

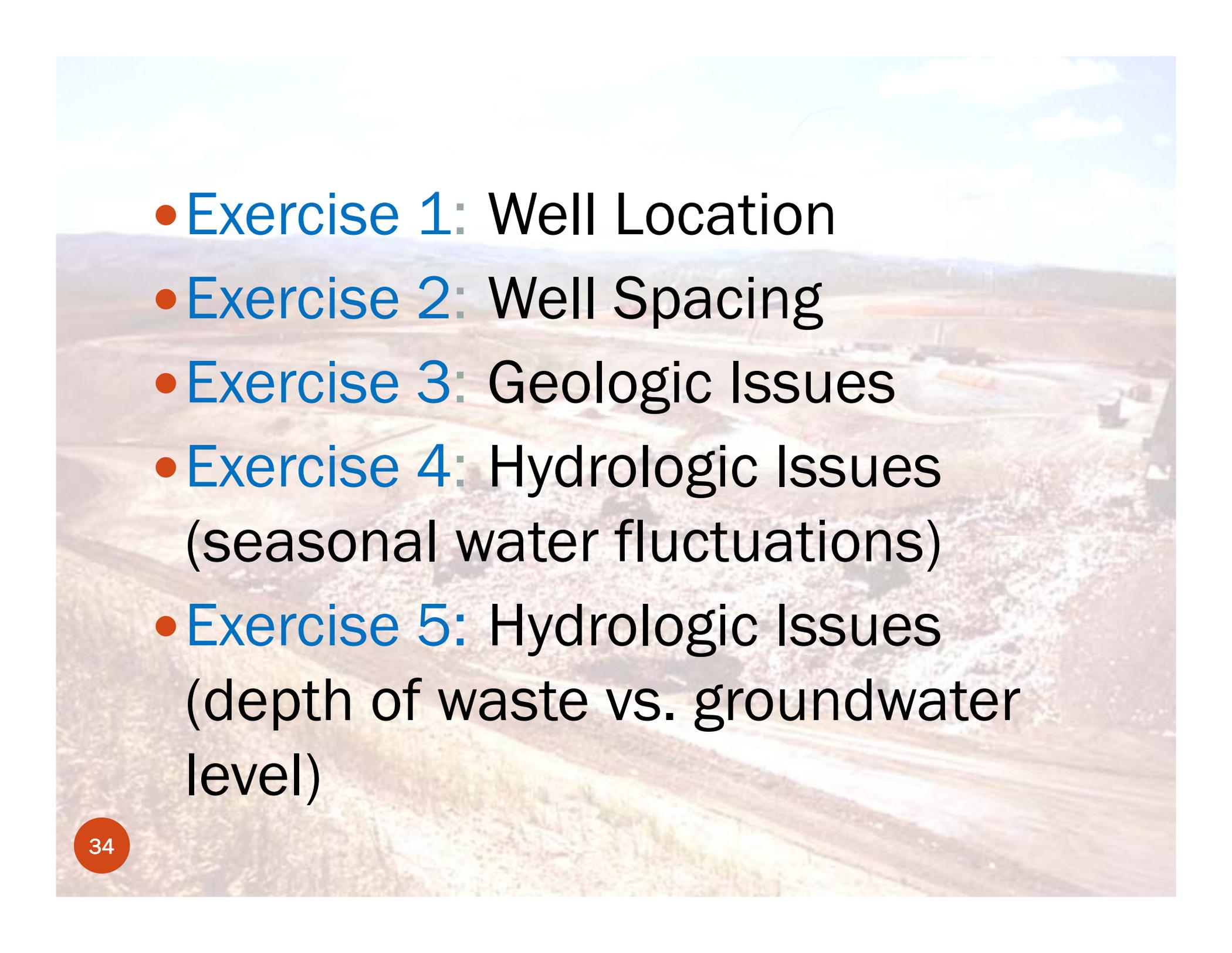
- Significant depth
- Discrete pathways
 - Perched water
 - Interbedded sand/clay layers

Depth Alternative Requirements

1. Conditions that may warrant alternatives
 - Subsurface geology
 - Preferential pathways
 - Barriers
 - Ground water
 - Bedrock
2. Must demonstrate alternative sufficient to detect LFG
3. Must provide protection to Public H&S

An aerial photograph of a large-scale construction project in a semi-arid, hilly landscape. In the foreground, there are dirt roads and construction equipment. The middle ground shows extensive earthmoving and foundation work. In the background, a large stadium with a distinctive roof structure is under construction. The sky is blue with scattered white clouds.

Group Problems

- 
- **Exercise 1:** Well Location
 - **Exercise 2:** Well Spacing
 - **Exercise 3:** Geologic Issues
 - **Exercise 4:** Hydrologic Issues
(seasonal water fluctuations)
 - **Exercise 5:** Hydrologic Issues
(depth of waste vs. groundwater level)



Group Reports

Regulatory Relief: Proposal

1. New sites & lateral expansions - prior to receipt of waste
2. Sites ceased disposal - immediately
3. Existing active disposal sites:

- *> 20 TPD - September 21, 2008 - PLAN*
- *> 20 TPD - September 21, 2009 - Implementation*
- *≤ 20 TPD - September 21, 2009 - PLAN*
- *≤ 20 TPD - September 21, 2010 = Implementation*

➤ Contact: **Bob Holmes** at rholmes@ciwmb.ca.gov

Regulatory Relief: Timeline

Moving forward with Rulemaking...

- 45 Day Comment Period until Oct. 27, 2008
- Hearing: October 29, 2008
- *Effective date: January 2009*

Suggested Enforcement Approach

September-January (Before Rulemaking finalized)

- **Area of Concern:** Plans submitted by 9/21/08, but programs not fully implemented
- **Violation:** Plans not submitted by 9/21/08

After January 2009 (Rulemaking Effective Date)

- **Violation:** Programs not fully implemented by 9/21/09, or approved extension date

Probe Functionality Study



Probe Functionality Study

Conducted under contract by SCS Engineers

- 1) To assess functionality of existing LFG monitoring systems
- 2) To refine GHG emission models

- Evaluation of 190 LFG monitoring probes at 20 landfills in CA
- Using a video borescope
- Fieldwork completed by March 2007

Major Finding.....

Significant number of these probes are either:

- Totally non-functional or
- Not configured to function properly.



Probe Study Recommendations

1. Probes should be constructed with longer screened segments (as opposed to shorter).
2. Wherever possible, probes should be assembled using materials that provide an adequate seal and do not interfere with sampling trace constituents. PVC probes should be assembled using threaded couplings with O-rings.

Probe Study Recommendations

3. Limit the number of probe pipe connections by using longer sections of PVC pipe.
4. Probes should be constructed using a non-specialized valve on the probehead assembly.





Probe Study Recommendations

5. LFG wells and probes should be properly labeled and identified.
6. LFG probes should be constructed to allow access by a bore monitor.



Probe Study Recommendations

7. The depth of the probe in relation to the water table should be a design consideration.
8. Probes should be preferentially located as far away from surface vegetation as possible in order to avoid root intrusion into shallow probes.

Probe Study Recommendations

9. A certified engineering geologist/ registered civil engineer must “field design” the screened interval for the probes and certify installation/completion of wells/probes in the as-builts required by the regulations.

**Don't forget that CONTROL
MEASURES are part of the
regulations too...**

**Section 20937 – Reporting and
Control of Excessive Gas
Concentrations**

When concentrations of methane or trace gases are in excess of the requirements, the operator shall:

1. Take steps to protect the H&S and the environment & notify the EA.
2. Within 7 days of detection, the operator shall verify:
 - validity of probe readings,
 - possibility of liquid interference,
 - possibility of the control well influence, and
 - possibility of barometric pressure effects.

The operator shall submit a letter to the EA & place in the operating record a description of:

- Levels of methane and trace gas detected
- nature and extent of the problem
- Steps taken by the operator to protect public health & safety and the environment
- any other corrective actions the operator or others need to take to adequately protect public health & safety and the environment.

Within 60 days of detection, the operator shall....

- 1.** Implement an approved remediation plan,
- 2.** Place a copy in the operating record and forward a copy to the EA & the CIWMB.
- 3.** Construct a gas control system:
 - Designed by a registered civil or mechanical engineer.
 - Within a time period specified by the EA .
 - Approved by the EA in coordination with RWQCB.

LFG Control System shall be designed to.....

1. Prevent methane accumulation in on site structures.
2. Reduce methane concentrations at the permitted facility boundary.
3. Reduce trace gas concentrations to the requirement (20921(a)).
4. Provide for collection, treatment & disposal of LFG condensate.

Subsurface LFG Control Systems May Include....

1. Active perimeter or interior control systems.
2. Perimeter air injection systems installed in native soils.
3. Passive systems including cutoff trenches, slurry walls & vent trenches with an impermeable geomembrane liner.

LFG control measures shall include one, or more, of the following:

1. Flexible membrane liners
2. Active collection systems
3. Passive collection systems designed to be upgraded to active systems
4. Alarms
5. Ignition source control
6. Utility collars installed within structures and outside in trenches
7. Ventilation

The operator shall implement a maintenance program in accordance with:

1. A site-specific operation & maintenance (O&M) manual.
2. The O&M manual shall provide for periodic inspections and servicing of gas control equipment
3. O&M shall be recorded and records retained by the operator

To assure construction quality assurance & quality control, the operator shall.....

1. Provide inspections to ensure system integrity.
2. Provide system monitoring and adjustment to ensure LFG control system is operating at optimum efficiency

The designer shall verify that all equipment used, or to be used, is in accordance with industry standards.

Final Questions

